UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

DEC 2 8 2016

THE ADMINISTRATOR

The Honorable Joseph Biden
President of the Senate
Washington, D.C. 20510

Dear Mr. President:

I am pleased to transmit the Environmental Protection Agency's *Report to Congress on the Global Supply and Trade of Elemental Mercury* as required under section 6 of the Mercury Export Ban Act of 2008.

Mercury, a naturally occurring element found in rock in the earth's crust, is a persistent, bioaccumulative neurotoxin and a threat to human health and the environment. MEBA was intended to reduce the availability of elemental mercury in domestic and international markets by prohibiting the export of elemental mercury.

As requested by Congress, the report assembles available information on the global supply and trade of mercury, including both primary mercury mining as well as mercury that has been recovered from a wide variety of sources and redistilled to a high level of purity. The report then examines the best estimates available to the Agency for the supply, demand, and trade of mercury, including estimates of the volume of mercury currently being mined and traded globally, indicates to the best of our knowledge where such mining is occurring, and identifies relevant factors related to primary mining at the global level after the effective date of MEBA.

If you would like to discuss this report, please contact me or your staff may contact Sven-Erik Kaiser in the EPA's Office of Congressional and Intergovernmental Relations at kaiser.sven-erik@epa.gov or (202) 566-2753.

Sincerely,

Gina McCarthy

Enclosure

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

DEC 2 8 2016

THE ADMINISTRATOR

The Honorable Paul D. Ryan
Speaker of the House of Representatives
Washington, D.C. 20515

Dear Mr. Speaker:

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WASHINGTON, D.C. 20460

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THE ADMINISTRATOR

The Honorable James M. Inhofe
Chairman
Committee on Environment and Public Works
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

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WASHINGTON, D.C. 20460

DEC 2 8 2016

THE ADMINISTRATOR

The Honorable Barbara Boxer
Ranking Member
Committee on Environment and Public Works
United States Senate
Washington, DC 20510

Dear Senator Boxer:

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WASHINGTON, D.C. 20460

DEC 2 8 2016

THE ADMINISTRATOR

The Honorable Fred Upton
Chairman
Committee on Energy and Commerce
U.S. House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

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Sincerely,

Gina McCarthy

Enclosure

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

DEC 2 8 2016

THE ADMINISTRATOR

The Honorable Frank Pallone Jr.
Ranking Member
Committee on Energy and Commerce
U.S. House of Representatives
Washington, DC 20515

Dear Congressman Pallone:

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Sincerely,

Gina McCarthy

Enclosure

Report to Congress on the Global Supply and Trade of Elemental Mercury

Prepared for the
Committee on Energy and Commerce of the U.S. House of Representatives and
the Committee on Environment and Public Works of the U.S. Senate

Office of Chemical Safety and Pollution Prevention
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue
Washington, D.C. 20460

DECEMBER 2016

Contributors

The U.S. EPA analyst responsible for this report is Timothy Lehman of the Economic and Policy Analysis Branch; Chemistry, Economics, and Sustainable Strategies Division; Office of Pollution Prevention and Toxics. Analytical and draft preparation support was provided by Abt Associates Inc. under EPA Contract No. EP-W-16-009.

Contents

Exhibits

Acronyms and Abbreviations

AMAP	Arctic Monitoring and Assessment Programme
ASGM	Artisanal and small-scale gold mining
CASRN	Chemical Abstract Services Registry Number
CEC	Commission for Environmental Cooperation
CIS	Commonwealth of Independent States
Comtrade	United Nations Commodity Trade Statistics Database
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
EC	European Commission
EU	European Union
GEF	Global Environment Facility
MEBA	Mercury Export Ban Act of 2008
NDS	National Defense Stockpile
PVC	Polyvinyl chloride
TSCA	Toxic Substances Control Act
UNEP	United Nations Environment Programme
USGS	United States Geological Survey
VCM	Vinyl chloride monomer
WCC	World Chlorine Council

1 Introduction

1.1 Purpose of this Report

Mercury is found in the earth's crust and can be released into the environment through industrial activity. It is a persistent, bioaccumulative neurotoxin and a public health threat, particularly to children, women of child-bearing age, and indigenous populations that rely heavily on fish and marine mammals as part of their diet. There is also a potential for worker exposure for workers who are involved in mercury-related industries, such as mining, refining and recycling, and transportation. Mercury warrants global attention due to its long-range atmospheric transport, its persistence in the environment, its ability to bioaccumulate in ecosystems, and its significant negative effects on human health and the environment. According to most estimates, at least 70 percent of total mercury deposition in the United States is attributed to mercury emissions that originate from non-U.S. sources.

Congress enacted the Mercury Export Ban Act of 2008 (MEBA) to reduce the availability of elemental mercury (a naturally occurring element, hereafter referred to as "mercury") in domestic and international markets. Among other measures, MEBA amended the Toxic Substances Control Act (TSCA) to prohibit the export of mercury effective January 1, 2013, and to require federal agencies to submit reports and other information to Congress.[1] This report is submitted to fulfill Section 6 of MEBA, which states:

> **REPORT TO CONGRESS.**
> At least 3 years after the effective date of the prohibition on export of elemental mercury under section 12(c) of the Toxic Substances Control Act (15 U.S.C. 2611(c)), as added by section 4 of this Act, but not later than January 1, 2017, the Administrator of the Environmental Protection Agency shall transmit to the Committee on Energy and Commerce of the House of Representatives and the Committee on Environment and Public Works of the Senate a report on the global supply and trade of elemental mercury, including but not limited to the amount of elemental mercury traded globally that originates from primary mining, where such primary mining is conducted, and whether additional primary mining has occurred as a consequence of this Act.

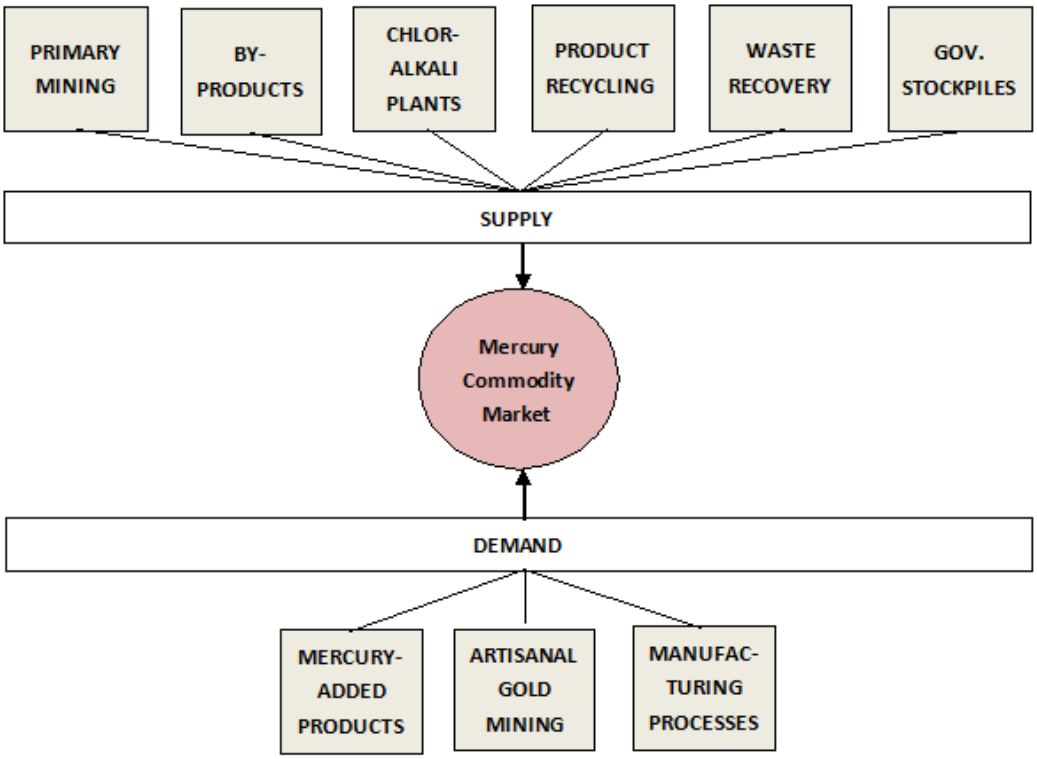
Therefore, the report's purpose is to assemble available information on the global supply and trade of mercury (Chemical Abstract Services Registry Number [CASRN] 7439-97-6), which includes mercury that has been mined and extracted from an ore (primary mining), as well as mercury that has been recovered from a wide variety of sources and redistilled to a high level of purity; it does not include mercury compounds formed when mercury bonds with other elements. This report examines the best estimates for supply, demand, and trade of mercury available to the agency at this time, including estimates of the volume

[1] TSCA was amended in June 2016 by the Frank R. Lautenberg Chemical Safety for the 21st Century Act (the Act). The Act amends TSCA to restrict the export of certain mercury compounds in addition to the existing export restriction on mercury under MEBA. The Act also amends TSCA to require the EPA to inventory mercury supply, use, and trade in the United States; requires the reporting of manufacturing of mercury or mercury-added products; and modifies MEBA provisions related to storage of mercury. The Act's provisions do not impact the focus of this report.

of mercury currently being mined and traded globally, and where such mining is occurring. Where possible, factors are identified that might suggest whether any additional primary mining has occurred at the global level after the effective date of MEBA.

Exhibit 1-1 illustrates the structure of the commodity market for mercury and the key components of its global trade. These components are discussed further in Chapter 2, which describes the international sources of mercury, and Chapter 3, which presents information on the global demand for mercury. Chapter 4 discusses international trade patterns for mercury. Chapter 5 summarizes the findings of the report.

Exhibit 1-1: Structure of the Global Mercury Commodity Market



1.2 Legislative/Policy Background

1.2.1 Mercury Export Ban Act of 2008

On October 14, 2008, President George W. Bush signed the Mercury Export Ban Act (MEBA), the intent of which is to reduce the supply of mercury in commerce at the global level. The three main provisions of MEBA, as amended by TSCA in 2016, are:

- Export of mercury is prohibited from the United States beginning January 1, 2013; export of certain mercury compounds is prohibited effective January 1, 2020.[2]

[2] Effective January 1, 2020, the Frank R. Lautenberg Chemical Safety for the 21st Century Act prohibits export of: mercury (I) chloride or calomel; mercury (II) oxide; mercury (II) sulfate;

- Federal agencies are prohibited from conveying, selling, or distributing mercury that is under their control or jurisdiction. This includes stockpiles held by the U.S. Department of Energy (DOE) and U.S. Department of Defense (DOD).
- DOE will designate one or more DOE facilities for long-term management and storage of mercury generated within the United States. If the facility is not operational by January 1, 2020, DOE must accept title to and pay for permitting and storage costs for all elemental mercury accumulated in accordance with MEBA prior to that date.

The provision prohibiting the export of mercury is the part of MEBA relevant to this report.

1.2.2 Minamata Convention on Mercury and the UNEP Global Mercury Partnership

The Minamata Convention on Mercury, adopted in 2013, is a global agreement to protect human health and the environment from the adverse effects of mercury. The Convention includes a ban on new mercury mines, the phase-out of existing ones, the phase-out and phase-down of mercury use in a number of specified products and processes, control measures on emissions to air and on releases to land and water, and strategies to reduce use of mercury in artisanal and small-scale gold mining (ASGM) at the global level. The Convention also addresses the interim storage of mercury and mercury compounds (other than waste mercury) and disposal of mercury once it becomes waste, in addition to other provisions (UNEP 2016b).

The Convention has been signed by 128 countries and will enter into force 90 days after 50 countries approve, accept, ratify, or accede to the Convention. As of December 2016, 35 countries have done so. The United States joined the Convention on November 6, 2013, and was the first country to do so.

The Global Mercury Partnership of the United Nations Environment Programme (UNEP) works to assist in the timely ratification and effective implementation of the Minamata Convention on Mercury. The partnership seeks to immediately minimize and, where possible, eliminate global anthropogenic mercury releases. Areas of focus include:

- Mercury reduction in ASGM
- Mercury control from coal combustion
- Mercury reduction in the chlor-alkali process
- Mercury reduction in products
- Mercury air transport and fate research
- Mercury waste management
- Mercury supply and storage
- Mercury releases from the cement industry.

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mercury (II) nitrate; and cinnabar or mercury sulphide, unless those mercury compounds are exported to member countries of the Organization for Economic Cooperation and Development for environmentally sound disposal, on the condition that no mercury or mercury compounds so exported are to be recovered, recycled, or reclaimed for use, or directly reused, after such export.

1.2.3 European Union Regulation Banning Mercury Export

Regulation (EC) No. 1102/2008 was adopted by the European Union (EU) to ban mercury exports and promote the safe storage of mercury. The regulation prohibits the export of elemental mercury and several mercury compounds from the EU as of March 2011, although the regulation does allow trade within the member states of the EU.

1.3 Data Sources and Limitations

Data on global mercury supply, demand, and trade are often limited and incomplete, making it difficult to harmonize supply and demand estimates for any given year. Where possible, the data used in this report come from government or international agency sources in areas where they are recognized as authoritative sources. News reports, environmental organizations, and other sources also provide additional qualitative or anecdotal data.

UNEP is a significant source of data on global mercury supply and demand. UNEP's Global Mercury Partnership has produced many documents that are cited in this report. However, as data tend to be gathered from in-country projects and responses from government officials, recent data can be limited to the locations where projects take place or where a relationship with the nation exists. UNEP's *Global Mercury Assessment 2013* (UNEP 2013a) is the most comprehensive source of data on global uses of mercury. As such, this Report to Congress relies on the 2013 Assessment, prepared by the Arctic Monitoring and Assessment Programme (AMAP) and UNEP Chemicals Branch, as well as older technical assessments. The 2013 Assessment provides estimates for mercury demand in 2010; thus, the estimates may be outdated. UNEP is currently preparing the next Assessment, but data are not yet available.

The United States Geological Survey (USGS) produces annual Minerals Yearbooks and Mineral Commodity Summaries. These annual reviews contain statistical data and information that are used in this report as a source of data on mercury production and demand. However, the world mine production rates provided by USGS include both primary and byproduct mining, and thus do not allow differentiation of the volumes for each category. World production estimates are also incomplete since the extent of mining operations is not fully known and U.S. production estimates are not available.

The World Chlorine Council (WCC) reports annually to UNEP on mercury use in the chlor-alkali industry. These data are the most comprehensive available, covering about 85 percent of the world chlorine production capacity based on mercury. The most recent data available are from 2014.

The Artisanal Gold Council created a database of global mercury use in the ASGM sector, called Mercury Watch, which contains data from various publications and researchers. Mercury Watch is updated pending data availability.

For international trade patterns, this report uses data from the United Nations Commodity Trade Statistics Database (Comtrade), which is considered to be the most comprehensive trade database available and is continuously updated. However, it relies on reports made by the countries and is known to contain inaccuracies. For example, countries do not necessarily report their trade statistics for each and every year, nor does Comtrade

contain estimates for missing data. Therefore, trade of a country could be understated due to unavailability of country data or incomplete reporting. In addition to missing data, imports reported by one country do not necessarily agree with exports reported by its trading partner due to various factors including valuation, conversion rates, differences in inclusions/exclusions of particular commodities, and timing. Illegal trade is also, by definition, not captured in official government statistics, but could be a significant contributor to trade flows. Human error also contributes to many of the inaccuracies, including wrong codes and numeric transpositions in reporting codes.

2 Supply – Sources of Mercury

The global mercury supply has remained relatively stable over the 2007-2016 period, with a slight reduction. The total global supply of mercury was estimated at 3,100 to 3,900 metric tons in 2007 (Narvaez 2010). As discussed below, the current global supply of mercury is estimated at approximately 2,900 to 3,600 metric tons.

This supply is derived from five main sources:

- primary (virgin) mercury mining;
- byproduct mercury production from other mining operations and mineral processing;
- decommissioning (closure) of chlor-alkali plants;
- product recycling and other waste recovery; and,
- the sale of government or private stockpiles.

Apart from primary and byproduct mining operations, the remaining sources are considered to be secondary sources of mercury. This chapter assembles and examines the most current information available for each of these global mercury sources and, if information is available, indicates where mercury originating from primary mining is traded globally. A summary table of the most recent data on supply is provided in Section 2.3.

2.1 Mercury Mining

Mercury is produced either as the target product or as a byproduct. Primary mercury mining is currently known to occur in only four countries (China, Indonesia, the Kyrgyz Republic, and Mexico). Byproduct mercury production is driven by the price of the target metal, such as gold, and not by an actual demand for mercury. Primary and byproduct mining are discussed in the following sections.

2.1.1 Primary Mercury Mining

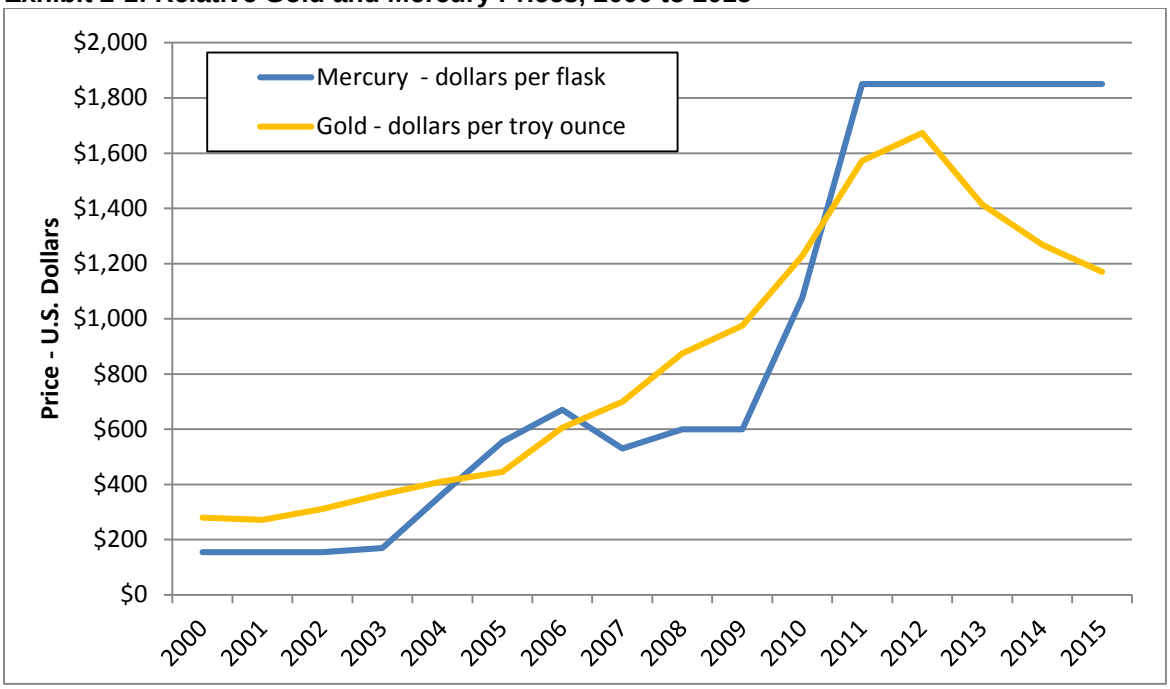
Primary mercury mining occurs in order to extract mercury rather than other commodities. According to a 2007 estimate, a total of 1,300 to 1,600 metric tons of mercury per year come from primary mines (Narvaez 2010). This Report to Congress compiles more recent information from various sources to develop a more up-to-date estimate of the amount of primary mining occurring worldwide. Over the past few decades, the primary mercury mining industry has been dominated by a handful of countries, and the number has steadily declined. For example, Spain and Algeria, both historically important mercury mining countries, ceased operations in 2003 and 2004, respectively. Currently, mining operations officially occur only in the Kyrgyz Republic and China (UNEP 2008). Kyrgyz mines have steadily reduced production. China's mining activity has remained the largest in terms of volume; however, much, if not most, of the mercury extracted is for domestic consumption. UNEP has engaged with the Government of Mexico to assess what is becoming recognized as an increasing supply of primary mined mercury from Mexico (Bernaudat 2016). Furthermore, Indonesian government officials have recently acknowledged primary mining occurring in Indonesia (Davis 2016).

Factors That Influence Primary Mining

The decision to conduct primary mercury mining and at what production level is dependent on several economic and political factors, including the overall demand for mercury; the price of mercury and other commodities such as gold; domestic economic and/or environmental policies; and participation in international agreements, such as the Minamata Convention. Increased primary mercury mining for export is likely to correspond with high global demand, constrained supplies, and high mercury prices.

The price of mercury is currently the highest it has been in recent history. Exhibit 2-1 presents the average price per flask of mercury from 2000 to 2015, based on data from Platts Metals Week, as summarized in USGS Minerals Yearbooks. Because mercury is primarily traded through private business agreements, published prices may not reflect the actual market price. In the early 2000s, mercury prices remained stable at 140 per flask (i.e., 76 pounds of mercury), then rose from 2004 until 2011, when the price of a flask reached and has remained at 1,850. Between 2011and 2015, this reported price was not reflective of market value. After 2015, the price was no longer reported. As described in Section 3.1, the greatest demand for mercury comes from artisanal and small-scale gold mining, and mercury s price is strongly correlated with gold prices.

Exhibit 2-1: Relative Gold and Mercury Prices, 2000 to 2015



Note that 1 flask 1,116 troy ounces; gold prices are significantly higher than mercury prices.
Sources: (USGS 2004; USGS 2005; USGS 2006; USGS 2007; USGS 2008; USGS 2009; USGS 2010; USGS 2011; USGS 2012; USGS 2013; USGS 2014; USGS 2015a; USGS 2016b)

The Minamata Convention includes limitations on primary mining. Under Article 3 of the Convention:

> 3. Each Party shall not allow primary mercury mining that was not being conducted within its territory at the date of entry into force of the Convention for it.

> 4. Each Party shall only allow primary mercury mining that was being conducted within its territory at the date of entry into force of the Convention for it for a period of up to fifteen years after that date. During this period, mercury from such mining shall only be used in manufacturing of mercury-added products in accordance with Article 4, in manufacturing processes in accordance with Article 5, or be disposed in accordance with Article 11, using operations which do not lead to recovery, recycling, reclamation, direct re-use or alternative uses.

Therefore, as the Convention is implemented, the amount of mercury produced from primary mines will be constrained.

China

It is estimated that China is currently producing approximately 780 metric tons of primary mercury annually (GEF 2015). China is the world's largest producer, consumer, and emitter of mercury (Irving 2016). However, in contrast to the Kyrgyz Republic, China is not a major exporter of mercury; it consumes the majority of the mercury produced domestically and has historically imported mercury to supplement its domestic supply (Chapter 4 of this report provides more information on levels of mercury exports and imports). China's primary production of mercury appears to have more than doubled over the past decade. The increase in Chinese production of mercury coincides with the end of its long-term mercury supply contract with the Kyrgyz Republic (European Commission 2006).

China ratified the Minamata Convention on August 31, 2016. As a Party to the Minamata Convention, China will be required to not allow new primary mercury mines after the Convention enters into force for it and to phase out its existing mines within 15 years of that same date (UNEP 2013c).

Indonesia

Indonesian national government officials acknowledged at a UNEP workshop in Jakarta in March 2015 that primary mercury mining is occurring in Indonesia. The government's estimate for annual mercury production from primary mining was 13 metric tons, but some Indonesian non-governmental organizations believe it may be more (Davis 2016). As discussed in Chapters 3 and 4, Indonesia is a country where ASGM is known to occur, and exports are insubstantial (United Nations 2016), suggesting internal use.

Indonesia signed the Minamata Convention in October 2013 (UNEP 2016c).

Kyrgyz Republic

The Kyrgyz Republic's Khaidarkan mine supplies primary mined mercury to the global marketplace. Mercury production in the Kyrgyz Republic peaked in the 1980s when it had three operating mercury mines, but two closed in the early 1990s (UNEP 2009). Production at the Khaidarkan mine was less than 300 metric tons by 2008 (UNEP 2009). Since then, production has been in decline. The Kyrgyz Republic produced an estimated 70 metric tons of mercury in 2015 (USGS 2016b), and closer to 50 metric tons in 2016 (Davis 2016). Factors contributing to this significant decrease in mercury production include difficulty finding buyers and reduced capital investment in mine infrastructure (Davis 2016). China ended its long-term supply contract with the Kyrgyz Republic in 2004

(European Commission 2006). Due to very little domestic demand, nearly all mercury produced at the Khaidarkan mine is exported.

As of December 2016, the Kyrgyz Republic has not joined the Minamata Convention. However, in support of the Minamata Convention, UNEP has made it a priority to assist the Kyrgyz government in transitioning away from primary mining (UNEP n.d.-a). In October 2009, the government of the Kyrgyz Republic announced its willingness to consider the closure of its Khaidarkan mine if certain issues could be addressed (UNITAR 2009), in particular the question of developing alternative livelihoods for its people. However, these issues have not yet been resolved. The Khaidarkan mine is state-owned, although there have been efforts in the past to privatize it. The mining industry is assisted by government subsidies in order to provide economic and social stability to the local area (UNEP 2009) and there have been other international efforts to assist with the phase-out of primary mercury mining, including one led by UNEP and implemented by UNDP to which the United States contributed. Building on this project, a Global Environment Facility (GEF) project was designed to identify and promote alternatives to mercury mining, in order to replace primary mercury mining with alternative sources of income (UNEP n.d.-c).

Mexico

Official primary mercury mining in Mexico ceased in 1994 due to low global mercury demand and price (Díaz 2013). However, there is increasing evidence that, beginning as early as 2007, a number of old mining operations have resumed producing mercury at a significant level. The Mexican Geological Service, a Mexican federal agency, reported in 2011 that three mines appeared to have been producing mercury intermittently (Díaz 2011). In June 2016, UNEP officials conducted a field visit and verified the existence of five resurrected mines; others may exist (Bernaudat 2016). This recent primary mining activity is informal.[3]

While there are no official data available on production volume from Mexican mines, a provisional estimate of about 38 metric tons of informally produced mercury for the period of 2007 to 2009 was provided by the Commission for Environmental Cooperation (Díaz 2013). This number was estimated by considering customs statistics, reports by journalists referring to informal mercury production, and commercial advertisements offering mercury for sale. Studies from two Mexican universities suggest that current primary production could be in the range of 300 to 400 metric tons per year (Bernaudat 2016).

Once the Convention enters into force, as a Party to the Minamata Convention (Mexico ratified on September 29, 2015), Mexico will be required to not allow new primary mercury mines and phase out any existing ones within 15 years (Minamata Convention, Article 3). The CEC notes that the challenges to the future discontinuation of mercury mining include economic incentives (demand for mercury including for ASGM) and the need for an

[3] According to CEC (2013), informal mining or mining-related activities are those undertaken without official governmental recognition. They may or may not be illegal, but are likely to be off the books.

adequate legal framework to regulate and enforce a ban on primary mercury mining (Díaz 2013).

2.1.2 Byproduct Mercury Production

Byproduct mercury production is associated with the recovery of mercury from non-ferrous ores such as gold, silver, zinc, copper, lead, and antimony. Mercury is captured as a byproduct when processing the ore of the target metal. Mercury is retorted from the metal ore, collected as liquid mercury, and sold or stored by the flask.

Estimates of the global supply of mercury from byproduct mercury mining ranged from 400 to 600 metric tons in 2007 (Narvaez 2010). The UNEP Global Mercury Partnership's Mercury Supply and Storage Area Program is currently working to determine the quantity of byproduct mercury generated from non-ferrous metal processing and gold mining (UNEP n.d.-b).

Factors That Influence Byproduct Mercury Production

Because byproduct mercury is recovered from the ore of other mined materials, its level of production is reliant on the production trends of those target metals. It is the price of gold and other metals that ultimately drives the decision about byproduct mercury production levels from industrial-scale mines.

The Minamata Convention does not directly address byproduct mercury production. However, Parties to the Convention are subject to restrictions to not allow the export of mercury except under certain conditions (UNEP 2013c).

Countries with Byproduct Mercury Production

Several countries generate byproduct mercury from mining operations, though not all contribute to the global market. For example, U.S. and EU mercury is not sold internationally because it cannot be lawfully exported. Countries identified by USGS (2016a) as those with mercury mine production, other than those known to have primary mining, are listed in Exhibit 2-2. Exhibit 2-2 presents each country's estimated annual production volume of byproduct mercury, the primary ores mined, and the country's Minamata Convention status. This list represents a minimum set of known byproduct producers; any country where gold or other ores are mined may produce some amount of mercury byproduct, based on local geologic conditions.

Exhibit 2-2: Byproduct Mercury Production and Minamata Convention Status, by Country

Country	2014 Annual Production Volume of Byproduct Mercury (metric tons)[1]	Primary Ores	Minamata Convention Status[2]
Russia	50	Gold[3]	Signed, 2014
Peru	40	Gold, Silver, Zinc, Copper, Tin[4]	Ratified, 2016
Tajikistan	30	Antimony[5]	No action taken
Norway	25	Zinc[6]	Signed, 2013
United States	12[7]	Gold, Silver[1]	Accepted, 2013
Chile	10	Gold[6]	Signed, 2013
Argentina	10	Gold[8]	Signed, 2013
Morocco	8	Silver[9]	Signed, 2014

Sources: [1] (USGS 2016a); [2] (UNEP 2016c); [3] (Stepanov and Moiseenko 2008); [4] (Peru Ministerio de Salud 2010); [5] (USGS 2016c); [6] (European Commission 2006); [7] minimum value estimate, based on 2012 Chemical Data Reporting submissions, (U.S. EPA 2014); [8] (Díaz 2013); [9] (USGS 2015b)

2.2 Other Sources of Mercury

2.2.1 Chlor-Alkali Plants

The chlor-alkali industry produces chlorine and sodium hydroxide (caustic soda) or potassium hydroxide (potash), which are important commodity chemicals. There are three main production methods: mercury cell, diaphragm cell, and membrane cell. The mercury cell method includes mercury that reacts with brine to form a sodium amalgam.

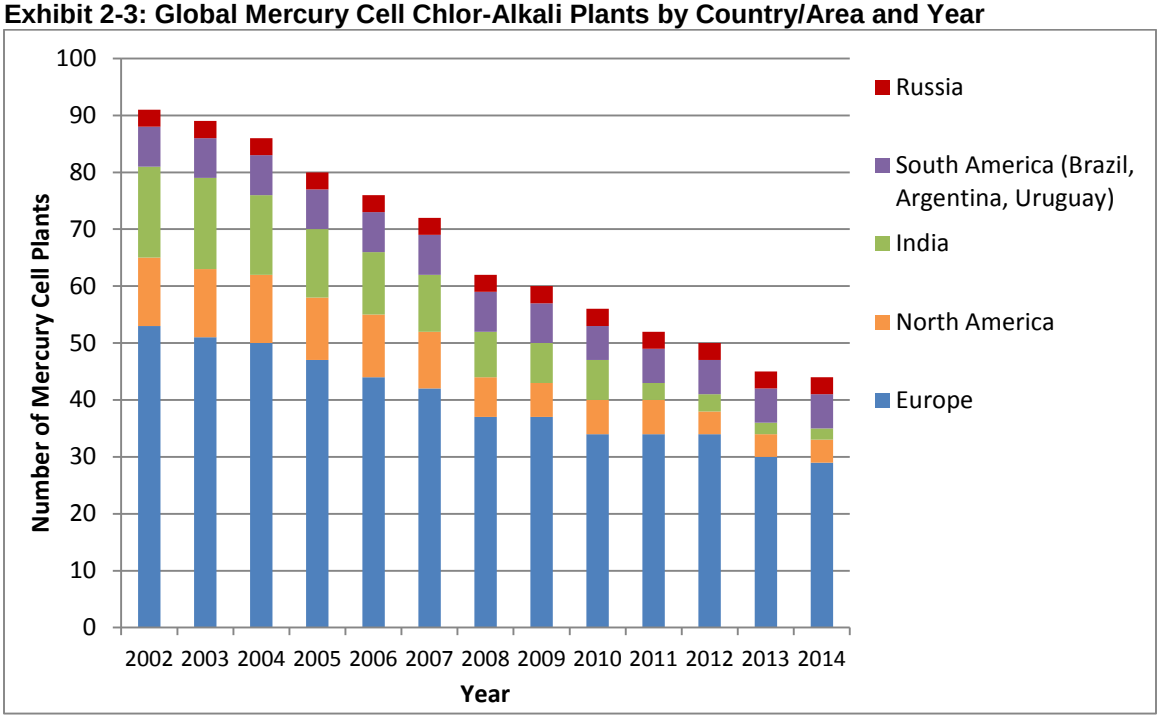
In recent decades, the decommissioning of chlor-alkali plants using the mercury cell process has been a large source of mercury worldwide. It was estimated that the global mercury supply available from this sector in 2005 was 700 to 900 metric tons (UNEP 2008) and is assumed to remain in this range currently. As with other areas of mercury supply, the UNEP Global Mercury Partnership's Mercury Supply and Storage Area Program is working to determine how much mercury will become available from the decommissioning efforts (UNEP n.d.-b).

Factors That Influence Availability of Mercury from the Chlor-Alkali Industry

Several incentives have prompted the chlor-alkali industry to decommission or convert to non-mercury cell processes, including health and environmental concerns, national regulations, the availability of more energy-efficient alternative processes, and the prospect of a reasonable rate of return for conversions. The availability of mercury from decommissioned chlor-alkali plants into the global market is dependent on a combination of private business decisions, policy, and government encouragement.

Given the trend toward decommissioning or converting mercury cells, the global capacity of mercury cell chlorine production has steadily declined by nearly 60 percent from 2002 to 2014 (Euro Chlor 2015). The World Chlorine Council (WCC) reports its data annually to UNEP on mercury use in the chlor-alkali industry, covering about 85 percent of the mercury-based world chlorine production capacity (UNEP n.d.-d). The distribution of mercury cell plants around the world according to WCC's data from 2002 to 2014 is shown in Exhibit 2-3.

Exhibit 2-3: Global Mercury Cell Chlor-Alkali Plants by Country/Area and Year



Source: (World Chlorine Council 2014).
Note: These data cover about 85% of the world chlorine production capacity using the mercury cell process.

The Minamata Convention calls for a phase-out of mercury cell chlor-alkali facilities by 2025 (Minamata Convention, Annex B) and for Parties to take measures to ensure that, if it determines that it has excess mercury from these facilities, to dispose of it in ways that do not lead to its recovery, recycling, reclamation, direct re-use, or alternative uses (Minamata Convention, Article 3). Mercury reduction in the chlor-alkali sector is one of the partnership areas within the UNEP Global Mercury Partnership, which promotes appropriate procedures and methods to convert chlor-alkali plants to non-mercury processes and minimize mercury pollution.

Europe

As shown in Exhibit 2-3, the majority of chlor-alkali plants using the mercury cell process are located in Europe. The EU's Industrial Emissions Directive requires that mercury-based production technology cease before December 11, 2017 (Euro Chlor 2016). As of 2015, 5,200 metric tons of mercury were still in use in European chlor-alkali manufacturing (European Commission 2016). However, mercury from decommissioned chlor-alkali plants cannot be exported from the EU under Regulation (EC) No 1102/2008, which bans exports of mercury outside of the EU (European Commission 2008). Under the regulation, this mercury is considered waste and must either be adequately stored or used to satisfy domestic/regional demand within the EU and its member states.

United States

No new mercury cell plant has been constructed in the United States since 1970 (U.S. EPA 2005). The decommissioning of mercury cell chlor-alkali plants has been a major contributor to U.S. mercury supplies, though this supply will be depleted as the last facilities using mercury cells begin to phase out. As of 2016, the United States has only

two remaining mercury cell facilities still operating. ASHTA Chemicals in Ohio, an owner of one of the remaining mercury cell facilities, announced in June 2014 that it plans to replace its mercury cell processing technology with membrane cell technology by 2017 (ASHTA Chemicals Inc. 2014). Once it does so, PPG Industries Inc. in West Virginia will be the only mercury cell facility remaining in the United States. Due to MEBA, mercury from these two remaining facilities will not become part of the global supply upon decommission.

Other Countries

Mexico is seeking funding to convert to membrane cells at its two chlor-alkali plants (UNEP 2016a). Approximately 265 metric tons of mercury reserves will be available when the two remaining chlor-alkali plants change to non-mercury technology (Díaz 2013). As a Party to the Minamata Convention, Mexico, like all Parties, will be required to phase out chlor-alkali production using mercury by 2025 (UNEP 2016b) or seek a time-limited exemption.

The two remaining mercury cell plants in India are currently in the process of conversion to membrane cell technology (UNEP 2016a). India has signed the Minamata Convention, but has not yet ratified it (UNEP 2016c).

Russia is currently operating three mercury cell plants. The nation has developed action plans to implement mercury reduction projects (UNEP 2016a). The Russian Federation has signed the Minamata Convention, but has not yet ratified it (UNEP 2016c).

2.2.2 Product Recycling and Waste Recovery

An estimated 600 to 800 metric tons of mercury were recycled or recovered globally from mercury catalysts, wastes, and products in 2007 (Narvaez 2010). It is assumed that mercury recycling and recovery remains in this range currently, making the recovery of mercury from industrial and consumer products an important source of secondary mercury supply.

Product Recycling

Mercury can be recovered from discarded mercury-added products, and then retorted. For example, in the United States in 2015, mercury-added automobile convenience switches, barometers, compact and traditional fluorescent lamps, computers, dental amalgam, medical devices, thermostats, and some mercury-added toys were collected by as many as 50 companies and shipped to six refining companies in the United States for retorting (USGS 2016a). The EPA's Toxic Release Inventory data also suggest an increasing trend in mercury recycling over the past decade (U.S. EPA 2016).

As the volume of newly manufactured products containing mercury declines, the volume of products available for recycling will also drop. This will mean in the long term that recycling as a global supply source of mercury will eventually decrease as well. In other words, the increased use of mercury substitutes results in less mercury in products, which decreases the amount of mercury in products that can be recycled. More information about specific products that contain mercury is found in Section 3.4 of this report.

Industrial Waste Recovery

Another secondary source includes mercury recovered from hazardous industrial wastes, such as contaminated soil and debris located around old mine sites, natural gas pipelines, and other industrial facilities, including mercury captured in air pollution control devices. Waste recovery of mercury from process streams, natural gas cleaning, and pollution control devices can also contribute to the global supply. For example, mercury can be recovered and recycled from the vinyl chloride monomer (VCM) process, which is used in the production of polyvinyl chloride (PVC). Although VCM can be produced using a mercury-free process, the acetylene process, known to be used exclusively in China, typically uses mercuric chloride on carbon pellets as a catalyst (European Commission 2006). An estimated 301 metric tons of mercury were recycled or recovered globally from the VCM process in 2005 (European Commission 2006).

Natural gas can contain trace quantities of mercury, which is sometimes removed from the gas before it can be used. Geographical location is the primary determinant of whether mercury concentrations in natural gas are high enough to require cleaning before use; the Netherlands, North Sea, Algeria, Croatia, South Africa, Far East, and Sumatra are reported as having such concentrations (UNEP 2006). In 2006, UNEP estimated that 30 to 40 metric tons of mercury are recovered from natural gas each year worldwide, with the European Union contributing about half of the amount of mercury recovered from gas cleaning wastes in a typical year (UNEP 2006).

Mexico has significant secondary mercury reserves resulting from the inefficiency of the silver amalgamation method used in historical silver production between the years 1545 and 1900. Secondary production from tailings is a significant source of mercury; it is estimated that 7,000 to 14,000 metric tons of mercury remain in mine tailings in the Zacatecas region alone. In 2013, secondary production at the two existing recovery plants in Zacatecas was approximately 24 metric tons per year. The potential combined mercury-production capacity of these two plants is estimated to be approximately 45 metric tons per year (Díaz 2013), but is dependent on the price of silver.

2.2.3 Stockpiles

The Minamata Convention calls for Parties to identify individual stocks of mercury or mercury compounds exceeding 50 metric tons, as well as sources of mercury supply-generating stocks exceeding 10 metric tons per year located within their territories (Minamata Convention, Article 3). Since 2010, 4,436 metric tons of mercury has been stored by the National Defense Stockpile (NDS) program at the Hawthorne Army Depot in Hawthorne, Nevada. Additionally, approximately 1,200 metric tons of mercury is being held by the U.S. Department of Energy in Oak Ridge, Tennessee (USGS 2016a). Prior to MEBA, the policy of both the DOE and the DOD was to store, not sell, its mercury stocks. MEBA codified these policies and ensured that federal stockpiles of mercury remain in storage. Under MEBA, the sale or distribution of the stockpiles held by DOE and DOD is prohibited. MEBA also prohibits the transfer of elemental mercury held by federal agencies, thus ensuring that this mercury cannot become a viable source of U.S. or global mercury supply.

Although subject to the EU Export Ban, Spain is believed to have the largest commercially available mercury stockpile. Estimated to be between 1,000 to 4,000 metric tons, this stock of mercury accumulated over the years from the operation of the (now closed) Almadén mine (UNEP 2008), which was one of the world's largest and longest operating mines. The stockpile is thought to be supplemented with mercury purchased from the Kyrgyz Republic and deliveries of mercury from decommissioned chlor-alkali facilities in Europe (UNEP 2008). India is also believed to have stockpiles of mercury, but information on the size of these stockpiles is uncertain (UNEP 2008).

2.3 Summary

A summary of the estimates of global supply of mercury that were discussed this chapter is provided in Exhibit 2-4.

Exhibit 2-4: Estimates of Mercury Supply, Worldwide

Mercury Source	Metric Tons per Year	Estimate Year	Reference
Primary mining	1,143 to 1,243		
Kyrgyz Republic	*50*	*2016*	*(Davis 2016)*
China	*780*	*2015*	*(GEF 2015)*
Mexico	*300-400*	*2016*	*(Bernaudat 2016)*
Indonesia	*13*	*2015*	*(Davis 2016)*
Byproduct production from other metals	400 to 600	2007	(Narvaez 2010)
Chlor-alkali plant decommissioning	700 to 900	2005	(UNEP 2008)
Product recycling and waste recovery	600 to 800	2007	(Narvaez 2010)
TOTAL	**2,843 to 3,543**		

World supply of mercury is estimated at approximately 2,900 to 3,600 metric tons per year. This is a 6 to 7 percent reduction from the estimated 3,100 to 3,900 metric tons of supply in 2007 (Narvaez 2010). It is important to keep in mind the limitations and caveats of these data (as discussed in Section 1.3).

The most significant source of mercury is from primary mining, with an estimated 1,143 to 1,243 metric tons of annual production (35 to 41 percent of total). As noted earlier, primary production of mercury occurs in the Kyrgyz Republic, China, Mexico, and Indonesia. With China generally not producing mercury for export, Mexico currently appears to be the largest primary producer of mercury in terms of global availability, based on an estimated 300 to 400 metric tons produced annually. Mexico, as a Party to the Minamata Convention, will be expected to discontinue mining activities in the future in accordance with the obligations under the Convention.

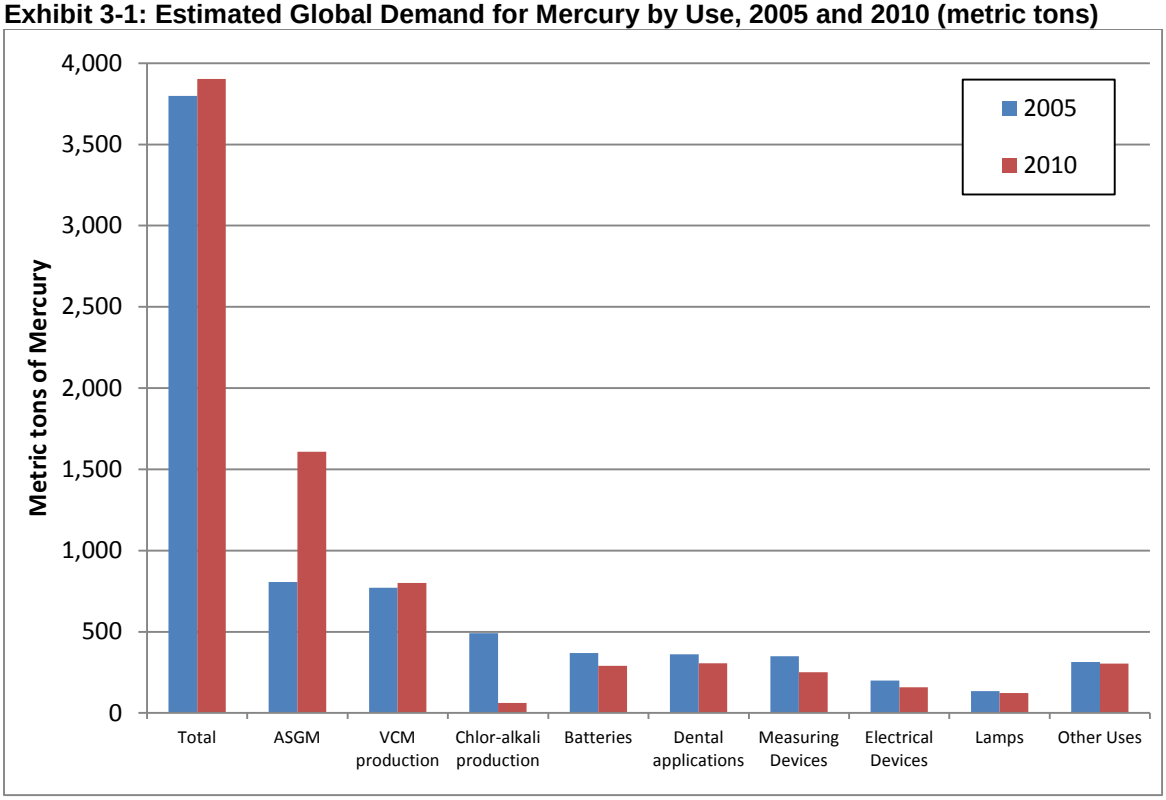
The next largest sources of supply come from chlor-alkali plant decommissioning and product recycling/waste recovery. Mercury from these sources will eventually be constrained due to reduced use of mercury in these areas. Production of mercury as a byproduct of other metals mining (e.g., gold, antimony) continues; levels of production are linked to the demand for the target ore.

3 Demand – Uses of Mercury

This chapter focuses on the demand for mercury worldwide by examining the significant categories of use. Globally, the overall level of demand for mercury has increased slightly over the past decade. Global demand was estimated at 3,798 metric tons in 2005 (AMAP/UNEP 2008) and at 3,903 metric tons in 2010 (using AMAP/UNEP 2013 estimates supplemented with 2010 data from WCC for chlor-alkali production). As discussed below, the current global mercury demand is estimated at approximately 4,000 metric tons per year subject to the data limitations discussed in Chapter 1.

Exhibit 3-1 compares the global demand for mercury by its major uses between 2005 and 2010. Many uses of mercury are being phased out due to regulatory and technological advances, so that the amount of mercury used in many products has declined; however, use in other activities, such as artisanal/small-scale gold mining (ASGM) and vinyl chloride monomer (VCM) production, seems to have increased.

Exhibit 3-1: Estimated Global Demand for Mercury by Use, 2005 and 2010 (metric tons)



Sources: (AMAP/UNEP 2008; AMAP/UNEP 2013; World Chlorine Council 2014)

This chapter assembles and examines the most current information available for each of these mercury uses worldwide to develop a more recent estimate of global demand. ASGM is described in Section 3.1. Another significant source of mercury demand is manufacturing processes. VCM manufacturing is described in Section 3.2 and chlor-alkali production is described in Section 3.3. Mercury-added products are described in Section 3.4. Mercury-added products include dental amalgam, batteries, measuring devices, lamps/lighting, electrical devices, formulated products, and other uses (UNEP 2013c;

Smith 2015). A summary table of the most recent data on global demand for mercury is provided in Section 3.5.

3.1 Artisanal and Small-Scale Gold Mining (ASGM)

ASGM is not only the largest global use of mercury, but is also the single largest source of anthropogenic mercury emissions and releases to the environment, estimated to contribute to more than 37 percent of total global mercury emissions (AMAP/UNEP 2013), despite being illegal in some countries. In ASGM, mercury amalgamation is used to separate gold from other minerals in ore. Once mercury is added to the gold ore, an amalgam forms containing gold and mercury. This amalgam is then heated to retrieve the gold. During this extraction process, mercury is released as a vapor, and into water or land via mine tailings. ASGM releases approximately 1,600 metric tons of mercury per year (Persaud and Telmer 2015).

3.1.1 Factors That Influence the Level of ASGM Consumption

Social and economic factors impact the level of ASGM consumption. Mercury is commonly used in the ASGM sector due to its ease of use, relative effectiveness in capturing gold, and low cost relative to the price of gold (Persaud and Telmer 2015). UNEP (2015) notes that mercury use allows miners to produce gold quickly, often in one day. ASGM is especially prevalent among areas with high levels of rural poverty, given rising gold prices (UNEP 2013a). The price of one troy ounce of gold rose from about US 280 in 2000 to peak in 2012 at about US 1,680, to settle at US 1,182 in 2015 (USGS 2004; USGS 2005; USGS 2006; USGS 2007; USGS 2008; USGS 2009; USGS 2010; USGS 2011; USGS 2012; USGS 2013; USGS 2014; USGS 2015a; USGS 2016b). As shown in Exhibit 2-1, mercury prices fairly consistently correlate with those of gold. It is likely that changes in mercury and/or gold prices will continue to impact the demand and use of mercury in the ASGM sector in the future.

Mercury use in ASGM is expected to decline when the Minamata Convention comes into force. This will be especially true as countries with extensive ASGM activity implement their ASGM National Action Plans. Article 7 of the Convention states:

> 2. Each Party that has artisanal and small-scale gold mining and processing subject to this Article within its territory shall take steps to reduce, and where feasible eliminate, the use of mercury and mercury compounds in, and the emissions and releases to the environment of mercury from, such mining and processing.
>
> 3. Each Party shall notify the Secretariat if at any time the Party determines that artisanal and small-scale gold mining and processing in its territory is more than insignificant. If it so determines the Party shall: Develop and implement a national action plan in accordance with Annex C.

3.1.2 Total Demand for ASGM and Major ASGM Countries

The majority of the consumption in the ASGM sector is informal, making estimates of the use of mercury in this sector highly speculative. Most estimates are made based on several factors, including average miner revenue, average gold to mercury ratio, and the number of mine shafts/sites (Persaud and Telmer 2015).

The Artisanal Gold Council maintains Mercury Watch, an interactive monitoring system for global mercury use in the ASGM sector. The Mercury Watch database provides information on the mercury used in artisanal mining based on data from researchers and other actors involved in the sector. Using Mercury Watch data, AMAP/UNEP (2013) listed the mean estimate for global mercury use in ASGM in 2010 at 1,608 metric tons per year, with a large margin of error. Mercury Watch's online database is updated whenever possible as new information becomes available; estimates for each country are from various years. According to the most recent Mercury Watch data (as viewed in August 2016), ASGM occurs in more than 70 countries, with the majority performed in South America, Africa, and Asia. According to the current Mercury Watch data, the top global users of mercury for ASGM include: Indonesia, Colombia, the Philippines, Peru, Ecuador, Brazil, the United Republic of Tanzania, Burkina Faso, Suriname, and Zimbabwe. Each of these countries is listed as using 25 or more tons of mercury for ASGM annually (Artisanal Gold Council 2016).

3.2 Vinyl Chloride Monomer (VCM) Manufacturing

The second largest demand sector for mercury is VCM manufacturing. VCM's primary use is as the building block of polyvinyl chloride (PVC), a widely used plastic. Mercury serves as a catalyst when VCM is produced via a coal-based manufacturing process (UNEP n.d.-e).

VCM production in China constitutes 80 to 90 percent of the world's VCM manufacturing (UNEP n.d.-e). The majority of China's VCM manufacturers use the coal-based process (AMAP/UNEP 2013), and China is the only country known to produce VCM with this mercury-using method. A large number of other countries, including the United States, Canada, Brazil, the Czech Republic, Poland, and many others use non-coal based processes in VCM production. It was estimated that in 2012, China produced about 10 million metric tons of PVC (GEF 2015) using 800 metric tons of mercury (AMAP/UNEP 2013). Demand for mercury for VCM manufacturing was estimated at 770 metric tons in 2005 (AMAP/UNEP 2008), so mercury use for this process has slightly increased.

Given the high demand for PVC, especially in countries where extensive construction is occurring, it may take some time before mercury demand ceases in the VCM production sector (UNEP 2013b). China's PVC market, for example, is expected to rise 6.7 percent annually between 2015 and 2018, possibly encouraging an increase in mercury demand (Hanna 2015). Globally, PVC production is expected to double between 2010 to 2020 (AMAP/UNEP 2013). Mercury-free alternative catalysts for the coal-based VCM production process used in China are not currently commercially available despite ongoing development efforts (European Commission 2006).

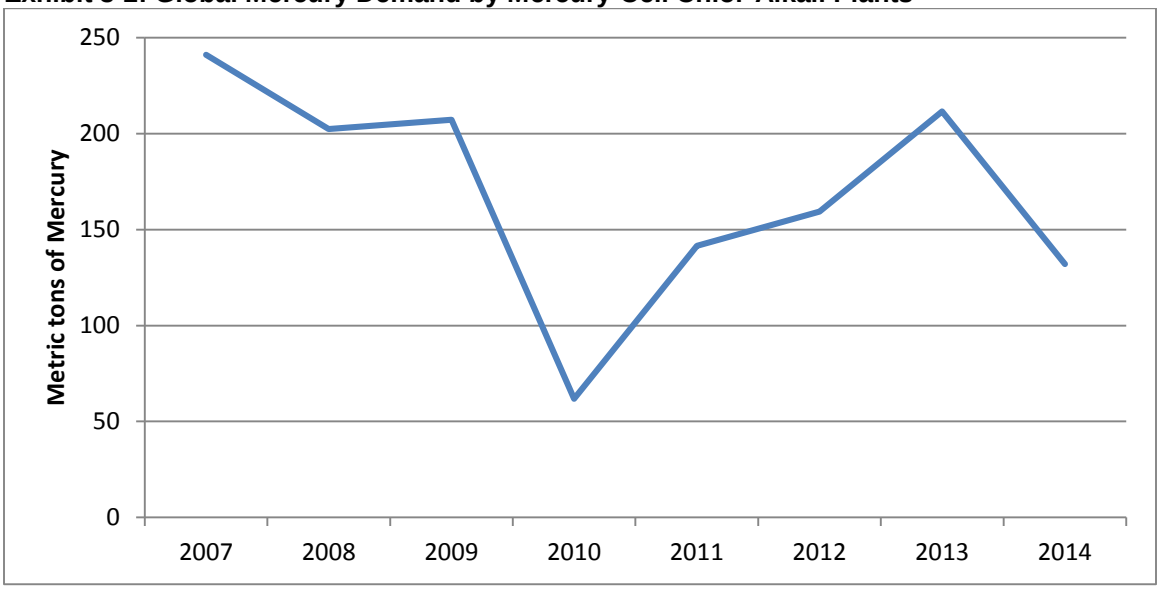
The Minamata Convention will require Parties to take measures to restrict the use of mercury in VCM production, including reducing use of mercury by 50 percent by the year 2020 and prohibiting the use of mercury five years after mercury-free catalysts are technically and economically feasible (UNEP 2013c). China is currently preparing a demonstration project with GEF support and led by the United Nations Industrial Development Organization (UNIDO) to investigate and address the PVC manufacturing sector (GEF 2015).

3.3 Chlor-Alkali Production

Chlor-alkali plants using the mercury-cell process have historically been a significant source of demand for mercury worldwide. However, the chlor-alkali industry has been transitioning to mercury-free processes in recent decades, due to cost, regulatory, and environmental and health factors. As these plants either close or convert to non-mercury processes, they may become a source of mercury supply (see Section 2.2.1 of this report).

As of late 2014, approximately 70 mercury-cell chlor-alkali facilities remained in operation in about 40 countries (UNEP, 2016b). Exhibit 3-2 presents global mercury use in the chlor-alkali sector from 2007 to 2014 as reported by the World Chlorine Council to UNEP. Mercury use in this context means the mercury added to the production cells and circuits throughout the year to keep the amount of mercury contained in the cells and circuits at the same constant level. Although the number of mercury cell chlor-alkali plants has steadily decreased over the period 2002 to 2014 (see Exhibit 2-3), demand for mercury in this sector is variable from year to year. Of the 132 metric tons of mercury reported by the World Chlorine Council as being used in 2014, 20 percent was used by the United States, Canada, and Mexico combined (with only two facilities remaining in the United States), and 19 percent by Russia. Nearly half (47 percent) was used in Europe (World Chlorine Council 2014).

Exhibit 3-2: Global Mercury Demand by Mercury-Cell Chlor-Alkali Plants



Source: (World Chlorine Council 2014)

3.4 Mercury-Added Products

The general categories of products containing mercury are dental amalgam, batteries, measuring devices, lamps/lighting, electrical devices, and other uses (UNEP 2013c; Smith 2015). The volume of global use of these mercury-added products for year 2005 and 2010 is summarized in Exhibit 3-3. Each category is described in more detail below.

As regulations and other initiatives around the globe have been promulgated to limit the use of mercury, and in response to consumer preferences for mercury-free alternatives,

some uses of mercury have decreased significantly. For many products, there are readily available and effective mercury substitutes: lithium, nickel-cadmium, zinc-air and indium batteries are replacing mercury-based batteries; digital thermometers are being substituted for mercury-based measuring products; and gallium alloys are providing nontoxic substitutes for mercury in a wide variety of applications (Merchant Research Consulting Ltd. 2015). Despite the reductions in the major uses of mercury, some uses persist. This includes applications such as large measuring devices or products used in esoteric, traditional or religious applications, such as spiritual cleansing rituals. However, such uses are only marginal (Merchant Research Consulting Ltd. 2015).

Exhibit 3-3: Global Mercury Use for Mercury-Added Products by Region and Year (metric tons)

Region	Dental Amalgam		Batteries		Measuring Devices		Lamps		Electrical Devices		Other Uses	
	2005	2010	2005	2010	2005	2010	2005	2010	2005	2010	2005	2010
East and Southeast Asia	80	67	240	191	129	98	42	42	61	50	54	56
South Asia	28	24	33	26	36	27	12	13	17	18	15	21
European Union	95	90	28	23	38	15	25	18	15	2	113	105
Commonwealth of Independent States (CIS) and other European countries	11	10	10	7	24	17	8	7	11	10	10	12
Middle Eastern States	20	16	7	5	17	13	6	6	8	7	7	6
North Africa	5	5	3	2	6	5	2	2	4	4	3	2
Sub-Saharan Africa	8	6	5	4	12	9	4	4	6	6	5	5
North America	40	34	19	11	48	34	25	15	60	43	90	76
Central America and the Caribbean	24	17	5	4	13	10	4	4	6	5	5	7
South America	48	33	20	16	24	18	8	10	12	10	10	13
Australia, New Zealand, and Oceania	4	4	3	2	6	4	2	2	3	3	3	2
Total	**362**	**306**	**370**	**291**	**350**	**250**	**135**	**123**	**200**	**158**	**313**	**305**
Percent change (global)	-15%		-21%		-29%		-9%		-21%		-3%	

Sources: (AMAP/UNEP 2008; AMAP/UNEP 2013)

With an estimated total of 306 metric tons of mercury used worldwide in 2010, dental applications are currently the source of the greatest demand for mercury out of all the categories of mercury-added products (AMAP/UNEP 2013). As of 2008, several nations (e.g., Sweden, Japan, Denmark, and Finland) had already implemented measures to reduce, and in many cases eliminate, the use of mercury-added dental amalgams. In other nations, this use has declined, as it did between 2005 and 2010 at the global level. For example, in the United States, where dental amalgam production is one of the most

common uses for mercury out of all the mercury-added products, use decreased from 27.9 metric tons in 2001 to 14.5 metric tons in 2013, a reduction of 48 percent (IMERC 2015a). The European Union has seen similar decreases from 95 to 90 metric tons in 2010 (Mudgal, Van Long et al. 2012).

The Minamata Convention does not ban the use of mercury in dental amalgam, but it does require the phase down of its use, taking into account the Party's domestic circumstances and relevant international guidance. The Convention requires that Parties take two or more measures from a provided list to phase down the use of mercury in dental amalgam (Minamata Convention, Annex A). If implemented appropriately at the global level, demand for mercury for use in dental amalgam is expected to decrease as the Convention enters into force.

Battery manufacturers were the second largest consumer of mercury for products. AMAP/UNEP reported a global total of 291 metric tons of mercury used in 2010 for batteries (AMAP/UNEP 2013). This is a 21 percent decrease from AMAP/UNEP's estimate of 370 metric tons used in 2005 (AMAP/UNEP 2008). The United States has seen a similar downward trend; between 2001 and 2013, mercury demand for batteries went from 2.53 to 0.51 metric tons, or decreased by 80 percent. Under the Minamata Convention, mercury-added batteries, except for button zinc silver oxide batteries and button zinc air batteries with a mercury content of less than two percent, will be phased out by most Parties by 2020 (that is, after 2020, the manufacture, import, or export will generally not be allowed) (Minamata Convention, Annex A).

Mercury-added measuring devices include barometers, thermometers, manometers, hygrometers, sphygmomanometers (blood pressure cuffs), strain gauges, and thermohydrometers (IMERC 2015c). AMAP/UNEP (2013) reported 250 metric tons of mercury use for measuring devices worldwide in 2010, a 29 percent decrease from its estimate of 350 metric tons in 2005 (AMAP/UNEP 2008). For most Parties, the Minamata Convention prohibits by 2020 the manufacture, import, or export of barometers, hygrometers, manometers, thermometers, and sphygmomanometers, except when installed in large-scale equipment or used for high precision measurement, where no suitable mercury-free alternative is available (Minamata Convention, Annex A).

Mercury is used in a variety of lighting types, including fluorescent lamps, high intensity discharge (HID) lamps, and neon lights/signs (AMAP/UNEP 2008; IMERC 2015b). AMAP/UNEP (2013) reported 123 metric tons of mercury demand for lamps worldwide in 2010.This represents a 8.9 percent decrease from the 135 metric tons of mercury used in 2005 (AMAP/UNEP 2008). The Minamata Convention prohibits, by 2020, the manufacture, import, or export of certain compact fluorescent lamps, certain linear fluorescent lamps, high pressure mercury vapor lamps, and mercury in cold cathode fluorescent lamps and external electrode fluorescent lamps for electronic displays for most Parties (Minamata Convention, Annex A).

Electrical and electronic devices can contain mercury in their switches and relays. This category includes thermostats that use mercury switches. AMAP/UNEP (2013) reported 158 metric tons of mercury demand for electrical devices worldwide in 2010. This represents a 21 percent decrease from the 200 metric tons of mercury used for the same

purpose in 2005 (AMAP/UNEP 2008). In the United States, many states have passed legislation restricting or banning the sale of mercury-added switches and relays and thermostats. Under the Minamata Convention, switches and relays (except for certain specific types), will be phased out by most Parties by 2020 (that is, after 2020, the manufacture, import, or export will generally not be allowed) (Minamata Convention, Annex A).

Other uses of mercury include various products and formulations where mercury has been intentionally added. These products include, for example, pesticides, laboratory chemicals, polyurethane elastomers, pharmaceuticals, preservatives in paints, traditional medicines, cultural and ritualistic uses, and cosmetics (especially skin-lightening creams) (AMAP/UNEP 2013). AMAP (2013) reported 305 metric tons of mercury demand worldwide in 2010 for the other uses category**.** The Minamata Convention prohibits for most Parties the manufacture, import, or export of cosmetics with a mercury content above 1 ppm, pesticides, biocides, and topical antiseptics after 2020 (Minamata Convention, Annex A). Furthermore, the Minamata Convention requires acetaldehyde production in which mercury or mercury compounds are used as a catalyst to be phased out by 2018, and addresses polyurethane production using mercury catalysts (Minamata Convention, Annex B).

3.5 Summary

The current global mercury demand is estimated at approximately 4,000 metric tons per year. A summary of the estimates of global uses of mercury that were discussed in this chapter is provided in Exhibit 3-4.

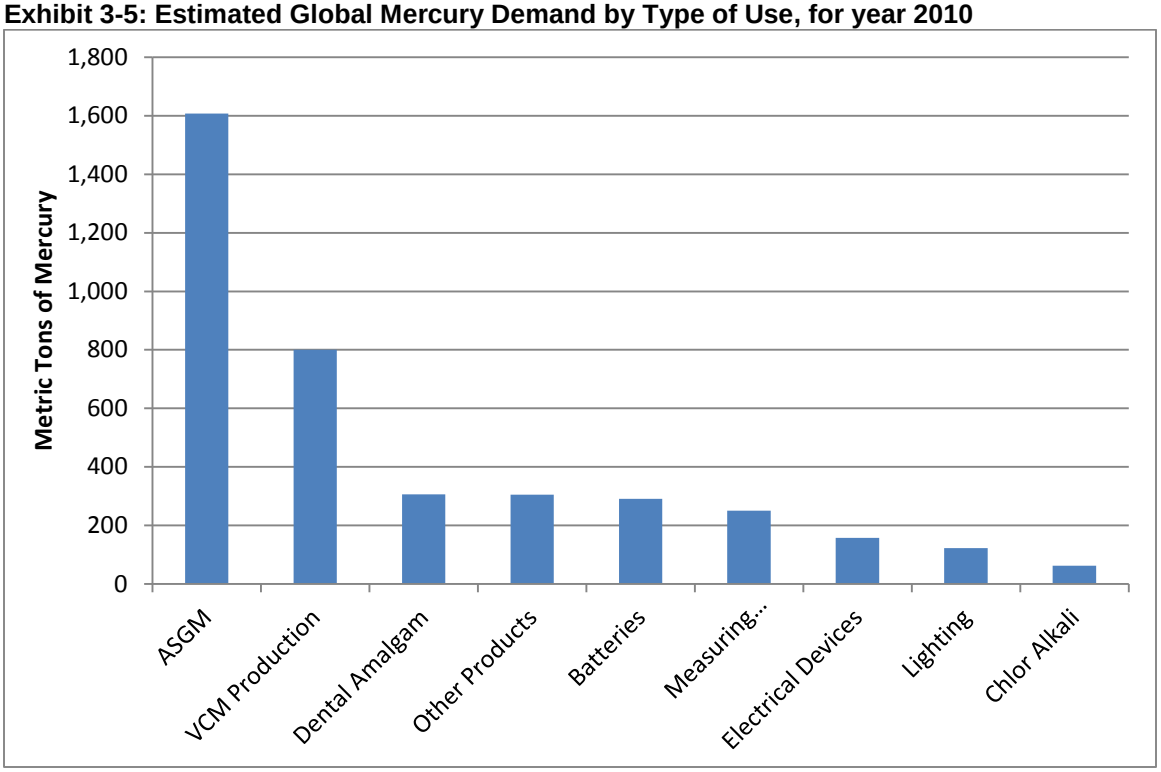
Exhibit 3-4: Uses of Mercury, Worldwide

Mercury Use	Metric Tons per Year	Estimate Year	Reference
ASGM	1,608[1]	2010	(AMAP/UNEP 2013)
VCM manufacturing	800	2010	(AMAP/UNEP 2013)
Chlor-alkali production	132	2014	(World Chlorine Council 2014)
Mercury-added products	1,433	2010	(AMAP/UNEP 2013)
Dental amalgam	*306*	*2010*	(AMAP/UNEP 2013)
Batteries	*291*	*2010*	(AMAP/UNEP 2013)
Measuring devices	*250*	*2010*	(AMAP/UNEP 2013)
Electrical devices	*158*	*2010*	(AMAP/UNEP 2013)
Lighting	*123*	*2010*	(AMAP/UNEP 2013)
Other products	*305*	*2010*	(AMAP/UNEP 2013)
TOTAL	**3,973**		

[1]The mean estimate of 1,608 metric tons is derived from the AMAP/UNEP (2013) report, which presents an estimated range of 910 to 2305 metric tons.

The global demand for mercury for the uses described in this chapter are summarized by region in Exhibit 3-5. Data for the year 2010 is used in this graphic for all uses, as this is the most recent year with data across all uses (number for chlor-alkali production varies slightly from what is presented in Exhibit 3-4).

Exhibit 3-5: Estimated Global Mercury Demand by Type of Use, for year 2010



Sources: (AMAP/UNEP 2013; World Chlorine Council 2014; Smith 2015; Artisanal Gold Council 2016)

ASGM, the largest user of mercury with an estimated consumption of 1,608 metric tons, is a growing industry driven by the high price of gold. Countries with significant ASGM activity that become Parties to the Minamata Convention must develop an Action Plan to reduce or eliminate mercury use in this practice.

VCM production in China is the second largest user of mercury, consuming 800 metric tons. This use may increase if the demand for PVC products increases before mercury-free alternative catalysts for VCM production become technologically feasible, although the Minamata Convention requires that Parties reduce the use of mercury per unit of VCM production by 50 percent by 2020 compared with 2010 use.

Mercury use in many product categories has been decreasing over the past decade, and is expected to continue to decrease to negligible levels if the Minamata Convention is implemented globally. Dental amalgam and lamps/lighting are products that may still use some amount of mercury, even under the obligations of the Minamata Convention.

4 International Trade Patterns of Elemental Mercury

This chapter describes the global trade flows of mercury, including import, export, and brokering activities. Data from the United Nations Commodity Trade Statistics Database (Comtrade)[4] are used to assess the volumes of import and export between countries, including those where primary mercury mining is known to occur. It should be noted that a simple comparison of import and export numbers over a certain period of years does not reveal the reasons for which countries have either entered or exited the marketplace. However, it is informative to look at the changes over time to determine whether shifts have indeed occurred, regardless of the driver.

Section 4.1 describes the overall volume of mercury traded, by global region. It then lists the top ten exporter and importer countries for the period of 2006 to 2015, and illustrates how this list has changed since 2013. Section 4.2 examines the trade patterns of countries known to be primary producers of mercury (see Chapter 2), and the United States.

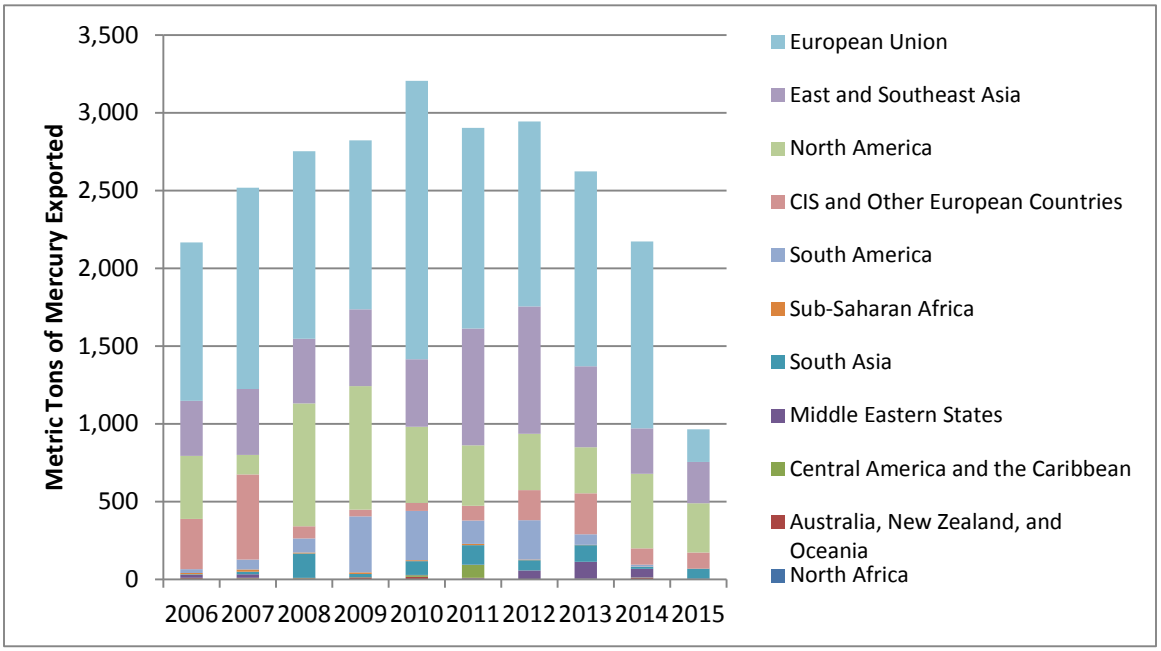
4.1 Global Market

The global mercury market consists of exporting suppliers (countries with primary mining operations and secondary mercury producers), mercury traders and brokers, and importing consumers (countries involved in the use of mercury (as described in Chapter 3)). Based on data from the Comtrade Database (2016), over the period 2006 to 2015, the amount of mercury exported decreased from 2,170 to 965 metric tons. As shown in Exhibit 4-1, the volume peaked at 3,200 metric tons in 2010 then declined sharply following the implementation of the EU and U.S. export restrictions.

While import and export volumes have decreased globally over the past 10 years, the makeup of major importing and exporting countries has shifted within the global market. As shown in Exhibit 4-1, in 2006, the highest-volume exporters of mercury were from the European Union, followed by North America. As shown in Exhibit 4-2, the European Union was also the region of the world with the top importers of mercury in 2006, followed by East and Southeast Asia. According to 2015 reports, North America (mainly Mexico) was the largest exporter of mercury, followed by East and Southeast Asia. The major importers of mercury in 2015 were East and Southeast Asia, South Asia, and South America. Specific top exporting and importing countries are shown in Section 4.2.

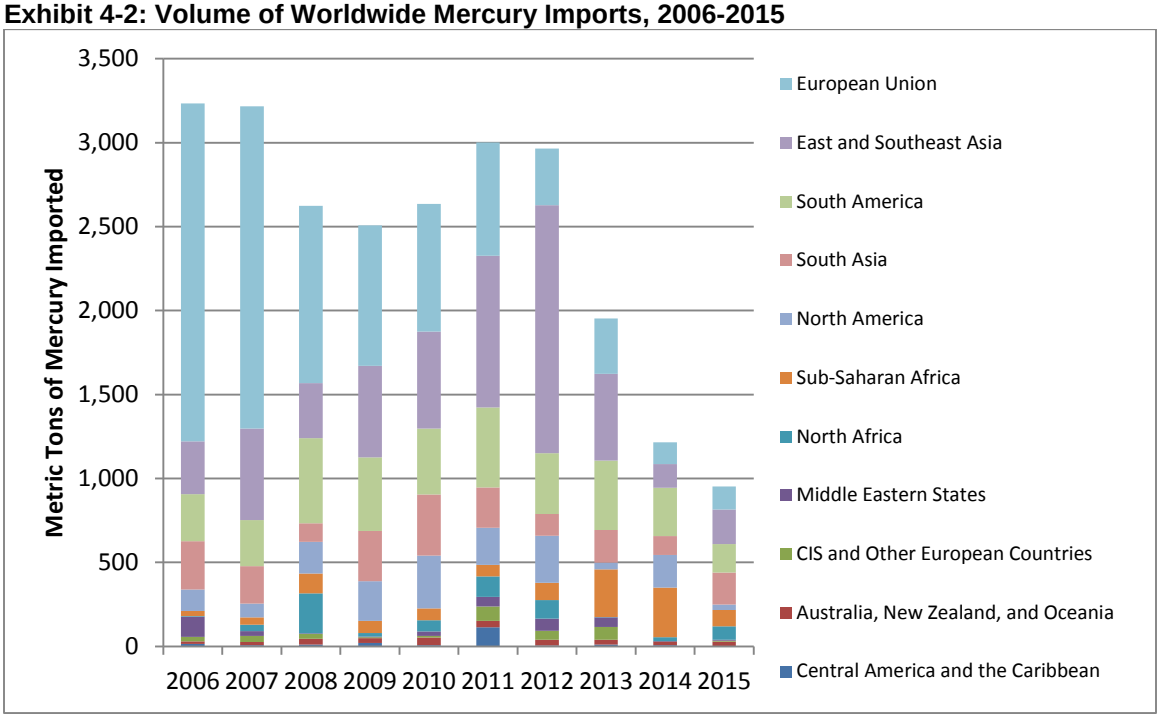
[4] Comtrade relies on self-reported data from countries. Countries do not necessarily report their trade statistics every year, and Comtrade does not present estimates for missing data. Therefore, estimates could be understated. There are also instances where the import volume reported by one country does not coincide with export volume reported by its trading partner.

Exhibit 4-1: Volume of Worldwide Mercury Exports, 2006-2015



Source: (United Nations 2016)
Notes: Countries do not necessarily report their trade statistics for each and every year. Comtrade does not contain estimates for missing data. Therefore, trade of a country could be understated due to unavailability of country data or incomplete reporting.

Exhibit 4-2: Volume of Worldwide Mercury Imports, 2006-2015



Source: (United Nations 2016)
Notes: Countries do not necessarily report their trade statistics for each and every year. Comtrade does not contain estimates for missing data. Therefore, trade of a country could be understated due to unavailability of country data or incomplete reporting.

4.1.1 Major Mercury Trading Countries

A comparison of the top trading countries in 2012 and in 2015 is shown in Exhibit 4-3 (exports) and Exhibit 4-4 (imports). As illustrated in Exhibit 4-3, Mexico has in recent years risen to be the highest-volume exporter, while South Africa has gone from being the top exporter in 2012 to not making the top 10 list in 2015. As shown in Exhibit 4-4, in 2015, the United States has dropped off of the list, while India and Bolivia (countries where ASGM takes place) have risen to be the top two mercury importers.

Exhibit 4-3: Top Ten Mercury Exporting Countries

Rank	2012		2015	
	Country	Average Metric Tons Per Year	Country	Average Metric Tons Per Year
1	South Africa	951	Mexico	307
2	Singapore	478	Netherlands	172
3	Mexico	262	Singapore	140
4	China	245	Japan	102
5	Argentina	188	Switzerland	102
6	Switzerland	165	India	64
7	Germany	103	China, Hong Kong SAR	20
8	Canada	73	Germany	12
9	Japan	69	Canada	9
10	Netherlands	67	Italy	8

Source: (United Nations 2016)
Notes: Countries do not necessarily report their trade statistics for each and every year. Comtrade does not contain estimates for missing data. Therefore, trade of a country could be understated due to unavailability of country data or incomplete reporting.

Exhibit 4-4: Top Ten Mercury Importing Countries

Rank	2012		2015	
	Country	Average Metric Tons Per Year	Country	Average Metric Tons Per Year
1	Singapore	609	India	154
2	Malaysia	512	Bolivia	136
3	China, Hong Kong SAR	348	Singapore	126
4	USA	249	Sudan	79
5	Netherlands	155	China, Hong Kong SAR	78
6	India	123	South Africa	52
7	Peru	111	Netherlands	47
8	Sudan	106	Togo	44
9	Colombia	101	Poland	37
10	Guyana	100	Pakistan	35

Source: (United Nations 2016)
Notes: Countries do not necessarily report their trade statistics for each and every year. Comtrade does not contain estimates for missing data. Therefore, trade of a country could be understated due to unavailability of country data or incomplete reporting.

4.1.2 Traders and Brokers

Mercury traders and brokers facilitate the trade of mercury by arranging for international transactions. Brokers can accumulate stocks of mercury for subsequent sale and distribution; these traders may store the mercury in warehouses until it is shipped to

customers worldwide. Several countries serve as trade centers for the international transfer of mercury rather than the receiving country that consumes the mercury. Significant amounts of mercury may be shipped and re-shipped several times during the same year. Thus, worldwide trade of mercury is a complicated web of imports and exports that cross many national borders as it flows from production to use.

Within the European Union, the Netherlands was the center of transit operations of the largest European mercury broker (the European Union has banned export of mercury outside of the EU since 2011; since this time, the Netherlands exports have been limited to other EU countries). Singapore and Hong Kong have emerged as major trading centers and appear in the top 10 importing and exporting country lists in Exhibit 4-3 and Exhibit 4-4. The Kyrgyz Republic historically supplied mercury mostly to larger Asian and CIS customers, and then to brokers in Europe, who had ties to a greater range of smaller customers. European brokers have tended to supply countries in Africa and the Middle East, while United States brokers historically supplied mainly Central and South America countries. These divisions in the global marketplace are likely based on language similarities, geographical proximity, and optimal warehousing and shipping costs (UNEP 2006).

4.2 Flows of Mercury – Selected Countries

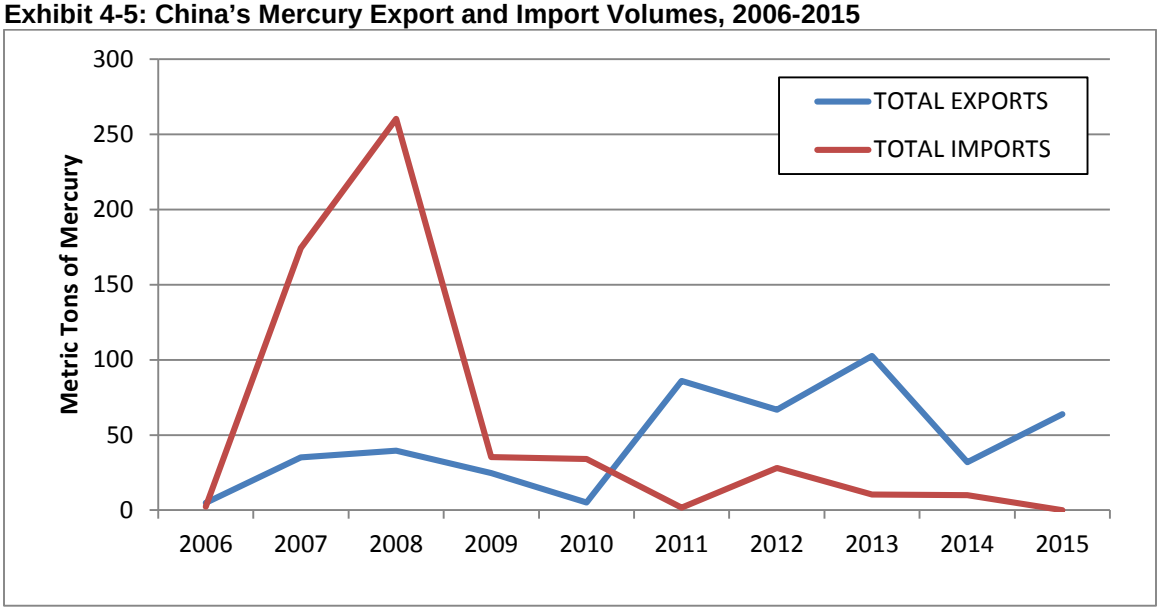
In order to identify shifts in major trading countries, and in particular to consider whether additional primary mercury mining occurred as a result of the enactment of MEBA, this section focuses on the flow of mercury from the countries known to mine mercury, major exporters according to the Comtrade data, and the major importers.

4.2.1 Trade from Primary Mercury Mining Countries

China

As described in Section 2.1.1, China consumes the majority of its domestically-produced mercury. According to Comtrade data, mercury exports from China averaged 46 metric tons per year from 2006 to 2015, while imports averaged 56 metric tons per year during the same time period. In 2015, 64 metric tons of exports were reported to Comtrade. As shown in Exhibit 4-5, import volume has trended downward, while exports have risen over recent years and surpassed import volume in 2011.

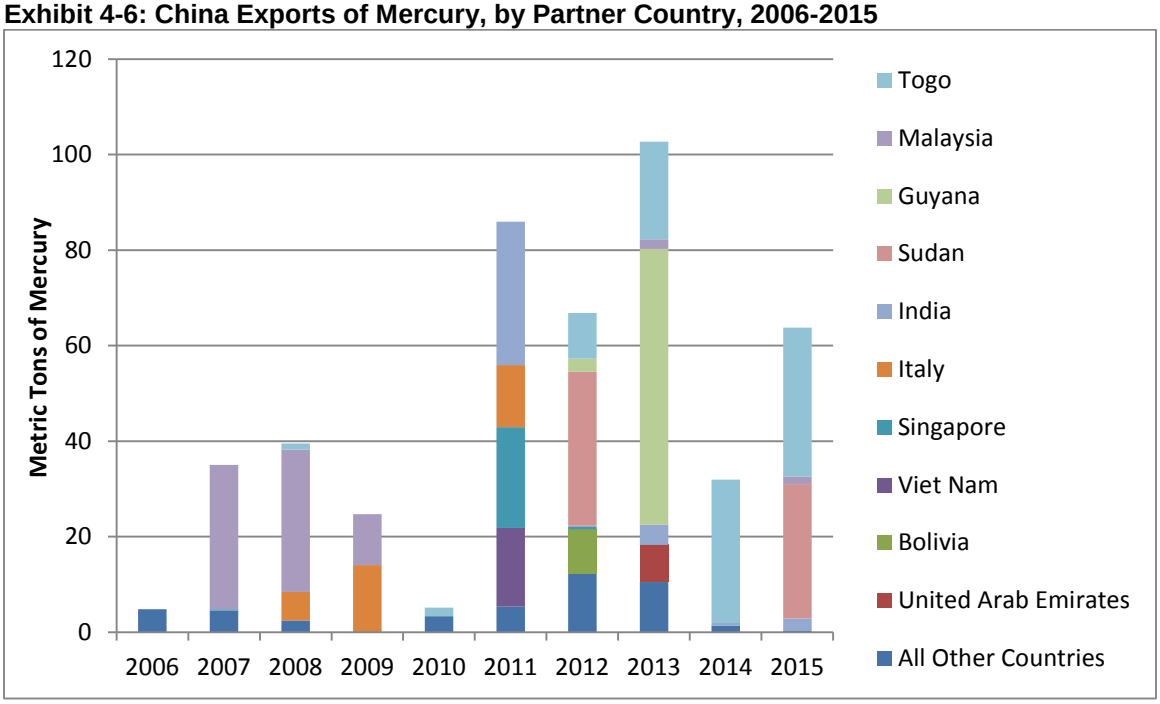
Exhibit 4-5: China's Mercury Export and Import Volumes, 2006-2015



Source: (United Nations 2016)
Notes: This graph contains both data reported by China and data reported by other countries on imports from/exports to China. Countries do not necessarily report their trade statistics for each and every year. Comtrade does not contain estimates for missing data. Therefore, trade of a country could be understated due to unavailability of country data or incomplete reporting.

As shown in Exhibit 4-6, China's highest-volume export partners over the past 10 years have been Togo, Malaysia, Guyana, Sudan, and India. All of these countries are listed by the Artisanal Gold Council as being engaged in ASGM. In 2015, the major countries receiving mercury from China were Togo, Sudan, and India.

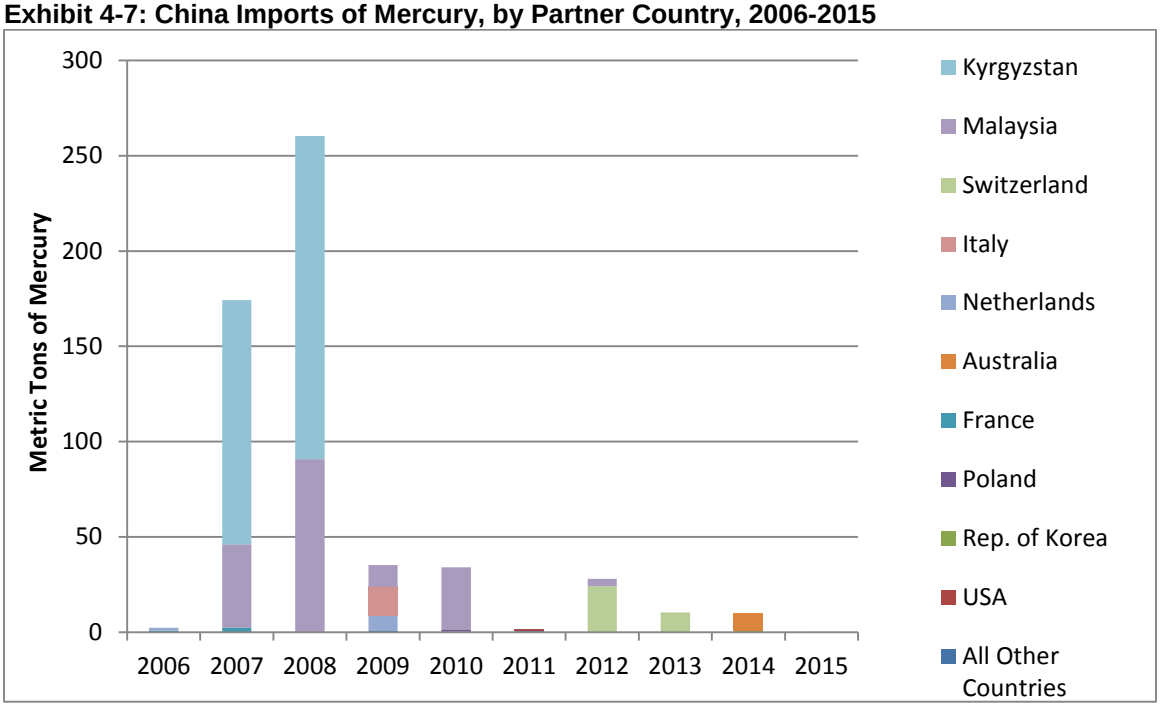
Exhibit 4-6: China Exports of Mercury, by Partner Country, 2006-2015



Source: (United Nations 2016)
Notes: This graph contains both export data reported by China and data reported by other countries on imports from China. Countries do not necessarily report their trade statistics for each and every year. Comtrade does not contain estimates for missing data. Therefore, trade of a country could be understated due to unavailability of country data or incomplete reporting.

As shown in Exhibit 4-7, China formerly received a large amount of mercury from the Kyrgyz Republic and Malaysia. In 2004, China ended its long-term supply contract with the Kyrgyz Republic. Imports have severely declined since 2008, when it began to increase domestic production. Part of this shift was based on the realization that it could produce mercury at its Guizhou mines for less than it would cost to import the mercury from elsewhere (European Commission 2006) (see Section 2.1.1 for a discussion of China's primary mining mercury production). In recent years, China has only received a negligible volume of imports from a range of broker countries.

Exhibit 4-7: China Imports of Mercury, by Partner Country, 2006-2015



Source: (United Nations 2016)
Notes: This graph contains both import data reported by China and data reported by other countries on exports to China. Countries do not necessarily report their trade statistics for each and every year. Comtrade does not contain estimates for missing data. Therefore, trade of a country could be understated due to unavailability of country data or incomplete reporting.

Indonesia

According to Comtrade data, mercury exported from Indonesia averaged 8 metric tons per year from 2006 to 2014, while imports averaged 108 metric tons per year during the same time period, primarily from Singapore from 2006 until 2010. Indonesian imports have trended downward since 2000; they declined from 31 metric tons in 2006 to 0.7 in 2014. As of August 2016, Indonesia's 2015 data have not yet been reported to Comtrade.

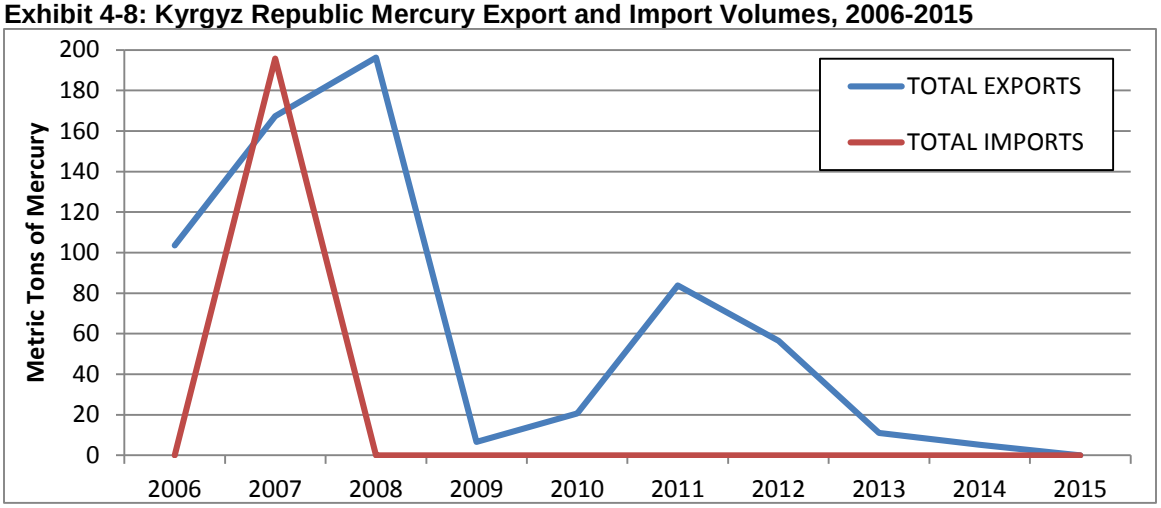
Exports in recent years peaked in 2011, and have exceeded imports since 2010. Indonesia's highest-volume export partners in recent years have been Timor-Leste (East Timor) and Malaysia. Malaysia is known to have ASGM.

Kyrgyz Republic

Between 2006 and 2015, the Kyrgyz Republic has operated one primary mercury mine (see Section 2.1.1 of this report). The Kyrgyz Republic did not report any mercury trade data to Comtrade for the years 2006 to 2015; data shown here were reported by other countries regarding their trade with the Kyrgyz Republic. According to Comtrade data, mercury exports from the Kyrgyz Republic averaged 72 metric tons per year from 2006 to 2015, and peaked in 2008 at 196 metric tons (United Nations 2016). Reports to Comtrade do not indicate that the Kyrgyz Republic traded any mercury in 2015. As shown in Exhibit 4-8, Comtrade indicates very little import of mercury into the Kyrgyz Republic for the years 2006 to 2015, with the exception of 2007. As shown in Exhibit 4-9, the Kyrgyz Republic's major trade partners from 2006 through 2015 have included countries such as Brazil,

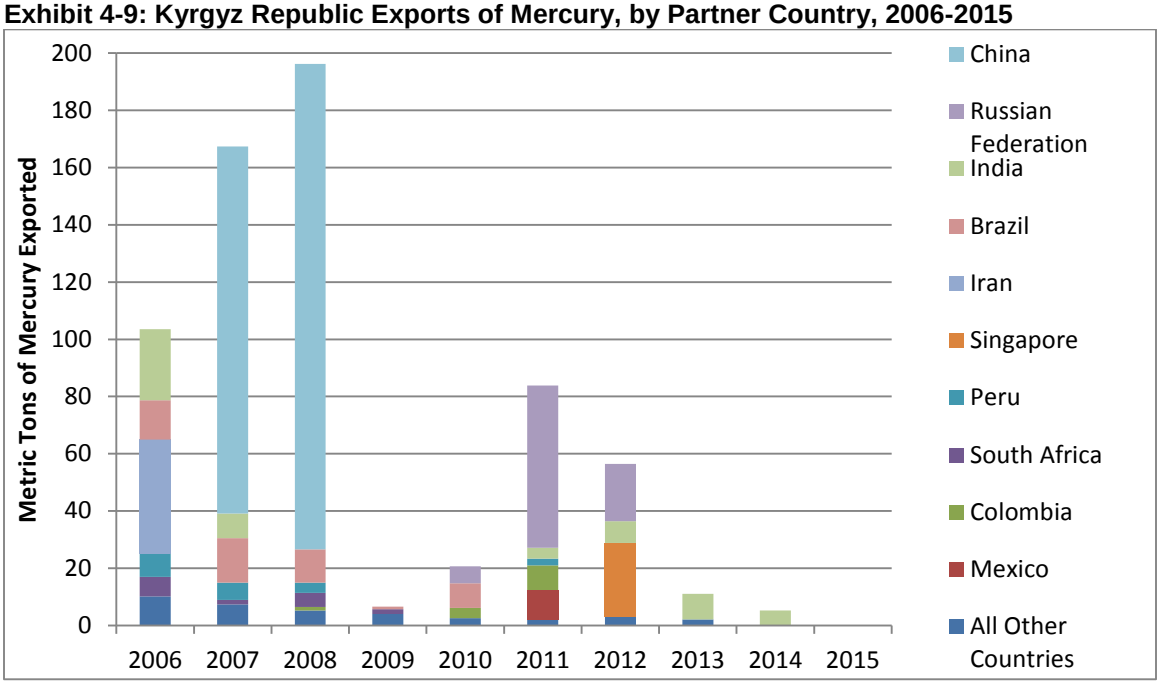
Colombia, India, Iran, Mexico, Peru, the Russian Federation, and South Africa, which are listed by the Artisanal Gold Council as countries where ASGM occurs.

Exhibit 4-8: Kyrgyz Republic Mercury Export and Import Volumes, 2006-2015



Source: (United Nations 2016)
Notes: This graph contains data reported by other countries on imports from and exports to the Kyrgyz Republic. Countries do not necessarily report their trade statistics for each and every year. Comtrade does not contain estimates for missing data. Therefore, trade of a country could be understated due to unavailability of country data or incomplete reporting.

Exhibit 4-9: Kyrgyz Republic Exports of Mercury, by Partner Country, 2006-2015

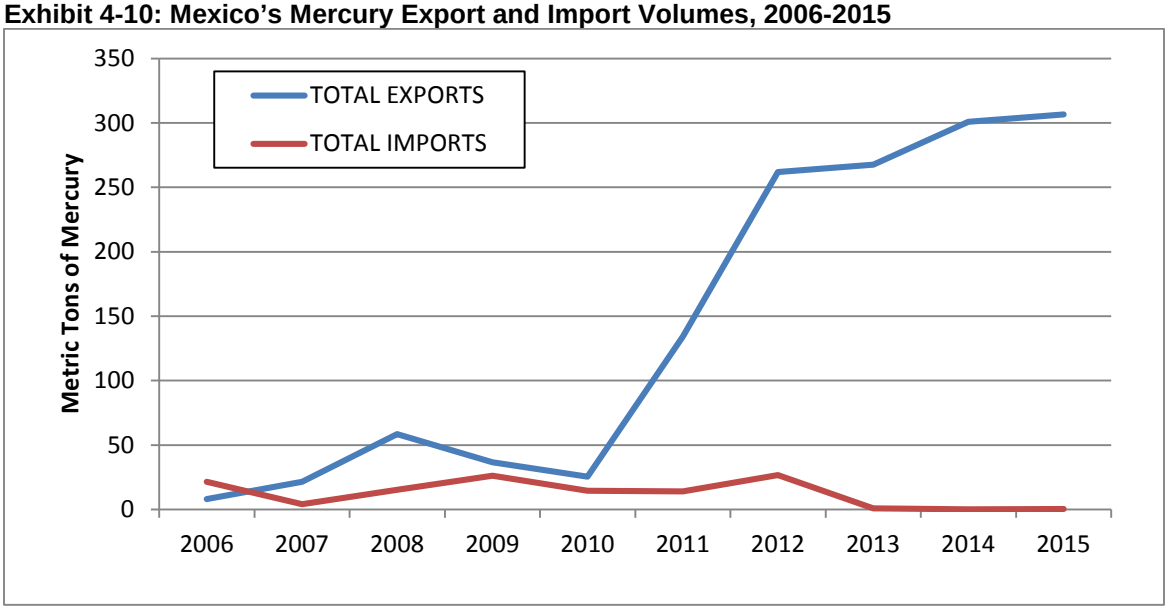


Source: (United Nations 2016)
Notes: This graph contains data reported by other countries on imports from the Kyrgyz Republic. Countries do not necessarily report their trade statistics for each and every year. Comtrade does not contain estimates for missing data. Therefore, trade of a country could be understated due to unavailability of country data or incomplete reporting.

Mexico

According to Comtrade data, exports from Mexico averaged 142 metric tons per year from 2006 to 2015. As shown in Exhibit 4-10, recent exports have risen substantially while imports have been nearly zero. In 2015, mercury exports were 307 metric tons. The increase in exports began to rise sharply in 2011, which coincides with an increase in mercury mine production in recent years. See Section 2.1.1 of this report for a discussion of Mexico's primary mercury mining activities.

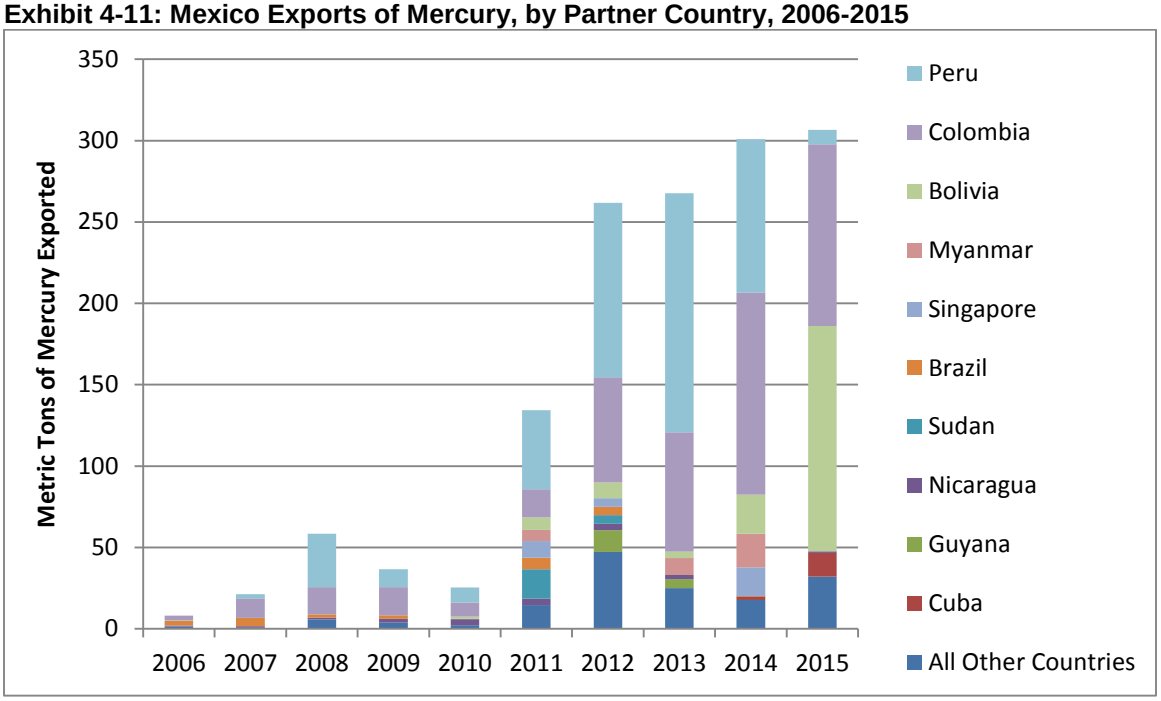
Exhibit 4-10: Mexico's Mercury Export and Import Volumes, 2006-2015



Source: (United Nations 2016)
Notes: Countries do not necessarily report their trade statistics for each and every year. Comtrade does not contain estimates for missing data. Therefore, trade of a country could be understated due to unavailability of country data and incomplete reporting.

As shown in Exhibit 4-11, Mexico's highest-volume export partners are Peru, Colombia, and Bolivia, all of which are known to have ASGM. In fact, eight out of the top ten export partners by volume (Peru, Colombia, Bolivia, Brazil, Nicaragua, Guyana, Myanmar, and Sudan) are where ASGM is present.

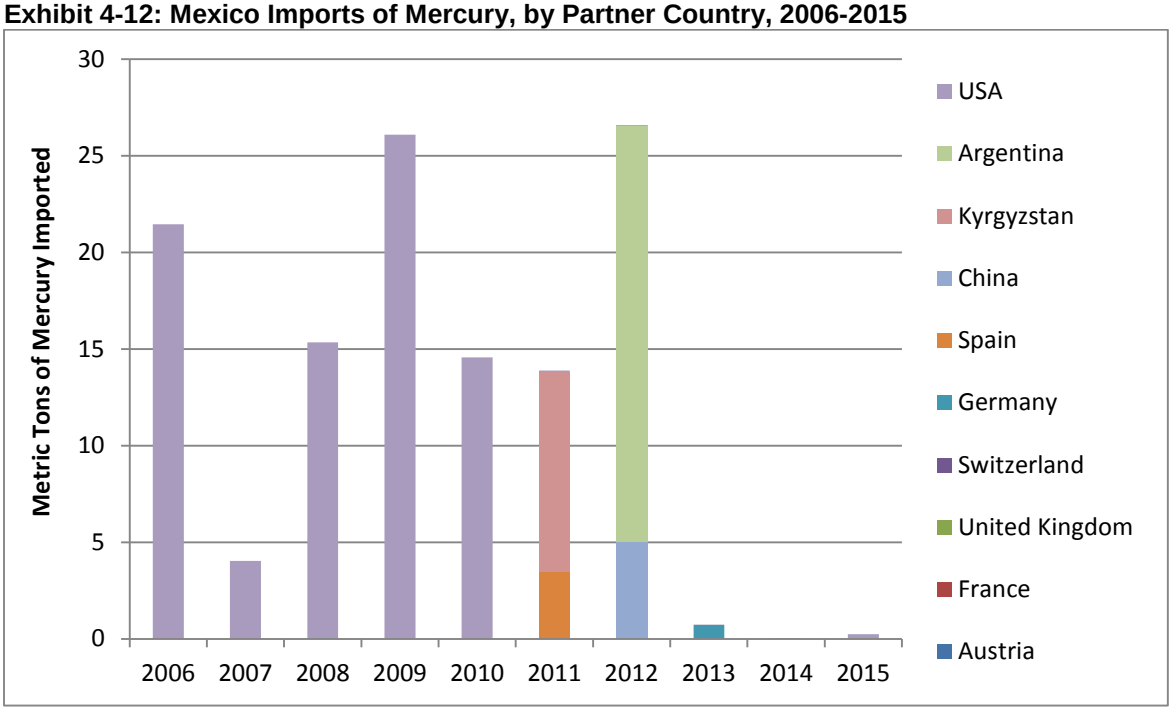
Exhibit 4-11: Mexico Exports of Mercury, by Partner Country, 2006-2015



Source: (United Nations 2016)
Notes: Countries do not necessarily report their trade statistics for each and every year. Comtrade does not contain estimates for missing data. Therefore, trade of a country could be understated due to unavailability of country data or incomplete reporting.

As shown in Exhibit 4-12, the United States was historically the source of most of Mexico's mercury imports, but the volume has dropped significantly since 2010. Mexico's overall import rates decreased to minimal levels by 2013.

Exhibit 4-12: Mexico Imports of Mercury, by Partner Country, 2006-2015

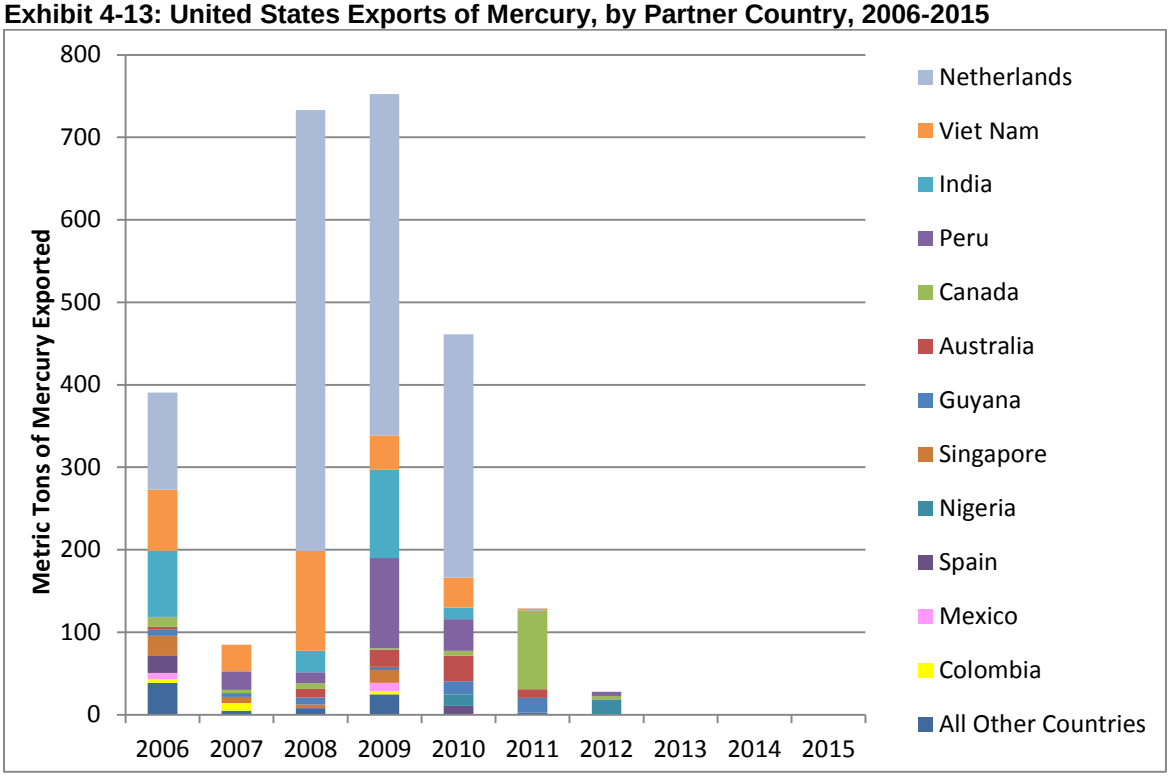


Source: (United Nations 2016)
Notes: Countries do not necessarily report their trade statistics for each and every year. Comtrade does not contain estimates for missing data. Therefore, trade of a country could be understated due to unavailability of country data or incomplete reporting.

4.2.2 United States

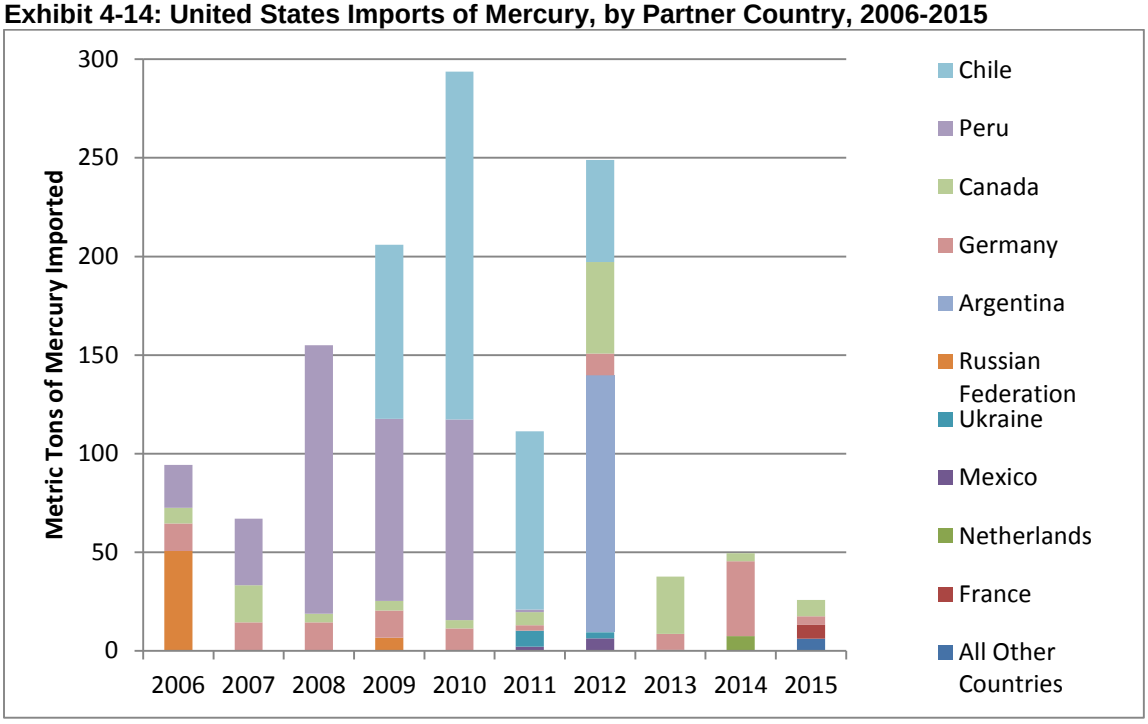
The United States mercury exports for 2006 to 2015 are shown in Exhibit 4-13. U.S. mercury exports averaged 258 metric tons per year during this ten-year period, and peaked in 2009, with most of the exports going to the Netherlands (a major brokering center). A steep decline in exports began in 2010, down to negligible levels by 2013, as would be expected with the January 1, 2013 effective date of MEBA. As shown in Exhibit 4-14, the top exporters to the United States over the past decade were Chile and Peru. Since 2013, imports have also significantly declined, to 26 metric tons in 2015. The top import partners since 2013 have been Germany and Canada.

Exhibit 4-13: United States Exports of Mercury, by Partner Country, 2006-2015



Source: (United Nations 2016)
Notes: Countries do not necessarily report their trade statistics for each and every year. Comtrade does not contain estimates for missing data. Therefore, trade of a country could be understated due to unavailability of country data or incomplete reporting.

Exhibit 4-14: United States Imports of Mercury, by Partner Country, 2006-2015



Source: (United Nations 2016)
Notes: Countries do not necessarily report their trade statistics for each and every year. Comtrade does not contain estimates for missing data. Therefore, trade of a country could be understated due to unavailability of country data or incomplete reporting.

Between 2006 and 2012, the United States top export partners were Singapore, India, Spain, Peru, the Netherlands, Guyana, Australia, Canada, Viet Nam, and Nigeria (Exhibit 4-13). There are many factors that have influenced the global mercury market in recent years, including an overall decline in demand over the past decade and international regulatory initiatives. Exhibit 4-15 shows the average imports by the United States from these countries for two periods, 2010-2012 and 2013-2015. Imports by the United States from most of these countries declined between these two periods. These data highlight the shifting nature of the global mercury market, including the decrease in import volume from ASGM producing countries.

Exhibit 4-15: Imports by the United States from Former Top Mercury Export Partners

Country	Average Annual Imports of Mercury, metric tons	
	2010-2012	2013-2015
Singapore	503	189
India	197	138
Spain	149	29
Peru	143	94
Netherlands	133	58
Guyana	107	42
Australia	39	26
Canada	36	50
Viet Nam	22	2
Nigeria	1	14

Source: (United Nations 2016)
Notes: Countries do not necessarily report their trade statistics for each and every year. Comtrade does not contain estimates for missing data. Therefore, trade of a country could be understated due to unavailability of country data or incomplete reporting.
[1] Nigeria data only includes the years 2012, 2013 and 2014 due to data availability.

4.3 Summary

Overall, global mercury trade flows have decreased in recent years. Exports reported to Comtrade have fallen from approximately 2,170 metric tons in 2006 to 965 metric tons (a 55 percent reduction) in 2015. During that time period, reported imports have similarly fallen from 3,220 to 952 metric tons (a 70 percent reduction). Mexico stands out as the new leading global exporter in terms of the volume of export with reported exports increasing from 8 metric tons in 2006 to 307 metric tons in 2015. This increase is concurrent with the rise in the price of gold, which began a steep increase in 2010 and reached its current plateau price in 2011. Mercury from Mexico has in the past three years been exported to, among other countries, Peru, Colombia, Bolivia, Brazil, Sudan, Nicaragua, and Guyana □places where ASGM is known to occur.

Exports from China, another primary producer, were estimated at 64 metric tons in 2015. China has also increased its exports to Guyana and India, among other ASGM countries, in the past three years.

The Kyrgyz Republic, once a major exporter, has decreased its levels of mercury output over the past few years. As the country considers closing its remaining mercury mine, it is uncertain whether it will continue to globally trade mercury. Also uncertain is the role of Indonesia, where there appears to be informal primary mining of mercury, with a small peak in exports levels in 2011 that followed a steep decline in imports. Indonesia□s mercury trade activity was minimal for 2014, the most recent year for which reports to Comtrade were made.

5 Report Analysis and Conclusions

The intent of this Report to Congress is to assemble and present available information on the global supply and trade of mercury. Specifically, Congress requested that the report describe the amount of elemental mercury traded globally that originates from primary mining, where such primary mining is conducted, and whether additional primary mining has occurred as a consequence of MEBA. This chapter summarizes the findings related to Congress request, and that are provided in more detail in the previous chapters in answer to these questions, while taking into account the limitations of the available data as noted in Chapter 1.

The data reviewed in this report indicate that, overall, global supply and trade have decreased while global demand has increased slightly. With respect to the amount of mercury produced globally through primary mining, the global supply has declined since MEBA went into effect. In 2007, mercury originating from primary mining was estimated to be 1,300 to 1,600 metric tons. According to the most recent data available for 2015, China, the Kyrgyz Republic, Indonesia, and Mexico, the countries where primary mining is currently taking place, produced a total of 1,163 to 1,263 metric tons. Of the total amount of mercury originating from primary mercury mining in 2015, approximately 370 metric tons were traded globally.

China remains the largest global primary mercury producer, currently producing approximately 780 metric tons of mercury per year. China has historically used this mercury to meet domestic demand, which means that most of its mercury is not traded globally. However, exports have slowly been increasing since 2010. In 2015, China exported approximately 64 metric tons of mercury, with the major countries receiving mercury being Togo, Sudan, and India, all of whom are engaged in ASGM.

The Kyrgyz Republic and Indonesia play only a small role in the global market. The Kyrgyz Republic, once a major primary mercury supplier, has decreased production over the past several years. The country s mercury exports were approximately 196 metric tons in 2008 and dwindled to approximately 5 metric tons in 2014. Indonesia is the only country to have entered the mercury primary production market within the past decade, and is estimated to produce a relatively small amount annually (about 13 metric tons in 2015). Indonesia is ranked by the Artisanal Gold Council as the largest consumer of mercury for ASGM.

Mexico is the only country where primary mining appears to have increased in recent years. Although primary mercury mining in Mexico officially ceased in 1994, informal mining appears to have continued and also appears to be on the rise. Data are not readily available or official, but based on communication with UNEP experts and analysis of export data, primary production in Mexico is estimated to be 300 to 400 metric tons per year. Exports of mercury (most likely originating from primary mining production) were rising before the implementation of MEBA, increasing from approximately 130 metric tons in 2011 to approximately 300 metric tons in 2015. By 2015, Mexico had replaced Spain, the Kyrgyz Republic, and the Netherlands to become the top global exporter of mercury by volume. The increased exports from Mexico are being sent to countries with known ASGM activity, including Bolivia, Colombia, and Peru.

As primary mercury mining decreased globally in the years since MEBA took effect, there was also a reduction in the global trade of mercury. Exports declined from approximately 2,940 metric tons in 2012 to 965 metric tons in 2015, of which 370 metric tons originated from countries known to be involved in primary mining of mercury. In recent years, global mercury brokering hubs have moved from European countries and the United States to Asian countries.

The driving factor in the slight overall global increase in mercury demand has been its use in ASGM. This has been due to localized rural poverty and a significant rise in the price of gold since 2009. Trade flows have shifted away from countries that produce mercury-added products or use mercury in chlor-alkali production to countries with ASGM. With the increase in ASGM comes an elevated demand for mercury in regions or countries where the process is prevalent. Based on the analysis of trade flows, it appears that two of the countries that conduct primary mining of mercury are exporting mercury to countries where ASGM activity is known to occur.

Based on the totality of information presented, global supply, including primary mercury mining, and global trade of mercury have decreased, while global demand has increased slightly in concert with increased demand in the ASGM sector. These conclusions are supported by the observed increase in the price of mercury since 2009, which is consistent with decreased supply and increased demand. This decrease in overall primary mining at the global level may be attributed to economic factors, environmental policy, and consumer preferences for products that contain less toxic chemicals. In addition, legal and policy initiatives such as MEBA and the EU mercury export ban, along with the soon-to-be implemented Minamata Convention, have or will place additional limitations on primary mining as well as on the use and export of mercury. While it is challenging to attribute overall trends of global supply, demand, and trade to a particular factor or event, MEBA has been effective in reducing the availability of mercury from the United States entering the global market and has been an important part of the policies and actions of the United States designed to protect human health and the environment from mercury.

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