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STORAGE AND DISPOSAL OF MERCURY IN MEXICO

Project for the Latin American and Caribbean Region

Mexico - Panama

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I. Executive Summary

This document was developed in the framework of the project "storage and disposal of mercury in Mexico," the Financing Agreement was signed between the Government of Mexico and the Division Technology, Industry and Economics of the Program of the United Nations Environment Program (UNEP DTIE), through the Regional Office for Latin America and the Caribbean (UNEP/ROLAC).

The project, coordinated by the National Institute of Ecology and Climate Change (INECC), aims to provide technical assistance to Mexico in search of storage options for the environmentally sound management of elemental mercury and mercury waste.

This report presents in the first place, a description of the regulatory framework at the international level in relation to mercury and mercury waste. It also underscores the broad participation of Mexico in the international forums that address the management of mercury at the regional and international levels. It also reports on the situation of the existing regulatory framework in the Mexican Republic, including the legal instruments related to the storage and disposal of mercury in the country. This section describes the most relevant aspects that give support to the decision-making for the management of mercury, which are based on the General Law of Ecological Equilibrium and Environmental Protection (LGEEPA), and the General Law for the Prevention and Comprehensive Management of Wastes (LGPGIR).

Next, the report describes the major fluxes of mercury in Mexico, noting that the information on the mercury production, demand, trade and final disposal is limited. However, the report identified tools and schemes for obtaining information that have promoted a better access to the data that are generated in the country. Notable examples of this include the reports of the Pollutant Release and Transfer Register (PRTR), which include 23 sources of transfers and emissions of mercury and its compounds. According to the PRTR, there is a 76% of mercury transferred (sent to disposal) and a 24% subject to processes of recycling.

It is noted in the information available in Mexico that there is a large quantity of waste that is already stored in tailings dams and disposal sites for hazardous waste. According to the data presented in the national inventory of mercury releases, with base year 2004, it should be noted that the estimates carried out must be taken with reservations and where possible should be updated.

Immediately, the report describes the type of existing facilities for treatment, collection and disposal of waste, and specifically those that have the approval of the appropriate regulatory entity. In this respect, there are 2 companies that have the authorization for a variety of processes established in the legal framework for the management of hazardous waste. The total installed capacity of 1,375,836 tonnes of hazardous waste.

The report also identifies the potential sites for temporary storage of elemental mercury and mercury waste in Mexico, highlighting those that have authorization for this option. There is also a review of the scientific literature to assess the feasibility of available saline domes. In both cases it is necessary to review the regulatory requirements and evaluate the possibility of making changes to the legal framework if necessary. In the case of the salt domes, experts recommend the need to carry out field studies that would allow having a better knowledge of these sites, in such a way that they meet the criteria required for the storage of mercury, as well as feasibility studies on technical-economic considerations.

In the same aspect, the report points out certain criteria for the selection of potential sites in order to prepare a national inventory for the temporary storage of mercury and mercury waste. To this point, the tool proposed by the international consultant of the project was used to identify potential sites in Mexico. According to these criteria, the report identifies as potential sites those that already exist and have authorization for the management of hazardous wastes. Additionally, the feasibility of plants chlor-alkali was also put into consideration, but some of its disadvantages, such as their remoteness from the sites of generation, as well as some type of geophysical features, make these type of sites a less viable option.

Finally, this report presents a proposal for guidelines and priority areas of work to establish a national plan of action. According to the discussions and exchanges of information between the representatives of various sectors that make up the national group of experts, some specific lines of action have been identified, including: (i) updating the inventory of mercury emissions; (ii) diagnosis of the primary informal mining sector; (iii) diagnosis of small scale gold mining; (iv) diagnosis of the existing processes and technologies; (v) strategy for the products with mercury at the end of its life cycle; (vi) strategy for the health sector.

II. Background

The identification of storage solutions for the environmentally sound management of mercury is recognized by the international community as a priority. The supply of mercury is greater than the demand in several parts of the world given the replacement of mercury free alternatives. This surplus must be managed and stored properly, thus avoiding its re-entry into the global market.

One of the first studies on the global problems of mercury was entitled "Reducing global emissions from burning mercury-added products" by the Global Alliance for Alternatives to incineration, under the coordination of Peter Maxson, in 2009. This study highlights the importance of emissions of mercury into the air at the global level, mainly because its use in products. It was also recommended to the Program of the United Nations Environment Program (UNEP), the establishment of an Intergovernmental Negotiating Committee for a legally binding instrument on mercury at its meeting in 2009, held in Nairobi (Maxson, 2009).

In 2010, a study was carried out on the safe storage of long-term mercury in Latin American countries by the Technological Laboratory of Uruguay (LATU) and several important aspects were analyzed, such as the existing legislation within the countries of the region, potential sites, progress made in other regions, etc. (UNEP, 2010).

The importance of the storage of mercury was stated in the second session of the Intergovernmental Negotiating Committee (INC 2) on mercury (January 24 2011, Chiba, Japan), where a large number of representatives agreed that the issue of storage was extremely important and is inherently related to the issues of supply and demand. During INC 3, the region of Latin America and the Caribbean (LAC) expressed its concern due to the lack of information on the capacity of developing countries to storage mercury on a long-term basis.

As a result of this, UNEP established the "Mercury Storage Project" to provide technical assistance to countries in the search of storage options for the environmentally sound (long-term) management of elemental mercury.

As a result of this technical assistance a project was developed in Uruguay and Argentina between June 2011 and June 2012. The project revealed that Argentina has four possible sites for the temporary storage, one of which is located in a province that allows the import of mercury waste (Olivet, 2012). Given the positive results obtained in these two countries, it was decided to replicate the project in Mexico and Panama.

The current legislative framework related to the use, disposal, storage and trade in several countries in the region of the Latin American and Caribbean Group (GRULAC) is generally limited, fragmented and differs considerably between countries. However, unlike some countries in this region, Brazil, Mexico and

Argentina have regulations relatively more mature, including mechanisms for the elimination of waste.

The text of the Convention of Minamata on Mercury was completed in January of 2013. Through the adoption of this text, the international community has recently taken decisive steps to cope with the adverse effects of mercury on human health and the environment. The treaty shall enter into force when it has been ratified by at least fifty Parties.

Among the provisions that includes the text of the Convention are: reduction of trade; prohibition of the primary mining of mercury; and elimination in the majority of products containing it, such as thermometers, measuring devices and batteries. The Convention also addresses the topic of artisanal small-scale gold mining, which is the largest source of emissions in the world today.

With regard to the situation in Mexico, existing records indicate the production of mercury since 1891, but in recent years that has decreased following trends in global production. Between 1920-1929 its production was minimal and reached a maximum of 1.118 tons in 1942; in 1991 there were 340 tons of mercury, while in 1994 only 11 tons. From 1995 there are no records of its mining (CEC, 2013a).

The main mining activities carried out in the states of Queretaro, San Luis Potosi and Zacatecas has already ceased. However, secondary production of mercury continues, in particular as a by-product of the extraction of silver and gold from tailings former mines in the state of Zacatecas, where 20 tonnes per annum have been reported (CEC, 2011; CEC, 2013a).

The last inventory of mercury releases available for the country dates back to 2008 (INE, 2008). The inventory was prepared based on information submitted by 895 facilities that reported releases of mercury and mercury compounds. The existence of a number of uncertainties means that the data should be treated with caution. However, the findings are indicative of certain trends. According to the inventory, in the year 2004, approximately 448 tons of mercury were released. The extraction and processing of gold was the largest source of mercury emissions, followed by batteries and controlled landfills/deposits. The inventory also reveals that approximately 40% of emissions are released as waste (185 tons), while only 10% is emitted to the air (50 ton).

III. Regulatory Scheme at the international level

Several international forums have been created to discuss the challenges that represent the sound management of chemicals and wastes; among others, the United Nations Environment Program (UNEP), the Organization for Economic Cooperation and Development (OECD), the Commission for Environmental Cooperation (CEC), the Rotterdam Convention on Prior Informed Consent (PIC), the Intergovernmental Forum on Chemical Safety (IFCS), the Convention of the Peace, the North American Border 2020 Program, and the Strategic Approach to International Chemicals Management (SAICM), in which

particular emphasis has been placed in highlighting that the safe management of chemicals can only be effective if a the life-cycle approach is implemented.

Mexico has participated in the international arena looking for solutions to the problems associated with chemicals, while trying to integrate the need for economic development with protection of the environment; the relevance of chemicals management in Mexico was also considered during the negotiation of the North American Free Trade Agreement (NAFTA), as well as with the accession to the Organization for Economic Cooperation and Development (OECD), resulting later in the adoption of legally binding commitments.

With the Law of International Treaties in Mexico, the agreements or international conventions approved by the Congress of the Union and signed by the Executive, are converted into national law. Examples in this regard are the result of the acceptance of implementing the provisions that emanate from the Agenda 21, its accession to the OECD and the subscription of the NAFTA.

III. 1.Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal.

The Basel Convention has the objective to minimize the generation of hazardous wastes and their movement across borders, as well as to ensure their environmentally sound management, promoting international cooperation and creates mechanisms for coordination and follow-up.

It was adopted by the Conference of Plenipotentiaries on March 22, 1989, through the signing of 116 countries; Mexico ratified the Convention on 22 February 1991, and later published in the Official Journal of the Federation on August 9 of that same year; its general provisions were approved on 5 May 1992, the date of the entry into force of this instrument. Being the oldest in the field of hazardous waste and chemicals, the Basel Convention published on 26 July 2011 the "Technical Guidelines for the Environmentally Sound Management of waste consisting of elemental mercury and waste that have or contain Mercury".

III. 2. Rotterdam Convention on the Prior Informed Consent Procedure for certain hazardous chemicals and pesticides in International Trade

Aims to establish a mechanism for the authorization prior to the import and export of hazardous chemicals and commercial pesticides, called Prior Informed Consent, PIC by its acronym. It has the purpose of having all the necessary information to learn about the characteristics and risks related to the handling of chemicals regulated under this Convention, allowing importing countries to decide which of those chemicals they can accept for trading purposes, as well as those they cannot manage safely to avoid risks to human health and the environment.

The Rotterdam Convention was adopted on 11 September 1998, date in which Mexico signed the treaty. On 24 February 2004, the Convention entered into

force. Mexico deposited its instrument of accession on May 4, 2005 to the General Secretariat of the UN, and is a Party to the Convention since 2 August 2005.

The Rotterdam Convention contains provisions relating to mercury compounds used as pesticides, including inorganic compounds of mercury compounds, and alkyl mercury compounds and several substituted compounds of mercury. These compounds are included in Annex III of the Convention, which lists the chemicals subject to the prior informed consent procedure.

Mexico through the Federal Commission for the Protection against Sanitary Risks (COFEPRIS, by its acronym in Spanish) of the Ministry of Health gives answer to export notifications made under the Rotterdam Convention by means of an internal procedure established in 2006.

IV. Regulatory Framework in Mexico

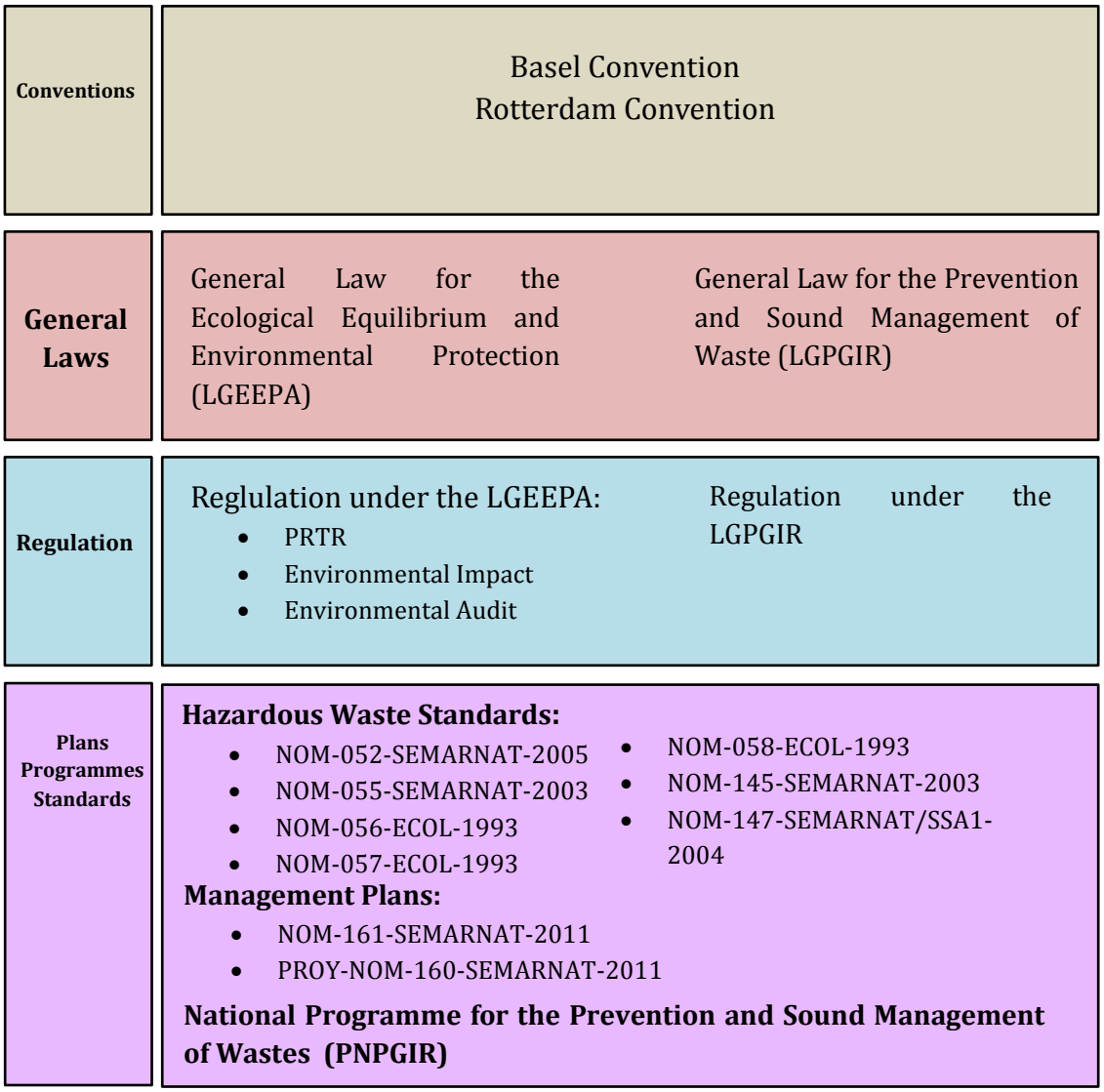
The Political Constitution in Mexico establishes on article 4 that every person has the right to a healthy environment to ensure its well-being, and that the State shall ensure the respect for this right and that the damage and deterioration will generate environmental responsibility for those who are responsible of these type of damages.

The agencies of the Federal Government related to the control and management of mercury are the Ministry of Labor and Social Welfare, the Ministry of Environment and Natural Resources, the Ministry of Communications and Transport and the Ministry of Health. In addition, the Ministry of Finance and Public Credit through the General Customs Administration, which coordinates the commercial movement of mercury in the borders and maintains information on imports and exports of mercury. A summary of the legal instruments related to the storage and disposal of mercury in Mexico is listed on Annex I in the Spanish version of this report.

In Mexico, the General Law of Ecological Equilibrium and Environmental Protection (LGEEPA by its acronym in Spanish) involves guaranteeing the right of every person to live in an environment suitable for his or her development, health and welfare. The same law is also intended to give a comprehensive management to wastes as indicated by the General Law for the Prevention and Comprehensive Management of Waste (LGPGIR by its acronym in Spanish) and also at the international level through the conventions of Basel. Figure 1 illustrates the different levels of the legislation applicable in the field of waste management in the country.

In addition, both the LGEEPA and LGPGIR have their relevant regulations, which support the implementation of the general laws.

Figure 1. Legal framework of the hazardous waste in Mexico



IV. 1. General Law for the prevention and comprehensive management of the Waste

In accordance with Article 7 of the LGPGIR, hazardous waste is within the purview of the federation. Also, the NOM-052-SEMARNAT-2005 provides the features, the procedure of identification, classification, and the listings of the hazardous waste, including those that contain mercury. It includes a listing of various waste products with mercury, which are classified as hazardous waste. Additionally, there is a criterion of toxicity, which has been established according to the concentration of various substances in the extract PECT (whose process is set in the NOM-053-SEMARNAT 1993), being of 0.2 mg/L for the case of mercury.

In Mexico, the waste is classified as solid urban waste (MSW), which falls under Municipal regulation; hazardous waste (RP), which is regulated by the Federation; and special waste management (RME), of State jurisdiction.

Hazardous waste and special handling wastes are further subject to specific management plans to minimize their generation and maximize recycling and recovery processes.

With regard to the sound management of waste, article 54 establishes that the mixing and contamination of waste with other materials should be avoided in order to reduce adverse effects to human health and the environment. In addition, article 67 establishes that the containment of liquid waste or semi-solid waste should only take place after these have been subject to treatments to eliminate the moisture, neutralize or stabilize and achieve its solidification.

With regard to the containment of waste, article 97 provides the official Mexican standards that set characteristics for the location of sites, the design, construction and operation of installations for the disposal of municipal solid waste and special handling waste, such as in landfills or in controlled confinements. This article also specifies other technical criteria that must be met by these facilities, for example to prevent the leachate formation and leakages.

IV. 2. Regulation of the General Law for the Prevention and Comprehensive Management of Wastes (LGPGIR)

This order is intended to support the implementation of the General Law for the prevention and comprehensive management of the Wastes, which has a federal jurisdiction through the Ministry of Environment and Natural Resources.

The specifications raised with regard to the facilities for temporary storage of hazardous waste are listed in articles 82, 83 and 84 of Chapter IV "criteria of operation for the Integral Management of Hazardous Waste, section I storage and collection centers of hazardous waste" of the regulation:

Article 82 stipulates that the areas of storage of hazardous waste from small and large generators, as well as service providers must comply with specific conditions which include: that wastes are separated from other areas; that generators have devices to control spills and that fire extinguishing systems are clearly identified; that facilities have ample space for the operations to be performed and count with a classification of the waste in a way that avoids the risks of chemical hazards.

Article 83 stipulates that the storage of hazardous waste by micro generators must be made in containers that are designed with specific characteristic to prevent leaks, spills, releases, explosions and fires. Other safety measures included in this article mention the prevention of transfer of pollutants to the environment and the guarantee of personal safety in case of accidents.

Article **84** stipulates that the hazardous waste, once collected and packed, must be safely stored in a warehouse where it may not remain for a period greater than six months.

Section V of the this Regulation, which consists of Articles 91 to 106, describes the requirements for the final disposal of hazardous waste at controlled confinements, and geologically stable formations. This section also describes other features on the location, design and construction, the complementary works and engineering controls for the release of pollutants, as well as the safety of the operations.[1]

Table 1 sets list the environmental standards related to the construction, management and operation of disposal sites for hazardous waste in Mexico.

IV. 3. Mexican Official Standards

The main Official Mexican Standards related to waste management are shown in table 1.

Table 1. Mexican Official Standards developed by the SEMARNAT related with the hazardous waste management in Mexico

Official Mexican Standard (NOM)	Description	Date of publication
NOM-052-SEMARNAT-2005	Sets the features, the procedure of identification, classification, and the listings of the hazardous waste.	June 23 2006
NOM-055-SEMARNAT-2003	Establishes the requirements that must be met by the sites that will be used for a controlled containment of hazardous waste previously stabilized.	November 3 2004
NOM-056-ECOL-1993	Establishes the requirements for the design and construction of the complementary works of a controlled containment of hazardous waste.	October 22 1993
NOM-057-ECOL-1993	Establishes the requirements that must be observed in the design, construction and operation of cells in a controlled containment for hazardous waste	October 22 1993
NOM-058-ECOL-1993	Establishes the requirements for the operation of a controlled containment of hazardous waste.	October 22 1993
NOM-145-SEMARNAT-2003	Containment of waste in cavities created by salt dissolution in domes geologically stable.	August 27 2004
NOM-147-SEMARNAT/SSA1-2004	Establishes criteria for determining the concentrations of remediation of soils contaminated by arsenic, barium, beryllium, cadmium, hexavalent chromium, mercury, nickel, silver, lead, selenium, thallium and/or vanadium	March 2 2007

[1] Controlled confinement, engineering work for the final disposal of hazardous waste;

Official Mexican Standard (NOM)	Description	Date of publication
PROY-NOM-160-SEMARNAT-2011	Sets the elements and procedures for formulating plans for the management of hazardous wastes	October 15 2010

Source: Official Gazette of the Federation

In addition, there is regulation related to mercury waste listed by the Ministry of Labor and Social Welfare, the Ministry of Health, and the Ministry of Communications and Transport (Annex I of the Spanish version of this report).

V. Current management and handling of hazardous waste

V. 1. Management of Hazardous Waste

In accordance with article 42 of the LGPGIR, generators of hazardous waste may hire the services of waste management companies that have been authorized by SEMARNAT for this purpose; or transfer them to industries that could use these wastes as inputs into their processes when previously it has been made known to this agency by a management plan for these inputs, based on his risk minimization.

V. 2. Management Plans

Under the current regulation in Mexico, a management plan is an instrument whose goal is to minimize the generation and maximize the recovery of municipal solid waste, the handling of special waste and of specific hazardous waste. There is also set criteria to consider environmental efficiency, technological, economic and social aspects of waste management practices. These plans were developed base on findings of the Basic Diagnostics for the Integral Management of Waste, designed under the principles of shared responsibility and integrated management. In addition, management plans take into account possible actions, procedures and viable means for the sound management of waste, and requests the participation of producers, importers, exporters, distributors, retailers, consumers, users of by-products and large generators of waste, as appropriate. The three levels of government should also take responsibility in the implementation of such plans.

Additionally articles 27 through 34 set out the characteristics of the management plans and the requirements for their development.

Article 27 stipulates that management plans must promote the prevention of the generation and use of waste as well as its integrated management, through measures that would reduce the costs of administration. It also includes measures to facilitate and make more effective waste management practices taken into consideration the environmental perspective, technological, economic and social aspects; in addition, this article also indicates that the principle of shared responsibility should be applied by all sectors involved, while encouraging innovation in processes, methods and technologies, to achieve a comprehensive and economically feasible management of waste.

Article 31 provides that, electrical batteries that are mercury-based and those based on nickel-cadmium; fluorescent lamps and mercury vapor lamps, are subject to the development of specific waste management plans.

In accordance with article 56, the storage of hazardous waste is limited to a maximum period of six months.

The list of companies authorized for the management of hazardous waste in Mexico is available on SEMARNAT website at: http://tramites.semarnat.gob.mx/index.php?option=com_wrapper&view=wrapper&Itemid=443

There are 15 listings of companies authorized for the management of hazardous waste, which are listed below:

Item 1 - Recycling of hazardous industrial waste
Item 2 - Use of hazardous industrial waste
Item 3 - Co-processing of hazardous industrial waste
Line 4 - Reuse of hazardous industrial waste
Line 5 - Treatment of hazardous industrial waste
Line 6 - Incineration of hazardous industrial waste
Item 7 - Containment of hazardous industrial waste
Item 8 - Harvesting and transport
Item 9 - Storage (collection)
Line 10 - Treatment of hazardous waste infectious biological (Regulated Medical Waste) in situ
Item 11 - Treatment of regulated medical waste ex-situ
Item 12 - Regulated medical waste incineration
Item 13 - Management of Polychlorinated Biphenyls (PCBS)
Item 14 - Export - Import of PCBS
Item 15 - Provision of services for the remediation of contaminated soils

These listings are updated when there is a renewal of the validity of authorizations for companies or when a new company is authorized to provide any of these services.

VI. Waste Stream of mercury in Mexico

This section contains a summary of the data obtained from various sources on the waste stream of mercury in Mexico. Although this report makes mention to the mercury releases inventory, data collected from that source is limited to specific sources of waste.

The information on the production of mercury, demand, trade and final disposal in Mexico is limited in comparison with other OECD countries. For this reason, and even though its seems simple to characterize the market, it is difficult to

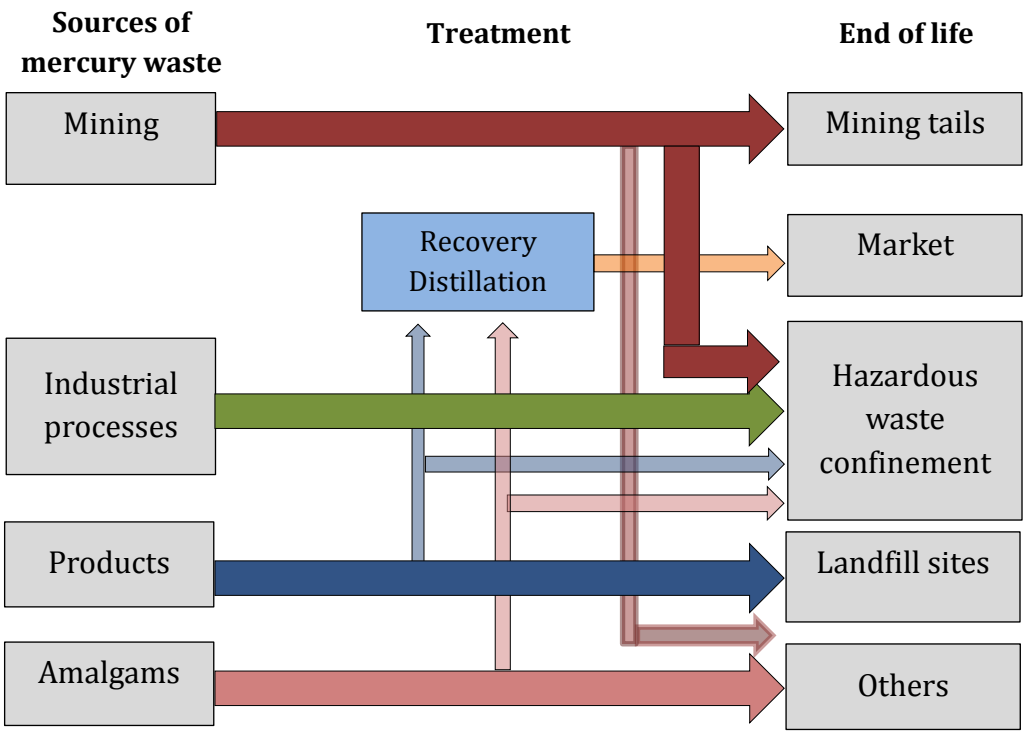
obtain detailed information on exact quantities, given that official sources of information on imports and exports, production and industrial sources are not compatible; in addition, the informal production makes it difficult to obtain accurate figures and generates differences among the sources of information.

In this context, the main sources of information on the trade of mercury in the country are based on the data provided by the General Administration of Customs and that reported in the studies carried out by the Commission on Environmental Cooperation of North America (CEC). With respect to mercury waste, the pollutant release and transfer register (PRTR) was used, as well as, the mercury releases inventory prepared by the INECC.

According to information from the tariff information system via the Internet (SIAVI), the export of 167 tons of mercury lamps to the United States was authorized in 2009. However, there are different products and materials that are imported and exported under different fractions, as for example, several devices used for the measurement of temperature, pressure, etc. for medical purposes. This type of classification makes it almost impossible to make specific distinctions between devices and appliances that contain mercury (SIAVI, 2013).

Figure 2 indicates the major fluxes of mercury in Mexico.

Figure 2. Major streams of mercury waste in Mexico.



VI. 1. Pollutant Release and Transfer Register (PRTR)

The PRTR is a national database with information of pollutants releases to the environment: air, water, soil and subsoil or those which are transferred in waste water and/or hazardous waste.

The public information reported on the PRTR includes the following data: The name of the establishment, its location, and the amounts released or transferred for a list of 104 substances that are included on the environmental standard NMX-AA-118-SCFI-2001. Current developments include the environmental standard PROY-NOM-165-SEMARNAT- 2012 where the number of substances subject to PRTR expands to 200). The PRTR is a regulatory tool mandated by article 109 bis of the LGEEPA and integrates information from industrial sources that are regulated by the three levels of government. The PRTR information is updated annually and is available to the public since the second half of 2006. The instrument to collect information from the industrial sector that falls under federal jurisdiction is called Annual Operations Certificate.

With regards to mercury, in 2004, the PRTR reported a total of 0,611 tons of emissions and a transfer of 6.85 ton, of which 6,662 ton were sent to final disposal and 0,075 tons were recycled. On the other hand, in 2011 a total of 2,152 tons of emissions and a transfer of 7,695 tons were reported, of which 7,643 ton were sent for final disposal and 0,036 ton to recycling.

In the case of the mercury compounds (salts such as mercuric chloride, mercuric sulphate, mercuric oxide, mercuric sulphide, etc.), in 2004, a total of 7,787 tons of emissions and a transfer of 0,048 tons were reported, of which 0,023 ton were sent to final disposal. In 2011 a total of 37,763 tons of emissions and a transfer of 93,095 tons were reported, of which 0,617 ton were sent to final disposal.

It should be noted that the information reported in the PRTR, only corresponds to the data submitted by industries that are regulated under federal jurisdiction. Measurements are done in-situ and fugitive releases are not considered. One of the shortcomings of current measurements is the lack of a detailed system for the validation of data. Table 2 presents the results of the PRTR database for the period 2004-2011.

Table 2. Releases of mercury to its final disposal or recycling.

Year	Tons of Hg Transferred		Tons of compounds of Hg Transferred	
	Final Disposition	Recycling	Final Disposition	Recycling
2004	6,662	0,075	0,023	-
2005	3,231	0,021	0,022	0,001
2006	7.74	0,004	0.04	0,986
2007	7,614	0.04	0,023	-
2008	3,457	0,175	0,085	0,002
2009	5,615	7,104	0,129	0,895
2010	4,605	7,485	0,168	0.000416
2011	7,643	0,036	0,617	-
PROM. ANNUAL	5,821	1,868	0,138	0,377

The results of table 2 show that the recycling of mercury both in elemental form and as a compound does not increment or decreases consistently over time. However, 95% of the mercury reported is in the form of elemental mercury.

The existing data in the PRTR, identified 23 sectors that reported both emissions and transfers of mercury and its compounds, the most important being the following:

1. Chemical Industry
2. Beverages and Tobacco
3. Metallurgy
4. Lime and cement
5. Automotive and electric power generation

Based on the average of the annual table 2 on the data reported by the PRTR, 76% of the mercury transferred has been sent to final disposal, while 24% is recycled. However it is important to emphasize that the universe of generators of mercury is greater than the companies requested to report to the PRTR. It is for this reason that additional analysis of other emissions sources is necessary to account for all mercury releases.

VI. 2. Inventory on the waste stream of mercury in Mexico

With the aim of integrating information from mercury waste coming from sectors which are not included in the PRTR, table 3 includes estimates on waste management in the mining sector as a by-product, industrial processes, products and amalgams. Data was obtained from the mercury releases inventory developed in 2004 (INE, 2008).

Table 3. Estimates on the generation of mercury contained in waste (ton) according to the inventory of releases of mercury to Mexico (base 2004) and other sources[1]

SOURCE	Total mercury as residue (Ton)	Tailings Dam (Ton)	Disposal sites for Hazardous Waste (Ton)	Sanitary landfills / Informal landfills (Ton)	Unknown (Ton)
Mining as a by-product	**147.28**	**135.92**	**1136**	**-**	**-**
Gold [2]	135.92	135.92	Unknown	-	-
Another (zinc, copper and lead)	1136	Unknown	1136	**-**	-
Industrial Processes	**6.32**	**-**	**6.32**	**-**	**-**
Chlorine-soda	4.13	-	4.13	-	-
Wastewater Treatment	1.82	-	1.82	-	-
Coal	0.33	-	0.33	-	-
Incineration of Medical Waste	0.03	-	0.03	-	-
Ferrous Metals Production	0.01	-	0.01	-	-
Products	**4.74**	**-**	**-**	**4.74**	**-**
Paintings	*0.75*		Unknown	*0.75*	
Lamps	*0.52*	-	Unknown	*0.52*	-
Switches	*2.17*	-	Unknown	2.17	-
Thermometers	*1.30*	-	Unknown	1.30	-

SOURCE	Total mercury as residue (Ton)	Tailings Dam (Ton)	Disposal sites for Hazardous Waste (Ton)	Sanitary landfills / Informal landfills (Ton)	Unknown (Ton)
Dental amalgams	**+7.76 %)**	-	**Unknown**	**Unknown**	**+7.76 %)**
TOTAL	**166.10**	**135.92**	**17.68**	**4.74**	**+7.76 %)**

1 The distribution of residues of mercury in the different disposal sites referred to in table 3, are based on what is reported in the document of the CEC, 2013b, which is in the process of revision.

[2] For the mining of gold, the national inventory of mercury releases and instrumentation for the identification and quantification of mercury releases published by UNEP (UNEP, 2013) mentioned that the materials accounted for as releases to land are placed, depending on the country, in municipal depots or on the ground, and sometimes the metals are reported as releases to land in situ. In the case of Mexico these releases correspond to the provision of tailings dams, and for that reason were included in the table as mercury in waste.

From the above data, it is noted that in Mexico 82% of the residues with mercury are stored in tailings dams and 10.6 % in disposal sites for hazardous waste. The 7.4 % of the mercury content in the waste remains available in landfills and informal dumping sites while the data for dental amalgams remains unknown. There is a mercury waste stream from informal mining called (terreros) which has not yet been estimated.

The industrial processes sector, which represents 4.6 percent of the total mercury content in the waste, generates 6.32 ton of mercury, a value similar in magnitude to the mean value reported by the PRTR (5.82 ton).

In the case of products at the end of their life cycle (e.g. lamps, switches, mercury thermometers, dental amalgams), the estimations indicate that 12.5 ton of mercury are not managed in an environmentally sound manner. Specific actions are therefore needed to improve management practices and also to regulate the content of mercury in new products.

It should be noted that these estimates are affected by uncertainty and errors and therefore data should be updated regularly. For example the list on table 3 does not include dry batteries, given the level of uncertainty detected on official sources on imports due to inconsistencies in data collection.

VI. 3. Mercury production or supply

In Mexico, mercury ores are mainly located in the following federal entities (in particular in the northwest and northeast of the territory): Aguascalientes, Chihuahua, Coahuila, Durango, Guanajuato, Hidalgo, Mexico, Morelos, Nuevo Leon, Queretaro, San Luis Potosi, Sinaloa, Sonora, Tamaulipas, Tlaxcala, and Zacatecas, reaching the main reservoirs in the states of: San Luis Potosi, Zacatecas, Queretaro, Guanajuato and Guerrero (CEC, 2013a).

Currently mercury as a commodity is produced in Mexico as a product of informal mining and as secondary mercury recovered from tailings. Mexico officially reported the production of primary mercury until 1994, but there are however non official records indicating a primary production of about

121.5 ton in 2011, according to the Report on the mercury market in Mexico (CEC, 2011).

The remaining mercury comes from waste or by-products that are processed in a retort and distilled to obtain a product of higher purity.

Table 4 indicates the estimates coming from the primary informal mining of mercury and recovery as a by-product, which includes secondary extraction from old mine tailings. In this, it is observed that the most important source is related to the informal primary mining, mainly in the State of Queretaro.

Table 4. Estimate of the annual supply of mercury as goods (ton)

SOURCE OF MERCURY	Ton/year
Primary informal mining of mercury	121.5
Industrial Waste	
Chlorine-soda	7.0
Secondary extraction of old mine tailings	24.0
TOTAL	**152.5**

Source: CEC, 2011 and 2013a

In Mexico there are still two chlor-alkali plants that account for approximately 240.82 tonnes of mercury (CEC 2011). This report suggests the necessary technological changes that would be necessary at this type of facility in order to eliminate the use of mercury cells.

Demand for mercury

Table 5 indicates the market for the use of mercury considering both products and industrial applications, and indicates that the most important source is the development of electrical switches and relays (imported products). However, nearly 50%, corresponds to non-specified uses which indicate a high degree of uncertainty. It is also important to note that pharmaceutical uses are still important, as is the case of the thimerosal/thimerosal (ethylmercury thiosalicylate) as a preservative in vaccines.

Table 5. Demand for mercury and mercury products in Mexico (ton/year)

PRODUCT OR SECTOR	Ton/year
DEMAND FOR MERCURY	
Chlorine-soda	4.2
Dental Amalgam	3.5
Lamps	1.0
Pharmaceutical	3.9
Sphygmomanometers	1.9
Production of chemicals / Other	9.1
MERCURY IN PRODUCTS IMPORTED	

PRODUCT OR SECTOR	Ton/year
Dental Amalgam	5.5
Switches/Relays	12.3
Lamps	0.5
Thermostats and other measuring devices	7.4
Batteries	0.2
Other products not specified	48.7
Total Demand	**98.2 ***

Notes:
* The data are not adjusted for exports. Exports of lamps from Mexico are unknown

CEC, 2011 and 2013a .

VII. Current treatment facilities, collection and disposal of waste

The listing of companies authorized by SEMARNAT for the management of hazardous waste is included on chapter V of this report. It should be noted that only items 5, 7, 8 and 9 refer to the management of mercury-containing wastes. The complete listing of authorized companies is located on the annex II of the Spanish version of this document.

In the case of line 5 - treatment of hazardous industrial waste: there are 43 companies licensed for the treatment of hazardous industrial waste. Of these, one has an approved treatment of solutions contaminated with mercury waste (Ecototal, S. A. de C. V.) and is located at km 8.5 of the old road to Arteaga, in Coahuila state (Figure 4). This company has an authorization to operate these types of processes until 2014 and has a capacity of **200,000 tons** of hazardous waste (SEMARNAT, 2013). There is no specific information for mercury-containing wastes at this facility.

In addition, the company SITRASA, S. A. de C. V. which is located in the city of Irapuato, Guanajuato, is authorized for the treatment of hazardous waste (lamps and batteries) and has a capacity of 42.680 tons. However, there is no mention on the amount of mercury-containing wastes at this facility.

In the case of item 7, there are four companies licensed to carry out controlled confinement of hazardous waste. However, none of these specifically mentioned in its authorization the handling of mercury. In addition, one of the companies is not operating and another only manages waste pertaining to the pharmaceutical industry. Table 6 summarizes the general characteristics of these companies while figure 3 indicates their location.

Table 6. Companies authorized to the containment of hazardous waste including waste with heavy metals

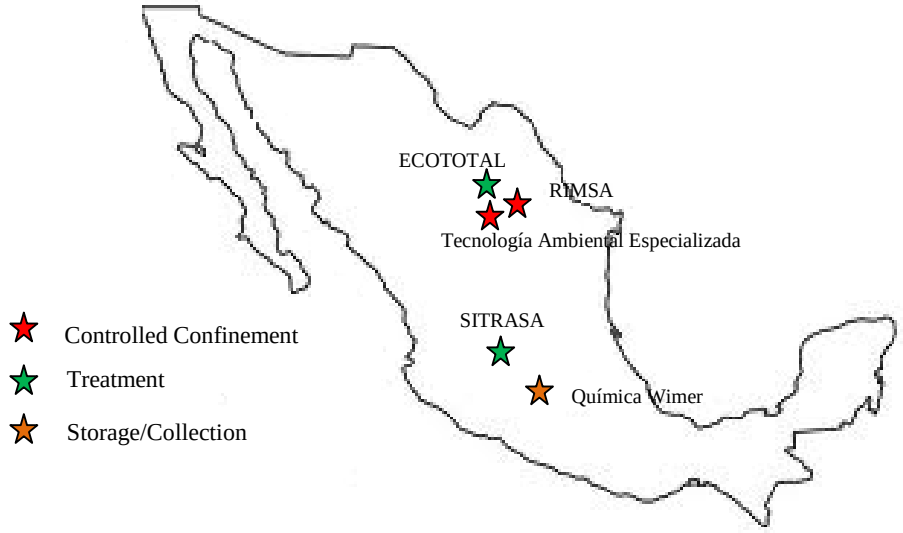
NAME	COMMENCEMENT OF OPERATIONS	TYPE OF WASTE	Amount authorized (Ton)
Tecnología Ambiental Especializada, S.A. de C.V. Km. 106 + 300 of the Federal Highway No. 57 Saltillo Monclova on the campus Las Coloradas, Ramos Arizpe, Coahuila Http://cimari.com/ubicacion.html	2006	Hazardous Waste	715.836
Residuos Industriales Multiquim, S. A. de C. V. (RIMSA by its acronym in Spanish) Av. Lázaro Cárdenas No. Poniente 2400, Col. San Agustin, San Pedro Garza Garcia, Nuevo Leon http://www.rimsa.com.mx/	80S	Hazardous Waste	660.000
Sistemas de Desarrollo Sustentable, S.A. de C.V.* Ejido Cuauhtemoc Zimapan Hidalgo 52 62 71 00	2011	Hazardous Waste	170.000
Ciba-Geigy Mexicana, S.A. de C. V. (Plant Atotonilquillo) ** 43.5 Km road Guadalajara-Ocotl ab, Atotonilquillo Chapala Jalisco 91- (5)-6-77-10-88	90S	Pharmaceutical Waste	90.833

Source: SEMARNAT, 2013. Listings of companies authorized to the management of hazardous waste. Revised on 19 June 2013.
http://www.semarnat.gob.mx/transparencia/transparenciafocalizada/residuos/Paginas/empresas.aspx
* The company is not operating by litigation
** The company only provides service to pharmaceutical waste

The two companies that can receive mercury-containing waste, have an installed confinement capacity of **1,375,836 tonnes of hazardous waste**; however, there is no information available about the specific capacity for the management of mercury waste.

The complete listing of the companies authorized to the containment of hazardous waste is located on annex II of the Spanish version of this document.

Figure 3. Location of facilities authorized for the controlled confinement of hazardous waste companies and/or for the treatment of hazardous waste containing mercury.



The company Residuos Industriales Multiquim, S. A. de C. V. (RIMSA) reported during a stakeholders meeting held in 2013, that the final disposal of hazardous waste is achieved using strict protection measures to minimize impacts at the the confinements, using a system "multi barrier" in which each of the elements of containment protects independently and the combination of all them ensures maximum protection of the environment in the long term.

The system "multi Barrier" includes the following:

- Geological Barrier (features of the site).
- Technical Barrier (roofing systems of artificial cells).
- Barrier material (generated by stabilizing the waste, prior to their disposal).

Any hazardous waste that does not comply with the required specifications must be subject to treatments before confinement, in order to stabilize and reduce the mobility; and therefore minimize the risk of soil/aquifer contamination by the possible generation of leachate.

The types of treatments applied at RIMSA prior to final waste disposal include:

- For elemental mercury the treatment consists of an amalgam with a mixture of liquid mercury combined with another metal to form a solid matrix. This reduces potential emissions of mercury vapor in the air; it also reduces the solubility in aqueous media and its bioavailability in order to avoid biotransformation into highly toxic metal species.
- For fluorescent lamps with content of mercury vapor, this facility uses a crushing pre-treatment in which the lamps are eventually broken, and then allowing mercury vapor to deposit in activated carbon filters. When

the filters are saturated these are disposed of together with the remaining of the crushed materials (glass, metal, etc).

- Waste contaminated with mercury in low concentrations. For this type of waste the facility applies a treatment of stabilization/solidification to immobilize the mercury in an array using conventional cementing and puzzolanic agents such as lime, fly ash, Portland cement, etc.
- Waste contaminated with mercury in ionic state (Hg^{2+}), in this case the facility applies precipitation treatment that consists of mixing precipitating agents, such as sodium sulphide, phosphates, ferrous sulfide, etc.

The Tecnología Ambiental Especializada facility reported the following process for the confinement of waste with metals, including mercury:

- The residues are characterized at the laboratory to identify its heavy metal content. If this is the case, the waste will be set into the treatment site.
- Wastes contaminated with heavy metals are subject to a treatment aimed to obtain a uniform mixture.
- The laboratory emits a formulation which considers the addition of raw materials.
- The additives are mechanically added to the residue after which a homogeneous mixture is obtained.
- The laboratory determines the effectiveness of the treatment.
- There have been cases in which mercury- containing waste is subject to an oxidizing-reduction treatment.

In the case of item 8, there are 1,363 companies authorized for the collection and transport of hazardous and biological waste. However, only 28 are authorized for the management of mercury-containing waste, totaling **2,698 tons** (SEMARNAT, 2013). There are 12 companies that report capacity for the treatment of mercury lamps and batteries (mercuric oxide) and that have a total capacity of **3,886 tons** (SEMARNAT, 2013), but no information about the specific capacity for the management of mercury waste was presented.

In the case of item 9, there are 598 companies authorized for the storage/collection[2] of hazardous waste, which in accordance with the law should not exceed 6 months (storage period). Four of these companies are also authorized for the management of mercury-containing waste, totaling **1,851 tons** (SEMARNAT, 2013) but there is no information available about the specific capacity for the management of mercury waste. In addition, there are 18 companies that are licensed for the storage/collection of waste, including mercury lamps and batteries (mercuric oxide), totaling **13,557 tons** but in the same way as in the previous case, no information about the specific capacity for the management of mercury waste was presented. (SEMARNAT, 2013).

In addition, the chemical company Wimer, S. A. de C. V. (figure 3) has an authorization for the storage of hazardous waste consisting of solids, liquids and

[2] Storage of hazardous waste: action temporarily retain the hazardous waste in areas that comply with the conditions laid down in the applicable provisions to prevent their liberation, in both are processed for its use, they applied a treatment, it is being transported and it has finally of them (Regulation of the LGPGIR, 30-Nov-2006).

semi solids that are corrosive, reactive, toxic and flammable (drums, slag, cuvettes polluted, contaminated textile, sludge sedimentation, of filter cake of chemicals, electroplating, vegetable oils and recovery of polyols, sludge of cyanide, fluorescent lamps, batteries, obsolete medicins, worn oils, acids and spent solvents) except: hexachlorine compounds and biological waste. This company has a capacity of **400 tons**, but does not specify the specific amount for mercury waste (SEMARNAT, 2013). However, through e-mail communication, the company has indicated that it can apply a protocol for the recovery of mercury from dental amalgams, through the method of distillation at a temperature of 350 to 370 ºC and with a cooling system at -10 ºC to condense mercury. The company also indicated that it has future plans to recover mercury from fluorescent tubes, and from medical devices, such as electrical equipment, pressure gauges, thermometers, etc., and that has a capacity to process mercury with purity of 99.9 % and of up to 44 tonnes per year, initially.

Generally, these companies use the retort process for the treatment of waste with mercury. This process is described below:

The retort system consists of a heating unit and vacuum distillation / condensation system to recover the metal mercury, solid objects, and by-products of other processes. These devices produce semi pure metallic mercury which is resold directly or sent to the triple distillation process for additional purification. The process of triple distillation uses a system of vacuum distillation to remove all traces of impurities of metallic mercury after which it can be resold as pure mercury with a "technical grade". In addition, the processed materials, now free of mercury, are claimed as scrap or as non-hazardous waste.

After reviewing existing information, the capacity for the management of mercury-containing waste in Mexico can be summarized as follows:

1. Confinement of 1,375,836 tonnes of hazardous waste (no specific capacity for mercury is reported, but this total is expect to be sufficient to handle mercury storage).
2. Collection and transport of 2,698 tonnes of mercury waste and its compounds.
3. Collection and transport of 3,886 tons of mercury lamps and batteries.
4. Storage and collection of 1,851 tonnes of mercury waste and its compounds.
5. Collection and transport of 13,557 tonnes of mercury lamps and batteries.
6. Treatment of 44 tonnes per year of mercury by the chemical company Wimer.

VIII. Potential sites for temporary storage of mercury

In accordance with the literature, the storage of mercury waste can be performed as follows:

- Storage in salt mines adapted for the disposal of metallic mercury or its compounds
- Storage in rock formations that provide a security level or equivalent to the containment in the salt mines
- Above ground storage facilities for the storage of metallic mercury or its compounds

VIII. 1. Above-ground disposal

In accordance with section III of this document, there are four companies authorized for the controlled confinement of hazardous waste, two of which are currently operating (Environmental Technology Specialist, S. A. de C. V. , and Residuos Industriales Multiquim, S. A. de C. V.), which can receive mercury-containing waste and with an installed capacity of **1,375,836 tonnes of hazardous waste** . This may be considered as a feasible option for the confinement of stabilized mercury waste.

VIII. 2. Under-ground disposal in saline domes

According to Hernandez-Mendoza (2007) the areas with salt structures of considerable size in the country are found in the states of Chihuahua, Coahuila, Tamaulipas, Veracruz, Tabasco, and in the Yucatan peninsula, as shown in figure 4.

Figure 4. Areas with presence of large saline structures in Mexico

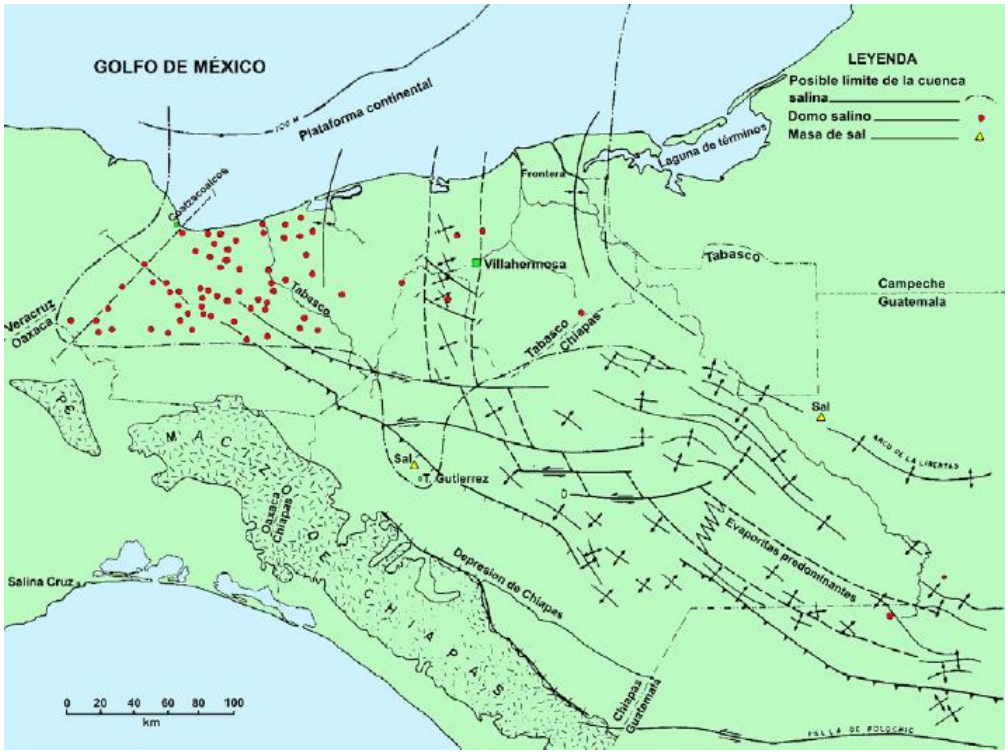
Source: Hernandez-Mendoza, 2007

According to Hernandez-Mendoza (2007) the best sites for the storage of hazardous waste are in the area of the Isthmus of Tehuantepec, particularly in the state of Veracruz, given its geographical, topographical, atmospheric characteristics, among others. This conclusion was derived from an analysis of the conditions of various sites in the Mexico, and according to criteria applied for the selection of disposal sites for hazardous waste. These criteria follows

guidelines recommended by the World Health Organization, the criteria of the Board of metropolitan Melbourne workers and the factors to define the location of the disposal sites for hazardous waste in the United States of America (CCE-AMCRSP, 1998).

Figure 6 indicates the feasible sites located in the area of the Isthmus. This saline basin is approximately 290 km in length and 70 km wide, and it occupies the entire coastal plain that stretches from southeast of Veracruz to the north-east of Tabasco, and possibly further to the east in the direction of the Yucatan Peninsula. Due to its characteristics, the volume of storage could be considerably large. The article by Hernandez-Mendoza points out that these domes were being exploited to commercialize the salt mined and that it would be necessary to conduct additional studies to identify the characteristics both of the dome of the saline cavity.

Figure 5. Saline structures and domes in the Isthmus of Tehuantepec



Source: Hernandez-Mendoza, 2007

On the other hand Arellano and Yussim (2005) have selected different potential sites for the storage of hazardous waste, hydrocarbons or other in the area of the Isthmus. These sites are listed in table 7.

Table 7. Potential Domes for the storage of hazardous waste reported by Arellano and Yussim in 2005[++]

Sanchez Magellan
Abkatun
Kanaab
Tonala
The Donkey
Amoca

[++] These structures are located in the eastern sector of the Salina Basin

The most important structures in which salt and/or sulfur has been extracted are listed in table 8. Although these sites may also be used for the storage of hazardous waste, the authors indicate that in some cases, these structures present cracks generated during the operation and may not be used for the storage of waste.

Table 8. Sites in which salt and/or sulfur have been extracted.
(Arellano and Yussim, 2005).

Denguevirus
Petapa *
Coachapa *
Zanapa
Chinameca

*poorly clogged sites 3

Finally, according to the investigation of Arellano and Yussim, presents a list of potential sites of storage that were salt domes but that have cracks and that they contain residues with high sulfur content (Table 9).

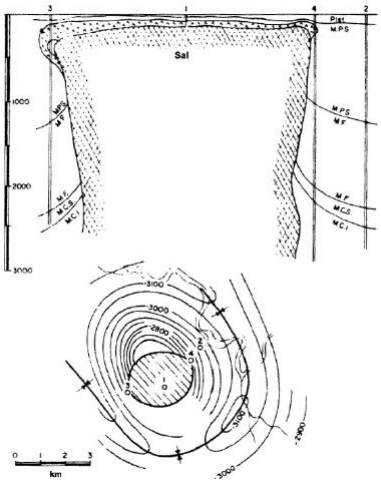
Table 9. Evil sites blocked and volumes of waste with high sulfur content. (Arellano and Yussim, 2005)

Jaltipan
Coachapa
Petapa
Tequistepec

Figure 6 shows the characteristics of the Zanapa salt dome, which has the greatest potential to be used for the disposal of hazardous waste liquids with a depth of approximately 100 m and a thickness of more than 1500 m.

[3] Refers to the fact that the tunnels or open cavities for the removal of material is not hermetically closed and where tightness cannot be ensured.

Figure 6. Structure and level curves of the Zanapa salt dome



Source: Hernandez-Mendoza, 2007

The company known as CYDSA, S. A. de C. V. owns saline domes in the area of Coatzacoalcos. It is indicated, however, that there are interconnections between these structures, which represents a limitation when considering the storage of hazardous waste.

It should be noted that although there is potential for the use of salt domes, it is necessary to carry out studies of greater detail to identify those sites that can be used for the disposal of mercury-containing waste. These sites must be evaluated according to criteria set in the environmental standard NOM-145-SEMARNAT-2003, which establishes the characteristics for the containment of waste in cavities created by salt dissolution in domes that are geologically stable.

Finally, it is also important to consider that sites that are poorly blocked or are fractured cannot be used for the storage of hazardous waste, since it the containment of materials cannot be guaranteed.

VIII. 3. Evaluation of potential sites for the storage of mercury and mercury waste

To conduct a general review of the possible storage sites, the categories listed above have been further analyzed. These categories cover the use of mercury in processes, the manufacture of products containing mercury, among others.

The main sites evaluated for the disposal of mercury and mercury-containing waste are listed in the following subgroups:

1. Disposal sites for Hazardous Waste
   - Specialized environmental technology, S. A. de C. V.
   - Residuos Industriales Multiquim, S. A. de C. V.

2. Facilities for temporary storage of hazardous waste
   - Systems of Environmental Treatment, S. A. de C. V.
   - Chemistry Wimer, SA de CV

3. Mines or smelting

4. Saline Domes
   - Zanapa, Tabasco
   - Amexquita, Tabasco
   - Jaltipan, Veracruz
   - CYDSA, Coatzacoalcos

The systematization tool used for this analysis is described on Annex III of the Spanish version of this report.

According to the criteria set forth in this tool, potential sites have been identified, in the following salt mines i) Zanapa, Tabasco; (ii) Amexquita, Tabasco, and (iii) Jaltipan Veracruz.

Additionally, the tool identifies the following sites that are already authorized for the confinement of hazardous waste: 1) RIMSA, Nuevo Leon and 2) Environmental Technology Specialist, Coahuila.

Criteria for the selection of potential sites

Annex III of the Spanish version of this report lists some of the criteria that are commonly applied for the assessment of sites with potential for the storage of hazardous waste, such as:

- Seismic Zone.
- Geological faults.
- Floodable area.
- Location Type: urban, rural or semi.
- Land Use: housing, commercial, agricultural, industrial.
- Property Type: private, public.
- Local Aquifer: superficial, deep.
- Soil Type: permeable, waterproof.
- Vulnerable Facilities in the surrounding environment (hospitals, schools, etc.).
- Cultural sites in the close vicinity of the installation (ruins, cultural heritage, etc.).
- Current management of Hg in the installation.
- Appropriate Access to the installation.

In accordance with national regulations on hazardous waste in Mexico, there is enough background information on the characteristics that storage sites must met, which includes operations for mercury-containing waste. These obligatory features are found on the following Official Mexican Standards:

Official Mexican Norm	Description
NOM-055-SEMARNAT-2003	This Official Mexican Standard establishes the requirements that must be met by the sites that will be used for the controlled containment of hazardous waste (except the fluids, the semi-solids, polychlorinated biphenyls (pcbs) and radioactive) previously stabilized, according to the geological characteristics, geological, hydrological, climatological and seismic. This Official Mexican Standard is mandatory for all responsible intending to establish the sites which will be made available for the controlled containment of hazardous waste (except the liquid, semi-solids, polychlorinated biphenyls and radioactive) previously stabilized.
NOM-056-SEMARNAT-1993	This Official Mexican Standard establishes the requirements for the design and construction of the complementary works of a controlled containment of hazardous waste.
NOM-057-SEMARNAT-1993	This Official Mexican Standard establishes the requirements that must be observed in the design, construction and operation of cells in a controlled containment for hazardous waste.
NOM-145-SEMARNAT-2003	This Official Mexican Standard establishes the characteristics of the containment of waste in cavities created by salt dissolution in domes geologically stable.

In accordance with the national regulation, there are two hazardous waste confinements with the characteristics for the proper handling of mercury waste, which meet the criteria described on Annex III of the Spanish version of this report.

Potential sites with greater viability for mercury storage

Even though there is limited information on some of the characteristics of existing sites in the country, it is likely that some of the most appropriate ones are precisely the confinements that are currently authorized for the management of hazardous waste, these being:

1) RIMSA, Nuevo Leon
2) Environmental Technology Specialist.

The existing chlor-alkali plants are seen as potential candidates for the storage of mercury and mercury waste, as well as the salines domes within those facilities. However during the national stakeholders workshop that took place in May 2013, reference was made to these domes and the fact that they are interconnected, which makes the storage of mercury unviable. There are other disadvantages, such as the remoteness from the sites of generation. They might however be considered as transitory units before final disposal.

In addition, there are two companies that have the ability to recover and recycle mercury waste:

1) Environmental Processing Systems, S. A. de C. V.

2) Chemical Wimer, SA de CV

VIII. 4. Analysis of options for the management of mercury

Taken into consideration the information collected from authorized facilities in Mexico for the treatment of hazardous industrial waste, as well as on the installed capacity for this purpose, it is likely that these facilities may be in fact, the most viable for the temporary storage of elemental mercury. Although certain technical details were not made available before the conclusion of this report some of these facilities have reported general aspects about the processes and treatments applied in situ for the treatment of elemental mercury and other wastes that contain metals.

As for elemental mercury, this issue requires further analysis and discussion by relevant stakeholders, before a decision is made on the feasibility of its temporary storage in the national territory. To achieve a consensus on this issue, it is vital that certain elements are incorporated into the analysis, including technical, economic, and regulatory aspects. Among the technical elements it is suggested that studies and/or on-site inspections are carried out in order to assess whether there is sufficient technical capacity and safety measures put into practice.

With respect to the regulatory framework, and although the LGEEPA provides for a maximum period of 6 months for the temporary storage of hazardous industrial waste, it is important to review this aspect and if necessary, make the necessary modifications in case it is decided that the storage of elemental mercury could be for a period greater than what is currently indicated in the current law. There are some other regulatory gaps that must be covered to ensure a comprehensive regulation of mercury, such as the absence of norms that specify limits and characteristics of the waste subject to treatment prior to its final disposal.

Similarly, it is important that the revision of the legal framework considers other aspects or additional measures, such as those provided for in the text of the Minamata Convention. Modifications to a legal framework are often a complex, time-consuming process, which often results in unnecessary delays that limit the effective application of international regulatory instruments. In this regard, it

is advisable to expedite and simplify the discussions between stakeholders to achieve the policy agreements that are necessary for the environmentally sound management of the mercury and mercury waste.

In addition, the feasibility studies on temporary storage sites must specify the economic aspects of greater relevance; as well include a cost-benefit analysis to support decision-making. The costs for both the public and private sectors should be considered and become part of an assessment that takes into consideration both and environmental impacts.

IX. Constitution of a national group of experts and government officials involved in the issue of mercury

On 20 May 2013, a preparatory meeting of the interdisciplinary group on mercury was held at the premises of SEMARNAT, located on Avenida Revolución No. 1425, Col. Tlacopac, C. P. 01040, Mexico, D. F.

The meeting was attended by 36 representatives and experts from the following sectors at the national level (see Annex IV):

- Public Sector
    - Ministry of Health
    - Ministry of Economy
    - Ministry of Environment and Natural Resources
    - Ministry of Foreign Affairs
    - Ministry of Finance and Public Credit
    - National Institute of Ecology and Climate Change
    - Federal Electricity Commission
    - Petroleos Mexicanos
    - Mexican Geological Service
- Industrial Sector
    - Hazardous Waste Confinement
    - Recycling from dental amalgams
    - Chlorine -soda Industry
- Cameras
    - Mining Chamber of Mexico
    - Mexican Association of batteries (AMEXPILAS)
- Academy
    - National Autonomous University of Mexico
    - College of Engineering geologists of Mexico

The agenda for the first meeting of the national group of experts involved in the activities listed in Appendix V of the Spanish version of this report.

Some of the major agreements of the meeting were the following:

1) Create technical working groups to address specific issues relating to the management of wastes with mercury at different scales (example: medical equipment, chlorine-alkali industry).

2) Updating the national mercury emissions inventory and address the comments made to the previous version, while requesting support from all sectors involved to obtain the most reliable information.

3) Validate the information on the capacity for the management of mercury using data from authorized service providers. This is aimed at developing a mechanism to implement action lines (example: collection of lamps, amalgams, among others).

4) Establish a focal point for information collection purposes.

5) Encourage the industrial sector to provide information that reflects clearly the technical characteristics of the facilities that are authorized for the management of hazardous waste.

X. Outline of a plan of action

Following the discussions of the stakeholders during the Project Results Workshop held in Mexico City on 3 and 4 July 2013, the establishment of a national committee was agreed. The role of this committee will be to support the implementation of specific actions for the management of mercury mercury waste in alignment with the Minamata Convention

Among the activities mentioned during the workshop, some of them should be sector-specific, and according to the following prioritization of action lines:

1. Inventory of mercury releases

1.1. Update of the inventory of mercury releases in Mexico.
1.2. Development of national emission factors for the largest sources of emissions as set in the text of the Minamata Convention
1.3. Involvement of all sectors to collect information with the aim of reducing uncertainty.

2. Primary informal mining of Mercury

2.1. Diagnosis of informal mining activities
2.2. Evaluation of the type of wastes generated during processing of the cinnabar and their current disposal methods
2.3. Identification of control measures for the environmentally sound management of waste.
2.4. Characterization of impacts to the environment as a result of current waste management practices.

3. Small-scale gold mining

3.1. Diagnosis of the small-scale gold mining activities of in Mexico.
3.2. Evaluation of the use of mercury in small-scale gold mining activities.
3.3. Evaluation of the type of waste generated during small-scale gold mining and their current disposal methods.
3.4. Definition of control measures for the environmentally sound management of generated waste.
3.5. Characterization of damages to the environment as a result of current waste management practices.

4. Processes

4.1. Diagnosis of the current technologies used for stabilization and solidification of mercury- containing waste in existing disposal sites.
4.2. Definition of the actions for the disposal and storage of mercury and mercury containing wastes generated during the dismantling of the chlorine-alkali plants with mercury cells.
4.3. Definition of the remediation plan of the site after the dismantling of chlor-alkali facilities.

5. Mercury products at the end of its useful life

5.1. Evaluation of the current capacity of the infrastructure installed in Mexico with the retort process for the management of mercury products at the end of its useful life.

Industrial
5.2. Implement management plans for large generators.

Residential
5.3. Development of a plan of segregation and selective collection
5.4. Implementation of a pilot program of the national management plan
5.5. Awareness raising activities.

Health Sector
5.6. Replacement of thermometers and other mercury-containing devices at the national level
5.7. Definition of the necessary regulations to restrict imports and uses.

6. Sector Salud-Amalgamas

6.1. Development of a plan of action for the replacement on the use of dental amalgam fillings.
6.2. Definition of a plan for the environmentally sound management of dental amalgam waste.

XI. Conclusions and recommendations

It is necessary to work on a national policy that allows defining actions to increase the amount of mercury waste that is handled in an environmentally sound manner. It is also important to develop a market for the establishment of sites for the temporary storage of mercury.

In agreement with the Mexican legal framework, mercury-containing waste is considered as hazardous waste and therefore its regulation should be of federal jurisdiction.

The leading agencies of the Federal Government related to the control and management of mercury are the Ministry of Labor and Social Welfare, the Ministry of Environment and Natural Resources, the Ministry of Communications and Transport and the Ministry of Health.

There is no current specific legal framework for the confinement of mercury waste. However, there are legal specifications for the regulation of controlled confinements for hazardous waste, which also take into consideration the construction of cells, or confinement in salt domes.

As for the development of limits of reference and compliance standards for sites viable for the temporary storage of mercury waste, it is important to share information with countries that have experience in the development of these values. Relevance should also be given to necessary research to identify and assess on the geological and hydrogeological characteristics of potential sites for the disposal of hazardous wastes.

With regard to the estimated values reported by the PRTR, there are significant variations between the sources of information, which is probably due to the uncertainties in each source, as well as to the lack of a validation method.

With regard to the amounts of mercury contained in waste, it is estimated a potential generation of 166 tonnes per year at the national level, of which nearly 135.92 tons come from gold mining activities of gold mining, and disposed of in mine tailings. There is a 10.6 % of waste coming from industrial activities which are disposed of in controlled facilities for this purpose. Finally, approximately 12.5 ton of mercury contained in products at the end of its useful life and amalgams are believed to be handled in an unsound manner, representing therefore a key challenge at the national level.

In Mexico, there appears to be sufficient capacity for the final disposal of mercury waste in the two confinements existing in the country; however, the law clearly specifies that the confinement of liquid waste is forbidden and that this must be stabilized and/or solidified prior to final disposal. In addition, there are several facilities that are authorized for the collection of this type of waste, using processes such as the retort method to generate mercury of sufficient quality to be used again in different products and processes.

With respect to confinement in salt mines, there is the potential to consider the feasibility of this type of site because some studies have been developed to store cuts drilling oil industry; however, current studies are still limited and do not include specifications for the storage of hazardous waste.

The creation of a legally-binding instrument can represent an opportunity for countries like Mexico to justify a larger government investment in monitoring compliance, as well as to fill existing gaps in regulation. Additionally, this instrument encourages countries to request financial support to implement strategies aimed at improving information, policy development, and training of authorities and other stakeholders.

According to the results and analysis of information obtained in the preparation of this report, it is necessary to obtain further details on the processes and activities that are performed in the authorized sites for hazardous waste management in Mexico. That would allow a better evaluation to determine the feasibility of these sites to become options for the temporary storage of mercury.

Finally, it is important that the national group of experts is given a legal mandate that will that facilitate its operation and the implementation of action lines identified for the country.

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List of Annexes (included only in the Spanish version of the report)

Annex I. Legal instruments related to the storage and disposal of mercury in Mexico
Annex II. List of companies authorized for mercury management, its products and mercury-contaminated materials.
Annex III. Matrix containing the location of potential sites
Annex IV. List of participants to the national workshop
Annex V.-Agenda of the first meeting of the mercury working group for the project on Storage and Disposal of Mercury in Mexico