

Japan International Cooperation Agency (JICA)

**Data Collection Survey
on
the Countermeasure
against Mercury pollution
in Asia, Central and South America**

Final Report

October, 2016

**Kokusai Kogyo Co., Ltd.
OYO International Co., Ltd.**

List of Abbreviations

Abbreviation	English name / Official name
Uruguay	
AUCI	International Cooperation Agency of Uruguay
DINAMA	National Direction of Environment
DINARA	National Direction of Aquatic Resources
Brazil	
IBAMA	Brazilian Environmental Agency
IEC	Evandro Chagas Institute
CETESB	Environmental Agency of the State of São Paulo
MME	Ministry of Mines and Energy
MOH	Ministry of Health
Nicaragua	
CIRA	Centro para la Investigación en Recursos Acuáticos de Nicaragua
CDNR	National Center of Diagnostic and Reference of Ministry of Health
CNRCST	National Commission of Control and Regulation of Toxic Substance
ENACAL	Empresa Nicaragüense de Acueductos y Alcantarillados
MARENA	Ministerio del Ambiente y los Recursos Naturales
MINSA	Ministerio de Salud
UNAN	Universidad Nacional Autónoma de Nicaragua
Indonesia	
BAPPENAS	Badan Perencanaan Pembangunan Nasional
EMC	Environmental Management Center
KLHK	Ministry of Environment and Forestry

Abbreviation	English name / Official name
Vietnam	
CEM	Center for Environment Monitoring
IET	Institute of Natural Resource and Environmental Science
ISEA	Industrial Safety Techniques and Environment Agency
MARD	Ministry of Agriculture and Rural Development
MOH	Ministry of Health
MOIT	Ministry of Industry and Trade
MONRE	International Cooperation Department
MPI	Ministry of Planning and Investment
PCD	Pollution Control Department
PPD	Plant Protection Department
VAST	Vietnam Academy of Science and Technology
VEA	Vietnam Environment Administration
VIHEMA	Health Environment Management Agency
VINACHEMIA	Vietnam Chemicals Agency
Philippines	
EMB	Environmental Management Bureau
DENR	Department of Natural Resources
DFA	Department of Foreign Affairs
DOH	Department of Health
DOLE	Department of Labor and Employment
DOST	Department of Science and Technology
TESDA	Technical Education and Skills
UP	University of Philippines
LLDA	Laguna Lake Development Authority
LGU	Local Government Unit
IAOMT	International Academy of Oral Medicine and Toxicology

Abbreviation	English name / Official name
Malaysia	
DOA	Department of Agriculture
DOE	Department of Environment
IMR	Institute for Medical Research
KIMIA	Department of Chemistry
KPDNKK	Ministry of Domestic Trade, Co-operatives & Consumerism
JPA	Jabatan Perkhidmatan Awam
MINT	Malaysian Institute for Nuclear Technology Research
MOH	Ministry of Health
NPRA	National Pharmaceutical Regulatory Agency
NRE	Ministry of Natural Resources and Environment Malaysia
SIRIM	Scientific and Industrial Research Institute of Malaysia
Thailand	
DIW	Department of Industrial Works
ERTC	Environmental Research and Training Center
FDA	Food and Drug Administration
MTEC	National Metal and Materials Technology Center
PCD	Department of Pollution Control
TICA	Thailand International Development Cooperation Agency
Others	
JICA	Japan International Cooperation Agency
APMMN	Asia Pacific Mercury Monitoring Network
UNEP	United Nations Environment Programme
UNIDO	United Nations industrial Development Organization
GEF	Global Environment Facility

Contents

1	Overview	1-2
1.1	Background	1-2
1.2	Objectives of the Survey	1-2
1.3	Implementation procedures	1-3
1.3.1	Work plan and the survey team composition.....	1-3
1.3.2	The points of concerning	1-3
2	The Mercury Pollution and the Mercury Control in the Researched Countries	2-7
2.1	The Asia Region	2-7
2.1.1	Indonesia	2-7
2.1.2	The Philippines	2-9
2.1.3	Thailand	2-13
2.1.4	Viet Nam.....	2-16
2.1.5	Malaysia.....	2-18
2.2	Central and South America	2-20
2.2.1	Brazil.....	2-20
2.2.2	Uruguay	2-25
2.2.3	Nicaragua	2-30
3	Possibility of application and development of Japanese technology regarding countermeasure on mercury pollution	3-37
3.1	Japanese technology seeds of Mercury control and the main source of mercury emission in the target countries.....	3-37
3.2	The application of Japanese technology regarding Stationary combustion and Cement production facilities	3-38
3.3	Technology of Mercury monitoring	3-39
3.3.1	Classification of mercury in the environment.....	3-39
3.3.2	Current status of mercury monitoring in Japan.....	3-39
3.3.3	Application and development of Japanese technology regarding Mercury monitoring for the target countries	3-41
4	Encouragement of applicants to JICA KCC program, and awareness raising of countermeasure against mercury pollution	4-47
4.1	Progress on the encouragement of applicants, and awareness raising	4-47
4.1.1	Philippines	4-47
4.1.2	Vietnam.....	4-49
4.1.3	Malaysia.....	4-50
4.1.4	Thailand	4-52
4.1.5	Indonesia.....	4-52
4.2	Proposal of training curriculum and implementation system.....	4-54
4.2.1	Outline of the Concept Paper	4-54
4.2.2	Schematic process of training	4-54
4.2.3	Draft of the detail schedule and curriculum of the training	4-55

1 Overview

1.1 Background

Minamata Convention on Mercury (hereafter referred to as Minamata Convention) is a global convention adopted in 2013 in Minamata City, Kumamoto Pref. Japan. The momentum was generated after UNEP published its Global Mercury Assessment 2002 and had been kept until the adoption, including the 25th UNEP Governing Council (GC25) agreement. The Japanese government, the presidency holder, expressed MOYAI Initiative which included various supports targeting the developing countries for early entry into force of the Convention and delivery information on preventing pollution and environmental restoration from Minamata City to the world. Moreover, “MINAS” (MOYAI Initiative for Networking, Assessment and Strengthening) program, also spreads by the Japanese government, shall support the developing countries to appropriately implement the Convention, utilizing Japan’s experience and technologies of the mercury control. In MINAS program, it is planned that Japan shall provide supports to the countries (1) in enhancing their monitoring capacity of mercury in environment and in bio-media, (2) in constructing monitoring networks and (3) in producing the inventory and developing mercury control plans as assists for Asia-Pacific region in developing their mercury pollution control.

Japan International Cooperation Agency (hereafter referred to as JICA) has been provided the technical cooperation on the matter in Latin American Countries since early 1990s. JICA has also started a Knowledge Co-Creation Program, i.e., Capacity Building for Ratification of the Minamata Convention on Mercury.

1.2 Objectives of the Survey

As mentioned above, the Japanese Government places importance on building of mercury monitoring network(s) in MOYAI Initiative and MINAS program, particularly in the Asia-Pacific region. An international mercury control initiative which includes developing the environmental monitoring network has been in discussion among the Japanese Government, the United States government, and Global Environmental Facility (GEF) as a joint cooperation program. As a part of this initiative, JICA is planning to provide training in the Knowledge Co-Creation Program tentatively named “Capacity strengthening for multi-media mercury monitoring (4M) in Asia-Pacific region” which would develop the mercury monitoring capacity in the environment, that is, one of the most basic and important issue of the mercury control. The training shall be commenced in the Japanese Fiscal Year 2017 and would consist of sessions with regards to analytical sample collection, analyses methods and quality assurance/quality control (QA/QC) of analytical values.

Within this context, the Survey shall collect information on the updated situation of the mercury control in Indonesia, the Philippines, Thailand, Viet Nam (suggested supported countries in the Japan-US-GEF support program), Malaysia, Brazil, Nicaragua, Uruguay (current/recent receiving countries of JICA technical cooperation on the mercury control). Utilizing the collected information, the Survey shall refine the designs of Monitoring Training discussed above and other related cooperation initiatives, and of awareness-raising in the countries. Moreover, the Survey shall act as an intermediary agent to promote applications from the surveyed countries for the JICA's Knowledge Co-Creation Programs.

1.3 Implementation procedures

1.3.1 Work plan and the survey team composition

The tables below show the work plan and the Survey Team members.

Table 1-1: Outline of work plan

Work Items	Year	2016							
	Month	4	5	6	7	8	9	10	
① 1st. Work in Japan									
A	Collection of the data in the Concerned Countries								
B	Preparation of the Questionnaire for the survey								
C	Data Collection on the Technology of Japan								
② 1st. Field Survey									
A	Collection of the data, Confirmation of the current situation & tasks in the Concerned Countries								
③ 2nd. Work in Japan									
A	Formulation of the curriculum and contents of the Training Course								
B	Preparation of Progress Report								
④ 2nd. Field Survey									
A	Operation of the seminar								
B	Encouragement of the Applicants to the Training Course								
⑤ 3rd. Work in Japan									
A	Preparation of the Final Report								
Output						▲ PGR		FR ▲	

Table 1-2: Outline of work plan

Region	Name	Designation	Affiliated Company
Asia	Hirokatsu UTAGAWA	Leader/ Mercury Control(1)	Kokusai Kogyo Co. Ltd.
	Kenji FUKUSHIMA	Mercury Monitoring (1)	OYO International Corporation
	Masayuki TAKAZAWA	Training Planning(1) / Awareness Raising (1)	Kokusai Kogyo Co. Ltd.
Latin America	Tamotsu SUZUKI	Mercury Control (2)	Kokusai Kogyo Co. Ltd.
	Takako UEDA	Sub-Leader/ Mercury Monitoring (2)	Kokusai Kogyo Co. Ltd.
	Yuko AOKI	Training Planning(2)/ Awareness Raising(2)	Kokusai Kogyo Co. Ltd.

1.3.2 The points of concerning

The points of concerning in the Survey are listed below.

a. Contribution to detailed designing of the training

Collected information on issues on the mercury problem and its control in the Survey should be utilized to update and/or revise the plan/design of KCC training “Capacity strengthening for multi-media mercury monitoring (4M) in Asia-Pacific region (draft)” which was planned to be started in the Japanese Fiscal Year 2017. The updated/revised plan/design also included

the detailed curriculum of the training. Moreover, “entrusted institution” which will conduct overall management of the training program and “implementation institution” (resource organizations/individuals) which take care of lectures, practices and observations were listed.

b. Appropriate explanation and information sharing with the Agencies

The needs survey for JICA’s Training was planned to be conducted in July-August 2016. In order to ensure enough applications from the targeted countries, the Survey should provide enough and appropriate explanation of the two Trainings, not only to the governmental agencies directly in charge of the mercury control/management but also to the contact-point agencies which would coordinate with the concerned agencies and assemble the applications.

The agencies/departments listed below have been set as the focal points of the Survey (Table 1-3). They are mainly governmental organizations in charge of environment and/or health administration and the information. Also, each country’s governmental organization which acts as the contact point for international cooperation is given importance. These agencies/organizations are selected so that face-to-face discussions are made in order to deepen the understanding of the objectives of the Survey and of Knowledge Co-Creation Program within the surveyed countries.

Table 1-3: Focal points and contact points for international cooperation

Country		Focal Point	Contact Point for International Cooperation
Asia	Indonesia	Department General of Waste and Toxic Substances Management/ Ministry of Environment and Forestry	State Ministry of National Development Planning (BAPPENAS)
	Viet Nam	Vietnam Chemicals Agency/ Ministry of Industry and Trade (VINACHEMIA)	Ministry of Planning and Investment (MPI)
	Philippines	Environmental Management Bureau/ Department of Environment and Natural Resources (EMB)	National Economic and Development Authority (NEDA)
	Malaysia	Department of Environment/ Ministry of Natural Resources and Environment (DOE)	Jabatan Perkhidmatan Awam (Public Service Department) (JPA)
	Thailand	Pollution Control Department/ Ministry of Natural Resources and Environment (PCD)	Thailand International Cooperation Agency (TICA)
Latin America	Uruguay	Director Nacional de Medio Ambiente/ Ministerio de Vivienda, Ordenamiento Territorial y Media Ambiente (DINAMA)	La Agencia Uruguaya de Cooperacion Internacional (AUCI)
	Brazil	Departamento de Qualidade Ambiental Na Industria/	Agencia Brasileira de Cooperacao (ABC)

		Ministerio do Meio Ambiente (DQAM)	
	Nicaragua	Ministerio del Ambiente y los Recursos Naturales (MARENA)	Ministerio de Relaciones Exteriores (MINREX)

c. Utilization of the Information from the Current JICA Projects

Currently, JICA is implementing technical cooperation projects on the mercury control in Nicaragua and in Uruguay. When collecting information, the Survey shall make a best use of the documents, reports, and other information compiled by these projects.

Table 1-4: Survey schedule

Year				2016																													
Month				4			5			6			7			8			9			10											
Total Work Process				<div>▲ Progress Report</div> <div>Final Report ▲</div>																													
①5/29 - 6/4 (7), ②7/17 - 21 (5), ③9/18 - 9/22 (5)							7						5			11						5											
①6/26 - 7/2 (7), ②8/18 - 8/27 (10)										7			10																				
①6/19 - 6/25 (7), ②7/27 - 8/6 (11)										7			11																				
①6/5 - 6/11 (7), ②7/17 - 21 (5), ③8/7 - 8/17 (11)							7						5			11																	
①7/3 - 7/9 (7), ②9/7 - 9/17 (11)													7						11														
①5/29 - 6/4 (7)							7																										
①6/5 - 6/13 (9)																																	
①5/21 - 5/28 (8)							8																										
Assignment		Name																															
Asia	1	Leader/ Mercury Pollution Countermeasures 1	Hirokatsu UTAGAWA				10			14			21			5			10			(5)			(5)			16			10		
	2	Mercury Monitoring Technology 1	Keniji FUKUSHIMA	5									10			32												10					
	3	Training plan 1/ Awareness Raising 1	Masayuki TAKAZAWA				14			21			6, 5, 5			32			16			10											
Central & South America	4	Mercury Pollution Countermeasures 2	Tamotsu SUZUKI	10			24						5																				
	5	Sub Leader/ Mercury Monitoring Technology 2	Takako UEDA				10						7			32			16			5											
	6	Training plan 2/ Awareness Raising 2	Yuko AOKI	6			17						10			10						5											

□ : Work in Japan ■ : Field Survey ▨ : Team own burden

2 The Mercury Pollution and the Mercury Control in the Researched Countries

2.1 The Asia Region

2.1.1 Indonesia

a. The Usage and Emission/Discharge of Mercury and the Pollution

a.1 Mercury Usage Characteristics

According to the UN statistics, Indonesia does not produce the mercury. However, in reality, imports/exports of mercury exist, as well as the Artisanal and Small Scale Gold Mining (ASGM), which indicates illegal imports of the mercury, according to the Indonesian government. ASGM, which refines gold ore to produce gold by using mercury, is widely practiced in the country. It is estimated that approximately 175 t of mercury is used per year (2010 estimation).

a.2 Emission/Discharge of Mercury and Environmental Pollution

It is estimated that approximately 220 t/year of mercury is discharged to the atmosphere, of which 50% (110 t) is thought to be due to ASGM. Remaining major sources of discharge include: waste incineration (approximately 50t/year, including open burning), and coal combustion (approximately 30t/year).

On the other hand, estimated 72 t/year of mercury is discharged into the water system, of which 39 t/year (more than 50%) is thought to be due to ASGM.

Another source of discharge is amalgam in dentistry, estimated approximately 11 t/year. The discharge of mercury into the soil is estimated to be 50 t/year, which, as estimated, is mostly derived from ASGM and illegal dumping of the waste.

b. Policy and Legal System

b.1 Mercury Control in National Development Planning

Mercury control in Indonesia is supposed to be led by the Ministry of Environment and Forestry (KLHK) which is the focal point in ratification of Minamata Convention. However, legal frameworks for systematic mercury control are yet to be built.

b.2 Basic Law(s) and other related Law(s) on Mercury Control

Although a holistic law on mercury control s yet to exist, governmental regulations on toxic waste management (e.g., of 1998, 1999) govern the mercury usage and treatment. In addition, the government plans to enact and implement legal restraint(s) to ban mercury usage in ASGM.

Table 2-1: Environmental Regulations on Mercury Management in Indonesia

Legislation	Enactment Year	Ministry in Charge
Governmental Regulations on Toxic Waste (PP No.18/1999)	1999	Ministry of Environment and Forestry
Governmental Regulations on Toxic Matters Management (PP No.74/2001)	2001	All Ministries
Ministerial Decision on Procurement, Circulation and Management on Toxic Matters	2009 (amd., 2011)	Ministry of Trade
Law on Mining and Related Governmental Regulations	2009 (amd., 2010)	Ministry of Energy and Mining Resources

b.3 Standard(s) on Mercury Emission/Discharge

As to environmental standards on mercury emission/discharge, in addition to the governmental regulations on toxic waste (see above), Environmental Ministerial Decision on emission of stationary combustion (KEP-13/MENLH/3/1995) and Environmental Ministerial Decision on industrial effluent standards (KEP-51/MENLH/10/1995) are in place. However, no standards are set for the stationary combustion including steel industry, coal-fired power generation, cement industry, which are major emission sources of mercury.

c. Organization(s) and System(s) on Mercury Control

c.1 Administrative Organizations for Mercury Control

In the current legal system, administrative organizations listed below are have their jurisdictions in regard with mercury control.

- Ministry of Environment and Forestry
- Minamata Convention, Emission/Discharge into Atmosphere and into Water System, into Soil system, Mercury Waste Management, and Polluted Sites
- Ministry of Energy and Mining Resources
- Mercury Management in relation to Mining Industry, ASGM, Mercury Management in relation to Petroleum and Gas, in relation Mercury Management in relation to Power Generation
- Ministry of Trade
- Imports and Exports of Mercury and Mercury-added Products
- Ministry of Industry
- Usage and Production Process of Mercury and Mercury-added Products
- Ministry of Health
- Mercury Control in Medicine and Health
- The National Agency of Drug and Food Control
- Mercury Control on Drug and Food

In order to construct the legal framework required to systematically implement mercury control, Mercury Control Technical Team was organized in 2011 based on an Environmental Ministerial order. The Team irregularly holds coordination meetings for construction of concerned policy framework.

c.2 Implementing System of Mercury Monitoring

So far a national-level systematic monitoring on mercury is yet to be implemented in Indonesia. Yet, Research Institutions, Universities, NGOs in and out of the country have implemented environmental monitoring.

d. Issues about Mercury Control and Mercury Pollution

As the most potent environmental problem in current Indonesia is water contamination, most of the environmental measures led by the government are for water contamination control. Although legal standards for effluent control are in place (see above), a vast majority of the indigenous small and medium size factories do not have the effluent treatment facilities and thus industrial liquid waste is generally discharged into the water system without proper treatment. Therefore, water contamination due to heavy metal as well as organic matters is wide-spread. Moreover, recently the contamination has spread out to the ocean in the coastal region, where the contaminated river water flows. According to the Ministry of Environment and Forestry, mercury supposedly derived from the industrial effluent has been found in the region.

d.1 Issues about Legal System Enhancement and Management, and on Administrative Organizations

In Indonesia, environmental legal system is very much developed; starting from the environmental basic law, i.e., Law on Environmental Management, various laws and regulations on water contamination, air pollution, waste management, environmental assessment, and standards governing sound noise, vibration, smell pollution and others are in place. However, viability of these laws and regulations are rather poor; as most of them have been introduced reproducing those of the developed countries' laws and regulations. Indonesia is yet to develop functional environmental monitoring system which is a basis of ensuring legal implementation.

d.2 Issues about Mercury Monitoring System

In order to monitor mercury effectively, not only the water but also the atmosphere monitoring is critical. However, due to financial and technical limitations, air pollution monitoring is implemented only in Jakarta, the capital. While legal framework construction and enhancement of regulations and standards are in progress, functional mercury control measures including human resource development and social awareness rising are yet to be developed.

2.1.2 The Philippines

a. The Usage and Emission/Discharge of Mercury and the Pollution

a.1 Mercury Usage Characteristics

Most of the mercury-added products sold and used in the Philippines are imported, as there are not produced in the country. No reliable data is found on the amount of mercury included in the mercury-added products imports/exports.

The Philippines produce various ores including gold, silver, copper, nickel, zinc and chrome.

Especially gold and silver mining provide livelihoods to many people including the poor, by using ASGM which uses mercury. Thus, it is characteristic of the country that ASGM-related amount of mercury is high in rate within the overall amount of mercury usage. It is estimated that mercury usage in ASGM may be up to 90 t/year in 2010¹.

a.2 Emission/Discharge of Mercury and Environmental Pollution

ASGM-related mercury emission into the atmosphere accounts for as much as 80% (26, 250 kg) of the whole atmosphere emission. This accounts for 1.6% of the worldwide emission²

According to UNEP Toolkit (2008), ASGM also is the major source of mercury emission into the soil and the water system, accounting for more than 80% of the whole amount. According to sporadic mercury monitoring reports, it is reported that above-the-standard mercury pollution is observed in and down the rivers where small-scale gold mining is going on and there are areas where above-the-acceptable concentration level of mercury in the atmosphere is observed.. Epidemiologic researches found out that the hairs of the women and children, who do the gold smelting, which indicates in-rooms mercury exposure serves as a possible sporadic contamination source. It is likely that in areas where ASGM is widely practiced, it is also a major source of mercury emission into the atmosphere.

b. Policy and Legal System

b.1 Mercury Control in National Development Planning

Within the Philippine Development Plan 2011-2016, mercury control is not discussed, while air pollution and water contamination is discussed in the item of “Conservation, Protection, and Rehabilitation of the Environment and Natural Resources”.

b.2 Basic Law(s) and other related Regulation(s) on Mercury Control

Major laws and regulations in the Philippines on mercury control and management are listed below.

Table 2-2: Major Laws and Regulations on Mercury Management in the Philippines

Laws and Regulations	Overview
1990 Republic Act #6969(RA6969)	Overall law to govern the management of toxic matter and toxic and radioactive waste
1992 Department Act (Ministry of Environment and Natural Resources) #29 (DAO92-29)	Implementation regulations for RA6969
1997 Department Act (Ministry of Environment and Natural Resources) #38	Chemical Control Order (CCO) on mercury control based on DAO92-29
1998 Department Act (Ministry of Environment and Natural Resources) #58	Prioritized Chemicals List (PCL) based on DAO92-29. Includes mercury compounds.

¹ Mercury Watch Database <http://www.mercurywatch.org/Default.aspx?PaneName=DATABASE>

² Technical Background Report for the Global Mercury Assessment 2013

2004 Department Act (Ministry of Environment and Natural Resources) #36 (DAO 2004-36)	Management Manual for toxic waste listed in DAO92-29. Mercury and mercury compounds are discussed.
2013 Department Act (Ministry of Environment and Natural Resources) #22	Amendment to DAO204-36. Threshold level for mercury waste is changed.
2000 Republic Act #9003 (RA9003)	Regulates proper management of toxic waste discharged from households. Development of management plan(s) of special waste by the local governments.
2005 Joint Department Act (Ministries of Health and of Environment and Natural Resources) #2	Regulates frameworks of medical waste management and responsibilities of the two Ministries.
2008 Department Act (Ministry of Health) #21	Sets the phase-out of mercury usage in medical facilities.
1999 Republic Act #8749	Overall law on air pollution management.
2004 Republic act #9275	Overall law on water contamination management.
Administrative Act #183	Promotion of energy-saving lighting equipment in governmental offices and buildings.
2013 Joint Department Act (Ministries of Environment and Natural Resources and of Energy) #9	Protection of environment and human health in disposal of lighting equipment.
1991 Republic Act #7076	Designation of lands available for mining and registration system of small-scale miners.
1997 Department Act (Ministry of Environment and Natural Resources) #30	Regulates safety measures, reporting, and records-management for small-scale miners
2012 Presidential Act #79	Strict compliance with environmental standards and ban on mercury usage in ASGM.

b.3 Standard(s) on Mercury Emission/Discharge

National environmental standards and emission standards on mercury are as follows:

- Into atmosphere: below 5 mg Hg Nm⁻³ in stationary source and below .05mg Hg Nm⁻³ in non-combustion stationary source.
- In the public water areas: Environmental Standards as below µg L⁻¹ -4 L⁻¹ and Emission Standards as below 2 µg L⁻¹ - 8 µg L⁻¹
- Drinking water: below 1µg L⁻¹

c. General Situation on Plan(s) and Program/Project(s)

In the Philippines, national-level projects on mercury control have been implemented, with supports from UNEP, ADB, UNDP, UNITAR, Swiss government and GEF. As a major outcome, National Action Plan (NAP) on mercury control has been developed.

Since 2000, epidemiologic researches have been implemented. AIST of Japan has been measuring mercury concentration in the human hairs in ASGM areas.

d. Organization(s) and System(s) on Mercury Control

d.1 Administrative Organizations for Mercury Control

In the NAP 2008 on mercury and mercury waste management, the governmental agencies share responsibilities as follows.

- Department of Environment and Natural Resources (DENR)
- Overall management of toxic materials and toxic waste including mercury control
- Department of Trade and Industry (DTI)
- Regulation of mercury-inclusion amount of the products (excl. lighting equipment)
- Department of Health (DOH)
- Regular monitoring and field inspections of, reporting to/from, application of penalties in, the medical facilities
- Department of Energy (DOE)
- Addition of mercury-inclusion conditions and others in relation to the national standards of equipment
- Department of Science and Technology (DOST)
- Identification of mercury management technology and promotion of research and development
- Department of Agriculture (DOA)
- Cooperation to the mercury inventory production, identification of mercury-using sites
- Department of Labor and Employment (DOLE)
- Awareness rising targeting the employees on mercury and mercury waste treatment

d.2 Implementation System of Mercury Monitoring

Environmental Management Bureau, The Department of Environment and Natural Resources (DENR-EMB) is in charge of mercury monitoring. DENR-EMB revises monitoring requisites, collects and analyzes data, promotes environmentally appropriate management of mercury wastes, monitors facilities, and implements policy and programs on pollution reduction. Actual mercury monitoring are conducted by National Reference Laboratory and Environmental Research and Laboratory Services Division (ERLSD, affiliated with EMB)

e. Program/Project(s) on Mercury Control by Donors and NGOs

BAN Toxics is an NGO dealing with Basel Convention and mercury pollution issues amongst others. Supported by US Department of State and UNIDO, BAN Toxics is implementing estimation of mercury imports/exports flow, situation researches of mercury usage in ASGM, education and awareness rising in ASGM communities, bio-monitoring and estimation of mercury in the atmosphere.

Medicine de Monde, an international humanitarian medical NGO, implements a project on waste fluorescent lamps collection, in which collected lamps are properly crushed and usable copper and silver is retrieved.

f. Issues about Mercury Control and Mercury Pollution

The Philippines have been developing the legal system in relation to mercury control, have identified the division of roles amongst the Departments, and published the National Action Plan. Yet, in reality, activities on mercury control have just begun, with few experienced experts. Thus, urgent issues include construction of functioning implementing system on mercury control. Also inventory research should be prioritized.

f.1 Issues about Legal System Enhancement and Management, and on Administrative Organizations

DENR is currently the sole administrative organization which is in charge of environmental governance. Yet, the situation is not all positive as, according to DENR, the majority of Members of the Parliament places more importance on development and economic growth than on environmental conservation. Also, in reality, it is more financially beneficial for enterprises and companies to pay penalties than to comply with the environmental standards.

As to mercury control, management of ASGM should be prioritized with urgency. According to the data by Mercury Watch³, the Philippines the world's 4th largest user of mercury and mercury accounts for the country's 80% of emission into the atmosphere. Responding to this, the government banned mercury usage in ASGM in 2012 (Presidential Act #72). In reality, however, legal action is not enough to deal with mercury usage in ASGM as ASGM is the source of livelihoods for 100,000 to 300,000 households, of which majority is the poor. In this context, the government has been trying to identify more effective means to properly manage ASGM. DOH is leading a inter-ministerial program which strives for improvement of the industrial health in the informal sector including ASGM.

f.2 Issues about Mercury Monitoring System

While the Philippines have set the mercury emission standards into the atmosphere and the water system, no such standards exists for the emission into the soil system. Mercury is either not included in the measured items of the atmosphere environmental standards, even though the mercury emission into the atmosphere majorly by ASGM has become an issue. Enhancement of monitoring capacity and inventory research are needed, as quantitative data management is critical. Thus, cooperation targeting the Philippines should prioritize (1) mercury monitoring and inventory research, (2) mercury control in ASGM, and (3) mercury waste management, where needs of the stakeholders are high.

2.1.3 Thailand

a. The Usage and Emission/Discharge of Mercury and the Pollution

a.1 Mercury Usage Characteristics

Since 2007, mercury imports/exports have been sharply decreased. Imports of mercury compound have also decreased since 2007, while exports amounts have fluctuated. Officially said, no mercury mining and no mercury production synthesis is done in Thailand. Looking at mercury usage in production process, Thai Environment Research Institute researched in 2014 on mercury-added products, which are subject to legal control where, unfortunately, no actual data is given. According to Mercury Watch, ASGM mercury usage amount is estimated as 1.0 – 1.5 t/year (2010). Due to energetic economic activities, Thailand shows comparatively large rate of mercury-added products within the usage of mercury as a whole.

a.2 Emission/Discharge of Mercury and Environmental Pollution

Pollution Control Department, the Ministry of Natural Resources and Environment (PCD) estimate the mercury emission into the atmosphere in 2010 as approximately 11 t/year.

³ <http://www.mercurywatch.org/default.aspx?panename=globalDatabase>

According to Technical Background Report (AMAP/UNEP 2013), prepared for Global Mercury Assessment 2013, estimates that of 2014 as 14.9t. The largest emission source is petroleum refining, followed by coal-fired power generation plants and cement production. It is thought that there is no emission derived from natural sources.

Emission of mercury into the water system in 2010 is estimated as 4.37t/year, with various sources. Emissions of mercury into the soil system are estimated as 7.72 t/year, more than half of which is accounted for by the illegal dumping of the waste.

No data/information is identified on mercury pollution in the Research.

b. Policy and Legal System

b.1 Mercury Control in National Development Planning

In National Environmental Quality Improvement Policy/Plan (1997-2016) discusses national plans and measures for proper management of general and toxic waste. No specific discussion is given on mercury.

b.2 Basic Law(s) and other related Regulation(s) on Mercury Control

Aside from environmental/emission standards, laws and regulations with regard to mercury management are as follows.

- Law on Toxic Materials (1992): Defines and categorizes toxic materials, identifies legally controllable toxic materials. 9 ministries including the Ministry of Natural Resources and Environment are responsible for its implementation.
- National Environmental Council Statement # 15⁴ (2011): Appointment of Assistant Members for management of silver
- National Environmental Council Statement #1 (2014) : Appointment of Assistant Members for Minamata Convention

As to mercury control in products, individual regulations govern either ban or content restrictions. These regulated products include cosmetic products and agrichemicals.

b.3 Standard(s) on Mercury Emission/Discharge

National environmental standards and emission standards regulates mercury emission/discharge into atmosphere, public water areas, ocean water areas, underground water, and soil. Official methods of analysis are set. The standard values are for mercury in general and no regulation is provided for organic mercury.

c. General Situation on Plan(s) and Program/Project(s)

In September 2014, Pollution Control Department, the Ministry of Natural Resources and Environment (MNRE-PCD) has started to lead the measures for Minamata Convention, ordering the local governments to sorted collection of wastes with special focus on sorting of the mercury-inclusive products.

⁴ Amended in 2012 and 2013.

PCD in collaboration with JGSEE (a cooperative graduate school) has produced 2010 Enumeration of Mercury Emission/Discharge.

d. Organization(s) and System(s) on Mercury Control

d.1 Administrative Organizations for Mercury Control

The National Environmental Council has appointed in 2011 to members of the Assisting Committee on mercury control as the organization to be in charge of Minamata Convention (Statement # 15). The committee has been re-organized twice, and in July 2014, the first National Environmental Council was held, in which an assisting committee on Minamata Convention, organized by 24 members from concerned Ministries.

d.2 Implementation System of Mercury Monitoring

The mercury monitoring in Thailand is conducted by MNRE-PCR (see above) and Environment Research and Training Center (ERTC). Regular monitoring of the public water areas is done in several points within the 366 monitoring points spread out in the country. Spot monitoring is done for underground water, targeting areas where contamination is suspected. Mercury monitoring is done in counties in Pichit Province, where gold mining is done.

Environmental standards are set only for the public water area, underground water and soil; standards for atmosphere, coast water, and sludge are yet to be set.

e. Program/Project(s) of Mercury Control by Donors and NGOs

According to JGSEE, three (3) program/projects on mercury control have been implemented in the outlet areas of Chaopraya River and in factory neighborhood by non-governmental organizations including NPOs, of which details are unpublished.

Two (2) epidemiologic researches in relation to mercury pollution have been done by US National Institutes of Health (2007) and by an NGO, Buranavives Foundation (2012).

f. Issues about Mercury Control and Mercury Pollution

f.1 Issues about Legal System Enhancement and Management, and on Administrative Organizations

The largest emission source of mercury into the atmosphere is petroleum refining, followed by coal-fired power generation and cement production. It is thought that no emission is made from natural emission sources. However, it should be noted that no environmental standards are set for mercury concentration in the atmosphere and no regular and/or holistic monitoring is conducted.

On the other hand, Acts by the Ministry of Factory and Ministry of Natural Resources and Environment regulate limits of mercury in gas emitted from factories and through the toxic waste incineration processes.

Considering these, regular mercury monitoring in the atmosphere is urgently required, as well as the related data accumulation and analysis in preparation of more efficient mercury

control.

f.2 Issues about Mercury Monitoring System

A pressing issue about mercury monitoring in Thailand is atmosphere analysis. MNRE-PCD currently owns 5 mercury analysis equipment, which are allocated to analysis of marine water, ground water, effluent, soil, and biological body specimen, respectively. Analysis of the atmosphere is yet to be done. ERTC, on the other hand, requests analysis of mercury in the atmosphere to a Taiwanese institute.

This situation is partly due to the non-existence of environmental standards on mercury in the atmosphere; yet, it is most desirable to develop the capacity of the related technology.

2.1.4 Viet Nam

a. The Usage and Emission/Discharge of Mercury and the Pollution

a.1 Mercury Usage Characteristics

According to 1990-2011 U.S. Geological Survey, no production of mercury ores, mercury concentrate, and metal mercury have been reported in Viet Nam.

a.2 Emission/Discharge of Mercury and Environmental Pollution

According to the statistics published by the Chemicals Agency of the Ministry of Industry and Trade, major industries/products using mercury in Viet Nam include: lighting equipment (fluorescent lights), production of fertilizers (coal-burning) and medicine (amalgam in the dentistry). It is said that legal AGSM practices have terminated the usage of mercury, while no statistical data is existent for illegal AGSM practices.

According to the reports of Center for Environmental Monitoring (CEM) of the Ministry of Natural Resources and Environment, sources of mercury emitted into the environment are mainly coal and limestone. Cement producing facilities, rather than the power generation plants, emit larger amount of mercury into the atmosphere. It should be noted that in general the mercury concentration in the atmosphere is below the national standards.

b. Policy and Legal System

b.1 Mercury Control in National Development Planning

Based on the Decision No.1811/QĐ-TTg (dated October 2013), the Prime Minister has appointed the Ministry of Industry and Trade as the central acting agency in relation to the ratification of Minamata Convention. The Ministry has started its action on Minamata Convention in cooperation with the concerned agencies. The country has signed the Convention on 11th October 2013⁵.

b.2 Basic Law(s) and other related Regulation(s) on Mercury Control

Recently, national technical regulation (QCVN) regulates the environmental standards, waste

⁵ <http://www.mercuryconvention.org/Countries>

gas standards and effluent standards, based on the 1995 TCVN (Vietnam standards). QCVN sets the “standards”, with more emphasis on regulation, compared to TCVN which “recommends” compliance. While the environmental standards of the atmosphere (QCVN05:2009/BTNMT) does not specifically regulates mercury, the regulations on waste gas, water quality, effluent are very strict (some are more strict than those in the developed world). No regulation specifically governs mercury control is provided.

b.3 Standard(s) on Mercury Emission/Discharge

Environmental standards on mercury regulates ground water, underground water, and coastal marine water, and atmosphere, but not on soil. Waste gas standards in relation to mercury is only set for incineration facilities (including those in medical facilities).

c. General Situation on Plan(s) and Program/Project(s)

Since 2014, the Ministry of Industry and Trade has started (1) national inventory production on mercury usage and emission, (2) impact assessment of signing and ratification of Minamata Convention, (3) consideration of legal measures on Minamata Convention, and (4) development of national action plan.

While these have been planned following the tentative roadmap, it is not clear how the progress is made, even after 2015 which was the completion deadline.

The Ministries of Health, of Natural Resources and Environment, and of Industry have been implementing projects on medical waste and/or toxic waste on and off.

d. Organization(s) and System(s) on Mercury Control

d.1 Administrative Organization for Mercury Control

The Ministry of Industry is responsible for Minamata Convention, imports and exports, and usage of mercury. The Ministry of Natural Resources and Environment is in charge of emission into the water system and to the soil, tentative storage, mercury waste, and polluted sited. The two ministries jointly manage the mercury emission into the atmosphere.

d.2 Implementation System of Mercury Monitoring

In Viet Nam, there are 20 Atmosphere Monitoring Offices. Firstly, mercury monitoring was done only in Ho Chi Minh, but is planned to be increased to 6 offices Ha Noi, Hoa Binh, Cuc Phuong, Da Nang, Can Tho, Tp. Ho Chi Minh, thanks to the cooperation with EANET⁶. Also, USEPA provides cooperation⁷.

CEM is planned to lead a mercury monitoring network in the country. It is planned that in 2015, monitoring spots and frequency are proposed, and that in 2016, technical manual on mercury monitoring is produced.

e. Program/Project(s) on Mercury Control by Donors and NGOs

UNIDO, in collaboration with GEF, has started the Minamata Convention initial assessment

⁶ East Asia Asid Rain Monitoring Network

⁷ <http://vietnam.usembassy.gov/pr041514.html>

in 2014. This is a project in which an inter-ministerial coordination body shall be established and existing laws and regulations shall be reviewed, identifying gaps. USEPA and Tiwanese Department of Environment Protection have supported the Ministry of Natural Resources and Environment to participate in the Asia-Pacific mercury monitoring workshops since 2013.

f. Issues about Mercury Control and Mercury Pollution

f.1 Issues about Legal System Enhancement and Management, and on Administrative Organizations

The law on environmental protection appoints the Ministry of Natural Resources and Environment to coordinate with concerned Ministries, yet in reality, it has been difficult. The national development strategy emphasizes economic growth, and the Ministry lacks scientifically reasonable negotiation skills and coordination capacity.

The Ministry, in an effort to improve this situation, has re-organized itself in which the Viet Nam Environment Agency (VEA) was established. VEA functions as the policy making and strategy making body, environmental impact assessment implementer, and administrative body in charge of inspections. It is expected that VEA shall lead the environmental management in Viet Nam with more holistic and effective approach.

f.2 Issues about Mercury Monitoring System

While the monitoring system of air pollution and water contamination is being developed, the social awareness on mercury pollution is yet to be high. The emphasis in the air pollution is mainly on smoke dust, and that in the water contamination is on BOD. Arsenic pollution is also being noted. Without a national policy change on environment, this overall situation is unlikely to change.

Having said that, know-how on chemical analysis and environmental monitoring is in place, and thus the country's potential is high. As Viet Nam is an socialist country, when/if its environmental policy focuses on mercury, the financial necessary on monitories shall be secured by the nation.

2.1.5 Malaysia

a. The Usage and Emission/Discharge of Mercury and the Pollution

a.1 Mercury Usage Characteristics

Data on the usage of mercury in Malaysia is not published. It is possible that production processes using mercury are in place. AMAP/UNEP. Technical Background Report for the Global Mercury Assessment 2013 stated that usage and emission of mercury except that in chlor-alkali production is unknown. There is a reporting that estimates the usage of mercury in ASGM is approximately 3.5 t/year (2010).⁸

a.2 Emission/Discharge of Mercury and Environmental Pollution

a.2.1 Emission/Discharge of Mercury

⁸ <http://www.amap.no/documents/doc/technical-background-report-for-the-global-mercury-assessment-2013/848>

Mercury emission into the atmosphere in Malaysia is estimated to be 6,130kg /year in 2010, with major emission sources of intentional usage in small-scale gold mining, coal-fired power generation and cement production. ASGM is wide-spread in the country and approximately half of the mercury used (1.75 t) is estimated to be emitted into the air. No published data on the emission of mercury into the water system and into the soil is published, neither of the amount of waste.

a.2.2 Mercury Pollution

Environmental standards on mercury within the general environment are set, and supposedly regularly monitored, but monitoring values except for those in the drinking water sources are unpublished. It is unclear whether there is any mercury pollution. It is reported that the department of industrial safety of the Ministry of Human Resources conducts monitoring of the atmosphere and water quality but the monitoring values are unpublished.

b. Policy and Legal System

b.1 Mercury Control in National Development Planning

A regulational law on toxic waste is in place, but no regulation is provided for the regulation of general industrial chemicals. Department of Environment of the Ministry of Natural Resources and Environment is in construction of the registration system of the chemicals and toxic chemicals, as an effort to comply with the international conventions including Basel and Stockholm Conventions. No specific information is identified as to mercury and mercury compound within this move.

b.2 Basic Law(s) and other related Regulation(s) on Mercury Control

Major laws and regulations in relation to mercury management are listed below.

- Law on Environmental Quality (1974) : Defines designated waste, regulates imports/exports/transit of waste
- Environmental Regulation on Designated Waste (1989): Regulates categorization and storage of designated waste
- Environmental Regulation on the Treatment of Designated Waste and its Treatment Facilities (1989): Regulates approval for the owners of the treatment facilities, and their reporting responsibility
- Law on Industrial Safety and Hygiene (1989): Regulates categorization, packaging, labeling of dangerous chemicals

b.3 Standard(s) on Mercury Emission/Discharge

The environmental standards on mercury are strict and as follows:

- In the atmosphere: for boilers and incenerating facilities, below 0.03 mg m^{-3} to 0.05 mg m^{-3}
- For drinking water sources: below 0.001 mg L^{-1}
- Environmentally Protected Ocean Areas: below $0.04 \text{ } \mu\text{g L}^{-1}$
- Fishing areas and coral reefs: below $0.16 \text{ } \mu\text{g L}^{-1}$
- Ports neighboring Industrial Sites: below $50 \text{ } \mu\text{g L}^{-1}$

- River Outlets in the Mangrove Areas: below $0.5 \mu\text{g L}^{-1}$

c. Organization(s) and System(s) on Mercury Control

c.1 Administrative Organizations for Mercury Control

The administrative organizations in charge of mercury control are as follows.

- Prime Minister's Office: Minamata Convention
- Ministry of International Trade and Industry: Imports and exports
- Ministry of Natural Resources and Environment: Primary mining, ASGM
- Ministry of Science, Technology and Innovation: Mercury-added products, mercury-using production process, tentative storage, mercury waste and polluted sites
- Ministry of Human Resources: Emission into the air, water system, and soil

c.2 Implementation System of Mercury Monitoring

The Ministry of Natural Resources and Environment does not have a chemical analysis laboratory and thus no regular environmental monitoring including that of mercury is conducted. On the other hand, laboratories affiliated with the Ministries of Health and of Agriculture regularly contacts mercury analysis, for checking the non-existence of mercury in marine products, agricultural products, medicines and fertilizers. The Ministry of Science, Technology and Innovation does mercury analysis from the standpoint of toxicology against the bio-orgasms, while no monitoring is done.

d. Issues about Mercury Control and Mercury Pollution

d.1 Issues about Legal System Enhancement and Management, and on Administrative Organizations

Malaysia is hesitant to publish data on environmental pollution including mercury pollution. Therefore, it is difficult to see whether the current legal and administrative system is appropriate for mercury pollution and control of the country.

d.2 Issues about Mercury Monitoring System

National research institutes in Malaysia are provided large budgets from the government. The capacity of their staff in terms of chemical analysis and technical knowledge is quite developed. Therefore, it is understood that the Ministry of Natural Resources and Environment should prioritize its cooperation with the other concerned Ministries and their laboratories so that a functional environmental monitoring system is developed.

2.2 Central and South America

2.2.1 Brazil

a. The Usage and Emission/Discharge of Mercury and the Pollution

a.1 Mercury Usage Characteristics

In Brazil there is no mercury production from the mine, and also there is no mercury

by-production generated from the other mining processes. Mercury to be used in the country are imported. On the other hand, there is a report that mercury is used per year, 23 tons in the chlor-alkali production, 45 tons in ASGM (the maximum 60 tons, the minimum 30 tons). This scale is the sixth largest in the world.⁹

a.2 Emission/Discharge of Mercury and Environmental Pollution

Emissions to air of mercury in Brazil is estimated to be approximately 39 tons per year in 2010. This accounts for about 2% of the emissions of the entire world (approximately 1,960 tons). The main emission sources are the ASGM and non-ferrous metal manufacturing facility. It has been reported that release amount to the water and soil is not known. According to the UNEP study¹⁰ in 2012, it has been reported that there was a mercury emissions of 7 kg from the chlor-alkali manufacturing to the water environment. In addition, the annually 300 million of fluorescent lamp is being consumed. However the amount of the appropriate recover is only approximately 1,600. The remaining is likely to have been discarded as ordinary garbage. It might have been a serious emission sources to the environment.

b. Policy and Legal System

b.1 Mercury Control in National Development Planning

Brazil has signed the Minamata Convention. Ministry of the Environment has played a key role, and it has been implementing Minamata Convention Initial Assessment (MIA). The capacity building for countermeasures against Mercury has become a policy agenda. Brazil National Chemical Safety Commission (Comissão Nacional de Segurança Química (CONASQ)) established a working group on mercury in March 2011.

b.2 Basic Law(s) and other related Regulation(s) on Mercury Control

The major environmental laws in Brazil are as follows.

- Federal Constitutional (Constituição da República Federativa do Brasil de 1988)
- Basic Environment Law (Lei Ambiental Básica de 1981)
- IBAMA establishment Act (Lei No.7,735, 22 de fevereiro de 1989)
- Water Resources Act (Lei No. 9,433/1997)
- environmental crimes Act (Lei No. 9,605/98)
- National Environment Commission Decision 23/1996 (Resolution CONAMA 23/1996)

b.3 Standard(s) on Mercury Emission/Discharge

The environmental standards and the pollution standards of mercury in air have not been defined in Brazil. The environmental standard value of mercury in water quality also has not been set. Effluent standards have been established with the 0.01 mg/L in Sao Paulo State and Rio de Janeiro State. On the other hand, the mercury restriction on the production processes

⁹ <http://www.mercurywatch.org/>

¹⁰ UNEP, Global Inventory of Mercury-Cell Chlor-Alkali Facilities,
<http://www.unep.org/chemicalsandwaste/Mercury/PrioritiesforAction/ChloralkaliSector/Reports/tabid/4495/language/en-US/Default.aspx>

and the products, which are thermometers, blood pressure monitors, fluorescent light and bulbs, are defined by the federal government.

c. General Overview regarding plans, individual projects

It had been approved that Minamata Initial Assessment (MIA) would be implemented by utilizing GEF in 2014, the activity is supposed to be done over two years. Its activities consist of the following four components¹¹:

- Utilization of the existing coordination mechanism and institution in the process
- Assessment of the domestic infrastructure and capacity (including domestic laws and regulations) for mercury management and monitoring
- Preparation of the mercury inventory by using the UNEP mercury toolkit, including the specific mercury contaminated site
- Preparation and verification of the national MIA report, implementation of attention activities, transmission of the results

d. Organization(s) and System(s) on Mercury Control

d.1 Administrative Organizations for Mercury Control

Each provision of the competent ministries of the Minamata Convention is shown in the table below. For each articles, many ministries and agencies have taken the jurisdiction cooperatively.

Table 2-3: Responsibilities of each ministry regarding mercury measures in Brazil

Contents of Article	Competent ministries and agencies
Manufacturing processes in which mercury or mercury compounds (Article 5)	<ul style="list-style-type: none"> - Ministério do Desenvolvimento, Indústria e Comércio Exterior (MDIC) - Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA) (/Ministério do Meio Ambiente (MMA)) - Companhia Ambiental Do Estado De São Paulo (CETESB, Estado de Sao Paulo), - Instituto Estadual do Ambiente (INEA, Estado de Rio) - Instituto do Meio Ambiente e Recursos Hídricos (INEMA, Estado de Bahia State)
ASGM (Article 7)	<ul style="list-style-type: none"> - Ministerio de Minas e Energia (MME) - Ministério da Saúde (MS)
Emissions of Mercury (Article 8)	<ul style="list-style-type: none"> - MMA - CETEB, INEA, INEMA, CPRH
releases of mercury (Article 9)	<ul style="list-style-type: none"> - MMA - CETEB, INEA, INEMA, CPRH

¹¹ GEF, REQUEST FOR PERSISTENT ORGANIC POLLUTANTS ENABLING ACTIVITY,

[http://www.thegef.org/gef/sites/thegef.org/files/gef_prj_docs/GEFProjectDocuments/POPs/Brazil%20-%20\(5861\)%20-%20Development%20of%20Minamata%20Convention%20on%20Mercury%20Init/5-26-2014_ID_5861_EA.pdf](http://www.thegef.org/gef/sites/thegef.org/files/gef_prj_docs/GEFProjectDocuments/POPs/Brazil%20-%20(5861)%20-%20Development%20of%20Minamata%20Convention%20on%20Mercury%20Init/5-26-2014_ID_5861_EA.pdf)

environmentally sound storage of mercury (Article 10)	- MMA - CETEB, INEA, INEMA, CPRH - IBAMA
Mercury waste (Article 11)	- MMA - CETEB, INEA, INEMA, CPRH - IBAMA
contaminated sites (Article 12)	- MMA - CETEB, INEA, INEMA, CPRH

d.2 Implementing System of Mercury Monitoring

Mercury monitoring in the general environment and emission sources are conducted under the responsibility of the provincial government. However, there is a difference of the analysis capability in each State. Also standardized methods for sampling and analysis have not been established. CETESB (Companhia Ambiental Do Estado De São Paulo) has the ability to perform the sampling and analysis of mercury. But, in the other states, equipment has not been installed and the number of technical staff is not enough. The technology of on-site monitoring is also not popular. Regarding air environmental monitoring, it is also under the jurisdiction of the environment corporation agencies in each state. In the large city such as Sao Paulo, air environment monitoring which targets some parameters like SO_x, NO_x and CO, have been implemented. But mercury has not been the subject of air quality monitoring.

Monitoring the atmospheric emissions from factories (as well as waste water) might have been a mandatory as a condition of the license for construction after checking the manufacturing process. In that case, factories take responsibility for implementation of the monitoring, and they should report the result to the State. CETESB in Sao Paulo State, and FEPAM (Fundação Estadual de Proteção Ambiental Henrique Luis Roessler) in Rio Grande do Sul State, have implemented the monitoring of 27 substances, including mercury. However, requirements for monitoring vary from state to state. Standard value is set at the federal level, but has not been unified the method for sampling and analysis. It may have been carried out in different ways, and there are compatibility issues of data. Further, data reported by the state are not shared by the central government level.

e. Efforts relating to mercury measures by the other donors

There are some efforts by the organizations other than the government as follows.

Table 2-4: Major efforts by organizations other than the government

Organization	Content of efforts
A part of "UNEP Global Mercury Partnership (ASGM) "	Implement the pilot plan of SGM12
US EPA (UNEP Global	Implement the trainings, for preparing mercury inventory, for the

12 UNEP. Inventory of ASGM projects undertaken by partners in the Global Mercury Partnership.

<http://www.unep.org/chemicalsandwaste/Mercury/PrioritiesforAction/ArtisanalandSmallScaleGoldMining/Activities/tabid/4488/language/en-US/Default.aspx>

Mercury Partnership (A part of "MERCURY CONTAINING PRODUCTS PARTNERSHIP AREA") 13	reduction and management of waste, in the medical field
JICA	Implement the projects, for technical assistant of mercury analysis, for enhancing enlightenment capacity for residents, for enhancing clinical diagnostic capability of mercury poisoning (1994-2010) ¹⁴
JICA	Implement the Project for strengthening health surveillance system of methyl mercury in Tapajos river basin (2007-2009) ¹⁵
International mercury lab, Minamata City, Netherlands Institute for Multiparty Democracy (NIMD)	Implement the Project for Strengthening the Health-related Mercury Monitoring in Acre State, Brazil (2011-2014) ¹⁶
Asahi Glass Co., Ltd., Chlorine Engineers Corp., Sumitomo Mitsui Banking Corporation, ERM Japan (Ltd.)	Survey on energy-saving system of caustic soda, chlorine manufacturing process in Brazil (2015)
Germany	Germany donated the facility of recycling the used refrigerators to companies that have been selected. The amount of the project was 5 million euros. With this equipment, it would be possible to separate mercury from refrigerators. ¹⁷
Norway	Under the Norway government support, mercury storage project of UNEP is raised in 2009, analyze the options for the environmentally proper management of surplus mercury. ¹⁸
Brazilian Environmental Justice Network (NGO)	Launched the Global Zero Mercury Campaign. Alerted the risks from mercury, and the necessity of disable mercury to the public. ¹⁹
Association of Environmental Protection Cianorte (APROMAC) (NGO)	Submit the appeal document for requesting the abolition, recovery, proper disposal of mercury thermometers, to the State Sanitary Supervision Bureau. ²⁰
UNEP, MIMA	Implement the Minamata Initial Assessment (MIA)(started in 2015)
MME, IBRD	Planned to implement the project related with small-scale mining (ASM)
CETEM, Alliance for responsible mining	Implement the diagnostic project of ASM (started in 2005).

13 UNEP. MERCURY-CONTAINING PRODUCTS PARTNERSHIP AREA Business plan

14 JICA. (2011) http://www.jica.go.jp/topics/2010/20110127_01.html

15 JICA(2009) <http://www.jica.go.jp/brazil/office/activities/project/01.html>

16 JICA(2014) <http://gwweb.jica.go.jp/km/ProjectView.nsf/4f3700b697729bb649256bf300087d02/992376d84c9195fa492578840079e561?OpenDocument>

17 Ministry of the Environment,

<http://www.mma.gov.br/informma/item/5336-germany-will-donate-5-million-euros-to-brazil-for-refrigerator-recycling>

18 UNEP. (2012) Global Mercury Partnership Business Plan (December 2012) Mercury supply and storage partnership area.

19 Diagnóstico Preliminar sobre o Mercúrio no Brasil (Preliminary Diagnosis on Mercury in Brazil), 2013.

MMA, ABRAEX

Preliminary Diagnosis on Mercury in Brazil (2013)

f. Issues about Mercury Control and Mercury Pollution

f.1 Issues about Legal System Enhancement and Management, and on Administrative Organizations

Brazil is on a stage of preparation for the ratification of the Minamata Convention on mercury. Though it seems to have studied the development and operation of the legal system and the administrative organization, the information of the progress of it was not obtained.

f.2 Issues about Mercury Monitoring System

In Brazil mercury monitoring system, such as water quality and soil, except the atmosphere has been established already. Therefore, in the future there is a need to develop a mercury monitoring systems for air. Issues regarding monitoring, had been mentioned in the report of the Ministry of the Environment, are listed below.

- Requirements for monitoring vary from state to state. The standard value is set at the federal level, but the methods of sampling and analysis have not been unified. It might have been implemented in different ways, there are data comparability problems.
- The monitoring ability is different from state to state. The monitoring capacity of the Environmental Corporation in each state except Sao Paulo is poor.
- The technology of on-site monitoring is not popular.
- Data that have been reported from the state is not shared at the national level.

2.2.2 Uruguay

a. The Usage and Emission/Discharge of Mercury and the Pollution

a.1 Mercury Usage Characteristics

In Uruguay, chlorine production by the mercury process is being carried out in the chlor-alkali manufacturing facilities, which is the subject to regulation of the Minamata Convention. The information about acetaldehyde production, chloride vinyl monomer production, sodium or potassium ethylate, methylate and polyurethane production, have not been obtained.

The environmental pollution by mercury discharged from the chlor-alkali production facility has been confirmed, but the details are unknown. DINAMA is suggesting toward the contaminating source of the chlor-alkali manufacturing facility, for management of contaminated sites and the conversion the technology without using mercury. In case of necessary, DINAMA have to consider the closing factories.

a.2 Emission/Discharge of Mercury and Environmental Pollution

During the survey, the information of that there is no mercury pollution by ASGM because there is no gold mine in Uruguay, was obtained. However, according to the report of the Ministry of the Environment; IPEN (Instituto de Pesquisas Energéticas e Nucleares) and RAPAL (La Red de Acción en Plaguicidas y sus Alternativas para América Latina) had

published a report jointly in November 2012. It said that the survey had been conducted by MVOTMA (Ministerio de Vivienda, Ordenamiento Territorial y Medio Ambiente) in Minas de Corrales City which is the town of gold mine closer to Brazil in 2009. The mercury emission had been estimated from this result as follows.

Table 2-5: Estimated amount of Mercury emissions in Minas de Corrales City (2009)

Air	Water	Process in the gold collecting sector
0.6 kg	1.3 kg/year	1.850 kg/year

In addition, emissions into the atmosphere of mercury (2010) in Uruguay have been estimated as approximately 330kg/ year (minimum: 78kg/ year, maximum: 946kg/ year). It accounts for about 0.02% of the emissions of the entire world (approximately 1,960 tons). The main emission sources are the corruption, the landfill and the non-ferrous metal manufacturing facilities.

Table 2-6: Estimated amount of mercury emission to air (2010 base)

Classification	Source of emission	Emission to air (kg/ year)
target in article 8	Coal-fired power plant	0.00
	Coal-fired industrial boilers	0.34
	Non-ferrous metal manufacturing facility	86.33
	Waste incineration facility	0.36
	Cement manufacturing facility	43.15
Out of target in article 8	Human-powered small-scale gold mining	0.00
	Iron and steel manufacturing facility	0.00
	Chlor-alkali manufacturing facility	70.00
	Petroleum refining facility	1.97
	Natural gas power plant	0.00
	Industrial boiler (petroleum)	2.39
	Industrial boiler (gas system)	2.20
	Cremation	3.44
	Corruption and landfill	114.84
Total		332.93

b. Policy and Legal System

b.1 Mercury Control in National Development Planning

In the report of National Assembly of MVOTMA in 2006, the issue of the development plan regarding the environment was announced. However there was no item on countermeasures against mercury pollution. In the same parliament, it was reported that the national water resource plan and the national water and sewerage plan had been under preparation. But it seemed that there was not item limiting to mercury.

b.2 Basic Law(s) and other related Regulation(s) on Mercury Control

In Uruguay the environmental laws and regulations on mercury management are as follows.

Table 2-7: Environmental laws and regulations related to mercury management (except for the environmental standards and emission standards)²⁰

Name of law	Established year	Major regulations	Competent agency
General Environmental Protection Act (17.283)	2000	Proper treatment of hazardous substances (Article 20: chemicals, Article 21: general waste)	
Domestic bring-your-own laws of hazardous waste (17.220)	1999	Prohibited to bring hazardous waste to domestic	MVOTMA (Ministerio de Vivienda, Ordenamiento Territorial y Medio Ambiente)
Decree 349/005	-	Environmental impact assessment and environmental approval	
Decree 307/008	-	Minimum protection to protect the workers who are exposed to the risk of chemical substances	
Standard	2003	Leachate test from the landfill (Mercury: 5mg/L)	Environmental Technology Committee

b.3 Standard(s) on Mercury Emission/Discharge

Water quality environmental standards are defined in the Decree No253 / 79.

Waters are classified into five classes from Class 1 to Class 4. And there are each acceptance criteria are determined.

Table 2-8: Classification in water quality environmental standards

Class 1	Water available for supplying drinking water by simple processing (primary treatment)
Class 2a	water available for irrigation and watering for vegetables and fruit trees
Class 2b	Water available for recreation, which people can contact with directly
Class 3	Water available for fish in general, protection of other aquatic plants, animals, irrigation of crops and irrigation of non-cultivated land
Class 4	Water which should be maintained the water quality in harmony with the surrounding environment after flowing down the urban areas, water available for irrigation to non-crop

²⁰ Report of Ministry of Environment in Japan

Table 2-9: Water quality environmental standards for mercury

Parameter	Class 1	Class 2a	Class 2b	Class 3	Class 4
Mercury (mg/L)	0.0002	0.0002	0.0002	0.0002	0.002

Industrial wastewater regulations have been determined for each discharge destination (sewer, surface waters, underground seepage) in Decree No.253 / 79. DINAMA is jurisdiction over the followings; approval of industrial wastewater, registration of full-time person, improvement request, on-site inspections, and the application of penalties for violation. The effluent standards are showed in below table.

Table 2-10: Emission standards of mercury (Unit : mg/L)

Drainage	River water	Public sewer	Surface waters	Underground seepage
0.005	0.005	0.005	0.005	0.05

c. Organization(s) and System(s) on Mercury Control

c.1 Administrative Organizations for Mercury Control

DINAMA is the competent authority of the environment sector in Uruguay. Authority of the comprehensive and wide range of law enforcement in water quality control administration is given to DINAMA by Decree No.257 / 997. In addition to the DINAMA, DINASA (Dirección Nacional de Agua y Saneamiento), DNH/ MTOP (Dirección Nacional de Hidrografía / Ministerio de Transporte y Obras Públicas), OSE (Obras Sanitarias del Estado), Nomakisho Natural Resources Directorate (Dirección General de Recursos Naturales Renovables: RENARE (Dirección General de Recursos Naturales Renovables) MGAP (Ministerio de Ganadería, Agricultura y Pesca), many government agencies are involved in water quality management.

Law No.9515 in Article 35 of, it is mentioned that the prefecture has the responsibility for maintain the conditions of hygiene in jurisdiction. With regard to environmental management, Decree No.253 / 79 in Article 31, it is set that DINAMA has to be able to order the necessary measures for the province. Law No.17283 in Article 8, DINAMA is able to transfer some of its water quality management services to local government. Law No.9515 in Article 35 of, it is mentioned that the prefecture has the responsibility for maintain the conditions of hygiene in jurisdiction. With regard to environmental management, Decree No.253 / 79 in Article 31, it is set that DINAMA has to be able to order the necessary measures for the province. Law No.17283 in Article 8, DINAMA is able to transfer some of its water quality management services to local government.

OSE and DNH, are involved in water quality management in terms such as construction and operation of water and sewage facilities, quantitative monitoring of water resources.

c.2 Implementing System of Mercury Monitoring

Since DINAMA was established in 1990, it has implemented a water quality monitoring

under various plans and programs. But, in recent years, these activities have been shrinking because of the financial reasons mainly. Water quality monitoring plan of the river has been carried out as "5.2 Design and Execution of Water Quality Monitoring" of the "Water Quality Report December 2004 to April 2005". In cooperation with the local governments, water quality monitoring is being carried out every two months in the Santa Lucia River Basin and Pando river basin. Water quality monitoring is being carried out approximately every three months in the other rivers. Incidentally, the parameter of monitoring is not only mercury. IMM (Intendencia de Montevideo) has launched a water quality monitoring survey as one of the components of the "city health plan" in early 1999 with hiring a consultant. This monitoring has been implemented as IMM's own activities since the summer of 2002. The content is a six times a year of campaign (summer three times, winter three times). In this campaign, the flow rate of the river has also been measured simultaneously. From 1999 to 2001, the monitoring in the totally 33 points of, 4 rivers (Pantanoso stream, Miguelete stream, Carrasco stream, Las Piedras stream) and Montevideo Bay, had been carried out. In 2002, 1 point of Carrasco stream basin was added to the above monitoring points in order to understand the impact of industrial waste water. All analytical work had been carried out in the Analytical Laboratory of Punta Carretas.

d. Efforts relating to mercury measures by the other donors

IDB had supported the development of environmental information system in 2011.

The following projects related to mercury with the support of international organizations have been carried out.

Table 2-11: Efforts related to mercury by international organizations

Gestión Ambientalmente Adecuado del Ciclo de Vida de los Productos que Contienen Mercurio y sus Desechos ²¹	
Donor	UNEP
Period	2011-2015
Outline	<p>The purpose of project was protection of human health and environmental. It ended in 2015. Regarding handling mercury, the following three activities were carried out.</p> <p>① Enhancements of regulation and support of policy regarding proper LCM of the products and waste including mercury</p> <p>② Introduction of alternatives way in products containing mercury with the aim of mercury zero.</p>
Wide-area projects, for minimizing mercury waste, and processing non-load toward environment, in Latin America and the Caribbean region (Uruguay, Argentina, Costa Rica)	
Donor	Basel Convention Regional Centre for the Caribbean Region
Period	2009-2010
Outline	This inventory were summarized of the release of mercury in the industrial sector in 2009

²¹ UNDP. (2014) Gestión Ambientalmente Adecuado del Ciclo de Vida de los Productos que Contienen Mercurio y sus Desechos
<http://www.uy.undp.org/content/dam/uruguay/docs/Prodocs/URU%2013%20G32%20Mercurio.pdf>

	Data collection on the detection of mercury contaminated site was implemented. The study, mercury emissions inventory tool 2010 of UNEP was used in order to quantify the current mercury emissions situation.
	Steering Committee consisting DINAMA (Chair), AUCI, MSP, UNDP
Donor	GEP/UNEP (Basel and Stockholm Convention Regional Centre)
Period	January 2014-
Outline	This project had started because Uruguay ratified the Minamata Convention in 2014. The initiated plan was in January 2014, but began the activity in October 2014. Two analytical instrument for total mercury analysis were purchased by the project funds (made by DMA800 Milestone, Inc.). In this center, the recovery, transportation, proper treatment, storage, of waste fluorescent lamps had been examined. Also mercury discharged from dental hospital had also been examined.

e. Issues about Mercury Control and Mercury Pollution

e.1 Issues about Legal System Enhancement and Management, and on Administrative Organizations

Uruguay signed the Minamata Convention in October, 2013 and ratified it in September, 2014. However the countermeasure has been considering after ratification. The issues are review and maintenance of the legal system and administrative organizations with considering the entry into force of Minamata Convention.

e.2 Issues about Mercury Monitoring System

The planning survey for strengthening of the water quality management in Montevideo metropolitan was conducted in 2007. As a technical cooperation project, "Project on Water Pollution Control and Management of Water Quality in the Santa Lucia River Basin (2008-2011)" had been implemented. The mercury monitoring system has been established by JICA assistance. Therefore there is no systematic problem with organization and equipment. The network of environmental laboratory which is linking with multiple analysis agencies has been established. The future issues are strengthening its network, and strengthening the capacity of the entire Uruguay.

2.2.3 Nicaragua

a. The Usage and Emission/Discharge of Mercury and the Pollution

a.1 Mercury Usage Characteristics

It is said that the chemical factory which had been operating from 1967 to 1991, in Miraflores Gulf of southeast side of Managua Lake, discharged approximately 40 tons of mercury into the Managua Lake. It has also been confirmed that the spring water containing mercury is gushing from the bottom of the lake originally from the Momotombo volcano in the northeast side of Managua Lake. There is possibility that mercury which is used for refining of gold in small-scale gold mine flow into Managua Lake through Viejo River and Shinecapa River.

b. Policy and Legal System

b.1 Mercury Control in National Development Planning

In Nicaragua, the National Water Act (Act No. 620) was enacted in September 2007, in order to clarify the legal framework of the institutional aspects for the management, conservation, development and sustainable use, of water resources. In addition, the Enforcement ordinance consisting of 25 Chapters 119 Articles was enacted for implementing the National Water Act. "General law for environment and natural resources (Law No. 217)" was enacted as a law on the environment in general in 2006. This law is composed of 4 Articles 166 Sections. The matters related with water environment have been defined in from Article 82 to Article 89.

b.2 Standard(s) on Mercury Emission/Discharge

b.2.1 Environmental Standard

In Nicaragua type of water usage has been classified as follows, Managua Lake is a "non-contact recreation" of the 4-B types.

Table 2-12: Type of water usage in Nicaragua (Unit: mg/L, MNP 100/mL)

Type	Purpose of use	DO	BOD	Heavy Metals	coliform bacteria (MPN)	Phenol
1	Drinking water, bathing					
1-A	With treatment of disinfection	>4.0	<2.0	9 parameters*	<2000	<0.002
1-B	With treatment of filtration, coagulation and disinfection		<5.0		<10000	<0.002
2	Irrigation					
2-A	Irrigation water for crops which human eat			18 parameters**	<1000	
2-B	Irrigation water for other crops				<5000	
3	Farming of fish and shellfish which human eat	>5.0			<70 10% of sample: <200	<0.002
4	Recreation (swimming, fishing, water sports)					
4-A	Contact recreation	>5.0			90% of sample: <1000 10% of sample: <5000	<0.002
4-B	Partial-contact recreation				80% of sample:	

					<5000 20% of sample: <10000	
5	Industrial water					<0.002
6	Ship navigation, hydroelectric power generation	>3.0				
* Fr, Hg, Pb, Zn, Cu, Cr, Mn, Ag, Se						
** Al, As, Ba, B, Cd, Cu, Cr, Fe, Li, Mn, Hg, Mo, Ni, Ag, Pb, Se, V, Zn						

In Nicaragua, the public water has been classified in to 6 types depending on usage.

In class 1 and 2, the standard values of heavy metals are defined. The environmental standard value of mercury is as follows.

Table 2-13: Standard value of heavy metals in class 1 & 2

	Class 1		Class 2
Parameter	1A	1B	2A, 2B
Total Hg (μ g/L)	0.01	0.1	0.1

b.2.2 General Effluent Standard

The drainage regulation has been set by the general effluent standards in Decree 33-95. As general effluent standards, the standard values of pH, eutrophication substance, and heavy metals (29 parameters) have been enacted. Some items of the criteria are established separately for the businesses such as a sewage treatment plant and the sugar factory. The following is the general drainage standards of mercury.

Table 2-14: General drainage standards of mercury

Parameter	Standard value
Total Mercury	0.02 mg/L

c. Organization(s) and System(s) on Mercury Control

c.1 Administrative Organizations for Mercury Control

As the administrative organization of the mercury measures, there are the National Water Directorate (Autoridad Nacional del Agua (ANA)), the Ministry of Environment and Natural Resources (Ministerio del Ambiente y los Recursos Naturales (MARENA)), Ministry of Energy and Mines (Ministerio de Energía y Minas (MEM)), the Ministry of Health (Ministerio de Salud (MINSa)), the Ministry of Agriculture (Ministerio Agropecuario (MAG)), Nicaragua Water Supply and Sewerage Corporation (Empresa Nicaragüense de Acueductos y Alcantarillados (ENACAL)). In 2014, hazardous substances registration and management committee (Comisión Nacional de Registro y Control de Sustancias Tóxicas (CNRST)) was established. It is planned that MARENA, MINSa and MEM would work

cooperatively for mercury measures under the supervise of CNRCST. Despite of that the necessity of consideration for the waste in the site of gold mining has been understood, specific efforts is not planned yet.

c.1.1 *Autoridad Nacional del Agua (ANA)*

Based on the National Water Act of 2007, ANA has been established in 2010 as the policy development engine regarding water resources under the National Water Resources Council which is the highest decision-making organization of water resources.

Based on the National Water Act of 2007, ANA has been established in 2010 as the policy development engine regarding water resources under the National Water Resources Council which is the highest decision-making organization of water resources. The salary of the staff is paid from government, but it is prerequisite that their activities would be made cooperatively with the other agencies like a donor. Though its organizations have been established, required personnel have not been arranged. It is difficult for them to perform their duties stipulated by law.

c.1.2 *Ministerio del Ambiente y los Recursos Naturales (MARENA)*

MARENA is the policy/ institutional development agency for conservation, protection, improvement, sustainable utilization of the environment and natural resources. It has implemented environmental management on the basis of the "Environment and Natural Resources Law". But this agency has not conducted water quality monitoring by itself. It has estimated the current state of water quality on the basis of the result of the drainage inspection research carried out by the other ministries businesses. But it doesn't know about mercury consumption of the country. Though MANERA has obtained the information of mercury contamination in fish in Managua lake, river by the small-scale gold mining, it have not yet considered to understand the current situation and to take concrete measures.

c.1.3 *Ministerio de Energía y Minas (MEM)*

MEM is in charge of the environmental impact assessment associated with energy development and mine development. Because the small-scale gold mining business is outside the scope, MEM has not understood the actual number of the business. It has information about the efforts of mercury use abolition which large-scale gold mining and refining companies proposed to small-scale gold mining businesses. It is promoting the transition from fluorescent lamp to incandescent light bulb, but it has not considered the recovery of mercury in fluorescent lamps.

c.1.4 *Ministry of Health (Ministerio de Salud (MINSAL))*

CDNR (Centro Nacional de Diagnóstico y Referencia del Ministerio de Salud)/ MINSAL is doing the management of hygiene of water to be used as drinking water for the residents. ENACAL is monitoring the water quality of the water source, which ENACAL is utilizing for supplying. MINSAL is regularly monitoring the water quality of personal tube wells because the poor people around Managua Lake are taking for drinking. Regarding mercury, MINSAL has plan to carry out the inspection of fish which directly links to health damage in the future. For this purpose, MINSAL purchased the mercury analyzer (DMA-80) in 2014 and it has been trying to operate it while joining the activities of the JICA project for

CIRA/UNAN.

Table 2-15: Mercury Analyzer in MINSA

Parameter	Analytical Method	Type of analyzer
Total Mercury	Mercury Analyzer	Milestone, Inc. DMA-80

c.1.5 Ministerio Agropecuario (MAG)

MAG is the government agency which formulates policy and systems related to agriculture, animal husbandry, and forestry. Since there is no criteria related to agricultural water, MAG is related to the mercury management from the point of view of pesticide management containing mercury. For the agriculture, the river water which flows to Managua Lake, rain water and ground water are used in the area around the Managua Lake. MAG does not have any concern about the water quality of Managua Lake. MAG has been managing the pesticides based on the law from 1994. Though the pesticides currently containing mercury is not used, MAG has not understood the extent of the pesticide containing mercury had been used in the past.

c.1.6 Empresa Nicaragüense de Acueductos y Alcantarillados (ENACAL)

ENACAL was established as the administrative organization of water supply and sanitation facilities to the urban areas in 1998. Based on the standards of drinking water, it conducts water quality management of drinking water. ENACAL had discharged the untreated sewage of Managua city into the Managua Lake, until the sewage treatment plant was constructed in Managua lake shore in the eastside of Managua city in 2009. After the construction of sewage treatment facilities, ENACAL has been implementing the water quality survey of, 7 points of waters in front of sewage treatment plant, four times a year, in order to check the water quality improvement effect of Managua Lake by the sewage treatment.

Table 2-16: Mercury Analyzer in ENACAL

Parameter	Analytical Method	Type of analyzer
Total Mercury	Atomic absorption spectrophotometry	PerkinElmer AAnalyst 300 Series

c.1.7 Centro para la Investigación en Recursos Acuáticos de Nicaragua/ Universidad Nacional Autónoma de Nicaragua (CIRA/UNAN)

CIRA is the Institute which was founded in 1980 as an object of the water resource conservation research and the provision of information for policy development support based on the research in Nicaragua and the Central American region, belongs to Nicaragua Autonomous University. This center consists from the management unit, the analysis unit, the technology and quality control unit, research and development unit and education unit. The research and development unit, which is providing the main activities, consists 9 research departments (waste water analysis, environmental water analysis, hydrogeological, metal analysis, organic compound analysis, mercury analysis, microorganisms, aquatic organisms,

environmental radioactivity). CIRA also accepts students from the University, focus on education as well as research. One of the notable features of CIRA/ UNAN, there is an environmental mercury laboratory (Laboratorio Mercurio Ambiental) to deal with only mercury. This laboratory has activities focused on kinetic studies of mercury in the environment. General Manager and five staff are engaged in research activities. CIRA owns one the cold vapor atomic absorption spectrometer (HG3500 type, for liquid sample), and one heating vaporizer atomic absorption spectrometer (DMA-80, for solid sample) separately. Besides, for methyl mercury analysis, CIRA has one ECD-GC (manufactured 6890 Model Agilent Technologies). Also there is a track record that CIRA has carried out the analysis of total mercury in soil, sediment and seafood.

Table 2-17: Mercury Analyzer in CIRA/UNAN

Parameter	Analytical Method	Type of Analyzer
Total Mercury	Cold vapor atomic absorption spectrometer	(For Liquid sample) HG3500 type
	Heating vaporizer atomic absorption spectrometer	(For solid sample) Milestone Inc. DMA-800
Methyl Mercury	ECD-GC	Agilent 6890 type

c.2 Implementing System of Mercury Monitoring

Currently, with focused on CIRA / UNAN, the project for mercury research and capacity building of analysis has being carried out Through this project activity, methyl mercury, which becomes a major cause of health damage, has been supposed to be changed from inorganic mercury by the action of microorganisms in the sediments and lake. Therefore it is necessary to pay attention to the change in the concentration of mercury contained in lake water, sediment and fish. In addition, the new inflow of mercury from gold mining, and the changes in pollution points due to the movement of the fish might be occurred also. In order to prevent the occurrence of health damage, it is necessary to set the effective monitoring point based on the preliminary survey, and update the information while measuring to some extent over time. Through the activities of JICA project, technical support of method of monitoring plan and implementation procedure have been provided also to MANERA and MINSA.

d. Issues about Mercury Control and Mercury Pollution

d.1 Issues about Legal System Enhancement and Management, and on Administrative Organizations

Nicaragua ratified the Minamata Convention in October 2014. However, the policy planning and legislation development which are necessary for applying the environmental standards of mercury and implementing this convention, have not been carried out specifically, and the action plan is absent. Therefore, it is expected that the relevant agencies (ANA, MANERA, MINSA, etc.) would cooperate, while CNRCST playing key role, towards the development of legal system. It is desirable to prepare the guidelines relating to mercury measures. But collecting and sharing information regarding pollution situation, and its diagnosis are deemed more necessary ahead, in order to prepare the national implementation plan like a policy

planning and legislation development.

d.2 Issues about Mercury Monitoring System

Nicaragua has the problem of mercury pollution in Managua Lake, because the factory (Pennart) had discharged wastewater containing Mercury during the 1970-1980's. Also pollution caused by gold mining industry to the same lake has been concerned. It has been known that water of Managua Lake flows into Lake Nicaragua in case of flood. ENACAL (Nicaragua Water Supply and Sewerage System) uses the water of Nicaragua Lake as a water source. Therefore, it is important to continue the monitoring of water quality. It is also necessary to conduct risk management and risk assessment of chemical substances. It is expected that the mercury monitoring system would be established, while centered on the CIRA / UNAN, along with the related organizations, through the activities of the JICA project which is currently being carried out for CIRA/UNAN.

3 Possibility of application and development of Japanese technology regarding countermeasure on mercury pollution

3.1 Japanese technology seeds of Mercury control and the main source of mercury emission in the target countries

In Minamata Convention, Stationary combustion facilities (Coal-fired power plants, coal-fired industrial boilers, etc.), non-ferrous metals production facilities, waste combustion treatment facilities, cement production facilities are selected as the target facilities, which are the source of Mercury emissions to atmosphere. Regarding start of new facilities, it is required to apply both the Best Available Techniques (BAT) and the Best Environmental Practice (BEP). On the other hand, Ministry of Environment in Japan made a result report divided into 8 parameters in the Mercury control technology seeds research; (1) mercury-free and low-mercury-containing product manufacturing, (2) mercury-free manufacturing process, (3) atmospheric emissions management of mercury, (4) water of mercury and soil release management, (5) the proper management and disposal of mercury waste, (6) small-scale gold mining (ASGM), (7) mercury monitoring and inventory creation, (8) others. It is considered that these technology seeds correspond BAT/BEP which are mentioned above.

Table 3-1 shows Hg by-product emission in target countries. Though the detail estimated value of 2010 was published by AMAP / UNEP in Technical Report (2013), there is no difference in the composition ratio of emission sources. Each total amount of Hg by-product emission from “stationary combustion facilities” and “cement production facilities” are exceeded 10,000kg, and these facilities exist in all target countries. Therefore, it will be described in the below about Mercury control technology seeds of Japan against these 2 types of facilities..

Table 3-1: Hg by-product emission (kg)

Source of Emission	Brazil	Nicaragua	Uruguay	Indonesia	Malaysia	Philippines	Thailand	Vietnam	Total
Stationary combustion	4,825	9	21	3,338	2,918	1,995	6,084	2,980	22,170
Non-ferrous metals production	3,605	0	0	1,315	0	858	576	0	6,354
Ferrous metal production	1,265	0	2	112	248	14	212	31	1,884
Cement production	2,936	48	88	2,960	1,432	1,040	3,032	2,320	13,856
Large-scale gold production	1659	0	73	5,649	169	1,510	177	121	9,358
Caustic soda production	1,805	0	0	0	0	0	0	0	1,805
Total	16,094	57	184	13,374	4,767	5,417	10,081	5,452	55,426

Source : Technical Background Report to the Global Atmospheric Mercury (AMAP/UNEP, 2008)

3.2 The application of Japanese technology regarding Stationary combustion and Cement production facilities

“Stationary combustion facilities” and “Cement production facilities” discharge gaseous and particulate mercury into the atmosphere through the process of combustion and firing of raw materials. The source of mercury of former is structurally boiler, and the latter is kiln. As it was mentioned in the previous section, the management of atmospheric emissions and creation of mercury monitoring inventory are essential in order to apply the Japanese technology seeds against Mercury pollution. Table 3-2 shows these technology seeds.

Table 3-2: Applicability of Japanese technology

(1) Atmospheric emissions management

Technology classification	Name of Technology
For Gaseous Mercury	Chelate injection type scrubber
	Halogen injection and desulfurization ORP control
	Activated carbon adsorption tower
	Activated carbon spray
	Mercury oxidation catalyst
For Particulate Mercury	High-performance dust removal system
	Denitrification, electrostatic precipitator and desulfurization

(2) Creating mercury monitoring inventory

Technology Classification	Name of Technology
Measurement Technology of Mercury Concentration	Exhaust gas in the mercury concentration continuous measuring device
	Exhaust gas and ambient air mercury concentration continuous measuring device
	Exhaust gas and ambient air mercury concentration measuring device
	Liquid / gas sample in mercury measurement device
	Reduction vaporization mercury measuring device
	Heating vaporization mercury measuring device
	Mercury automatic measuring device
	Portable mercury assumed equipment
Know-how	Creating Method of material flow related to mercury <ul style="list-style-type: none"> ● The amount of domestic use contained in the raw fuel, etc. ● The amount of movement to the other countries by export, etc. ● The amount of emissions to the environment ● The amount of final disposal
	Methods of risk assessment, risk management and risk communication

Of the atmospheric emissions management technology, Suppression technology of mercury using activated carbon is the most proven method in Japan. It is said that the expected removal rate of mercury is 70-90% in the activated carbon spray, and more than 90% in activated carbon adsorption tower, generally. Since the Mercury monitoring is the main target of this survey, it will be described in detail in the following section.

3.3 Technology of Mercury monitoring

In this report, "Environmental monitoring" is defined as that "to observe the environmental situation in certain regions or fixed point, continuously in a certain way". Therefore its activities are different from "environmental management" which is to take countermeasures to let the measured value meet the criteria. It also differs from "environmental inspection" which is to understand the situation, state by measuring the environmental samples. This definition is also applied to the mercury monitoring, and it will be mentioned below.

3.3.1 Classification of mercury in the environment

Mercury is the chemical form, it is roughly divided into metal mercury and mercury compounds. Among mercury compounds are classified into an inorganic mercury and organic mercury by the presence or absence of carbon contained in the skeleton structure. In general, in case of mercury monitoring in the environment, it is often measured as "Total mercury" and "Methyl mercury". "Total mercury" is indicated the total amount of metallic mercury and mercury compounds. "Methyl mercury" is one of alkyl mercury, causes the Minamata disease (Figure 3-1). In case of the concentration of Total mercury is not high, it is considered that the concentration of Methyl mercury is also not high. Conversely, if the measured concentration of total mercury is high, considering the influence on the human body, it is preferable to perform the concentration of methyl mercury. Since mercury analysis is low concentration analysis, Quality Assurance and Quality Control is highly required for appropriate sampling, pre-treatment, measurement methods, and preparation of test solution in order to obtain reliable analysis data.

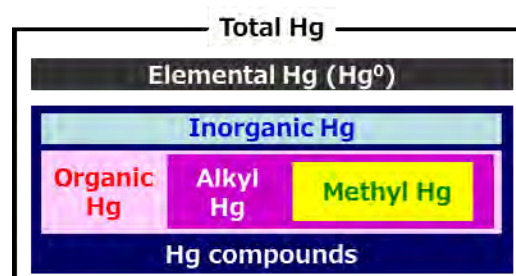


Figure 3-1: Relationship of total mercury and methylmercury

3.3.2 Current status of mercury monitoring in Japan

In Japan, in order to prevent mercury pollution in the environment and to achieve the preservation of human health protection and living environment, a variety of countermeasures based on environment-related legislation have been promoted. As environmental medium to cause pollution of mercury, the environmental standard for water quality has been set. It is the national uniform as the reference, which should be maintained and achieved, in the public water and groundwater. In order to ensure it, the drainage regulations and underground seepage regulations has been carried out for the factories and business establishments. In addition to the criteria of the national uniform for effluent standards, in necessary case, local government is established a more stringent standards to prevent mercury pollution in the

environment, and implement countermeasures to promote the conservation of human health protection and living environment. With determining the environmental standards for soil, the soil content standards and soil elution standard amount are determined based on the Soil Contamination Countermeasures Law, it has been promoted a variety of research and countermeasures (Table 3-3). Regarding atmosphere, the guideline value, this pursuant to environmental standards, is defined in order to reduce health risks. Reduce of emissions has been carried out by businesses voluntary. By the chemical release and transfer amount notification system based on the law (PRTR system), business which deal with mercury and its compounds by a chemical substance, are required especially to report the emission amount to the environment and the movement amount included in waste. Moreover, a standard for Alkyl mercury has been established as "Not detectable" in environmental standards and emission standards.

Table 3-3: Japanese environmental and emissions standards on mercury

Target	Overview of Reference Value	Name of Basis Laws
Air	Guideline value : Under 40ngHg/m ³ as Mercury (Mercury vapor)	Air Pollution Control Act
Public waters	Environmental standard : Under 0.0005mg/L as Total Mercury	Basic Environment Law
	Wastewater standard : Under 0.0005mg/L	Water Pollution Prevention Law
Ground water	Environmental standard : Under 0.0005mg/L as Total Mercury	Basic Environment Law
	Requirements of underground seepage regulation : Not detectable	Water Pollution Prevention Law
	Cleanup standard : Under 0.0005mg/L	Water Pollution Prevention Law
Soil	Environmental standard : Under 0.0005mg/L as Total Mercury per liter of Test solution	Basic Environment Law
	Elution standard : Under 0.0005mg/L	Soil Contamination Countermeasures Act
	Content standard : Under 15mg/kg	

Table 3-4 shows the results of mercury monitoring in fiscal 2011 which is an excerpt from materials of the Ministry of the Environment. Regarding air in 1998 fiscal year or later, there is no point that exceeded the guideline values. It should be noted, 1 point of exceeding reference value in public waters is caused by mercury derived in nature.

Table 3-4: Mercury monitoring results (2011)

Target	Results of Monitoring	Frequency
Air	Average concentration : 2.1ngHg/m ³ Maximum concentration : 5.3ngHg/m ³ No. of Exceeded Reference Value : 0/261poits	Once a month
Public water	Average concentration : 2.1ngHg/m ³ Maximum concentration : 5.3ngHg/m ³ No. of Exceeded Reference Value : 0/261points	Approximately Once a month
Ground water	No. of Exceeded Reference Value : Overview research (0/2908points) Area survey surrounding polluted wells (3/75 points)	Approximately Once a month

	Continuous monitoring survey (24/107points)	
Soil	Average concentration : 2.1ngHg/m3 Maximum concentration : 5.3ngHg/m3 No. of Exceeded Reference Value : 0/261points	Once a year

3.3.3 Application and development of Japanese technology regarding Mercury monitoring for the target countries

a. The current situation of Hg analysis in target countries

a.1 Total Mercury

At the moment, configuration of the analyzer in the measurement of total mercury is roughly classified into two parts. One is apparatus part for vaporizing the mercury in the sample, the other is the device unit to quantify the vaporized mercury.

In addition, the former is classified into two methods; "reducing vaporization method" and "heating vaporization method". The latter is also classified into two; "atomic absorption method" and "atomic fluorescence method". In other words, quantitative instrument of total mercury is divided into four by a combination of these (① ~ ④ in Figure 3-2).

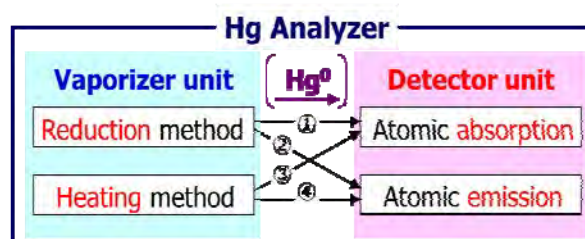


Figure 3-2: Type of total mercury analyzer

In the principle type mentioned above, reduction vaporized + atomic absorption method (①) has been the mainstream of mercury analysis from the 1960s. Therefore all of the target eight countries own this type of analyzer. On the other hand, heating vaporization + atomic absorption method (③) has been adopted recently because its operation is simple. Particularly it is advantage for solid samples (soil, sediment, plants, fish and shellfish, etc.). Moreover, since US Environmental Protection Agency (USEPA) has set this method as an official method, this method tends to be spread widely. It is said that the quantitative sensitivity by atomic fluorescence Method (② and ④) is 10 times higher than the atomic absorption Method. But it is not required to quantify very small amount of mercury, and this instrument should be installed in high clean indoor environment. Therefore it is not many that the target countries apply this method. Table 3-2 shows T-Hg Analysis Methods adopted by target countries.

Table 3-5: T-Hg Analysis Methods adopted by target countries

System	Merit	Countries adopting
① Reduction + AAS	General purpose	All
② Reduction+ AES	Low Hg conc. samples	Thailand (PCD*) , Philippines (EMB**)
③ Heating + AAS	Advantage for solids	Nicaragua, Uruguay, Brazil, Thailand, Indonesia

④ Heating+ AES	Advantage for trace amounts like air samples	Thailand (ERTC***)
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*PCD : Pollution Control Department

**EMB : Environment Management Bureau

***ERTC: Environmental Research Training Center

For air analysis, it is common to measure in the same way as water samples after absorbing/ concentrating mercury in the air sample to the absorbing solution.

However, recently the gold amalgam method, which is the method of measurement by heating vaporization of mercury in air sample after collecting it by using collection tube as gold amalgam, has been universal. This method is also used for the activities of Thailand is Asia Pacific Ocean Monitoring Network (below, APMMN). ERTC in Thailand collects air samples by this method and sends them to the university in Taiwan for analysis as one of APMMN activities. At the same time, ERTC has been trying to analyze the same sample by using the type of equipment of the "heating vaporization + atomic fluorescence" (④ in Figure 3-2) by themselves.

a.2 Methyl Mercury

For Methyl mercury analysis, the measurement method by using the equipment, which is combined Gas Chromatograph (GC) and Electron Capture Detector (ECD), is common. Besides, it is required to repeat extraction of the sample by organic solvent as a pretreatment of this method. Since this procedure of pretreatment is very complicated, a contamination or losses of the solvent are easily happened during the pretreatment. It means that, in obtaining an accurate analytical data, methyl mercury analysis is more difficult than Total mercury analysis. Moreover, since organic solvent is used for the pretreatment, it is required to reduce the effect on the health of analysts. For this purpose, it is necessary to set up suitable working environmental conditions like exhaust equipment and to pay attention on treatment of the waste organic solvent which is occurred during the pretreatment.

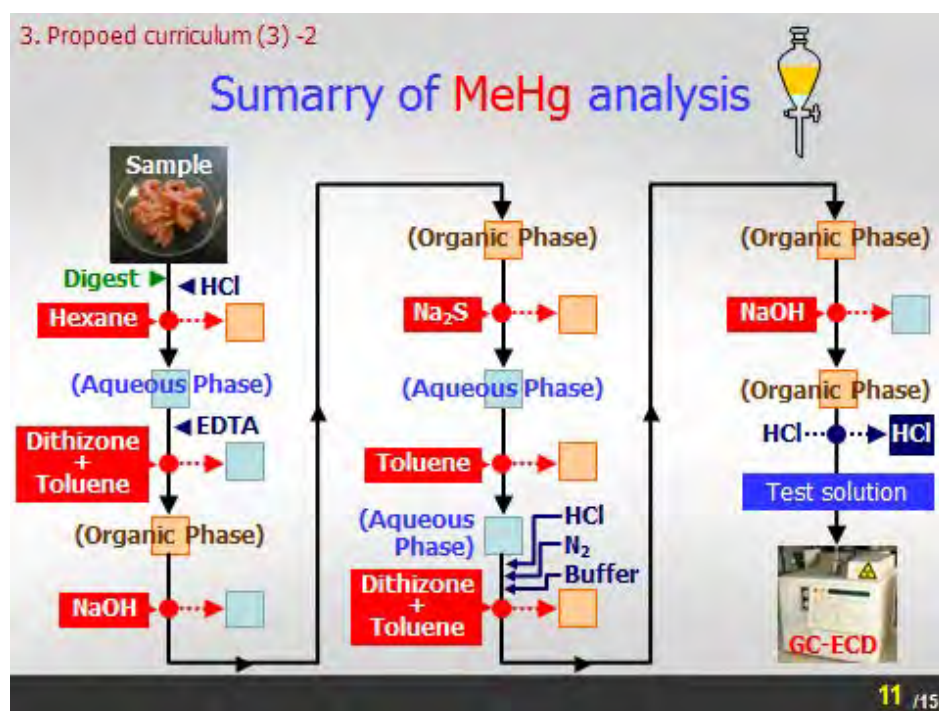


Figure 3-3: Conventional analytical method of methyl mercury (Excerpt from the explanatory material of Study Team)

In Brazil, Uruguay, Nicaragua and Malaysia from the target eight countries of this survey, there is analysis track record of methyl mercury. In 3 countries of Latin America, the method of GC-ECD is applied through the Japanese technical cooperation project. At the laboratory of DOH in Malaysia, the advanced method of the measurement by using Inductively Coupled Plasma - Mass Spectrometry (ICP-MS) after separating methyl mercury by High-Performance Liquid Chromatograph (HPLC), is used.

On the other hand, in Japan, “the manual of mercury analysis (March, 2004)” has been issued by the Ministry of Environment. In this manual, the sampling method and measurement method are described in detail, and the heating cold vapor atomic absorption spectrometry method (for total mercury analysis) and the GC-ECD method (for alkyl mercury analysis) has been designated as the official measurement method.

a.3 The correspondence against environmental media and the establishment of standard value in each country

Table 3-6 shows the summary of the situation of mercury monitoring in target countries. In Malaysia, Uruguay, Brazil and Nicaragua, the mercury monitoring in only water is operated. Department of Environment, under the Ministry of Natural Environment in Malaysia has disclosed the result of monitoring on their website (Figure 3-4). Regarding mercury monitoring in air, Indonesia, Vietnam and Thailand collect mercury samples in air and send them to Natural Central University in Taiwan for analysis as one of activities of APMMN. On the other hand, in three countries of Latin America and Malaysia, they can analyze methyl mercury. However, the former is still incomplete monitoring systems, and the latter is measuring the concentration of mercury in the food, for the purpose of checking (not

monitoring).

Table 3-6: Situations of Mercury monitoring in the target countries

	Total Mercury				Methyl Mercury
	Air	Water	Soil	Bio	
Indonesia	○	△	△	×	×
Vietnam	○	△	×	△	×
Philippines	×	△	×	×	×
Malaysia	×	●	×	△	△
Thailand	○	△	△	△	×
Uruguay	×	●	△	△	△
Brazil	×	●	△	×	△
Nicaragua	×	●	△	△	△

● : Conduct monitoring in the country

○ : Conduct monitoring by requesting analysis to the other countries

△ : Analysis is possible, but monitoring is not implemented

×

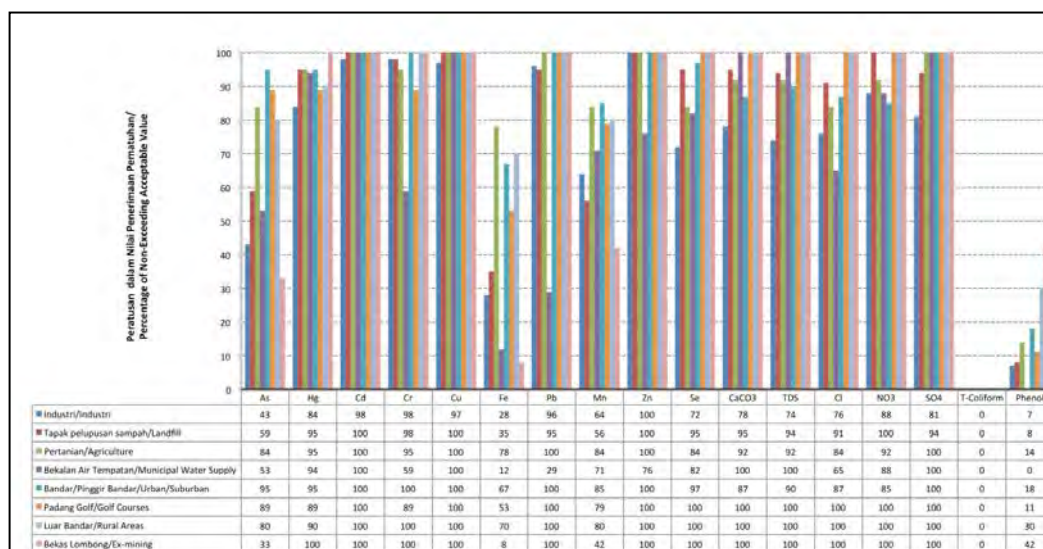


Figure 3-4: Publication of monitoring results by Malaysia DOE

(<http://www.doe.gov.my/portalv1>)

Table 3-7 shows the summary of the status regarding standard value in each country. The detail information is given in annex.

Table 3-7: Setting status of the reference value for mercury in the target countries

	Environment Standard			Emission Standard	
	Air	Water	Soil	Air	Water
Indonesia	×	○	○	○	○
Vietnam	○	○	×	○	○
Philippines	×	○	×	○	○
Malaysia	×	○	×	○	○
Thailand	×	○	○	○	○
Uruguay	×	○	×	○	○
Brazil	×	×	×	×	○
Nicaragua	×	○	×	×	○

Each country had set up the effluent standard value of mercury in the early stage, like Malaysia did it in 1970, because it was concerned that the environmental pollution and health damage would be caused by mercury contained in industrial wastewater. The almost countries have set up also the environmental standard value of mercury in water quality. However, the environmental standard value of mercury in air has been set in only Vietnam. In Vietnam, allowed concentration of hazardous substances was defined in 2009, based on the standard method (Standards Law, 2006). The standard value of Mercury in soil, which hardly cause health damage directly to human body, is set for agricultural land and settlements in Thailand only.

b. Application and development of the Japanese mercury monitoring technology

Based on the survey results mentioned above, Table 3-8 shows the application and development of the Japanese mercury monitoring technology.

Table 3-8: Applicability of Japanese technology

(1) Technical Issue

Learning technology	Applicability of Japanese technology
Method of sampling and pretreatment of environmental samples	<ul style="list-style-type: none"> • Air: Method of collecting mercury as gold amalgam • Bio: Separation extraction method of methyl mercury
Mercury analysis by quantitative equipment	<ul style="list-style-type: none"> • Air: Heating vaporization - atomic absorption method/ atomic fluorescence method • Bio: GC-ECD method, HPLC-ICPMS method for Methyl mercury • Maintenance method of analytical equipment
Quality control	<ul style="list-style-type: none"> • Validation method of analysis data • Preparation method of Standard Operating Procedure (SOP)

(2) Institutional issues

Learning technology	Applicability of Japanese technology
Operation and maintenance	<ul style="list-style-type: none"> • Planning method of funding for the lab management

method of laboratory	<ul style="list-style-type: none"> • Procurement method of equipment and consumables • Securement and education of human resources
Planning method of mercury monitoring	<ul style="list-style-type: none"> • Establishing method of the monitoring points, the frequency of monitoring and the criteria of evaluation
Utilizing method of mercury monitoring data	<ul style="list-style-type: none"> • Establishing method of the standard value and the guideline of mercury in environment • Method of the edit and disclosure of the monitoring data • Preparation method of model and hazard map based on the monitoring data • preparation method of manual for coping mercury pollution • Establishing method of monitoring network

Regarding monitoring technology, it is essential to acquire the mercury analysis method in air, in case of considering the global pollution of Mercury which has characteristics of mobility and fluidity in environment. For sampling mercury in air, there are some types of method; absorbing solution, solid scavenger, passive sampler, etc. “Gold amalgam collection - heating vaporization method” which is described in “Measurement method manual for hazardous air pollution substance” of Japan, is effective for each country to carry out the survey. The following is the reason of it; the cost of installation and maintenance are low, the quantitative sensitivity is good, the limits by status of study area are small.

Learning method of the methylmercury analysis is indispensable for reviewing the accumulation of mercury in seafood and human body (blood, urine, hair, etc.). However, it is necessary to consider the equipment which each county owns. And, it is also important to pay much attention to the difficulty of adaption and the running costs. Learning the method of quality control and process of validation is also essential, because mercury analysis is the low concentration analysis.

It is considered that the solution of the institutional problems in mercury monitoring is more important than the acquisition of the analytical technique. This institutional issue contains the maintenance method of laboratory, the planning method of monitoring and the utilizing method of the monitoring data. It is considered that the solution of the institutional problems in mercury monitoring is more important than the acquisition of the analytical technique. This institutional issue contains the maintenance method of laboratory, the planning method of monitoring and the utilizing method of the monitoring data. It is important to secure the budget and the human resources in order to manage/ operate laboratory. Besides, the technology transfer for utilizing the monitoring data, and establishing the monitoring network, is very essential.

4 Encouragement of applicants to JICA KCC program, and awareness raising of countermeasure against mercury pollution

4.1 Progress on the encouragement of applicants, and awareness raising

In three countries of Latin America, the JICA Survey team visited some agencies which would be the target for the KCC training and the team gave them explanation of the training contents, according to the advice of JICA local office.

On the other hand, in five countries of Asia, the JICA Survey Team conducted the seminar for the experts of some related ministries and academic institutions in order to report the survey result, and introduce the contents of KCC training. The contents of the seminar which was held in each country is described in the operating day order, in the below.

4.1.1 Philippines

a. Outline

Title	Seminar on Countermeasures against Mercury Pollution
Organizer	JICA Philippines Office
	Department of Environment and Natural Resources/ Environmental Management Bureau (DENR/EMB)
Date	August 5, 2016 (FRI)
Venue	Hotel Marco Polo Ortigas

b. Program

Since ASGM problem in Mindanao islands is remarkable in the Philippines, one the other session was added to the seminar program. In this session, the mercury pollution problems, which the Philippines is suffering, was announced from the Philippines side.

Time	Topic
09:00-09:45	Registration
09:45-10:00	Coffee and snacks served
10:00-10:10	Welcome Remarks (DENR-EMB) - Mr. Renato T. Cruz (Chief, Environmental Quality Management Division)
	Opening Remarks (JICA Philippines Office) - Mr. Takayuki TOMIHARA (Project Formulation Advisor, JICA Philippines Office)
Session 1. Results of the JICA Study and JICA Training Program	
10:10 -11:10	Data Collection Survey on the Countermeasures against Hg pollution in Asia, Central and South America: Summary of the survey results - Ms. Takako UEDA (Kokusai Kogyo Co., Ltd.)
	Present State of the Minamata Convention on Mercury: Approach in Japan toward Ratification and Efforts in the Future - Mr. Kenji FUKUSHIMA (Oyo International Corporation)
	JICA Knowledge Co-Creation Program: Capacity Building for Ratification and Implementation of the Minamata Convention on Mercury - Mr. Masayuki TAKAZAWA (Kokusai Kogyo Co., Ltd)

	Introduction of JICA's Training and Dialogue Programs: Capacity Strengthening for Multi-media Mercury Monitoring (4M) in Asia-Pacific Region - Ms. Takako UEDA (Kokusai Kogyo Co., Ltd.)
11:10-11:30	Question and Answer Session 1
11:30-12:45	Lunch
Session 2. Addressing Mercury Pollution in the Philippines	
12: 45-13:40	Mercury Waste Management in the Philippines and Update on the Ratification of the Minamata Convention - Engr. Geri-Geronimo Sañez (Chief, Hazardous Waste Management Section, Environmental Quality Management Division, EMB)
	Health Monitoring Programs on Mercury Exposure - Dr. Rodolfo Antonio Alborno (Chief, Occupational Diseases Division, Disease Prevention and Control Bureau, Department of Health)
13:40-14:20	Updates on the Small-Scale Mining Act and MGB Efforts vs the Use of Mercury on SSM Operations - Engr. Esteban Martin (Mining Technology Division, Mines and Geosciences Bureau)
	The Journey for Minahang Bayan and Mercury Elimination in ASGM: LGU-Jose Panganiban Experience - Ms. Sarah Aviado, (MENRO, Local Government of Jose Panganiban, Camarines Norte)
14:20-14:50	Question and Answer Session 2
14:50-15:00	Closing

c. Participant

Belonging agency	No. of Participant
Philippines Side	(42)
Department of Natural Resources (DENR)	13
Department of Science and Technology (DOST)	1
Laguna Lake Development Authority (LLDA)	2
Department of Health (DOH)	5
Department of Labor and Employment (DOLE)	2
Department of Foreign Affairs (DFA)	1
Department of Interior and Local Government (DILG)	2
Local Government Unit (LGU)	6
Technical Education and Skill Development Authority (TESDA)	1
International Academy of Oral Medicine and Toxicology (IAOMT)	2
University of the Philippines (UP)	5
Others	2
Japanese Side	(10)
JICA Philippines Office	2
JICA Survey Team	3
Environweave (Local Consultant)	5
Total=	52

d. Result

During the seminar, some presentations regarding the mercury pollution problems which the

Philippines is facing, were provided from not only EMB, the organizer of this seminar, also some agencies (Mines and Geosciences Bureau (MGB), Department of Health, Municipal Environment and Natural Resources (MENRO)). The information sharing among the participants was carried out actively.

4.1.2 Vietnam

a. Outline

Title	Seminar on Introduction of the JICA Knowledge Co-Creation Program on Minamata Convention on Mercury
Organizers	JICA Vietnam Office Ministry of Industry and Trade/ Vietnam Chemicals Agency (MOIT/ VINACHEIA)
Date	August 12, 2016 (FRI)
Venue	Conference room of VINACHEIA

b. Program

Time	Topic
08:30-08:45	Registration
08:45-08:55	Opening Remarks - Mr. Nguyen Xuan Sinh (Deputy Director General, VINACHEMIA) - Mr. Kataro TANIGUCHI (Senior Representative, JICA Vietnam Office) -
08:55-09:10	Policy and future direction on the Minamata Convention in Vietnam - Mr. Le Viet Thang (Official, Division of Convention and International Cooperation, VINACHEMIA)
09:10-09:30	The JICA KCC Training Program: Conditions and Procedures for Application - Mr. Masayuki TAKAZAWA (Kokusai Kogyo Co., Ltd.)
09:30-10:00	Data Collection Survey on the Countermeasures against Hg pollution in Asia, Central and South America: Summary of the survey results - Ms. Takako UEDA (Kokusai Kogyo Co., Ltd.) Progress toward Ratification of Minamata Convention" of the target countries - Mr. Kenji FUKUSHIMA (Oyo International Corporation)
10:00-10:15	Tea Break
10:15-11:00	Capacity Building for Ratification and Implementation of the Minamata Convention on Mercury - Mr. Masayuki TAKAZAWA (Kokusai Kogyo Co., Ltd.) Capacity Strengthening for Multi-media Mercury Monitoring (4M) in Asia-Pacific region - Ms. Takako UEDA (Kokusai Kogyo Co., Ltd.)
11:00-11:30	Question and Answer Session
11:30-11:40	Closing
11:55-12:30	Dismiss and Lunch

c. Participant

Belonging agency	No. of Participant
Vietnamese Side	(15)
Ministry of Industry and Trade (MOIT)	4
Ministry of Natural Resources and Environment (MONRE)	4
Ministry of Agriculture and Rural Development (MARD)	1
Ministry of Health (MOH)	2
Vietnam Academy of Science and Technology (VAST)	4
Japanese Side	(9)
JICA Vietnam Office	2
JICA Survey Team	3
Envicom (Local Consultant)	4
Total=	24

d. Result

In Vietnam the roadmap toward the ratification of the Minamata Convention had been prepared already, and the information of that Vietnam has been making the progress according to this map was shared with the other participant during the seminar.

Though the mercury pollution is not serious in Vietnam, the monitoring of total mercury in water is conducted. As the participants have understood the importance of learning the method of methyl mercury analysis, they showed positive reactions toward the KCC training of Mercury monitoring.

4.1.3 Malaysia

a. Outline

Title	JICA-NRE Seminar on Countermeasures against Hg Pollution
Organizer	JICA Malaysia Office
	Ministry of Natural Resources and Environment Malaysia (NRE)
Date	August 25, 2016 (THU)
Venue	Putrajaya Marriott Hotel

b. Program

During the seminar in Malaysia, the keynote lecture to introduce the impact on the human body by heavy metals was given by the JICA Survey team. At the same time, the Japanese waste management including mercury waste was also presented.

Time	Topic
08:30 - 09:00	Registration
09:00 - 09:10	Welcome Remarks - Mr. Jaya Singam Rajoo (Under Secretary, NRE)

	Opening Remarks - Mr. Shinsaku FUKAZAWA (Senior Representative, JICA Malaysia Office)
09:10 - 09:30	Introduction of heavy metals: Human effect & advanced analytical technology - Dr. Hirokatsu UTAGAWA (Kokusai Kogyo Co., Ltd.)
Session 1. Ratification of the Minamata Convention – International Experiences	
09:30 - 10:00	Policy and program on countermeasures against mercury contamination and progress toward ratification of the Minamata Convention in Malaysia - Ms. Marhaini Binti Mat (Principal Assistant Secretary, NRE)
10:00 - 10:20	Present State of the Minamata Convention on Mercury: Approach in Japan toward Ratification and Efforts in the Future - Mr. Kenji FUKUSHIMA (Oyo International Corporation)
10:20 - 10:40	Hg contained waste management in Japan - Dr. Yuko AOKI (Kokusai Kogyo Co., Ltd.)
10:40 - 11:00	Tea break
Session 2. Results of the JICA Survey and JICA Training Programs	
11:00 - 11:20	Data Collection Survey on the Countermeasures against Hg pollution in Asia, Central and South America: Summary of the survey results - Ms. Takako UEDA (Kokusai Kogyo Co., Ltd.)
11:20 - 12:00	Capacity Building for Ratification and Implementation of the Minamata Convention on Mercury” - Mr. Masayuki TAKAZAWA (Kokusai Kogyo Co., Ltd)
	Introduction of JICA's Training and Dialogue Programs: Capacity Strengthening for Multi-media Mercury Monitoring (4M) in Asia-Pacific Region - Ms. Takako UEDA (Kokusai Kogyo Co., Ltd.)
12:00 - 12:30	Question and Answer Session
12:30 - 02:00	Dismiss and Lunch

c. Participant

Belonging Agency	No. of Participant
Malaysia Side	(23)
Ministry of Natural Resources and Environment (NRE)	3
Department of Environment (DOE)	2
Department of Agriculture (DOA)	2
Department of Chemistry (KIMIA)	1
Ministry of Health (MOH)	14
Ministry of Domestic Trade, Co-operatives & Consumerism (KPDNKK)	1
Japanese Side	(8)
JICA Malaysia Office	3
JICA Survey Team	5
Total=	31

d. Result

Participant from Malaysia have had much interest in the Japanese correspondence (regulation and technology) toward the Minamata Convention. They said that they would like to consider

what is necessary, what can be applied for Malaysia in the future after collecting information of the seminar.

Since they were interested in the technology and method of waste management particularly, many questions regarding waste management were made aggressively from the participants.

4.1.4 Thailand

In Thailand, the seminar was not held. However, the JICA Survey Team visited some relevant agencies and gave them the report of the survey result and also provided the explanations of the training contents by the same materials which were used for the seminar in the other countries.

Date	Visited agencies	No. of participant from Thailand side
September 12, 2016 (MN)	King Mongkut's University of Technology Thonburi	2
September 13, 2016 (TUE)	Pollution Control Department (PCD)	7
September 14, 2016 (WED)	Department of Primary Industries and Mines	2
September 14, 2016 (WED)	Department of Industrial Works	4
September 15, 2016 (THU)	Environmental Research and Training Center (ERTC)	6
September 16, 2016 (FRI)	Food and Drug Administration	3

Thailand has not signed the Minamata Convention. However, the committee for Minamata Convention was already established, and they have meetings 3 times a year to take some necessary activities. Besides PCD and ERTC is conducting mercury monitoring in water. It can be said that the technical level of monitoring which Thailand has is higher than the other countries. However each agency, which JICA Survey Team visited, has much interest in the KCC training. It is expected that Thailand would take the position of a leader for the other countries. Therefore it is desirable that Thailand would participate in KCC training actively.

4.1.5 Indonesia

a. Outline

Title	JICA Meeting on Countermeasures against Mercury Pollution in relation to the Minamata Convention
Organizer	JICA Indonesia Office
	Ministry of Environment and Forestry/ Hazardous Toxic Substances Management (KLHK/PB3)
Date	September 20, 2016 (TUE)
Venue	Conference room of KLHK

b. Program

Time	Topic
09:00 - 09:30	Registration
09:30 - 09:40	<p>Welcome Remarks (Ministry of Forest and Environment (KLHK))</p> <ul style="list-style-type: none"> - Ms. Yuni Insiani (Director of Hazardous Toxic Substances Management, Directorate General of Soil Waste, Hazardous Waste and Hazardous Substances Management, KLHK)) - Ms. Ibu Sulistyowati (Director for Open Access Land Degradation Control, KLHK) <p>Opening Remarks (JICA Indonesia Office)</p> <ul style="list-style-type: none"> - Mr. Tetsuya HARADA (Senior Representative, JICA Indonesia Office)
Session 1. Ratification of The Minamata Convention — Japanese Experience	
09:40 - 10:10	<p>Present State of the Minamata Convention on Mercury: Approach in Japan toward Ratification and Efforts in the Future</p> <ul style="list-style-type: none"> - Dr. Hirokatsu UTAGAWA (Kokusai Kogyo Co., Ltd.)
10:10 - 10:30	Tea break
Session 2. Results of the JICA Survey and JICA Training Programs	
10:30 - 10:50	<p>Data Collection Survey on the Countermeasures against Hg pollution in Asia, Central and South America: Summary of the survey results</p> <ul style="list-style-type: none"> - Ms. Takako UEDA (Kokusai Kogyo Co., Ltd.)
10:50 - 11:30	<p>Capacity Building for Ratification and Implementation of the Minamata Convention on Mercury</p> <ul style="list-style-type: none"> - Mr. Masayuki TAKAZAWA (Kokusai Kogyo Co., Ltd.) <p>Introduction of JICA's Training and Dialogue Programs: Capacity Strengthening for Multi-media Mercury Monitoring (4M) in Asia-Pacific Region</p> <ul style="list-style-type: none"> - Ms. Takako UEDA (Kokusai Kogyo Co., Ltd.)
11:30 - 11:50	Question and Answer Session
11:50 - 12:00	Closing
12:00 - 01:00	Dismiss and Lunch

c. Participant

Belonging agency	No. of Participant
Indonesia Side	(28)
Ministry of Environment and forestry	20
Ministry of Industry	1
Ministry of Energy and Mineral Resources	3
Environment Research Monitoring	2
Agency for Assessment and Application of Technology	2
Japanese Side	(8)
Embassy of Japan in Indonesia	1
JICA Indonesia Office	3
JICA Survey Team	3
Local Consultant	1
Total =	36

d. Result

Since Indonesia is facing the problems of Mercury pollution in especially ASGM. Understanding the current situation and controlling it, are their current issues. Therefore, they want to learn the countermeasures from the other countries which have similar problems, and they hope to consider the possibility of utilization of it in their country. Moreover, they have requested to have curriculum in the training course to learn the alternative technology for ASGM without using mercury.

4.2 Proposal of training curriculum and implementation system

4.2.1 Outline of the Concept Paper

In the concept paper of the KCC training “Capacity strengthening for multi-media mercury monitoring (4M) in Asia-Pacific region”, five of outcomes and training content has been set (Figure 4-1). Based on this, JICA Survey Team proposes the curriculum and implementation system by reflecting the results of the seminars and interviews in the target countries, in the next section. In the preparation of the curriculum proposal, JICA Survey Team proposes many practical contents to follow the original idea of the concept paper while covering the outcomes and content which are described in the concept paper.

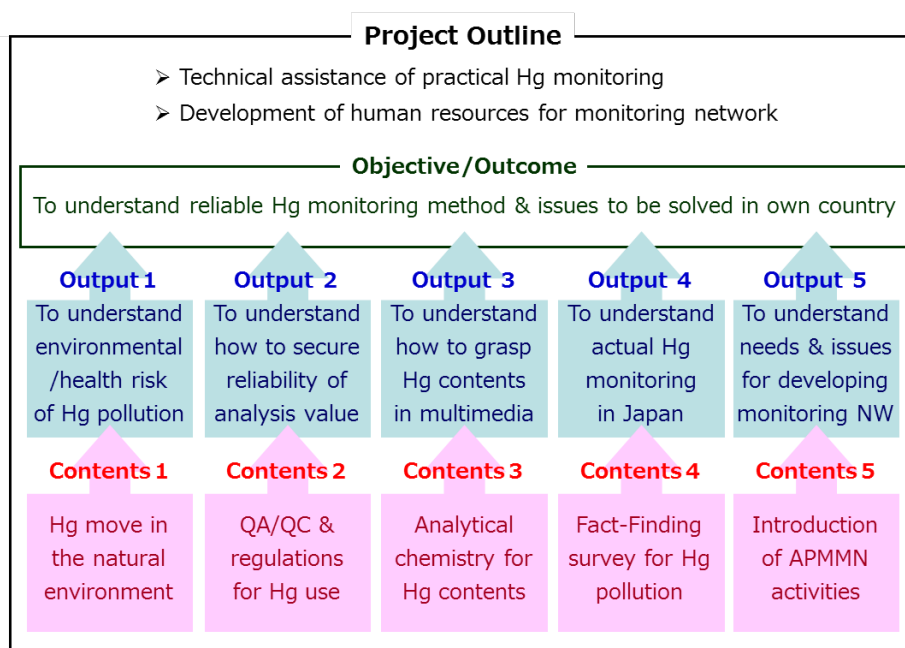


Figure 4-1: Summary of the concept paper

4.2.2 Schematic process of training

Table 4-1 shows the schematic process of training. According to the concept paper, the implementation period has been assumed one and a half months, from the end of September to the mid-November in 2017. Therefore, we defines 6 weeks as the period of the training tentatively, the mercury analysis exercises of water, soil and seafood would be carried out for 2.6 weeks (13-day) in this period. It consists of each 2 days (totally 8 days) for the total mercury analysis in four media mentioned above, and the rest 5 days for methyl mercury

analysis of seafood and hair.

Table 4-1: Outline of the training content

Unit	1 st . week	2 nd . week	3 rd . week	4 th . week	5 th . week	6 th . week
Characteristics of mercury and environmental dynamics, pathology of Minamata disease		(5 days)				
Mercury analysis of environmental multi-media (practice)					(13 days)	
Validation and QA / QC (lecture & practice)					(2 days)	
Cases of Japan in Mercury analysis and monitoring (lecture)						(5 days)
Establishment of monitoring network (lecture & discussion)					(5 days)	

For 2 days, the learning of the validation and QA/QC including basic statistics by using the analysis data obtained from analysis practice would be carried out. This training focuses on the acquisition of practical mercury monitoring methods. It is important to learn the validation methods of analysis for the purpose of taking a high reliability and accuracy consistent data. The trainee would learn how to evaluate the quality, reliability, and consistency of the analysis data from this activity. The practical training and the confirmation of quality management by validation are inseparable for this training. Therefore, these lecture and practice should be carried out in the same institutions to examine the cause of the outlier in the mercury analysis.

It would be the best to implement this training contents of the physical and chemical characteristics and the dynamics of mercury, at National Institute for Minamata Disease, from the first week to fourth week in this training. As a second best option, National Environmental Research and Training Institute (NETI) (Tokorozawa city, Saitama Prefecture) would be recalled. However, this institute accepts only government officers, who engage in national and local governments in environmental administration in Japan. So it would be difficult to negotiate for implementation of this training.

Regarding the explanation of the survey of mercury contamination in Japan, it is assumed to be carried out at the Center for Global Environmental Research and the Center for Environmental Risk Research (both centers belong to National Institute for Environmental Studies (NIES) (Tsukuba City, Ibaraki Prefecture)). NIES has an atmospheric and aerosol observation station locates in Cape Hedo at the northern end of the main island of Okinawa, and operates the constant monitoring of mercury in air at this station. In addition, with regard to establishment of the monitoring network, it is planned to invite a officer of Environment Management Bureau, which is the central department of "Minamata Convention implementation Promotion Project on mercury" in the Ministry of the Environment to JICA headquarters (Chiyoda ku, Tokyo). On the basis of the lecture on establishment of APMMN, the trainee would consider the challenges in mercury monitoring system of the country and also they would discuss the future initiatives.

4.2.3 Draft of the detail schedule and curriculum of the training

Table 4-2 in the next page shows the draft of the detailed schedule and curriculum of the training.

Table 4-2: The proposed schedule of the KCC training "Capacity strengthening for multi-media mercury monitoring (4M) in Asia-Pacific region"

Date		Location/Move	Title	Contents	Purpose
1	TUE	Arrive in Japan ⇒ Kitakyushu	—	—	—
2	WED	JICA Kyushu	JICA Briefing, program orientation	—	—
3	THU		JICA General orientation, Japanese class	—	—
4	FRI		Job report recital	Presentation on the contents of responsible duty by the trainees of each country	Review and sharing the information regarding current situation and the issues of each country related to mercury pollution countermeasures
5	SAT				
6	SUN	Kitakyushu⇒Minamata			
7	MON	National Institute for Minamata Disease (NIMD)	Guidance	Introduction of organization and staff, curriculum guidance, Introduction of Minamata disease and the current situation of the patients	To understand the overall guidance of MIND training and the Minamata disease
8	TUE		physical, chemical and toxicological characteristics and environmental fate of mercury	Physical and chemical characteristics and pharmacokinetics of mercury, toxic mechanism	Understand the mechanisms of Mercury being spreaded into the environment, and the health effects
9	WED		Field work (1)	Exhibition tour in Minamata Disease Museum, Visit to the Minamata Memorial	Understand the history of Minamata disease and the process of environmental restoration in Minamata Bay
10	THU		Field work (2)	Minamata disease - Taiji screening	Understand the evaluation method of the health effects of mercury
11	FRI		Introduction of analytical chemistry for mercury analysis	principle, procedure, key points of in total mercury and methyl mercury analysis	Verify the contents of the analysis exercises carried out in the next week.
12	SAT				
13	SUN				
14	MON		Practical training of total mercury analysis	Total mercury analysis of water	Learn the analytical methods of total mercury of various media properly
15	TUE			Total mercury analysis of soil and sediments samples	
16	WED			Total mercury analysis of seafood samples	
17	THU			Total mercury analysis of human urine samples	
18	FRI			Total mercury analysis of hair samples	
19	SAT				
20	SUN				
21	MON		Practical training of methyl mercury analysis	Description of the extraction method and the determination method of methyl mercury using seafood samples and hair samples	Understand the dynamics of methyl mercury in a living body, and learn the correct analysis method.
22	TUE			Methyl mercury analysis of fish samples	
23	WED			Methyl mercury analysis of hair samples	

Date		Location/Move	Title	Contents	Purpose
24	THU		Training on the confirmation method of quality control / quality assurance of analytical results	Presentation of mercury analysis result, lecture of the quality control / quality assurance of the analysis results	Understand the importance of quality control / quality assurance with paying attention to the error of the analysis result
25	FRI			training on the method validation of mercury analysis	Learn a confirmation method of quality control / quality assurance of analytical results
26	SAT				
27	SUN	Minamata⇒Okinawa			
28	MON	JICA Okinawa	Guidance	Organization and staff introduction, tour of the Okinawa International Center	
29	TUE	Air and aerosol observation station	Introduction of atmospheric observation case in Japan (1)	Tour of the air and aerosol observation station managed by the National Institute for Environmental Studies	Understand the air monitoring at the national level in Japan.
30	WED	Okinawa Prefecture, Air Quality Division	Introduction of atmospheric observation case in Japan (2): the municipal level	Explanation of measurement situation of air pollutants Okinawa Prefecture has implemented, tours of constantly monitoring and measurement stations	Understand the local government level air monitoring and network in Japan.
31	THU	Okinawa⇒Tokyo	—	—	—
32	FRI	JICA headquarters or JICA Tokyo	Explanation of safety of food by the Ministry of Health, Labor and Welfare Pharmaceutical and Food Safety Bureau	Information and survey of contaminants in food	Understand the notes on eating of seafood such as containing mercury.
33	SAT				
34	SUN	Tokyo⇒Tsukuba			
35	MON	National Institute for Environmental Studies (NIES)	Advanced research of mercury in the environment	Precision analysis and estimation of the origin of mercury of mercury stable isotope ratio	Learn the advanced technology related to mercury analysis.
36	TUE		Establishment of the all multimedia model of mercury, and the migrating prediction of marine life	Introduction of global multi-media model using a mercury observation data in the air	Understand the method of utilizing mercury monitoring data.
37	WED		Construction and operation of environmental information media	Introduction of "environmental observatory"	Learn about the enlightenment and the method of publishing the mercury monitoring data.
38	THU	JICA headquarters or JICA Tokyo	Commentary of APMMN by the Ministry of the Environment Water and air quality stations	Japan-US environmental policy joint statement and the current situation of APMMN	Understand the organization structure and current activities of APMMN.
39	FRI		Challenges extraction toward the establishment of a mercury monitoring network	Discussion of initiatives and the extraction of the challenges for the construction of the mercury monitoring network in the participating countries	Consider the efforts and challenges in their own country, toward the establishment of a mercury monitoring network.
40	SAT				
41	SUN				
42	MON	JICA headquarters	Guidance on the preparation of the action plan, workshop	How to prepare the action plan that utilizes the PCM method	Learn the process of planning after choosing the best plan from among the path of exploring and multiple choices to solve the problem relates to the construction of the mercury monitoring system in the country.
43	TUE		Preparation of the action plan	Divided into groups, preparation of the action plan	
44	WED		Presentation of the Action plan, Closing ceremony, Evaluation meeting	—	—
45	THU	Leave Japan	—	—	—

**Environmental Standards &
Emission standards of mercury
in the target countries**

Environmental standards Emission standards of mercury in the target countries

		Environmental standard			Emission standard	
		Air	Water	Soil	Air	Water
Japan		Environmental standards are not set. Specified in the mercury and priority initiatives substance its compounds (for a list according to the hazardous air pollutants): 0.00004mg / m3 (Hazardous air pollutant guideline value)	Public waters: 0.0005mg / L (the environmental standards relating to water pollution) Groundwater: 0.0005mg / L (environmental standards related to water pollution of groundwater) Drinking water: 0.0005mg / L (Ordinance relating to water quality criteria)	0.0005mg / L or less (in the test solution) (Soil environmental standards (for environmental standards in accordance with the pollution of the soil))	×	Effluent standards into public waters: 0.005mg / L (Ordinance to define the wastewater standards)
Asia	Indonesia	×	A (Available for drinking) : 0.001mg / L B (Drinking water source): 0.001mg / L C (Fisheries and livestock): 0.002mg / L D (Agriculture): 0.005mg / L (Decree on the Prevention of Water Pollution (1990 Decree No. 20))	×	Air emissions standards from non-specific stationary sources (2000): 10mg Hg / m3 (Minister of the Environment decision relating to emissions of stationary sources (KEP-13 / MENLH / 3/1995))	Water use for drinking water: 0.002 mg / L Water use for fisheries and animal husbandry: 0.005mg / L (Decision the Minister of the Environment in accordance with the industrial effluent standards (KEP-51 / MENLH / 10/1995) (different reference value for each industry))
	Vietnam	The maximum allowable concentration of 24-hour average of mercury (metal and its compounds): 0.3 µg / m3 (QCVN06: 2009 / BTNMT)	Surface water: 0.001mg / L (QCVN08: 2008 / BTNMT) Seawater: 0.001mg / L (QCVN10: 2008 / BTNMT) Groundwater: 0.001mg / L (QCVN09: 2008 / BTNMT)	×	The maximum allowable concentration from industrial waste incinerator A (Existing factory): 0.5mg / Nm3 B (New factory): 0.2mg / Nm3 (QCVN30: 2012 / BTNMT)	The maximum allowable concentration of mercury emissions in accordance with the industrial wastewater A (life clean water): 0.005mg / L B (other than for life clean water): 0.01mg / L (QCVN40: 2011 / BTNMT)
	Philippines	×	Surface water: 0.001 mg / L (Water Quality Criteria (DENR AO 1990-34 (set for each class)) Drinking water: 0.001mg / L (DOH AO 2007-0012: Philippine National Standards for Drinking Water 2007)	×	Specific emission sources of air pollutants nationwide emission standard: 5mg / N-Hg (NESSAP)	0.002 mg/L (Effluent Standards (DENR AO 1990-35))
	Malaysia	×	Class I (Available for drinking): natural state Class II (Drinking water source): 0.001 mg / L Class III (Livestock): 0.004 mg / L Class IV (Irrigation): 0.002 mg / L (National Water Quality Standards for Malaysia (NWQS))	×	0.01g/Nm3 (International Law Book Services, Environmental Quality Act 1974 (Act 127) & Subsidiary Legislations (as at 25th August 1998), 1998)	0.005 mg/L (Environmental Quality (Sewage and Industrial Effluents) Regulation, 1979)
	Thailand	×	Public water: 0.002 mg / L Seawater: 0.1µg / L Groundwater: 0.001 mg / L (Basic Environment Law)	Residential areas and farmland: 23mg / kg Other land: 610 mg / kg (National Environmental Council on the basis of the Basic Environment Law (Buddha history 2547 years - Statement No. 25))	A fuel combustion plant: 3.0mg / m3 (industry are issued on the basis of the Factories Act Ordinance (2005 - 2006)) Contaminated waste incineration treatment plant: 0.05 mg / m3 (Ministry of Natural Resources and Environment Ordinance (2003))	0.005mg / L (Ministry of Science, Technology and Environment 1996 (MOSTE) issued as a notice)
Latin America	Uruguay	×	1: Water supply 2a: Agricultural irrigation 2b: Recreation 3: Agriculture 4: Urban agriculture 0.002mg / L (Decree No253 / 79 (set for each body of water classification))	×	×	Public Sewer: 0.005 mg / L Surface water: 0.005 mg / L Underground penetration: 0.05 mg / L (Decree No.253 / 79)
	Brazil	×	×	×	×	Sao Paulo State (8468/76): 0.01 mg / L Rio de Janeiro State / KEEMA criteria (NT-202, R-10): 0.01 mg / L
	Nicaragua	×	Drinking water: 0.001 mg / L Agricultural water: 0.01mg / L (Normas para la Clasificación de los Recursos Hídricos (NTON 05-007-98))	×	×	General effluent standard: 0.02 mg / L (Decree 33-95) (Beginning to set a different reference value for each industry.)

