Eliminate mercury use and adequately manage mercury and mercury wastes in the chlor alkali sector in Mexico

Part I: Project Information

GEF ID

Project Type

FSP

Type of Trust Fund

GET

CBIT/NGI

☐CBIT

☐NGI

Project Title

Eliminate mercury use and adequately manage mercury and mercury wastes in the chlor alkali sector in Mexico

Countries

Mexico

Agency(ies)

UNEP

Other Executing Partner(s)	**Executing Partner Type**

Other Executing Partner(s)	**Executing Partner Type**
The Secretariat of Environment and Natural Resources (SEMARNAT)/ General Directorate for Integral Management of Materials and Riskable Activities (DGGIMAR) - National Institute of Ecology and Climate Change (INECC) - CYDSA, S.A de C.V.	Government

GEF Focal Area

Chemicals and Waste

Taxonomy

Chemicals and Waste, Focal Areas, Sound Management of chemicals and waste, Disposal, Eco-Efficiency, Waste Management, Hazardous Waste Management, Industrial Waste, Industrial Emissions, Mercury, Best Available Technology / Best Environmental Practices, Climate Change, Climate Change Mitigation, Energy Efficiency, Technology Transfer, Influencing models, Transform policy and regulatory environments, Strengthen institutional capacity and decision-making, Stakeholders, Local Communities, Type of Engagement, Information Dissemination, Participation, Civil Society, Academia, Community Based Organization, Communications, Strategic Communications, Awareness Raising, Private Sector, Capital providers, Large corporations, Beneficiaries, Gender Equality, Gender results areas, Capacity Development, Participation and leadership, Access to benefits and services, Knowledge Generation and Exchange, Gender Mainstreaming, Sex-disaggregated indicators, Gender-sensitive indicators, Women groups, Capacity, Knowledge and Research, Knowledge Exchange, Peer-to-Peer, North-South, Field Visit, South-South, Innovation, Learning, Indicators to measure change, Theory of change, Knowledge Generation, Course, Workshop, Training

Rio Markers

Climate Change Mitigation

Climate Change Mitigation 1

Climate Change Adaptation

Climate Change Adaptation 0

Duration

60 In Months

Agency Fee($)

1,080,000

Submission Date

3/23/2020

A. Indicative Focal/Non-Focal Area Elements

Programming Directions	Trust Fund	GEF Amount($)	Co-Fin Amount($)
CW-1-1	GET	12,000,000	129,700,000
	Total Project Cost ($)	**12,000,000**	**129,700,000**

B. Indicative Project description summary

Project Objective

Reduce negative impacts of mercury and mercury wastes from the chlor-alkali sector on human health and the environment in Mexico

Project Component	Financing Type	Project Outcomes	Project Outputs	Trust Fund	GEF Amount($)	Co-Fin Amount($)

Project Component	Financing Type	Project Outcomes	Project Outputs	Trust Fund	GEF Amount($)	Co-Fin Amount($)
1. Improve national capacity in the management of hazardous chemical facilities and mercury contaminated sites	Technical Assistance	1.1 Mexico's relevant agencies have adopted a good practice guide and put in place plans for decontamination, monitoring and remediation of the contaminated sites of Monterrey and Coatzacoalcos	Output 1.1.1: Good practice guide for the monitoring and management of hazardous chemical facilities and contaminated sites is completed and distributed to national stakeholders Output 1.1.2: Characterisation and decontamination plan and strategy to manage decontamination for the Monterrey and Coatzacoalcos sites are developed by experts and shared with national stakeholders Output 1.1.3: Monitoring and remediation programme of Monterrey and Coatzacoalcos sites are developed and accepted by corresponding authorities	GET	2,100,000	20,000,000

Project Component	Financing Type	Project Outcomes	Project Outputs	Trust Fund	GEF Amount($)	Co-Fin Amount($)
2. Introduce BAT during and after decommissioning/ conversion and seek investment for environmental management	Technical Assistance	2.1 Mercury cell chlor alkali facilities are converted and decommissioned in Mexico and financing mechanisms for clean-up and rehabilitation of the sites adopted	Output 2.1.1: Detailed engineering of BAT for new plant in Coatzacoalcos developed and made available to national stakeholders Output 2.1.2: Technical support provided to CYDSA to decommission and collect excess mercury and mercury contaminated materials from Coatzacoalcos and Monterrey sites Output 2.1.3: Technical support provided to CYDSA to convert to new plant in Coatzacoalcos (exclusively co-financed) Output 2.1.4: Financing packages prepared and shared with investors in environmental cleanup and rehabilitation of sites	GET	6,600,000	104,000,000

Project Component	Financing Type	Project Outcomes	Project Outputs	Trust Fund	GEF Amount($)	Co-Fin Amount($)
3. Stabilization, treatment and disposal of excess mercury and contaminated materials from the two decommissioned and converted plants	Technical Assistance	3.1 100 metric tons of mercury safely stored and disposed	Output 3.1.1: Technical support provided to CYDSA to stabilize excess mercury Output 3.1.2: Technical support provided to CYDSA to safely store, treat and/or dispose excess mercury and contaminated materials/equipment	GET	2,000,000	3,000,000

Project Component	Financing Type	Project Outcomes	Project Outputs	Trust Fund	GEF Amount($)	Co-Fin Amount($)
4. Knowledge management and communication	Technical Assistance	4.1 Countries and global operators apply the new knowledge to phase out remaining mercury chlor alkali facilities	Output 4.1.1: National stakeholders increased awareness and knowledge through project information dissemination Output 4.1.2: Mercury cell chlor alkali countries and global operators increased their knowledge and learned lessons from the project in Mexico Output 4.1.3: Chlor alkali mercury cell conversion guidelines updated and shared with industry partners and stakeholders	GET	528,600	1,800,000
5. Monitoring and evaluation	Technical Assistance	5.1 Project achieves objective on time through effective monitoring	5.1.1 Project monitored and evaluated	GET	200,000	300,000
				Sub Total ($)	**11,428,600**	**129,100,000**

Project Management Cost (PMC)

GET	571,400	600,000

Project Management Cost (PMC)

	Sub Total($)	**571,400**	**600,000**
	Total Project Cost($)	**12,000,000**	**129,700,000**

C. Indicative sources of Co-financing for the Project by name and by type

Sources of Co-financing	Name of Co-financier	Type of Co-financing	Investment Mobilized	Amount($)
Government	SEMARNAT	In-kind	Recurrent expenditures	500,000
Government	INECC	In-kind	Recurrent expenditures	1,500,000
Donor Agency	Spain	In-kind	Recurrent expenditures	50,000
GEF Agency	UNEP	In-kind	Recurrent expenditures	50,000
Private Sector	CYDSA	Equity	Investment mobilized	124,500,000
Private Sector	CYDSA	In-kind	Recurrent expenditures	3,000,000
Private Sector	Eurochlor	In-kind	Recurrent expenditures	50,000
Private Sector	Chlorosur	In-kind	Recurrent expenditures	50,000
			Total Project Cost($)	**129,700,000**

Describe how any "Investment Mobilized" was identified

CYDSA has secured financing for the conversion of the Coatzacoalcos plant. This financing is supported by six different insitutions: Citibanamex, Santander, Banorte, BBVA Bancomer, Sabadell and Scotiabank Inverlat.

D. Indicative Trust Fund Resources Requested by Agency(ies), Country(ies), Focal Area and the Programming of Funds

Agency	Trust Fund	Country	Focal Area	Programming of Funds	Amount($)	Fee($)	Total($)
UNEP	GET	Mexico	Chemicals and Waste	Mercury	12,000,000	1,080,000	13,080,000
				Total GEF Resources($)	**12,000,000**	**1,080,000**	**13,080,000**

E. Project Preparation Grant (PPG)

PPG Required

☐

PPG Amount ($)

300,000

PPG Agency Fee ($)

27,000

Agency	Trust Fund	Country	Focal Area	Programming of Funds	Amount($)	Fee($)	Total($)
UNEP	GET	Mexico	Chemicals and Waste	Mercury	300,000	27,000	**327,000**
				Total Project Costs($)	**300,000**	**27,000**	**327,000**

Core Indicators

Indicator 6 Greenhouse Gas Emissions Mitigated

Total Target Benefit	(At PIF)	(At CEO Endorsement)	(Achieved at MTR)	(Achieved at TE)
Expected metric tons of CO_2e (direct)	43186	0	0	0
Expected metric tons of CO_2e (indirect)	0	0	0	0

Indicator 6.1 Carbon Sequestered or Emissions Avoided in the AFOLU (Agriculture, Forestry and Other Land Use) sector

Total Target Benefit	(At PIF)	(At CEO Endorsement)	(Achieved at MTR)	(Achieved at TE)
Expected metric tons of CO_2e (direct)				
Expected metric tons of CO_2e (indirect)				
Anticipated start year of accounting				
Duration of accounting				

Indicator 6.2 Emissions Avoided Outside AFOLU (Agriculture, Forestry and Other Land Use) Sector

Total Target Benefit	(At PIF)	(At CEO Endorsement)	(Achieved at MTR)	(Achieved at TE)
Expected metric tons of CO_2e (direct)	43,186			
Expected metric tons of CO_2e (indirect)				
Anticipated start year of accounting	2024			
Duration of accounting	5			

Indicator 6.3 Energy Saved (Use this sub-indicator in addition to the sub-indicator 6.2 if applicable)

Total Target Benefit	Energy (MJ) (At PIF)	Energy (MJ) (At CEO Endorsement)	Energy (MJ) (Achieved at MTR)	Energy (MJ) (Achieved at TE)
Target Energy Saved (MJ)				

Indicator 6.4 Increase in Installed Renewable Energy Capacity per Technology (Use this sub-indicator in addition to the sub-indicator 6.2 if applicable)

Technology	Capacity (MW) (Expected at PIF)	Capacity (MW) (Expected at CEO Endorsement)	Capacity (MW) (Achieved at MTR)	Capacity (MW) (Achieved at TE)

Indicator 9 Reduction, disposal/destruction, phase out, elimination and avoidance of chemicals of global concern and their waste in the environment and in processes, materials and products (metric tons of toxic chemicals reduced)

Metric Tons (Expected at PIF)	Metric Tons (Expected at CEO Endorsement)	Metric Tons (Achieved at MTR)	Metric Tons (Achieved at TE)
150.00	**0.00**	**0.00**	**0.00**

Indicator 9.1 Solid and liquid Persistent Organic Pollutants (POPs) removed or disposed (POPs type)

POPs type	Metric Tons (Expected at PIF)	Metric Tons (Expected at CEO Endorsement)	Metric Tons (Achieved at MTR)	Metric Tons (Achieved at TE)

Indicator 9.2 Quantity of mercury reduced (metric tons)

Metric Tons (Expected at PIF)	Metric Tons (Expected at CEO Endorsement)	Metric Tons (Achieved at MTR)	Metric Tons (Achieved at TE)
150.00			

Indicator 9.3 Hydrochloroflurocarbons (HCFC) Reduced/Phased out (metric tons)

Metric Tons (Expected at PIF)	Metric Tons (Expected at CEO Endorsement)	Metric Tons (Achieved at MTR)	Metric Tons (Achieved at TE)

Indicator 9.4 Number of countries with legislation and policy implemented to control chemicals and waste (Use this sub-indicator in addition to one of the sub-indicators 9.1, 9.2 and 9.3 if applicable)

Number (Expected at PIF)	Number (Expected at CEO Endorsement)	Number (Achieved at MTR)	Number (Achieved at TE)

Indicator 9.5 Number of low-chemical/non-chemical systems implemented, particularly in food production, manufacturing and cities (Use this sub-indicator in addition to one of the sub-indicators 9.1, 9.2 and 9.3 if applicable)

Number (Expected at PIF)	Number (Expected at CEO Endorsement)	Number (Achieved at MTR)	Number (Achieved at TE)
1			

Indicator 9.6 Quantity of POPs/Mercury containing materials and products directly avoided

Metric Tons (Expected at PIF)	Metric Tons (Expected at CEO Endorsement)	Metric Tons (Achieved at MTR)	Metric Tons (Achieved at TE)
53,700.00			

Indicator 11 Number of direct beneficiaries disaggregated by gender as co-benefit of GEF investment

	Number (Expected at PIF)	Number (Expected at CEO Endorsement)	Number (Achieved at MTR)	Number (Achieved at TE)
Female	7,500			
Male	7,500			
Total	15000	0	0	0

Part II. Project Justification

1a. Project Description

1. The global environmental and/or adaptation problems, root causes and barriers that need to be addressed

1.1 Mercury as a global pollutant

Mercury is a naturally occurring element found throughout the world and used today in many industrial processes due to its unique chemical and physical characteristics. Natural sources of mercury such as volcanic and geological activity, create background environmental levels that have been present long before humans appeared. However, recent estimates of anthropogenic sources of mercury emissions ranging from 2,000 to 2,820 tonnes every year (GMA, 2018). Once released, mercury is distributed to the environment through air-surface exchanges with soil, freshwater and vegetation, as well as exchanges between soil-vegetation and water-vegetation.

Mercury exists in three chemical forms (elemental, methyl mercury, and additional inorganic and organic species), each with specific effects on human health capable of causing malfunction of the central nervous system with severe physiological responses. It is considered by the World Health Organization (WHO) as one of the top ten chemicals of major public health concern. Methyl mercury, the most toxic form, is capable of crossing the brain and placental barriers with devastating effects on cognitive function and fetal development in humans. The inhalation of mercury vapour can produce harmful effects on the nervous, digestive and immune systems, lungs and kidneys, and may be fatal. The inorganic salts of mercury are corrosive to the skin, eyes and gastrointestinal tract, and may induce kidney toxicity if ingested. Exposure to high concentrations of this toxic substance via inhalation may result to pneumonia, bronchitis, chest pain, dyspnea, cough, stomatitis, gingivitis, excessive salivation and diarrhea. On the other hand, chronic exposure to low doses of mercury, can impact the central nervous system causing tremors, behavioral changes and abnormal reflexes. Mercury poisoning is most commonly associated with elevated levels of methyl mercury in freshwater and marine fish, made famous after the tragic number of mercury related deaths observed in the fishing village of Minamata in Japan in the late 1950s. These transport and transformation mechanisms allow mercury to travel long distances and contaminate global food supplies at levels that represent major risks to human health (Figure 1).

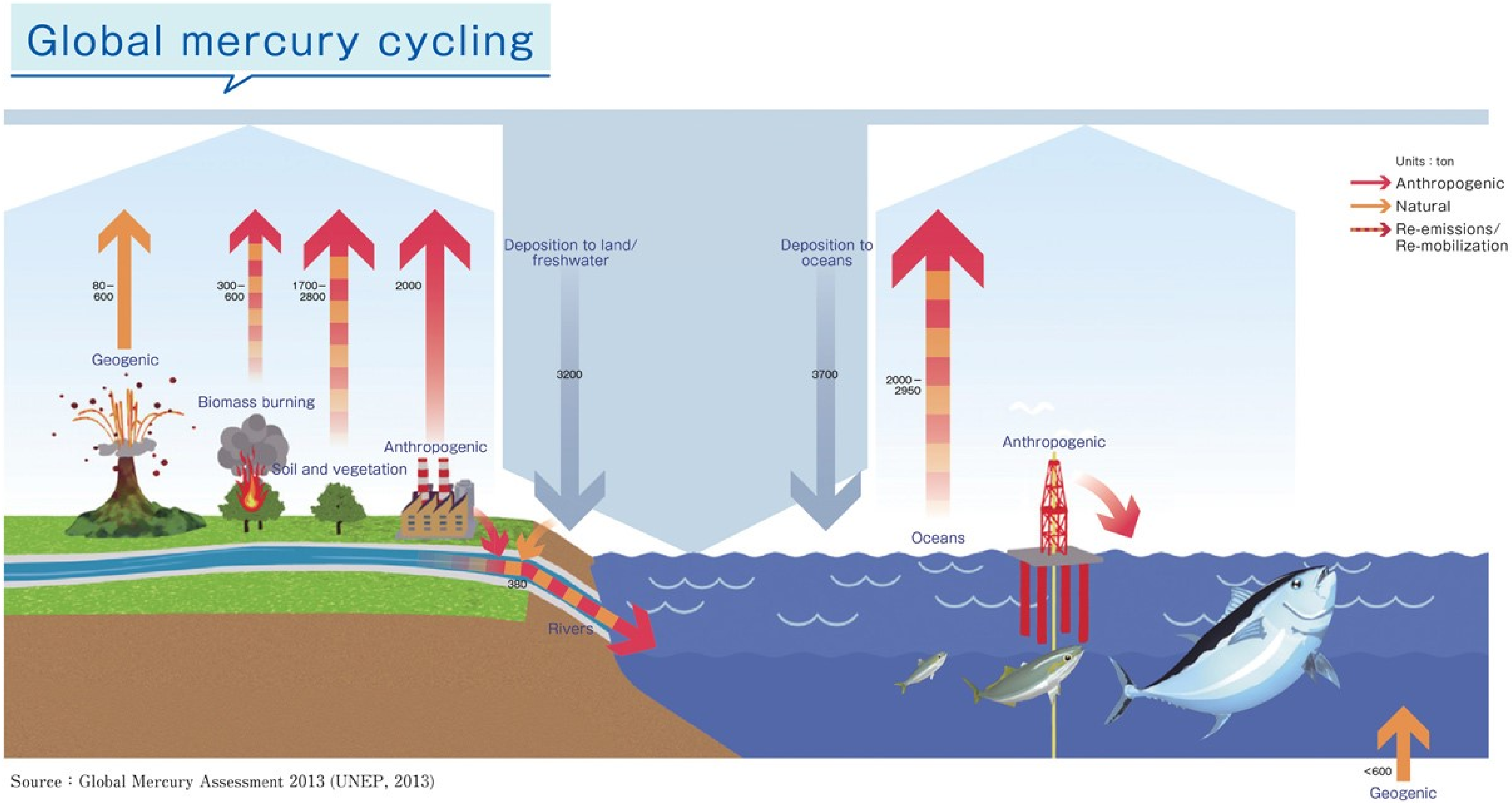


Figure 1. Global Mercury Cycling. Mercury from several industrial activities may be emitted to the atmosphere, and eventually cycle through different environmental compartments. Ultimately, it may bioaccumulate and bio-magnify through the food chain, affecting important food sources for humans

Due to its toxicity, persistence, long range mobility and tendency to bioaccumulate in the food chain, recent attention has been focused on mercury as a global pollutant. In response to growing international concerns about the long term ecological and health effects of mercury in the global environment, UN Environment Programme formalized the

Global Mercury Partnership in 2008, focusing in several sectors, including chlor alkali, to safeguard human health and the global environment from the release of mercury and its compounds.

In 2008, the United Nations Environment Programme developed a report entitled, "Global Atmospheric Mercury Assessment: Sources, Emissions and Transport", which consolidated existing information regarding the worldwide emissions, releases and transport of mercury in atmospheric and aquatic environments. An updated report released in 2013 included an inventory of new sources that were quantified for the first time, and provided fresh insights into atmospheric mercury fate and transport. Both reports were instrumental in global decision-making, and served as impetus for the development of an international treaty- The Minamata Convention on Mercury.

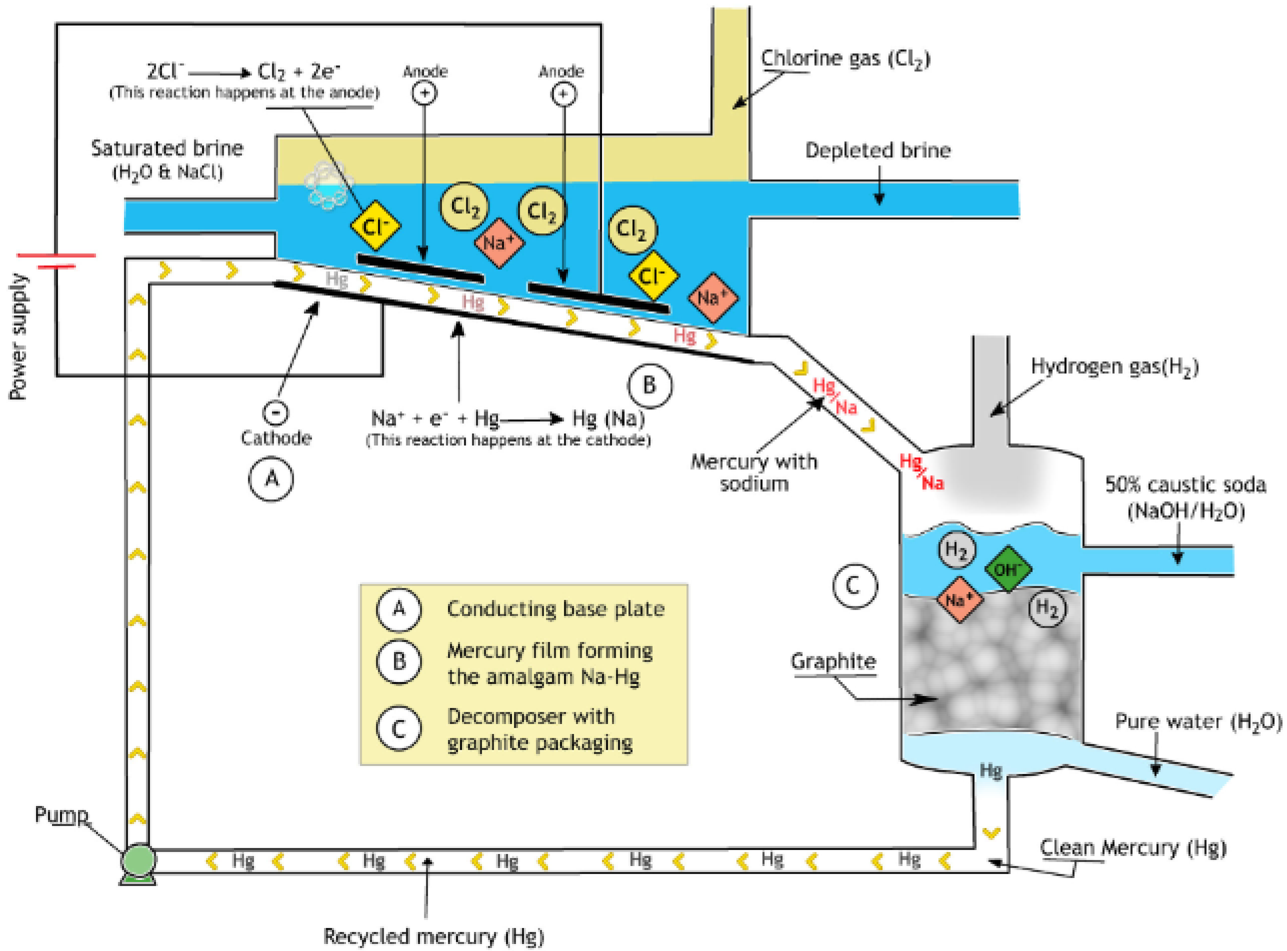
The Minamata Convention on Mercury entered into force as of 16 August 2017. This Convention requires a reduction in the use, emission, and release of mercury to the environment, as well as supporting research and development of mercury-free processes. In particular, parties to the Convention shall not allow, by taking appropriate measures, the use of mercury or mercury compounds in chlor-alkali production after 2025 (Article 5 Annex B) and mercury from primary mining and decommissioned chlor-alkali facilities cannot be used in artisanal gold mining.

1.2 Chlor-alkali sector overview

Process Overview

Based on the 2018 Global Mercury Assessment, chlor alkali sector emits approximately 12-18 tons of mercury per year (without taking into account that mercury in waste can be treated/recovered/stored/disposed properly and not resulting in emissions). Although not one of highest emitting industrial sources, it is still considered as one of the major users of mercury. The sector does have other significant impacts related to: a) destination and usage of excess mercury from the plants, b) health of workers, communities and environmental around the plants, and c) extent of environmental management after closure/decomissioning and the importance of land value after rehabilitation. In sum, mercury-cell facilities which close or convert to non-mercury technologies require careful site management as well as management of any excess mercury and mercury wastes.

The mercury-cell process is one of the three manufacturing processes used by the chlor-alkali sector to produce chlorine and caustic soda. Chlorine and caustic soda (sodium hydroxide) are two of the most important commodity inorganic chemicals, and together are referred to as chlor-alkali. In the mercury cell chlor-alkali process, chlorine is produced by two reactions. During the first reaction, electrolisis occurs between a saturated brine and a mercury bath acting as cathode to produce an amalgam of sodium and mercury, and chlorine. In the second reaction, the amalgam reacts in a decomposer with water to produce hydrogen and caustic soda (Figure 2). The mercury is then returned to the first step of the process and reused. Byproducts of the reaction are caustic soda and hydrogen.



Source Euro Chlor

Figure 2. Reactions occurring in the mercury cell unit for the production of chlorine

In addition to mercury cell technology, where mercury acts as a cathode and transports the sodium to a separate reactor for caustic and hydrogen production, two other technologies are available: diaphragm and membrane technologies.

Diaphragm technology - this type of technology uses a porous fibre separator system and produces a diluted, less pure caustic soda (containing a high concentration of sodium chloride), which has limitations for certain applications. The diaphragm is usually made of asbestos but more recently non-asbestos diaphragms (using fluorocarbon polymeric fibres) have been introduced. The new materials extend the lifetime of cells.

Membrane technology - this is the result of the technological advances in the polymer industry. While the ion-exchange membrane itself is very expensive and requires very high purity brine, the technology yields a high quality product. It needs less electricity than mercury cell technology, but the caustic produced usually needs to be concentrated to the 50% commercial grade by evaporation. For some applications, the chlorine gas produced needs to be processed for oxygen removal. Membrane cells occur in different structural configurations- monopolar (where anodes and cathodes are electrically connected in parallel) or bipolar (where anodes and cathodes are connected in series). Bipolar cells represent a more advanced technology with lower electricity consumption. In membrane technology, innovation is focusing mainly on electricity consumption reduction via improvements in membranes and cells design.

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Global Phase Out of the Mercury Cell Technology

Mercury cell technology is one of the oldest methods of chlor-alkali production and first one to be used at industrial scale. At the beginning of 1970s, the use of mercury cell technology started raising concerns regarding the protection of the health of workers and the environment. This translated into conversion to other technologies in different parts of the world (Figure 3).

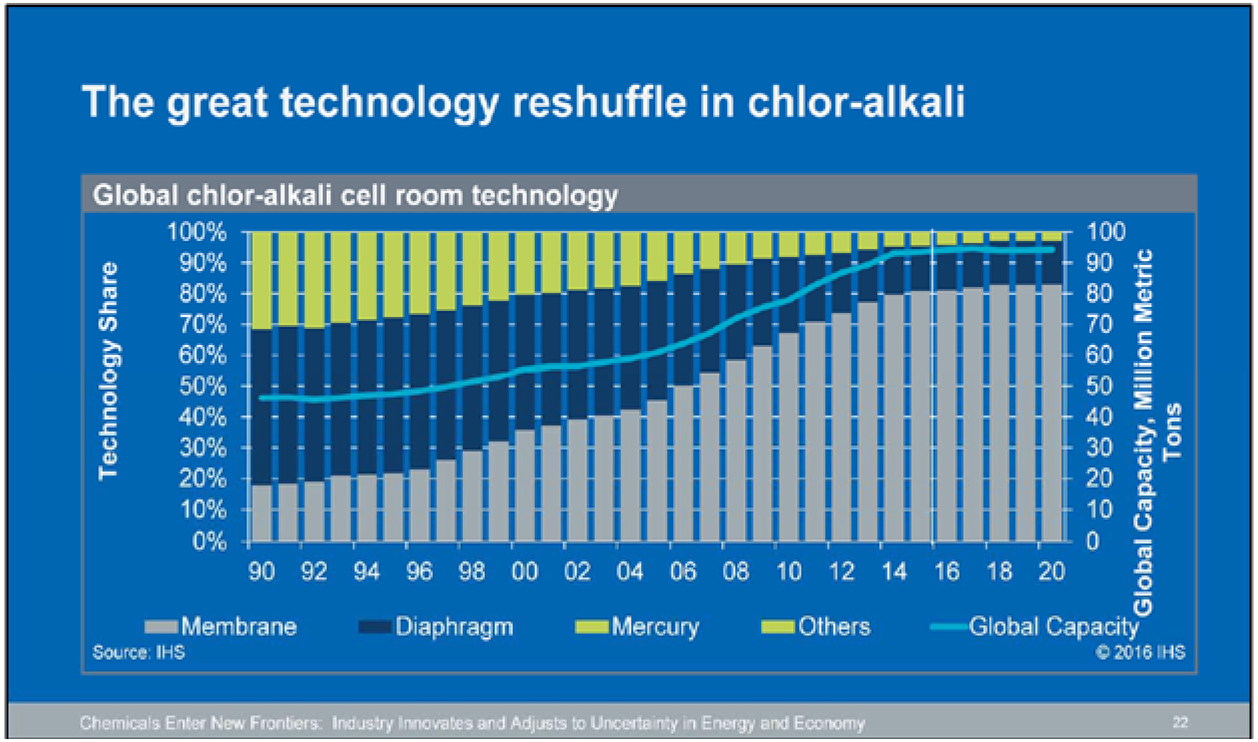

Figure 3. Global chlor-alkali global capacity. IHS Markit.

Since most of the chlor-alkali plants currently operating with mercury technology have been built before the 1970's, many companies have made efforts and investments to continuously modernize these units in order to have efficient production and ensure environmental and health protection. Innovation in mercury technology processes has focused particularly on reduction of electricity consumption, improvements around cell maintenance efficiency and the reduction of fugitive mercury emissions. Still, it is generally agreed that the mercury-cell process is no longer an economically or environmentally preferred technology for new chlor-alkali facilities or capacity additions. Furthermore, the industry recognizes that the membrane technology and non asbestos diaphragm technology are considered as best available technologies (BAT). There is a voluntary agreement in place, which has been officially recognized by the Global Mercury Partnership (GMP) to phase out the mercury cell technology by year 2025, aligned with the requirements of the Minamata Convention.

Voluntary commitments to ensure phase-out of mercury technology have already been put in place by industry in India (by the end 2012) and in the European Union, Switzerland and Norway (by the end of 2017).

In addition, the global chlor-alkali industry community have been continuously reducing use and emissions of mercury. The reduction in the number of chlor-alkali facilities in WCC member countries from 2015-2018 is illustrated in the next Tables.

Table 1. Chlor-alkali years production

Production year: 2015									
Country or Area	**Hg plants**	**Capacity**	**Purchases /Sales**	**Consumption /Use**	**Hg in products**	**Hg to water**	**Hg to air**	**Total emissions**	**Solid waste**
	N.	In 1000 t Cl_2/y	kg Hg /y (- if sold)	kg Hg /y	kg Hg /y	kg Hg /y	kg Hg /y	kg Hg /y	kg Hg /y
Europe	25	2,486	51,620	17,230	137	89.5	1,469	1,695	48,443
United States of America + Canada + Mexico	4	193	3,002	15,747	64	43	1,281	1389	3,663
India	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Brazil + Argentina (1 plant) + Uruguay (1 plant)	6	342	20,286	14,432	34	14	1,844	1,892	2,989
Russia	3	414	23,273	20,814	94	44	471	609	15,433
Total	**38**	**3,435**	**98,181**	**68,223**	**328**	**191**	**5,065**	**5,585**	**70,528**

Production year: 2018									
Country or Area	**Hg plants**	**Capacity**	**Purchases /Sales**	**Consumption /Use**	**Emission with products**	**Emission to water**	**Emission to air**	**Total emissions**	**Solid waste**

	Number	In 1000 t Cl_2/y	kg Hg /y (- if sold)	kg Hg /y	kg Hg /y	kg Hg /y	kg Hg /y	kg Hg /y	kg Hg /y
United States of America + Canada + Mexico + Brazil + Argentina (1 plant) + Uruguay (1 plant)	9	566	27,188	31,041	109	26	2,792	2927	12,067
Russia	3	426	35,754	7,737	78	42	293	413	2,728
Total	**12**	**992**	**62,942**	**38,778**	**187**	**68**	**3,085**	**3,340**	**14,795**

There has been a significant reduction of mercury plants in different areas and countries of the world. Thus, from 2015 to 2018, operations have been suspended in Europe, Asia and the total number of plants has decreased from 38 to 12. So currently there are only active plants in the regions of America and Russia. Moreover, during this period, total chlorine production capacity with mercury cell technology went from 3'435,000 to 992,000 tons. In the region of North America (United States of America + Canada + Mexico), the number of plants was reduced from 4 to 3, when the new IQUISA Noreste plant began operating in year 2016 with membrane technology in García Nuevo León, Mexico. Note that there are still areas in the world that do not belong to the World Chlorine Council membership community that operate mercury cell chlor alkali plants. Information from the HIS-Markit shows that 1.8 million tons of chlorine are produced globally in 2018 and of which 992,000 tons is taking place in the WCC membership countries.

Energy Consumption

Chlor-alkali production generally is an energy-intensive process, with electricity costs typically accounting for 40-50% of total operating production costs. Electricity consumption depends on different technology used in chlor-alkali production. Producing chlorine and caustic soda comes down to passing an electric current through brine (a solution of common salt / sodium chloride in water). The brine dissociates and recombines through exchange of electrons (delivered by the current) into gaseous chlorine, dissolved caustic soda and hydrogen. By the nature of the chemical reaction, chlorine, caustic soda and hydrogen are always manufactured in a fixed ratio 1:1.126 tons of caustic soda and 0.03 tons of hydrogen per tons of chlorine. This production combination is called an Electrochemical Unit (ECU). The average electricity consumption of a chlorine electrolysis mercury plant is about 3.3-3.5 MWh per ECU. About 90% of the electric current is used as raw material that cannot be substituted. Therefore reduction potential is limited. The remaining

10% of the electricity is used for lighting and operating pumps, compressors and other necessary equipment. Steam is also needed in the chlor-alkali production e.g. for salt preparation and concentration of the caustic soda. How much steam is necessary depends on the production process used in the plant.

The technology shift from mercury cells to membrane will lead to lower electricity consumption in the sector. A membrane plant uses less electricity than a mercury plant, but requires more steam in order to obtain the standard commercial concentration of caustic soda. The differences in energy consumption between the three processes are listed below:

Table 2. Energy consumption in the three chlor-alkali processes (Source: EU chlor-alkali BREF 2014)

Process equipment			Electrolysis cells ([1])	Other electrical equipment ([1]) ([2])	Caustic soda concentration ([1]) ([3])	Total
Mercury cell technique	Electricity	AC kWh/t Cl_2 produced	3 400	200	NA	3 600
	Steam	t/t NaOH (50 wt-%) produced	NA	NA	0	0
	Primary energy ([4])	GJ/t Cl_2 produced	30.6	1.8	0	**32.4**
Diaphragm cell technique	Electricity	AC kWh/t Cl_2 produced	2 800	200	NA	3 000
	Steam	t/t NaOH (50 wt-%) produced	NA	NA	2.6	2.6
	Primary energy ([4])	GJ/t Cl_2 produced	25.2	1.8	8.1	**35.1**
Membrane cell technique	Electricity	AC kWh/t Cl_2 produced	2 600	200	NA	2 800
	Steam	t/t NaOH (50 wt-%) produced	NA	NA	0.70	0.70
	Primary energy ([4])	GJ/t Cl_2 produced	23.4	1.8	2.2	**27.4**

([1]) Median values of chlor-alkali plants in the EU-27 and EFTA countries. The values may vary considerably from one plant to another, depending on the current density and other plant-specific factors.
([2]) Energy consumption for chlorine liquefaction/vaporisation is not included.
([3]) Caustic concentration may not be necessary.
([4]) Assuming an exergy of 2.5 GJ/t steam (at 10 bar and with condensate return at 90 °C), a power generation efficiency of 40 %, a steam generation efficiency of 90 % and a production ratio of 1.128 t NaOH/t Cl_2.
NB: NA = not applicable.

Factors Influencing Conversion Decision

Many factors associated with economic conditions, regulations, customer product requirements and local aspects of specific plant operations should be considered when deciding whether to convert an existing mercury cell plant to another technology or to cease operation of the facility. While the primary replacement technology (membrane technology) has lower energy and operating cash costs, the conversion itself requires significant capital investment. Therefore, both the payback period and financial underpinning of the investment (ROI) are major elements in the decision to convert.

It is important to note, that every facility considering a conversion will have a different set of economic, financial, technical and regulatory conditions. Elements influencing the decision include the scope of the project, the market situation (Offer-Demand of Chlorine & Caustic and vigent market prices), the cost of electricity, the possibility of extending or reducing production capacity, financing mechanisms, technical specifications and regulatory constraints.

The investment costs of conversion from mercury to membrane technology vary considerably due to many influencing factors that are described below:

• Energy prices and efficiency. As chlor-alkali production relies on energy intensive electrochemical technology, the price of electricity, representing roughly 40% of the operating cash costs, has a strong influence in the decision making process. Membrane technology requires less electrical energy and will lower operating cash costs by an average of about 30% lees than Mercury Technology.
• Production capacity. If the market demand for the products is increasing, the need for increased production of either chlorine or alkalis could support additional capacity investment, which may favour conversion at the same time.
• Access to finance. Appropriate access to finances and availability of fiscal measures and investment grants could favour conversion. Conversions are typically financed by banks loans or other financial instruments, but may also be paid for by reinvestment of profits.
• Technical constraints. Technical specificities, such as the link between two different technologies in the same production unit, can add severe complications in changing the current installation structure (e.g. shifting from a combined diaphragm and mercury plant to a diaphragm and membrane plant).
• Scale of the conversion/ condition of equipment. A key factor to consider is the possible re-use of a significant part of the mercury plant. Depending on the age of the plant, it may or may not be technically feasible and convenient to continue using some existing parts of the facility. Even if it is technically feasible, the re-use of parts of the former installation may not be an option from an overall business perspective.
• Feedstock and product quality. As stated before, a membrane plant requires higher brine purity than a mercury plant because brine impurities affects seriously membrane performance and electricity consumption. Furthermore the chlorine gas from a membrane plant is of higher quality than that from a mercury plant, because chlorine from membrane plants usually has lower oxygen content. Higher brine purity triggers a need for additional treatment units for a new membrane plant. An alkali concentration unit is often needed to concentrate the caustic soda or potassium hydroxide from the membrane cells to commercial grade products (usually 50%).

• Market conditions. Various market-related factors highly influence the potential for conversion: the economic situation in the countries such as a mature or growing market; chlorine market price is not a significant income in the profitability of a chlorine-soda business because is linked like a commodity by contracts to big producers of PVC/Titanium Dioxide and other Chlorine derivate compounds . The price of caustic soda is the main income and driver of the profitability of caustic soda and as all commodities are governed by the supply-demand and cycles of the economy and the chlorine-soda and associated industry, many times their price fluctuate in a wide price band affecting profitabilty of this bussines and financial indicators that justify new plant investment.

In order to convert an existing chlor-alkali plant from mercury cell to membrane, at a minimum, the following modifications have to be made:

- Replace the mercury cells with membrane electrolysis cells and adapt the building
- Replace or adapt electricity transformers/rectifiers
- Add secondary brine purification and filtration units since membrane technology requires higher purity brine.
- Add a caustic soda concentration unit since the caustic concentration from membrane cells needs to be increased to the commercial standard of 50% in most of the cases.

Experience shows that the time to convert a plant is 1.5-2.5 years depending on the administrative procedures and the scope of the conversion. Once the permit has been granted, the delivery time for the cells, caustic concentration unit, transformers and rectifiers is usually the most critical activity.

1.3 Root Causes and Barriers to be Addressed

The root causes and barriers to be addressed regarding mercury usage and emissions in the chlor-alkali sector are presented in the Problem Tree below and can be summarised as the following:

AWARENESS barrier: lack of awareness of the health and environmental dangers of mercury and its alternatives. The lack of awareness of the health and environmental impacts are apparent with both industry and government officials. For Mexico, provincial officials are unaware of the dangers posed by mercury and the lack of alternatives, compounding the problem. In addition, public awareness of the health risks related to mercury is still relative low, therefore, most people are not concious and trained on the safe handling, storage, treatment and disposal of this toxic chemical.

FINANCIAL barrier: scarcity of sufficient capital for conversion and after conversion environmental management (this applies to many remaining active mercury cell chlor alkali plants but Mexico has already secured financing for the conversion of its last plant). Most chlor-alkali companies use mercury because it is an old low-Capital cost technology. Changing to improved mercury-free technologies requires high capital for the new technology,equipment, setup, management systems, and how-how to operate and obtain a larger and more efficient products. The negative perception towards contamination and environmental problems also make investors and financiers suspicious of involvement in the

sector, keeping it divested of the necessary capital, despite the high opportunities for incomes. In addition, companies also need to allocate important bresources for after conversion environmental clean-up and management. Depending on the extent of the contamination, this could represent significant resources and high cost and expertises affecting seriously the investment profitability and promoting not to change technology leaving as result a contaminated site as well as an enviromental and health problem.

TECHNICAL barrier: lack of technical capacity to identify, collect, monitor and manage mercury contamination and mercury waste after the conversion. Site remediation is extremely expensive, challenging and time consuming. Currently, there are no existing stabilization and final disposal options in the Latin America region. A detailed remediation plan and appropriate experts need to be developed and recruited, respectively, to facilitate and adequately manage the post-decommission environmental process.

POLICY and CAPACITY barrier: lack of legal framework and government capacity to properly and safely store, stabilize, treat, and dispose mercury and mercury wastes. In addition, lack of government capacity to manage and monitor contaminated sites and lead the rehabilitation work to maintain or raise the value of land.

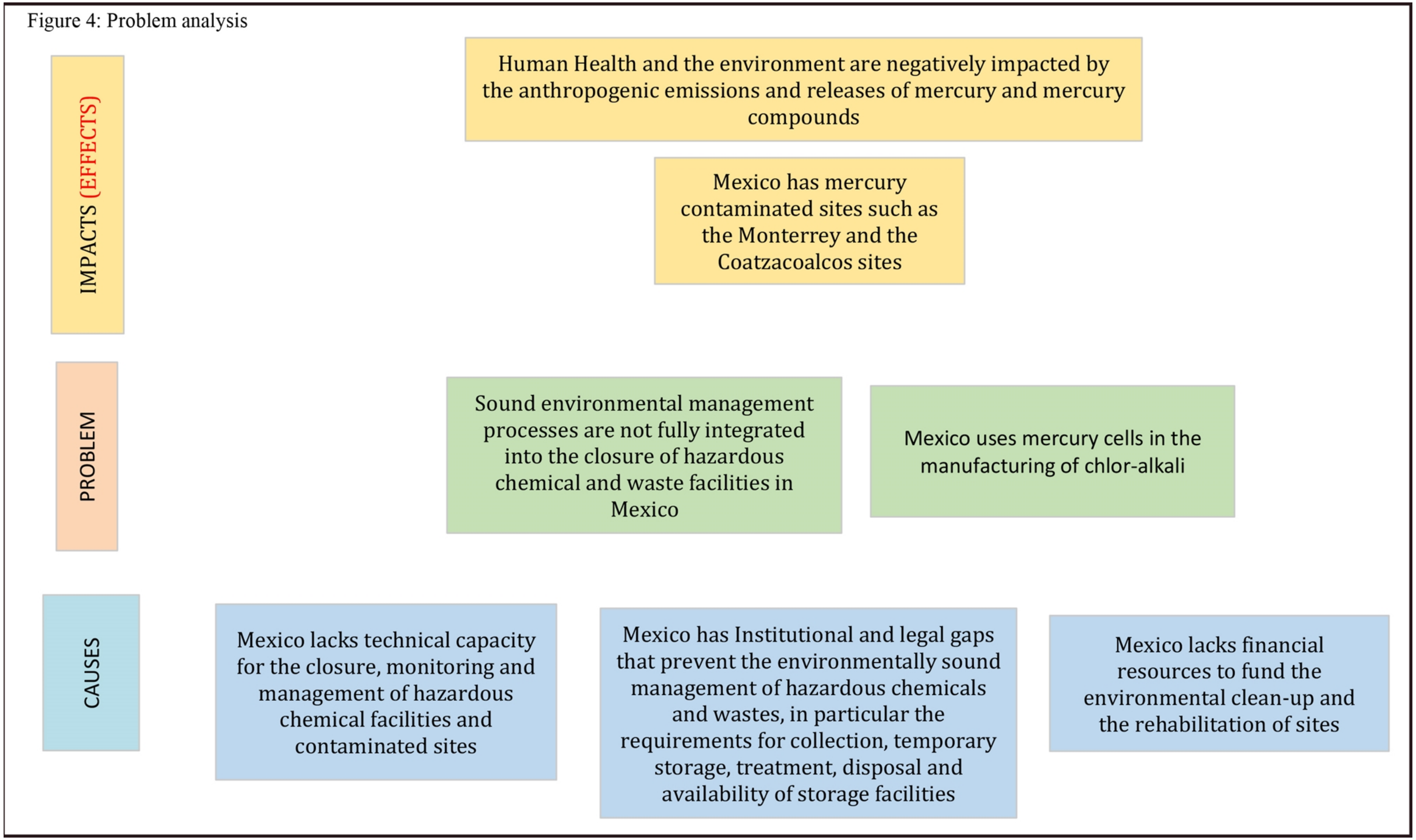

Figure 4: Problem analysis

2. The baseline scenario or any associated baseline projects

In the early 1950s, CYDSA Group (owner of three chlor-alkali plants in Mexico) was providing caustic soda from a chlorine-soda plant in the City of Monterrey Nuevo León, using mercury cell technology that was the available and most advanced technology at that time. The first plant in Monterrey has, since 2016, converted to the environmentally friendly membrane technology for its chlorine production (and it is now in operation as the Noreste plant), and the former mercury cell unit located in the center of Monterrey was left unremediated as illustrated on **Figure 5**.

Figure 5. (Top) Former membrane cell, (Mid) former chlor-alkali unit with mercury cells and (Bottom) abandoned tanks and pipes of the the former chlor-alkali unit

The second mercury cell technology plant is located inside of a petrochemical complex (Pajaritos) in the municipality of Coatzacoalcos, in the southeast state of Veracruz (Olmec region), comprised of 25 municipalities and dominated by the cities of Coatzacoalcos and Minatitlan. The area has a population of nearly two million and comprises approximately 41% of the economic activity in the state. This facility began chlorine production in 1967 using mercury cell technology as well and conversaion is planned for 2020-2022 with secured financing.

Monterrey plant is operated by IQUISA NORESTE S.A. de C.V. (IQNE), and Coatzacoalcos plant is operated by Industria Química del Istmo, S.A. de C.V. (IQUISA), acquired by CYDSA in 1967.

In 2010, IQUISA acquired from MEXICHEM its third chlorine plant located at Santa Clara near Mexico City, initially this plant was using mercury cells. In 2006, this site was converted to membrane technology and started production in 2007. After being purchased by IQUISA, surface and underground cell room area were remediated because all mercury cells and building were removed already by the old owner. This remediation project was successfully completed in two years (2012-2014) complying with all code and standards required by Mexican Government with a cost of 123 million pesos (approximately US $6.6million). The learned lessons, experience and knowledge acquired through the cleanup of the Santa Clara plant can serve as a model for remediation planned at Monterey and Coatzacoalcos mercury contaminated sites.

According to the Minamata Initial Assessment in Mexico, chlorine-alkali plant in Coatzacoalcos is estimated to contribute 7.8 tons of mercury, The excess mercury of Monterrey was sold and other proportion was transfered to Coatzacoalcos plant and contaminated materials and equipment from the Monterrey plant have not been fully assessed.

Table 3. Basic information on the Monterrey, Noreste, and Coatzacoalcos plants

	Monterrey (mercury cell)	**IQ Noreste (membrane)**	**Complejo industrial Pajaritos (mercury cell)**
Location	Monterrey Nuevo Leon	Garcia Nuevo Leon	Veracruz
Date built	1958	March 2016	August 1967
Status	Not in operation	Operation	Conversion planned in 2020-2022
Annual chlorine production	20,772 TPA	61,013 TPA	90,000 TPA
# Workers			

Total workers	72	72	58
Men Workers	65	68	49
Women workers	7	4	9
Union members (all male)	108	96	175

* Data for the Monterrey plant is based from 2015, prior to the conversion

Mexico's current regulation on mercury management

Mexican legislation follows an established hierarchy and respects different attributions in function of government level, as federal laws, statal laws and municipal laws.

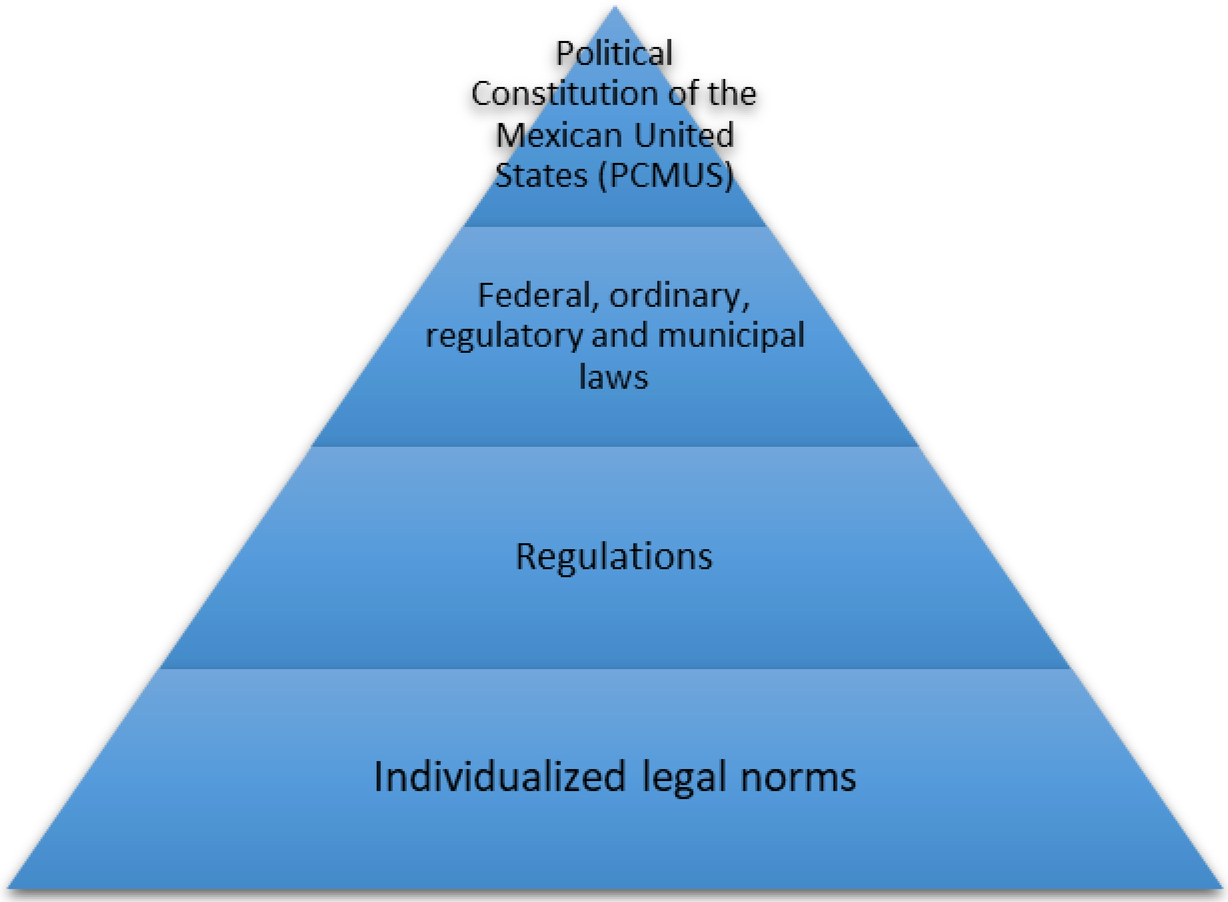

Figure 6. Mexican legislation hierarchy table

Mexico ratified the Minamta Convention on mercury on September 29, 2015. After entry into force in August 2017, it was published in the Official Gazette of the Federation on 31 October the same year. The current laws and guidelines related to the management of nature resources, including mercury, in Mexico are described below:

<u>Political Constitution of the United Mexican States</u>

Being the Political Constitution the document of greatest hierarchy in the United Mexican States, in its content it establishes that “Corresponds to the Nation the direct domain of all the natural resources, substances and minerals”, among which is the explotation of mercury. Within the legislation it is relevant to point out that the Federal Government has the power to establish national reserves and suppress them.

Federal Laws

Federal Public Administration Organic Law

The next level of hierarchy includes the Organic Law of Federal Public Administration. Among its provisions it writes the activities designated to each Secretariat in the Federal Government, among which the Ministry of Environment and Natural Resources (SEMARNAT) stands out (responsible for the protection, formulation of environmental policy, regulation thereof, monitoring and promoting the compliance with national laws, promote the environmental information system, etc.)

Federal Labor Law

This law is of general observance throughout the Republic and governs the labor regulations included in article 123 of the Constitution. It mentions the rights and obligations of employers and workers to be able to comply with the amendment on having a healthy and safety decent job.

General Laws

General Law of Ecological Balance and Protection of the Environment.

It is the law that governs the Environmental Legislation in the country. It establishes the responsibilities and faculties of the federation, states and municipalities so that in collaboration they work for a healthy environment, environmental impact assessment without conflicts of authority between them. It mentions some of the main initiatives in view of compliance with the Minamata Convention.

General Law of Ecological Equilibrium and the Protection of the Environment in Matters of Ecological Planning Regulation

This law determines the basis for executing ecological management programs.

General Law of Ecological Balance and the Protection of the Environment in the Matter of Prevention and Control of Pollution of the Atmosphere Regulation

This law considers air pollution that can be increased by emissions from the plants where they use mercury in the process.

General Law for the Prevention and Integral Waste Management

Its obligations are of public order and social interest and are intended to guarantee the right of every person for an appropriate environment and promote sustainable development through the prevention of the generation, recovery and integral management of hazardous waste, preventing pollution of sites with this waste and carry out its remediation as dictated by law.

General Law for the Prevention and Integral Management of Waste Regulation

This law defines wastes in the industrial process, the wastes generated in the operations of chlor-alkali industry. It also establishes the appropriate final waste disposal from the industrial process.

Federal Regulation of Safety, Hygiene and Work Environment

This regulation is of general observance throughout the national territory, its dispositions are of public order and social interest, and aims to establish the necessary measures to prevent accidents and occupational diseases, aimed at ensuring that the provision of work is develop in conditions of safety, hygiene and environment suitable for workers.

Official Mexican Guidelines

There are Mexican Official Guidelines (NOM) or voluntary Mexican Guidelines (NMX) related to management of hazardous wastes:

NOM-052-SEMARNAT-2005 establishes the characteristics, the process of identification, classification and listings of hazardous wastes. It establishes the maximum permissible limits of mercury with a value of 0.2 mg /l and is registered as a chronic toxic waste.

NOM-147-SEMARNAT / SSA1-2004 establishes criteria to determine the remediation concentrations of contaminated metal soils to be monitored among which mercury is found, and it is important since it allows establishing a limit concentration value which in case of overcoming it could have adverse effects on the environment and human health.

By type of land use it establishes mercury values at 23 mg/kg for agricultural/residential/commercial land, and at 310 mg/kg for industrial land. In addition to establishing the reference value of soluble mercury (.020 mg/l), which represents the maximum value above which there is a risk to the environment.

In summary, there are existing laws, regulations and guidelines in place in Mexico to manage hazardous chemicals, including mercury, however, many of them require thorough review for their applicability in the chlor alkali sector, specifically regarding the environmental management of mercury and mercury wastes after decommission. While there are some standards in place for mercury, there are no stabilization, storage and final disposal options in Mexico.

Other Initiatives

There has been no international assistance towards the chlor alkali sector in Mexico. However, represenatives from CYDSA participated in the Expert Group Meeting (EGM) on the elimination of the use of mercury in chlor alkali chemical processes, held from 28-29 June 2016 in Vienna. CYDSA indicated that there are significant challenges with environmental cleanup after the conversion and financing is also a major obstacle. The EGM was organized by UNIDO and USEPA, as co-leaders of the chlor alkali sector under UNEP Global Mercury Partnership. The objective of the meeting was to analzye the sector in terms of location of the remaining chlor alkali facilities, historical context regarding the development and adoption of technologies across the sector and sharing conversion experiences. It also underlined the importance of assisting developing countries such as Mexico with technical and financial support to address conversion of existing facilities in a sound environmental manner.

CYDSA is also a member/producing associate under the Latin American Chlorine Industry Association, Alkali and Derivatives (Clorosur). Clorosur is the major chlor alkali producers in Latin America and the Carribean. Together, there are ten companies across seven countries in the region. Founded in June 1998, Clorosur is committed to science, the preservation of the environment and the safety of the communities in which its members operate. In line with this objective, it has become an important center for the dissemination of best international practices and technologies for the storage, handling, use and distribution of chlorine and derivatives. There was special meeting organized by Clorsur on the Minatama Convention in September 2019 in San Paulo, Brazil, attended by 40 representatives, including CYDSA, of all producer members of the region to discuss phase out plans and technology transfer and financing alternatives. Other discussions included the best place to store metallic mercury before stabilisation and final safe disposal, residues, and waste management. Companies who provide services to stabilise mercury were present from Germany and Switzerland.

CYDSA also a member of the WCC (World Chlorine Council), association for the majority of chlorine producers around the world. In 2006, the Cotzacoalcos site organized a seminar to promote the best practices and available technology in handling mercury cell chlorine production. As a requirement to the membership, each year IQUISA reports to WCC all the statatics related to mercury operations including consumption, emissions and wastes generated.

CYDSA is also a member of Chlorine Institute, a private association for major chlor alkali producers in North America region (USA, Canada And México). CYDSA participates and reports mercury statistics and follow their recommendations on mercury use, handling and storage.

3. The proposed alternative scenario, GEF focal area strategies, with a brief description of expected outcomes and components of the project.

The Mexican government recently completed the execution of the MIA, which helped provide a more accurate inventory on mercury sources and emissions, and potential contaminated sites across the country. However and despite the soundness of the previous investigations, some uncertainties remain on the extent of the mercury contaminated sites in the chlor-alkali plants of Monterrey and Coatzacoalcos. Additional investigations to complement the previous ones and fully characterize the extent of mercury pollution onsite are needed. Therefore, as part of the proposed project, technical support to facilitate the complementary investigation process and identifying the best option for sound monitoring and management of mercury containing wastes and contaminated sites will be provided. In sum, the project will act as a facilitator to build national capacity and organize the transfer of knowledge on mercury monitoring and management to Mexico. The experience can also improve Mexico's capacity in managing their other hazardous chemical facilities and promote further global phase out of the mercury cell chlor alkali production process.

Specifically, the project will strengthen national and local capacity to effectively manage and monitor mercury and contaminated sites (as presented in Annex A – Theory of Change) by:

Component 1: Improve national capacity in the management of hazardous chemical facilities and mercury contaminated sites

Since the project will facilitate the closure of the last mercury cell chlor alkali plant in Mexico, the specific actions and activities under component 1 will serve as an example to improve national capacity in the closure, monitoring and management of hazardous chemical facilities, including extensive consideration towards sound treatment and disposal of contaminated materials. During the PPG phase, consultation with the GMP on the design and development of good practice guide and remediation plans at the two plants will be conducted.

Outcome 1.1: Mexico's relevant agencies have adopted a good practice guide and put in place plans for decontamination, monitoring and remediation of the contaminated sites of Monterey and Coatzacoalcos

Output 1.1.1: Good practice guide for the monitoring and management of hazardous chemical facilities and contaminated sites is completed and distributed to national stakeholders

· Activity 1.1.1.1: Develop a good practice guide for the closure and management of hazardous chemical facilities in Mexico with a specific chapter on mercury cell chlor alkali sector

· Activity 1.1.1.2: Assess laws, policies and administrative instrument related to the management of chemical and waste facilities, including requirements for collection, temporary storage, treatment, disposal, and availability of storage facilities in Mexico

Output 1.1.2: Characterization and decontamination plan and strategy to manage decontamination for the Monterrey and Coatzacoalcos sites are developed by experts and shared with national stakeholders

· Activity 1.1.2.1: Initiate environmental sound management by developing characterization and decontamination plans for both sites (Monterrey and Coatzacoalcos)

Output 1.1.3: Monitoring and remediation programme of Monterrey and Coatzacoalcos sites are developed and accepted by corresponding authorities

· Activity 1.1.3.1: Environmental monitoring takes place for both sites (Monterrey and Coatzacoalcos)

Component 2: Introduce BAT during and after decommissioning/conversion and seek investment for environmental management

Using the remediation plans developed in component 1, component 2 will focus on the actual decommissioning and conversion of the mercury cell plants and in the collection of all excess mercury and mercury contaminated materials for further processing/treatment/disposal in component 3. For the decommission and conversion, IQUISA has already secured co-financing funds, approximately 120,000,000 USD (with six financial institutions: Citibanamex, Santander, Banorte, BBVA Bancomer, Sabadell and Scotiabank Inverlat) in a new membrane technology facility at Coatzacoalcos site between 2020-2022. However, for the sound environmental management that is needed after the conversion at both sites, additional resources will be sought during the PPG phase from the investment sector in Mexico. Preserving the quality of land will be very important to investors when the area is ready for resale or rebuilding after the conversion, therefore, environmental cleanup and rehabilitation will be an important step in preserving future value of the land.

At Coatzacoalcos, the converted plant with an initial annual production capacity will be 100,000 metric tons of chlorine together with its associated production of 112,600 metric tons of caustic soda. Annual production is intended to be increased in the future to 150,000 metric tons of chlorine together with its associated production of 168,900 metric tons of caustic soda after conversion. From this experience, the future closure and management of hazardous chemical and waste facilities in Mexico will also be more efficient and effective.

Outcome 2.1: Mercury cell chlor alkali facilities are converted and decommissioned in Mexico and financing mechanisms for clean-up and rehabilitation of the sites adopted

Output 2.1.1: Detailed engineering of BAT for new plant in Coatzacoalcos developed and made available to national stakeholders

· Activity 2.1.1.1: BAT assessed and selected for Coatzacoalcos site

Output 2.1.2: Technical support provided to CYDSA to decommission and collect excess mercury and mercury contaminated materials from Coatzacoalcos and Monterrey sites

· Activity 2.1.2.1: Recover/collect/safely store mercury and mercury contaminated wastes

Output 2.1.3: Technical support provided to CYDSA to convert to new plant in Coatzacoalcos (exclusively co-financed)

· Activity 2.1.3.1: Decommission and convert (supported by co-financing from IQUISA) takes place in Coatzacoalcos

Output 2.1.4: Financing packages prepared and shared with investors in environmental cleanup and rehabilitation of sites

· Activity 2.1.4.1: Prepare and share financing packages with investors in the management of mercury containing wastes and other environmental activities after decommission/conversion

Component 3: Stabilization, treatment and disposal of excess mercury and contaminated materials from the two decommissioned and converted plants

(**NOTE:** actual remediation costs will be supported by co-financing from Mexico, GEF resources will support in the identification of appropriate procedures and technologies that can assist the remediation process)

Component 3 will focus on excess mercury stabilization resulting from the conversion and safe handling/treatment/disposal of the mercury contaminated materials and equipment from the two plants. The full feasibility of the technical measures will be applied on a site-specific basis. Currently there are no stabilization facilities in the region. Stabilization, transport, treatment, storage and final disposal options will be evaluated further during the PPG phase. Feasibility tests and analysis will be conducted and coordinated with GMP during project implementation. It is expected that 100 tons of mercury will be collected from Coatzacoalcos plant, the project will support their stabilization and it is expected that over the course of the project, 50 tons of mercury will be reused in several South American chlorine producers that still continue operating during these years, totaling to 150 tons of anticipated mercury reduction through the project. This calculation will be confirmed during the PPG phase when more comprehensive estimation is made on the amount of the mercury that can be recovered from both sites.

Outcome 3.1: 100 metric tons of mercury safely stored and disposed

Output 3.1.1: Technical support provided to CYDSA to stabilize excess mercury

- Activity 3.1.1.1: Conduct feasibility studies of stabilization, storage, treatment and final disposal (based on remediation plans from component 1)
- Activity 3.1.1.2: Stabilize 100 tons of mercury

Output 3.1.2: Technical support provided to CYDSA to safely store, treat and/or dispose excess mercury and contaminated materials/equipment

- Activity 3.1.2.1: Initiate the implementation of selected options (with financial support received from component 2)

Component 4:Knowledge management and communication

Component 4 ensures the dissemination of information from Mexico through the Global Mercury Partnership to other countries with active mercury cell chlor alkali plants, to allow south-south cooperation and peer-to.peer learning. The communication and knowledge management report and main outputs of this component will be disseminated through the UN Environment GMP website, regional offices and at international mercury and chemicals related fora. This component will also include the organization of a regional (Americas) and a global dissemination forum with relevant stakeholder on experience sharing aiming to decommission and convert all remaining mercury cell chlor alkali plants around the world. Finally, this component will work with the GMP to update the chlor alkali mercury cell conversion guidelines including the experience of this project.

Outcome 4.1 Countries and global operators apply the new knowledge to phase out remaining mercury chlor alkali facilities

Output 4.1.1 National stakeholders increased awareness and knowledge through project information dissemination

- Activity 4.1.1.1: Organization of various awareness raising and dissemination workshops with relevant stakeholders in the chemicals management industry in Mexico

Output 4.1.2: Mercury cell chlor alkali countries and global operators increased their knowledge and learned lessons from the project in Mexico

- Activity 4.1.2.1:Use the network of GMP and other conferences/meetings to disseminate information from the project
- Activity 4.1.2.2: Organization of a regional and a global forum to disseminate information on the project

Output 4.1.3: Chlor alkali mercury cell conversion guidelines updated and shared with industry partners and stakeholders

· Activity 4.1.3.1: Provide training for relevant national stakeholders in the safe handling, storage, treatment and disposal of mercury and mercury containing wastes and site remediation options (based on remediation plans from component 1)

· Activity 4.1.3.2: Use and update the existing chlor alkali mercury cell conversion guidelines (from the GMP) to include experiences in Mexico.

4. Alignment with GEF focal area and/or Impact Program strategies

The proposed project is fully aligned with the GEF7 Focal Area "Chemicals and Waste" and Programming Direction "CW-1-1 Strengthen the sound management of industrial chemicals and their waste through better control, and reduction and/or elimination", as it aims to completely eliminate mercury in the chlor-alkali sector and promote sound environmental management prior, during and after the conversion. Furthermore, the project supports the broader sound management of chemicals and waste with the Strategic Approach to International Chemicals Management (SAICM), the United Nations policy framework to promote chemical safety around the world. Finally, the project supports the work undertaken by the UNEP Global Mercury Partnership in the chlor alkali sector. The Partnership was establishe prior to entry into force of the Minamata Convention to promote early mercury reduction in all major emitting sectors. Existing publications and expertise from the Partnership will assist in different components of the project and the results of the project will improve the guidelines and create greater awareness in phasing out the remaining chlor alkali mercury cell plants around the world.

5. Incremental/additional cost reasoning and expected contributions from the baseline, the GEFTF, LDCF, SCCF, CBIT and co-financing

By integrating the activities of this project with the existing network of the UN Environment Global Mercury Partnership, leverage of financial and knowledge resources will be maximized. In the knowledge management component, this project will build on current efforts to collect, share, and create knowledge resources, such as case studies, guidance documents, and training materials. Building on this existing network is ideal to notably increase the co-financing possibility.

Although the main project stakeholders are aware of the negative impact of mercury’s use, emissions and releases to the environment, the country lacks technical capacity and knowledge as well as institutional and policy framework to prevent and remediate mercury pollution. The lack of information on the presence, sources, and quantity of mercury used and emitted by the chlor-alkali sector in Mexico makes prioritization of this sector for intervention difficult and evaluation nearly impossible. With the GEF’s support, potential hazardous sources can be identified systematically to prioritize areas for intervention while institutional capacity needs and policy analysis will assist to identify potential barriers to implementation.

The proposed project will have a catalytic effect in providing the institutional frameworks to support Mexico to comply with obligations of the Minamata Convention. The conversion from mercury cell to membrane technology to be conducted by CYDSA will significantly reduce the quantity of mercury used in Mexico. The proposed project and the associated GEF's resources will provide technical support to facilitate the complementary investigation process necessary to conclude CYDSA's remediation plan and support the implementation of Best Available Techniques (BAT) in conversion of the last mercury-cell facility.

It should be noted that coordinating efforts among key national actors and collecting and sharing knowledge generated from both sites will be crucial. This project will also create new knowledge where stakeholders identify gaps and provide solutions and contribute to increased political awareness of the issue.

The following is an interrelated and mutually supportive contribution strategy that the project will employ from the baseline:

- Multi-stakeholder engagement. Industry, academic, government and other stakeholders take part in activities to achieving the objectives of the project;
- Broader environmental and health protection initiatives, and other areas, e.g. gender, children's rights, among others, are linked to exisiting programmes and networks and will build on past and current experiences;
- Institutions and networks to facilitate exchange of information, and assistance in the promotion of successes achieved under the project;
- Peer-to-peer trainings to facilitate technology transfer and to support capacity building for the reduction of mercury use in chlor-alkali sector;
- South-to-south exchange to facilitate knowledge transfer between contaminated sites, as well as leveraging success among project areas;
- Manage project site rehabilitation efforts with national/local governments and potential investors; and
- UN Environment with its Global Mercury Partnership and Mercury Programme will contribute to the efforts of the project by bringing its convening power and wide expertise on the mercury issue. The Global Mercury Partnership has been active for more than 10 years and UN Environment has access to a wide range of experts, both within the Chemicals and Health Branch and outside who can contribute to the project.

The project will also contribute to the following SDG targets:

- SDG3.9: By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination

- SDG 12.4: By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment

6. Global environmental benefits (GEFTF) and/or adaptation benefits (LDCF/SCCF)

As mercury is a recognized global pollutant subject to the recently finalized legally binding agreement, it is a critical time for Mexico to take proactive measures and set a strong precedent for environmental management and regulatory compliance. Because mercury is a chemical element, once it is released, it will remain in the environment indefinitely, affecting organisms far away from the emission point. The Government of Mexico will directly benefit from the project, by increasing its compliance with the requirements of the Minamata Convention. Another direct beneficiaries will be the Mexican population through its enhance awareness on the risks posed by mercury exposure from contaminated sites.

As indicated previously, the project is expect to collect and stabilize and avoid at least 100 and 50 tons of mercury, summing to 150 tons over the course of 5 years of the project. In addition, the energy savings from the conversion of the Coatzacoalcos plant will contribute to reduction of at least 43,186 tons of CO2 equivalent. This current calculation is made under the assumption that the same amount of chlorine will be produced at the new membrane plant and the electricity consumption reduction is at 25%. The GHG reduction was calculated using the estimation from the service provider Sistemas Energéticos SISA, S.A. de C.V. Calculator[1].

Chlorine capacity (tons per year)	Total annual consumption (KWH) – Mercury Cell	Total annual consumption (KWH) - Membrane	Annual Reduction (KWH)	CO2 Equivalent (MT)
100,000	340,970,000	257,300,000	83,670,000	43,186

All calculations on global environmental beneftis will be verified during the PPG phase.

Also during operation of membrane plants, hydrogen subproduct generated in the stoichiometrical reaction of producing chlorine and caustic soda from electrolysis of salt solution is used as a fuel mixed with natural gas in a boiler for process steam consumption, generating other important energy savings. Combustion of H2/O2 emits water vapor instead of carbon dioxide which reduce at least 9,651 tons of CO2 equivalent per year in addition to reduction calculated above, providing additional environmental benefits.

Specifically, the project is consistent with the Chemicals and Waste objective no. 2, which aims to “reduce the prevalence of harmful chemicals and waste and support the implementation of clean alternative technologies/substances.” Program 4 under the Chemicals and Waste objective calls for the “reduction or the elimination of anthropogenic emission and releases of mercury to the environment.” Stabilization of excess mercury will also be reinforced. In a regional dimension, the achievement of the project will ensure healthy lives for workers and communities near the chlor-alkali waste sites, develop strategies to prevent exposure of vulnerable populations near mercury emissions and releases from the chlor-alkali sector and consequently will contribute to reduce the number of deaths and illnesses from mercury compounds. The project will also encourage risk reduction through the development of an environmentally sound management of mercury wastes, in accordance with agreed National frameworks that support the Minamata Convention.

Furthermore, the mercury remediation to be initiated based on the results of this project will reduce the quantity of mercury in the local environment and due to the specificities of mercury (long distance travel through air and water, meaning that local release from anthropogenic sources extend risks to human well-being and ecosystem health well beyond the point of origin) will also have a positive global environment impact.

Lastly, the project is also consistent with the advocacies of various multilateral environmental agreements (MEAs) including the Minamata Convention on Mercury. The project contributes directly to Article 5 (reduce mercury in manufacturing processes), Article 8 (emissions), Article 10 (environmentally soun interim storage of mercury), Article 11 (mercury wastes), and Article 12 (contamined sites). It also indirectly contributes to Article 3 (Supply and Trade).

The results of this project will also contribute to the replication of good practices and cross cutting initiatives to promote the sound management of hazardous chemicals in Mexico with local, regional and global benefits.

7. Innovation, sustainability and potential for scaling up

In Mexico, there is a growing awareness of sophisticated technical solutions for the reduction of environmental and human health risks through treatment of contaminated soils, surface and groundwater but scarce technical expertise exists specifically for mercury.

The development of good practice guidelines with a focus on mercury will assist in prioritizing mercury-waste contaminated sites disposition and management. The regulatory tools will also provide the policy framework to sustain the efforts made during the project and ensure long term environmentally sound management of mercury and other hazardous chemicals in Mexico. Furthermore, involving key stakeholders from the private sector supporting environmental management in the chlor-alkali industry will bring innovative approaches in improving the quality of life for all Mexicans. The involvement of other key stakeholders including scientific and research institutes, will contribute to having an enriched dialogue on the control of pollution in the contaminated areas that will be assessed during the project. Experiences learned from this project can be widely applied to manage and monitor other hazardous chemicals and contaminated sites. Regionally and globally, the project will have a positive effect to promote additional conversions of other active mercury cell chlor alkali facilities, especially for plants located in Argentina, Brazil and Uruguay . This is the ultimate aim of the GMP and the Minamata Convention on mercury.

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[1] 0.4003 Ton CO2/MWh

1b. Project Map and Coordinates

Please provide geo-referenced information and map where the project interventions will take place.

Monterrey Plant

Name	Latitude	Longitude
Celdas 1 IQ- Monterrey	25o42’40.47’’N	100o20’5.86’’W
Celdas 2 IQ- Monterrey	25o42’39.42’’N	100o20’5.88’’W
Celdas 3 IQ- Monterrey	25o42’39.39’’N	100o20’6.99’’W
Celdas 4 IQ- Monterrey	25o42’40.58’’N	100o20’6.95’’W

Coatzacoalcos Plant

2. Stakeholders

Select the stakeholders that have participated in consultations during the project identification phase:

Indigenous Peoples and Local Communities Yes

Civil Society Organizations Yes

Private Sector Entities Yes

If none of the above,please explain why:

Stakeholder	Role in the project preparation	Proposed engagement in project
International Governmental Organizations		
UN Environment	Led consultation with national project partners, discussing co-finance contributions, and seeking input into the project design. Leader of the Global Mercury Partnership. Co-led consultation with national project partners.	UN Environment Chemicals and Health Branch GEF Unit is the IA, responsible for implementing the project, in line with project budget and workplan, and overseeing the Executing Agency for these components. It is the implementing agency for both the MIA and the NAP in Mexico.
Global Mercury Partnership	Provided input into the project design. Provided information on baseline remediation projects.	The Global Mercury Partnership will provide targeted technical assistance on the conversion guidelines, good practice guide on hazardous facility closures, remediation assessment and dissemination.
International Environmental Technology Centre	Consulted during project for environmentally sound technology development with a focus on waste management	IETC is responsible for implementing project component 3 developing technology support and capacity building for the stabilization of mercury wastes.
Governments		
General Directorate of Integral Management of Materials and Hazardous Activities (DGGIMAR)	Key partner and technical focal point of the project. Consulted on project design and execution arrangements. Key supporter of many partners under this project.	DGGIMAR will will also coordinate the implementation and regulation of mercury management in contaminated sites.
National Institute of Ecology and Climate Change (INECC)	Executing partner for the implementation of the project.	INECC will assist the monitoring and preliminar evaluation of the mercury contaminated sites.
Private Sector		
CYDSA S.A. de C.V.	Mexican company chlor-alkali producer concerned with a comprehensive environmental management system. Key partner consulted on project design and execution of project's components.	Will commit to assess mercury contaminated sites in the chlor-alkali plants of Monterrey and Coatzacoalcos, and will encourage the technology transfer for a mercury-free chlor-alkali production in the Coatzacoalcos plant following the Mexican legislation and proper environmental management standars.

Investors	Consulted during baselining and investor's meeting organized by UN Environment and the Mexican Government.	Will invest in the project's mercury-free technology transfer and in environmental management activities in order the accelerate the transition to mercury-free chlor-alkali industry.
World Chlorine Council (via Euro Chlor)	Consulted during project implementation for environmentally sound development with a focus on safety, environment and best practices.	The WCC will provide technical knowledge and information
Non-Governmental Organizations		
Academia	Consulted during preparation of baseline report of contaminated sites, and review of current information completed.	The contacted academia scientific groups will participate and gather information for the baseline mercury concentration on the contaminated sites for a future assessment of environmental and human risks of mercury. They will also provide scientific advice on mercury contamination and identification of potential hot-spots that will be part of the remediation plan (Component 1)

In addition, provide indicative information on how stakeholders, including civil society and indigenous peoples, will be engaged in the project preparation, and their respective roles and means of engagement.

Civil Society and local communities will be informed about the project through stakeholder workshops throughout the project and their involvement will be sought during the design of the decommission of the plants and the design of the contamination containment.

3. Gender Equality and Women's Empowerment

Briefly include below any gender dimensions relevant to the project, and any plans to address gender in project design (e.g. gender analysis).

Gender mainstreaming will be included from the design of this project and will be based on GEF's Policy Gender Mainstreaming and UN Environment's gender policy, mainly by involving women and vulnerable groups at the affected communities near the contaminated sites. The proposed intervention measures and establishment of national strategic plan on sound mercury management can benefit all Mexicans, but will offer particular advantages to women and children who often bear the burden of mercury poisoning. Intervention at mercury contaminated sites, such as the Coatzacoalcos site, can generate specific benefits for women and children due to physiological specificities that increase the risk of developmental and birth defects. As a consequence, reducing environmental and human health risks at the contaminated sites and a proper remediation assessment will deliver household benefits by reducing mercury exposure risks, specifically to women and children.

Based on health and livelihood concerns, it is very important to design a sanitary risk evaluation plan with targeted messaging for female audiences and provide specific information to increase women's awareness of the health risks associated with mercury exposure. In a broader sense, the promotion of women's involvement through socially inclusive and gender sensitive models of engagement in this project not only respect the differential risks to mercury poisoning in Mexico but could help women to have a stronger voice at local and national levels.

In addition, special attention will be paid to gender equality when evaluating and inviting members to participate to trainings as well as the awareness workshops. Time and location of these events will be adapted to the audience and gender sensitized, taking into account local specificities.

During the PPG phase, a gender expert will be recruited to develop a gender action plan including planned activities to achieve gender specific targets.

Does the project expect to include any gender-responsive measures to address gender gaps or promote gender equality and women empowerment? Yes

closing gender gaps in access to and control over natural resources;

improving women's participation and decision-making; and/or Yes

generating socio-economic benefits or services for women. Yes

Will the project's results framework or logical framework include gender-sensitive indicators?

Yes

4. Private sector engagement

Will there be private sector engagement in the project?

Yes

Please briefly explain the rationale behind your answer.

There will be many different levels of private sector engagement in the project. First, CYDSA, the owner of the chlor alkali plants will be the main company driving the conversion process as they have secured co-financing for the decommissioning and conversion of the plant. They will be following the appropriate codes and standards in place to carry out the entire conversion process. Second, as a regional industry association, and the GMP, will be engaged in knowledge sharing on best available practices and techniques for decommissioning and sound management of mercury, as well as dissemination of lessons learned on a regional and global basis, respectively. Third, companies that offer stabilization, storage, treatment and disposal options and solutions for mercury and mercury wastes will participate in the project. During the PPG phase, a list of potential providers will be finalized. Fourth, commercial, private banks and other investors interested in financing the conversion and environmental cleanup afterwards will be closely involved in the project. A list of these institutions, especially supporters on the post conversion mercury management, will be finalized during the PPG phase. Finally, selected experts from the private sector (including hazardous waste specialists) from the GMP will be invited to provide their experience and expertise on the project.

5. Risks

Indicate risks, including climate change, potential social and environmental risks that might prevent the Project objectives from being achieved, and, if possible, propose measures that address these risks to be further developed during the Project design (table format acceptable)

Risk	Level	Mitigation measure
Change in the political and economic situation during the lifetime of the project impacts its implementation.	Medium	Mexico has ratified the Minamata Convention and is under the obligation to implement it. The project is in line with the Article 5 under the Convention, and Mexico's international commitment can be counted upon to support the project. Project stakeholders have built a strong working relationship with the people directly involved in overseeing compliance to these obligations.
Inability or lack of capacity for government to provide adequate support services.	Medium	The project will assist government partners in 1) identifying gaps in the implementation of its mandate, especially as duty bearers, in the area of environmental sound management, and 2) creating avenues or programmes that can address the gaps identified.
Ensure capacity building and knowledge transfer on monitoring remediation and management of mercury, mercury wastes and contaminated sites.	Moderate	Capacity transfer and the integration of mercury pollution research and knowledge of the application of containment methods in local and national institutions are among the most challenging aspects of the project. However, the length of the project intervention will allow for gradual and systematic training of the institutions.

Effective private sector involvement is difficult to achieve	Low	For the long-term sustainability of the technology transfer, the project aims to target the financial sector and demonstrate the long-term benefits to be derived from any jointly defined coordination mechanism that is established. Their further investment in the project will be cost effective and for mutually beneficial.
Cost estimates for remediation in the contaminated sites are not sufficient and not properly planned.	Moderate	The scientific uncertainties and the corresponding technological problems will be answered during the preparation of the project. These investigations would refine the cost estimates.

6. Coordination

Outline the institutional structure of the project including monitoring and evaluation coordination at the project level. Describe possible coordination with other relevant GEF-financed projects and other initiatives.

Awareness about the toxicity of mercury has significantly grown in the past several years. The United Nations Environment Programme (UN Environment) leads the international community in developing the legally binding instrument to control this toxic substance. In 2008, UN Environment also formed the Global Mercury Partnership to address issues holistically and share experience from previous and current projects in order to eliminate duplication of effort and improve efficiency. This project will benefit from the partnership and viceversa, through sharing of information and experience, especially of projects conducted in this region and others in this industrial sector. The partnership also represents a large network of experts, many of whom are from low and middle-income countries who can both lend expertise to the project , and gain from it.

This project is also complimentary to the overreaching Strategic Approach to International Chemicals Management (SAICM) policy framework to promote chemical safety around the world. Application of SAICM principals are capable of finding key leverage points for intervention by reducing mercury related risks, governance, capacity-building and technical cooperation, knowledge and information sharing, and reducing trans-boundary mercury movements. This project will strengthen Mexico's capacity to soundly manage mercury wastes.

UNEP, as the implementing agency, will lead the process of project preparation and development with close consultation with national key stakeholders including the private sector. The UNEP task manager will provide project implementation oversight, in particular with monitoring and evalutions through annual supervision visits to Mexico.

The project will be nationally executed by SEMARNAT/INECC with involvement from PROFEPA. SEMARNAT is the administrative authority responsible for most environmental issues under federal jurisdiction, and has delegations in each state for handling federal issue. General Directorate for Integral Management of Materials and Riskable Activities (DGGIMAR), where the Minamata Convention focal point is housed, will be engaged to ensure that project activities are in compliance with the Convention. It is envisioned that technical support will be provided by the experts from the GMP, detailed of GMP involvement will be finalized during the PPG phase. The project

management unit will be established and hosted in INECC for overall project coordination and management of day-to-day activities to ensure information sharing, high efficiency and effectiveness.

Mexico has already completed its Minamata Initial Assessment which conducted a mercury inventory, discussed measures the country will take to implement the Convention, estimated associated costs and communicated this information to national stakeholders. As indicated previously, chlor alkali sector was determined as one of the major emitting sectors in Mexico, therefore, the implementation and results of this project will further strengthen national decision-making toward an effective ratification of the Minamata Convention on Mercury and reinforce national capacity towards hazardous chemicals management.

7. Consistency with National Priorities

Is the Project consistent with the National Strategies and plans or reports and assesments under relevant conventions

If yes, which ones and how: NAPAs, NAPs, ASGM NAPs, MIAs, NBSAPs, NCs, TNAs, NCSAs, NIPs, PRSPs, NPFE, BURs, INDCs, etc

This project supports the national priorities of Mexico, particularly on the issues around the economic development and proper management of chemicals and wastes. Beyond the environmental dimension, the project contributes to Mexico's UNDAF (United Nations Development Assistance Framework):

Mexico (2020-2025): The project will contribute to cooperation area III which refers to climate change and green economy by coordinating the three orders of government, the private sector, academia and civil society on advocacy, political dialogue, technical support and strengthening of institutional capacities so that territorial planning instruments are linked with an ecological planning instruments and strengthen the sustainable inclusive management of resources with an integrated approach in the processes of legislation, programming and decision making.

As a party of the Minamata Convention, Mexico is also committed in fulfilling all of its obligations in a timaly and effective manner. This project will address Article 5 (mercury used in manurfacturing processes), Article 10 (interim storage), Article 11 (mercury wastes), and Article 12 (contaminated sites).

8. Knowledge Management

Outline the Knowledge management approach for the Project, including, if any, plans for the Project to learn from other relevant Projects and initiatives, to assess and document in a user-friendly form, and share these experiences and expertise with relevant stakeholders.

The knowledge management will be increased through information campaigns and organization of workshops for key target groups such as population potentially exposed to mercury. Particular importance will be given to women and children that are more vulnerable due to physiological specifities that increase the risk of developmental and birth defects. It is foreseen to organize workshops at a national level, but also in the impacted localities where mercury waste sites will be identified during the remediation assessment.

In the knowledge management component, this project will build on current efforts to collect, share, and create knowledge resources, such as case studies, guidance documents, and training materials. Lessons learned will be preserved and future projects will be able to start from a state of increased knowledge of the issue, the solutions, and what works and does not work. Finally, in order to disseminate the experiences gained from the project, there will be one regional and one global forum targeting remaining mercury cell chlor alkali plant operators and governments to promote a worldwide phase out of this technology and sound environmental management during and after decommission/conversion.

Part III: Approval/Endorsement By GEF Operational Focal Point(S) And Gef Agency(ies)

A. RECORD OF ENDORSEMENT OF GEF OPERATIONAL FOCAL POINT (S) ON BEHALF OF THE GOVERNMENT(S): (Please attach the Operational Focal Point endorsement letter with this template).

Name	Position	Ministry	Date
Mrs. Fernanda Montero Lara	Director for Sustainable Finance	Ministry of Finance and Public Credit	3/19/2020

ANNEX A: Project Map and Geographic Coordinates

Please provide geo-referenced information and map where the project intervention takes place