MERCURY TRADE IN THE PHILIPPINES

An investigative research on mercury flows in the Philippines

INTRODUCTION

Mercury is a naturally occurring element that is highly toxic. But despite its toxicity it possesses many unique properties that makes it a necessary evil in many common household and health-care products and niche processes. Globally, there are four identified sources of mercury. These are: i) primary mercury from mercury mines ii) residual mercury from de-commissioned chlor-alkali facilities iii) recycled or recovered mercury from wastes and mercury-containing products and iv) by-product mercury from other resource extraction activities.

Most of these mercury substances can be found in Russia, China, Spain, Kyrgyzstan, and the United States. In 2010, China was the world's leading producer of mercury with a staggering 1,500,000 kilograms followed by Kyrgyzstan with an estimated quarter of a million kilograms of mercury production. Spain, once a leading producer of mercury, relies mostly on stockpiled material since the closure of its Almaden Mine in 2003. Mercury occurrences are also present in the United States particularly in the states of Alaska, Arkansas, California, Nevada and Texas. Like Spain, most of the mercury originating from the U.S. also comes from stockpiled material after it stopped mining mercury as a primary metal commodity in 1992. In the Philippines, mercury mining took place in the province of Palawan from 1955 to 1976, with an estimated annual production of 140 tons. However, since its closure, the country's mercury supplies now rely primarily on imported mercury.

Although the global mercury commodity market is small in both tonnage and value of sales, demand for mercury has long been widespread. Mercury is routinely traded several times before "final consumption" and statistics hint that global yearly trades of mercury and its compounds are most likely in the range of US$ 131 million in value. Mercury is consumed in a broad range of products and processes around the world and the major categories of mercury demand include: chlor-alkali production , dental amalgams, thermometers and other measuring and control equipment, mercuric oxide and other batteries, neon, compact fluorescent and other energy-efficient lamps, electrical switches, contacts and relays, pharmaceutical processes products and preservatives, and some product uses. In developing countries, mercury demand is more prevalent for use in artisanal gold mining, cosmetics and skin creams, paints, pesticides and other agricultural chemicals.

In an effort to gain a good picture of mercury trade in the Philippines, **Ban Toxics** conducted an investigative research during the first semester of 2012. The investigative research involved not only web and book research, but also included field visits and interviews with mercury traders and small-scale gold miners in the country.

PHILIPPINE MERCURY IMPORTS

In the Philippines, most of the known mercury supply or imports come from the United States, Spain and Germany. Based on statistics from the United Nations Statistical Division-Commercial Trade (COMTRADE), the Philippines imported over 295,000 kilograms of mercury from 2000-2011. Annual breakdown of mercury imports are found in the following table.

Table 1: Philippine Mercury Imports, 2000-2011

YEAR	COMMODITY	TRADE FLOW	TRADE PARTNER	TRADE VALUE (in US$)	QUANTITY (in kgs)
2011*	Mercury	Import	China, Hong Kong SAR	394,497	6,750
2010	Mercury	Import	Australia	1,975	45
			Germany	4,164	3,850
			Japan	40,490	3,830
			Switzerland	43,589	3,977
			Spain	50,576	11,100
			USA	52,155	4,845
			Netherlands	66,311	5,850
2009	Mercury	Import	Spain	560,922	27,975
			Germany	418,935	58,704
			USA	106,398	9,597
2008	Mercury	Import	USA	50,099	7,656
2007	Mercury	Import	Russian Federation	378,730	18,216
			Spain	187,848	9,250
			Netherlands	69,427	4,326
2006	Mercury	Import	Spain	185,038	12,950
			USA	84,385	3,719
			Japan	76,888	14,250
			Singapore	43,928	2,174
			Austrailia	263	5
2005	Mercury	Import	Spain	177,848	7,215
			China, Hong Kong SAR	130,500	5,632
			Singapore	80,000	3,700
			USA	27,750	4,899

2004	Mercury	Import	Russian Federation Spain	55,500 2,991	9,250 235
2003	Mercury	Import	Spain USA United Kingdom	378,730 187,848 255	18,216 9,250 1
2002	Mercury	Import	Spain USA	1,069 262	115 8
2001	Mercury	Import	Singapore Spain USA	47,351 914 227	19,950 111 11
2000	Mercury	Import	Spain China USA Germany United Kingdom	70,875 8,496 1,151 1,032 580	19,950 10,271 12 78 163

**Data was accessed in April 2012 and may only be partial results for 2011.*
Source: Commodity Trade Statistics Database, United Nations Statistics Division[viii]

The 2011 global mercury trade map released by Geneva-based ZOÏ Environmental Network identifies the Philippines as one of the main mercury trading centers in Asia. Indonesia, Thailand, China, Myanmar, Vietnam, North and South Korea are also identified as main trading centers in the region. Most of the elemental mercury entering these countries is generally coming from the European Union.

Very few countries actually have systems in place to collect and centralize information on domestic commercial transactions of mercury. Mercury transactions between countries are also not without statistical challenges. However, it makes it less challenging to track because of their unique tariff codes and is generally reported by national customs offices and other authorities to centralized databases such as the UN Statistics Division COMTRADE database. Unfortunately, some countries do not fully report their mercury exports to UNSD, and the COMTRADE data may be considered a minimum representation of the global exports of elemental mercury.

Image 1: Mercury-containing flask bearing Kyrgyzstan as origin.

REGIONAL MERCURY TRADE ROUTE & BLACK MARKET

When mercury reaches the Philippines from its main trading partners, these are normally contained in 34.5-kg standard flasks, often unmarked. The lack of markings makes it difficult to ascertain the real points of origin of these imports. However, one of the empty flasks examined in a miner's property in Zamboanga del Sur showed **Kyrgyzstan** as a possible source.

Ban Toxics also cites of a mercury inventory in 2006 in Mount Diwata, Monkayo, Compostela Valley jointly conducted by the local barangay unit and Mr. Lars Hayden of Uppsala University in Sweden where some containers examined indicated **Algeria** as a point of origin. Interviews with mercury traders also reveal that some of their mercury is sourced out from China. Furthermore, information from a mercury trader in Davao point to **Spain**, presumably from the Spanish state company **MAYASA**. It is worthy to note, however, that the European Union has enacted a mercury export ban that took effect in 2011. The EU mercury export ban and storage legislation focuses on a ban on mercury exports by 2011 and requires all chlor-alkali mercury not needed within the industry to go to long-term storage or disposal. The mercury supply in Davao may very well still be part of an old inventory.

Most countries import much more mercury than is actually needed for legal uses. The excess amount is sold in the black market for unsustainable practices such as in artisanal and small-scale gold mining or ASGM. Field investigations reveal that domestic mercury trade is rather a challenge to track as it assumes an air of mafia-type secrecy. Domestic mercury trade is also run by a tightly-controlled network making investigation doubly difficult. Most mine operators give guarded answers about their mercury sources and mercury traders do not disclose any information as to the volume and origin of their mercury imports. This characteristically cautious behavior from these sources validates suspicions that mercury is being shipped into the country illegally.

In August 2011, a mercury importer in Manila claims to have been able to allegedly bring in 5,000 kilograms of mercury from an undisclosed origin. Given that the smallest storage container for shipment is 15,000 kilograms, it can be surmised that this mercury import possibly entered the country *undeclared* and mixed with other goods, or *misdeclared* and disguised as another product.

Image 2: A 5000-kg mercury shipment will only occupy one-third of the space of this typical 15,000-kg storage container. (Photo from: offshore-technology.com)

It is also common practice among chemical importers to receive only one container or shipment at a time for good reason. The motive behind this is that one container hardly ever requires storage at port. Not only do importers save on storage fees but they also avoid the risk of these goods being seized.

In Mindanao, all the field interviews with miners consistently pointed towards the services of Muslim retailers of mercury. In the 1990s mercury was openly sold in the old Barter Trade in Zamboanga City, a commercial complex with goods mostly coming from neighboring countries in the region. But when the Barter Trade burned down and was moved to the pueblo or city center, open vending of mercury became unviable. This is mainly because the new, spacious but smaller and less busy Barter Trade is more conspicuous in the city and subject to the prying eyes of local authorities. What is interesting in the miners' accounts is that, as a possible alternative to the Barter Trade, a limited volume of mercury enters the country illegally, transported from either Indonesia or Malaysia by some fishing boats into three major fish ports in Mindanao, namely Zamboanga, South Cotabato and Sarangani. In fact, a news article from the Philippine Daily Inquirer reported that a 20-foot motorized boat carrying 500 kilograms of mercury sunk in Sarangani Bay in October 2011.[xiii] Bureau of Customs officials admitted that the city has become a drop-off point for smuggled mercury from Indonesia. The smuggled mercury is then transported by land through Davao City. Although recent interviews do not mention actual volume of the mercury being smuggled, what is clear is that this is a frequent activity.

DOMESTIC MERCURY SUPPLY & DISTRIBUTION

According to mercury traders interviewed, mercury supply and distribution in the Philippines follows the main trading centers in the country and their geographical distribution of mercury in the country. Manila as the main trading center for Luzon is the main source of mercury for the island, while Cebu and Davao are the sources for Visayas and Mindanao, respectively.

There are at least two major mercury traders in Manila [xiv] that supplies the entire Luzon Island. Both traders operate through a *cell* or a network of distributors. Based on the interviews conducted, these cells are the ones engaged directly with the mine operators who in turn act as the retailers in the mine site.

In the Visayas, there is at least one major mercury trader in Cebu which incidentally is also one of at least two traders known in Mindanao.[xv] Cebu mainly supplies the mercury requirements of gold mining sites in Masbate and Negros Occidental, with Bacolod as a secondary mercury trading city. The mercury traders based in Davao City are known to supply the mercury requirements of artisanal and small scale gold mining (ASGM) in the Zamboanga Peninsula, Bukidnon, Agusan del Norte, Davao del Norte, Compostela Valley and South Cotabato. The 2006 mercury inventory earlier cited specifies five mercury dealers in the area who were granted in 2003 and 2004 with permission to sell a combined volume of 367,000 kilograms of mercury. The same inventory showed that 5,000-10,000 kilograms of mercury is used annually for gold mining in Mount Diwata. In 2010, only two mercury dealers were operating with Chemical Control Order.

Customarily, the purchase of mercury from a major trader requires a referral. Mercury traders are extremely suspicious of walk-in buyers with no known backer or referral. On the other hand, once the liquid metal reaches the host locality of the mine and nearby areas, access to mercury becomes fairly easy as it is re-sold openly in mostly *sari-sari* stores and sometimes dental clinics as well.

WHOLESALE & RETAIL PRICES

As of February 2012, wholesale prices of mercury in the country ranged from Php 270,000 to Php 350,000 per standard flask while retail prices vary widely across different mine sites. Retail prices range from Php 7,500/kg in Davao City to a whopping Php 30,000/kg in Kalinga. The following table summarizes the different retail prices of mercury in the country.

Table 2: Retail prices of mercury in selected mining areas in the Philippines [xvi]

Area/ Mining Site	Retail Price (in PHP/kg)
Jose Panganiban, Camarines Norte	8,000 - 9,000
Paracale, camarines Norte	9,000
Mount Diwata, Monkayon, Compostela Valley	10,000 -10,500
Aroroy, Masbate	9,500 - 10,000
Davao City	7,500
Sitio Balabag, Bayog, Zamboanga del Sur	8,000
Baguio City	15,000
Kalinga	30,000

Mercury is also further retailed at Php 15.00-20.00 per gram depending on the area. When bought in retail, mercury is placed in a variety of containers – from old rhum bottles to recycled plastic containers.

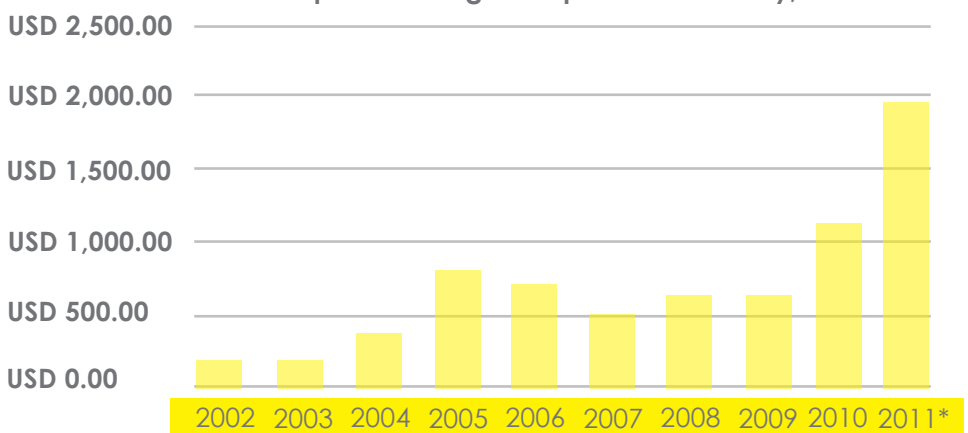
Image 3: Retail of mercury is placed in unsuitable containers such as plastic.

What is significant in all these local trading activities is that no official receipt is issued to the buyer. At the most, only a delivery notice by registered traders are given but often indicate other construction items such as nails, lead weights or nuts and bolts.

Miners have also lamented on the spike in mercury prices over the past decades. At the height of the gold rush in Mount Diwata in the early 1990s, the cost of mercury was only Php 7,000.00 for each standard flask and/or Php 300.00/kg. It is now sold at a minimum of Php 10,000/kg. Similarly, mercury in Camarines Norte was sold in December 2010 at a retail of Php 2,400-2,800/kg but is now fetching a price of Php 8,000 - 9,000/kg.

The increase in global mercury prices can be traced to the middle of 2004, which can be explained almost entirely by the tightening mercury supplies due to the closure of both the Spanish and Algerian mercury mines. Between 2000-2002, China reduced its annual mercury imports by about half a million kilograms, and subsequently increased their domestic mercury production in 2002-2003 but not enough to meet its own needs, creating tight supplies in the large Chinese market as well. In addition, the Kyrgyz mine had a limited ability to increase production and inventories other than MAYASA were limited. In 2004, MAYASA exercised more care over whom its mercury was sold to, effectively reducing deliveries by some 30%. A particular example would be in 2000 and 2001 where the Philippines imported almost 20,000 kilograms of mercury from Spain in both years. But in 2003, this volume was radically decreased to a little over 5000 kilograms. The resulting mercury shortfall led to further speculation and additional price increases.

Graph 1: Average U.S. price for mercury, 2002-2011



Price, average value, dollars per flask, free market

Source: U.S. Geological Survey, Mineral Commodity Summaries, January 2012
**estimate*

MERCURY USE IN ASGM

One of the earliest accounts of mercury use in the mining industry dates back to 2700 BCE in Spain. Mercury use in gold extraction became widespread from 1860 to 1925 and amalgamation was the main technique used for gold recovery worldwide. While some countries have already abandoned the use of elemental mercury for gold recovery in response to health problems and the development of mercury-free processes for gold extraction, majority of small-scale gold mine operators in the Philippines still resort to amalgamation. One of the reasons often cited by miners is that under field conditions, mercury is easy to use and is highly effective in capturing gold. In fact, there is a misguided practice among miners that the more mercury is used, the more gold that can be captured. Although mercury is a regulated substance, it is fairly accessible to mining networks which guarantees quick money for the miners' families. There is also the lack of affordable alternative technologies. These reasons explain the pervasiveness of mercury use in most of the country's gold mining provinces. The volatility and uncertainty of mercury prices over the years, however, have led miners to shift towards mercury-free gold extraction and processing techniques. One method that is used is cyanidation either through carbon-in-leach or carbon-in-pulp systems where the cyanide solution dissolves gold from the host rock. This alternative method is said to be gaining popularity among miners due to its higher recovery. Also, most of the miners engaged in whole ore amalgamation in the past are now engaged in bigger operations making cyanidation a more convenient method in gold recovery.

DENTAL AMALGAM

Amalgam is an alloy consisting of mercury (50%), silver (~22-32%), tin (~14%), copper (~8%) and other trace metals. This term is commonly used to refer to the material employed for dental filling. It became the dental restorative material of choice due to its low cost, ease of application, strength and durability.

The Chemical Control Order for Mercury in its current form does not include dental amalgamation in the application of the requirements. This exemption has resulted in the proliferation of dental clinics that supply mercury from dental amalgam for gold mining.

Statistics from COMTRADE for the period 2007-2011 show that the Philippines imported more than 65,000 kilograms of inorganic and organic compounds of precious metals, whether or not chemically defined, including amalgams, under tariff code 284390. The following table illustrates the volume of amalgam imported by the country from 2007-2011.

Table 2: Philippine Imports of inorganic compounds including amalgam, 2000-2010

YEAR	COMMODITY	TRADE FLOW	TRADE PARTNER	TRADE VALUE (in US$)	QUANTITY (in kgs)
2011*	Inorganic/organic compounds of precious metals; amalgams of precious metals	Import	Spain	2,124	2
2010	Inorganic/organic compounds of precious metals; amalgams of precious metals	Import	China, Hong Kong SAR Republic of Korea USA	4,873 61,376 1,041	25 39,600 184
2009	Inorganic/organic compounds of precious metals; amalgams of precious metals	Import	China, Hong Kong SAR Japan Singapore	143 978 1,143	1 84 24
2008	Inorganic/organic compounds of precious metals; amalgams of precious metals	Import	Australia Germany Japan Republic of Korea Malaysia USA	4,851 665 519,989 63,501 16,780 17,414	146 5 2,089 21,080 1,042 830
2007	Inorganic/organic compounds of precious metals; amalgams of precious metals		Australia China	527 64,722	15 20,840

**Data was accessed in April 2012 and may only be partial results for 2011.*
Source: Commodity Trade Statistics Database, United States Statistics Division

There is a noticeable spike in the importation of amalgam in the Philippines in 2010 but although 39.0 tons seem large it is comparative to the increase of amalgam imports in the United States which more than doubled from 15.0 tons in 2008 to 34.0 tons in 2011.

Unfortunately, there are no known data nor statistics on dental restorations in the Philippines. In contrast, a 2012 report on the real cost of mercury, the estimated amalgam restorations in the United States reached more than 51,000,000 procedures in 2009. It is worth remembering that during a restorative procedure, a dentist placing an amalgam filling cannot afford to run short of the alloy because it hardens and therefore, the dental practitioner normally prepares more amalgam than needed for a given filling. So apart from the excess amalgam that is carved away as the filling is shaped, there is additional amalgam, also known as "non-contact scrap," that goes directly to waste. The amalgam that is carved away is either spit out into the sink, suctioned from the mouth into the wastewater system or worse, swallowed.

Dentists categorize restorative procedures by surface types. A typical 1-surface dental filling requires one "spill" of amalgam, equivalent to 400mg of mercury mixed with metal powders of approximately the same weight. A 2-surface filling will require two spills, with 600mg of mercury and 3+surface fillings three spills and 800mg of mercury. Undoubtedly, some fillings may require more but these quantities provide a sound basis for overall estimation of amalgam use and mercury consumption. Using these spills as bases, the 2009 amount of new mercury introduced by dental practitioners relative to the number of amalgam procedures conducted in the same period in the United States would be over 32 tons, which is equivalent to an average use of 583.5mg of mercury per filling (see Table3). However, of the 32 tons consumed, most of the mercury waste that is generated in dental clinics is not from "carving" a new filling or discarding unused amalgam but from drilling out damaged amalgam in order to make room for the new filling.

Table 3: Mercury Use in Amalgam Restoration Procedures in the United States, 2005-2009

Amalgam Restoration size	Fillings 2005-6	Percentage distribution 2005-6 & 2009	Fillings 2009	Mercury used (mg) per filling	Mercury used (mg) per filling	Total Mercury (tons)
1 surface	16,763,750	32.1%	16,386,566	400	6,555	7.225
2 surfaces	22,972,950	44.0%	22,456,059	600	13,474	14.854
3+surfaces	12,455,470	23.9%	12,175,222	800	9,740	10.737
TOTAL	**52,192,170**	**100%**	**51,017,846**		**29,768**	**32.814**

Source: The Real Cost of Dental Mercury, Concorde East/West Sprl.

The primary sources of mercury waste coming from the dental clinics include mercury waste generated during the preparation of more amalgam than the filling requires, excess material carved from new amalgam fillings, removal of damaged amalgam fillings, removal of teeth containing amalgam, other mercury going to solid waste or wastewater, mercury emissions and particulate matter going directly to the air especially from drilling procedures, the traps, filters and other devices in dental clinics intended to remove mercury from the wastewater and sometimes from the clinic's ventilation system – and the downstream flows of mercury from there.

In the Philippines, although past interviews with local miners revealed that mercury is frequently sourced out from dental clinics which, aside from supplying the substance, also operate as gold buyers, this practice appears to be common mostly in mining areas in Northern Luzon only. In fact, in Baguio City, it is quite typical to see a jewelry shop/gold dealer and a dental supplier/ clinic located right beside each other. Interviews in February 2012 with several dental suppliers in Manila also revealed that some dental clinics and/ or suppliers source the individual components of dental amalgam from local suppliers. Further inquiries established that mercury is sourced out from the two traders in Manila

Image 4: Dental clinic as mercury source

MERCURY-CONTAINING LAMP WASTES

The energy efficient lighting (EEL) market has gone through big changes since the mid-1990s. The unknown and expensive compact fluorescent lamps (CFL) have evolved to a popular and readily accessible lighting product for households as well as for commercial and industrial organizations. Because of its energy efficiency and cost saving features, it is among the widely used electric light sources. The dramatic transformation of the lighting market in the Philippines is mainly due to the emergence of informal channels and low-cost CFL imports. Most of the CFLs in the local market are imported, primarily from low-cost Asian producers. In a market assessment study done in 2000, lighting product imports - including CFLs - doubled from US$ 19 million in 1994 to US$ 40 million in 1998. This dropped to US$ 34 million in 1999. Recent statistics show that in 2010 over US$ 29 million lighting products were imported, with over 19 million units of fluorescent lamps. The 2000 study also showed that although the CFL market was already crowded with more than 50 CFL brands there were only 18 traders granted with Import Commodity Clearances in (ICC) 1999 and 2000. With countless CFLs not carrying ICC labels, consumers are vulnerable to fake, sub-standard and unreliable CFLs.

Apart from not getting the expected quality, utility or value for money, these CFLs including other types of energy efficient lighting unfortunately also contain mercury, of which small amounts are in vapor form. A typical fluorescent lamp is composed of a phosphor coated glass tube with electrodes located at either end. When voltage is applied, the electrodes energize the mercury vapor causing it to emit ultraviolet (UV) energy. The phosphor coating absorbs the UV energy causing the phosphor to fluoresce and emit visible light. The amount of mercury used in these lamps varies according to lamp type, manufacturing year, manufacturing plant and the manufacturer. The following table summarizes the relative mercury content of common fluorescent lamps.

Table 4: Mercury content of flourescent lamps

LAMP TYPE	USAGE	MERCURY CONTENT (in mg)
Compact fluorescent lamps	General illumination, usually in homes	1-25
Fluorescent U-tubes	General illumination, in schools commercial buildings, hospitals	3-12
Linear fluorescent lamps • **Mercury reduced** • **Non-mecury reduced**	General illumination, in schools commercial buildings, hospitals	 3-12 10-50
Mercury vapor lamps • **75-watt** • **1500-watt**	Industrial applications and outdoor lighting, e.g. security, roadway, sports arena	 25 225
Metal halide lamps • **75-watt** • **1500-watt**	Commonly used in warehouses, stadiums, any industrial setting where distinguishing colors is important, bright blue-tinted car headlights and aquarium lighting	 25 225
Sodium vapor lamps • **35-watt** • **1000-watt**	Limited to outdoor and industrial applications where high efficacy and long life are priorities	 20 145
Mercury short-arc lamps	Special applications such as search lights, specialized medical equipment, photochemistry, UV curing and spectroscopy	100-1000
Mercury Capillary lamp	Special industrial applications, i.e. for printed circuit boards, UV curing and for graphic arts	100-1000

Source: Philippine Efficient Lighting Market Transformation Project

When mercury-containing lamps are broken, compacted, crushed or disposed of improperly, it releases mercury into the environment and this is the main reason why mercury-containing lamp wastes are regulated. Lamp wastes are defined as any type of mercury-containing lamp that is already busted or spent, generated by various sectors most especially the household, businesses and institutions.

In a 2006 survey, 6.7 million pieces of mercury-containing lamp wastes in the form of tubular fluorescent lamps (TFL) were generated annually from the household sector. At an average of 20 mg per TFL, this is equivalent to 133 kilograms of mercury. Thirty-two percent (32%) was generated by the middle class, of which 78% of the respondents have shifted from incandescent bulbs to EEL systems. The lowest income bracket had 3-14 lamps while the highest income bracket had 24-75 lamps. In the business sector, the total lamp wastes generated reached 11 million pieces annually which is equivalent to 221 kilograms of mercury, assuming that all are TFLs. Thirty-eight percent (38%) and twenty-eight percent (28%) of lamp wastes were generated by the manufacturing sector and the wholesale-retail establishments, respectively.

Lamp wastes generated by government offices, public hospitals and public schools are called institutional lamp wastes. In the same survey, these institutions generated an annual total of 7.2 million pieces equivalent to 145 kilograms of mercury. Public schools accounted for 88% of the wastes, while hospitals and office buildings were responsible for 9% and 3% of the lamp wastes, respectively. Unfortunately, no method of disposal for these lamp wastes was discussed in the survey.

Similarly, a report brief on mercury emission estimates in Cebu City commissioned by Ban Toxics and released in November 2011 shows that, of the 149 grams of mercury generated per year from electronics and electrical household appliances, 50% come from CFLs while 18% come from linear fluorescent lamps. Of those surveyed, over 41% or 61 grams of the total mercury generated annually from appliances is stored in households while the rest are disposed of as waste.

ELECTRONIC WASTES

The country's booming consumption of electronic and electrical goods has created a corresponding explosion in electronic scrap. The insatiable demand for newer, up-to-the-minute gadgets has created a serious mounting problem in electronic waste or e-waste. Electronic products contain a complex mixture of heavy metals like lead, mercury and cadmium, as well as other hazardous chemicals. Mercury is mainly used in lighting devices that illuminate flat screen displays. It is also used in switches and relays of older mainframe computers.

Most of the common electronic products we use on a daily basis, whether for work or recreation, contain mercury. While many industries have already found the alternatives for mercury or have decreased mercury use, the unique electrochemical and photoelectric properties of mercury and its compounds have made replacement of mercury difficult in some application. The following table is a summary of electronic products with mercury and specific mercury use content as developed by the United States Electronic Industries Alliance (USEIA). It is important to note, however, the some product categories in the table already have a number of non-mercury containing alternatives.

Table 5: Mercury content in common electronic products

Electronic Product	Product component containing mercury	Mercury content (in mg)	Mercury Application in product
Camcorders	Lamp	0-5	Liquid crystal display (LCD) back light; color VF light; lighting efficiency
Cameras	Lamp	0-5	LCD back light; lighting efficiency
Audio Equipment	Lamp	0-5	LCD back light; CCFL lamp lighting; lighting efficiency
Laptops/Notebook computers	Lamp	0-5 10-50	LCD back light; display screen; lighting efficiency
Telephones	Lamp	0-5	LCD back light; lighting efficiency
DVD Players	Lamp	0-5	LCD back light; lighting efficiency
Flat Panel (LCD)Display TV	Lamp	0-5 5-10 10-50	LCD back light; lighting efficiency
LCOS TV	Lamp	10-50	LCD back light; lighting efficiency

Electronic Product	Product component containing mercury	Mercury content (in mg)	Mercury Application in product
Flat Panel (LCD) display monitors	Lamp	0-5 5-10 10-50	LCD back light; lamp contact; lighting efficiency
Multi-function devices (i.e. fax, copy,print)	Lamp	0-5 10-50	LCD back light; scanner lamp; lighting efficiency
Fax machines	Lamp	0-5	LCD back light; lighting efficiency
Scanners	Lamp	0-5 10-50	LCD back light; lighting efficiency of scanner lamp
Photocopiers	Lamp	0-5 10-50	LCD back light; lighting efficiency, scanner lamp; operation panel
WEB appliances	Lamp	0-5	LCD back light; lighting efficiency
Document processing equipment	Lamp	0-5	LCD back light; lighting efficiency
Products containing LCD display	Lamp, LCD back light	0-5	Llighting efficiency, LCD back light for display panel
Palm top PCs/ Personal Digital Assistants	Lamp	0-5	LCD back light; lighting efficiency scanner lamp
Measurement devices	Lamp	0-5	LCD back light; lighting efficiency
Medical devices	Lamp	0-5	LCD back light; lighting efficiency
Electronic books	Lamp	0-5	LCD back light; lighting efficiency
Digital sender	Lamp	0-5	LCD back light; lighting efficiency
VHS Duplicator	Lamp	0-5	LCD back light; lighting efficiency
Multi-media monitor	Lamp	50-100	Lighting efficiency
Digital Picture Frame	Flat panel back light	0-5	Back light, lighting efficiency
LCD Projector TV	Lamp	50-100	Lighting

Source: US Electronics Industries Alliance

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In Ban Toxics' report The Vanishing E-waste of the Philippines, it cites a study conducted in 2005 that assessed the potential quantity of e-waste that will be generated in the Philippines. It estimated that approximately 2.7 million units of televisions, refrigerators, air conditioners, washing machines and radios will have become obsolete at the end of the study period. More than 65% of this volume was expected to end up in landfills. Between 1995-2005, 25 million units became obsolete with an additional 14 million units also expected to reach obsolescence in 2010.

The increase in electronics consumption is further driven by the emergence of numerous second-hand stores of electronic goods in both the rural and urban centers. These stores offer used but cheap electronic items such as televisions, desktop comupters and air conditioners from countries like Japan and South Korea and are typically marketed as "surplus" products.

In 2011, Ban Toxics attempted to estimate the amount of e-waste ending up in the country based on the business permits issued by local governments to electronics store to ascertain whether an increasing trend in the number of surplus electronic stores would suggest an increasing influx of e-waste into the country. This approach proved to be unsuccessful because the business permits and licenses issued by the Quezon City and Manila City Halls do no indicate precise categories for this type of business.

On the other hand, a quick look at the sheer volume of Philippine electronics imports would suggest that e-waste can only get worse than it already is. In 2010, the country's electronic imports grew by 22.3% with an estimated value of US$ 18.5 billion. Of the US$ 6.7 billion imports that came from Japan in 2010 almost 50% are electronics, electrical machinery and telecommunication equipment. 58% of imports from the United States and 52% of imports from South Korea were all electronics. Furthermore, statistics from the United Nations suggest staggering electronics and electrical imports. Close to 21 million units of colored or monochrome television recievers, monitors, projectors, fluorescent lamps, colored cathode-ray tubes, monitors and other parts were shipped into the country in 2010. The USEIA reports that LCD televisions and monitors contain as much as 50-mg of mercury per unit. With this figure, it can be estimated that the 21 million units of imported television equally brought into the country potentially more than 1000 kilograms of lethal, toxic mercury. It is not unlikely that some of these electronics entered the country as e-waste in the guise of "surplus" or recyclable electronics.

The rate at which these mountains of obsolete electronics are growing are approaching catastrophic proportions unless manufacturers face up to their responsibility of phasing out heavy metals and hazardous chemicals in their production process. Government must also immediately ratify the very much needed Basel Ban Amendment to mitigate the stream of electronic waste in the Philippines.

MERCURY IN SHIPBREAKING

Shipbreaking is the process of dismantling an obsolete vessel's structure for scrapping or disposal. The dismantling process occurs at a pier, normally on dry dock or dismantling slip, and includes a wide range of activities, from removing all gear and equipment to cutting down and recycling the ship's infrastructure. [xxxiv]

While the shipbreaking industry is perceived as beneficial from a life-cycle assessment and jobs-generation point of view, over the years it has gravitated toward countries with low labor costs, weak regulations on occupational safety, and limited environmental law enforcement. This "shift" in the industry to countries with weaker regulatory systems is a main cause for concern as these ships contain many hazards that can have significant implications on public health and the environment.

Some risks associated with shipbreaking activities include exposing workers to a wide range of hazards like asbestos, polychlorinated biphenyls, and some heavy metals like mercury which is found in fluorescent light tubes, thermometers, electrical switches, light fittings, fire detectors and tank level indicators.

The global center of the shipbreaking and recycling industry is located in South Asia, particularly Bangladesh, India and Pakistan, which account for up to 80% of the international market for ship breaking of ocean-going vessels. China and Turkey account for most of the rest while only about 5% of the global volume of such vessels is scrapped outside these countries.

A 2010 study commissioned by World Bank looked into the environmental impacts arising out of the shipbreaking and recycling industry in Bangladesh and Pakistan. In the said study, widespread but varying degrees of contamination in soil were found with deposits of cadmium, chromium, lead and mercury in the ship yards of Chittagong in Bangladesh and Gadani in Pakistan. Mercury contamination was measured at 0.078 to 0.158 mg/kg of soil in the sites. Naval and merchant ships in the yards were also studied and discovered to contain mercury. For merchant v essels, the study recorded 44 kilograms of mercury per million of gross tonnage (GT) and in a particular Panamax tanker of 40,000 GT, 1.8 kgs of mercury was recorded. On the other hand, a naval fleet of 14 ships consisting of aircraft carriers, cargo, radar and tankers revealed a total of 75 kilograms of mercury per million light displacement tons (LDT) . In a particular Destroyer class vessel with 5000 LDT, 0.38 kilograms of mercury was also recorded

In the Philippines, the Maritime Industry Authority (MARINA) announced in 2009 that it sought assistance from the Japan International Cooperation

Agency (JICA) in setting up the country's shipbreaking industry. The initial site being considered is Mindanao and that JICA has already presented a proposal on how the country should design its shipbreaking industry. Further influence from the Japanese Shipowners' Association has also put pressure on the government to embark on shipbreaking as the global financial crunch pushed many shipping firms to retire and scrap some 300 vessels. However, this move was strongly cautioned by Ban Toxics, stating that the shipbreaking industry is a "dirty, dangerous and deadly business that has been notorious for totally deplorable levels of workers' injury and death and environmental pollution and destruction."

At present, an ongoing study on hazardous materials in shipbreaking, ship building and ship repairs in the country is being conducted by XXXXX. The insidious presence of mercury in these ship yards is expected given anecdotal reports to such effect but levels of contamination are yet to be established.

LEGAL FRAMEWORK ON MERCURY

There are several laws in the country that provide varying degrees of framework on mercury trade. The primary legislation that governs the regulation of hazardous and toxic substances including mercury and mercuric compounds is Republic Act 6969 or the Toxic Substances, Hazardous and Nuclear Wastes Control Act. This law and its corresponding Implementing Rules and Regulations prescribe a general framework on procedures and requirements for hazardous waste management in the Philippines, prohibit the entry, transit and disposal of hazardous wastes into the Philippine territory and encourage proper management of hazardous wastes through minimization, recycling, treatment and land-filling of various of hazardous waste. In support of this key legislation is an administrative order (AO) issued by the Department of Environment and Natural Resources (DENR) aimed at further controlling the use and dispersion of mercury and mercury compounds into the environment. Administrative Order 97-38, otherwise known as the Chemical ControlOrder (CCO) for mercury and mercury compounds, provides for additional requirements and procedures in the importation, manufacture, distribution and use of mercury and mercury compounds. The CCO also enumerates definitive conditions in the treatment, transport, storage and disposal of mercury-containing wastes in the Philippines. However, the CCO also identifies certain industries as exempt and are therefore allowed to bring mercury into the country. These industries are: chlor-alkali plants,

mining and metallurgical industries, electrical apparatus (lamps, arc rectifiers, battery cells and others), industrial and control instruments, pharmaceutical, paint manufacturing, pulp and paper manufacturing, dental amalgam, industrial catalyst and fungicide production or formulation.[xlii]

The Clean Air Act of 1998 or Republic Act 8749 aspires for a comprehensive air pollution program that includes the implementation of air quality standards. It further prohibits the burning or incineration of municipal, biomedical and hazardous wastes as these wastes emit poisonous and toxic fumes. The law also directs DENR to promote non-burn technologies which are environmentally-sound and safe for the handling, treatment, thermal destruction, utilization and disposal of sorted, unrecycled, uncomposed municipal, biomedical and hazardous wastes.

Another law is the Pollution Control Law of 1976, or Presidential Decree 984. This decree bans the disposal of any liquid, gaseous or solid wastes into the water, land and/or air resources of the country that will tend to alter the physical, chemical, and biological properties of such resources or that will likely cause such air, water and land resources to be harmful, detrimental or injurious to public health, safety or welfare and/or will adversely affect the domestic, commercial, industrial, agricultural, recreational utilization or other legitimate purposes of these resources.

The Department of Health (DOH) has also come up with an administrative order for the gradual phase-out of mercury and mercury-containing equipment from all health-care facilities in the country. Administrative Order No. 2008-0021 directs all hospitals, infirmaries, birthing homes and all types of clinics to immediately stop the distribution of mercury thermometers in patient kits, adhere to a gradual phase-out plan that will lead to a full implementation by 2010 and to carry out an inventory of all mercury-containing devices in these facilities. In April 2011, Health Secretary Enrique T. Ona signed Memorandum 2011-0145 which enumerates the Department's guidelines for the temporary storage of mercury wastes in all healthcare facilities pursuant to the gradual phase-out plan of mercury.

Similar to DOH's AO 21, the Department of Education (DepEd) has issued Memorandum No. 160 in 2010 that calls for a review of existing department regulations on safety in science laboratories that endeavors to exclude mercury from the list of commonly used chemicals.

CONCLUSION

A solid understanding of commercial mercury trade is a fundamental foundation upon which the government can build effective strategies and promote specific measures to address national and even global mercury challenges. Examining commercial mercury creates a better understanding of the specific mercury sources and uses, the trade routes and the main stakeholders involved. It also informs not only the stakeholders, specific trading countries and regions that have established plans and targets for reducing mercury supply and demand but also national and international agencies mandated to take a broader approach in addressing mercury problems. A closer inspection on mercury supply and demand furthermore provides a tool to measure progress toward national objectives of reducing mercury flows in the biosphere through reductions in mercury supply and demand. Despite several laws that regulate the importation, sale, distribution and use of hazardous substances, analysis of related studies, field investigations and interviews lead to the conclusion that mercury flow is relatively unobstructed in the Philippines. Unless definitive steps are taken to mitigate mercury discharges, its effect on public health and the environment will be devastating.

[i] National Strategic Plan for the Phase Out of Mercury in Artisanal and Small Scale Gold Mining in the Philippines 2011-2021; Environmental Management Bureau, Department of Environment and Natural Resources (http://bantoxics.org/v2/images/downloads/nsp-asgm%20final.pdf) last accessed May 4, 2012

[ii] British Geological Survey, World Minerals Production 2006-2010.

[iii] U.S. Geological Survey, Mineral Commodity Summaries, January 2007.

[iv] The Price of Gold: Mercury Use and Current Issues Surrounding Artisanal and Small-Scale Gold Mining in the Philippines; Ban Toxics!: December 2010

[v] Mercury Flows and Safe Storage of Surplus Mercury; European Commission Directorate General for Environment: August 2006

[vi] Mercury continues to be employed as a catalyst in certain industrial processes to produce chlorine and caustic soda in mercury-cell chlor-alkali plants. The mercury cell process takes place in an electrolytic cell, where liquid mercury acts as a cathode. It attracts sodium (or potassium) cations with which it forms an amalgam. Chlorine gas collects at the anode (graphite). When the amalgam is added to water, the sodium (or potassium) reacts with the water to form sodium hydroxide, leaving the mercury, which can then be reused. Because mercury is highly volatile, mercury contamination occurs throughout the process, commonly leading to both the product (caustic soda) and the waste-water stream containing small amounts of mercury.

[vii] European Commission, 22-23

[viii] UNData, Commodity Trade Statistics Division (http://comtrade.un.org/db/dqBasicQueryResults.aspx?cc=280540&px=HS&r=608&y=All&p=ALL&rg=1&so=9999) last accessed May 5, 2012

[ix] Mercury Trade Map 2011. ZOI Environmental Network. 2012. (www.zoinet.org/web/sites/default/files/publications/MercuryTrade Map 2011.pdf) last accessed May 5, 2012

[x] Ban Toxics!, 37

[xi] Regulation (EC) No 1102/2008 of the European Parliament and of the Council of 22 October 2008 on the banning of exports of metallic mercury and certain mercury compounds and mixtures and the safe storage of metallic mercury.

[xii] Ban Toxics!, 21

[xiii] Zonio. A. Sarangani Bay faces mercury poisoning risk from sunken boat. Philippine Daily Inquirer. October 13, 2001.

[xiv] Cleveland Industries Inc. and Sytengco Philippines Corp.

[xv] McMai Trading Corporation has its main office in Cebu but operates a branch in Davao City. It deals mainly with chemical imports. Davao Diamond Industrial Supply is a dealer of hardware, construction and industrial supplies.

[xvi] Based on field interviews conducted in January-February 2012

[xvii] European Commission, 31-32.

[xviii] Materials in Dentistry: Principles and Application; Jack L. Ferracane: 2001

[xix] UNDATA, Commodity Trade Statistics Division (http://comtrade.un.org/db/dqBasicQueryResultsd.aspx?action=print&cc=284390&px=HS&r=608&y=All&p=ALL&rg=1&so=9999) last accessed May 6, 2012

UNDATA, Commodity Trade Statistics Division (http://comtrade.un.org/db/dqBasicQueryResults.aspx?cc=284390&px=HS&r=841,%20842&y=All&p=ALL&rg=1&so=9999) last accessed July 12, 2012

Concorde East/West Sprl. The Real Cost of Dental Mercury. March 2012.

[xxi] Concorde East/West Sprl., 8
[xxii] Concorde East/West Sprl., 14
[xxiii] A Market Assessment Study on Energy Efficient Lighting Products in Philippine Urban Centers; Arthur Andersen, Inc: 2000 (http://www.efficientlighting.net/FormerELI/philippines/doc/Lighting_market.pdf) last accessed March 21, 2012
[xxv] UNData, Commodity Trade Statistics Division (http://data.un.org/Data.aspx?q=fluorescent&d=ComTrade&f=_l1Code%3a85%3brtCode%3a608%3bcmdCode%3a853931&c=2,3,4,5,7,8,9,11,12&s=_crEngNameOrderBy:asc,yr:desc,_l2Code:asc&v=1)
[xxvii] Module 8, Lamp Waste Management, Philippine Efficient Lighting Market Transformation Project (http://www.doe.gov.ph/pelmatp/training%20modules%20to%20school%20curricula/college/Module-8-Lamp-Waste-Management.pdf) last accessed March 21, 2012
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[xxviii] Mercury Emission Estimates in Cebu City; Research Group for Alternatives to Development Inc.: November 2011
[xxix] Toxic Tech: The Dangerous Chemicals in Electronic Products. Greenpeace Briefing Paper: 2005
[xxx] https://www.premierinc.com/quality-safety/tools-services/safety/topics/computers/downloads/k_2_cei_mercury.pdf
[xxxi] The Vanishing E-wastes of the Philippines; Ban Toxics!: June 2011
[xxxii] Philippine National Statistics Office (http://www.census.gov.ph/data/sectordata/2010/sr1159906.htm) last accessed March 21, 2012
[xxxiii] UNData, Commodity Trade Statistics Division http://comtrade.un.org/db/dqBasicQueryResultsd.aspx?action=print&cc=284390&px=HS&r=608&y=All&p=ALL&rg=1&so=9999) last accessed May 7, 2012
[xxxiv] US Department of Labor, Occupational Safety and Health Administraion Factsheet, 2001. (http://www.osha.gov/OshDoc/data_MaritimeFacts/shipbreaking-factsheet.pdf) last accessed June 30, 2012
[xxxv] World Bank. Ship Breaking and Recycling Industry in Bangladesh and Pakistan. December 2010
[xxxvi] The results for merchant vessels are presented on the basis of a measure of cargo capacity which, in this case is gross tonnage or GT as recommended by the International Maritime Organization.
[xxxvii] Results for naval vessels are based on displacement, which is presented in the study as light displacement tons, which is a common measure of the steel weight of a vessel.
[xxxviii] World Bank. 42
[xxxix] http://www.timawa.net/forum/index.php?topic=17661.0 last accessed June 30, 2012
[xl] Cabuag, VG. Japanese shipowners urge RP to set up shipbreaking industry. Business Mirror. March 25, 2009.
[xli] Olchondra, Riza. Gov't warned on shipbreaking business. Philippine Daily Inquirer. March 31, 2009.
[xlii] Sec. VII, 3, DENR Administrative Order No. 97-38