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

Part I: Project Information

GEF ID
10526

Project Type
FSP

Type of Trust Fund
GET

CBIT/NGI
CBIT **No**
NGI **No**

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)
UNIDO

Executing Partner Type
GEF Agency

GEF Focal Area
Chemicals and Waste

Taxonomy
Waste Management, Chemicals and Waste, Focal Areas, Best Available Technology / Best Environmental Practices, Eco-Efficiency, Industrial Emissions, Mercury, Hazardous Waste Management, Emissions, Climate

Change, Climate Change Mitigation, Local Communities, Civil Society, Non-Governmental Organization, Stakeholders, Trade Unions and Workers Unions, Communications, Behavior change, Public Campaigns, Awareness Raising, Education, Beneficiaries, Type of Engagement, Consultation, Information Dissemination, Partnership, Participation, Gender Equality, Gender Mainstreaming, Sex-disaggregated indicators, Capacity, Knowledge and Research, Learning, Theory of change, Adaptive management, Indicators to measure change, Innovation, Knowledge Generation, Knowledge Exchange, Targeted Research, Capacity Development, Influencing models, Transform policy and regulatory environments, Deploy innovative financial instruments, Strengthen institutional capacity and decision-making, Convene multi-stakeholder alliances, Private Sector, Large corporations

Sector

Mixed & Others

Rio Markers

Climate Change Mitigation

Climate Change Mitigation 0

Climate Change Adaptation

Climate Change Adaptation 0

Submission Date

2/14/2022

Expected Implementation Start

5/1/2022

Expected Completion Date

4/30/2027

Duration

60In Months

Agency Fee($)

1,080,000.00

A. FOCAL/NON-FOCAL AREA ELEMENTS

Objectives/Programs	Focal Area Outcomes	Trust Fund	GEF Amount($)	Co-Fin Amount($)
CW-1-1		GET	12,000,000.00	125,422,215.00
		Total Project Cost($)	**12,000,000.00**	**125,422,215.00**

B. Project description summary

Project Objective

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

Project Component	Financing Type	Expected Outcomes	Expected Outputs	Trust Fund	GEF Project Financing($)	Confirmed Co-Financing($)
1. Improve national capacity to manage chemical facilities and mercury contaminated sites	Technical Assistance	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: Good practice guide for the monitoring and management of hazardous chemical facilities and contaminated sites is completed and distributed to national stakeholders Output 1.2: Decontamination plans for the Monterrey and Coatzacoalcos sites are developed and shared with national stakeholders Output 1.3: Remediation and monitoring plans are developed	GET	1,117,000.00	360,815.00

Project Component	Financing Type	Expected Outcomes	Expected Outputs	Trust Fund	GEF Project Financing($)	Confirmed Co-Financing($)
2. Support for conversion, decommission and remediation	Technical Assistance	Mercury cell chloralkali facilities are converted and decommissioned in Mexico and financing mechanisms for clean-up and rehabilitation of the sites adopted	Output 2.1: Support is provided for the conversion of the Coatzacoalcos facility Output 2.2: Technical support provided to IQUISA to decommission mercury cell plants in Coatzacoalcos and Monterrey Output 2.3: Financing packages prepared and shared with investors	GET	2,517,600.00	118,628,000.00

Project Component	Financing Type	Expected Outcomes	Expected Outputs	Trust Fund	GEF Project Financing($)	Confirmed Co-Financing($)
3. Final disposal or transfer of excess mercury	Technical Assistance	100 metric tonnes of mercury safely stored and disposed	Output 3.1: Technical support provided to IQUISA to stabilize excess mercury Output 3.2: Stabilisation of residual mercury extracted during decontamination	GET	6,994,500.00	250,000.00
4. Knowledge management and communication	Technical Assistance	Countries and global operators apply the new knowledge to phase out remaining mercury chloralkali facilities	Output 4.1: Lessons learned shared with key stakeholders Output 4.2: Chloralkali mercury cell conversion guidelines updated and shared with industry partners and stakeholders	GET	599,500.00	111,400.00
5. Monitoring and evaluation	Technical Assistance	Project achieves objective on time through effective monitoring and evaluation	Output 5.1 Project monitored and evaluated	GET	200,000.00	100,000.00

Project Component	Financing Type	Expected Outcomes	Expected Outputs	Trust Fund	GEF Project Financing($)	Confirmed Co-Financing($)
				Sub Total ($)	**11,428,600.00**	**119,450,215.00**

Project Management Cost (PMC)

GET	571,400.00	5,972,000.00
Sub Total($)	**571,400.00**	**5,972,000.00**
Total Project Cost($)	**12,000,000.00**	**125,422,215.00**

Please provide justification

C. 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($)
Recipient Country Government	SEMARNAT	In-kind	Recurrent expenditures	860,815.00
GEF Agency	UNEP	In-kind	Recurrent expenditures	50,000.00
Private Sector	CYDSA	Equity	Investment mobilized	124,500,000.00
Other	USEPA	In-kind	Recurrent expenditures	11,400.00
			Total Co-Financing($)	**125,422,215.00**

Describe how any "Investment Mobilized" was identified

Investment mobilized describes CYDSA/ IQUISA?s investment in the new membrane facility and the value of mercury liquid mercury to be stabilised. These investments developed concurrently with the current project.

D. 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($)
UNEP	GET	Mexico	Chemicals and Waste	Mercury	12,000,000	1,080,000	13,080,000.00
			Total Grant Resources($)		**12,000,000.00**	**1,080,000.00**	**13,080,000.00**

E. Non Grant Instrument

NON-GRANT INSTRUMENT at CEO Endorsement

Includes Non grant instruments? **No**

Includes reflow to GEF? **No**

F. Project Preparation Grant (PPG)

PPG Required **true**

PPG Amount ($)

300,000

PPG Agency Fee ($)

27,000

Agency	Trust Fund	Country	Focal Area	Programming of Funds	Amount($)	Fee($)	Total($)
UNEP	GET	Mexico	Chemicals and Waste	Mercury	300,000	27,000	**327,000.00**
				Total Project Costs($)	**300,000.00**	**27,000.00**	**327,000.00**

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?e (direct)	43186	74100	0	0
Expected metric tons of CO?e (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?e (direct)				
Expected metric tons of CO?e (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?e (direct)	43,186	74,100		
Expected metric tons of CO?e (indirect)				
Anticipated start year of accounting	2024	2024		
Duration of accounting	5	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)
145.00	**130.00**	**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)
145.00	130.00		

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	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	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	7,500		
Male	7,500	7,500		
Total	15000	15000	0	0

Provide additional explanation on targets, other methodologies used, and other focal area specifics (i.e., Aichi targets in BD) including justification where core indicator targets are not provided

The proposed project will produce global environmental benefits that can be captured across three core indicators: 6 (greenhouse gas emissions mitigated); 9 (chemicals of global concern); and 11 (direct beneficiaries). The methods used to calculate the anticipated benefits are described below. With regard to greenhouse gas emissions (indicator 6), the project will result in an estimated 24.4 % energy savings on an annual basis once the new plant is operational. This 24.4 % value is consistent with experience elsewhere; the average energy savings in European plants upon converting to membrane technology from mercury cells was 23.5 % with the largest differential for a single plant being 48 %.1 The membrane cell plant will come online in year 3 of the project. Thus for the purpose of calculating GEBs, savings are estimated from 2.5 years only. CYDSA operates its own power plant at the Coatzacoalcos facility under the subsidiary Sistemas Energ?ticos SISA, S.A. de C.V. (herein SISA). The plant uses natural gas cogeneration (Combined heat and power [CHP]). Up to two-thirds of energy is lost in the form of heat in traditional power plants. CHP captures this heat and reuses it, typically in municipal heating. This reuse can result in efficiency gains of up to 80 %.2 At the Coatzacoalcos plant the recaptured steam heat is used in the chloralkali process, thus resulting in further energy savings. Annual consumption (GWh) ? 92,000 ECU mercury plant 314 Est. annual consumption (GWh) ? 100,000 ECU membrane plant 257 Annual Savings (GWh) 57 Annual CO2 reduction (tonnes) 29,640 CO2 reduction over 2.5 years (tonnes) 74,100 Table 1. Estimated CO2 reductions as a result of the plant conversion Carbon dioxide emissions from gas-fired power plants are much lower than those from other fossil fuels systems such as petroleum or coal. The United States Energy Information Administration calculates average CO2 emissions of 0.41 kg per kWh generated by gas power in that country, versus 0.97 kg for petroleum and 1 kg for coal.3 Capturing and reusing heat through CHP results in further CO2 reductions; the inter-governmental panel on climate

change (IPCC) estimates emissions of ~0.3 kg CO_2/ kWh for CHP plants.4 IQUISA approximates power demand for their planned 100,000 ECU membrane facility at 257 GWh per year (1 GWh = 1m kWh). Current demand at their 92,000 ECU mercury plant is 313 GWh. Thus even after production gains of more than 8 %, the new plant will use 57 GWh less energy per year. The CYDSA subsidiary SISA which manages the plant calculates average CO_2 emissions of 0.52 kg CO_2/kWh associated with power used at the chloralkali plant. Thus annual CO_2 emissions reductions after the conversion should be equivalent to 29,640 tonnes. GEBs are conservatively calculated here over a 2.5 year time horizon only. The resulting contribution against indicator 6 is 74,100 tonnes. Table 1 summarizes these calculations. With regard to indicator 9, 100 tonnes of mercury will be stabilised and disposed of as part of Component 3. In addition, the current plant has mercury inputs of 6 tonnes/ year. It is assumed that no mercury will be procured beginning halfway through the project, thus Hg use will be reduced by 30 tonnes during the life of the project (5 years x 6 tonnes). Finally a conservative value of 15,000 direct beneficiaries is calculated for indicator 11. Both sites potentially adversely impact the health of nearby human populations and further communities downstream through the uptake of mercury in fish. In the absence of more detailed epidemiological evidence the most conservative value (i.e. 2500 people) is taken for the 3 communities near the Coatzacoalcos plant and assumed to be equivalent for Monterrey. As a result of additional research carried out during the PPG, CO_2 emission reduction targets increased by 70 % from those presented in the PIF while mercury use avoided decreased from 45 to 30 tonnes. The primary reason for this reduction is that in anticipation of the project, the IQUISA plant has recently reduced its annual mercury demand from 9 to 6 tonnes.

Part II. Project Justification

1a. Project Description

describe any changes in alignment with the project design with the original pif

Additional work carried out during the PPG identified higher than expected costs associated with mercury stabilisation in Mexico. To account for these costs which are incurred by activities in Component 3 resources have been reallocated from Component 2. The project initially envisaged a more substantive role in the design of the new membrane plant. In advance of project implementation, IQUISA has completed a full design of the plant without requiring GEF resources. Thus work in Component 2 will involve providing ongoing technical support during construction, including adapting engineering plans where required. Additionally, in view of the limited capacity at INECC, UNIDO, the co-lead of the Global Mercury Partnership area on chlor-alkali was proposed by the counterparts as executing agency.

1a.1 the global environmental and/or adaptation problems, root causes and barriers that need to be addressed (systems description);

<u>1.1 Mercury sources, migration and exposure</u>

Mercury is a naturally occurring element with a set of unique chemical and physical characteristics. It is a good conductor of electricity and is the only metal that is liquid at room temperature. It has a high expansion coefficient and amalgamates with several other metals, including gold, silver and, relevantly, sodium. These characteristics make it useful in multiple commercial and industrial applications including medical devices, electric switches and as an amalgamate in gold and silver mining operations.[1][1]

Mercury occurs globally in nature in mostly stable cinnabar (HgS) deposits. It is released to the environment as these rocks are worn down by weather and volcanic activity.[2][2] Anthropogenic sources of emissions have resulted in a 450 % increase in atmospheric Hg levels above natural concentrations. Most of these emissions (~2/3) occurred between the early 16th and 20th centuries as a result of gold mining operations while the balance came from coal-fired powered plants and other industrial activities after 1920. The largest contemporary source of the anthropogenic Hg emissions is artisanal small-scale gold mining (ASGM) which contributes to just under 40 % of the 2,220 tonnes released to the atmosphere annually from human activities.[3][3]

Mercury exists in multiple forms that can be usefully organized under three principal categories: elemental (i.e. metallic mercury), organic and inorganic. These forms mediate how mercury migrates through the environment as well as how humans and other organisms become exposed and respond toxicologically. Elemental mercury is a neurotoxicant if inhaled, for example, though perhaps only 0.01 % is absorbed through the gastrointestinal tract if ingested.[4][4] Conversely ingestion of either organic or inorganic forms of mercury results in serious adverse toxicological effects. By way of example a recent case study of a 3-year-old Libyan boy that ingested a remarkable 750 grams of elemental mercury found that the child never developed any symptoms.[5][5] By contrast a fatal dose of inorganic mercury for a 70 kg adult is in the range of 0.7?3 grams. Similarly, dermal exposure to elemental mercury is not associated with an adverse toxicological response. Dermal exposure to organic mercury can result in blisters and rashes, while even very small amounts of inorganic mercury on the skin can be fatal to humans.[6][6]

The largest consumers of mercury globally are ASGM (872?2,598 tonnes/ year) and vinyl chloride monomer production (1,210?1,241 tonnes/ year). Other significant uses include dental amalgams (226?322 tonnes/ year), measuring devices (267?392 tonnes/ year) and the chloralkali sector (233?320 tonnes/ year). Importantly, while emissions and, relatedly, consumption of mercury by the chloralkali sector are relatively low, there are perhaps 10,000 tonnes of mercury stored in cells within chloralkali plants.[7][7] Thus a major consideration with regard to this sector is the possible irresponsible reuse elsewhere when these plants close.

The chloralkali sector utilizes liquid elemental (i.e. metallic) mercury. When released in the environment elemental mercury can be converted to the more bioavailable methylmercury (CH_3Hg) through interactions with various microorganisms. Methylmercury is lipophilic and bioaccumulative, meaning that organisms tend to absorb it more quickly than they expel it. These characteristics in turn contribute to its tendency to biomagnify, meaning that creatures further up the food chain contain proportionally more mercury; shark or albacore have proportionally more mercury than salmon, for instance. Accordingly, humans consuming fish vast distances from mercury sources can incur mercury-attributable disease.

On 16 August 2017 the Minamata Convention on Mercury came into force. The Convention, which was shepherded into existence by the United Nations Environment Programme (UNEP), currently has 128 Signatories and 135 Parties (countries where it has been ratified). The treaty covers a range of issues associated with mercury production and use, providing a list of acceptable uses and applicable phase out date or reduction target. Allowances include certain medical devices and industrial applications. With regard to the chloralkali sector Annex B of the Convention obligates parties to phase-out the use of mercury in chloralkali production by 2025. Article 3 Section 5 (b) further state that countries are obligated to ?Take measures to ensure that, where the Party determines that excess mercury from the decommissioning of chlor-alkali facilities is available, such mercury is disposed of in accordance with the guidelines for environmentally sound management referred to in paragraph 3 (a) of Article 11, using operations that do not lead to recovery, recycling, reclamation, direct re-use or alternative uses.?

1.2 The chloralkali process

The term chloralkali describes the industrial production of chlorine and sodium hydroxide through the electrolysis of a salt (typically sodium chloride [NaCl]). In chemistry, electrolysis simply refers to a chemical reaction driven by electricity. Thus in a chloralkali plant, a large amount of direct current (DC) is introduced into a highly concentrated brine (water and > 50 % NaCl) to induce a reaction. The sodium in the NaCl reacts with hydrogen in the water to form sodium hydroxide (NaOH), leaving behind chlorine (Cl_2) and hydrogen (H_2). For each tonne of chlorine produced, 1.1 tonnes of caustic soda and 0.03 tonnes of hydrogen are also produced.[8][8] In the chloralkali industry, this product is referred to as an Electrochemical Unit (ECU). Thus the installed capacity of a given facility is commonly noted in ECU, which is equivalent to the number of tonnes of chlorine a facility is capable of producing in a year. Potassium chloride (KCl) can also be used (in place of NaCl) and represents < 3 % of global production.[9][9] In this case the outputs are potassium hydroxide (KOH), chlorine and hydrogen.

Chlorine is a highly reactive element and an essential industrial input. It is used primarily in the production of polyvinyl chloride (PVC) plastics to increase their durability and retard combustion, but is also commonly applied in water treatment to mitigate biological contamination and as a disinfectant (e.g. bleach). Sodium hydroxide (commonly known as caustic soda, caustic or lye) is a highly alkaline chemical with a range of industrial uses, including various applications in paper pulping, as a gelling agent in soap manufacture, and to remove sulphur in petroleum refining. Potassium hydroxide is used in dyes, soaps and various other applications. Hydrogen is typically burned onsite to produce steam for the facility, though is also used in the production of other chemicals (e.g. ammonia, hydrogen peroxide and methanol).

Chloralkali plants are not uncommon; more than 50 countries reported sodium hydroxide exports of over USD 1 million in 2019. The largest exporters are the US, China, Belgium, the Netherlands, South Korea, and Japan, though many other countries produce large volumes as well.[10][10] China is by far the world?s largest producer and user of chlorine and caustic soda and is expected to comprise the majority of future growth in the chloralkali sector.[11][11] Mexico is a relatively small exporter of chlorine and sodium hydroxide. By way of example the country exported USD 4.7 million of caustic soda in 2019 compared with USD 2.5 billion from the US and USD 500 million from China.[12][12] The global markets for both chlorine and sodium hydroxide are each just under USD 40 billion/ year.[13][13]

Chloralkali plants rely on three distinct technologies to separate sodium and chlorine. All use the same basic chemistry though differ in application. One of the oldest is mercury cell technology (?Castner?Kellner? after the inventors) which has been in use since the late 19th century. In this approach, a brine solution floats above a bath of elemental liquid mercury in an enclosed casing. An anode (where current is introduced) sits in the brine; the mercury bath acts as a cathode (where current leaves the cell). When engaged, the mechanism forms chlorine gas at the anode ? which is captured and removed from the cell ? and a sodium-mercury amalgam at the cathode. The specific reactions are oxidation (loss of electrons) at the anode and reduction (gaining of electrons) at the cathode. The amalgam enters a decomposer where, through interactions with deionized water and further electrolysis, caustic soda and hydrogen gas are produced. Both are captured and removed and the mercury is reintroduced to the cell to continue the process.[14][14]

A second approach (?diaphragm cell?) ? the use of which historically precedes mercury cell technology ? relies on a brine solution flowing through an asbestos diaphragm within an enclosure. Electrical current and brine are introduced at the anode forming chlorine gas, as above. The solution then flows through the diaphragm to the cathode on the other side of the cell, where sodium hydroxide is produced. The continuous flow of the solution away from the anode, along with diaphragm, prevents the reaction of chlorine with the sodium hydroxide.[15][15]

These two types of cells dominated the chloralkali industry through the 20th century. In the year 2000 for instance, 75 % of chloralkali facilities in the US used diaphragm technology while 77 % of European facilities used either mercury or diaphragm cells.[16][16] Beginning in the 1970s a third technology (?membrane cell?) began to be employed at industrial scale in Japan. This transition was expedited partly in response to the event at Minamata Bay. Membrane cells function similarly to diaphragm cells, only rather than relying on a flowing solution in combination with the diaphragm, these cells use an ion-conducting polymer membrane to prevent a reaction between caustic soda and chlorine. Membrane cells are less energy intensive and present fewer environmental and human health hazards than mercury or diaphragm cells. Accordingly the nearly all newly constructed facilities use the membrane cell process, which is considered the Best Available Technique (BAT) in chloralkali.[17][17]

The chloralkali sector is a massive consumer of electricity. The sector comprised 1 % (~35 million kWh) of all electrical demand in Europe in 2010 which corresponded to 17 % of electricity used in the chemical and petrochemical industries there.[18][18] In the United States, chemical manufacture comprised about 20 % (207 million kWh) of industrial electrical demand (~1 billion kWh) in 2018. Of that, 43 million kWh was used in the manufacture of basic inorganic chemicals, a category to which chloralkali is one larger contributors.[19][19] Data for the sector alone were not readily available.

The chloralkali process requires power first and foremost to drive electrolysis, which comprises ~90 % of electrical use in the sector. The remaining 10 % is used to prepare salt, generate steam to produce commercial grade caustic soda, and to power auxiliary equipment.[20][20]

Each of the three major technologies has different amounts of energy demand. The median amount of electricity used by European mercury cell plants in 2008 to produce one tonne of chlorine (Cl_2) was 3,401 kWh. Diaphragm cells by comparison required only 2,220 kWh. Membrane cells required 2,600 kWh.[21][21]

Of note mercury cells directly produce a commercial grade caustic soda, while the caustic soda produced by the diaphragm and membrane cells requires further refinement using steam, which is energy intensive to produce. A 2014 analysis by the European Commission found that with these factors considered, diaphragm technology was the least energy efficient process of the three, requiring 8 % more energy per tonne of chlorine produced than mercury cells. Membrane cells were found to be the most efficient, requiring < 85 % the amount of energy used in mercury cells.[22][22] Further, the energy efficiency of membrane cells is regularly improving through technological advances such as improved salt production and membrane manufacture.[23][23]

Chloralkali facilities present a number of occupational safety and health hazards. Perhaps the most obvious relate to the primary products of the process. Chlorine gas is a water-soluble pulmonary irritant that can cause acute damage the upper and lower respiratory tract in the event of exposure.[24][24] Likewise sodium hydroxide is a highly corrosive powder with dermal contact and ingestion resulting in severe burns and eye contact potentially resulting in blindness.[25][25] Additional chemical hazards relate to mercury exposure where mercury is employed. Unique safety hazards include electrocution and the risk of explosion owing to the nature of some of the chemicals present (e.g. chlorine, hydrogen) and the presence of sources of ignition.[26][26]

All chloralkali facilities also pose potential ecological hazards. These relate primarily to direct chemical releases to air, water and soil. Carbon dioxide is released during brine acidification through the breakdown carbonate and hydrogen carbonate to water and carbon dioxide. Chlorine gas emissions tend to minimal as the gas is extremely hazardous and care is taken to mitigate releases. A range of other chemical releases are also associated with the chloralkali process. These include chlorate, sulphate, halogenated organic compounds, refrigerants from hydrogen processing and some dissolved metals (e.g. nickel, zinc, iron).[27][27] Further, each type of technology presents its own specific hazards. Diaphragm cells contain asbestos, with potential emissions occurring during operation and as a result of inappropriate disposal.[28][28] When human exposure occurs, asbestos can cause fibrotic lung disease (asbestosis) and can act as a carcinogen.[29][29] Membrane cells contain Nafion ($C_9HF_{17}O_5S$) a per and poly fluoroalkyl substance (PFAS). PFAS are a group of thousands of synthetic chemicals with wide application ? from use as a water repellent in clothing to as a non-stick coating on cookware ? that were first developed by the 3M Company in 1949.[30][30] PFAS are known to be extremely persistent in the environment and exposure to many PFASs has been associated with adverse health outcomes in humans. The Stockholm Convention currently only considers two PFAS subgroups: perfluorooctane sulfonic acid (PFOS), its salts, and perfluorooctane sulfonyl fluoride (PFOSF) in Annex B in 2009 and perfluorooctanoic acid (PFOA), its salts, and PFOA-related compounds in Annex A in 2017. The PFAS utilised in membrane technology (i.e. Nafion; $C_9HF_{17}O_5S$) does not belong to these groups and is therefore not currently restricted in use. However it should be noted that PFAS have come under substantial scrutiny in recent years owing to human health and ecological concerns.[31][31] Despite these concerns, membrane technology is presently the Best Available Technique (BAT) for the chloralkali process.

Mercury cell chloralkali facilities universally release mercury into the environment on a regular basis. This occurs onsite through spills and vapour emissions as well as in small amounts of residual mercury contamination in their products (i.e. chlorine, caustic soda, and hydrogen). When released in products, mercury can present further risks downstream. A 2009 study for example found that residual mercury in corn syrup processed with caustic soda from chloralkali plants presented a viable health risk to consumers.[32][32] The scope of these releases is notoriously difficult to quantify as most of the relevant data are proprietary.[33][33] Generally speaking, significant progress was made by producers throughout the 20th century to reduce emissions (particularly in Europe), but fugitive releases remain implicit to the process.[34][34] The 2018 Global Mercury Assessment estimated annual environmental mercury releases from the Chloralkali sector were in the range of ~15 tonnes, though this is likely an underestimate.[35][35] The single active facility covered by this project ? the CYDSA Coatzacoalcos plant ? consumes > 6 tonnes of mercury annually for instance.

Importantly, fugitive emissions represent a fraction of the actual mercury used in the chloralkali sector, which remains the largest intentional user of the material in the world. At present a mercury reservoir of perhaps 10,000 tonnes exists in the sector.[36][36] Thus a much larger consideration is the potential re-use or sale of this mercury.

1.3 Phase out of mercury cells

Both diaphragm and mercury cell technologies have been used in chloralkali plants since the late 19th century. A third technology, the membrane cell, was developed in the mid-20th century and is now the dominant approach employed in the sector. The transition to membrane cells began in Japan in the early 1970s following mass mercury poisoning events resulting from industrial emissions at Minamata Bay (Kumamoto Prefecture) and Niigata Prefecture. From 1973 to 1977, Japan?s reliance on mercury cells in caustic soda production decreased from ~95 % to ~40 %. By 1987, mercury cells had been completely phased out of chloralkali facilities in Japan.[37][37] This is distinct from Europe where as recently as 2000, mercury cells comprised more than 50 % of chloralkali production.[38][38] US production, which was traditionally more reliant on the diaphragm process, was about 10-15 % reliant on mercury cells at the same time.[39][39]

Beginning in the 1980s some countries around the world initiated actions to control mercury emissions. In the US, legislation on batteries in 1986 virtually eliminated mercury demand by the sector. In 1984 mercury-added batteries made up 54 % of US mercury use. By 1992, they made up only 2 %. Owing to this progress and related regulation of other products ? particularly paints ? overall mercury consumption decreased by more than 50 % from 1988 to 1990 in the US (from > 1,500 tonnes/ year to < 750 tonnes).[40][40]

In 1990 Parties to the OSPAR Convention (a group of European Countries) recommended a total phase-out of mercury cells by 2010.[41][41] This would not be achieved until 2020 (10 years after the target), however significant progress immediately followed the recommendation.[42][42] Indeed from 1992 to 1997, total global chlorine capacity from mercury cells decreased from 12,625 tonnes to 11,640 tonnes, or from 27.8 % of total chlorine capacity to 23.5 %, with nearly all decreases occurring in the US and Europe. Over a comparable period ? from 1990 to 1996 ? mercury use (i.e. consumption) decreased from 2,003 to 1,344 tonnes/ year.[43][43]

Beginning in the 2000s, the momentum shifting away from mercury cells increased. In 2002, UNEP completed the first Global Mercury Assessment in response to a request from its Governing Council (GC). The report, which identified the chloralkali industry as the largest single user of mercury, quantified releases from major anthropogenic and natural sources and provided an important basis for further action. In 2005 the UNEP GC initiated the development of the Global Mercury Partnership (GMP) noting that ?*there is sufficient evidence of significant global adverse impacts from mercury and its compounds to warrant further international action to reduce the risks to human health and the environment from the release of mercury and its compounds into the environment*.?[44][44] Further action by UNEP ushered in the Minamata Convention on Mercury which entered into force on 16 August 2017 and has been ratified by 131 Parties (as of August 2021). Annex B of the Convention obligates Parties to phase-out the use of mercury cells in chloralkali by 2025, while Article 3 Paragraph 5(b) obliges countries to *?[t]ake measures to ensure that, where the Party determines that excess mercury from the decommissioning of chloralkali facilities is available, such mercury is disposed of in accordance with the guidelines for environmentally sound management referred to in paragraph 3(a) of Article 11, using operations that do not lead to recovery, recycling, reclamation, direct re-use, or alternative uses*.?

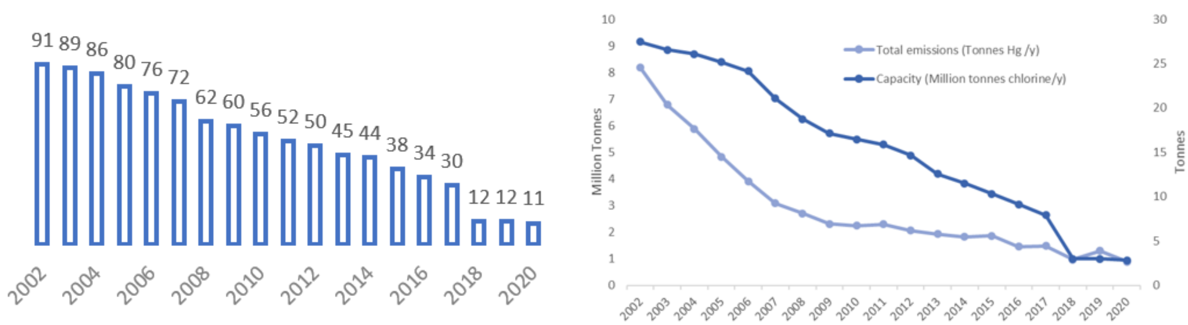


Fig. 1. Reductions in the number of chloralkali plants with mercury cell capacity and commensurate reductions in mercury cell chlorine capacity and mercury emissions from 2002?2020 in World Chlorine Council member countries ***[45]***[45]

Through the 2000s a number of countries began to more deliberately phase out the use of mercury cells in chloralkali. In India, for example the Ministry of Environment and Forests organized a voluntary commitment from industry through the ?Corporate Responsibility for Environment Protection? to phase-out mercury cells by 2012.[46][46] The European Union later adopted such a commitment with a target date of 2020.[47][47] The World Chlorine Council (WCC) ? a trade group shoes members represent 90 % of chlorine production ? reported that its members decreased their mercury cell capacity from 9.1 million tonnes to 5.5 million tonnes by 2010.[48][48] These values continued to fall in the subsequent decade. Indeed, as part of their regular reporting to the UNEP GMP, WCC reported only 11 plants worldwide with mercury cells. These plants had a total capacity of 940,000 tonnes of chlorine production, down from 74 plants with 7,929,000 tonnes of chlorine production in 2006 (the first year for which data are available).[49][49] Figure 1 presents the number of chloralkali plants with mercury cell capacity and commensurate reductions in mercury cell chlorine capacity and mercury emissions from 2002?2020 in World Chlorine Council member countries. Eight of the 11 WCC members with Hg cell plants are located in the Americas, across Argentina, Brazil, Canada, Mexico, the United States and Uruguay.[50][50]

As recently as 2007, there were three active mercury cell chloralkali plants in Mexico. Two of these (Coatzacoalcos, Veracruz and Monterrey, Nuevo Le?n) were operated by the IQUISA unit of the Mexican group CYDSA. A third, Santa Clara (Mexico state), was converted to membrane cell technology by its owner (Mexichem) in 2007. IQUISA then acquired the plant and the associated environmental liability in 2010. From 2011?2016 IQUISA spent ~USD 6.6 million to carry out soil and groundwater remediation work at the site.

In 2016 IQUISA completed construction a new membrane cell facility in Monterrey and ceased operations at the mercury cell plant. The company has yet to remediate the site. The last active mercury cell plant in operation in Mexico is Coatzacoalcos facility, which contains approximately 150 tonnes of mercury in cells and which was estimated in the Minamata Initial Assessment for Mexico to release 2.7 tonnes Hg/ year to the environment.[51][51] IQUISA has recently secured financing for the construction of a new membrane cell facility and has expressed intentions of closing the mercury cell plant once the new facility is operational.

1.4 Managing the legacy of mercury cells

Phasing out mercury cells in chloralkali is a necessary action to minimize anthropogenic Hg emissions. However doing so also creates substantial additional ecological and human health risks that require careful management. The two most significant of these relate to safe disposal of mercury reservoirs and the appropriate management of residual contamination on site. These are addressed separately below.

1.4.1 Decommissioning plants and Hg Stabilisation

The most significant consideration in the decommissioning of mercury cell plants is the appropriate handling and final disposal of the vast amounts of mercury contained in the cells. The Minamata Convention obliges countries to dispose of surplus mercury from decommissioned chloralkali facilities ?[?]in accordance with the guidelines for environmentally sound management[?].? The purpose here is to mitigate downstream leakages to other sectors (e.g. artisanal and small-scale gold mining) where fugitive releases are much more common. Some of the mercury can be considered non-surplus and be sold to other mercury-cell chlor-alkali plants in accordance with article 3 of the Convention.

Mercury is an element and cannot be created or destroyed. Mercury wastes can be responsibly disposed of in a manner consistent with the Basel Convention using two principal methods. In the first, it can be stabilised through a physicochemical treatment and disposed of in a specially engineered landfill.[52][52] The stabilisation is intended to covert mercury into a more thermodynamically stable compound that is less volatile and soluble. This is typically done through one of the following four principal stabilisation methods: with sulphur (forming HgS) or selenium (forming HgSe); as HgS in a polymer matrix; as an amalgam; or in an insoluble matrix (such as cement, phosphate ceramic, or magnesia binder).[53][53] In the second it can be permanently stored, typically after having been solidified and usually deep underground.[54][54] Where capacity exists, costs for stabilisation before final disposal range widely from USD 30/ tonne to USD 4,000 tonne.[55][55] Long term storage costs are in the range of USD 750/ tonne.[56][56] There is currently no installed capacity in Mexico to stabilise mercury. As part of the PPG, a Terms of Reference and preliminary costing were conducted (Appendix 13) for the stabilisation and final disposal of 100 tonnes of elemental mercury. The envisaged process would involve the installation of a stabilisation plant at the Coatzacoalcos site and the construction of a final repository in-situ in line with Basel and Minamata Convention provisions. The total the process was estimated to cost in the range of USD 4 million, or USD 40,000/ tonne.

Plant decommissioning also involves extensive site characterization, decontamination and remediation. In 2009 the European trade group Euro Chlor developed the *?Guideline for decommissioning of Mercury Chlor-Alkali Plants?* which includes a range of considerations for decommissioning plants and which is available on the Global Mercury Partnership website.[57][57].

1.4.2 Contaminated sites management

Once sites have been decommissioned the land on which they sit requires attention. The majority of mercury cells in the chloralkali sector were built before 1970, and while they have gone through continuous improvements in many cases, they have universally emitted mercury during operation.[58][58] The 11 WCC facilities still operating in 2020 reported annual environmental emissions totalling 2,667 kg Hg, for instance.[59][59] Once in the environment mercury can be highly mobile, migrating over long distances. However that mobility is highly dependent on local environmental factors. Indeed, absent intervention residual mercury can remain at chlor-alkali sites for extended periods.[60][60] The Euro Chlor guidance referred to above provides information on remedial considerations at these sites. Similarly, the UNEP ?*Guidance on the Management of Contaminated Sites?* developed for the Minamata Convention contains step by step instruction for remediation design and execution at mercury contaminated sites.[61][61]

1.5 Financial implications of conversion to membrane cells

There has been significant progress in the phase out of mercury cells in the chloralkali sector. The membership of the trade group the World Chlorine Council represents 90 % of global production. Within their membership, the number of facilities employing mercury cell technology decreased 88 % from 2002?2020, from 91 pants to 11. Three of the remaining plants are in Russia, while the balance is in the Americas. The IQUISA Coatzacoalcos plant in the last such facility remaining in Mexico.[62][62]

The steep and rapid decline in the number of mercury cells globally has occurred in the context of vastly increased chlorine manufacturing capacity. In 2001, global chlorine production capacity was 46.7 million tonnes.[63][63] This reached 58 million tonnes by 2010 and was more than 89 million tonnes by 2020.[64][64] Moreover conversions to mercury-free technologies were almost wholly the result of voluntary commitments on the part of industry rather than a response to government regulation. This indicates that the change has been driven at least in part by market forces ? including those related to energy prices, increased demand and access to finance ? as well as desire on the part of industry to be responsible stewards of the environment.

Analyses have been conducted in Europe and US on the costs associated with transition from mercury to membrane cell technology. A 2012 report by UNEP identified four components of a conversion: replacing mercury cells and adapting the building (where feasible); replacing or adapting electrical transformers/ rectifiers; adding secondary brine purification and filtration units to produce the higher quality brine required by membrane plants; adding a caustic soda concentration unit. Together the costs associated with these steps have been found to be in the range of USD 500?700 per ECU (tonne of chlorine capacity production; 2008 USD) for European facilities.[65][65] A 2010 USEPA analysis found a similar, albeit broader, range of USD 240?850/ ECU with an average cost of USD 535/ ECU (in 2007 USD). The analysis relied on data from 15 plant conversions, including 4 from the US, 9 from Europe and 1 from Asia. The cost of each conversion ranged from USD 13?171 million with a median cost of USD 71 million.[66][66]

Capital costs associated with conversions are typically recovered through increased capacity and through savings on various operational costs. With regard to capacity, the USEPA study noted above found that because membrane cells require a smaller physical footprint, some producers opted to increase capacity during conversions, thus offsetting some upfront expenditures. With regard to operational costs, savings include those related to regulatory compliance, energy savings from more efficient membrane cells, and the impact of investment depreciation on corporate tax. The 2010 USEPA study found that regulatory costs associated with mercury management ranged from USD 2.20/ ECU in Europe to 4.81/ ECU in the US (2007 USD). Adjusted for inflation, this would amount to present day annual savings of USD 362,500 in Europe to USD 793,750 in the US for a 125,000 ECU plant (the average size in the US study) after conversion.[67][67]

Mercury cell technology is much more energy intensive than membrane cell technology. This is important as these expenses can comprise upwards of 44 % of operational costs at mercury cell plants.[68][68] The 2010 USEPA study noted that each ECU produced by a membrane cell plant used 2,500 kWh of electricity versus 3,230 kWh/ ECU for a mercury cell plant, representing a savings of 730 kWh/ ECU, or 22.6 %.[69][69] A separate analysis by the European Commission found a similar average energy savings (23.5 %) with a broad range between individual plants. The most energy intensive mercury cell plant in their study used a whopping 4,400 kWh/ ECU while the most energy efficient membrane cell plant used only 2,279 kWh/ ECU, or 48 % less power.[70][70] Importantly these values include consideration of additional steam generation required by membrane cells to further refine caustic soda (membrane cells produce a slightly lower grade caustic soda compared to mercury cells).

In the USEPA study a 730 kWh/ ECU differential in energy demand was observed between membrane cells and mercury cells. Thus in a 125,000 ECU facility, this would amount to 91,250,000 kWh (91,250 MWh) in annual energy savings following a conversion to membrane cells. In the same study, the cost per kWh ranged from USD 0.0390?0.0577 (2007 USD) depending on geography. In present day dollars this would mean an annual savings of USD 3.5?5.2 million for a 125,000 ECU plant.[71][71] Of note a separate analysis by UNEP of European facilities used an average energy cost of USD 0.063/ kWh, indicating that the costs would be comparable to the US.[72][72]

The 2012 UNEP study identifies a final cost consideration ? that of the effect of corporate tax on investment recovery. This acts both as a cost ? decreased expenses on energy and regulation result in increased taxable income ? as a well as a source of significant savings ? through the annual depreciation of the investment cost for conversion. With regard to increased taxes, the UNEP study estimates that before tax income from a membrane cell plant can be as much as four times greater than that derived from one using mercury cells. Accordingly this increased income would result in a commensurate four-fold increase in taxation.[73][73]

With regard to depreciation the UNEP analysis assumes that the entire value of the investment will depreciate to zero over a 10-year period. This depreciation would result in a reduction in corporate tax equal to the annual depreciation amount multiplied by the corporate tax rate. UNEP assumes a linear 10-year depreciation and a corporate tax rate of 30 % (coincidentally equal to Mexico?s corporate tax rate).[74][74] As noted above, the average cost of conversion in the USEPA study was USD 535/ ECU, or USD 705 in present day dollars. Thus the expected cost of conversion of a 125,000 ECU facility would be USD 88 million. Using UNEP?s assumptions (30 % tax rate, 10-year linear depreciation) results in an annual tax reduction of USD 2.6 million, or USD 26 million over 10 years.

Table 2 summarizes the costs and savings identified in this section for illustration purposes. Importantly the table is not comprehensive; additional savings in variable costs and maintenance are not included nor are any additional expenses such as raw materials. The estimated total savings could therefore be considered conservative and the table considered an indicative rather than a definitive outline of applicable costs.

Parameter	**Unit**	**Unit Cost (USD)***	**Subtotal (USD)**	**Expense over 15 years (USD)**	**Savings after 15 years (USD)**
capital costs?	125,000 ECU	316?1,121/ ECU	39.5?140 million	39.5?140 million	
regulatory costs savgings?	125,000 ECU	2.20?4.81/ ECU	275,000?600,000		4?9 million
energy costs savings?	730 kWh/ ECU @ 125,000 ECU	0.05146?0.07622/ kWh	4.7?7 million		70.5?105 million
corporate tax (@ 30 %)?	5.25 million increase in pre-tax income**	--	1.59 million**	23.85 million	
depreciation (10 year linear)?	39.5?140 million	--	--		11.85?42 million

Total		**63.35?163.85 million**	**86.35?156 million**

Table 2: Indicative list of select items affecting investment recovery chloralkali conversion to membrane technology over a 15-year period

? USEPA, ?Regulatory Impact Analysis: Proposed National Emission Standards for Hazardous Air Pollutants (NESHAP) for Mercury Emissions from Mercury Cell Chloralkali Plants? (n 53).

? UNEP, ?Conversion from Mercury to Alternative Technology in the Chlor-Alkali Industry UNEP Global Mercury Partnership Chlor-Alkali Area?

*adjusted to present day dollars

**UNEP point estimates scaled to 125,000 ECU facility and adjusted to present day dollars

1.6 Root Causes and Barriers to be Addressed

The root cause of the hesitancy to transition away from mercury cells is a lack of transparent data on the size and scope of the environmental liability. This knowledge gap exists because of insufficient technical capacity to assess the liability and an absence of clear regulatory guidance on how to manage it. Together these amount to a financial risk of unknown quantity. Investors are therefore reluctant to fund the significant upfront costs associated with conversion.

The Project Information Form identified several barriers inhibiting facility conversions. They were confirmed during the PPG and are presented below.

? *Lack of financing*

Conversions to membrane cell technology from mercury cells require large amounts of upfront capital. Very little of the existing infrastructure is immediately reusable, meaning that companies are essentially financing the construction of new plants. In addition there are significant costs associated with the environmental liability of old mercury cells. These include those related to the stabilization of the mercury onsite, decontamination of the facility and remediation of residual contamination in area soils and other media. Remediation costs pose a unique challenge when the extent of contamination ? and thus the cost of the liability ? is unknown. As noted above past conversions have consistently rewarded investors; the sticker price however acts as a substantial barrier.

? *Lack of technical capacity*

There is limited technical capacity in Mexico to manage the environmental liability associated with decommissioned plants. This lack of capacity relates to all aspects of the conversion, including decontamination, remediation and stabilisation of mercury from the cells. The general outlines of an adequate regulatory regime are in place with regard to mercury wastes and some of the required infrastructure exists. However the technical capacity to comply with these regulations and utilize the existing infrastructure for mercury is insufficient. For example, there is not currently a facility in Mexico capable of stabilizing the 150 tonnes of mercury present at the IQUISA Coatzacoalcos plant, despite stabilization being required by Mexican law and despite the existence of at least two hazardous waste landfills capable of accepting stabilised mercury wastes.[75][75] With regard to environmental remediation, there is a robust private environmental consulting sector with expertise and analytical capacity. However these firms have almost wholly developed around managing contamination associated with the hydrocarbon sector and are relative newcomers to managing mercury wastes. This lack of capacity does not indicate a lack of mercury hazards in Mexico. To the contrary Mexico is a major (informal) producer and user of mercury. Thus any nascent technical capacity supported as part of a project could be applied elsewhere, particularly in the context of improved management encouraged by the Minamata Convention.

? *Inadequate regulatory framework*

The broad outlines of an adequate regulatory regime on mercury use and disposal are in place in Mexico. However the regime lacks sufficient specificity, particularly with regard to the chloralkali sector. This lack of specificity potentially results in confusion and occasional disagreement on the part of industry, regulators and private sector environmental experts. There is a need to provide clear regulatory guidance based on best international practice. For example, the Official Mexican Norm NOM-052-SEMARNAT-2005, which establishes the characteristics, identification procedure, classification and the lists of hazardous wastes, requires an update of the maximum permissible limits of mercury in waste in accordance with recent guidelines of the Minamata Convention.

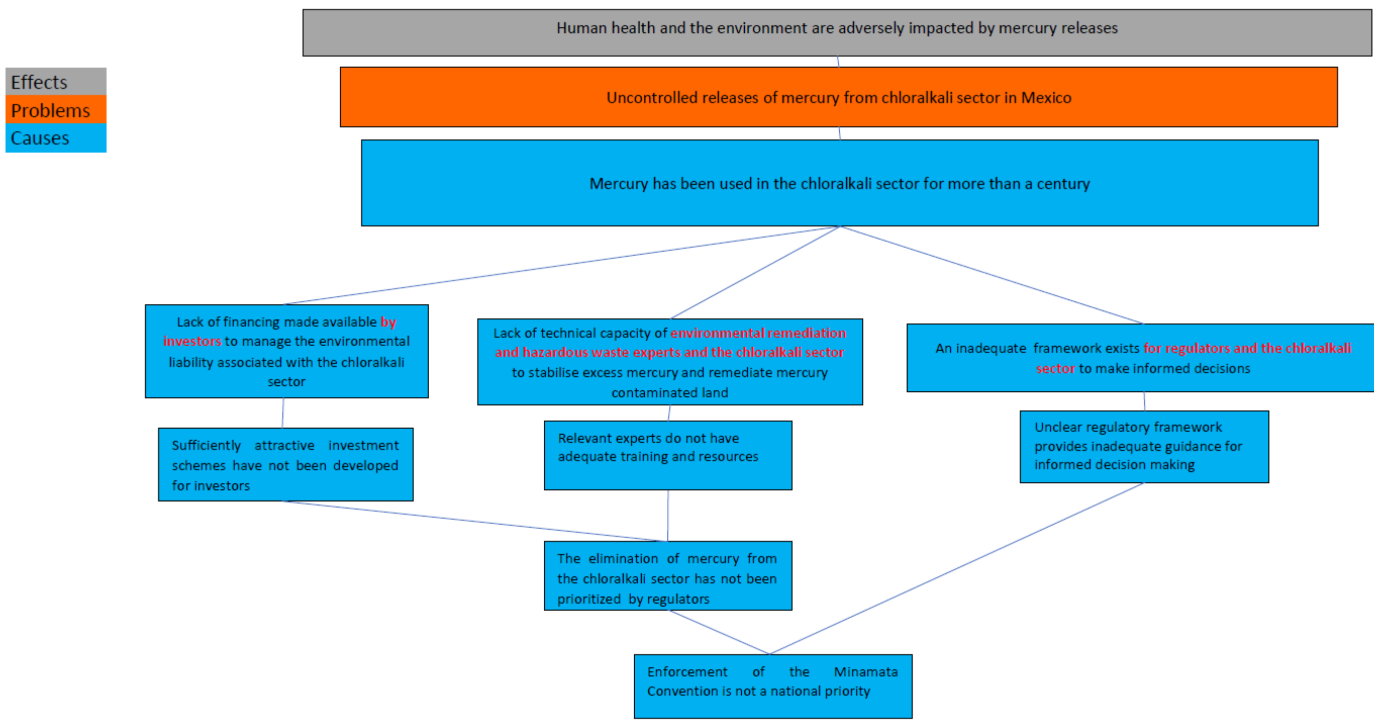


Fig. 2. Problem Tree

1a.2 the baseline scenario and any associated baseline projects;

2.1 Geographic context

2.1.1 Mexico

The United Mexican States (herein Mexico) is a large upper middle-income North American country of more than 125 million people with a per capita GDP at PPP of around USD 17,000. It is located south of the United States and north of Belize and Guatemala; bordered to the east by the Gulf of Mexico and the Atlantic Ocean and to the west by the Pacific. The country is a federal presidential constitutional republic that gained its independence from Spain in 1810 and whose current constitution has been in place since 1917. The Mexican economy grew at a moderate rate of 2 % per year over the past two decades before contracting dramatically (8 %) as a result of the pandemic in 2020.[76][76] It is expected to make a partial recovery in 2021 with GDP growth of > 6 %.[77][77]

Mexico is an OECD member with a heterogeneous economy. Owing largely to the North American Free Trade Agreement, the share of Mexico?s GDP comprised of manufacturing increased from 19 % to 38 % in the period 1990?2017. Mexico?s largest trading partner is by far the US, accounting for more than three quarters of the country?s exports and 94 % of its remittances. Remittances ? which totalled USD 33 billion in 2018 ? are comparable in size to agriculture with each contributing about 3 % of GDP.[78][78] Tourism is also a major of the economy, making up about 8.5 %.[79][79] Like much of the Latin American region, a large percentage of total employment (> 53 %) is in the informal sector.[80][80]

Ranked by UNDP?s Human Development Index (HDI) ? a composite of three metrics measuring a long and healthy life, knowledge and a decent standard of living ? Mexico is 74th in the world, of 189 countries evaluated.[81][81] Income inequality in Mexico is very high (and 129th out of 153 of countries in the world by Gini coefficient) with nearly 42 % of its population below national poverty lines.[82][82]

Women make up only 51 % of Mexico?s population and > 48 % of parliamentary seats.[83][83] For context, Mexico is 5th of 188 countries listed by the Inter-Parliamentary Union by women in parliament, with a higher percentage than all countries except Rwanda, Cuba, the UAE and New Zealand.[84][84] Mexico has a gross enrolment rate for women in tertiary education of 42 % meaning that this percentage of women aged 18?22 are enrolled in university in any given year. This exceeds the rate for men; only 40 % of whom are enrolled.[85][85] Ranked by UNDP?s Gender Development Index (GDI; the ratio of female to male HDIs) Mexico is 90th of 167 measured.[86][86]

2.1.2 Nuevo Le?n

Nuevo Le?n is a mountainous northern Mexican state that borders the states of Coahuila, San Luis Potosi, Tamaulipas and Zacatecas. It also shares a small but important section of its northern border with the US; 10 km west of the American city Laredo, Texas. Nuevo Le?n has the third largest GDP of all Mexican states, after Mexico City and the state of Mexico, and the seventh largest population (5.7 m).[87][87] Ranked by subnational HDI, Nuevo Le?n is 3rd of 32 states.[88][88] The economy of Nuevo Le?n is dominated by manufacturing, which comprised 47 % of the state?s income and 30 % of its employment in 2019. The largest driver of Nuevo Le?n?s manufacturing is the ?*maquiladoras? sector ?* assembly plants developed for export to the US ? many of which are situated near its capital city of Monterrey. The state sold more than USD 30 billion worth of goods and services to the US in 2019, by far its largest trading partner.[89][89] Nuevo Le?n received more foreign direct investment (FDI) than any other state besides Mexico City in 2019, receiving > USD 3 billion with > USD 1.2 billion coming from the US.[90][90] The state experiences relatively low levels of poverty, with 17.5 % living in moderate poverty and 1.4 % living in extreme poverty in 2015, the most recent year for which data were available.[91][91] The state fairs less well with regard to gender equality, ranking 24th of 32 states in GDI.[92][92]

Monterrey has just over a million residents, comprising more than 20 % of Nuevo Le?n?s population. The city, like much of Mexico is experiencing a demographic transition, characterized by a drop in the birth and death rates. About 30 % of the population in Monterrey is aged 15 to 29 years, followed by 0- to 14-year-olds who make 23 % of the population.

About 52 % of adults are economically active (i.e. employed), including 63 % of males and 37 % of females. The 47.4 % that is the non-economically active is made up of people working domestically, students, retirees or traditionally unemployed. About 44 % of the population of Monterrey have completed primary education, 33 % have secondary degrees, 21 % have tertiary degrees and 2.4% have no formal schooling.[93][93]

2.1.3 Veracruz

Veracruz de Ignacio de la Llave (herein Veracruz) is southern coastal state along the Gulf of Mexico with a population of 9 million people. Like Nuevo Le?n, it also has a large GDP for Mexico, ranking 6th among 32 states in 2019.[94][94] It does not however enjoy a comparable quality of life; ranked by HDI Veracruz is 23rd of 32 states.[95][95] The state?s economy is highly reliant on manufacturing which comprises 38 % of income and 14 % of employment.[96][96] Mexico?s first (Coatzacoalcos), second (Veracruz) and fourth (Tuxpan) busiest ports by tonnage in 2020 were located in the state. This is explained in part by the large petroleum refineries there; petroleum shipments comprised 50 % of tonnage in Veracruz ports in 2020.[97][97] Like Nuevo Le?n, Veracruz?s largest international trading partner is the US, to whom it sells ~USD 500 million a year in goods and services. In 2015, the most recent year for which data were available, 13 % of Veracruz?s residents live in extreme poverty and 44 % live in moderate poverty.[98][98] With regard to gender parity, the state ranks 28th of 32 in GDI.[99][99]

About 52 % of the population of both Veracruz and Coatzacoalcos are female. Coatzacoalcos is a demographically young city; the median age of its 275,000 people is 28. The city is heavily reliant on industry associated with the port an experienced an annual economic growth rate of around 1 %. Fifty-two percent of population above 12 years of age is economically active (i.e. employed), including 70 % of males above age 12 and 36 % of females. Twenty-five percent of the population identifies as indigenous and 2.5 % speak an indigenous language at home.[100][100]

2.2 The CYDSA Group

2.2.1 Background

The CYDSA company was founded in Monterrey in 1945 as a manufacturer of rayon fibre. It shortly diversified into various product lines including cellulose film and synthetic silk. At present the group provides a range of goods and services for industrial and commercial applications through its five subsidiaries. These include table salt, refrigerants, propellants, power generation, hydrocarbon storage and chloralkali production.

CYDSA?s first chloralkali plant was established in a Monterrey industrial park (Ruiz Cortines Industrial Complex) in 1958 and relied on mercury cell technology. The plant had an installed capacity of 22,000 ECU and used 51 tonnes of mercury. A decade later (in 1967) CYDSA developed a second plant in the coastal city of Coatzacoalcos and established a subsidiary to manage its chloralkali production at both locations (*Industria Qu?mica del Istmo;* IQUISA).

The Coatzacoalcos plant was vastly larger than the Monterrey site, initially containing 105 tonnes of mercury in its cells. Over the next fifty years that quantity would expand to 160 tonnes representing an installed capacity of 92,000 ECU (though presently operating with ~150 tonnes). It is currently the second largest chloralkali facility in Mexico after a diaphragm plant operated by Mexichem S.A. de C.V. with an annual capacity of 260,000 ECU and also located in Coatzacoalcos. It is also the only chloralkali plant in Mexico using mercury cells. IQUISA owns and operates a third plant located in Mexico City (Santa Clara) which it acquired from Mexichem in 2010. The Santa Clara plant has an installed capacity of 40,000 tonnes of chlorine per year and relies on membrane cell technology.[101][101]

2.2.2 Plant Conversions

Concurrent with Mexico?s signing of the Minamata Convention in 2013, IQUISA began the construction of a new membrane cell plant in the municipality of Garcia, 15 km from the Monterrey site. Construction of the 60,000 ECU plant was financed through the issuance of USD 120 million in bonds on global stock markets that are set to mature in 2027. The new plant came online in 2016 ? at which point IQUISA ceased operations at the Monterrey mercury cell facility and transferred the 51 tonnes of mercury in its cells to the Coatzacoalcos plant. Consistent with experience elsewhere, the Garcia cells are nearly 30 % more energy efficient than those in Monterrey. Table 3 presents data provided by IQUISA on energy demand. Actual data from the Hg cells in Monterrey and the membrane cells are provided. Counterfactual data are provided for the purpose of modelling what costs might be at both sites if an alternative technology were used.

Items	Former Monterrey Plant, Actual (Hg)	Former Monterrey Plant, Counterfactual (membrane)	Current Garcia Plant, Counterfactual (Hg)	Current Garcia Plant, Actual (membrane)
Mercury cells (@3,500 kWh/ ECU)	77,000,000	--	217,000,000	--
Membrane cells (@2,500 kWh/ ECU)	--	55,000,000	--	155,000,000
Plant capacity (ECU)	22,000	22,000	62,000	62,000
Energy cost (USD)	0.065	0.065	0.065	0.065
Annual total costs (USD)	5,005,000	3,575,000	14,105,000	10,075,000
Annual total savings (USD)		**1,430,000**		**4,030,000**

Table 3: Actual and counterfactual energy demand at the Monterrey and Garcia Chloralkali Plants

In advance of the current project CYDSA has secured financing for and begun construction of a membrane plant at the Coatzacoalcos site. The total investment required is estimated to be USD 120 million, which CYDSA has self-financed through the sale of bonds on international stock exchanges. The initial annual capacity of the plant will be in 100,000 tonnes of chlorine which IQUISA intends to increase to 150,000 tonnes in the near future. Based on this increased capacity and additional savings attributable primarily to reduced energy demand, IQUISA calculates a repayment period of less than 6 years. Construction of the plant foundation began in January 2021 (Figure 3) and is expected to be completed in mid-2024. The new plant has been designed jointly with the Chinese firm Bluestar (Beijing) Chemical Machinery Company, Ltd.[102][102]

The mercury cell plant in Coatzacoalcos will be decommissioned once the membrane plant is in operation in 2024. Of the 150 tonnes Hg present in the cells, 100 will be stabilised and permanently disposed of as part of project. The balance will be transferred to other operating mercury cell chloralkali plants in the region, an allowable use under the Convention (non excess mercury). This could include facilities in Argentina or Peru, as both countries have exemptions on mercury use in chloralkali production until 2030 under the Convention.[103][103]

Figure 3: Overhead view of Coatzacoalcos plant construction, September 2021

IQUISA has evaluated multiple environmental and social benefits that will result from the conversion in Coatzacoalcos. The most obvious of these is the complete elimination of mercury and subsequent releases from the operation. A second major benefit is the estimated 24.4 % decrease in electrical demand that will result from the more modern membrane facility. IQUISA has calculated that this decreased demand will lower annual $C0_2$ emissions by 43,186 tonnes. Finally, the plant construction will directly employ ~1,500 workers and support an additional ~3,000 indirectly. Once constructed, it will continue to employ ~257 workers directly and 500 indirectly, which is commensurate with current levels.[104][104]

IQUISA has made a number of substantial investments in environmental control of pollutant emissions. The table below was provided by the company and lists measures currently in place at the Coatzacoalcos plant to control emissions.

Release	**Target**	**Control and mitigation measures**	**Comments**
Water	Wastewater from the cell area	Mercury removal and effluent treatment plant; water recycling	Regulatory compliance
Air	Cell area emissions; hydrogen	Hermetic cell inlet/ outlet boxes; Cooling and condensation	Regulatory compliance
Products	Chlorine, caustic, KOH, sodium hypochlorite, hydrochloric acid	Chlorine purification process; cooling and filtering	Products certified by NSF International for use in the treatment of water for human consumption
Industrial waste	Brine sludge; soda filtration sludge	Disposition to controlled confinements	Regulatory compliance
General waste	Packaging, safety equipment, miscellaneous materials	Disposition to controlled confinements	Regulatory compliance
Soil	Cell area spills	Recovery traps and pits; remediation and confinement	Regulatory compliance

2.2.3 Environmental Contamination

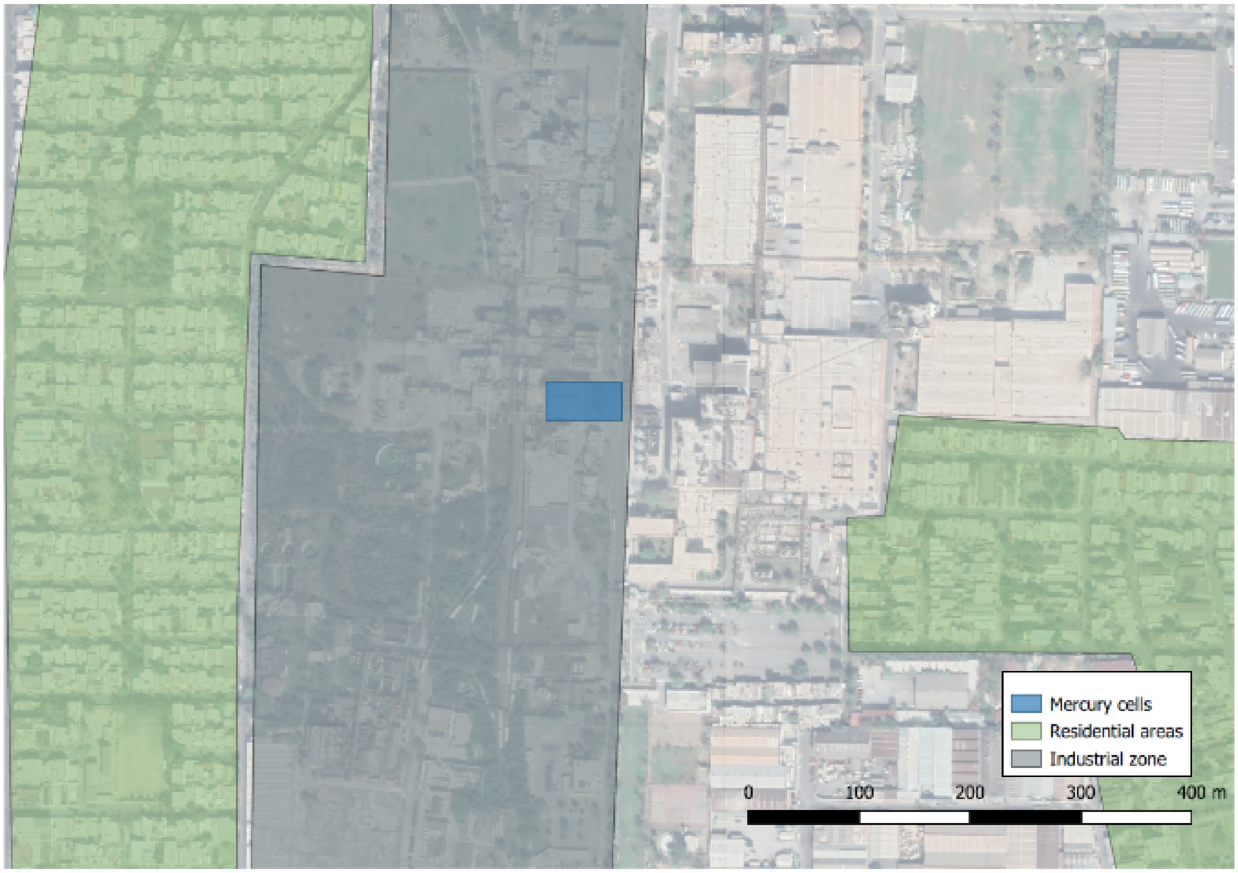


Figure 4: Proximity of former Monterrey site to residential areas

Both the Monterrey and Coatzacoalcos sites were initially located in industrial areas away from human settlements. This is still the case in Coatzacoalcos, where the nearest residential area (5 de febrero) is 1.5 km south of the southern edge the chloralkali plant. In Monterrey however several residential areas developed and expanded around the site in the second half of the 20th century. These include the communities of Hidalgo, Estrella, Pedro Lozano, Garza Nieto, Popular and Fraccionamiento Bernardo Reyes. This is relevant because mercury cell chloralkali plants regularly release mercury to the environment. Thus the proximity of these sites to the abandoned plant has implications for human health (see Figure 4).

The Coatzacoalcos site is located 2.75 km due east of the Coatzacoalcos River and 2 km south of the ?Pajaritos Lake,? which forms the majority of the port of Coatzacoalcos and which is another 4 km south of the Gulf of Mexico. Academic studies carried out of sediment and biota in the river have found elevated concentrations of mercury. Ruelas-Inzunza, et al (2008) identified average Hg muscle concentrations ranging from 0.02 ?g/g in Oreochromis sp (Tilapia) to 0.871 ?g/g in Centropomus viridis (white snook).[105][105] As context the average Hg muscle concentration of Tilapia monitored by the US Food and Drug Administration between 1990?2012 was 0.013 ?g/g, or about 2.5 less that identified here.[106][106] A separate 2013 review of studies of Mexican coastal sediment concentrations found those in Coatzacoalcos to be generally higher than other states studied (Baja California, Campeche, Colima, Sonora, Tabasco, Veracruz) with the exception of a single port in Baja California (Port of Ensenada).[107][107]

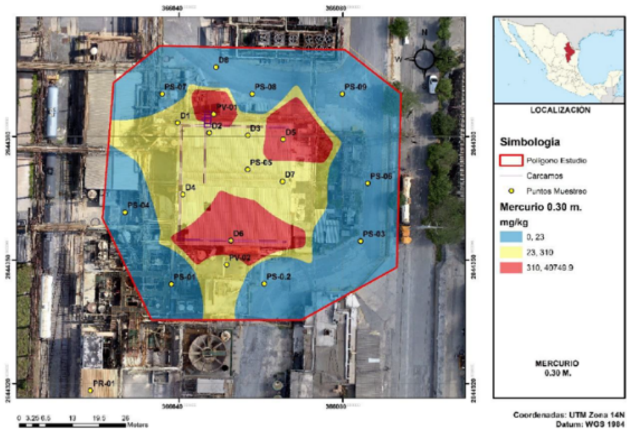
Neither the Monterrey nor Coatzacoalcos chloralkali plants had been subject to extensive environmental assessment prior to the present project. A 2014 environmental assessment by the Mexican firm Corporativo de Tecnolog?a e Investigaci?n Ambiental (C-TIA) completed a preliminary Phase II assessment of the Monterrey industrial park where the former IQUISA plant sits. As part of the study 151 samples were taken and analysed finding elevated levels of mercury.

As part of the PPG baseline remedial investigations were conducted at both sites by the Mexican NGO *Instituto para la Protecci?n Ambiental de Nuevo Le?n*. In addition air monitoring of both sites was conducted by the Mexican government agency *Instituto Nacional de Ecolog?a y Cambio Clim?tico*. These reports are attached as Appendix 12 and summarized below.

2.2.3.1 IQUISA Monterrey Baseline Remedial Investigations

An assessment of soil, dust and water metal and metalloid concentrations was carried out at the IQUISA Monterrey plant from June to July 2021 in accordance with Mexican regulations NOM-147-SEMARNAT/SSA1-2004 and NMX-AA-132-SCFI-2006. In advance of assessment activity and worker health and safety training was carried out for site investigators. Adequate PPE was confirmed was assured by the project manager.

The assessment which focused on the ~4,000 m2 area in which the former mercury cells were located included a review of relevant climatic and geological conditions and basic historical information about the site. In addition a topographical assessment was carried out using a Sokkia Set 630 RK-3 total station and assisted by drone photography. Subsurface geophysical characteristics were assessed in-situ using Electrical Resistivity Tomography.



Figures 5 and 6: Map of soil mercury concentrations at 0.6 m depth at former Monterrey site. View of the interior of the plant, July 2021.

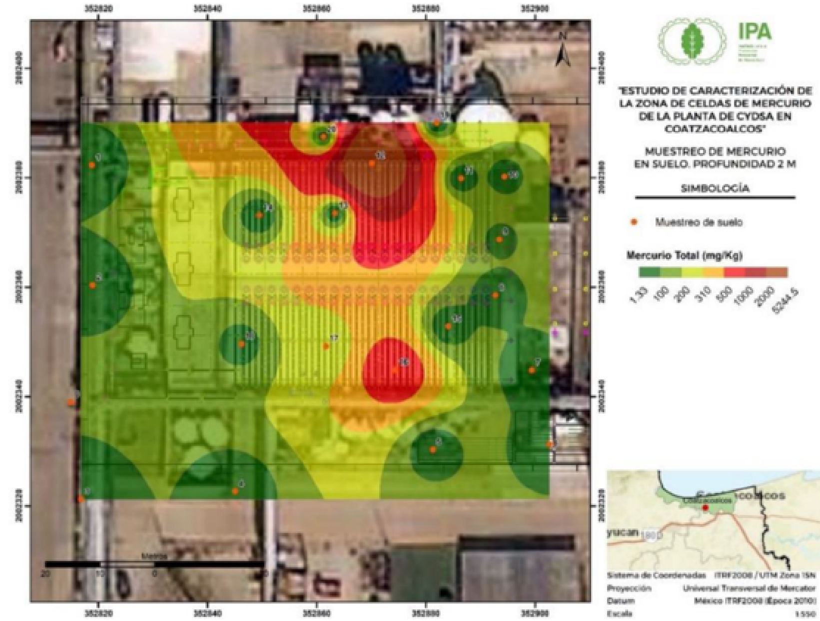
Altogether, 65 soil samples were collected at different depths ranging from 0.3 m to 1.2 m using both mechanical and manual augers. Samples were georeferenced, labelled, and kept at 4 degrees centigrade during transport to the laboratory. Analysis was conducted by Atomic Absorption Spectrometry (Analyst 100 Atomic Absorption Spectrometer, Perkin Elmer) in accordance with USEPA 3052 by *Laboratorios y Suministros Ambientales e Industriales, S.A. de C.V.* The laboratory is accredited by *Procuradur?a Federal de Protecci?n al Ambiente* (PROFEPA) with EMA No. R-054-029/14. Quality control was conducted against NIST SRM 1547 reference material.

In addition to soil samples 5 dust samples and 6 vegetation samples (6 leaves of ~10 grams reach) were collected in and analysed with ICP-MS.

Of the 65 soil samples assessed, 5 exceeded applicable standards (NOM-147-SEMARNAT/SSA1-2004) for mercury (Hg) while 60 were within maximum permissible limits for cadmium (Ca), mercury (Hg), nickel (Ni), silver (Ag), lead (Pb), thallium (Ta), barium (Ba), beryllium (Be), vanadium (V), arsenic (As), selenium (Se) and hexavalent chromium (Cr6). Mercury was detected in 59 of the soil samples with concentrations ranging from 0.23?40,749 mg/kg. Dust samples revealed Hg concentrations ranging from 46?51,160 mg/kg. In total the assessment calculates 508 m^3 of contaminated soil at the site requiring remediation Appendix 12 contains the complete results of the study. Figures 4 and 6 show a view of the interior the facility and soil mercury concentrations at 0.6 m.

2.2.3.2 IQUISA Coatzacoalcos Preliminary Environmental Assessment

An assessment of soil, dust, water and biota metal and metalloid concentrations was carried out at the IQUISA Coatzacoalcos plant from June to July 2021 in accordance with Mexican regulations NOM-147-SEMARNAT/SSA1-2004 and NMX-AA-132-SCFI-2016. The assessment included a review of relevant climatic and geological conditions and basic historical information about the site. In addition a topographical assessment was carried out.



Figures 7 and 8: Map of soil mercury concentrations at 2 m depth at Coatzacoalcos site. Sample collection, July 2021.

Altogether, 66 soil samples were collected at different depths ranging from 0.3 m to 2 m using both mechanical and manual augers. In the case of mechanical equipment, a Power Probe 9100-SK was used. Samples were georeferenced, labelled, and kept at 4 degrees centigrade during transport to the laboratory. Analysis was conducted by Graphite Flame Atomic Absorption Spectrometry (GFAAS; Analyst 100 Atomic Absorption Spectrometer, Perkin Elmer) in accordance with USEPA 3052 by *Laboratorios y Suministros Ambientales e Industriales, S.A. de C.V.* Quality control was conducted against NIST SRM 1547 reference material.

Four water samples were collected and analysed using in accordance with NMX-AA-054-SCFI-2001 using GFAAS. Ten different dust samples from various locations inside about outside the facility were also collected and analysed using by GFAAS after being processed with a MARS6 microwave digestion system. Quality control was conducted against NIST SRM 2710 reference material. Finally seven 300 g biota samples were taken from trees near the site. These were washed in the laboratory with water and various solutions before being dried and homogenized in a blender. The resulting dust was digested in the MARS6 and analysed in the GFAAS as for soil and dust samples.

Of the 66 soil samples assessed, all contained detectable levels of mercury ranging from 1.06?2,267 mg/ kg. All four water samples contained mercury with concentrations ranging from 0.02?3.75 mg/L, significantly above Mexican guidelines of 0.001 mg/L (NOM-127-SSA1-1994). All ten dust samples had elevated concentrations of mercury ranging from 14?275,618 mg/kg, though it should be noted that no Mexican standard for dust Hg concentrations exists for this context. All biota samples contained elevated mercury levels ranging from 0.74?24.15 mg/kg. In total the assessment calculates 5,287 tonnes of contaminated soil at eh site requiring remediation. Appendix 12 contains the complete results of the study. Figures 6 and 7 show a map of soil mercury concentrations at 2 m.

2.2.3.3 INECC measurements of mercury in air concentrations

To provide a more comprehensive assessment of environmental mercury concentrations, the *Instituto Nacional de Ecolog?a y Cambio Clim?tico* (INECC) carried out exploratory air monitoring at both sites utilizing a Lumex RA 915+. This instrument uses atomic absorption spectrometry and has a lower detection limit of 2 ng /m3 and a flow of 20 L/min. The study was carried out in August at both sites. The full study is attached as Appendix 12.

Monterrey

Ambient temperatures ranged from 23?36 degrees centigrade, indicating that recorded concentrations likely represent high end values. Thirty-six measurements were taken in the former mercury cell area. The average concentration of all 36 sample was 8,513 ng Hg/m3, with a maximum value recorded at 37,329 ng Hg/m3. Of these 32 of the 36 (89%) measurements exceeded the average annual exposure limits recommended by WHO of 1000 ng Hg/m3. Measurements were also taken in the surrounding residential areas, revealing a maximum concentration of 409 ng Hg/ m3.

Coatzacoalcos

Thirty-nine measurements were taken in and around the active cells at the site. The average concentration of all 39 sample was 4,305 ng Hg/m3, with a maximum value recorded at 42,790 ng Hg/ m3. Of the 39 points monitored, 72 % exceeded the average annual exposure limits recommended by the WHO of 1000 ng/m3. The average concentration identified in the cells area was 28,229 ng Hg/ m3, with a maximum value identified at 49,820 ng /m3. The highest concentration identified in a residential area was 291 ng Hg/m3.

2.3 Legal framework

Mexico is a federal presidential constitutional republic with a bicameral and representative congress comprised of upper and lower houses. Each of the 31 states and the autonomous entity of Mexico City has its own legislature and executive branch. Both the federal government and states are empowered by the constitution to make laws and decrees which are articulated through regulations. Laws and decrees can be created by either executive of legislative branches at the federal level and by legislatures at the state level. Regulations are created and enforced by the relevant executive branch. The framework is organized hierarchically, with the Constitution taking precedence over federal law which in turn takes precedence over state law.[108][108] As part of the PPG a review of relevant laws was undertaken. The results are presented below.

2.3.1 International Obligations

<u>Basel Convention on the Control of Transboundary Movements of Hazardous Wastes</u>

The Mexican President signed the Basil Convention on 22 March 1989, which was ratified by the Mexican Congress on 22 February 1991. The Convention obliges Mexico to a number of provisions related to the management of hazardous waste including those related to generation, disposal and transboundary movement. Mercury and mercury containing wastes as hazardous in Annexes 1 and 8 of the Convention.

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<u>Minamata Convention on Mercury</u>

The Mexican President signed the Minamata Convention on 10 October 2013, which was ratified by the Mexican Congress on 29 September 2015. Both decrees were recorded in the Official Gazette of the Federation.[109][109] Annex B of the Convention obliges Parties to phase-out chloralkali production by 2025. Further, subsection 5(b) of Article 3 obliges Parties to ?Take measures to ensure that, where the Party determines that excess mercury from the decommissioning of chlor-alkali facilities is available, such mercury is disposed of in accordance with the guidelines for environmentally sound management referred to in paragraph 3 (a) of Article 11, using operations that do not lead to recovery, recycling, reclamation, direct re-use or alternative uses.?

<u>Paris Agreement</u>

The Mexican President signed the Paris Agreement on 22 April 2016, which was ratified by the Mexican Congress on 21 September of the same year. Both decrees were recorded in the Official Gazette of the Federation.[110][110] The Agreement ?[?] aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty [?].?

2.3.2 Applicable Federal Laws

<u>Federal Labour Law</u>

The Federal Labour Law has several provisions relevant to the present project. These include protection of the health and safety of contractors (Article 15-C) as well as employees at industrial estates as noted in Article 132 paragraph 16, which obliges employers to install and operate places of work in a manner consistent with regulations on ?[?] safety, health and the work environment in order to prevent accidents and occupational diseases.?[111][111]

<u>General Law of Ecological Balance and Protection of the Environment</u>

The General Law of Ecological Equilibrium and Environmental Protection, passed in 1988, is Mexico?s foundational environmental law. It contains a number of provisions relevant to the project including those regarding atmospheric pollution (Chapter 2), releases to water and aquatic environments (Chapter 3) and soil (Chapter 5).[112][112]

<u>General Law for the Prevention and Management of Wastes</u>

This law considers the comprehensive management of solid waste ? including hazardous waste ? and contains provision for the prevention and management of contaminated sites. Chapter 5 of the law includes provisions consistent with the polluter pays principle. [113][113]

2.3.3 Applicable Federal Regulations

The table below summarizes regulations (*Normas Oficiales Mexicanas*), voluntary standards (*Normas Estandares Nacionales ? Normas Mexicanas*) and declarations identified as part of the PPG. The table was adapted from the 2013 UNEP report ?Storage and Disposal of Mercury in Mexico? based on data collected by the Minamata Initial Assessment for Mexico and independent review.[114][114]

Regulation, Standard or Declaration	**Description Date of publication**	**Date of publication**
NOM-001-SEMARNAT -1996	Establishes maximum permissible limits for pollutants in discharges to water	23 April 2003
NOM-043-SEMARNAT-1993	Establishes maximum permissible atmospheric particle emissions from stationary sources	23 April 2003
NOM-052-SEMARNAT-2005	Sets the features, the procedure of identification, classification, and the listings of the hazardous waste	23 June 2006
NOM-053-SEMARNAT 1993	Establishes the procedure to carry out the extraction test to determine the constituents of hazardous waste	23 April 2003
NOM-055-SEMARNAT2003	Establishes the requirements that must be met by the sites that will be used for a controlled containment of hazardous waste previously stabilized	3 November 2004
NOM-056-ECOL-1993	Establishes the requirements for the design and construction of the complementary works of a controlled containment of hazardous waste	22 October 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	22 October 1993
NOM-058-ECOL-1993	Establishes the requirements for the operation of a controlled containment of hazardous waste	22 October 1993
NOM-083-SEMARNAT-2003	Environmental protection specifications for the site selection, design, construction, operation, monitoring, closure and complementary works for the final disposal of urban solid waste and special management.	20 October 2004
NOM-145-SEMARNAT-2003	Containment of waste in cavities created by salt dissolution in domes geologically stable.	27 August 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	2 March 2007
PROY-NOM-160-SEMARNAT-2011	Sets the elements and procedures for formulating plans for the management of hazardous wastes	15 October 2010
NOM-147-SEMARNAT/SSA1-2004	Establishes criteria for the characterization and determination of remediation concentrations of soils contaminated with arsenic, barium, beryllium, cadmium, hexavalent chromium, mercury, nickel, silver, lead, selenium, thallium, vanadium and their inorganic compounds; as well as the remediation criteria.	2 March 2007
NOM-165-SEMARNAT-2013	Establishes the list of substances subject to reporting to the pollutant release and transfer registry.	24 January 2004
NMX-AA-132-SCFI-2006	Voluntary guidance on sampling for metal and metalloid identification and quantification, and sample handling	5 September 2006
Coatzacoalcos River Declaration	Defines maximum pollutant discharge limits for distinct areas of the Coatzacoalcos River	6 February 2008

Table 5. Relevant laws and regulations identified during the PPG

2.4 Associated Baseline Projects

2.4.1 GEF involvement in chloralkali

The GEF has not yet supported a project in this sector, however two recently approved GEF-supported, UNEP-implemented projects in Mexico are highly relevant. The first, ?Reducing global environmental risks through the monitoring and development of alternative livelihood for the primary mercury mining sector in Mexico? (GEF ID 10086) includes capacity building in risk assessment and management of mercury contaminated areas. The second ?Development of National Action Plan for the Artisanal and Small Scale Gold Mining in Mexico? (GEF ID 10422)? also includes related capacity building exercises. Both projects are being executed by INECC. This arrangement will facilitate knowledge sharing across projects. To the extent that analytical equipment or other infrastructure costs ? including human infrastructure ? are shared across projects there could exist potential cost savings.

2.4.2 UN involvement in chloralkali

The UNEP Global Mercury Partnership is a voluntary multi-stakeholder partnership that formed in 2005 with the purpose of addressing mercury emissions and their effect on human health and the environment. The partnership has eight priority areas that it has identified for action, one of which is the chloralkali sector. In the sector the partnership provides educational, financial and technical resources to promote alternative technologies. Research conducted or organized by the partnership has been utilized throughout this document.[115][115]

CYDSA participated in the 2016 Expert Group Meeting (EGM) organized by UNIDO and USEPA on the elimination of the use of mercury in chloralkali chemical processes. The objective of the meeting was to assess the sector in terms of location of the remaining chloralkali facilities, historical context regarding the development and adoption of technologies, and sharing conversion experiences. The meeting highlighted the importance of assisting low- and middle-income countries with technical and financial support to address conversion of existing facilities in a sound environmental manner. During the meeting CYDSA representatives stressed the challenges with financing costs associated with remedial activities. The present project was developed in part as an outcome of the EGM.

2.4.3 Sectorial coordination

CYDSA is a member of the trade group Latin American Chlorine, Alkali and Derivatives Industry Association (Clorosur). Clorosur represents the 13 major chloralkali producers and 12 associated non-producing companies in five Latin American countries. Clorosur is an important regional centre for the dissemination of best practices for the storage, handling, use and distribution of chlorine and derivatives. Clorosur held a special meeting on the Minamata Convention in September 2019 in San Paulo, Brazil which was attended by 40 different firms including CYDSA. The purpose of the meeting was to discuss phase out plans and approaches, technology transfer and financing alternatives. Two European mercury stabilisation firms attended the meeting.

CYDSA is a member of the WCC (World Chlorine Council), the largest association of chlorine producers in the world and partner group of Clorosur. WCC has a partnership in place with UNEP ?to promote and share best practices to reduce mercury use by and emissions from chloralkali manufacturing sites.? As a member of WCC, CYDSA complies with this obligation including regularly reporting of mercury inputs and released to UNEP. These data are made publicly available through the UNEP website.

Finally, IQUISA is a member of the Chlorine Institute, a North American technical trade group that includes as part of its objectives safe and ?environmentally compatible? chlorine production.

1a.3 the proposed alternative scenario with a brief description of expected outcomes and components of the project;

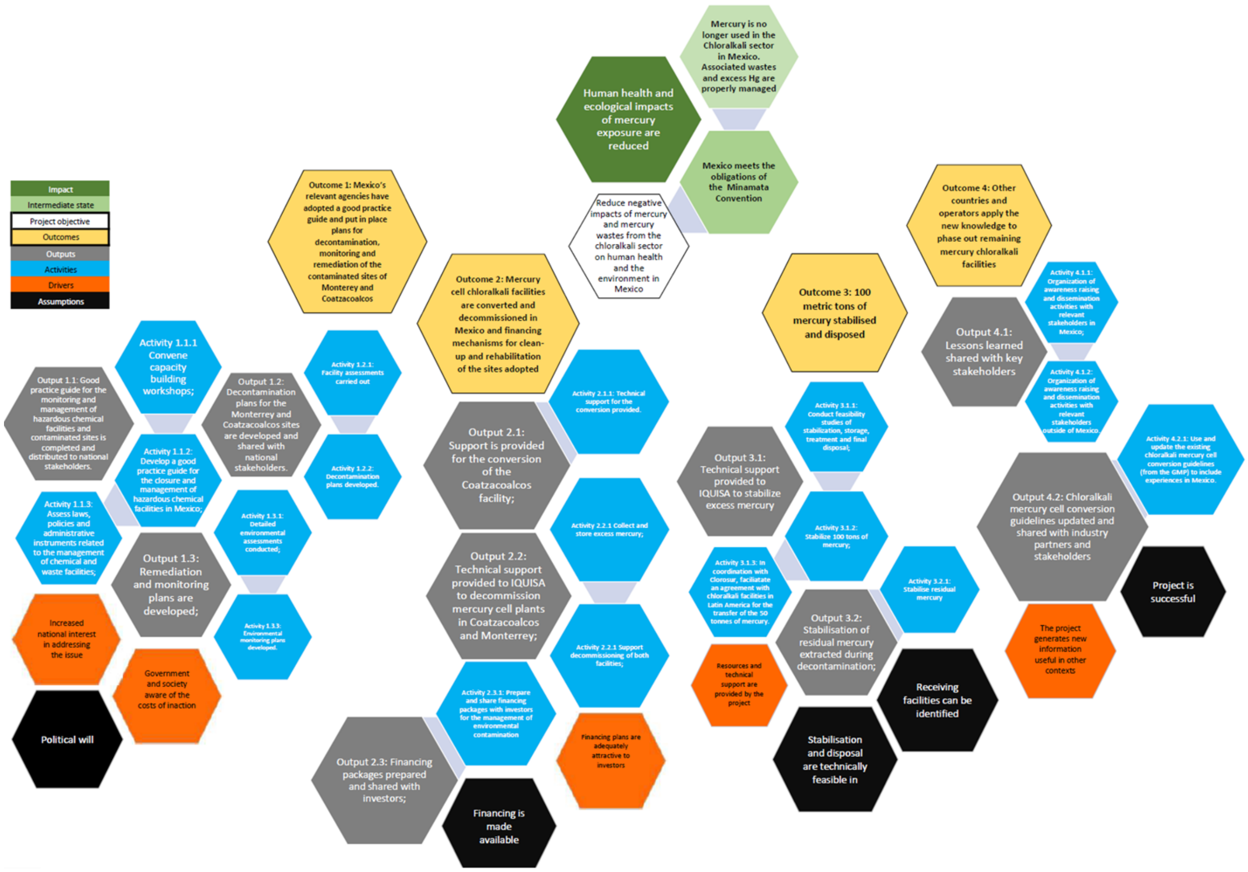

Figure 9: Theory of Change

The overall Objective of the project is to eliminate mercury use and adequately manage mercury and mercury wastes in the chloralkali sector in Mexico. As part of the baseline the following three major barriers to achieving this were identified:

? *Lack of financing;*

? *Lack of technical capacity;*

? *Inadequate regulatory framework;*

The alternative scenario presented below is comprised of four distinct Components and corresponding Outputs and Activities. This structure responds to the barriers listed above. The first Component addresses the capacity in Mexico to manage hazardous waste sites, including those contaminated with mercury. The Component considers both technical and regulatory capacity and includes both Mexican government agencies and the private sector. Specific Outputs include detailed assessment and remedial planning at the Coatzacoalcos and Monterrey sites, thus grounding an otherwise theoretical training program in practical application. Importantly, by targeting government agencies the Component supports adequate oversight of work carried out as part of Components 2 and 3, both of which are executed largely by the private sector.

A second Component supports the responsible closure of both sites and the appropriate construction of a new facility in Coatzacoalcos. In all cases the substantial physical works carried out as part of this Component will be financed entirely by other partners and will not utilize GEF resources. Thus project Outputs here relate to the provision of technical expertise and capacity building. Specifically, the project will assist in the decommissioning and remediation of the mercury cell chloralkali plants in both cities and the installation of a new membrane chloralkali plant in Coatzacoalcos. It will also include work with project partners to ensure adequate financing is acquired to manage residual contamination.

The current plant in Coatzacoalcos contains ~150 tonnes of liquid mercury in its cells. There are limited options for disposing of this mercury in method consistent with the Minamata Convention. One acceptable reuse of the material is to replace mercury used at other active chloralkali plants. The project therefore envisages an arrangement facilitated through the regional trade group Clorosur to use 50 tonnes of this material in other plants in the region. The balance (i.e. 100 tonnes) will be permanently disposed following stabilisation. Component 3 will support both of these actions through the provision of technical expertise and financing.

A fourth Component deals with Knowledge Management. There are a limited number of mercury cell chloralkali facilities remaining in the world. World Chlorine Council member countries have a total number of 11 facilities remaining. Eight of these facilities are in countries that are parties to the Minamata Convention, and all 8 are located in the Americas. Each of these countries are obligated to ensure the phaseout of their remaining mercury plants by 2025. This component will share lessons learned from the project with regulators and plant operators in these countries, as well as more broadly through the Global Mercury Partnership, Clorosur and WCC.

Component 1: Improve national capacity to manage chemical facilities and mercury contaminated sites

There is a lack of capacity in Mexico to adequately manage the legacy of hazardous waste sites contaminated with mercury. This lack of capacity relates to technical aspects such as assessment, remedial design and final disposal, as well as to oversight considerations such as legal and regulatory frameworks and their application. The project offers a unique opportunity to address this gap through capacity building and practical application. In this case, two extensively contaminated sites will be assessed and remedial plans developed. The overarching legal and regulatory frameworks will be reviewed in parallel. To ensure that remedial works are adequately monitored, plans will be developed.

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

As a basis for the practical measures to be carried out elsewhere in the project, Output 1.1 will develop a coherent and robust conceptual framework for the intervention. The activities are desk or classroom based and focus primarily on developing the capacity of government institutions. The Output includes capacity building workshops, legislative and regulatory review and the development of guidance documentation.

Activity 1.1.1 Convene capacity building workshops

At least four (4) national workshops will be held over the course of the project to ensure that relevant government institutions and private sector partners have adequate capacity to carry out the project in a manner consistent with best practice and the Convention. Two workshops will be held in the first year and will cover central elements of environmental assessment and remedial design including sampling and analysis techniques, conceptual site model development, occupational health and safety and assessment of remedial options. These workshops will also cover legislative and regulatory approaches to contaminated sites including accordance with the Convention. Participants will be drawn primarily from government institutions but will also include NGOs, academia, and private sector firms, among others. A preliminary workshop was organized during the PPG phase. Additional workshops will be held on a bi-annual basis for the remainder of the project to address any remaining knowledge gaps and to review lessons learned.

The workshops will rely in part on the use of international experts. Experts will be identified through established global networks such as the Global Mercury Partnership as well as regional groups such as the Latin American Network on Contaminated Sites (?*Relasc*?).

Activity 1.1.2: Develop a good practice guide for the closure and management of hazardous chemical facilities in Mexico with a specific chapter on mercury cell chloralkali sector

A desk study will be carried out by national and international consultants on the management of hazardous waste sites in Mexico and abroad. The review will consider practices implemented in disparate geographies and with differing levels of resource constraints. The study will also review current practice in Mexico and assess available technical, operational and financial resources for the management of hazardous waste sites. These reviews will form the basis of series of recommendations in the form of a good practice guide. The guide ? which will include a specific chapter on the mercury cell chloralkali plants ? will undergo peer review by experts in Mexico and abroad and will be prepared in years 1 and 2 of the project.

Activity 1.1.3: Assess laws, policies and administrative instruments related to the management of chemical and waste facilities, including requirements for collection, temporary storage, treatment, disposal and availability of storage facilities in Mexico

An extensive review of Mexico?s legal and regulatory environment related to hazardous waste sites will be conducted in years 1 and 2 of the project. The review will consider all major aspects of chemicals management from cradle-to-grave. To provide context, regulators in other countries will be interviewed and a review of their approach to chemicals management will be carried out. These ?international? reviews will not be exhaustive but will cover a range of economic and geographic settings; sufficient to ensure informed decisions are made in the Mexican context. The assessment will result in a compendium of suggested modifications to the existing legal and regulatory frameworks which will be disseminated among government agencies. At least (1) legal and regulatory workshop will be held to attain feedback from stakeholders.

Output 1.2: Decontamination plans for the Monterrey and Coatzacoalcos sites are developed and shared with national stakeholders

As part of the PPG, preliminary environmental assessments were carried out at both the Monterrey and Coatzacoalcos sites. The report on those assessments is attached as Appendix 12 and provides the major findings and preliminary assessment of remedial measures. The full project will build on these initial assessments by more comprehensively assessing the extent of contamination. This will include an assessment of residual mercury in equipment and materials on site as well as the surrounding environment. This Output will produce both a more detailed investigation of each site and a decontamination plan.

Activity 1.2.1: Facility assessments carried out

Teams trained as part of Activity 1.1.1 will carry out detailed assessments of the Coatzacoalcos and Monterrey facilities in years 1 and 2 of the project. The facility assessments will include inventories of all equipment and a quantification of residual mercury and will result in the development of individual reports for each site.

Activity 1.2.2: Decontamination plans developed

Following facility assessments, experts will develop decontamination plans. Decontamination plans will differ from remediation plans in that they will deal with residual mercury within facilities and their equipment and materials, whereas remediation plans will deal with environmental contamination resulting from fugitive emissions. Decontamination plans will be accordance with Mexican law and the Conventions. The plan will be executed as part of Output 2.1.2.

Output 1.3: Remediation and monitoring plans are developed

Mercury cell chloralkali plants universally emit large quantities of mercury into their surrounding environments. While the metal is highly mobile and capable of global transport the specifics of each site are mediated by local environmental and operational factors. The associated environmental liability with these plants can be significant. However the scope of that liability in these cases is not known ?

owing in part to a lack of clear regulatory guidance and local technical expertise. This Output will explicitly define the extent of the liability and assure that the measures proposed are in accordance with appropriate regulations.

Activity 1.3.1: Detailed environmental assessments conducted

As part of the PPG, preliminary environmental assessments were conducted (Appendices 12 and 13). As part of this activity, the results of these assessments will be complemented by additional analysis and interpretation where necessary. At a minimum this will include mercury speciation and improved estimation of human receptors, including disaggregation by gender and vulnerable groups. The results will be used for the development of remediation plans as part of Activity 1.3.2.

Activity 1.3.2: Remediation plans developed

Remediation plans for both sites will be developed in years 1 and 2. The remediation plans will be based on the results of the environmental investigations carried out as part of Activity 1.3.2 and during the PPG. Remedial options will be informed by the reviews carried out as part of Activities 1.1.2 and 1.1.3 and be supported by the capacity developed as part of Activity 1.1.1. The Second Component of the project includes activities related to the identification of funding for these remediation plans.

Activity 1.3.3: Environmental monitoring plans developed

Regulators trained as part of Output 1.1 will develop monitoring plans in response to the remedial and decontamination plans proposed as part of Activities 1.2.1 and 1.3.1. The monitoring plans will contemplate risks associated with both active remediation work and long-term site maintenance.

Component 2: Support for conversion, decommission and remediation

The second Component of the project covers the conversion of the site in Coatzacoalcos and the implementation of the plans developed in the first Component. As noted above, financing for the conversion has largely been secured by IQUISA?s parent company CYDSA. Strictly speaking, the facility in Coatzacoalcos will not be ?converted.? Rather an entirely new plant will be constructed using membrane cell technology and the old mercury cell plant closed and decontaminated. The sites are located 100 meters from each other within the larger CYDSA Coatzacoalcos complex. GEF resources will not support actual construction but rather will be used to provide engineering support for the development of the facility.

Component 2 will also include the decontamination of the mercury cell facilities in Coatzacoalcos and Monterrey and the identification options for the remediation of legacy wastes at the sites. These actions will be based on the plans developed as part of Component 1. Unlike the construction of the new facility, financing has not yet been identified to handle the whole of the environmental liability. As part of this Component, innovative financing packages will be developed to attract investment for the implementation of remediation plans. Any new investment will join GEF co-financing which will be used for the treatment, stabilisation and disposal of mercury wastes from the site under Component 3.

Outcome 2: Mercury cell chloralkali facilities are converted and decommissioned in Mexico and financing mechanisms for clean-up and rehabilitation of the sites adopted

Output 2.1: Support is provided for the conversion of the Coatzacoalcos facility

The project will provide international and national engineering expertise to support the development of the new facility in Coatzacoalcos. Detailed engineering plans for the site have already been developed though will require ongoing refinement through the first two years of the project.

Activity 2.1.1: Technical support for the conversion provided

In the first year of the project a team of engineers will be engaged for the purpose of supporting the development of the new membrane cell facility in Coatzacoalcos. The engineering team will ensure the use of Best Available Techniques (BAT) in the development of the facility. To do so the team will work closely with thematic experts from relevant organizations including the World Chlorine Council, Clorosur, Eurochlor and the Global Mercury Partnership. The engineering team will be embedded in IQUISA?s day-to-day operations and hold a central role in finalizing the engineering plans of the new membrane facility.

Output 2.2: Technical support provided to IQUISA to decommission mercury cell plants in Coatzacoalcos and Monterrey

As part of this Output, decommission plans developed as part of Output 1.2 will be implemented. In some cases equipment may be able to be reused in other mercury cell plants in the region. In others it is possible that ? following decontamination ? certain components could be used in the new membrane facility. It is likely however that much of equipment and materials will have to be disposed of permanently. The project will ensure that this work is done in a manner consistent with best practice and the Convention. The ~150 tonnes of liquid mercury at the Coatzacoalcos site will be extracted as part of this Output and put in interim storage. Additionally, where mercury can be extracted for the purpose of stabilisation it will be stored in an interim manner until it can be stabilised as part of Component 3. Finally, IQUISA will carry out excavation of soils on site with high mercury content that will be treated as part of Component 3.

Activity 2.2.1 Collect and store excess mercury

The Coatzacoalcos facility contains ~150 tonnes of liquid mercury in its cells. As part of this activity this mercury will be extracted in a manner consistent with best practice and placed in interim storage. The process will be conducted in coordination with the Global Mercury Partnership and with international experts present. 100 tonnes of the extracted mercury will be stabilised and finally disposed of as part of Component 3. An additional 50 tonnes will be transferred to other active mercury cell chloralkali facilities in the region for use as an industrial input in deals in part facilitated by the project under Component 3.

Activity 2.2.2 Support decommissioning of both facilities

Beginning in the first year of the project, national and international consultants will support IQUISA staff and contractors to safely and responsibly deconstruct and decommission both sites. The work will follow the plan developed as part of Output 1.2. To the extent possible, mercury will be recovered and stored while contaminated equipment will be disposed of in a manner consistent with best practice. Decommissioning will include IQUISA?s excavation of soils on site with high mercury content that will be treated as part of Component 3.

In advance of any work a comprehensive inventory of all equipment and materials will be conducted as part of Output 1.2. During this work measures will be taken to mitigate mercury releases including keeping a closed system where feasible. Government regulators will be informed of all activities and provided work plans. Where appropriate government regulators trained as part of Output 1 will be present at the site.

Output 2.3: Financing packages prepared and shared with investors

Financing has been largely secured by IQUISA?s parent company CYDSA for the construction of the new membrane cell facility, however no financing has yet been identified to manage environmental contamination associated with the site. This is in part due to a lack of information on the size and scope of the environmental liability as well as a lack of available financing options. Site assessments and remediation plans conducted at both sites as part of Output 1.3 will quantify that liability and propose viable management options. As part of Output 2.3, the project will develop and investigate the feasibility of unique financing options for site remediation.

Activity 2.3.1: Prepare and share financing packages with investors for the management of environmental contamination

Beginning in year 2 the project will endeavour to attract investment for the remediation of residual contamination at the sites. Traditional approaches such as grant funds, revolving funds and bonds will be assessed. In addition, non-traditional mechanisms will be developed and assessed and may include innovate land use proposals designed to maximise return. Once a list of viable packages are developed they will be shared with investors to identify required finances.

Component 3: Final disposal or transfer of excess mercury

The active cells at the Coatzacoalcos IQUISA facility contain approximately 150 tonnes of liquid mercury. Approximately of third of this material (~50 tonnes) will be placed in flasks and reused in other chloralkali facilities in the region. This is an allowable use under the Convention, in part because it reduces reliance on primary mercury mines. The balance (100 tonnes) will be stabilised and disposed under the project utilising GEF funds. There is not currently a known Mexican firm capable of conducting stabilisation/ solidification at this scale. A preliminary tender for the stabilisation has been drafted as part of the PPG and is attached as Appendix 13. As part of this Output the tender will be modified as necessary and issued. Bids received will be evaluated across a series of parameters in a transparent process. The execution will then be overseen and technical advice provided where necessary. In addition, the mercury transfer to other active chloralkali plants will be facilitated by the project through interaction with the regional trade group Clorosur. Finally, Component 3 will involve treatment and stabilisation of residual mercury from equipment, materials and soils on site that have been extracted or excavated as part of Output 2.2.

Outcome 3: 100 metric tonnes of mercury safely stored and disposed

Output 3.1: Technical support provided to IQUISA to stabilize excess mercury

The project will facilitate the stabilization of the liquid mercury currently used in the cells of the Coatzacoalcos plant. This material is estimated to be ~150 tonnes in quantity. The mercury will need to be stabilised/ solidified before it can be finally disposed. Two Mexican landfills have been identified that can accept the stabilised waste, though no Mexican provider has been identified for the stabilisation/ solidification.

Activity 3.1.1: Conduct feasibility studies of stabilization, storage, treatment and final disposal

Experts will be engaged in the first year of the project to evaluate domestic, regional and international capacity to stabilise/ solidify and dispose of mercury wastes. These efforts will result in the production of a single report assessing the feasibility of the proposed intervention and making recommendations. Preliminary work has been conducted in the development of the stabilisation ToR (Appendix 13). The report will include an evaluation of the available disposal options evaluated across parameters.

Activity 3.1.2: Stabilize 100 tonnes of mercury

The project will stabilise/ solidify and dispose of at least 100 tonnes of liquid mercury from the cells of the Coatzacoalcos plant in years 4 and 5 of the project which is considered excess mercury. Associated costs will be paid with GEF resources. The entirety of the process, including bidding, contracting, packaging, shipment, stabilisation and disposal will be carried out in a manner consistent with the Convention and UNEP procurement policies. A preliminary terms of reference for the stabilisation was developed as part of the PPG and is attached as Appendix 13.

Activity 3.1.3: In coordination with Clorosur, facilitate an agreement with chloralkali facilities in Latin America for the transfer of the 50 tonnes of mercury

Beginning in the first year of the project agreements will be negotiated with other chloralkali plants in the region to purchase at least 50 tonnes of liquid mercury recovered from the Coatzacoalcos plant. The regional trade group Clorosur will play a key role in facilitating these arrangements. The reuse of mercury from chloralkali facilities as an input into separate active chloralkali facilities is allowed under the Convention. Current mercury demand in the region is ~32 tonnes/ year, thus the 50 tonnes recovered from Coatzacoalcos would represent approximately 1.5 years of mercury input. The project will ensure that mercury originating in Coatzacoalcos will be used in this way and transported in a manner consistent with the Basel Convention, relevant regional laws, and international best practice.

Output 3.2: Stabilisation of residual mercury extracted during decontamination

This Output considers residual mercury at both facilities recovered during decommissioning conducted as part of Activity 2.2.2. The mass of this material represents a significant unknown that could not be quantified during project preparation. The budget has been developed to accommodate an additional 5 tonnes which is considered a high end estimate.

Activity 3.2.1: Stabilise residual mercury

As part of Component 2 residual mercury contained in facility equipment and on site will be extracted and stored. In addition, under Component 2, IQUISA will finance the excavation of soils on site with high mercury content. Under Component 3, this material will be treated, stabilised and disposed of in a manner consistent with the Convention and international best practice. Specifically mercury will be separated from its substrate (e.g. piping, concrete, soil) using thermal desorption within a sealed enclosure. The concentrated mercury will then be stabilised/ solidified and disposed of in a secure landfill.

Component 4: Knowledge management and communication

As noted in the baseline, the number of mercury cell chloralkali plants in the world has declined rapidly since the turn of the century, owing largely to voluntary changes on the part of industry. These conversions have been initiated in part because of cost savings associated with significantly reduced energy consumption which can amount to a 23?48 % cost savings. Within the WCC ? which represent 90 % of global capacity ? only 11 mercury cell plants remain, with 3 in Russia and the balance in the Americas. Further, an unknown number of chloralkali facilities are operated by non-members in low- and middle-income countries. Each of these plants face certain challenges to conversion, some of which have been identified the barrier above. This project is in a unique position to develop and implement innovative solutions to these challenges. As part of this Component the project will work with the Global Mercury Partnership to document and share the knowledge generated in a structured manner with the goal of facilitating conversions elsewhere. Likewise, much of the knowledge generated will be applicable beyond the chloralkali industry to firms handling other hazardous chemicals. As part of this Component that knowledge will be shared with key stakeholders through targeted meetings.

Outcome 4: Countries and global operators apply the new knowledge to phase out remaining mercury chloralkali facilities

Output 4.1: Lessons learned shared with key stakeholders

As part of this Output a technical workshop (n=1) will be held with chloralkali producers in other countries to share lessons learned in a structured manner. The last mercury cell chloralkali plant in Mexico will close during the project. Thus Mexico activities will focus on firms that work in other industries handling hazardous chemicals.

Activity 4.1.1: Organization of awareness raising and dissemination activities with relevant stakeholders in the chemicals management industry in Mexico

A series of targeted meetings will be held with key stakeholders in the chemicals industry in years 4 and 5 for the purpose of sharing lessons learned. These stakeholders are likely to come from both chemical manufacturers and related ancillary firms such as waste management companies and environmental consultants. The objective of the meetings will be to improve knowledge of waste management considerations including disposal and remediation as well as to share any lessons learned on innovative financing mechanisms developed as part of Activity 2.3.1. These meetings will be supplemented with the development of an online course available in English and Spanish. The course will be comprised of a short number of modules that will cover key thematic areas including site assessment, remediation and waste management.

Activity 4.1.2: Organization of awareness raising and dissemination activities with relevant stakeholders in the chloralkali industry outside of Mexico

The project will organize at least one (1) international workshop for chloralkali operators to disseminate lessons learned and facilitate the sharing of information. The workshop will be organised in cooperation with the Global Mercury Partnership and various trade groups including the World Chlorine Council. Participants will include technology providers, regulators, members of the Global Mercury Partnership and waste managers, among other key stakeholders.

Output 4.2: Chloralkali mercury cell conversion guidelines updated and shared with industry partners and stakeholders

Activity 4.2.1: Use and update the existing chloralkali mercury cell conversion guidelines (from the Global Mercury Partnership) to include experiences in Mexico

The most recent conversion guidelines document produced by the Global Mercury Partnership was published in 2012 and is based largely on data collected before 2010.[116][116] Cost estimates are drawn largely from the US and Europe. In addition the document does not consider costs associated with final disposal of mercury recovered from cells. As part of this activity experts will integrate lessons learned from the current project and more broadly over the past decade for the purpose of updating the guidance. The completed guidance will be shared through the Partnership and the UNEP website.

1a.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 chloralkali sector in Mexico 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 chloralkali sector. The Partnership was established 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 chloralkali mercury cell plants around the world.

1a.5 incremental/additional cost reasoning and expected contributions from the baseline, the GEFTF, LDCF, SCCF, and co-financing;

The most significant costs of the project will be borne by CYDSA in the form of the construction of a new membrane facility and in writing off the value of 100 tonnes of liquid mercury. Other major project costs include those related to the adoption and application of new or modified regulations by the Mexican government. The incremental cost of the project can be quantified as those expenses associated with bringing the project fully in line with the Minamata Convention. These include those related to increasing national capacity and stabilising and disposing of excess mercury.

By integrating the activities of this project with the existing network of the UNEP 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 chloralkali sector in Mexico makes prioritization of this sector for intervention difficult. 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.

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 existing 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

1a.6 global environmental benefits (GEFTF) and/or adaptation benefits (LDCF/SCCF);

The proposed project will produce global environmental benefits that can be captured across three core indicators: 6 (greenhouse gas emissions mitigated); 9 (chemicals of global concern); and 11 (direct beneficiaries). The methods used to calculate the anticipated benefits are described below.

With regard to greenhouse gas emissions (indicator 6), the project will result in an estimated 24.4 % energy savings on an annual basis once the new plant is operational. This 24.4 % value is consistent with experience elsewhere; the average energy savings in European plants upon converting to membrane technology from mercury cells was 23.5 % with the largest differential for a single plant being 48 %.[117][117] The membrane cell plant will come online in year 3 of the project. Thus for the purpose of calculating GEBs, savings are estimated from 2.5 years only.

CYDSA operates its own power plant at the Coatzacoalcos facility under the subsidiary Sistemas Energ?ticos SISA, S.A. de C.V. (herein SISA). The plant uses natural gas cogeneration (Combined heat and power [CHP]). Up to two-thirds of energy is lost in the form of heat in traditional power plants. CHP captures this heat and reuses it, typically in municipal heating. This reuse can result in efficiency gains of up to 80 %.[118][118] At the Coatzacoalcos plant the recaptured steam heat is used in the chloralkali process and in other industrial processes (i.e. table salt production), thus resulting in further energy savings.

Annual consumption (GWh) ? 92,000 ECU mercury plant	**Est. annual consumption (GWh) ? 100,000 ECU membrane plant**	**Annual Savings (GWh)**	**Annual CO_2 reduction (tonnes)**	**CO_2 reduction over 2.5 years (tonnes)**
314	257	57	29,640	74,100

Table 4. Estimated CO_2 reductions as a result of the plant conversion

Carbon dioxide emissions from gas-fired power plants are much lower than those from other fossil fuels systems such as petroleum or coal. The United States Energy Information Administration calculates average CO_2 emissions of 0.41 kg per kWh generated by gas power in that country, versus 0.97 kg for petroleum and 1 kg for coal.[119][119] Capturing and reusing heat through CHP results in further CO_2 reductions; the inter-governmental panel on climate change (IPCC) estimates emissions of ~0.3 kg CO_2/ kWh for CHP plants.[120][120] IQUISA approximates power demand for their planned 100,000 ECU membrane facility at 257 GWh per year (1 GWh = 1m kWh). Current demand at their 92,000 ECU mercury plant is 313 GWh. Thus even after production gains of more than 8 %, the new plant will use 57 GWh less energy per year. The CYDSA subsidiary SISA which manages the plant calculates average CO_2 emissions of 0.52 kg CO_2/kWh associated with power used at the chloralkali plant. Thus annual CO_2 emissions reductions after the conversion should be equivalent to 29,640 tonnes. GEBs are conservatively calculated here over a 2.5 year time horizon only. The resulting contribution against indicator 6 is 74,100 tonnes. Table 4 summarizes these calculations.

With regard to indicator 9, 100 tonnes of mercury will be stabilised and disposed of as part of Component 3. In addition, the current plant has mercury inputs of 6 tonnes/ year. It is assumed that no mercury will be procured beginning halfway through the project, thus Hg use will be reduced by 16 tonnes during the life of the project (2.5 years x 6 tonnes).

Finally a conservative value of 15,000 direct beneficiaries is calculated for indicator 11. Both sites potentially adversely impact the health of nearby human populations and further communities downstream through the uptake of mercury in fish. In the absence of more detailed epidemiological evidence the most conservative value (i.e. 2500 people) is taken for the 3 communities near the Coatzacoalcos plant and assumed to be equivalent for Monterrey. As part of the project, detailed site assessments will be carried out under Component 1 at both sites. These assessments will more accurately approximate the number of receptors and will include a disaggregation by gender and vulnerable groups.

1a.7 innovativeness, sustainability and potential for scaling up.

The innovative aspects of the project relate primarily to the financial packages produced as part of Output 2.3. The legacy of contaminated hotspots is notoriously difficult to manage, particularly in resource poor environments. AS part of this Output, innovative financing mechanisms will be developed and shared with investors. Lessons learned will be documented to improve future efforts.

Sustainability in this context relates to the permanent closure of Mexico?s last remaining mercury cell chloralkali plant and the final disposal of 100 tonnes of mercury in a manner consistent with best practice (Component 3). Scaling up will be addressed most directly addressed through Component 4 which will share lessons learned with domestic and international stakeholders to facilitate the closure of remaining plants.

The WHO guidance ?Nine steps for developing a scaling up strategy? outlines the following measures: Planning actions to increase the scalability of the innovation; Increasing the capacity of the user organization to implement scaling up; Assessing the environment and planning actions to increase the potential for scaling-up success; Increasing the capacity of the resource team to support scaling up; Making strategic choices to support vertical scaling up (institutionalization); Making strategic choices to support horizontal scaling up (expansion/replication); Determining the role of diversification; Planning actions to address spontaneous scaling up; and Finalizing the scaling-up strategy and identifying next step. This guidance and associated resources will inform the development of the good practice guide (Component 1) and knowledge management work carried out as part of Component 4.

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1b. Project Map and Coordinates

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

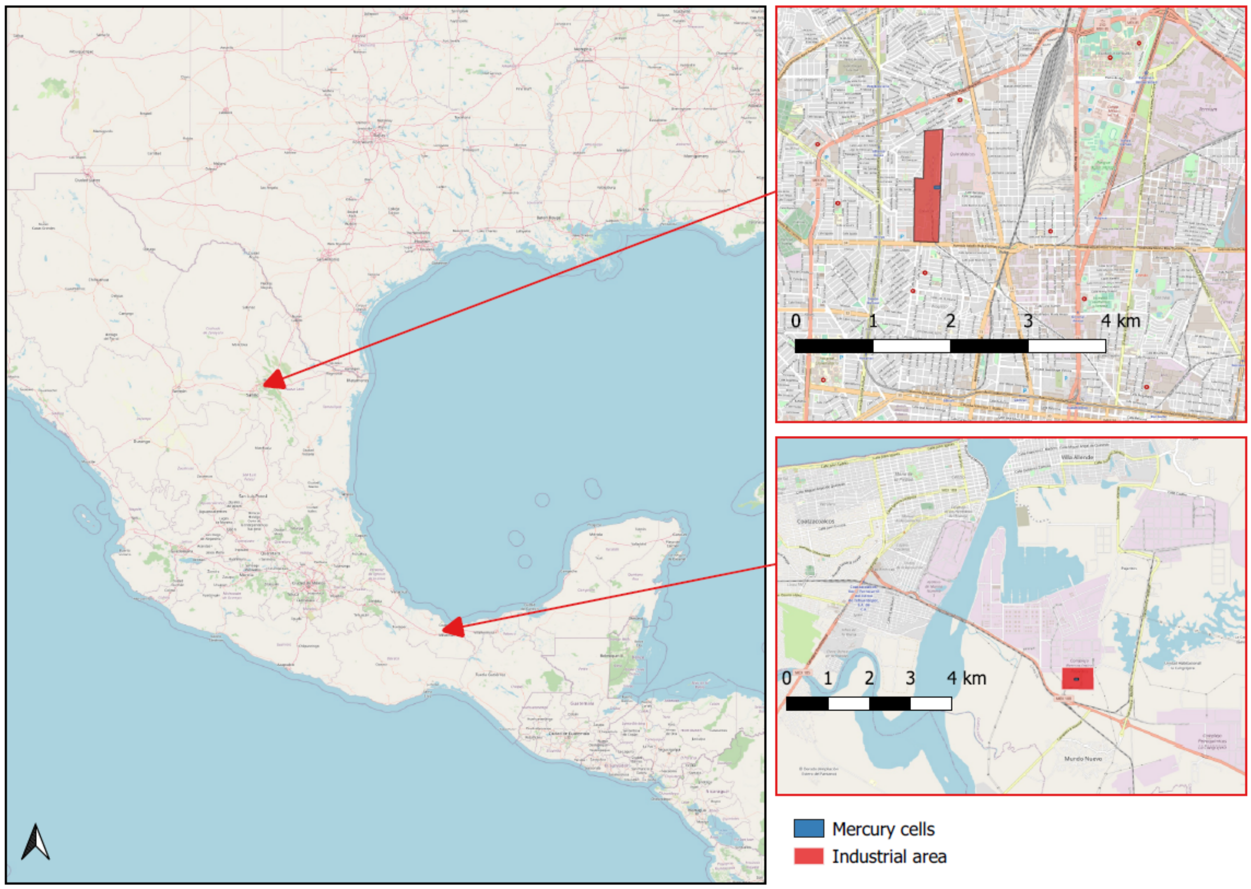

Figure 10: Project Map

1c. Child Project?

If this is a child project under a program, describe how the components contribute to the overall program impact.

n/a

2. Stakeholders

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

Civil Society Organizations Yes

Indigenous Peoples and Local Communities

Private Sector Entities Yes

If none of the above, please explain why:

Please provide the Stakeholder Engagement Plan or equivalent assessment.

Key stakeholders will be drawn from both the private and public sectors, including the chloralkali industry, the environmental assessment and remediation industry and relevant regulatory authorities. In addition local communities will be actively engaged. The general public will have access to major project documents and will be provided with public facing materials on the project website.

Stakeholders will be engaged through formal annual in-person stakeholder workshops as well as through ongoing project activities such as training workshops and consultations. To inform consultation work in the communities a socioeconomic expert will be engaged in year one of the project to further develop the stakeholder engagement and gender analysis conducted during the PPG. During the annual workshops, progress against indicators will be reviewed, necessary adjustments will be discussed and proposed, and next steps will be decided. All documentation generated as part of the project will be available on the project?s server to which all stakeholders will have access. An assessment of need and resource allocation will be made where required to ensure that all principal stakeholders are able to attend the annual meetings. In addition, hard copies of project documentation will be made available for stakeholders without readily available access to a computer.

Stakeholder Name and Function	**Stakeholder Interest**	**Involvement in the Project**	**Influence of Stakeholder**	**Risk Management**
Government				
General Directorate of Integral Management of Materials and Hazardous Activities (DGGIMAR)	High	DGGIMAR is the Minamata Convention focal point and will apply its regulation of mercury management experience in the contaminated sites of Monterrey and Coatzacoalcos. As Chair of the Steering Committee, DGGIMAR will play a key role in the project decisions. Further elaboration on DGGIMAR?s role is provided below in section 6.	Medium	Low risk/medium risk
National Institute of Ecology and Climate Change (INECC)	High	INECC is a national environmental agency. INECC?s role include: -Collaborate in the proper development and provide technical environmental assistance of Component 1 and 3 of the project - Provide assistance to CyDSA for implementing the monitoring and preliminary evaluation of the mercury contaminated sites	High	Low risk

Ministry of Environment of Nuevo Le?n and Veracruz	High	As the local environment ministries from SEMARNAT in the states where the interventions will take place, they will provide regulations support to provide updates on the progress of the activities. Additionally they will contribute to local messaging about the importance and benefits of mercury-free industrial processes.	Medium	Low risk
Federal Attorney General?s Office for Environmental Protection (PROFEPA)	High	PROFEPA is a national environmental agency and will provide technical assistance for component 1 and 3 of the project. Will assist the project to ensure the level of compliance with environmental regulations in order to contribute to sustainable development of the sites and will enforce national environmental laws.	Medium	Low
International Governmental Organizations				
UN Environment Programme	High	UNEP will act as the implementing agency for this project.	High	Low risk
Global Mercury Partnership	High	Will provide assistance for the remediation assessment and dissemination with the partners.	High	Low risk
International Environmental Technology Centre	High	The agency will be responsible for implementing project component 3 developing technology support and capacity building for the stabilization of mercury wastes.	High	Low risk
United States Environmental Protection Agency	High	The US EPA is the co-lead of the Global Mercury Partnership area on Chlor-alkali. Through its network, it will disseminate the results of the project	High	Low Risk

UNIDO	High	UNIDO is the co-lead of the Global Mercury Partnership area on Chlor-alkali. Through its network, it will disseminate the results of the project and will be involved in the execution of the project.	High	Low Risk
Private Sector				
CyDSA S.A. de C.V.	High	Lead agency committed to assess mercury contaminated sites from the chlor-alkali facilities of Monterrey and Coatzacoalcos. It will promote the technology transfer to guarantee a mercury-free chlor-alkali production in the plant of Coatzacoalcos in compliance with the Mexican legislation and sound national/international environmental management standards. Will contribute to the global messaging about the importance and benefits of the mercury-free chlor-alkali process.	High	Low risk
World Chlorine Council (via Eurochlor)	High	This agency will provide technical knowledge and information dissemination for Components 2 and 3	High	Low risk
Clorosur	High	Will assist with the sale of excess mercury to other chloralkali plants in the Latin America region under Component 3.	High	Low risk
Non-Governmental Organizations				
Institute for Environmental Protection of Nuevo Leon (IPA)	High	This agency will assist component 1 and 3. Will provide technical environmental assistance and scientific advice on mercury contamination and identification of hot-spots for the stabilization/remediation plan.	High	Low risk

National Association of the Chemical Industry (ANIQ)	High	This NGO will assist components 1 and 4. Will also lead the cooperation with the communities with an the industrial sector. It is a lead NGO recognized nationally and internationally for its influence and management in the promotion of sustainable development of the chemical industry. They have experience in information and training dissemination.	Medium	Low risk
Academia	Medium	This group will be responsible to provide useful information on project impact during the remediation and Best stabilization treatment process. Their participation and engagement will help project implementation group channel information relevant to the project and will support legitimacy and credibility to the project	Medium	Low risk
Civil society and local communities				
Local communities from Monterrey and Veracruz	Medium	The local communities are interested because of the following: The community will benefit also positively from this project through improved knowledge on the hazards posed by mercury to environment and human health. Local communities will be useful agents in collection of data that will be vital in monitoring and as such they will play a role in the monitoring framework.	Medium	Low risk/ medium risk
General public	Low	The general public will be able to access online training materials guidance documents. Pubic facing documentation will be developed and shared on the project website.	Medium	Low risk

Table 6. Stakeholders identified during PPG

In addition, provide a summary on how stakeholders will be consulted in project execution, the means and timing of engagement, how information will be disseminated, and an explanation of any resource requirements throughout the project/program cycle to ensure proper and meaningful stakeholder engagement

Select what role civil society will play in the project:

Consulted only; Yes

Member of Advisory Body; Contractor;

Co-financier;

Member of project steering committee or equivalent decision-making body;

Executor or co-executor;

Other (Please explain)

3. Gender Equality and Women's Empowerment

Provide the gender analysis or equivalent socio-economic assesment.

Despite making regular annual progress, Mexico maintains one of the larger gender employment gaps in the OECD. In 2019, only Turkey had a lower employment rate for women. Corporate leadership in the country is also largely male. In 2017, only 7.5 % of the largest publicly traded companies were headed by women, well below the 22.3 % average for OECD countries. Only Estonia, Japan and Korea were lower in the OECD.[1] The UNDP gender development index is a metric that endeavours to combine the relative wellbeing of women with regard to health, knowledge, and living standards. Of the 181 countries for which a ranking was available in 2018, Mexico ranked 96th, above only Turkey and South Korea in OECD.[2] A related but distinct UNDP metric, the gender inequality index is intended to measure women?s reproductive health, empowerment and the labour market. Of the 178 countries for which a ranking exists for 2018, Mexico ranked 79th, last in the OECD. By contrast, Mexico?s political leadership is the 4th most female in the world; at the close of 2018 both chambers of Congress were approaching 50 % female. For context, the US was less than 25 % female while the UK was less than 30 % female. All Latin American countries with the exception of Argentina (~40 % female) were less than 31 % female.[3]

Mexico is highly unequal from an economic perspective. The Gini coefficient is a widely used measurement of economic inequality in a given country, with 0 representing perfect equality and 100 representing complete inequality. The global average is < 40. In the last year for which data are available (2016) Mexico?s Gini coefficient was the highest in the OECD at 48.3. The next highest country in the OECD was Spain with Gini coefficient of 36.1. The inequality in Mexico is also regional. Chiapas, Oaxaca, and Guerrero each have extreme poverty rates > 20 %, compared to a national average of 7.4 %. Veracruz has a poverty rate of 13 %. By contrast a relatively small 1.4 % of Monterrey residents live in poverty.[4]

Mexico maintains a number of programs intended to benefit vulnerable groups and improve their relative role in society. The national institute for women (INMUJERES) was established in 2001 and works on a range of issues including promoting an improved gender perspective across Mexican institutions and combating rape. The PROSPERA program provides conditional cash transfers to low-income households. A recent analysis by the World Bank found that beneficiaries of the programme were much more likely to improve over their parents with regard to education, assets holding, and income.[5] Mexico?s gender inequality and development indices have been consistently improving since 1985 (the first year for which data are available) ? both in absolute terms and relative to other countries. However, despite these significant and laudable efforts gender and economic inequality remain intractable issues in Mexico. Accordingly, the proposed project has integrated a gender perspective in all major outputs. The Gender Gap Analysis (Appendix 9) includes a gender action plan organized by Output. This work will be further developed in year 1 of the project through the engagement of socioeconomic expert.

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[5] Arturo Aguilar and Giacomo De Giorgi, ?Long-Term Effects of PROSPERA on Welfare?.

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 Yes

Generating socio-economic benefits or services or women

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

Yes

4. Private sector engagement

Elaborate on the private sector's engagement in the project, if any.

There will be multiple levels of private sector engagement in the project. First, CYDSA, the owner of the chloralkali plants, will be the main company driving the conversion process as they have secured financing for the decommissioning and conversion of the plant. They will follow the appropriate codes and standards in place to carry out the entire conversion process. Second, a regional industry association 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. 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 Terms of Reference and preliminary costing were prepared (Appendix 13). Fourth, commercial, private banks and other investors interested in financing the conversion and environmental clean-up afterwards will be involved in the project. Finally, selected experts from the private sector (including hazardous waste specialists) from the Global Mercury Partnership will be invited to provide their experience and expertise on the project.

5. Risks to Achieving Project Objectives

Elaborate on indicated risks, including climate change, potential social and environmental risks that might prevent the project objectives from being achieved, and, if possible, the proposed measures that address these risks at the time of project implementation.(table format acceptable):

Risk	Risk ranking	Mitigation measures
Operational/delivery risks		
Political instability and shifting priorities	Medium	The institutionalization of the project and the National Coordination Group will be encouraged, limiting its reliance on any one or set of individuals who may be susceptible to replacement due to political changes.
National support is not provided or is not adequate for project needs	Medium	Have clear country and co-finance agreements and ensure country commitments to the established agreements.
Inadequate suppliers for mercury stabilisation	Low	A preliminary market survey carried out as part of the PPG identified multiple actors.
Lack of transparency in financial management and distribution	Low	Clear terms or reference in advance of work. Regular reporting of disposed funds against activities completed. Execution coordinated via EA to increase scrutiny of financial transactions.
Increased COVID-19 exposure risk to project staff and targeted communities	Medium	Best practices with regard to personal hygiene, PPE, social distancing and other measures will followed by project staff. Compliance will be monitored by the project manager.

Limited mobility of project team due to the ongoing COVID-19 pandemic inhibits project execution	High	The project would begin in 2022. In the event that the current situation has not improved and movement continues to be equally restricted (domestically and internationally) the project will be adjusted accordingly, including utilising remote guidance of international experts and an increased reliance on local experts. In either case, remote tools will be central to implementation. At the time of writing (October 2021) 42 % of Mexicans have received one dose of a vaccine and 55 % are considered fully vaccinated.
Supply chain issues owing to COVID-19 pandemic limit supply of essential equipment and materials	Medium	Supply chains are beginning to improve as countries improve management of the pandemic. Procurement will begin earlier to hedge against these issues.
Financing cannot be secured for remediation	High	Lessons learned are documented and shared with CYDSA and government stakeholders. Grant instruments are explored.
Environmental safeguard risks		
Accident or spill during disposal	Medium	Have in place adequate health and safety plans, PPE and spill response plans and teams.
Lack of adequate storage and disposal options available	Low	Two secure landfills have been identified during the PPG
Climate change risks		
Climate change impacts the feasibility of remediation designs	Medium	Remediation designs complete climate risk screening following GEF guidance
Increased volatility from warmer weather increases worker exposure	Low	Proper PPE is provided and training is provided on use
Climate change risks impact stabilisation methods	Low	Selected stabilisation methods will be adequately robust against a changing climate. Decommissioning plans and stabilisation plans will include a climate risk screening in line with GEF guidance.

Table 7. Project risks matrix

6. Institutional Arrangement and Coordination

Describe the institutional arrangement for project implementation. Elaborate on the planned coordination with other relevant GEF-financed projects and other initiatives.

The organizational structure for project coordination and management is illustrated in Figure 11.

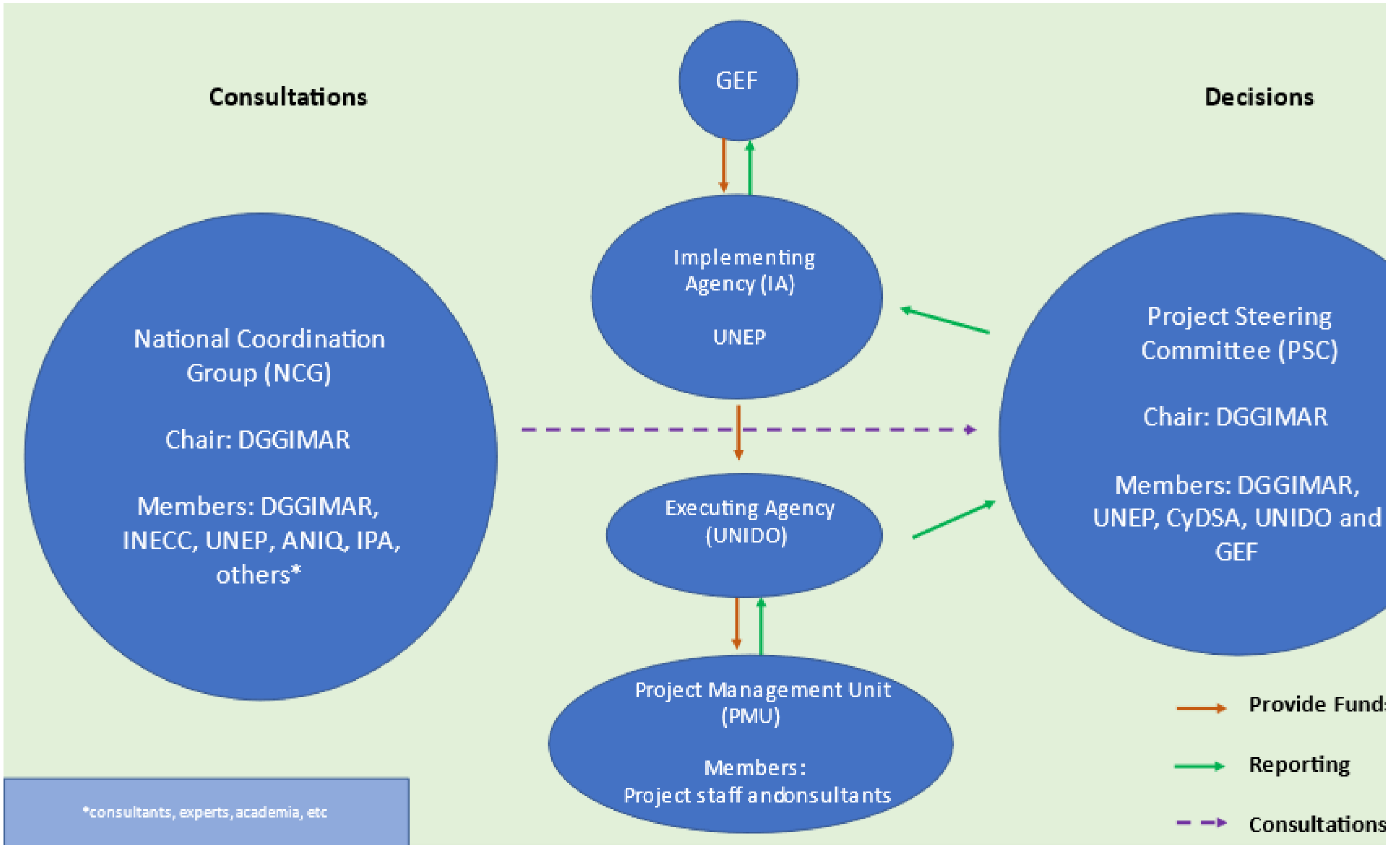


Figure 11: Coordination and institutional arrangements

Implementing Agency (IA): UNEP will act as IA. The IA will be responsible for the overall supervision of the project, monitoring the progress of the project by monitoring and evaluating the activities and progress reports of the established components. It will be responsible for quality assurance procedures, organise procurement in coordination with DGGIMAR and the Executing Agency (EA), approve progress reports and authorise the release of payments. The IA will also monitor progress to ensure proper product quality. UNEP will report on progress in the implementation of the project to the GEF. The IA will also participate in the Project Steering Committee (PSC) and may request the PSC to meet outside the schedule if it deems it necessary.

UNEP, as an implementing agency, will have the following role:

? Participate in PSC meetings and ensure that decisions are in accordance with the rules dictated by the GEF and UNEP;

? Communicate with the GEF about the implementation of the project;

? Validate the quarterly reports received from the DGGIMAR;

? Validate and finalize the project implementation assessment (PIR) and submit it to the GEF;

? Organize the mid-term review of the project (*Mid-Term Review*);

? Organize an independent final evaluation.

Executing Agency (EA): UNIDO will act as EA. The EA is responsible for the overall management of financial and human resources directly related to the execution of the project in the country, under the guidelines of the DGGIMAR. The EA will serve as the overall overseer of the project and will be responsible to the implementing agency and the Project Steering Committee (PSC) for the achievement of the project's outputs and results. The EA will receive guidance from the GEF and the PSC on all matters related to the project. In the performance of its duties, the EA shall be a member of the PSC and the National Coordination Group.

UNIDO, as the executing agency, will have the following role:

? Convene PSC meetings;

? Coordinate the Project Management Unit (PMU);

? Report quarterly to UNEP and DGGIMAR on expenditures and progress;

? Prepare the annual project implementation report (for approval by the PSC);

? Prepare progress reports of the project at the request of the DGGIMAR.

? Provide an independent annual financial audit to UNEP in coordination with DGGIMAR;

? Propose consultants and hire subcontractors according to the terms of reference and the budget approved by the PSC and in accordance with the approved procedure;

? Ensure the quality of reports and results before being sent to the PSC for approval;

? Identify, develop and foster contacts and relationships that are beneficial to the project;

? Carry out the hiring of the personnel necessary for the development of the project, in accordance with the provisions established by the GEF.

Project Steering Committee (PSC): The PSC will be chaired by DGGIMAR and will provide project direction and overall guidance for the implementation of this, making critical decisions on strategic issues. The members of the PSC shall have the right to make decisions, each with one vote: DGGIMAR, UNEP, UNIDO, CYDSA. The GEF may participate as one more member and have the right to one vote, when it so decides. The Project Management Unit (PMU) will act as Secretary and provide annual work plans for approval and periodic progress reports. The PSC will be composed of representatives of the beneficiary country, the IA and AE It will also ensure the timely delivery of the project products and the eventual achievement of the results of this through the revision of the work plan and progress reports. At all times, the PSC and its activities shall comply with the policies, conditions and regulations of the UN and the GEF.

DGGIMAR, as a project counterpart, focal point of the Minamata Convention and main stakeholder, will have the following specific functions:

? Chair the Project Steering Committee;

? Approve the agenda;

- ? Coordinate the Government's efforts by communicating and disseminating information to government stakeholders and other relevant actors to support the effective implementation of the project;
- ? Suggest the required consultants;
- ? Approve the selection of consultants;
- ? Supervise the preparation of the ToR and approve the ToR of consultants and service providers of the PMU.
- ? To guide UNIDO, as executing agency, through the project implementation process;
- ? Take an active role in the implementation and dissemination of lessons learned from the Project;
- ? Support UNIDO and the local partner organization(s) to collect, document, analyse and share with stakeholders for possible adaptation and/or replication, information on successful models, best practices and lessons learned from the project;
- ? Facilitate communication and dissemination of information within the Government and with other stakeholders, as appropriate.

The **Project Steering Committee**, under the direction of the DGGIMAR:

- ? Meet annually (additional meetings may be requested by members);
- ? Approve the ToR of the members that will integrate the PMU;
- ? Approve membership of the national/international coordination group;
- ? Discuss and approve the work plan and budget (annually);
- ? Approve the reports of consultants and subcontractors;
- ? Adopt the annual reports;
- ? Discuss and approve the terms of reference of consultants and subcontractors;
- ? Guide communication and dissemination of information;
- ? If necessary, it will propose changes to the logical framework of the project;

National Coordination Group (NCG): Mexico will establish a group of national experts and advisors that will provide continuous advice on the technical implementation of the project and may make technical suggestions to the Project Steering Committee. The PSC and NCG will also facilitate the project's collaboration with other initiatives, stakeholders and institutions in the country and may suggest candidates for the various project consultancies. The role of this group is also to maintain communication with a wider group of national stakeholders. The group can be consulted to suggest candidates for the different consultancies of the project. The group can suggest semi-annually or annually, that the group be expanded and more stakeholders included (Minamata Secretariat, international technical experts, etc.) or may form advisory working groups, depending on the area of execution of the project (Veracruz or Nuevo Le?n).

The **National Coordination Group** may:

- ? Organize quarterly or semi-annual meetings (the PSC will decide the best option as appropriate);
- ? Once a year, international stakeholders (Minamata Secretariat, experts, academics, NGOs, etc.) will also be invited;
- ? Provide technical advice for the proper development of the project;
- ? Ensure the dissemination of project activities and results to their networks;
- ? Provide feedback on the main project outputs and their reports;
- ? Suggest the recruitment of candidates for the project.

The **Project Management Unit (PMU)** will be responsible for the day-to-day management of the project. It will be composed of a project manager and staff, who will be under the direct supervision of DGGIMAR, under the administrative guidelines of UNIDO. The location will be in the facilities of the DGGIMAR. PMU will provide updates to DGGIMAR on a regular basis and will send monthly progress reports to UNIDO, previously approved by DGGIMAR.

Among its responsibilities will be:

- ? Annual workplans and progress reports will be submitted to DGGIMAR and UNIDO for approval;
- ? The PMU will be responsible for the day-to-day finances of the project with the approval of the project coordinator;
- ? It will coordinate regularly with UNIDO on the administrative side and with DGGIMAR on the implementation of the project;
- ? Prepare field coordination to facilitate project implementation;
- ? Effective and timely implementation of project activities;
- ? Follow-up to the daily management of the financial and human resources of the project;
- ? Participate in technical working groups;
- ? Ensure timely delivery of project results;
- ? Review the project's products before submitting them for approval to DGGIMAR;
- ? Organize the administration of all project meetings;
- ? Execute a periodic monitoring plan of the project;
- ? Prepare the agenda of the project meetings for approval by the PSC;
- ? Act as secretary of project meetings;

? Prepare the reports of the meetings for approval by the PSC;

? Prepare the annual report, work plan and annual budget for consideration by the PSC;

? Prepare and execute the communication strategy according to the indications of the DGGIMAR;

? Facilitate coordination meetings and other dialogues related to the guidance of DGGIMAR and UNIDO;

? Identify, develop and foster contacts and relationships that are beneficial to the project;

? Apply the knowledge management approach of the project;

? Manage the day-to-day running of the project in accordance with the work plan and budget approved by the PSC;

? Review the reports of consultants and subcontractors according to the ToR;

? Act as the PSC secretary;

? Prepare documents for the PSC (expenditure statement, work plan, terms of reference of consultants and subcontractors, agenda);

? Write the minutes of the Steering Committee and distribute them for approval.

7. Consistency with National Priorities

Describe the consistency of the project with national strategies and plans or reports and assesments under relevant conventions from below:

NAPAs, NAPs, ASGM NAPs, MIAs, NBSAPs, NCs, TNAs, NCSAs, NIPs, PRSPs, NPFE, BURs, INDCs, etc.

The project supports the national priorities of Mexico, particularly on the issues around economic development and proper management of chemicals and wastes. Beyond the environmental dimension, the project contributes to Mexico?s United Nations Sustainable Development Cooperation Framework (UNSDCF) as noted below:

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 to fulfilling its obligations in a timely and effective manner. This project will address Article 5 (mercury used in manufacturing processes), Article 10 (interim storage), Article 11 (mercury wastes), and Article 12 (contaminated sites).

8. Knowledge Management

Elaborate the "Knowledge Management Approach" for the project, including a budget, key deliverables and a timeline, and explain how it will contribute to the project's overall impact.

The Knowledge Management Strategy for the project will be closely linked to the monitoring and evaluation function and coordinated by the EA. It is an important function because of the broad relevance of the chloralkali sector. The project also needs very specific technical expertise on contaminated sites management and long-term capacity building. Mexico will benefit from the close coordination initiated during the PPG that will continue through the project to share experiences and coordinate activities.

UNEP will maintain regular communication throughout the project in order to obtain up-to-date information and share results of the project components and ensure smooth and effective implementation of activities. Given the multiple partners involved in the project, UNEP will be cautious of redundancy and keep partners apprised of project progress and developments. As the results of this project are planned to be used for future projects, there will be a strong emphasis on documenting activities and outputs while developing user-friendly communication materials ensuring further dissemination. Much of this will be done through the Global Mercury Partnership given its significant experience with chloralkali elsewhere as well as with trade groups such as Clorosur, the WCC and Euroclor.

A central deliverable of the project will be the updated conversion guidelines under Output 4.1 which will facilitate scaling up of the project. The guidelines will integrate lessons learned from the project with existing Global Mercury Partnership guidance and expert advice. The project will organize an international workshop for chloralkali plant operators to share experiences and facilitate conversions elsewhere. This work will be supplemented with an online course on the management of hazardous waste sites developed as part of Output 4.1 and available in Spanish and English. Trade groups will be encouraged to engage their membership in these activities and to share documents developed.

At the country level, the project will also develop or build on existing country-specific communication and knowledge management plans or platforms to ensure efficient cascading of information down to the community level and to ensure sustainability of interventions. These mechanisms will be embedded in existing federal, local government or academic institutions facilitating use of knowledge products after the end of the project.

9. Monitoring and Evaluation

Describe the budgeted M and E plan

Project M&E will be conducted in accordance with established UNEP and GEF procedures and will be provided by the EA. The M&E plan includes an inception report, annual review and final evaluations. The Project Manager will be responsible for stakeholder engagement, gender monitoring, and outreach to the broader community in the country. The M&E plan will be reviewed and revised as necessary during the project inception workshop to ensure project stakeholders understand their roles and responsibilities vis-?-vis project monitoring and evaluation. Indicators and their means of verification may also be fine-tuned at the inception workshop. Day-to-day project monitoring is the responsibility of the project management team but other project partners will have responsibilities to collect specific information to track the indicators. It is the responsibility of the Project Manager to inform UNEP of any delays or difficulties faced during implementation so that the appropriate support or correlative measures can be adopted in a timely fashion.

The project Steering Committee will receive periodic reports on progress and will make recommendations to UNEP concerning the need to revise any aspects of the Results Framework or the M&E plan. Project oversight to ensure that the project meets UNEP and GEF policies and procedures is the responsibility to the Task Manager in UNEP-GEF. The Task Manager will also review the quality of draft projects outputs, provide feedback to the project partners, and establish peer review procedures to ensure adequate quality of scientific and technical outputs and publications.

At the time of project approval ~70 % of baseline data are available. Baseline data gaps will be addressed during the first year of project implementation. The main aspects for which additional information are needed are:

? Finalisation of remedial planning;

? Confirmation of costs and providers of stabilisation.

Project supervision will take an adaptive management approach. The Task Manager will develop a project supervision plan at the inception of the project which will be communicated to the project partners during the inception workshop. The emphasis of the Task Manager supervision will be on outcome monitoring but without neglecting project financial management and implementation monitoring. Progress vis-a-vis delivering the agreed project global environmental benefits will be assessed with the Steering Committee at agreed intervals. Project risks and assumptions will be regularly monitored both by project partners and UNEP. Risk assessment and rating is an integral part of the Project Implementation Review (PIR). The quality of the project monitoring and evaluation will also be reviewed and rated as part of the PIR. Key financial parameters will be monitored quarterly to ensure cost-effective use of financial resources.

A mid-term management review or evaluation will take place after 12 months of project execution as indicated in the project milestones. The review will include all parameters recommended by the GEF Evaluation Office for terminal evaluations and will verify information gathered through the GEF tracking tools, as relevant. The review will be carried out using a participatory approach whereby parties that may benefit or be affected by the project will be consulted. Such parties were identified during the stakeholder analysis (see **section 2** of the project document). The project Steering Committee will participate in the mid-term review and develop a management response to the evaluation recommendations along with an implementation plan. It is the responsibility of the UNEP Task Manager to monitor whether the agreed recommendations are being implemented.

In line with UNEP Evaluation Policy and the GEF?s Monitoring and Evaluation Policy the project will be subject to an independent Terminal Evaluation (TE). The Evaluation Office will be responsible for the

Terminal Evaluation (TE) and will liaise with the Task Manager and EA throughout the process. The TE will provide an independent assessment of project performance (in terms of relevance, effectiveness and efficiency), and determine the likelihood of impact and sustainability. It will also have two primary purposes: (i) to provide evidence of results to meet accountability requirements, and (ii) to promote learning, feedback, and knowledge sharing through results and lessons learned among UNEP, the GEF, executing partners and other stakeholders. The direct costs of the evaluation will be charged against the project evaluation budget. The Terminal Evaluation will be initiated no earlier than six months prior to the operational completion of project activities and, if a follow-on phase of the project is envisaged, should be completed prior to the submission of the follow-up proposal. Terminal Evaluations must be initiated no later than six months after operational completion.

The draft TE report will be sent by the Evaluation Office to project stakeholders for comments. Formal comments on the report will be shared by the Evaluation Office in an open and transparent manner. The project performance will be assessed against standard evaluation criteria using a six-point rating scheme. The final determination of project ratings will be made by the Evaluation Office when the report is finalised and further reviewed by the GEF Independent Evaluation Office upon submission. The evaluation report will be publicly disclosed and may be followed by a recommendation compliance process.

Type of M&E activity	**Responsible Parties**	**Budget from GEF**	**Budget co-finance**	**Time Frame**
Inception Meeting	EA	10,000	0	Within 2 months of project start-up
Inception Report	EA	10,000	0	1 month after project inception meeting
Measurement of project progress and performance indicators	EA	10,000	0	Annually
Baseline measurement of project outcome indicators, GEF Core indicators (Tracking tools?)	EA	10,000	0	Project inception
Mid-point measurement of project outcome indicators, GEF Core indicators (Tracking tools?)	EA	10,000	0	Mid Point
End-point measurement of project outcome indicators, GEF Core indicators (Tracking tools?)	EA	10,000	0	End Point

Semi-annual Progress/ Operational Reports to UNEP	EA	0	0	Within 1 month of the end of reporting period i.e. on or before 31 January and 31 July
Project Steering Committee (PSC) meetings and National Steering Committee meetings	EA	40,000	50,000	Once a year minimum
Reports of PSC meetings	EA	0	0	Annually
Project Implementation Review (PIR) report	EA/IA	5,000	0	Annually, part of reporting routine
Monitoring visits to field sites	EA	5,000	0	As appropriate
		0	0	
Mid Term Review/Evaluation	IA	30,000	0	At mid-point of project implementation
Terminal Review/Evaluation (whether a project requires a management-led review or an independent evaluation is determined annually by UNEP?s Evaluation Office)	UNEP Evaluation Office	30,000	0	Typically initiated after the project?s operational completion
Audit	EA	0	0	Annually
Project Operational Completion Report	EA	10,000	0	Within 2 months of the project completion date
Co-financing report (including supporting evidence for in-kind co-finance)	EA	10,000	0	Within 1 month of the PIR reporting period, i.e. on or before 31 July
Publication of Lessons Learnt and other project documents	EA	10,000	0	Annually, part of Semi-annual reports & Project Final Report
Total M&E Cost		**200,000**	**50,000**	

Table 8. M&E Activities

10. Benefits

Describe the socioeconomic benefits to be delivered by the project at the national and local levels, as appropriate. How do these benefits translate in supporting the achievement of global environment benefits (GEF Trust Fund) or adaptation benefits (LDCF/SCCF)?

The project will deliver direct socioeconomic benefits to workers engaged in the construction of the new membrane facility and those of ancillary firms. This work is being funded in its entirely by CYDSA and leveraged in part through the project. To the extent that remediation work receives investment and is carried out, the project will deliver benefits to the workers engaged to carry out this work.

The existing chloralkali plant workforce will benefit from significantly reduced occupational hazards. Air monitoring carried out as part of the PPG identified elevated levels of Hg in air throughout the facility. The removal of this hazardous material from the process will result in an immediate reduction in their exposure.

The project will also result in reduced environmental concentrations of mercury and other pollutants emitted from the plant, including carbon dioxide emissions. This will result in decreased exposure in the surrounding communities which could translate into socioeconomic benefits. In year 1 of the project a socioeconomic expert will be engaged to better characterize the communities near the site and in turn improve estimation of these benefits.

11. Environmental and Social Safeguard (ESS) Risks

Provide information on the identified environmental and social risks and potential impacts associated with the project/program based on your organization's ESS systems and procedures

Overall Project/Program Risk Classification*

PIF	CEO Endorsement/Approval	MTR	TE
	Medium/Moderate		

Measures to address identified risks and impacts

Elaborate on the types and risk classifications/ratings of any identified environmental and social risks and impacts (considering the GEF ESS Minimum Standards) and any measures undertaken as well as planned management measures to address these risks during implementation.

Please refer to Appendices 7a, 7b and 8

Supporting Documents

Upload available ESS supporting documents.

Title	Module	Submitted
Appendix 8 - Risk management plan - 10526	CEO Endorsement ESS	
Appendix 7b - COVID questions - 10526	CEO Endorsement ESS	
Appendix 7a - SRIF - 10526	CEO Endorsement ESS	

ANNEX A: PROJECT RESULTS FRAMEWORK (either copy and paste here the framework from the Agency document, or provide reference to the page in the project document where the framework could be found).

Eliminate mercury use and adequately manage mercury and mercury wastes in the chloralkali sector in Mexico						
Project Objective	**Objective level Indicators**	**Baseline**	**Targets and Monitoring Milestones**	**Means of Verification**	**Assumptions & Risks**	**UNEP MTS reference* and link to SDGs**

Reduce negative impacts of mercury and mercury wastes from the chloralkali sector on human health and the environment in Mexico	# quantity of mercury reduced, treated and disposed # of mercury cell chloralkali facilities converted in Mexico and globally # of women and men workers working in mercury free chloralkali facilities # quantity of CO2 equivalent reduced	*Absence of technical expertise and financial resources to adequately decommission, collect, treat and dispose mercury and mercury waste*	***Mid-Point Target:*** *At least 30% of the objective tonnes of mercury reduced* ***End of project Target:*** *100% of the objective of mercury and CO2 equivalent reduced* *At least 50% of women workers are trained and working in non mercury chloralkali facilities*	*Plants decommission and conversion reports*	**Risks**: Change in the political and economic situation during the lifetime of the program impacts its implementation Finding the right investors and amounts and ensuring sustainability once the intervention is over ***Assumptions:*** Governments are engaged in creating enabling environment for phasing out mercury cell chloralkali plants Financial sector is able to overcome barriers to providing finance toward mercury waste management	*EA1 and EA2* *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* *1.1 Amount of chemicals and wastes reduced 1.3 Quantity of products or waste contaminated with chemicals avoided; 1.2 Quantity of waste and polluting chemicals*

Component 1: Improve national capacity to manage chemical facilities and mercury contaminated sites						
Outcome 1	**Outcome Indicators**	**Baseline**	**Targets and Monitoring Milestones**	**Means of Verification**	**Assumptions & Risks**	**MTS Expected Accomplish ment**
Mexico?s relevant agencies have adopte d a good practice guide and put in place plans for decontamina tion, monitoring and remediation of the contaminate d sites of Monterrey and Coatzacoalc os	# of hazardous chemical facilities properly monitored # of regulations and/policies strenghtene d to manage and monitor hazardous chemical facilities	*The government is undertaking steps to regulate hazardous waste facilities but additional activities are needed to expedite and reinforce the efforts.*	***Mid-Point Target:*** *50% of targeted regulations/po licies are assessed and strengthened* ***End of project Target*** *100% of targeted regulations/po licies assessed and strengthened*	-Workshop meeting reports - Policies and laws developed/streng thened -Database of active and closed hazardous chemical facilities	**Risks** Governments sideline the issue of hazardous chemicals facilities management and fail to put it forward as an agenda for policy change and support Inability or lack of capacity for governments to provide adequate support services **Assumptions** Governments engaged in creating enabling environment for hazardous chemicals facilities management	*EA1 and EA2*
Component outputs	**Output Indicators**	**Baseline**	**Targets and Monitoring Milestones**	**Means of Verification**	**Assumptions & Risks**	**PoW Output Reference Number**

Output 1.1: Good practice guide for the monitoring and management of hazardous chemical facilities and contaminated sites is completed and distributed to national stakeholders	# Steps identified by government officials and experts to better manage hazardous chemical facilities # of people that have received technical training on the good practice guide	*Many people is unaware of health and environmental impact of hazardous waste facilities*	***Mid-Point Target:*** *At least 50 government officials and experts (30% women) attending the workshop on formulation of good practice guide* *At least 200 stakeholders (30% women) received technical training on the practice guide* ***End of project Target:*** *Good practice guide recognized as an official document in managing and monitoring hazardous chemical facilities*	- Formulation workshop reports -List of participants - Training reports - List of participants	**Risks** Inability or lack of capacity for governments to provide adequate support services Disconnect between national, provincial and district governments make implementing policy change difficult **Assumptions** Governments engaged in creating enabling environment for management and monitoring of hazardous chemical facilities	*EA1 and EA2*

Output 1.2: Decontamination plans for the Monterrey and Coatzacoalcos sites are developed and shared with national stakeholders.	Availability of characterization and decontamination plans for Monterrey and Coatzacoalcos sites # of workshops organized	*Characterization and decontamination plans for both sites not available*	***Mid-Point Target:*** *At least 8 (4 for each site) workshops are organized for plan development* ***End of project Target:*** *At least 1 characterization and decontamination plan for each site developed*	- Activity documentation - List of participants	**Risks** Inability or lack of capacity for governments to provide adequate support services **Assumptions** Governments engaged in creating enabling environment for management and monitoring of hazardous chemical facilities	*EA1 and EA2*
Output 1.3: Remediation and monitoring plans are developed;	Availability of monitoring and remediation plans for both sites # of workshops organized	*No environmental monitoring and remediation activities are taking place at both sites*	***Mid-Point Target:*** *At least 8 (4 for each site) workshops are organized for plan development* ***End of project Target:*** *At least 1 monitoring and remediation plan for each site developed*	- Activity documentation - List of participants	**Risks** Inability or lack of capacity for governments to provide adequate support services **Assumptions** Governments engaged in creating enabling environment for management and monitoring of hazardous chemical facilities	*EA1 and EA2*
Component 2: Support for conversion, decommission and remediation						
Outcome 2	**Outcome Indicators**	**Baseline**	**Targets and Monitoring Milestones**	**Means of Verification**	**Assumptions & Risks**	**MTS Expected Accomplishment**

Mercury cell chloralkali facilities are converted and decommissioned in Mexico and financing mechanisms for clean-up and rehabilitation of the sites adopted	# of plants converted, decommissioned and cleaned up Amount of mercury recovered, treated and disposed	*There is limited amount of financial support for mercury waste management in Mexico* *There is lack of expertise in conversion of mercury cell chloralkali plants*	***Mid-Point Target:*** *Potential investors identified* *At least 40 tonnes of mercury recovered* ***End of project Target:*** *Financial support framework defined and financing packages developed* *At least 150 tonnes of mercury recovered* *At least 100 tonnes of mercury stabilized and disposed*	- Investments data from appropriate financial institutions - Surveys and interview - Technical reports from conversion and decommissioning activities	**Risks** Finding the right business model for investors and ensuring sustainability once the intervention is over **Assumptions** Governments engaged in creating enabling environment for decommission and conversion of mercury cell chloralkali plants Investors/providers are supportive, engaged and interested.	*EA2*
Component 2 Outputs	**Output Indicators**	**Baseline**	**Targets and Monitoring Milestones**	**Means of Verification**	**Assumptions & Risks**	**PoW Output Reference Number**

Output 2.1: Support is provided for the conversion of the Coatzacoalcos facility;	# of guidance documents drafted	*No guidance documents drafted*	***Mid-Point Target:*** *Draft guidance developed* ***End of project Target:*** *Final guidance developed*	- Surveys and interviews of experts - Progress reports -Guidance	**Risks** Finding the right approach for Mexico and ensuring sustainability once the intervention is over **Assumptions** Governments engaged in creating enabling environment for management of mercury cell chloralkali plants	*EA2*
Output 2.2: Technical support provided to IQUISA to decommission mercury cell plants in Coatzacoalcos and Monterrey;	Amount of excess mercury and mercury contaminated materials collected	*No collection has been conducted*	***Milestone: Mid-Point Target:*** *At least 40 tonnes of mercury recovered* ***End of project Target:*** *At least 150 tonnes of mercury recovered* *At least 100 tonnes of mercury stabilized and disposed*	- Activity documentation - Surveys and interviews - Progress reports	**Risks** Finding the right interim storage options for collected excess mercury and mercury wastes **Assumptions** Decommission and collection activities do not encounter challenges	*EA2*

Output 2.3: Financing packages prepared and shared with investors;	Availability of financing packages Number of investors with whom packages are shared	*No financing packages available for investors in environmental clean-up and rehabilitation of sites*	***Milestone: Mid-Point Target:*** *Draft financing package prepared* ***End of project Target:*** *Final financing package prepared*	- Meeting minutes from investor conferences and meetings - Progress reports	**Risks** Finding the right investors and framework that will sustain after project ends **Assumptions** Potential investors are available and accessible in Mexico	*EA2*
Component 3: Final disposal or transfer of excess mercury						
Outcome 3	**Outcome Indicators**	**Baseline**	**Targets and Monitoring Milestones**	**Means of Verification**	**Assumptions & Risks**	**MTS Expected Accomplishment**
100 metric tonnes of mercury safely stored and disposed	Quantity of mercury safely stored and disposed Availability of stabilization, storage and disposal options assessment reports	*No mercury stabilization facilities are available in Mexico and in the region*	***Mid-Point Target:*** *Assessment of treatment, storage and disposal options* ***End of project Target:*** *Treatment, storage and disposal of mercury and mercury wastes completed*	- Progress reports - Surveys and interviews	**Risks** Treatment, storage and disposal options are difficult or too expensive **Assumptions** Governments engaged in creating enabling environment for management of mercury and mercury wastes	*EA1 and EA2*
Component 3 outputs	**Output Indicators**	**Baseline**	**Targets and Monitoring Milestones**	**Means of Verification**	**Assumptions & Risks**	**PoW Output Reference Number**

Output 3.1: Technical support provided to IQUISA to stabilize excess mercury;	Detailed analysis and report on options for stabilization, treatment, storage and disposal of excess mercury and mercury wastes # of stakeholders trained on stabilization, treatment, storage and disposal techniques and processes Amount of mercury stabilized Amount of mercury reused by other chlorine producers in Latin America	*No mercury treatment has been conducted in Mexico previously*	***Mid-Point Target****:* *1 analysis report including options in country and region* ***End of project Target:*** *At least 50 stakeholders (30% women) are trained on stabilization, treatment, storage and disposal techniques and processes* *At least 100 tonnes of mercury stabilized* *At least 20 tonnes of mercury sold to other chlorine producers in Latin America*	- Detailed assessment - Progress report - Surveys and interviews - - Stabilization report	**Risks** Treatment and storage options not easily available or too expensive **Assumptions** Governments engaged in creating enabling environment for management of mercury and mercury wastes	*EA1 and EA2*
Output 3.2: Stabilisation of residual mercury extracted during decontamination;	Amount of mercury disposed	*No mercury disposal options available*	***Mid-Point Target****:* *None* ***End of project Target:*** *All residual mercury disposed*	- Progress report - Surveys and interviews - Disposal report	**Risks** Disposal options not easily available or too expensive **Assumptions** Governments engaged in creating enabling environment for management of mercury and mercury wastes	

Component 4: Knowledge management and communication						
Outcome 4	**Outcome Indicators**	**Baseline**	**Targets and Monitoring Milestones**	**Means of Verification**	**Assumptions & Risks**	**MTS Expected Accomplish ment**
Countries and global operators apply the new knowledge to phase out remaining mercury chloralkali facilities	*# of* mercury cell chloralkali plants closed and/or converted	*There are active mercury cell chloralkali plants operating around the world*	***Mid-Point Target:*** *None* ***End of project Target:*** *Information from the project reaches to other mercury cell chloralkali governments and operators*	- Global forum agenda and participants list	**Risks** Find the right messaging to other mercury cell chloralkali governments and operators **Assumptions** Relevant information can be synthesized in a manner that is useful to a variety of stakeholders Interests to phase out mercury cell chloralkali plants at the local, national, and international levels remain high	*EA1 and EA2*
Component 4 outputs	**Output Indicators**	**Baseline**	**Targets and Monitoring Milestones**	**Means of Verification**	**Assumptions & Risks**	**MTS Expected Accomplish ment**

Output 4.1: Lessons learned shared with key stakeholders	Amount of Information and communication materials and other awareness raising tools developed # workshops disseminating information	Currently no information regarding the chloralkali industry are widely disseminated in Mexico	***Mid-Point Target:*** *Draft communication templates and materials developed depending on project progress* ***End of project Target:*** Finalized project communication materials At least 2 workshops (with 30% women participation) organized to disseminate information	communication materials progress reports workshop agenda and participants list	**Assumptions** Interests by stakeholders at the local and national levels remain high	EA1 and EA2
Output 4.2: Chloralkali mercury cell conversion guidelines updated and shared with industry partners and stakeholders	Availability of chloralkali mercury cell conversion guidelines on the GMP website to include to Mexico?s conversion experience including best practices, knowledge, insights, lessons learned, success stories to keep regional and international stakeholders engaged	Guidelines need update	***Mid-Point Target:*** *None* ***End of project Target:*** *Guideline updated*	Updated guidelines and posted on GMP website	**Assumptions** Relevant information can be synthesized in a manner that is useful to a variety of stakeholders	EA2

ANNEX B: RESPONSES TO PROJECT REVIEWS (from GEF Secretariat and GEF Agencies, and Responses to Comments from Council at work program inclusion and the Convention Secretariat and STAP at PIF).

STAP Comments	Agency response
It was indicated that a theory of change was prepared and included in Annex A of the PIF. This is, however, missing. Annex A in the PIF is the project map and geographic coordinate, not a theory of change. A problem analysis was, however, provided in Figure 4. Given STAP guidelines on the importance of the theory of change, it is recommended that the proposal should consider developing a "theory of change" that builds on the problem analysis to capture the drivers and root causes, key assumptions, planned interventions, causal and alternative pathways, and outcomes. Please see STAP's theory of change primer for further guidance on theory of change preparation. (https://stapgef.org/sites/default/files/publications/STAP%20ToC%20Primer_webposting.pdf).	A theory of change was developed and is included in the Alternative scenario above and as Appendix 9. Problem and Solution Trees, which support the TOC, are also included.
Barriers and interventions: The PIF lists several barriers, including awareness, financial, technical, policy, and capacity. While the PIF shows how the awareness, financial, technical, and capacity barriers will be addressed, the interventions are very weak in overcoming the policy barriers. STAP recommends that this should be addressed as it may impact the success or failure of the project.	A new barrier ?inadequate regulatory framework? has been added. Output 1.1 directly addresses this barrier through the development of a good practice guide which includes an assessment of laws and capacity (Activity 1.1.3).

Although the PIF stated that the BAT to be adopted for decommissioning is yet to be selected, it would have been useful to present examples of BAT that will be considered in the current PIF. Overall, the specifics on the activities of the project in the PIF is not detailed enough.	Reference to BAT was initially included in the PIF with regard to the design and development of the new membrane plant. In the intervening period, IQUISA has advanced beyond the stage where specific designs could be introduced by the project. Accordingly Output 2.1 has been revised to provide technical support more generally for the conversion. BAT, where applicable, will be identified on an ongoing basis to ensure the plant design is consistent with international best practice. Several guidelines are now referred to throughout the document including the EuroChlor guidance ?Guideline for decommissioning of Mercury Chlor-Alkali Plants? (2009) and UNEP?s ?Conversion from Mercury to Alternative Technology in the Chlor-Alkali Industry? (2012). These documents are indicative of the sort of considerations that will be made as part of the project. Ultimately

Innovation, sustainability, and potential for scaling-up: This section does not explicitly discuss the innovative approach in this project, although the project will use BAT to eliminate mercury use. The PIF does not address the sustainability and scaling up aspects. The project proponent may review the GIZ paper: 2 scaling up in development cooperation - practical guidelines (https://www.shareweb.ch/site/Learning-andNetworking/sdc_km_tools/Documents/GIZ-Scaling-up-in-development-cooperation.pdf).	This section has now been rewritten and explicitly states how these considerations will be addressed as part of the project. We are grateful to the STAP for providing reference to the GIZ document. A related document by WHO ??Nine steps for developing a scaling up strategy? has been referenced by the STAP elsewhere and has been reviewed during the development of the project. This guidance will inform work conducted as part of Components 1 and 4.
The stakeholder section of the PIF presents relevant stakeholders and provides information on how they will be engaged in the project ? this is good.	

The potential impact of climate change on achieving the objective of the project seems to have been ignored. The project involves the decontamination of mercury-contaminated sites and disposal of mercurypolluted materials. It is, hence, essential to consider how projected climate change will influence the decision on technologies and approaches to be adopted in the implementation. For example, how will projected climate change influence how contaminated lands are treated or how mercury-contaminated materials are disposed of? STAP recommends that a detailed climate risk screening should be prepared at the PPG stage. For guidance on climate risk screening, we suggest relevant STAP papers including guidance on climate risk screening of GEF projects April 2020 (https://stapgef.org/stap-chairs-report-gefagency-retreat-1-april-2020) and STAP guidance on climate risk screening, June 2019 (https://stapgef.org/stap-guidance-climate-risk-screening)	Remediation and decommissioning plans developed as part of Component 1 will include detailed climate risk screening. The Terms of reference for the stabilisation will require that climate risk screening be carried out. Given the highly specific nature of each of these aspects, a general climate risk screening was not carried out during the PPG. This information has been added to the risk matrix under section 5.
Coordination: It is shown in the PIF that SEMARNAT/INECC will implement the project with involvement from PROFEPA. However, under sections 2 and 4, the PIF commits to work with other stakeholders, including the private sector. The coordination of all players and stakeholders is, however, not explicit in the PIF. Section 6 did not present information on how the coordination will be done.	Section 6 and Appendix 3 provide a more detailed description of implementation arrangements and coordination.

More information is needed on what will be done with the mercury being recovered from the old facility. How will the mercury be disposed of in accordance with the guidelines for environmentally sound management? The PIF indicates that 50 tons will be reused in South America. Article 3 paragraph 5b of the Minamata Convention states that mercury from the decommissioning of chlor-alkali should be disposed of in accordance with the guidelines for environmentally sound management.	After consultation with the Global Mercury Partnership and the ZeroHg Working Group, Article 3, paragraph 5b applies to excess mercury coming from the decommission of chlor-alkali plants. Non-excess mercury can be used according to the allowable use definition of Article 2k, the Article 3.6 a) i) for the trade, and Article 5 for its use until the phase out date of 2025. The CYDSA plant (90,000 ton capacity) currently purchases 9 tons of mercury per year to compensate mercury losses to air, soil and used catalyst. According to Chlorosur, the current chlorine production capacity using mercury cells in the Latin American region (Argentina, Brazil, Peru and Uruguay) is 385,000 tons which means approximately 38.5 tons of mercury are needed each year. Of the 120 tons currently in the cells of the Coatzacoalcos plant, 81,5 tons will therefore be excess mercury during the year

Norway and Denmark	
We very much welcome this project. The project appears to have very tangible benefits by addressing an already identified 145 metric tons mercury, 53,700 metric tons contaminated material, and 43,186 metric tons CO2e in two different chlor alkali plants in northern Mexico	
Considering that Mexican operators usually have few incentives to upgrade to more environmentally friendly alternatives this seems like a very good use of resources.	
The chemical production industry has been in rapid growth in Mexico the last decade and had an annual production value of 20,4 billion USD in 2018. There is a government framework in place to control the kind of waste management that is discussed in this project, but there are legal loopholes and the current 64 government has other priorities. Mexico is also a signee to the Minamata convention on mercury (2013).	
As noted, this is the first chlor alkali project supported by the GEF and should therefore create important knowledge which must be made readily available to other countries to address their chlor alkali sectors. The sector leaves behind considerable amounts of waste and contaminated land when decommissioned.	Guidance will be generated and shared as part of Component 4.
Germany	
Germany fully supports the proposal; it has great potential to phase out mercury use in Mexico in accordance with the Minamata Convention.	
There is one minor suggestion: Only SEMARNAT and institutions from the environmental sector are included. It may be good to evaluate with SEMARNAT if the inclusion of the Secretar?a de Economia and possibly ANIQ (Asociaci?n Nacional de la Industria Qu?mica) make sense. A broader base of government and private sector actors may improve the impact of the project.	ANIQ has now been included in as a project stakeholder and is listed in the table above (Section 2). The Economy Secretary was considered but not ultimately included as a project stakeholder as other government agencies (SEMARNAT, PROFEPA, INECC) are more directly relevant to the project.
United Kingdom	
It would be good to understand what government buy-in is for this project, and who the main counterparts are on the Mexican side. Is it the Environment Ministry SEMARNAT, the Agenda 2030 team in the President?s Office or another ministry?	DGGIMAR is the main stakeholder of the project as host of the Minamata Convention Focal Point. They have coordinated the PPG activities at the national level.

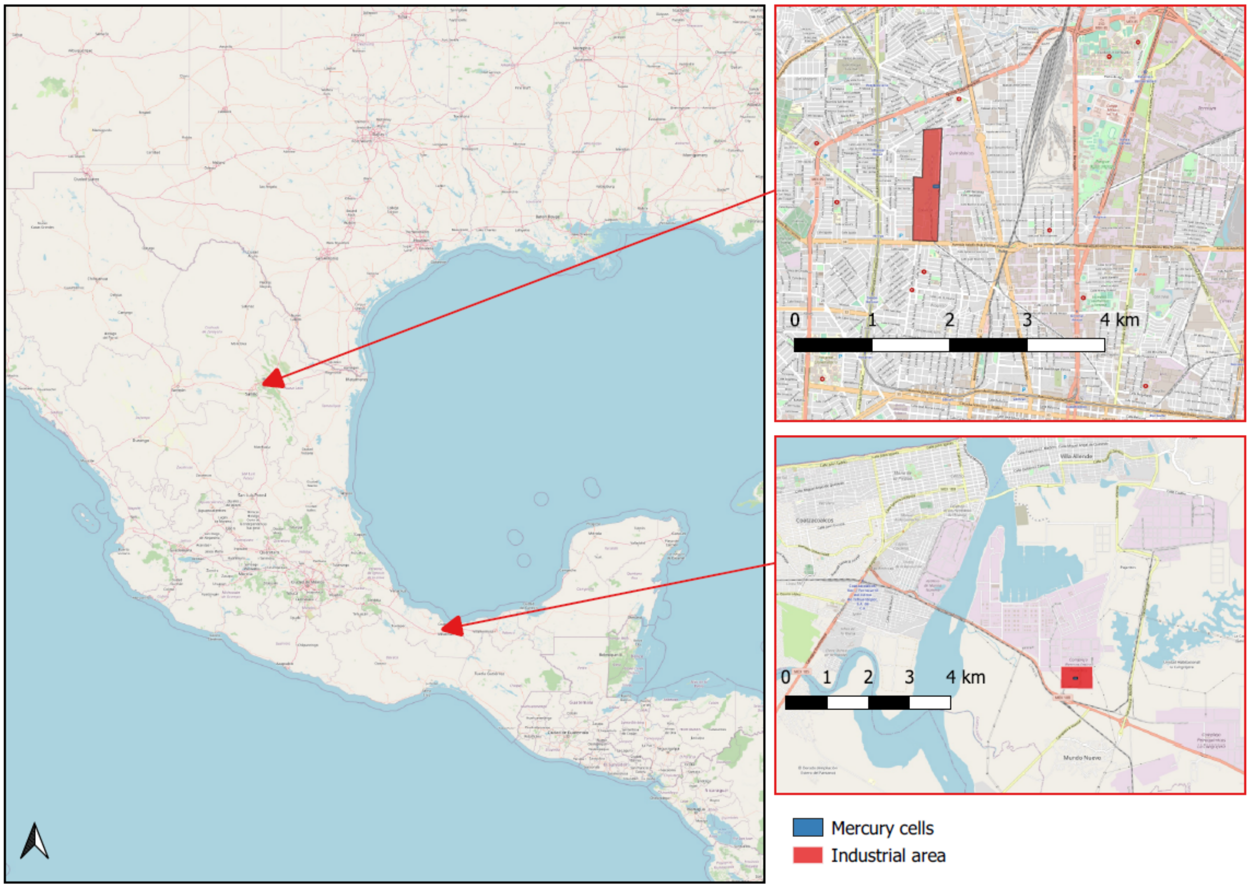
ANNEX C: Status of Utilization of Project Preparation Grant (PPG). (Provide detailed funding amount of the PPG activities financing status in the table below:

PPG Grant Approved at PIF: $300,000			
Project Preparation Activities Implemented	***GETF/LDCF/SCCF Amount ($)***		
	Budgeted Amount	***Amount Spent Tod ate***	***Amount Committed***
Subcontract INECC	**$ 110,000**	**$ 50,000**	**$ 60,000**
Subcontract IPA	**$ 157,000**	**$ 103,148**	**$ 53,852**
Consultants	**$ 33,000**	**$ 33,000**	**$ 0**
Total	**$ 300,000**	**$186,148**	**$ 113,852**

ANNEX D: Project Map(s) and Coordinates

Please attach the geographical location of the project area, if possible.

Coatzacoalcos mercury cells: 18.10499120, -94.39064050 (WGS84)
Monterrey mercury cells: 25.710978, -100.334821, (WGS84)



ANNEX E: Project Budget Table

Please attach a project budget table.

PROJECT TITLE: ELIMINATE MERCURY USE AND ADEQUATELY MANAGE MERCURY AND MERCURY WASTES
IN THE CHLOR ALKALI SECTOR IN MEXICO

Project Number: 10526							
Project Implementing Agency: UN Environment							
Project Executing Agency: UNIDO							
Project implementation period:		**From:**	**Jul-22**	**To:**	**Jul-27**		
Class	**Description**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Total**
	Component 1						
Output 1.1							

010		**Staff & Personnel (Including Consultants)**						
	011-0101	Contaminated sites coordinator	60,000	60,000				120,000
	011-0102	Technical assistants	30,000	30,000				60,000
	011-0103	Legal expert	78,000	39,000				117,000
	011-0104	Socioeconomic expert	20,000					20,000
	011-0105	Contaminated sites expert	60,000	60,000				120,000
		Subtotal	**248,000**	**189,000**	**0**	**0**	**0**	**437,000**
120		**Contract Services**						
	110-1201	Capacity building workshops	8,000	8,000				16,000
	110-1202	Publication costs		10,000				10,000
		Subtotal	**8,000**	**18,000**	**0**	**0**	**0**	**26,000**
160		**Travel**						
	011-1601	Travel for workshops	5,000	5,000				10,000
	011-1602	Travel for regulatory review	5,000	5,000				10,000
		Subtotal	**10,000**	**10,000**	**0**	**0**	**0**	**20,000**
		Output 1.1 Total	**266,000**	**217,000**	**0**	**0**	**0**	**483,000**
010		**Staff & Personnel (Including Consultants)**						
	012-0101	Decontamination expert (national)	30,000	60,000				90,000
	012-0102	Technical Assistants	36,000	72,000				108,000
		Subtotal	**66,000**	**132,000**	**0**	**0**	**0**	**198,000**
120		**Contract Services**						
	110-1201	Capacity building workshops	8,000	8,000				16,000
		Subtotal	**8,000**	**8,000**	**0**	**0**	**0**	**16,000**

130		**Supplies, Commodities & Materials**						
	012-1301	Sampling Supplies	10,000	10,000				20,000
	012-1304	Personal Protective Equipment	10,000	10,000				20,000
	012-1305	Laboratory analysis	35,000	35,000				70,000
		Subtotal	**55,000**	**55,000**	**0**	**0**	**0**	**110,000**
160		**Travel**						
	012-1601	Travel for assessments	15,000	15,000				30,000
		Subtotal	**15,000**	**15,000**	**0**	**0**	**0**	**30,000**
		Output 1.2 Total	**144,000**	**210,000**	**0**	**0**	**0**	**354,000**
010		**Staff & Personnel (Including Consultants)**						
	013-0101	Remediation and monitoring Expert (Coatzacoalcos)	35,000	35,000				70,000
	013-0102	Remediation and monitoring Expert (Monterrey)	35,000	35,000				70,000
		Subtotal	**70,000**	**70,000**	**0**	**0**	**0**	**140,000**
130		**Supplies, Commodities & Materials**						
	013-1301	Sampling Supplies	10,000	10,000				20,000
	013-1302	Personal Protective Equipment	10,000	10,000				20,000
	013-1303	Laboratory analysis	35,000	35,000				70,000
		Subtotal	**55,000**	**55,000**	**0**	**0**	**0**	**110,000**
160		**Travel**						
	013-1601	Travel for assessments	15,000	15,000				30,000
		Subtotal	**15,000**	**15,000**	**0**	**0**	**0**	**30,000**

		Output 1.3 Total	**140,000**	**140,000**	**0**	**0**	**0**	**280,000**
		COMPONENT 1 TOTAL	**550,000**	**567,000**	**0**	**0**	**0**	**1,117,000**
	Component 2							
010		**Staff & Personnel (Including Consultants)**						
	021-0101	Site coordinators (x2)		86,400	86,400	86,400	86,400	345,600
	021-0102	Chloralkali experts (x2)		72,000	144,000	144,000	144,000	504,000
	021-0103	Mechanical engineer (x2)		30,000				30,000
	021-0104	Electrical Engineer (x2)		30,000				30,000
	021-0105	Process Engineer (x2)		30,000				30,000
	021-0106	Civil Engineer (x2)		30,000				30,000
	021-0107	Instrument and control engineer (x2)		30,000				30,000
	021-0108	Piping engineer (x2)		30,000				30,000
	021-0109	Technical assistants		30,000	152,333	152,333	152,333	487,000
		Subtotal	**0**	**368,400**	**382,733**	**382,733**	**382,733**	**1,516,600**
160		**Travel**						
	021-1601	Travel for meetings	10,000	10,000				20,000
	021-1602	International travel	10,000	10,000				20,000
		Subtotal	**20,000**	**20,000**	**0**	**0**	**0**	**40,000**
		Output 2.1 Total	**20,000**	**388,400**	**382,733**	**382,733**	**382,733**	**1,556,600**
010		**Staff & Personnel (Including Consultants)**						
	022-0101	Decontamination Expert (Coatzacoalcos)			60,000	60,000		120,000

	022-0102	Decontamination Expert (Monterrey)			60,000	60,000		120,000
	022-0103	Decontamination Expert (International)			64,000	64,000		128,000
	022-0104	Industrial Emissions Monitoring Expert			60,000	60,000		120,000
	022-0105	Technical Assistants			72,000	72,000		144,000
		Subtotal	**0**	**0**	**316,000**	**316,000**	**0**	**632,000**
130		**Supplies, Commodities & Materials**						
	022-1304	Personal Protective Equipment		20,000	20,000			40,000
		Subtotal	**0**	**20,000**	**20,000**	**0**	**0**	**40,000**
160		**Travel**						
	022-1601	Travel for meetings and assessments		20,000	20,000			40,000
		Subtotal	**0**	**20,000**	**20,000**	**0**	**0**	**40,000**
		Output 2.2 Total	**0**	**20,000**	**336,000**	**316,000**	**0**	**712,000**
010		**Staff & Personnel (Including Consultants)**						
	023-0101	Finance Expert (National)	30,000	60,000				90,000
	023-0102	Finance Expert (International)	48,000	96,000				144,000
		Subtotal	**78,000**	**156,000**	**0**	**0**	**0**	**234,000**
160		**Travel**						
	023-1601	Travel for meetings	5,000	5,000	5,000			15,000
		Subtotal	**5,000**	**5,000**	**5,000**	**0**	**0**	**15,000**
		Output 2.3 Total	**83,000**	**161,000**	**5,000**	**0**	**0**	**249,000**
		COMPONENT 2 TOTAL	**103,000**	**569,400**	**723,733**	**698,733**	**382,733**	**2,517,600**
	Component 3							

120	**Contract Services**						
031-1201	Thermal desorption unit	3,500,000	250,000				3,750,000
031-1202	Mercury stabilisation unit	920,000	60,000				980,000
031-1203	Training services		50,000				50,000
031-1204	Logistics and freight		220,000				220,000
031-1205	training services						0
031-1206	Stabilised mercury transfer and final disposal				25,000	75,000	100,000
	Subtotal	**4,420,000**	**580,000**	**0**	**25,000**	**75,000**	**5,100,000**
125	Operating & other costs						
031-1251	Electricity			170,000	170,000	170,000	510,000
031-1252	Operating expenses			316,800	316,800	316,800	950,400
	Subtotal	0	0	486,800	486,800	486,800	1,460,400
140	**Transfers & Grants to Implementing Partners**						
031-1401	Development of best practices guide	48,000	48,000	48,000	48,000	48,000	**240,000**
	Subtotal	48,000	48,000	48,000	48,000	48,000	**240,000**
160	**Travel**						
031-1601	International travel			5,000	5,000	5,000	15,000
031-1602	Travel for assessment			5,000	5,000	5,000	15,000
	Subtotal	**0**	**0**	**10,000**	**10,000**	**10,000**	**30,000**
	Output 3.1 Total	**4,468,000**	**628,000**	**569,800**	**569,800**	**619,800**	**6,830,400**
010	**Staff & Personnel (Including Consultants)**						
032-0101	Decontamination Expert	0	0	30,000	39,100	30,000	99,100
	Subtotal	**0**	**0**	**30,000**	**39,100**	**30,000**	**99,100**

125	Operating & other costs						
032-1251	Electricity	0	0	5,000	5,000	5,000	15,000
032-1252	Operating expenses	0	0	10,000	10,000	10,000	30,000
	Subtotal	0	0	15,000	15,000	15,000	45,000
160	**Travel**						
032-1601	Travel for meetings	0	0			10,000	10,000
032-1602	Travel for assessment	0	0			10,000	10,000
	Subtotal	**0**	**0**	**0**	**0**	**20,000**	**20,000**
	Output 3.2 Total	**0**	**0**	**45,000**	**54,100**	**65,000**	**164,100**
	COMPONENT 3 TOTAL	**4,468,000**	**628,000**	**589,800**	**623,900**	**684,800**	**6,944,500**
Component 4							
010	**Staff & Personnel (Including Consultants)**						
041-0101	Communication consulting firm	0	50,000	40,000	43,000	50,000	183,000
	Subtotal	**0**	**50,000**	**40,000**	**43,000**	**50,000**	**183,000**
120	**Contract Services**						
041-1201	International workshop				50,000		50,000
041-1202	Technical writer	0	0	0	4,500	4,500	9,000
041-1203	Interpretation				15,000		15,000
041-1204	Regional and national workshops for Activity 4.1.2			10,000	0	10,000	20,000
	Subtotal	**0**	**0**	**10,000**	**105,000**	**30,000**	**145,000**
160	**Travel**						
041-1601	International workshop travel	0	0	0	50,000	0	50,000
041-1603	Other International travel	0		4,000	4,000	4,000	12,000
	Subtotal	**0**	**0**	**4,000**	**54,000**	**4,000**	**62,000**

	Output 4.1 Total	**0**	**50,000**	**54,000**	**166,500**	**68,500**	**339,000**
010	**Staff & Personnel (Including Consultants)**						
041-0103	Technical writer			29,333	29,333	29,334	88,000
	Subtotal	**0**	**0**	**29,333**	**29,333**	**29,334**	**88,000**
120	**Contract Services**						
042-1201	Regional and national workshops			5,000	5,000	5,000	15,000
	Subtotal	**0**	**0**	**5,000**	**5,000**	**5,000**	**15,000**
140	**Transfers & Grants to Implementing Partners**						
0424-1401	Development of dissemination package		36,000	36,000	36,000	36,000	**144,000**
	Subtotal	**0**	**36,000**	**36,000**	**36,000**	**36,000**	**144,000**
160	**Travel**						
042-1601	Travel within Mexico			2,000	2,000	2,000	6,000
042-1602	International travel			2,500	2,500	2,500	7,500
	Subtotal	**0**	**0**	**2,500**	**2,500**	**2,500**	**13,500**
	Output 4.2 Total	**0**	**36,000**	**72,833**	**72,833**	**72,834**	**260,500**
	COMPONENT 4 TOTAL	**0**	**86,000**	**126,833**	**239,833**	**141,334**	**599,500**
MONITORING AND EVALUATION							
120	**Contract Services**						
0ME-1201	Monitoring and Evaluation	40,000	40,000	40,000	40,000	40,000	200,000
	MONITORING AND EVALUATION TOTAL	**40,000**	**40,000**	**40,000**	**40,000**	**40,000**	**200,000**

PROJECT MANAGEMENT COSTS (PMC)							
010	**Staff & Personnel (Including Consultants)**						
PM-0101	Project Manager	66,000	66,000	66,000	66,000	66,000	330,000
PM-0102	Project Management Assistants	44,000	44,000	44,000	44,000	44,000	220,000
	Subtotal	110,000	110,000	110,000	110,000	110,000	**550,000**
160	**Travel**						
PM-1601	Travel Project management	4,280	4,280	4,280	4,280	4,280	21,400
	Subtotal	4,280	4,280	4,280	4,280	4,280	**21,400**
PMC Total		**114,280**	**114,280**	**114,280**	**114,280**	**114,280**	**571,400**
USD GRAND TOTAL							**12,000,000**

ANNEX F: (For NGI only) Termsheet

Instructions. Please submit an finalized termsheet in this section. The NGI Program Call for Proposals provided a template in Annex A of the Call for Proposals that can be used by the Agency. Agencies can use their own termsheets but must add sections on Currency Risk, Co-financing Ratio and Financial Additionality as defined in the template provided in Annex A of the Call for proposals. Termsheets submitted at CEO endorsement stage should include final terms and conditions of the financing.

ANNEX G: (For NGI only) Reflows

Instructions. Please submit a reflows table as provided in Annex B of the NGI Program Call for Proposals and the Trustee excel sheet for reflows (as provided by the Secretariat or the Trustee) in the Document Section of the CEO endorsement. The Agencys is required to quantify any expected financial return/gains/interests earned on non-grant instruments that will be transferred to the GEF Trust Fund as noted in the Guidelines on the Project and Program Cycle Policy. Partner Agencies will be required to comply with the reflows procedures established in their respective Financial Procedures Agreement with the GEF Trustee. Agencies are welcomed to provide assumptions that explain expected financial reflow schedules.

ANNEX H: (For NGI only) Agency Capacity to generate reflows

Instructions. The GEF Agency submitting the CEO endorsement request is required to respond to any questions raised as part of the PIF review process that required clarifications on the Agency Capacity to manage reflows. This Annex seeks to demonstrate Agencies? capacity and eligibility to administer NGI resources as established in the Guidelines on the Project and Program Cycle Policy, GEF/C.52/Inf.06/Rev.01, June 9, 2017 (Annex 5).