The Global Greenchem Innovation and Network Programme

Part I: Project Information

GEF ID
10353

Project Type
FSP

Type of Trust Fund
GET

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

Project Title
The Global Greenchem Innovation and Network Programme

Countries
Global

Agency(ies)
UNIDO

Other Executing Partner(s)
Yale University

Executing Partner Type
Others

GEF Focal Area
Chemicals and Waste

Taxonomy
Focal Areas, Chemicals and Waste, Persistent Organic Pollutants, New Persistent Organic Pollutants, Green Chemistry, Sound Management of chemicals and waste, Mercury, Influencing models, Convene multi-

stakeholder alliances, Deploy innovative financial instruments, Demonstrate innovative approache, Transform policy and regulatory environments, Strengthen institutional capacity and decision-making, Stakeholders, Beneficiaries, Private Sector, Individuals/Entrepreneurs, SMEs, Type of Engagement, Consultation, Participation, Information Dissemination, Partnership, Communications, Education, Strategic Communications, Awareness Raising, Gender Equality, Gender Mainstreaming, Gender-sensitive indicators, Sex-disaggregated indicators, Gender results areas, Capacity Development, Knowledge Generation and Exchange, Capacity, Knowledge and Research, Knowledge Generation, Master Classes, Training, Course, Workshop, Seminar, Professional Development, Targeted Research, Innovation, Knowledge Exchange, Peer-to-Peer, Conference, Field Visit, Learning, Theory of change, Indicators to measure change

Rio Markers

Climate Change Mitigation

Climate Change Mitigation 0

Climate Change Adaptation

Climate Change Adaptation 0

Submission Date

11/26/2021

Expected Implementation Start

7/1/2022

Expected Completion Date

6/30/2028

Duration

72In Months

Agency Fee($)

1,134,000.00

A. FOCAL/NON-FOCAL AREA ELEMENTS

Objectives/Programs	Focal Area Outcomes	Trust Fund	GEF Amount($)	Co-Fin Amount($)
CW-1-1	Strengthen the sound management of industrial chemicals and their waste through better control, and reduction and/or elimination	GET	12,600,000.00	127,556,440.74
		Total Project Cost($)	**12,600,000.00**	**127,556,440.74**

B. Project description summary

Project Objective

To scale up green chemistry for POPs and mercury replacement through capacity building and innovation, and creation of a global unifying green chemistry network for implementation and uptake.

Project Component	Financing Type	Expected Outcomes	Expected Outputs	Trust Fund	GEF Project Financing($)	Confirmed Co-Financing($)
Component 1: Green Chemistry Inclusion Network for Capacity Building	Technical Assistance	Outcome 1. Functional Green Chemistry inclusion network	Output 1.1. Developed and provided training and awareness events Output 1.2 Networking mechanism in place through established programmatic content schedule Output 1.3 Mobilized Network to support Accelerator Programme	GET	1,400,000.00	13,686,064.00

Project Component	Financing Type	Expected Outcomes	Expected Outputs	Trust Fund	GEF Project Financing($)	Confirmed Co-Financing($)
Component 2: Green Chemistry Accelerator Programme	Technical Assistance	Outcome 2. Regional Accelerator Programmes developed and implemented for scaling and green business creation	Output 2.1 Accelerators established with completed curriculum training for Judges, Mentors and Administrators Output 2.2 Business competitions held (?Innovation Challenges?) Output 2.3 Global winners connected to further technical resources, investors, and commercial partners	GET	4,700,000.00	50,013,444.00

Project Component	Financing Type	Expected Outcomes	Expected Outputs	Trust Fund	GEF Project Financing($)	Confirmed Co-Financing($)
Component 3: Green Chemistry alternatives for POPs for upscale and replication	Investment	Outcome 3. Green Chemistry alternatives for POPs implementation and upscaling of successful demonstrations	Output 3.1. Green Chemistry alternatives for POPs implemented Output 3.2. Replication mechanisms of green chemistry alternatives for national, regional, and global level up-take developed and implemented	GET	5,500,000.00	55,656,932.74

Project Component	Financing Type	Expected Outcomes	Expected Outputs	Trust Fund	GEF Project Financing($)	Confirmed Co-Financing($)
Component 4: Monitoring and evaluation	Technical Assistance	Outcome 4. Project monitoring and evaluation in line with GEF and UNIDO requirements	Output 4.1. Project monitoring and evaluation plan designed and implemented Output 4.2 Mid-term evaluation completed Output 4.3. Terminal project evaluation completed	GET	400,000.00	2,000,000.00
				Sub Total ($)	**12,000,000.00**	**121,356,440.74**

Project Management Cost (PMC)

GET	600,000.00	6,200,000.00
Sub Total($)	**600,000.00**	**6,200,000.00**
Total Project Cost($)	**12,600,000.00**	**127,556,440.74**

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	Ministry of Environmental Protection, Serbia	In-kind	Recurrent expenditures	300,000.00
Recipient Country Government	National Environment Management Authority (NEMA), Uganda	In-kind	Recurrent expenditures	583,969.00
Recipient Country Government	Ministry of Environmental Protection and Natural Resources of Ukraine	In-kind	Recurrent expenditures	550,000.00
Recipient Country Government	Ministry of Environment (MINAM), Peru	In-kind	Recurrent expenditures	177,954.00
Recipient Country Government	Ministry of Environment (MoE), Jordan	In-kind	Recurrent expenditures	4,940,208.74
Recipient Country Government	Ministry of Transport (MoT, Jordan	In-kind	Recurrent expenditures	122,000.00
Recipient Country Government	Ministry of Industry, Trade and Supply (MIT), Jordan	In-kind	Recurrent expenditures	128,952.00
Recipient Country Government	Ministry of Higher Education & Scientific Research (MoHESR)/Scientific Research&Innovation Support Fund (SRISF)	In-kind	Recurrent expenditures	300,000.00
Recipient Country Government	Ministry of Labour (MOL), Jordan	In-kind	Recurrent expenditures	101,740.00
Recipient Country Government	Badan Pengkajian dan Penerapan Teknologi, Indonesia	In-kind	Recurrent expenditures	1,000,000.00

Sources of Co-financing	Name of Co-financier	Type of Co-financing	Investment Mobilized	Amount($)
Private Sector	E-Reciklaza (Serbia)	Grant	Investment mobilized	654,080.00
Private Sector	IEIDCO, Engineering Industries&Design Co, Jordan	Grant	Investment mobilized	1,238,000.00
Private Sector	Finding XY, Uganda	Grant	Investment mobilized	14,217,180.00
Private Sector	pT Inkote Indonesia	In-kind	Recurrent expenditures	24,900.00
Private Sector	Quimica Verde, Peru	In-kind	Recurrent expenditures	50,000.00
Private Sector	Newreka	In-kind	Recurrent expenditures	900,000.00
Private Sector	Newreka	Grant	Investment mobilized	65,000.00
Private Sector	P2 Science, U.S.A	In-kind	Recurrent expenditures	18,000,000.00
Private Sector	Raise Green	In-kind	Recurrent expenditures	2,000,000.00
Private Sector	Gsk GalxoSmithKline	In-kind	Recurrent expenditures	50,000.00
Private Sector	Gsk GalxoSmithKline	Grant	Investment mobilized	150,000.00
Private Sector	Noya	In-kind	Recurrent expenditures	3,000,000.00
Private Sector	Millipore Sigma	In-kind	Recurrent expenditures	60,000.00

Sources of Co-financing	Name of Co-financier	Type of Co-financing	Investment Mobilized	Amount($)
Civil Society Organization	Beyond benign-green chemistry education	In-kind	Recurrent expenditures	1,300,000.00
Civil Society Organization	Chemical Angel Network, LLC	In-kind	Recurrent expenditures	870,000.00
Civil Society Organization	Chemical Angel Network, LLC	Grant	Investment mobilized	600,000.00
Civil Society Organization	Green Chemistree Foundation	In-kind	Recurrent expenditures	700,000.00
Civil Society Organization	Chemical Society of Thailand under the Patronage of Her Royal Highness Princess Chulabhorn Mahidol	In-kind	Recurrent expenditures	30,000.00
Civil Society Organization	Chemical Society of Thailand under the Patronage of Her Royal Highness Princess Chulabhorn Mahidol	Grant	Investment mobilized	30,000.00
Civil Society Organization	Green Sciences for Sustainable Development Foundation	In-kind	Recurrent expenditures	120,000.00
Civil Society Organization	Institute for General and Physical Chemistry, Belgrade (IGPC), Serbia	In-kind	Recurrent expenditures	200,000.00
Other	Innovation Fund of Serbia	In-kind	Recurrent expenditures	37,677,644.00
Other	Royal Scientifiy Society (RSS), Jordan	In-kind	Recurrent expenditures	200,000.00
Other	Jordan Customs	In-kind	Recurrent expenditures	6,423,131.00

Sources of Co-financing	Name of Co-financier	Type of Co-financing	Investment Mobilized	Amount($)
Other	National Cleanar Production Centre (NCPC), Serbia	In-kind	Recurrent expenditures	100,000.00
Other	Uganda Cleaner Production Centre (UCPC)	In-kind	Recurrent expenditures	172,090.00
Other	Ukraine Resource Efficient and Cleaner Production Centre (RECPC)	In-kind	Recurrent expenditures	90,000.00
Other	CPU, Jordan (National Cleaner Production Centre)	In-kind	Recurrent expenditures	250,000.00
Other	Grupo GEA, Peru (National Cleaner Production Center)	In-kind	Recurrent expenditures	286,000.00
Other	Innovation Holding ?Sikorsky Challenge?	In-kind	Recurrent expenditures	50,000.00
Other	Chem Forward	In-kind	Recurrent expenditures	600,000.00
Other	Federal University of Sao Carlos, Department of Chemistry, Brazil	In-kind	Recurrent expenditures	100,000.00
Other	Egypt National Cleaner Production Center	In-kind	Recurrent expenditures	43,200.00
Other	McGill, Department of Chemistry, Montreal, Canada	In-kind	Recurrent expenditures	2,000,000.00
Other	Addis Ababa University, Ethiopia	In-kind	Recurrent expenditures	120,000.00
Other	University of Massachusetts, Bosten, U.S.A.y of Massachusetts, Bosten, U.S.A.	In-kind	Recurrent expenditures	429,600.00
Other	Continuing Education Programs, Seattle, U.S.A.	In-kind	Recurrent expenditures	450,000.00

Sources of Co-financing	Name of Co-financier	Type of Co-financing	Investment Mobilized	Amount($)
Other	The University of Auckland, New Zealand	In-kind	Recurrent expenditures	182,000.00
Other	Hohenstein	In-kind	Recurrent expenditures	11,700,000.00
Other	The George Washington University	In-kind	Recurrent expenditures	1,200,000.00
Other	Air Company	In-kind	Recurrent expenditures	10,000.00
Other	Max Planck Institute	In-kind	Recurrent expenditures	2,100,000.00
Other	Lowell Center for Sustainable Production	In-kind	Recurrent expenditures	400,000.00
Other	On Demand Pharmaceuticals	In-kind	Recurrent expenditures	1,200,000.00
Other	Green Chemistry and Commerce Council	In-kind	Recurrent expenditures	1,000,000.00
Other	Yale University	In-kind	Recurrent expenditures	6,861,271.00
GEF Agency	UNIDO	Grant	Investment mobilized	165,000.00
GEF Agency	UNIDO	In-kind	Recurrent expenditures	1,282,521.00
			Total Co-Financing($)	**127,556,440.74**

Describe how any "Investment Mobilized" was identified

As per GEF co-financing guidelines, investment mobilized is co-financing that exclude recurrent expenditures. Investment mobilized was identified mainly from the commitment of the private sector. UNIDO, with support from Yale, will support at least 6 companies with the implementation of a GC alternative of a process using a POPs chemical or a POPs-containing material, in a selected sector reconfirmed during the project preparation phase. The private sector for Component 3 was requested to provide co-financing letters to show interest, commitment and sources of co-financing provided for the pilot projects Co-financing is a condition for pre- selection of pilots and pilot companies were informed that they would be required to provide co-financing to participate in the project. Due to the some national impacts of the COVID-19 pandemic, country co-financing contribution differs among the countries, however, efforts will be made during the project inception phase to obtain additional co-financing. Private companies under Component 1 and 2 have also provided grant co-financing to express their technical support in the accelerator activities of the 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($)	Fee($)
UNIDO	GET	Global	Chemicals and Waste	POPs	9,600,000	864,000
UNIDO	GET	Global	Chemicals and Waste	Mercury	2,000,000	180,000
UNIDO	GET	Global	Chemicals and Waste	SAICM	1,000,000	90,000
				Total Grant Resources($)	**12,600,000.00**	**1,134,000.00**

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 ($)

287,616

PPG Agency Fee ($)

25,885

Agency	Trust Fund	Country	Focal Area	Programming of Funds	Amount($)	Fee($)
UNIDO	GET	Global	Chemicals and Waste	POPs	287,616	25,885
				Total Project Costs($)	**287,616.00**	**25,885.00**

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)	0	0	0	0
Expected metric tons of CO?e (indirect)	0	81000	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)				
Expected metric tons of CO?e (indirect)		81,000		
Anticipated start year of accounting		2024		
Duration of accounting		4		

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)

Technolog y	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)
748.94	**572.80**	**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)	
SelectShort-chain chlorinated paraffins (SCCPs)	702.45	176.00			
SelectPerfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride	19.91	189.20			
SelectHexabromocyclodo decane (HBCDD)	26.58	24.00			
SelectDecabromodiphenyl ether (commercial mixture, c-decaBDE)		183.60			

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)

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)

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)
2,316,937.00	3,107,737.20		

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	550	2,092		
Male	750	3,138		
Total	1300	5230	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

Please see detailed explanations in the Global Environmental Benefit section. During PPG pilot sectors and GEBs have been calculated on a specific representative national company and/or on available literature research for 4 years of project implementation (Output 3.1), and with replication factors under Output 3.2. Component 2 will achieve the GEBs based on multiply companies supported under the accelerator program, while Component 1 will achieve indirect GEBs through capacity-building, information exchange, and compendium of GC options. Please note that the use of PFHxS has also been identified with 32,68 t, however, there is no related GEF indicator yet. There are replication factors for Component 1 and 2 described in the Global Environmental Benefit section, which most realistically can be elaborated on during the project stage.

Part II. Project Justification

1a. Project Description

Changes in alignment with the project design with the original PIF

1. The request for the CEO endorsement is in-line with the original PIF document submitted and approved by the GEF Council (GEF ID 10353). The project framework is still based on four components: (1) Green Chemistry Inclusion Network for Capacity Building: (2) Green Chemistry Accelerator Programme: (3) Green Chemistry alternatives for POPs and mercury for up-scale and replication and (4) Monitoring and Evaluation. The related outcomes and outputs remain unchanged, however, activities for the outputs have been designed to elaborate on practical aspects of the global and country components.

2. During the PPG phase also technical gaps were identified and new elements were added to the CEO endorsement to better reflect the COVID-19 pandemic situation, to solidify short, medium, and long term goals for the Green Chemistry Innovation and Inclusion Network, including an exit strategy, and to main standards of the practical operating procedures for accelerators.

3. This CEO endorsement has been written during the COVID-19 pandemic, including its limitation on in-person meetings (e.g. remote stakeholder consultations and site visits for the national pilot projects; and home-based work). During the PPG phase, all negotiations and consultations among UNIDO as the Implementation Agency, Yale as the main executing entity, relevant Ministries in the participating countries, and country teams, have been conducted via e-mail, Skype, and/or zoom. Although it has been noted that the online consultations have contributed to good team-building opportunities, the main challenge for the country teams was to obtain sectoral data and information from pilot companies (other than the available data from the NIP updates, MIAs, and other available sources). The reason is that the COVID-19 situation strongly impacted all six participating countries in matters related to human health, economic factors (such as the disruption of global value chains, especially affecting those countries which are integrated into global value chains), external finances (e.g. negative short-term economic growth, decline in employment, foreign direct investments) and others (https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/publication/CDP_Comprehensive_Study_2021.pdf), leading to national lock-downs, restrictions and other COVID-19 related issues.

4. In line with UNIDO?s common response to COVID-19, UNIDO joins the response efforts of the international community, including the G20, and the United Nations system in particular. As a specialized agency of the UN system, UNIDO?s mandate is to promote inclusive and sustainable industrial development. UNIDO?s response framework is to prepare and contain, respond and adapt, and recover and transform. The UNIDO approach is strategically aligned and synergized with:

5. ? A United Nations ?Framework for the immediate socio-economic response to COVID-19? to implement the Secretary General?s report ?Shared responsibility, global solidarity: Responding to the Socioeconomic impacts of COVID-19?

? The 2030 Agenda for Sustainable Development, and the UN Decade of Action calling for the acceleration of sustainable solutions to all the world?s biggest challenges

? The UN 75th Anniversary ?The World Needs Solidarity?, prioritizing the human family and how we can build a better future for all. Thus, the following applicable but revised COVID-19 measures related to this project will be applied:

6. <u>Prepare and contain</u>

? Continuously monitor the impact of the outbreak on project monitoring indicators

? Assist with industrial risk management and emergency plans formulation

? Share with government and industry actors best practices resulting in coordinated and agile response through virtual collaboration platforms;

7. <u>Respond and adapt</u>

? Expand e-learning modules increasing virtual outreach;

8. Potential COVID-19 risks have also been incorporated into the risk table to ensure proper mitigation measures, in case the pandemic will continue to impact the participating countries during the project duration. COVID-19 risks and opportunities are described in the CEO endorsement risk section.

9. Pilot selections have been made based on the applicability of the sector and chemicals to GC, national priorities, and stakeholders consultations as far as possible and, for specific cases, will require final confirmation during the inception phase. A summary of the PPG stakeholder engagement and consultations, pilot selection process, and selected sectors (along with GEF criteria) can be found in Annex I.

10. The following Table 1 provides an overview of the changes from the PIF structure versus the CEO endorsement:

TABLE 1: AN OVERVIEW OF THE CHANGES FROM THE PIF STRUCTURE VERSUS THE CEO ENDORSEMENT

PIF Version	CEO Endorsement Version	Comments/Justification
Component 1		
Leadership Committee not present.	Activity 1.1.1.1. Creating the framework for the Green Chemistry Innovation and Inclusion Network (Year 1-6) Formation of the Leadership Committee from the domestic and international network members who represent industry, academia, NGOs.	The PPG phase recognized a need for the Leadership Committee, which will be an advisory body reporting to the PSC. The Leadership Committee will be formed to advise on (i) short, medium and long term goals of the network, (ii) incentives to maintain the network growth and new member recruitment, (iii) shape the ultimate role of the network to best serve its members, (iv) develop an effective communication strategy.

A website not well defined	Activity 1.1.1.2. Web-based Green Chemistry Global Innovation and Inclusion Network (Year 2-6) Additional details on the website functionality provided	During the PPG phase, the functionality of the web portal that will inform the structure of the network has been requested. The portal will reflect the different needs of the Innovation and Inclusion Network members and will have five primary functions: 1. Serve as a resource for the Innovation and Inclusion Network members by offering awareness trainings, technical support, guidelines and webinars on green chemistry trends 2. Allow networking and exchanging ideas between different stakeholders 3. Be a primary platform for running the accelerator program and innovation challenges 4. Provide a coordination mechanism between six participating countries 5. Serve as a knowledge repository for all project documents and products
Component 2		
Training for mentors and experts not included	Activity 2.1.1.2. Expert training (Year 2-3) Expert training has been added to facilitate coordination and cohesiveness between countries.	During PPG phase, different levels of training needs among green chemistry experts have been identified. Therefore, expert training will be provided virtually on how to provide mentorship (including technical aspects and support for financial access) and impactful guidance to the accelerator participants. The training will also help with coordination, cohesiveness and setting expectations across all six participating countries. After completing the training, mentors, coaches, administrators, and judges will be given a certificate of completion allowing them to serve in their role. Please note that the mentees will be selected through the competition to be organized under component 2. The mentors will be selected within entities part of component 1 and based on the specific needs of the mentees. It is planned to have dedicated categories for women-led businesses under the competitions of component 2. Specific category for indigenous-led businesses, where possible, will also be included.

Accelerator Guidebook not present	Activity 2.1.1.1. Develop curriculum and Accelerator Guidebook to guide in the operation of the accelerator programme. (Year 1-2) Development of the guidebook to help with the standard operating procedures for accelerator set up.	PPG has identified a need for informing accelerator design from the procedural standpoint. To address the complexity of the accelerator network across all six countries and to maintain the standards of the practical operating procedures, templates and questionnaires for mentors, and, applicant selection and judging criteria, the Accelerator Guidebook will be developed and disseminated to help inform the process.
Sustainability strategy not well defined COVID-19 not considered	Innovation, Sustainability, Upscaling Sustainability and exit strategy for accelerator. COVID-19 measures Output 1.1.1. Developed and provided training and awareness events Output 1.1.2. Networking mechanism in place through established programmatic content schedule Output 1.1.3. Mobilized Network to support Accelerator Programme Output 2.1.1. Accelerators established with completed curriculum training for Judges, Mentors and Administrators Output 2.1.3. Global winners connected to further technical resources, investors, and commercial partners COVID-19 measures incorporated into all programme outputs.	National executing partners will be asked to develop a sustainability strategy for each country to ensure a continuation of the accelerator beyond the funding cycle. All in-person events (leadership committee meeting, Train the Facilitators Training, conference networking, accelerator recruitment, accelerator program, and judging) have been revised to include a virtual element, or, operate at the reduced capacity following a local COVID-19 guidelines.
Accelerator programmes are not defined	Inclusion of microplastics and mercury as dedicated category	The pilots could not identify a specific mercury case, however, tmercury will be included as category under the Accelerator work, such as substituting mercury or innovative/greenchem solutions for mercury waste management/remediation. Microplastics will be also considered.

Component 3		
Pilot selection	Selection of some pilot sectors have changed from PIF to CEO endorsement due to an intensive stakeholder consultation and data collection process.	A summary of the PPG stakeholder engagement and consultations, pilot selection process and selected sectors (along GEF criteria) can be found in Annex I. Mercury and microplastics will be part of Component 1 (Network and knowledge compilation) and Component 2, which will include a mercury, and microplastics dedicated category. This will include either substituting mercury or innovative greenchem solutions for mercury waste management/remediation.
GEF budget allocation was US$ 5 million	GEF budget allocation proposed to be US$ 5.5 million	During PPG phase, technical support for the PPG activities at national level was needed to ensure compliance with the GEF, UNIDO and project objective. To ensure availability of technical support during project execution and delivery of the project objective, additional US$ 500,000 have been allocated to component 3 for Yale technical support. The corresponding amount was deducted from component 2.
Other considerations		
Winner of the accelerator to provide annual estimate of the contribution to reduce microplastics in Component 2 Microplastics reduction established for scaleup and replication in Component 3	Microplastics training and awareness-raising events in Component 1 (Activity 1.1.1.3.) Knowledge generation and training resources on microplastics in Component 1 (Activity 1.1.2.1) Case studies on alternatives to microplastics encouraged at the conference for the global members in Component 1 (Activity 1.1.2.3) Accelerator submission category that will accept innovative technologies to displace or reduce microplastics in Component 2 (Activity 2.1.1.3) Microplastics as a business competition theme (Activity 2.1.2.1)	Given that microplastics alternatives are new and emerging field, the programme is designed to harness the interest and provide training, knowledge and acceleration opportunities for emerging ventures. Activity 2.1.2.1 will also expand the theme of microplastics to microfibers. Additional consideration of microfibers will also be made for Component 3 and its work on textiles in Uganda and Ukraine.

Winner of the accelerator to provide annual estimate of the contribution to reduce mercury in Component 2	Mercury training and awareness raising events in Component 1 (Activity 1.1.1.3.) Knowledge generation and training resources on mercury in Component 1 (Activity 1.1.2.1) Case studies on alternatives to mercury encouraged at the conference for the global members in Component 1 (Activity 1.1.2.3) Accelerator submission category that will accept innovative technologies to replace an existing mercury technology or provide a viable solution to mercury waste management and remediation in Component 2 (Activity 2.1.1.3)	While an important health and environmental threat, alternatives to mercury have stagnated and have not progressed in the last couple of years. Training and prioritizing mercury through accelerator programme will enable new ideas and solutions to be developed. The project will monitor and report on mercury reduction under component 1 and especially component 2 once relevant activities have started.
Co-financing	PIF co-fincancing was US$ 89,697,521.00	Through extensive stakeholder consultations, co-financing of the CEO endorsement is now US$ 127,556,440.74

1) Global environmental and/or adaptation problems, root causes and barriers that need to be addressed

Global environmental problems

Problem: Hazardous chemicals including POPs and mercury are still being used for industrial applications and thus continue to threaten human health and the environment.

10. There are 182 million organic and inorganic substances disclosed in the literature since the early 1800s. A recent analysis of 22 chemical inventories from 19 countries found over 350,000 chemicals and mixtures which are registered for production and use. Of those with an identifiable Chemical Abstracts Service (CAS) number, less than 21% were registered within the past decade and had received scrutiny for safety and environmental hazards. The other 80% of chemicals registered for production and use may have been poorly characterized without an understanding of impact on health and the environment.

11. With a predominance of chemicals lacking sufficient environmental health and safety evaluation, a regrettable chemical substitution can occur. Regrettable substitutions happen when a hazardous chemical is intentionally replaced with another substance which has comparable if not greater hazard than the original chemical. A classic example includes Bisphenol A (BPA), an endocrine disruptor, which for years has been used as an additive in most plastics. The initial replacements of BPA included BPS (Bisphenol S) and BPF (Bisphenol F) to attempt to minimize the hazard while maintaining the performance characteristics. Unfortunately all BPA alternatives were determined to have comparable health hazards. In fact, studies found that BPS persists in the body longer and at higher concentrations than BPA. Other examples of regrettable substitutions include chemicals, which are now listed under the Stockholm Convention (SC) on Persistent Organic Pollutants (POPs) such as dichlorodiphenyltrichloroethane (DDT) replacement with organophosphate pesticides, and polybrominated biphenyls (PBBs) replacement with polybrominated diphenyl ethers (PBDEs). All alternatives were shown to have a worse persistence, biodegradation and toxicity profiles, and contributed to a number of human toxicity and environmental issues including climate change.

12. The chemical industry contributes an estimated $5.7 trillion to the world Gross Domestic Product (GDP) through direct, indirect, and induced impacts, equivalent to 7% of the world?s GDP. The chemical industry provides essential feedstocks, commodity chemicals, specialty chemicals, and more to arguably every sector in the economy. With global chemical production

capacity doubling from 2000 to 2017 and sales projected to double from 2017 to 2030, the same growth trend is visible in emerging economies as well, further demonstrating the importance of the chemical industry on global and local economy.

13. Multi-lateral environmental agreements such as the Basel, Rotterdam, Stockholm, and Minamata conventions were designed to address hazardous waste, pesticides, Persistent Organic Pollutants (POPs), and mercury, respectively. While these agreements have had a demonstrated positive impact, the chemicals continue to exist in the environment, especially through unsound management of these chemicals, as well as in industrial applications. Climate change amplifies the effect of chemicals by re-volatilizing deposited chemicals including mercury and POPs, and releasing trapped hazardous chemicals from melting ice, all prolonging the impact of these chemicals in the environment.

14. Implementation of safer green chemistry is essential to achieving the UN Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development. As previously stated, chemicals touch every sector of the economy; therefore, hazardous chemical production and use can broadly impact many, arguably all, SDGs. Very directly, chemicals align with SDG targets:

- ? 3.9 (By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.) and
- ? 12.4 (Target: 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.), and indirectly with:
- ? SDG 3 (Good health and well-being);
- ? SDG 6 (Clean water and sanitation);
- ? SDG 7 (Affordable and clean energy);
- ? SDG 9 (Industry, Innovation and Infrastructure);
- ? SDG 11 (Sustainable cities and communities);
- ? SDG 12 (Responsible Consumption and Production);
- ? SDG 13 Climate Action;
- ? SDG 14 (Life below water).

15. With the recent emphasis on circular economy as a key strategy for meeting SDGs, the presence of hazardous chemicals is increasingly problematic. In a transition from a linear to a circular economy, materials are intended to remain in commerce at their highest use-value. Materials containing hazardous chemicals then remain in circulation as well extending the lifetime of use and increased risk of exposure to the environment and human health. Elimination of hazardous chemicals in materials is a prerequisite for a circular economy to function to its full potential.[7][1] The elimination of hazardous substances by design can be achieved with green chemistry. An overview of the 12 Green Chemistry Principles can be found in Annex J.

Root causes and barriers that need to be addressed

16. The production and use of hazardous chemicals including POPs and mercury can be traced back to four main root causes, namely:

17. (1) Speciality chemicals import dependency: Many developing and countries with economies in transition rely on the importation of hazardous chemicals and/or the import of hazardous-containing products, which are needed for further manufacturing of products and/or articles. This situation limits the ability to manage and control the hazardous chemicals incorporated into the products and articles brought into the country.

18. (2) Mixture of minority hazardous substances: POPs and Hg are being used for specific production purposes based on their properties (e.g. oil and grease resistance, flame retardants) and

they remain in the produced products and/or articles throughout their lifespan. Large amounts of chemical pollutants are released from production, products, and wastes, which illustrates the inefficient use of resources;

19. (3) Global volume of hazardous chemicals produced increasing: The Global Chemicals Outlook Report II from IISD noted that there is a projected rapid growth of production capacity and sales, which are expected to almost double from 2017 to 2030. It is projected that growth will be highest in Asia. China is estimated to account for almost 50% of global sales by 2030. Chemical production is linked to and affects global material flows, however, chemical-intensive products and complex global supply chains also create challenges for circularity. Interestingly, the EU production of the most hazardous chemicals hardly changed over the period from 2010 until 2021.

20. (4) Competitive and profit-oriented chemical industry: The chemical industry is a key driver for economic development and wealth, providing modern products and materials and enabling technical solutions in virtually all sectors of the economy. The chemical sector is also one largest industrial sectors contributing to direct and indirect employment. Due to lower prices, availability, and lack of enforcement and incentives for safer alternatives, the chemical industry often uses hazardous chemicals, including toxic POPs and Hg.

21. All of these causes have a number of barriers that prevent a wide implementation of safer alternatives. The following are the main barrier, which needs to be addressed during the project, whose linkages are also shown in Figure 1:

? Limited influence of specialty chemical design;

? Limited transparency on chemical composition;

? Limited monitoring capacity of importing countries on chemical composition;

? Lack of awareness or knowledge on safer chemical alternatives;

? Lack of collaborations between academia and industry;

? Incomplete environmental legislation to adequately address POPs and Hg, including containing products;

? Lack of investment and business training for scaling-up safer alternatives;

? Absence or limited incentives for innovation and entrepreneurship;

- Cost-prohibitive incumbent technology replacement.

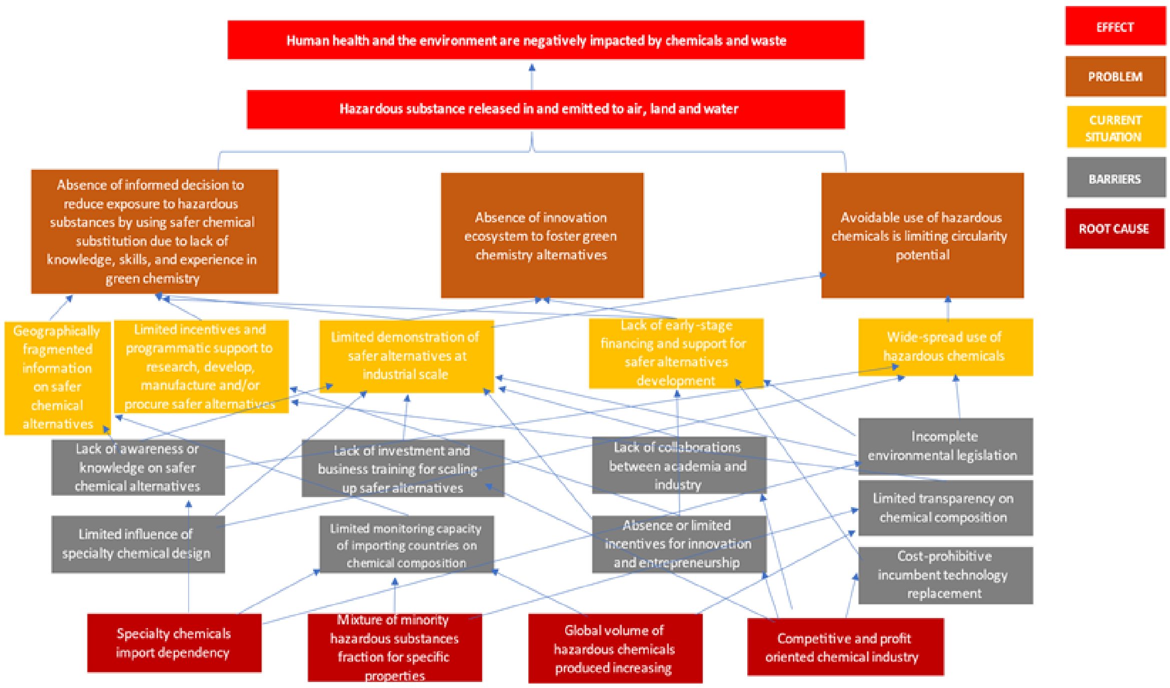


FIGURE 1: PROBLEM TREE

2) The Baseline scenario and any associated baseline projects

Baseline scenario

22. In the absence of the proposed GEF project, hazardous chemicals including POPs and Hg will continue to be released and potentially increased to air, water and land as a consequence of their use, manufacturing or environmentally unsound disposal. There will not be enough of knowledge, skills, abilities, experience, training and competencies in green chemistry to make informed decisions to reduce exposure to hazardous substances by using safer chemical substitution. Technologies, processes and products that are currently in place, will continue to be used even if they do not meet requirements set by the International Chemicals Conventions. The continuity of the current status at the participating countries will lead to a severe impact on human health and wellbeing, particularly reproductive health of men and women in which the effects could be multigenerational, environment, lost opportunity to boost green chemistry innovation and knowledge sharing and no regional partnerships between six participating countries and the rest of the world.

Baseline projects

23. This project has two global components with national interventions and one national component focusing the application of green chemistry alternatives, however, all project components are interlinked towards achieving the project objective. The following section is structured into the overarching component baselines, which are relevant for each of the participating countries and beyond, following component-specific baseline, which is particularly relevant for outlined project-specific outputs and activities.

(I) Overarching baselines for component 1, 2 and 3

(Ia) Summary of hazardous chemicals commonly in use in relevant industrial sectors

24. Progress to reduce the production and use of hazardous chemicals has been made but not consistently and not of a sufficient magnitude to assure safety for human health and the environment. As mentioned above, according to EU chemicals production and consumption data, production of chemicals hazardous to health have remained generally steady from 2012 - 2019 despite an increase in 2017. Production of chemicals hazardous to the environment generally declined from 2010 ? 2015; however, increased production in 2016-2017 negated those earlier reductions bringing the production back up to 2011 levels.

25. These chemicals are produced and used when there is a there is a lack of awareness or knowledge of the hazard and/or safer alternatives, when the incumbent technology is cost-prohibitive to replace, when the safer technology does not meet the performance specifications, and when there is no safer alternative. For some hazardous chemicals such as the POPs and Hg production and its use has been prohibited through the International Conventions with only a few specific exemptions and acceptable purposes. However, due to the identified barriers the following POPs and Hg is still in use, as summarized below:

26. In the textile, apparel, and footwear (including leather and rubber) industries, the following chemical categories continue to present the biggest challenge:

? PFCs and PFASs provide durable water repellency and stain management properties to textiles and leather. Current non-fluorinated products do not provide oil repellency reinforcing the need for safer chemicals that meet performance and cost expectations.

? Alkylphenols & ethoxylates (APEOs) are commonly used in detergents, scouring agents, spinning oils, wetting agents, softeners, emulsifier/dispersing agents for dyes and prints, impregnating agents, de- gumming for silk production, dyes and pigment preparations, polyester padding and down/feather fillings. There are safer, high-performing, and cost-effective alternatives which has eliminated their production in the EU for the textile industry; however, APEOs continue to be used in washing drums and janitorial work, as well as the apparel sector in other countries where the chemicals are not regulated.

- ? Phthalates are commonly used as flexible plastic components (e.g. PVC), adhesives, plastic buttons, plastic sleevings, and polymeric coatings. Brand leadership encouraging usage bans has played a role in demonstrating some reductions, but the phthalates continue to be used in the textile industry.

27. Products in the construction sector have commonly used styrene and brominated flame retardants, including Hexabromocyclododecane (HBCDD) which is being used to reduce the flammability of products including its application in the manufacturing of extruded polystyrene and expanded polystyrene (XPS and EPS, respectively). Foam Board, walls, floors, ceilings, roofs may be constructed with Expanded Polystyrene (EPS) commonly containing styrene and brominated flame retardants.

28. Regarding the polyvinyl chloride (PVC) sector, the use of short-chain chlorinated paraffins (SCCPs) as secondary plasticizers in flexible polyvinyl chloride has been exempted under the Stockholm Convention, except for the use in toys and children?s products where the use is not allowed. Primary plasticizers in PVC are used to increase the elongation properties and softness of the polymer often together with secondary plasticizers (such as SCCPs or CP mixtures) leading to an enhancement of the plasticizing effects. It is possible that pellets (masterbatch) containing SCCPs are manufactured outside of most countries and then imported into the country for further processing. Another recommended POP to be listed under the Stockholm Convention is UV-328, which is a substituted phenolic benzotriazole (BZT) used as a UV absorber in many applications and products, including the PVC sector.

29. For the pulp, paper and packaging, the Stockholm Convention guidance mentions that perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride (PFOSF). Perfluorooctanoic acid (PFOA), its salts and PFOA-related compounds as well as the recommended POP Perfluorohexane sulfonic acid (PFHxS), its salt and PFHxS-related compounds were used for specific papermaking applications due to their high resistance to friction, heat, chemical agents, low surface energy and usage as waster, grease and oil repellent.

30. Mercury was commonly used in vinyl chloride monomer (VCM) production, measuring and control devices, and the chlor-alkali production (together with ASGM) production have been responsible for more than 60% of the global mercury demand, with East and Southeast Asia being responsible for over half of global mercury demand. In 2020, 3,700 metric tons of mercury were produced worldwide, up from the 2.2 million metric tons produced in 2010. Mercury production peaked at 4,500 metric tons in 2016 and has shown a general decreasing trend since that time.

31. The EU has 211 chemicals currently listed as substances of very high concern due to their designation as carcinogenic, mutagenic or toxic for reproduction (CMR) category 1A or 1B in accordance with the CLP Regulation; substances which are persistent, bioaccumulative and toxic (PBT) or very persistent and very bioaccumulative (vPvB), and other case-by-case assessments. Common industrial uses of substances of very high concern (SVHCs) include:

- ? Plastic additive, solvent, in coatings/inks, in adhesives and sealants, and heat transfer fluids
- ? Washing and cleaning products, polishes and waxes, cosmetics and personal care products
- ? Electrical/electronic parts containing phthalates and short chain chlorinated paraffins
- ? Heat stabilizer in PVC plastics, as a catalyst in the production of certain plastics
- ? Solder flux applications, adhesive production, printing inks, paint strippers, adhesive removers and paint binders.
- ? Solvent in battery electrolytes for sealed lithium-ion batteries.
- ? Polymer manufacturing

- ? Pharmaceutical manufacturing
- ? Brominated flame retardants used in various applications including polystyrene products in building materials, packaging material, in the plastic housing of electronic or electric devices, upholstered furniture, automobile interiors textiles and industrial protective clothing.
- ? Antibacterial deodorant finishing agents
- ? Pesticides
- ? Textile treatments and dyes including water-repellent antifouling agents, antibacterial finishing agent, mothproof agent
- ? Leather preparations

32. Import-dependent developing countries often have little control over the composition of the products imported into the country; however, strengthened legislation and custom monitoring to control the import products potentially containing POPs and/or Hg increased awareness of safer and greener alternatives and knowledge about green procurement can enable informed purchasing decisions to minimize hazardous chemical impact to humans and the environment.

(Ib) Key data from Stockholm Convention and Minamata Convention and underreporting

33. Despite the strong efforts and benefits of frameworks including the Stockholm and Minamata Conventions, POPs and Hg continue to be produced, utilized and thus persist in the environment. POPs production and use have been restricted in 184 nations; however, exemptions still exist for the following chemicals allowing continued manufacturing and use: DDT (1,1,1-trichloro-2,2-bis 4-chlorophenyl)ethane); Decabromodiphenyl ether (BDE-209) present in commercial decabromodiphenyl ether; Hexabromocyclododecane; Hexabromodiphenyl ether and heptabromodiphenyl ether; Pentachlorophenol and its salts and esters; Perfluorooctanoic acid (PFOA), its salts and PFOA-related compounds; Polychlorinated biphenyls (PCB); Polychlorinated naphthalenes; Short-chain chlorinated paraffins; Technical endosulfan and its related isomers; and Tetrabromodiphenyl ether and pentabromodiphenyl ether.

34. Difficulties with obtaining valid and precise inventories under the POPs and Hg Conventions, especially from developing countries, results in the likelihood of underreported POPs. From 2001-2016, only 35% of developing countries reported under the Stockholm Convention as compared to 73% of developed countries. Regionally, Africa?s reporting rate was 29% and Asia?s was 46%.[5][2] Related, developed countries have requested more exemptions than developing countries. It is recognized the reduced number of exemptions from developed countries may be similarly aligned with underreporting, generally related to lack of awareness of the chemicals in use and availability of safer alternatives.

35. Increasing emphasis on circular economy raises concerns that hazardous chemicals may stay in commerce rather than being safely managed for disposal. Green chemistry innovations will be critical to minimize the risk of circulating hazardous materials while increasing opportunities for circularity.[6][3]

(Ic) Global Market for Green Chemistry

36. Green Chemistry focuses on the inherent properties of chemicals to ensure they are benign and beneficial throughout their lifecycle. Its purpose is not simply to reduce pollution at the source by eliminating the hazards of chemical feedstock, reagents, solvents, and products, but also to ensure that the broad spectrum of sustainability concerns are built into the design framework through innovation and invention. Because of this goal, green chemistry offers a great opportunity for alternatives to persistent organic pollutants and other environmental issues. The concept of Green Chemistry has had a large impact due to the fact that it goes beyond the research laboratory

and has touched industry, education, the environment, and the general public. It has demonstrated how chemists can design next-generation products and processes so that they are profitable while being good for human health and the environment.

37. The global market for green chemistry, including bio-based chemicals, renewable feedstocks, green polymers and less hazardous chemical formulations, was projected to grow from US$ 11 billion in 2015 to nearly US$ 100 billion by 2020, representing a CAGR of 55.5%.A more recent analysis anticipates the green chemicals market is expected to reach $167.1 Billion by 2027.

38. In research pending publication later this year, from 2015-2019, Green Chemistry-marketed products in the 10 studied categories grew 12.6 times faster than their conventional counterparts, and 5.4 times faster than the U.S. market. This market increase continued in 2020 despite the COVID-19 pandemic.

39. Sustainability is consistently a high-impact driver for innovation across a broad number of sectors, including consumer goods, energy and resources, health and nutrition, automotive, agriculture, and electronics markets (Figure 2).

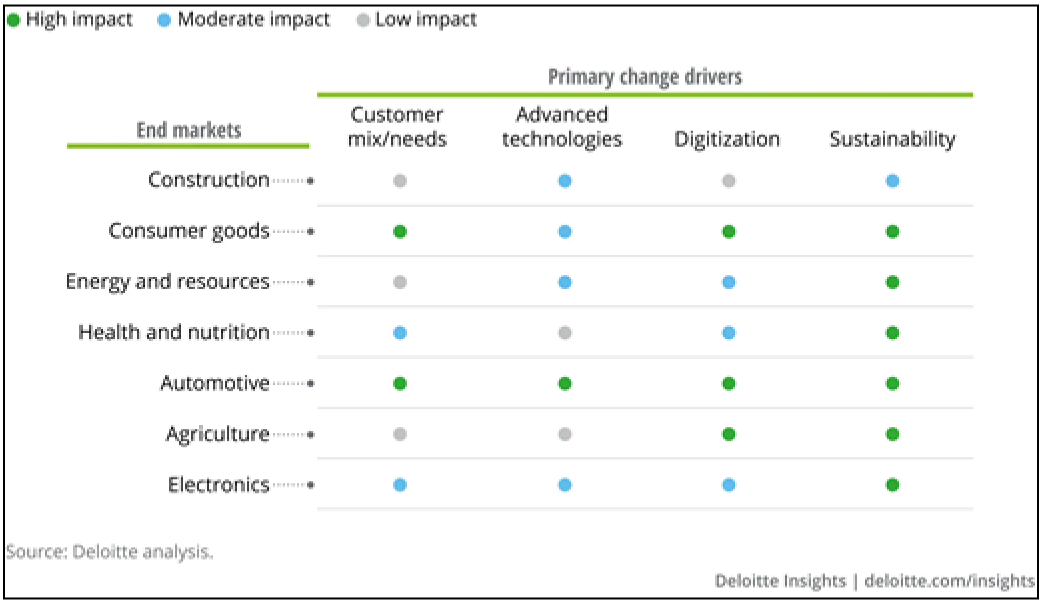


FIGURE 2: PERFORMANCE AND CHANGES IN END MARKETS WILL HAVE A CLEAR IMPACT ON THE INDUSTRY'S INNOVATION TRAJECTORY

40. The EU?s toxic-free hierarchy (Figure 3) as described in their Chemicals Strategy for Sustainability integrates innovation as a key element to protect human health and the environment by identifying new technologies to support the elimination of hazardous materials and improvement of waste management technologies, minimizing their use, and development of safer chemicals. It is not sufficient to rely on others to develop safer chemistries, and the market shows green chemistry innovation can have a positive economic impact.

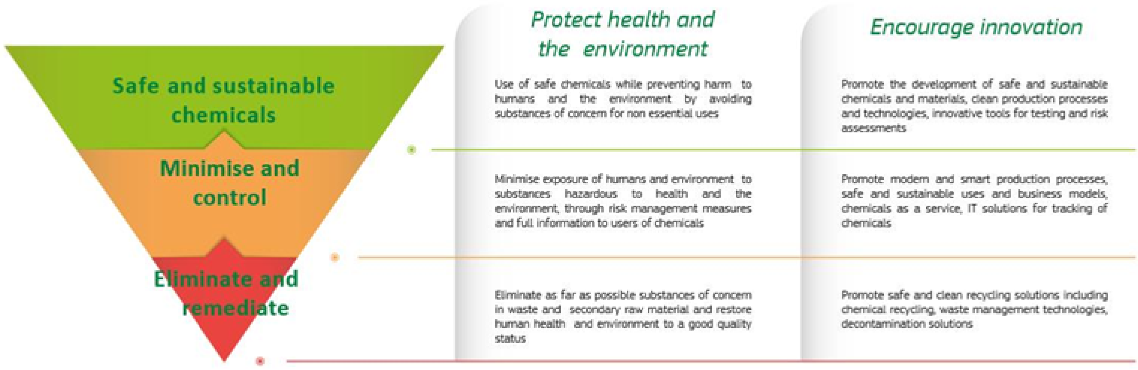


FIGURE 3: EU'S TOXIC-FREE HIERARCHY

41. The Green Chemistry & Commerce Council (GC3) based out of the University of Massachusetts, Lowell has a startup network as a key component to enable their mission to accelerate commercialization of green chemistry. As a business-to-business collaborative, GC3 seeks to engage startups developing innovative sustainable solutions to challenges faced by the larger strategics. Of the 47 startups that have been part of the GC3 Startup Network, a majority are still in operation, some have filed bankruptcy, and a few have been acquired. The Network accepts startups from seed stage to advanced venture capital regardless of geographic location, provided the company meets certain prerequisites. A sampling of the startups are provided below:

? Paxymer (Sweden) - Paxymer is a flame retardant synergistic technology for boosting the performance of halogen free flame retardants in plastics.

? Tandem Repeat Technologies (United States) - Tandem Repeat focuses on sustainable manufacturing to create programmable textiles.

? Chinova Bioworks (Canada) - Chinova Bioworks has developed a natural antimicrobial preservative using a fiber from mushrooms, chitosan. It's a broad-spectrum and clean label.

? P2 Science, Inc. (United States) - P2 Science has developed a set of unique chemical process technologies for converting renewable feedstocks into high-value, specialty chemicals, including flavor and fragrance ingredients, cosmetics ingredients and renewable monomers.

(Id) Green chemistry innovation and opportunities for investment

42. Green chemistry innovation has the potential to drive sustainability in important sectors of the economy. This includes, but is not limited to the manufacture, energy, transport, and textile.

43. Opportunities for innovation and investment include, but are not limited to:

44. Manufacture

? Biobased feedstocks: Given the depletion (and ultimate scarcity) of fossil resources, their contribution to greenhouse gas emissions, and uncertainties in global supply chains, opportunities are being explored to use new biobased sources for producing chemical feedstocks. Biomass is derived from living organisms, usually plants. Biorefinery technologies have the potential to yield a range of basic chemicals traditionally produced through energy intensive and polluting petrochemical refinery technology. Examples include biofuels, chemical building blocks, bioethylene and biopropylene. Biomass may provide the foundation for a range of products and applications, including food, energy, materials, and pharmaceuticals.

? Carbon dioxide as a feedstock

Several pathways exist to utilize CO2, a potent greenhouse gas, as a resource. These include the conversion of CO2 into fuels, the use of CO2 as a feedstock for the chemical industry, and non-conversion uses of CO2. These technologies have the potential to absorb CO2 from the atmosphere, and thus may help mitigate climate change.

? Plasticizers

Plasticizers are chemicals added to plastics to enhance flexibility of polymer blends and improve their processability. Innovations to advance sustainability of plasticizers include the design of plasticizers with low migration rates, low volatility, no adverse health effects, and biodegradability.

? Catalysis

Catalysis is the process of increasing the rate of a chemical reaction. Problems with the use of catalysts arise when toxic materials are used in reactions, or the catalyzed reactions requires extreme conditions which lessen the overall benefit of the catalyst. Approaches towards more sustainable catalysis include the development of low-toxicity catalysts, processes requiring less energy-intensive reaction conditions, or catalysts which can harvest renewable energy sources for reactions.

? Solvents

Solvents act to dissolve a solid, liquid, or gaseous solute. Many organic solvents have hazardous properties and are released to the environment in significant quantities. Innovation areas in solvents include development of non- toxic solvents from biotic waste; use of water as a solvent in the production of pharmaceuticals and other chemicals instead of organic solvents.

45. Textile

? Repellents

Repellents are chemicals affecting the resistance to the absorption or passage of water, oil or dirt resulting from the application of surface coating treatment. Most of these treatments are based on fluorochemicals. A range of innovations has been developed to advance sustainability repellents. In the textile industry, innovation efforts focus on the development of sustainable water repellents for fabrics that are biocarbon-based and PFC-free.

? Flame retardants

Flame retardants include a diverse group of chemicals which are added to manufactured materials, such as plastics, textiles, surface finishes or coatings to make them resistant to fire. Flame retardants generated from biological sources have a significant potential. They tend to be low cost, may be nontoxic, and are independent of petrochemical market fluctuations. Another promising area of innovation is the development of novel bio-based flame-retardant systems from tannic acid.

46. Transport

? Surfactants and lubricants

Surfactants are chemicals that are added to a liquid to reduce surface tension, thereby increasing spreading and wetting properties of the product.

The spectrum of green alternative surfactants on the market is diverse and includes, for example plant-based saponins, amino acid derivatives, and betaines. Often, more eco-friendly surfactant molecules are derived from renewable biomass building blocks. Further innovation opportunities exist through modifying fermentation technologies and microbial strain improvement methods.

47. Across sectors

? Chemical preservatives

Chemical preservatives are chemicals added to products to prevent decay of a product by microbial growth or unwanted chemical changes. They are widely used in food products, beverages, pharmaceutical drugs, paints, cosmetics, wood, etc. Given the direct contact that many chemical preservatives have with the human body, chemistry innovation to develop safer chemical preservatives is important. Efforts focus on identifying and developing chemical preservatives which are less toxic, in comparison to those on the market.

48. Energy

? Energy efficiency

Chemistry innovation has a significant potential to increase energy efficiency and reduce greenhouse gas emissions. One example are efficient, new building materials like cellulose aerogel isolated from tea stem waste is a good heat insulator and fire retardant. It is environmentally friendly, thermally stable and can be produced at low cost.

49. These examples are a sampling of the potential opportunities for development and funding through the accelerator programme.

(Ie) Summary of policy frameworks related to green chemistry

50. Green chemistry development and innovation can be advanced by supportive policies and regulatory actions. In general the policy approaches are divided into four categories:

- push policies driving new ideas;
- pull policies helping to stimulate market demand;
- grow policies helping to grow ideas into marketable products; and
- strengthen policies that cut across the clean innovation system, making it more effective and resilient.

51. All are important to foster innovation, with government policies identified as a core push policy enabler. Example of policy intervention is summarized in Figure 4 below[2][4]:

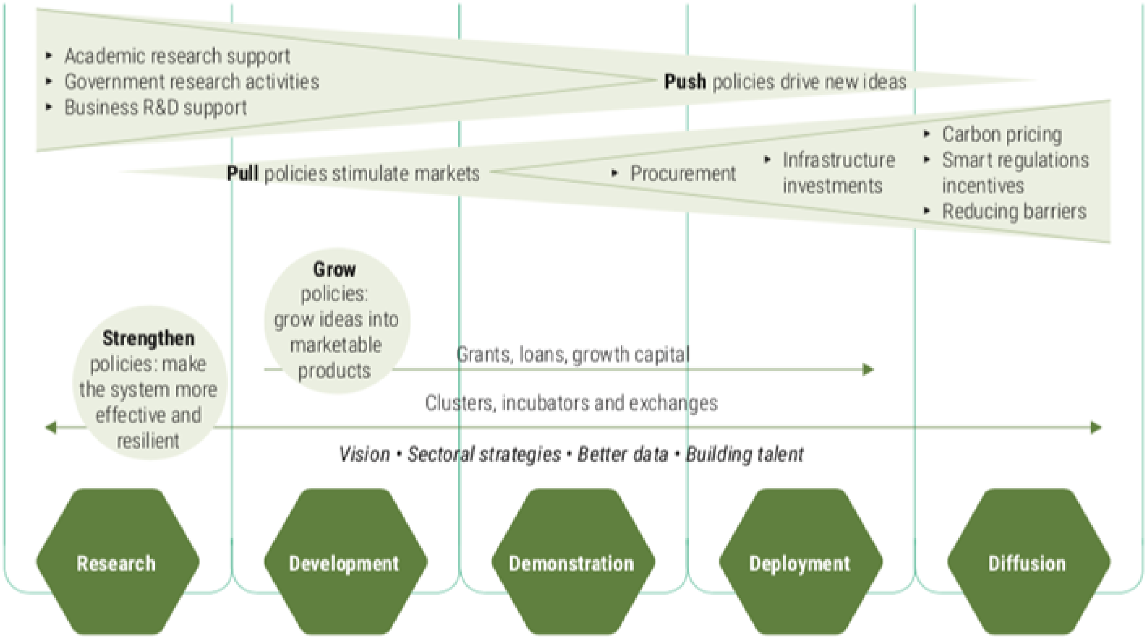


FIGURE 4: EXAMPLE OF POLICY INTERVENTION

52. There are several policies relevant to green chemistry that have been implemented. In the United States, in 2021, **The US Sustainable Chemistry, Research and Development Act** was passed into law. The Sustainable Chemistry R&D Act will enable coordination efforts between all United States federal agencies to accelerate innovation in green and sustainable chemistry across all sectors. The multiagency task force will coordinate activities that will allow to incorporate green chemistry requirements into grants and beyond.

53. In the EU there are a number of policy initiatives that are relevant to sustainable chemistry, circular economy, that are relevant to green chemistry. On 14 October 2020, the European Commission published a **Chemicals Strategy for Sustainability**, a document that will boost innovation for safe and sustainable chemicals, and increase protection of human health and the environment against hazardous chemicals. The strategy bans the most harmful chemicals in consumer products and phases out PFAS in EU ensuring that all chemicals are used more safely and sustainably. The Strategy is part of the first step towards a zero-pollution ambition for a toxic-free environment announced in the European Green Deal that transitions EU to a climate neutral, clean, circular economy.

54. Another initiative, the **Strategic Approach to International Chemicals Management (SAICM)** is a program hosted by United Nations Environment Programme (UNEP). Recently, SAICM has engaged in preparation of recommendations regarding the Strategic Approach and the sound management of chemicals and waste beyond 2020. Green and sustainable chemistry have been considered as one of the solutions to address the waste issue.

55. Finally, European Union has the **REACH** regulation since 2006. REACH addresses the production and use of chemical substances, and their potential impacts on both human health and the environment. It is the strictest law to date regulating chemical substances and affects industries throughout the world. Listing of substances of very high concern (SVHC) on the Candidate list for inclusion of substances for authorization under Annex XIV of REACH, conveyed the intention of the regulator to take risk management action. This action incentivizes industry to prioritize replacement activities.

(If) Summary of green chemistry education

56. Green chemistry education plays a critical role in capacity building to assure informed consumers at all levels in the value chain, educators to pass the knowledge on to the next generation, as well as researchers solving some of today?s greatest challenges. It is not just for students pursuing chemistry degrees; any decision-maker should have general awareness of hazardous chemicals and the opportunities for safer alternatives.

57. Green Chemistry has a scientific record since the 1990s and there are several publications describing the principles of green chemistry approaches and technologies and examples of green chemistry applications. However, there are only a few universities who have included Green Chemistry into its curricula to lecture the principle to a wider range of chemistry students. Most university science, design and technology-based courses related to the physical environment have included information on sustainability and the environment, although generally this is in the form of an elective course. Beyond Benign?s Green Chemistry Commitment, launched in 2013, has been asking universities to commit to overhaul chemistry curricula with a through integration of green chemistry. More than 70 higher-education institutions, from developed and developing countries, have taken the pledge.[1]5 Proving the global applicability of the commitment, institutions in North America, South America, Europe, Africa, Asia, and Oceana have committed to green chemistry curricula.

58. Using the number of papers addressing green chemistry education and sustainable chemistry education as an indicator, there has been distinctive growth in the subjects since the early 2000?s.[2] Growth is progress, but it?s not enough. Green chemistry education needs broader implementation in all countries, whether or not there is a strong chemical industry presence. Enhanced cooperation between networks would be especially important in developed, developing and transition economies. Efforts to enable green chemistry to date have been effective, yet isolated, and as a result, there are several expert networks across the globe that have developed mainly out of academic institutions. It would be beneficial to all to have a unifying mechanism to connect the networks together while allowing them to remain autonomous to serve their intended purpose.

59. The recently concluded project entitled *?Guidance development and case study documentation of green chemistry and technologies?* (GEF Project ID: 150185), developed an awareness raising workshop and train-the-facilitator approach to accelerate green chemistry education. That training model was recommended to continue to advance capacity building objectives in other regions. Recognizing the importance of practical, tangible support, the project developed the first technical guideline summarizing Green Chemistry, its technical applicability and practical case studies. Recommendations from that project included the development of a global green chemistry network to optimize awareness and implementation for a sustainable outcome. Additionally, it was recommended to strengthen cooperation between academia, research institutes, chemical societies, and industry to increase green chemistry implementation and commercialization. Furthermore, support for entrepreneurship and industrial pilot projects was recommended to be increased to facilitate local implementation of green chemistry.

Baseline for project components

Component 1. Green Chemistry Inclusion Network for Capacity Building

Green chemistry in industrialized vs emerging nations

60. Some of the earliest programs in green chemistry were in highly industrialized countries in North America, Europe, and Japan. Many of them are now listed in Stakeholder Identification as potential stakeholders. For the past 30 years, the green chemistry growth has taken place in variety of ways:

61. European green chemistry efforts are centered around universities and academic initiatives. The notable centers and initiatives include **International Union of Pure and Applied Chemistry (IUPAC), the Royal Society of Chemistry, University of Nottingham, and University of York**. All initiatives and academic programs have a robust research which incorporates areas such as polymers, solvents, catalysis, biobased/renewables, analytical method development, synthetic methodology development, and the design of safer chemicals.

62. North America has a strong green chemistry industry support. Companies representing different industry sectors (such as pharmaceutical, manufacture, and formulator sectors) belong to the **American Chemical Society Green Chemistry Institute (ACS GCI)** round tables, and their goal is to incorporate green chemistry into their industrial products and processes. Through their round table meetings, they also provide guidelines for greener alternatives and safer standards for other companies to follow. United States also houses the **Green Chemistry & Commerce Council (GC3)**, a multi-stakeholder collaborative that drives the commercial adoption of green chemistry. Their 100 members across individual companies, NGOs, local governments and consulting firms benefit from green chemistry collaborations and partnerships across the entire supply chain.

63. Japan has developed a **Green and Sustainable Chemistry Network (now The Japan Association for Chemical Innovation - JACI)** that brings together industries and awards grants to companies and individuals that further the goals of green chemistry. JACI is one of the key, public interest networks in Japan that promotes technological innovation through sustainable development and green chemistry.

64. All industrialized countries also share a relatively well-developed green chemistry education sector. Many universities have incorporated green chemistry training as part of their higher education curriculum. That effort is supported by a non-profit organization, **Beyond Benign**, who provides educators with tools, training and support to make green chemistry integral part of chemistry education. Their global initiative, the **Green Chemistry Commitment**, encourages universities and departments to share their green chemistry resources and incorporate elements of green chemistry into a current curriculum. Today, 70 colleges and universities from around the world have signed the Green Chemistry Commitment for access to shared up-to-date resources, collaborative discussions and projects, improved curriculum, and accountability to track progress on specific learning and research goals. Most recently, Beyond Benign and ACS GCI started a three year initiative, **the Green Chemistry Teaching and Learning Community (GCTLC)**, which will be online hub for the green chemistry education.

65. The growth of green chemistry in emerging economies has been more modest. Emerging nations recognize the importance of improving chemical processes and synthesis and seek solutions that will lead to a more efficient and less wasteful manufacturing. A number of industries in Latin America, Africa and Asia are focusing on energy and water reduction. These changes are implemented to become more sustainable and competitive on EU markets but also lower the overall operating costs. The cleaner production has been an important tool for improving process efficiency coupled with environmental protection, decrease in environmental pollution and preserving natural resources from excessive depletion.

66. Another important area, in addition to energy and water efficiency in emerging nations, is waste management. Many businesses struggle to properly dispose of generated waste, and open

disposal sites are not uncommon. There is an effort to reduce or recycle waste, but these attempts are still isolated and infrequent.

67. China started early in green chemistry research, not long after the green chemistry concept was proposed. The **Chinese Academy of Sciences and the Ministry of Science and Technology of China** have funded many related research projects since then. Chinese scientists and enterprisers have made a lot of significant contributions in basic research and technology development, specifically in safer solvents and high performance, environmentally friendly materials. However, the scale of green chemistry in China is still relatively small to satisfy the production of chemical products for over 1.3 billion people.

68. India?s approach to green chemistry has taken a different path. A research and development green chemistry company, **Newreka,** works directly with pharma-, agro- and dyes and pigments industries and actively customizes and implements green chemistry solutions on the industrial scale. Their business model allows to re-design a unit process and maximize utilization of benign and renewable raw materials used.

69. In South America, Peru and Brazil lead green chemistry efforts, which are more focused on circular economy. Given the abundance of natural resources, both countries adopted a circular approach, where the produced waste can become a feedstock for another process. In Peru, the circular economy approach is based on Legislative Decree No. 1278, Law of Comprehensive Management of Solid Waste and its regulations (Supreme Decree No. 014-2017-MINAM), which has been applied since its publication in coordination with the private sector and other government entities, through specific mechanisms such as clean production agreements (from 2018 to date there are 10 agreements signed between the industry, MINAM and PRODUCE). The practice of circular economy is also promoted through the practice of industrial symbiosis and eco industrial parks. On the other hand, the green chemistry efforts have been amplified in Brazil in 2019, after Train-the Facilitators workshop which was launched through the **National Service for Industrial Training** (SENAI).

70. Green chemistry in Africa has taken root in Uganda, South Africa, and Egypt. All three countries have a number of industrial examples of green chemistry applications (Annex K, which documents the Technology Compendium delivered through the Global Green Chemistry Initiative). In addition to the industry engagement, South Africa has shown a strong capacity in green chemistry dissemination and training through their National Cleaner Production Center. Their national green chemistry activities have been especially present in academia. To date at least three universities (University of Pretoria, Tshwane University of Technology, and Wits University) have added green chemistry content to their current curriculum.

71. Many of the identified initiatives and efforts lead towards green chemistry and there is eagerness to improve the overall process design that goes beyond incremental changes. These attempts could be amplified if the green chemistry ecosystem which supports science and innovation was formed. With the proper training and opportunities for growth and development green chemistry solutions can be cultivated, ultimately leading to widespread implementation that can impact lives. This becomes especially relevant when dealing with hazardous chemicals which have been traditionally used in manufacturing. These chemicals, including POPs and mercury are still widely used in many emerging economies despite their poor environmental and health profile. Their continued usage stems from the wide range of the chemical functions that they offer.

Baseline projects

72. For component 1, the following institutions have been consulted and expressed interest in contribution to the project: Beyond Benign and the ACS Green Chemistry Institute, Federal University of Sao Carlos, Brazil, University of New Delhi, Addis Ababa University, Chemical Society of Thailand, Centre for Green Chemical Science at University of Auckland, ACS Green Chemistry Institute, IUPAC, University of Washington, Training Centre for Green Chemistry in Manufacturing at Monash University, Serbia Ministry of Environmental Protection, Chemical Angels Network, University of Massachussets Boston, Millipore Sigma. Detailed descriptions of

each of these institutions, including their specific work area, their relevantce to the project goals, project preparation consultation, project potential collaboration and indication about co-financing contribution are outlined in Annex L (Baseline and baseline projects) and the detailed Stakeholder Engagement Plan (Annex M). Below Table 2 summaries the baseline stakeholders for component 1 using the following definitions:

? Interest in joining the network ? The representative from the network/center expressed interest in being involved in Component 1 or Component 2 activities.

? Academic/Research Programs ? The network/center has a green chemistry research which advances the green chemistry field in catalysis, solvents, safer chemical design, energy, waste or chemical synthesis. Research is typically grant funded.

? Education/Outreach ? The network/center is involved in green chemistry education; it offers green chemistry materials or courses. It promotes green chemistry through conferences and social media.

? Industrial Connections ? The network/center has projects and connections with industry.

? Government/Policy Influence ? The network/center is involved in drafting/influencing policy related documents. Government contacts the network/center for science recommendations.

? Funded ? The network/center is self-sustained and has a financial stability and independence.

? International Collaborators ? The network/center collaborates with other international partners which expands the networks reach.

? Influence from Center ? The center/network is recognized and respected by the others who are outside of the network. It has a strong reach to various stakeholders.

Table 2: Summary of baseline stakeholders

Country of Origin	**Network Name**	**Interest in joining the network**	**Academic/ Research Programs**	**Education/ Outreach**	**Industrial Connections**	**Government/ Policy Influence**	**Funded**	**International Collaborators**	**Established Network**	**Influence from Center**
Australia	Training Centre for Green Chemistry in Manufacturing at Monash University	Y	Y	Y	N	N	Y	Y	N	Y

Australia	Asia-Oceania Green and Sustainable Chemistry; University of Auckland	Y	Y	U	N	U	S	S	N	S
Brazil	SENAI Innovation Institute for Green Chemistry	Y	Y	U	Y	U	Y	S	N	S
Brazil	Federal University of S?o Carlos	Y	Y	U	Y	U	S	S	N	S
Canada	GreenCentre	Y	Y	U	Y	U	Y	S	S	Y
Canada	McGill University	Y	Y	Y	U	U	Y	Y	Y	Y
Canada	Canadian Green Chemistry Network	-	N	Y	N	U	Y	Y	S	Y
Canada	The Chemical Institute of Canada	-	N	Y	Y	U	S	S	S	S
Canada	Centre for Catalyst Research and Innovation (University of Ottowa)	-	Y	U	U	U	S	S	S	N

China	Chinese Chemical Society	-	N	Y	U	U	Y	S	S	S
China	Chinese Academy of Sciences	-	Y	U	U	U	Y	S	S	S
Ethiopia	Pan-African Green Chemistry Network	Y	Y	U	U	U	N	S	S	S
Germany	Aachen University, Germany	Y	Y	Y	Y	Y	Y	Y	Y	Y
Germany	Leibniz Institut f?r Katalyse (Leibniz Institute for Catalysis)	-	Y	U	Y	Y	S	S	S	N
Germany	Green Chemistry and Sustainable Processes at the Max Planck Institute	Y	Y	U	Y	U	Y	Y	S	S
Germany	Chemical Invention Factory (CIF) at TU Berlin	-	U	Y	Y	U	S	S	S	S
Germany	German Chemical Society	-	Y	Y	Y	Y	S	Y	Y	Y

India	Industrial Green Chemistry World	-	N	Y	Y	N	S	S	N	S
India	The Green ChemisTree Foundation	-	N	Y	Y	N	N	S	S	S
India	Green Chemistry Network Centre	Y	N	Y	Y	U	N	N	N	N
Indonesia	Indonesia Cleaner Production Centre	-	N	Y	Y	Y	S	S	S	S
Italy	University of Venice	-	Y	U	Y	U	N	S	S	S
Italy	Consorzio Interuniversitario Nazionale "La Chimica per l'Ambiente"	-	N	Y	U	U	U	S	Y	S
Italy	Green Chemistry Committee of the International Union of Pure and Applied Chemistry	-	Y	Y	Y	U	Y	Y	Y	Y

Japan	Japan Association for Chemical Innovation (JACI)	-	Y	S	Y	U	S	S	N	S
Japan	The International Green Purchasing Network	-	N	Y	Y	U	S	S	N	N
Jordan	Cleaner Production Jordan (NCPC)	Y	N	Y	Y	Y	S	S	N	S
Peru	Peru NCPC	Y	N	Y	Y	Y	S	S	N	S
Serbia	Cleaner Production Centre of Serbia	Y	N	Y	Y	Y	S	S	N	S
Serbia	University of Belgrade	Y	Y	Y	Y	Y	S	S	N	S
Spain	Red Espa?ola de Qu?mica Sostenible	-	N	Y	Y	U	S	S	N	S
Thailand	Chulalongkorn University; Council of Science and Technology Professionals of Thailand;	Y	Y	Y	Y	U	S	S	N	N

Uganda	Uganda Cleaner Production Center	Y	N	Y	Y	Y	N	N	N	N
United Kingdom	Royal Society of Chemistry	Y	Y	Y	Y	Y	Y	Y	Y	Y
United Kingdom	University of Nottingham, UK	-	Y	Y	Y	Y	Y	Y	Y	Y
United Kingdom	Green Chemistry Centre of Excellence (University of York)	Y	Y	U	U	U	S	S	S	S
Ukraine	Resource Efficient and Cleaner Production Centre	-	N	Y	Y	Y	S	S	S	S
USA	Beyond Benign	Y	N	Y	Y	U	S	S	S	S
USA	Center for Green Chemistry at UMASS Boston	-	N	Y	U	U	N	N	N	N
USA	GC3 Sustainable Chemistry Alliance	-	Y	U	Y	Y	S	N	Y	N

USA	Advancing Green Chemistry	-	N	Y	Y	N	N	N	N	N
USA	American Institute of Chemical Engineers (AIChE): Institute for Sustainability	-	N	Y	Y	U	S	S	Y	S
USA	Clean Production Action	-	Y	Y	Y	Y	S	S	N	S
USA	Michigan Green Chemistry Clearinghouse	-	N	Y	N	N	N	U	N	S
USA	Oregon University ? Green Chemistry	Y	Y	U	U	U	S	S	N	S
USA	Greener Educational Materials for Chemists	Y	N	Y	N	N	U	U	Y	S
USA	Green Chemistry and Engineering Conference (GCI)	Y	Y	Y	U	U	S	S	Y	S

USA	Green Chemistry Summer School (GCI)	Y	N	Y	N	N	S	S	S	S
USA	Green Chemistry Student Networks (GCI)	Y	N	Y	N	N	S	S	S	S
USA	World Business Council for Sustainable Development	-	N	Y	Y	Y	S	S	S	S
USA	United States Business Council for Sustainable Development	-	N	Y	Y	Y	S	S	S	S
USA	Biomimicry Institute	-	U	Y	U	U	S	U	S	S
USA	The National Science Foundation Center for Sustainable Polymers	Y	Y	Y	U	U	S	S	S	S
USA	American Sustainable Business Council	-	N	Y	Y	Y	S	S	S	S

USA	BOTTLE Consortium	Y	Y	Y	U	Y	S	U	S	S
International	European Technology Platform for Sustainable Chemistry (SusChem)		Y	Y	Y	Y	S	S	S	S

Legend	
Y	Yes, the network/center has a strong capacity and can share resources if integrated into the network.
S	Some, the network/center has some capacity, but it needs help/resources. It is likely to benefit from the network if integrated.
N	No, the network/center has no capacity in this area but would benefit from the network if resources were received.
U	Unknown. There is not enough information to make an assessment.

Component 2 - Green Chemistry Accelerator Programme

Importance of the role of Small and Medium Enterprises (SMEs) in the innovation ecosystem

73. Large corporations are better positioned with the financial mechanisms to invest in research and development as well as new equipment and technologies than SMEs.SMEs tend to be characterized as fast and flexible, while large corporations may be slower to act, but can make a larger impact when they do. All corporations, regardless of size, are important to advancing green chemistry solutions.

74. As an example, in October 2019, Corteva, Inc., a leader in the insecticide market, announced a $145 million capital investment to expand production capacity by 30% for Spinosad and Spinetoram products that are naturally derived solutions for insect-control options. Both Spinosad and Spinetoram had been awarded the U.S. EPA Green Chemistry Award in 1999 and 2008, respectively. The global insecticide market is estimated at $14.5 billion and is expected to grow at a 3% compound annual growth rate (CAGR).

75. SMEs are the drivers of innovation in both emerging and developed economies. SMEs are the cornerstone to a country?s sustained and steady economic growth, and are the main source of job creation globally, accounting for over 95% of firms and 60-70% employment. Since they are smaller, less bureaucratic, and more agile than big companies, SMEs have potential to drive the

transformational change that addresses some of the biggest global challenges like POPs, resource depletion, or pollution by actively developing and adopting green chemistry and engineering approaches. SMEs contribution to a better and more sustainable future using green chemistry can range from a disruptive technology or service to a more incremental change that addresses efficiency problem. The type of business depends on (i) local needs of the community, (ii) access to an adequate support system, including financing and network and (iii) existing infrastructure.

76. There are couple of programs and initiatives that support SMEs in six participating countries, but none of them are chemistry and sustainability oriented or offer long term and sustainable funding.

77. In Indonesia, national programs that support innovation and SMEs covering a wide range of areas like finance, entrepreneurship education, innovation, or public procurement. The development of incubators and accelerators have been made priorities by two government roadmap strategies. According to Roadmap for Incubator Development, there will be 657 new incubators by the end of 2029. These will be accompanied by development of over 100 Science and Technology parks. With such a great number of support measures for SMEs and entrepreneurship, Indonesia offers a supportive environment for green chemistry innovation

78. The early entrepreneurial activity in Jordan was 8.2% in 2016. In comparison to other countries, Jordan is ranked among the lowest (average rate is 14.2%). Nonetheless the entrepreneurship system has potential. Jordan is investing in the renewable energy sector. Given its geographical location, Jordan focuses on technologies that advance solar and wind as major sources of renewable energy. At the same time, the incentives for investment in these technologies are still very modest

79. According to USAID?s Serbia Business Survey 2017, 84 percent of small and medium enterprises (SMEs) are financed solely from their own sources. This is accompanied by high cost for discovery and limited network to match entrepreneurs and investors. Lack of affordable financing, coupled with limited training and mentoring, is preventing Serbian companies from modernizing their production and investing in innovation and commercialization, with young firms and SMEs particularly affected by this.

80. There is a need for early-stage funding, which coupled with mentoring can create a robust entrepreneurial ecosystem. And while the World Bank offered some funding towards that goal through their recent project - Serbia Accelerating Innovation and Growth Entrepreneurship - it is estimated that with a better business environment, the average venture capital investment in Serbia could increase by several fold.

81. In Uganda, entrepreneurship and innovation play an important role as an emerging opportunity for the new generation. The Global Entrepreneurship Monitor (GEM) ranked Uganda the second most entrepreneurial country in the world amongst the countries. Unfortunately, while new businesses are eager to launch, a significant number of startups fail before they reach their potential. That lack of continuity and ability to bring the innovation beyond the experimentation and early investment phase has been attributed to limited market opportunities for entrepreneurs. In the last couple of years, there has been a growth is certain sectors in Uganda, including agrotechnology, financial industry, and health technology. There are couple of startups, especially present in the Kampala region that have benefited from Incubators such as Growth Africa, Mekerere Incubation Hub, or accelerators such as Innovation Village or Shona. And while these programs offer some level of support to entrepreneurs, they frequently target post revenue ventures. For many young entrepreneurs, who are just at the beginning of their entrepreneurship journey, that business model is not viable as they require a well-rounded, basic business and marketing training.

82. Ukraine has adopted the 2020 SME Strategy which led to a significant progress in both delivering support services to SMEs and in modernizing the SME support infrastructure. The SME Strategy 2020 calls also for greening SMEs and developing green technologies. Specifically, it offers access to finance, and it encourages financial institutions to provide a long-term and low-interest credit for the development of green products and implementation of green technologies. In addition to financing, the new SME Strategy has specific steps for greening SMEs, including developing ecological regulations and supporting the implementation of green practices,

sustainable production, and Environmental Management Systems. In Peru, the National Program of Innovation for Competitiveness and Productivity (Inn?vate Per?) of the Ministry of Production also relates to this project, since the initiatives that this program co-finances have technological innovation approaches that include safe products for MYPES, as mentioned in table 4 of this document.

83. Green chemistry SMEs also address another trend which has been observed in many big and/or international corporations which started to adopt sustainability agenda to satisfy new consumer demands. Sustainability commitments often span from sourcing and supply chains, manufacturing to marketing and a customer. Companies often pledge a zero-waste commitment or are transforming their business model to embrace a circular economy. This shift often leads to opportunities for local SMEs. Corporations are looking for local partners who understand local challenges and together they link their operations to address issue at hand, while ensuring compliance with the local environmental standards. In parallel, corporations work frequently with accelerators and incubators and together they develop innovation challenges for SMEs. These innovation challenges have multiple advantages: they offer an opportunity to develop partnerships with corporations, they encourage a design that?s desired and will be accelerated into a market, they frequently offer a co-investment. Additionally, potential fab labs and marker spaces have been investigated for the six participating countries (Annex O).

Baseline projects

84. For component 2, the following institutions have been consulted during the PPG phase and are expressed interest in contribution to the project, including support for the Green Chemistry support for start-ups, R&D of Green Chemistry innovations, Green Chemistry in academia or Green Investment: Green Chemistry & Commerce Council, International Sustainable Chemistry Collaborative Centre, Green Centre Canada, Warner Babcock Institute, McGill University, Air Company, Raise Green, Finding XY, Innovation Fund Serbia, Chemical Angels Network, Millipore Sigma, Sikorsky Challenge Ukraine, Ministry of Environmental Protection and Natural Resources of Ukraine, Boehringer-Ingelheim, TCG GreenChem.

85. Detailed descriptions of each of these institutions, including their specific work area, their relevance to the project goals, project preparation consultation, project potential collaboration and indication about co-financing contribution are outlined in Annex L (Baseline and baseline projects) and the detailed Stakeholder Engagement Plan (Annex M).

Component 3 - Green chemistry alternatives for POPs, mercury and micro-plastics for up-scale and replication

86. The six (6) participating countries for Component 3 are Indonesia, Jordan, Peru Serbia, Uganda and Ukraine, whose detailed baseline information have been summarized in Annex L. Although the countries are very different in terms of geography, economy, industry and status of SC and MC implementation, all countries are faced with similar key challenges and problems regarding hazardous chemical management and application of Green Chemistry principles as solutions.

Green chemistry baselines as solution to POPs, mercury and microplastics

87. POPs can act as water repellents, fire extinguishers or additives to insulation in buildings and constructions. They can be frequently found in automobile parts, leathers, coatings and sealants, additives, adhesives, plastics and textiles. Their usefulness is coupled with a low purchasing price which keeps the chemical process at a low cost. Companies frequently choose raw materials containing POPs for multiple reasons, but most can be traced to a lack of knowledge and awareness of other safer processes that offer a similar technological solution or a belief that an alternative solution will be more expensive that an established process which has been optimized. Green chemistry can help with both of these preconceptions. There are a number of commercial green chemistry technologies that have been implemented in the construction, textile and metal working

industries that displaced POPs in developed economies. All are safer for human and environment and superior in performance to the existing POPs containing products. Table 3 includes couple of examples of the green chemistry alternatives that have been applied so far, and Annex N includes an extended list of GC technologies.

88. Mercury has historically been used in numerous industries due to its existence as a liquid heavy metal. Due to health hazards of mercury such as mercury poisoning, brain damage, and central nervous system disruption, many uses of the element are being phased out. However, mercury remains in use as a catalyst in chemical industries, as fluorescent light bulbs and switches in electrical industries, in artisanal mines, and as emissions from cement production and the burning of fossil fuels. Green chemistry alternatives are safer for humans and ecosystems and can be more efficient than mercury in processes. In cement production, mercury emissions can be reduced and remediated through sorbent addition, dust shuttling, and more mindful selection of fuel sources. Instead of Mercury Cell Batteries, Zinc Air Batteries, Alkaline Manganese Dioxide Batteries, and zinc sponge synthesis batteries have lower, and in some cases zero, mercury content within them.

89. Green chemistry helps improve production of chlorine and caustic soda by utilizing membrane technology instead of mercury. Membrane cells employ electrolysis of aqueous sodium chloride to eradicate the need for mercury in the production process. Creating chlorine and caustic soda via membrane cells is also less expensive and much less energy intensive leading to potential GHG emission reductions than producing them through mercury cells. In cement production, sorbents can be added during the coal burning process to lower the amount of mercury emitted. The sorbents are mixes of halogen, calcium, alumina, and silica and can be added before or after coal combustion. Sorbents serve to reduce mercury emissions and to trap more mercury and heavy metals in highly hardened coal ash so as to prevent leaching.. The table below elaborates upon examples of green chemistry alternatives to mercury applied.

90. Microplastics are plastics no larger than 5 millimeters in diameter. They do not biodegrade and do bioaccumulate, appearing in water bodies, animals, soil, treated drinking water, and humans. Primary microplastics are designed and sold as microplastics, while secondary microplastics are fragments from the breakdown of larger plastics. Despite the human and environmental health risks posed, primary microplastics continue to be used in cosmetics, turf, cleaning products, fabrics, fertilizers, and industrial processes, and secondary microplastics still spawn from the existence of single use plastic items. Green chemistry alternatives to microplastics and plastics are safer for humans and the environment. Substitutes for primary microplastics in cosmetics include biodegradable microbeads and microbeads made from natural materials such as oat, corn, wood, wax, and more. Biodegradable and compostable materials, such as cellulose, bamboo, and sugarcane, to name a few, can be used instead of fossil fuels as the basis for plastic materials. These are natural, cost competitive, and safe methods to reduce opportunities for secondary microplastics to form. Utilizing biodegradable and natural fibers, such as from bamboo and hemp, can reduce microplastic emanation from textiles. Applying a finishing coat, especially made from natural materials like pectic, on textiles will allow them to stand up better amidst repeated washing cycles and release fewer microplastic fibers.

91. Green chemistry alternatives work to eliminate the need for primary microplastics, and to reduce the potential for formation of secondary microplastics. The company CFF GmbH & Co. KG has launched SENSOCEL, an alternative to microplastics in cosmetics formed from natural fibers. The natural fibers incorporated include ?wood, bamboo, oats, wheat, sugar cane, corn, and apples,? are chemically unreactive, and are stable at various acidity levels and temperatures. Full Cycle Bioplastics are bioplastic products made of Bioplastic-Polyhydroxyalkanoate, formed by bacteria that consume organic waste. These bioplastics are compostable, degrade in water once they are at the end of their use cycle, and are similarly priced compared to synthetic plastics made from petroleum bases. Pectin, a polysaccharide found in plant cell walls, is a natural material that can be used to green the textile industry. When pectin modified with glycidyl methacrylate is added to polyamide fabrics, about 90% fewer fabric fibers are released when the textile is washed. The table below includes some already in use green chemistry alternatives to microplastics and plastics.

92. Microplastics will not be part of component 3, however, component 1 and 2 will include capacity-building, training opportunities and opportunities to be included as a category for the Green Chemisty Acccelerator program.

Table 3: Examples of the green chemistry alternatives

Industry	Use	Alternative	Details	Source
Persistent Organic Pollutants				
Construction	Endosulfan, Lindane, Pentachlorophenol, Polychlorinated Naphthalenes in wood treatment	Jerol Composite distribution poles	A composite pole alternative to wood distribution poles used for power lines and traffic lights. Composite poles do not require biocides coatings.	Presidential Green Chemistry Awards https://jerol.se/en/technical-info/composite-utility-poles/
Construction	Pentachlorophenol in wood treatment	Viance, ACQ Preserve? Wood Preservative	A wood preservative designed to replace chromated copper arsenate (CCA) preservatives using alkaline copper quaternary (ACQ) technology. ACQ is made mostly of a combination of bivalent copper complex and a quaternary ammonium compound.	Presidential Green Chemistry Awards Pinepac: https://www.pinepac.co.nz/timber/timber-processing/treatments/acq-treatment/ Viance: https://www.treatedwood.com/products/preserve

Transformers	PCBs in High voltages transformers	Cargill, Inc. Vegetal-oil-based Fluid insulator for high-voltage transformers (Envirotemp? FR3?)	Vegetal-oil-based dielectric fluid that can be used in transformers as an insulator. EnvirotempTM FR3TM can be used to substitute the petroleum-based mineral oil in conventional transformers, and even reduce the size of new transformers.	Presidential Green Chemistry Awards Cargill: https://www.cargill.com/bioindustrial/dielectric-fluids/fr3-fluid
Flame retardants	Decabromodiphenyl ether, Fluoroalkanesulfonates, Hexabromobiphenyl, Hexabromocyclododecane Pentachlorobenzene, Tetrabromodiphenyl ether in firefighting foams	The Solberg Company, RE-HEALING. Halogen-Free Firefighting	A hydrocarbon alternative to the fluorinated surfactants, the active ingredient of traditional firefighting. RE-HEALING foam is free of halogens and meets the standards for fire protection.	Presidential Green Chemistry Awards The Solberg Co: https://www.solbergfoam.com

Flame retardants	Decabromodiphenyl ether, Fluoroalkanesulfonates, Hexabromobiphenyl, Hexabromocyclododecane Pentachlorobenzene, Tetrabromodiphenyl ether in flame retardants	FRX POLYMERS? Inc.	A halogen-free flame retardant (FRXP FR) is composed of diphenyl methyl phosphonate (DPMP) polymers that are synthesized in a solventless reaction. FRXP FR can be used in by itself or in the production of other polymeric materials, such as polyesters, polyureas, and epoxies, without interfering with their physical properties.	Presidential Green Chemistry Awards FRX Polymers: https://www.frxpolymers.com

Agriculture	Hexachlorobenzene, Pentachlorobenzene, Pentachlorophenol in pesticides	Bayer Cropscience (Formerly AgraQuest Inc.)	Biofungicide for fruits and vegetables. Serenade? was created with the Bacillus subtilis QST-713 and has been commercialized in the US and many other countries since 2000. It can be used in organic plantations and has been evaluated for 30 crops in 20 different countries.	Presidential Green Chemistry Awards Bayer Crop Science: https://www.cropscience.bayer.com
Agriculture	Hexachlorobenzene in pesticides	Corteva, Delegate WG	A biopesticide for tree fruits and tree nuts that is less persistent than spinosad. Spinetoram is 1,000x less toxic than organophosphate insecticides such as azinphosmethyl.	Presidential Green Chemistry Awards Corteva: https://www.corteva.us/products-and-solutions/crop-protection/delegate-wg.html

Construction	Hexabromobiphenyl, Hexabromocyclododecane in building insulation	Cargill, Inc., BiOH TM Polyols	An alternative to conventional foams that are manufactured from petroleum-based products and used for polyurethane applications. The technology consists of epoxidyzing carbon-carbon double bonds in vegetable oils to make polyols using mild temperature and atmospheric pressure.	Presidential Green Chemistry Awards Cargill: https://www.cargill.com/bioindustrial/foams-flooring
Plasticizer	Short-chain Chlorinated Paraffins as plasticizers	Eastman, Eastman 168 ? Non-Phthalate Plasticizer	A non-phthalate plasticizer in market for over 40 years. One of the few plasticizers widely certified by many evaluation tools such as GreenScreen and CleanGradients.	Eastman: https://www.eastman.com/Brands/Eastman_plasticizers/Pages/EMN168_40th.aspx

Building insulator	Hexabromocyclododecane in insulation	Non-flame retardant EPS or XPS	Used with a thermal barrier instead.	Stockholm Convention, Annex A ttp://chm.pops.int/Implementation/NationalImplementationPlans/Guidance/tabid/7730/ctl/Download/mid/20999/Default.aspx?id=1&ObjID=27217
Building insulator	Hexabromocyclododecane in insulation	Perlite insulation	Manufactured from volcanic mineral, available as rigid board or used as loose to fill insulation or concrete aggregate.	Flame Retardant Alternatives for HBCDD, EPA https://www.epa.gov/sites/default/files/2014-06/documents/HBCDD_report.pdf
Building insulator	Hexabromocyclododecane in insulation	Mineral Wool/rockwool	Available as a semi-rigid or rigid board	Flame Retardant Alternatives for HBCDD, EPA https://www.epa.gov/sites/default/files/2014-06/documents/HBCDD_report.pdf
Building insulator	Hexabromocyclododecane in insulation	Cellulose	Used as blown-in loose-fill insulation made from recycled paper.	Flame Retardant Alternatives for HBCDD, EPA https://www.epa.gov/sites/default/files/2014-06/documents/HBCDD_report.pdf
Building insulator	Hexabromocyclododecane in insulation	Cementitious foam	Foamed-in-place insulation made from magnesium oxide.	Flame Retardant Alternatives for HBCDD, EPA https://www.epa.gov/sites/default/files/2014-06/documents/HBCDD_report.pdf
Building insulator	Hexabromocyclododecane in insulation	Cotton insulation	Available as a batt and is made of cotton and polyester (recycled).	Flame Retardant Alternatives for HBCDD, EPA https://www.epa.gov/sites/default/files/2014-06/documents/HBCDD_report.pdf

Building insulator	Hexabromocyclododecane in insulation	Fiberglass	Available as batt, blown-in loose fill and semi-rigid board.	Flame Retardant Alternatives for HBCDD, EPA https://www.epa.gov/sites/default/files/2014-06/documents/HBCDD_report.pdf
Metal plating (wetting agents)	Perfluorooctane sulfonic acid (PFOS) used as a wetting agent	Walter Kasper: Helio Chrome Wetting Agent FF	3,3,4,4,5,5,6,6,7,7,8,8,8-Tridecafluorooctane sulfonic acid (H4PFOS) wetting agent for Hard chromium plating.	German Environment Agency Helioscope: https://www.helioscope.de/komplettloesung/?lang=en
Metal plating (wetting agents)	Perfluorooctane sulfonic acid (PFOS) used as a wetting agent	Coventya, Antispray S	(Z)-Octadec-9-enylamine,ethoxylated	German Environment Agency Coventya: https://www.coventya.com
Textile (Carpets)	Perfluorooctane sulfonic acid (PFOS) to prevent stains	Universal Fibers sulfonated nylon copolymer	Sulfonated nylon based fibers that prevent acid dyes and stains and amide functional waxes for low-soil finish.	US Environmental Protection Agency Universal Fibers: https://www.universalfibers.com

Cement	Dioxins, Furans and Other Unintentional POPs	Delta S? asphalt rejuvenator	Cold mix asphalt is manufactured in a portable pugmill utilizing a blended emulsified asphalt with Delta S? asphalt rejuvenator and 100% reclaimed asphalt pavement or millings.	Collaborative Aggregates: https://collaborativeaggregates.com/about-delta-s/
Agriculture	Alpha Hexachlorocyclohexane, Beta Hexachlorocyclohexane,DDT, Endosulfan, Endrin, Hexachlorobenzene, Lindane, Mirex, Pentachlorophenol, Toxaphene used in pesticides	Monterey, Spinosad	A pesticide that is produced from a soil microorganism. Spinosad combats insect pests in fruit and vegetable plantations, is biodegradable, has a low mammalian and avian toxic, and doesn't pose ricks of groundwater contamination. Currently used in more than 250 crop plantations worldwide to combat chewing insect plagues.	Monterey: https://www.montereylawngarden.com/product/monterey-garden-insect-spray/

Agriculture	Endosulfan, Pentachlorophenol used in pesticides	Rhodia, a member of the Solvay Group, THPS Biocides; SMC Global	A biocide for the prevention of algae and bacteria growth in water for industrial use. Tetrakis(hydroxymethyl)phosphonium sulfate (THPS) is non-halogenated and is produced in a water solution.	SMC Global: https://smc-global.com/tetrakis-hydroxymethyl-phosphonium-sulfate-thps/
Agriculture	Aldrin, Chlordane, Chlordecone, Dieldrin, Endosulfan, Endrin, Heptachlor, Hexachlorobenzene, Mirex used in pesticides	Clarke, Natural Larvicide: Encapsulated Spinosad	An alternative to current pesticides. Spinosad can be kept in water in significant concentrations for up to 180 days. The calcium sulfate capsule matrix dissolves slowly and does not persisting in the environment	Clarke: https://www.clarke.com/natular

Agriculture	Endosulfan, Pentachlorophenol used in pesticides	The Dow Microbial Control, KATHON ? 7 TL	A solid biocide used in the treatment of water in industrial cooling systems. Kathon(tm) 7 TL uses a binder to solidify CMIT/MIT without heavy metals.	The DOW: http://www.bencide.co.kr/data/KATHON%207TL.pdf
Mercury				

Chlorine Production	Mercury in chlorine and caustic soda production	Membrane Technology	Membrane cell plants use electrolysis of aqueous sodium chloride in membrane cell. Membrane cell plants have a lower operating cost compared to mercury cell plants. Existing mercury cell plants can be converted to membrane cell plants through a series of modifications. This can take up to two years depending on the administrative procedures. Membrane plants require higher brine purity and yield a high-quality product.	Partnership Document on the Conversion from Mercury to Alternative Technology in the Chlor-Alkali Industry. https://worldchlorine.org/wp-content/uploads/2015/08/Partnership-Document-on-the-Conversion-from-Mercury-to-Alternative-Technology-in-the-Chlor-Alkali-Industry.pdf https://www.chemguide.co.uk/inorganic/group7/diaphragmcell.html

Chlorine Production	Mercury in chlorine and caustic soda production	Diaphragm Technology	The diaphragm process has two chambers with a porous fiber separator between them. The brine is placed in the anode compartment and flows to the cathode department and the chlorine ions or oxidized to produce chlorine. The remaining water contains hydrogen and caustic soda. The caustic soda is less pure than the mercury cell method and must be concentrated. While the diaphragm (the porous separator) is conventionally made from asbestos, there are now non-asbestos diaphragms that can be used.	Partnership Document on the Conversion from Mercury to Alternative Technology in the Chlor-Alkali Industry. https://worldchlorine.org/wp-content/uploads/2015/08/Partnership-Document-on-the-Conversion-from-Mercury-to-Alternative-Technology-in-the-Chlor-Alkali-Industry.pdf https://www.chemguide.co.uk/inorganic/group7/diaphragmcell.html

Alcoholate/ Biodiesel Production	Mercury in alcoholate production	Production of Biodiesel Fuel by Transesterification of Triglycerides in the Presence of Sodium Pyrophosphate	Two plants in Germany use a process that uses mercury amalgam in electrolytic cells to produce sodium methylate and potassium methylate, chemicals that are used in the production of biodiesel. Anhydrous sodium pyrophosphate and its decahydrate can be used in the transesterification of triacyl glycerides (with sunflower and rapeseed oils as examples) with methanol to obtain biodiesel fuel.	Kurzina, A. V. & Evdokimov. A. N. (2019). Production of Biodiesel Fuel by Transesterifi cation of Triglycerides in the Presence of Sodium Pyrophosphate. *Russian Journal of Applied Chemistry* 92(10), 1377?1382. https://link.springer.com/content/pdf/10.1134/S1070427219100070.pdf

Cement Production	Mercury emissions during cement production	Selection of Fuel Source	Coal typically has a mercury concentration in the range of 10 to 50 ppb. Some sources of alternative fuels (such as waste-derived fuels) also contain mercury. Selecting fuels with low mercury content can significantly reduce mercury emissions. Coke typically has a very low mercury content and can be substituted in place for coal. Having a high thermally efficient kiln also reduces mercury emissions.	Guidance for reducing and controlling emissions of mercury compounds in the cement industry. Cement Sustainability Initiative. http://docs.wbcsd.org/2016/07/CSI_Guidance_Cement_Industry.pdf

Cement Production	Mercury emissions during cement production	Sorbents added during coal combustion	Sorbent components containing halogen, calcium, alumina, and silica are used in combination during coal combustion. Sorbents such as calcium bromide are added to the coal ahead of combustion and other components are added into the flame or downstream of the flame, to reduce emissions of elemental and oxidized mercury; increase the level of Hg, As, Pb, and/or Cl in the coal ash; decrease the levels of leachable heavy metals (such as Hg) in the ash, preferably to levels below the detectable limits; and make a highly cementitious ash product.	United States Patent US20190101286A1 (2019). Reducing Mercury Emissions from the Burning of Coal. https://patentimages.storage.googleapis.com/cd/a5/07/10946d923b7edc/US20190101286A1.pdf

Cement Production	Mercury emissions during cement production	Dust Shuttling (remediation)	Dust shuttling can be used in all kiln types and can reduce mercury emissions by 10-40%. Dust shuttling is the process of selectively purging kiln dust to limit buildup of mercury. The removed dust carries the adsorbed mercury and is then added to the cement produce, which prevents its emission to the atmosphere. This is most effective in long wet and long dry kilns, as well as in preheater kilns with a raw mill in the circuit.	Guidance for reducing and controlling emissions of mercury compounds in the cement industry. Cement Sustainability Initiative. http://docs.wbcsd.org/2016/07/CSI_Guidance_Cement_Industry.pdf

Cement Production	Mercury emissions during cement production	Sorbents for Mercury Control (remediation)	Sorbents can enhance the adsorption of mercury from the gas stream. They are injected into mercury-laden exhaust gases and are designed to enhance mercury capture. They can be added to the cement with the filter dust (in dust shuttling) however it is important to understand how the sorbent may affect cement properties, or otherwise disposed of. Sorbents can be used with any kiln system and work best at lower temperatures. Several sorbents are currently available, including bituminous, linate, and zeolites and reactive mineral mixture. These solvents are often doped with bromine or sulfate to improve efficiency.	Guidance for reducing and controlling emissions of mercury compounds in the cement industry. Cement Sustainability Initiative. http://docs.wbcsd.org/2016/07/CSI_Guidance_Cement_Industry.pdf

Batteries	Mercury cell batteries	Zinc Air Batteries	Zinc air batteries use oxygen from ambient air to produce electrochemical energy; they are often used in hearing aids. They have a high energy density and can be used in continuous discharge. The mercury content of zinc air batteries is usually between .3%-2.0% of the battery weight, however, there are mercury free zinc air batteries available in Europe.	An Investigation of Alternatives to Miniature Batteries Containing Mercury. Lowell Center for Sustainable Production. http://sustainableproduction.org/downloads/MaineDEPButtonBatteryReportFinal12-17-04.pdf

Batteries	Mercury cell batteries	Alkaline Manganese Dioxide Batteries	Alkaline manganese dioxide batteries have a cathode primarily composed of electrolytic manganese dioxide and an anode that is powered by zinc. These batteries have the lowest energy density when compared to other miniature batteries, and have a sloped discharge profile (the voltage gradually decreases during battery discharge). These batteries can be used in a variety of small electronics including toys, calculators, remote controls, and cameras. The mercury content of alkaline manganese dioxide batteries is usually between .1%-.9% of the battery weight. There is a manufacturer (New Leader) that	An Investigation of Alternatives to Miniature Batteries Containing Mercury. Lowell Center for Sustainable Production. http://sustainableproduction.org/downloads/MaineDEPButtonBatteryReportFinal12-17-04.pdf The rechargeable ones are commercially available since 1992.

Batteries	Mercury cell batteries	Low-cost green synthesis of zinc sponge for rechargeable, sustainable batteries	This study found a green synthesis method for zinc sponge for use in batteries, eliminating the use of hazardous hydrocarbons, and reduced materials cost.	Hopkins, B. J. et al (2020). Low-cost green synthesis of zinc sponge for rechargeable, sustainable batteries. *Sustainable Energy Fuels*. https://pubs.rsc.org/en/content/articlepdf/2020/se/d0se00562b
Microplastics				
Plastics	Persistent plastics (which can degrade into microplastics)	Full Cycle Bioplastics	Full Cycle Bioplastics makes bioplastics using bacteria which feed on organic waste. Bioplastic-Polyhydroxyalkanoate (PHA) is compostable and marine degradable once used. It is cost competitive to petroleum-based products and can replace a wide range of synthetic plastics.	Full Cycle Bioplastics. http://fullcyclebioplastics.com/

Plastic Packaging	Persistent plastics (which can degrade into microplastics)	Elk Packaging	Elk Packaging makes fully recyclable, fully compostable or bio-based custom packaging for companies. Types of packaging include folding cartons, flexible film, stand-up pouches, labels, and displays.	Elk Packaging. http://www.elkpackaging.com/sustainability-strategist

Plastic Packaging	Persistent plastics (which can degrade into microplastics)	VTT Technical Research Centre of Finland's cellulose packaging Thermocell	Cellulose is safe, renewable, recyclable, and compostable. VTT developed a lightweight packaging material by combining cellulose films with complementary properties. The packaging can be used for both dry and greasy products. It can be produced with existing production machinery with minor modifications. VTT, in cooperation with Arla Foods, Paulig and Wipak, have developed a material that can be used in food packaging similarly to plastic due to its thermoformable properties, using cellulose and fatty acids. In this technology, the molar mass of cellulose is first adjusted in a controlled	The Ellen MacArthur Foundation awarded VTT for a bio-based packaging solution that reduces the use of plastics. https://www.nutritech.fi/ongoing/news-future-food-factory/the-ellen-macarthur-foundation-awarded-vtt-for-a-bio-based-packaging-solution-that-reduces-the-use-of-plastics VTT Research (2020). Plastic-like packaging material made from completely renewable raw materials by VTT. https://www.vttresearch.com/en/news-and-ideas/plastic-packaging-material-made-completely-renewable-raw-materials-vtt

Plastic Packaging	Persistent plastics (which can degrade into microplastics)	Cellulose nanofiber reinforced starch membrane	As a potential substitute for petrochemical plastic packaging, this study developed a biodegradable TEMPO-oxidized cellulose nanofiber (TCNF)/starch membrane using starch and cellulose, both inexpensive biomass resources. TCNF was mixed with modified starch in a certain ratio to obtain a transparent membrane with excellent water resistance and mechanical properties. TCNF/hydroxypropyl starch (HPS) has been found to show good biodegradability in marine environments, and further research is ongoing.	Raghav Soni, Taka-Aki Asoh & Hiroshi Uyama (2020). Cellulose nanofiber reinforced starch membrane with high mechanical strength and durability in water. *Carbohydrate Polymers* 238. https://doi.org/10.1016/j.carbpol.2020.116203

Plastic Packaging	Persistent plastics (which can degrade into microplastics)	CBPAK-Bio-based material for food containers from cassava	CBPak is a company that has used the cassava plant, which is a woody tuber widely cultivated in South America and which has a non-edible starch component to make robust and fully compostable packaging products.	Ellen MacArthur Foundation (2017). Bio-based material for single-use food containers. https://www.ellenmacarthurfoundation.org/case-studies/bio-based-material-for-single-use-packaging

Plastic Packaging	Persistent plastics (which can degrade into microplastics)	Ecoware	Ecoware makes food packing from a variety of renewable sources including bamboo, sugarcane, and birchwood. The make PLA (polylactide) bioplastics, which are created from renewable plant material. While having a shorter shelf life than traditional plastic packaging, it can last between 18-24 months when stored correctly (cool, dry, and not in direct sunlight).	Ecoware. https://www.ecoware.co.nz/

Plastic Alternative	Persistent plastics (which can degrade into microplastics)	Sulapac	Sulapac is a wood-based material which is microplastic-free and fully biodegradable. If a product made out of the material ends up in the ocean, naturally occurring micro-organisms can digest and transform it into CO_2, H_2O and biomass, so it does not harm the ecosystem.	Sulapac (2019). Sulapac Portfolio. https://www.sulapac.com/portfolio/#straw
Fabrics	Persistent plastics (which can degrade into microplastics)	Hemp	Hemp is a viable alternative to current clothing materials. The hemp plant is fast growing and produces a higher fiber yield per acre. It can grow in most regions, is tolerant to frost and requires almost no pesticides.	Innovative Alternative Ways to Make Sustainable Clothing https://interestingengineering.com/innovative-alternative-ways-make-sustainable-clothing

Plastic Packaging and Fabrics	Persistent plastics (which can degrade into microplastics)	Bamboo	Bamboo does not require replanting, pesticides, or fertilizers. Its roots retain water in the watershed, which sustains riverbanks and reduces water pollution. It is one of the fastest growing renewable plants and is consists primarily of cellulose, hemicellulose, and lignin. Bamboo fiber can be used to make both packaging and textiles. Bamboo fabric properties include high tenacity, high strength and stiffness.	A comparative study of mechanical and comfort properties of bamboo viscose as an eco-friendly alternative to conventional cotton fibre in polyester blended knitted fabrics https://www.sciencedirect.com/science/article/pii/S0959652614011834 Green Composites Made of Bamboo Fabric and Poly (Lactic) Acid for Packaging Applications?A Review https://www.mdpi.com/1996-1944/9/6/435 The Bamboo Fabric Store https://bamboofabricstore.com/

Fabrics	Microplastics from washing of textiles	MERMAIDS Life+ project	?One of the possible solutions to the fiber release is the application of a textile finish on the fabric. These treatments will allow the development of more resistant textiles to repetitive washings. Moreover, they may confer more adhesion and stability to the fabric since it assumes that more compact yarns and a denser structure are responsible for increasing mechanical properties of textiles as well as reduce fiber breakage. Among the different selected products for the textile treatment there are acrylic resins, polyurethane dispersions and one silicone macro-emulsion. All these products have been applied by lab-scaled conventional	MERMAIDS Life+ project. Preliminary steps in the Implementation Action. http://life-mermaids.eu/en/preliminary-steps-in-the-implementation-action/

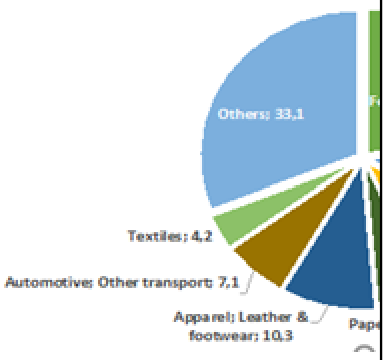
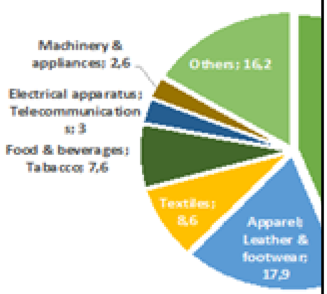
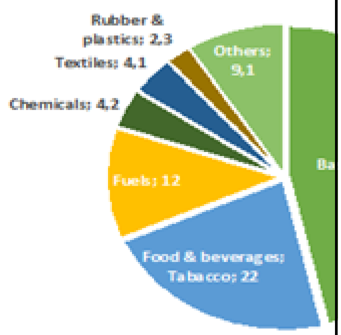
Fabrics	Microplastics from washing of textiles	Fiberclean Project	The FIBERCLEAN project is looking at two perspectives for dealing with the emission of microfibers. First, research and development of new yarns, fabrics and finished products with properties that prevent the release of microfibers during several phases of the life cycle of the product or that allow to revalue them. Second, research and development of new technologies for the elimination or reduction of microfibers during washing and purification that are compatible with conventional systems.	Leitat (2017). Fiberclean: Minimization of microfibers in the life cycle of textile products. https://projects.leitat.org/fiberclean/

Fabrics	Microplastics from washing of textiles	Pectin-based textile coating	A finishing treatment of polyamide fabrics has been developed based on the use of pectin, a natural polysaccharide present in the cell walls of plants. Pectin was firstly modified with glycidyl methacrylate (GMA) and then grafted on polyamide. Washing tests of treated fabrics showed the effectiveness of the treatment in reducing of about 90% the amount of microfibres released by untreated fabrics.	De Falco et al. (2018). Pectin based finishing to mitigate the impact of microplastics released by polyamide fabrics. *Carbohydrate Polymers* 198, 175-180. https://www.sciencedirect.com/science/article/pii/S0144861718307161

Specific country baseli Component 3 will focus on the implementation of GC alternatives for POPs and Hg, and its replication mechanism for national, regional and global level up-take in the six participating countries. During the PPG phase, detailed national baselines for the participating countries covering the project components 1-3 were elaborated upon, whose summary can be found below. The detailed baseline assessments can be found in Annex L. Table 4 and 5 provide summaries of the baseline assessments.

TABLE 4: SUMMARY OF BASELINE ASSESSSMENTS FOR INDONESIA, JORDAN AND PERU

	Indonesia	Jordan	Peru

Country data	**Population**: 270.6 million (2019) **GDP**: USD 1.15 trillion (2020) **All imports**: USD 141.57 million (2020) **Chemical imports**: Organic chemicals USD 5.02 million (2020)	**Population**: 10.806.000 (2020) **GDP**: USD 44.503 billion (2019) **All imports**: 20.309.900,97 (USD Thousands) (2018) **Chemical imports**: 1.612.299,71 (USD Thousands) (2018)	**Population**: 32.625.948 (2019) **GDP**: PER? Instituto Nacional de Estad?stica e Inform?tica (inei.gob.pe) **All imports**: PER? Instituto Nacional de Estad?stica e Inform?tica (inei.gob.pe) **Chemical exports**: PER? Instituto Nacional de Estad?stica e Inform?tica (inei.gob.pe)
Industries/ SMEs outlook	**Industry share of total manufactured exports (%)** Indonesian SMEs account for nearly 97% of domestic employment and for 56% of total business investment. However, about 70% of national employment and more than 90% of total businesses are estimated to be informal. 	**Industry share of total manufactured exports (%)** Small and Medium Enterprises contribute to the creation of almost half of the GDP. They comprise 99.4% of the total industrial sector and are characterized by their diversified products and their ability to create jobs. However, SMEs face a number of challenges of which the most notable is access to finance. The early entrepreneurial activity in Jordan was 8.2% in 2016, this decrease most probably reflects the regional instability, which has clearly increased since 2011 considering the Arab Spring and the enduring Syrian crisis. 	**Industry share of total manufactured exports (%)** Small and micro enterprises is one of the most important economic sectors in Peru, representing 96.5% of the companies that exist in Peru. These companies employ 75% of the Economically Active Population. 

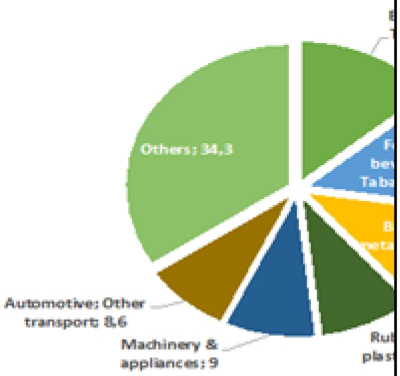
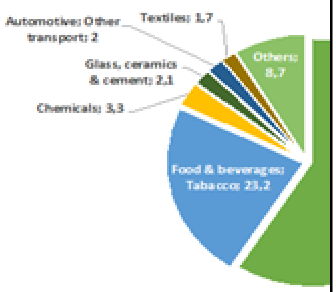
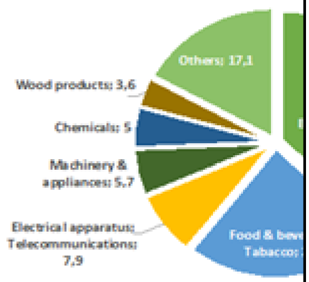
Conventions and policy	**NIP**: Submitted in April 2010 and updated in October 2014 **MIA/NAP**: Ratified in September 2017. Not yet submitted **SAICM**: Ratified in 2006	**NIP:** Submitted in December 2006 and updated in September and November 2017 **MIA/NAP**: Ratified in December 2015 and submitted in 2018	**NIP**: Submitted in December 2007 and updated NIP, approved by Supreme Decree No.010-2021-MINAM **MIA/NAP**: Ratified in November 2015. MIA, approved by Supreme Decress No.004-2019-MINAM **SAICM**: Law No. 31182 (2021) , which is associated with the regulation of lead in paints and other coating materials ? "Law No. 31182, Law that protects the health and physical integrity of people from the lead content in paints and other coating materials".
National priorities	Under the 2015-2019 Medium-Term National Development Plan, the strategy to control environmental pollution and degradation as related to hazardous wastes and substances states: - The development of standards and regulations and the strengthening of control; - Enhancement of the management of wastes, and - Coordinated recovery of critical abandoned land and areas.	-Develop and enforce the regulations related to chemical substances management during their life cycle. -Enhance control on the management of chemical substances, by providing the necessary technical support and capacity building for Customs Department staff. _ Develop technical support for laboratories with the necessary infrastructure and technology transfer.	-Reduce the use of POPs pesticides and others in disuse in the country. -Promote the reduction of the use and consumption of goods containing industrial POPs in the country. -Reduce the release of unintentional POPs in the country's productive and service sectors. -Optimize the application of the Stockholm Convention in public entities. -Reduction of risks to health and the environment in relation to the use or management of chemicals (throughout their life cycle) and their wastes, addressed in the Basel Conventions (management of hazardous wastes), Stockholm (POPs and unintentional POPs), Minamata (management of mercury and associated wastes), as well as the sound management of chemical substances within the framework of SAICM, as is the case with GHS, among other risk management mechanisms.

Institutional and legislative framework	The Environmental Protection and Management Law (2009) is complemented by other corresponding laws related to POPs. The government?s role in the management of hazardous substance is placed under the subfield of management of hazardous wastes. There is no subfield that specifically regulates hazardous substances or chemicals.	The ministry seeks to put in place the legislative framework, policies and strategies and to specify roles and mandates for relevant authorities related to chemicals and waste management of all kinds and coordinate their application, safe disposal, safe handling and controlling their flow across borders. POPs Reduction & elimination is one of the main projects contributing to this strategic goal.	The regulations aim at developing control and inspection measures for chemical inputs that may be used in illegal mining; strengthening the mandate of the National Agricultural Health Service; creating a health standard that establishes maximum residue limits (MRLs) of pesticides for agricultural use in food for human consumption. There is also "General Law of the Environment, approved by Law No. 28611. Peru also has regulations on solid waste management, management and registration of pesticides for agricultural use (which includes chemical pesticides), regulation of supervised chemical inputs that can be used in illicit activities, as well as National Plans that operationalize international conventions such as Stockholm and and Minamata, which provide the roadmap for compliance with the provisions included in these agreements, and may involve approval of more specific associated regulations.
National Baseline Green Chemistry	Low investment prospects are indirectly coupled with generally low skill sets among Indonesian labor market. There are a number of national programs that support innovation and SMEs covering a wide range of areas like finance, entrepreneurship education, innovation, or public procurement. Indonesia has a number of small programmes for women entrepreneurs. According to Roadmap for Incubator Development, there will be 657 new	12 institutes (8 public & 4 Private) awarded chemistry degrees. However, most Green Chemistry works are available on individual basis (research works) and not yet on institutional level. 6 initiatives are underway in Jordan for training green entrepreneurship experts; creating a supportive environment; providing consulting services and knowledge sharing.	The Inn?vate Per? Program of the Ministry of Production delivered non-reimbursable resources for the amount of S/. 8 million to 12 incubators and business accelerators in the last two years, in order to strengthen the advisory work they provide for the development of new ventures or early-stage companies with high potential, facilitating their scaling up in the business world.

National Baseline Innovation Ecosystem	incubators by the end of 2029. These will be accompanied by development of over 100 Science and Technology parks, there are currently 23.	The Government has facilitated access to finance through doubling bank loans granted to SMEs from 10% to 20% and creating a banking window at the Central Bank of Jordan and concessionary financing windows at commercial banks. Moreover, a credit bureau has been established and export and loan guarantee programs have been launched. 6 accelerators are operating in Jordan.	

TABLE 5: SUMMARY BASELINE ASSESSMENTS, 2

	Serbia	Uganda	Ukraine
Country data	**Population**: 6.945 million (2019) **GDP**: USD 61 billion (2021) **Import statistics:** The top imports of Serbia are Crude Petroleum (USD 1.14 billion) and Cars (USD 887 million) **Chemical imports**: Serbia is an importer of chemicals and chemical products, fuel and oil, basic metals, machinery and equipment and motor vehicles.	**Population:** 44.27 million (2019) **GDP**: USD 35.17 billion (2019) **Import statistics:** The top imports of Uganda are Packaged Medicaments (USD 280 million) and Planes, Helicopters, and/or Spacecraft (USD 121 million) **Chemical imports**: Average value of about USD 718.125.129 (18.91%) of the total imports in Uganda (petroleum products, fertilizers, pesticides mostly)	**Population**: 44.39 million (2019) **GDP**: USD 153.8 billion (2019) **Import statistics**: Value of Ukraine?s imports in 2020 is USD 53 billion, mostly mineral fuels & oils and machinery. **Chemical imports**: Most of the imported chemicals are inorganic chemicals and organic chemical combinations.

Industries/ SMEs outlook	**Industry share of total manufactured exports (%)** In 2008, the manufacturing industry contributed to about one-quarter of Serbia?s GDP. The chemical industry's share in gross domestic product of the overall industry of Serbia is about 10.5%. SMEs in Serbia account for 66.3 % of employment and 55.6 % of value added, similar to the respective EU averages of 66.5 % and 56.3 %.  	**Industry share of total manufactured exports (%)** From 1992 to 2011, the GDP grew at an average annual rate of 7.1%. The manufacturing sector sees the presence of several Ugandan firms, and of a handful of large Ugandan?Asian conglomerates, which tend to have very diversified investment ranging from agriculture to manufacturing to services. In employment terms, the manufacturing sector is dominated by SMEs. However, firms are struggling to keep the cost of local products in line with imported products and goods according to market needs.  	**Industry share of total manufactured exports (%)** In 2018, there were about 1,9 million enterprises in Ukraine, about 99% of which were SMEs. The largest share of the green business development potential is taken by energy saving technologies, waste management, and water purification equipment. Because of Ukraine?s dependence on fossil fuels to satisfy its energy requirements, alternative sources of energy might be also considered as attractive green development. 
Conventions and policy	**NIP**: Submitted in June 2010 and updated in 2015 **MIA/NAP**: Not ratified yet **SAICM**: Adopted in 2002	**NIP**: Submitted in January 2009 and updated in 2016 **MIA/NAP**: Ratified in March 2019 and submitted in 2018 (MIA) and in 2019 (NAP) **SAICM**: As part of Agenda 21, Uganda agreed that a national chemicals management system should include several elements in line with SAICM.	**NIP**: Submitted in January 2016 not yet updated **MIA/NAP**: Not yet submitted. Draft Law of Ukraine "On Accession of Ukraine to the Minamata Convention on Mercury" proposed in August 2020 **SAICM**: Adopted in February 2006

National priorities	Complete establishment of relevant legislation and strengthening of stakeholders capacities; Preparation of overview of import, production and use of new POPs; PCB management and phase out management of PCB equipment until 2015; Sound waste management; Identification and remediation of POPs contaminated sites; Implementation of BAT/ BEP; Addressing the obsolete pesticide issue and prevention of generation of new waste.	Uganda Vision 2040 provides development paths and strategies to operationalize Uganda?s Vision statement and is implemented in line with the National Development Plan (NDPII). The goal of the plan is to propel the country into middle income status by 2020 with a per capita income of USD 1.033. Under the Environment and Natural Resources (ENR) sector of the NDPII, government has prioritized electronic and other hazardous waste management and sound management of chemicals, through their life cycle.	_Development of legal and regulatory framework for management of POPs. _ Improvement of POPs monitoring system. _Research for decision making on POPs issues and selection of technologies for treatment. _Treatment of POPs containing equipment, waste and releases. _Awareness raising and mobilization of resources to fulfill the obligations under the Stockholm Convention.
Institutional and legislative framework	The legislative framework created by the adoption of the Law on Chemicals, the Law on Biocidal Products and the relevant bylaws has established a modern chemicals management system, which is significantly harmonized with the EU regulations. Serbia adopted all relevant rulebooks in the field of chemicals, including restrictions and bans on production, placing on the market and the use of chemicals.	Uganda?s policy framework does not specifically address concerns on POPs and mercury management. However, there are enabling laws that facilitate mercury and POPs management with a broad focus on preventing human and environmental exposure to hazardous and toxic chemicals.	Legal relations concerned with chemical safety and chemical substances management are regulated by Ukrainian Constitution. Policies and strategies call for greening SMEs and developing green technologies; integrate EU legislation about circular economy and extended responsibility of the manufacturers; identify relationships in the field of waste management and define waste as an object of property.
National Baseline Green Chemistry	Several projects are currently ongoing in Serbia related to circular economy; Environmental protection and Energy transition; green public procurement; chemicals pollution and toxicity and innovative technologies.	Uganda Cleaner Production Centre (UCPC) has been an active participant of the UNIDO?s Chemical Leasing (ChL) Programme that promotes a chemical leasing model. Other Green Chemistry initiatives in the country include research in the area of Green Chemistry and the various implemented projects in the area of energy efficiency and renewable energy.	3 universities deal with the subject of green chemistry in Ukraine. The Ukrainian Chemists Union (UCU) is a non-governmental organization that unites the chemical industry enterprises. UCU is a member of The Ukrainian Union of Manufacturers and Enterprisers and The Ukrainian National Committee of the International Trade Chamber.

National Baseline Innovation Ecosystem	The innovation ecosystem largely rests on state funding through the Innovation Fund of Serbia and the Scientific Fund of Serbia. There are currently 4 science and technology parks, 5 innovation centres and 112 startups.	Uganda has a strong base of entrepreneurship, with 35.5% of workers engaged in entrepreneurship. There has been a growth in certain sectors in Uganda, including agrotechnology, the financial industry, and health technology. Nevertheless, the ecosystem is fragmented and doesn?t cultivate cooperation between sectors to deliver a technological solution that would benefit the community.	Accelerators and incubators in Ukraine are supported both by private developments and educational organizations. Makerspaces and fab labs are still not very common. Two acceleration programs are being implemented annually, including a Cleantech Startup Competition, a Business Academy and a mentoring program.

93. During the PPG phase, a national sector selection process for the pilot projects per country has been conducted including the desk review and national consultations with potential companies working within sectors relevant to potential industrial POPs and/or Hg use and selection of pilot sector. All proposed interventions have been developed in line with the GEF-7 principles of cost-effectiveness; sustainability; innovative approaches; private sector engagement; promotion of GC. Annex I details the pilot sectors for each country, including national stakeholder consultations, sector description, pilot selction criteria and an Environmental and Social Management Plan (ESMP). The following can be summarized:

(i) **Indonesia**- Pulp and paper industry contributes significantly to the national economy. In 2018, this industry contributed 17.6% to the non-oil and gas processing industry and 6.3% to the national processing industry. Indonesia's pulp production capacity is 11 million tons per year, and paper production is 16 million tons per year. There are 84 pulp and paper companies in Indonesia. Indonesia is ranked ninth for the world's largest pulp producer and sixth for the world's largest paper producer. The pulp and paper industry absorbs 260,000 direct workers, of which less than 30% are female, and 1.1 million indirect workers on the labor side. Indirectly, the pulp and paper industry is classified as a labor-intensive and export-oriented sector. Many chemicals and processes are used in the pulp and paper industry, but the potential POPs are PCDD (polychlorinated dibenzodioxins) / PCDF (polychlorinated dibenzofurans) and PFOS (Per-Fluorooctane Sulfonic acid). According to NIP on Elimination and Reduction of Persistent Organic Pollutants in Indonesia (2008), the emission of PCDD/PCDF in pulp industries is as much as 838 g TEQ (Anonymous, 2008) at 8-million-ton production. If the capacity of Indonesian pulp production 11 million tonnes, the pulp sector will generate PCDD/PCDF as much as 1152 g TEQ in 2021. Besides generating PCDD/PDCF, which produces dioxin and furan emissions, another potential POPs is Per- and polyfluoroalkyl substances (PFAS). The potential amount of PFAS is estimated based on statistical data (1999-2012) from pulp and paper is 1751 tonnes (Anonymous, 2019). The PFAS produced per year from pulp and paper manufacturing processes is 134.7 kg in 2012. It is expected PFAS production in 2021 for the pulp and paper manufacturing process is 161 kg. It is assumed that the pulp and paper industries growth at 2% per year in the last decade.

(ii) **Jordan- EPS/XPS foam**- Jordan?s Building Insulation Sector is growing vastly encompassing and meeting the construction sector needs for insulation inclusive of chemical & manufacturing industries, housings, private and public sector, shopping mega stores, educational institutes etc. There is direct proportionality between the population growth and the insulation demand as both are associated with the increase in housings. As population is increasing exponentially, the demand for housings and insulation will simultaneously increase. Furthermore, Jordan has 4 distinct seasons; winter and spring are relatively short, while summers are long, dry and relatively hot. This has generated fire-safety concerns and was alarming enough to be the main driving factor and opportunity for the insulation sector. Fire retardancy is very critical especially these days of unusual high temperatures the globe is experiencing due to global warming effect. Two types of insulation manufacturing processes are dominant in Jordan, Expanded Polystyrene

(EPS) & Polyurethane (PU) rigid foams. The use of Extruded polystyrene in Jordan is minimal and mostly Fire retardant free.

After an extensive baseline analysis, field visits and meetings with several companies leading the insulation sector it was concluded that Flame retardant (FR) Expanded Polystyrene (EPS) Foam production is major playmaker in the local Construction/building insulation sector due to its commercial viability, ease of production, and its unique thermal properties potentially associated to the HBCCD flame retardant additives. Expanded Polystyrene (EPS) is a white foam plastic material produced from solid beads of polystyrene. It is primarily used for insulation. It is a closed cell, rigid foam material produced from: 1) Styrene ? which forms the cellular structure 2) Pentane ? which is used as a blowing agent. EPS spherical beads produced via polymerization is imported to Jordan to several EPS production companies. The conversion of these expandable polystyrene to expanded polystyrene is carried out in three stages: Pre-expansion, Maturing/Stabilization and Molding respectively. Polystyrene beads is produced from the crude oil refinery product styrene. For manufacturing expanded polystyrene, the polystyrene beads are impregnated with the foaming agent pentane. Polystyrene granulate is prefoamed at temperatures above 90?C. This temperature causes the foaming agent to evaporate and hence inflating the thermoplastic base material to 20-50 times its original size. After this, the beads are stored for 6-12 hrs allowing them to reach equilibrium. Then beads are conveyed to the mold to produce forms suited as per application. During final stage, the stabilized beads are molded in either large blocks (Block Molding Process) or designed in custom shapes (Shape Molding Process).

The following is the process info:

Raw Materials Input	Energy input	Product	Technology
Styrene + Pentane = EPS spherical Beads (from	Electrical power supply	EPS foam	Suspension - Moulding process
Steam			

The potential piloting companies in Jordan import the EPS beads and only go through suspension - moulding process. EPS has very low thermal conductivity due to its closed cell structure consisting of 98% air. This air trapped within the cells is a very poor heat conductor and hence provide the foam with its excellent thermal insulation properties. These thermal properties are enhanced further by the halogenated flame retardant additive that the EPS beads are treated with prior to expansion and molding. Halogenated flame retardants are used in virtually most foam-plastic insulation for building applications. Extruded polystyrene (XPS) contains approximately 2.5% HBCDD by weight, and expanded polystyrene (EPS) contains 0.5% to 0.7% HBCDD by weight.

5 companies are in the field so at least 4 companies can scaleup and replicate. Also new FR-EPS companies will open soon. One company on average produces 250 Tons/Year, while the largest company (EIDCO) produces around 600Tons/year of EPS FR Foam.

There is currently a commitment from the largest Company (EIDCO Engineering Industries & Design Co. Ltd) and the other 5 companies showed great interest and look forward to being part of the project once officially launched. EIDCO?s production capacity for EPS Flame Retardant Foam is in the range of 600-1000 Tons of annual production.

(iii) **Peru- PVC-related sector**- PVC is a plastic that contains chlorine in its composition (57% of virgin plastic is chlorine). Its manufacture, like other industrial processes that use chlorine, involves the formation and emission into the environment of toxic, persistent and bioaccumulate organochlorine substances. The gases, wastewater and wastes emitted and discharged by factories producing this plastic contain vinyl chloride, hexachlorobenzene, PCBs (POPs), dioxins (uPOPs) and many other extremely toxic organochlorine substances. When chlorine-containing materials are burned, hydrochloric acid and organochlorine compounds are formed. Hydrochloric acid is a highly corrosive gas that causes severe damage to humans. This acid also reacts with the additives contained in PVC, creating a larger volume of toxic fumes.

In Peru, the plastics sector and its manufactures have been becoming a good option for the Peruvian consumer. The purchase of materials and inputs to produce different kinds of plastics has led to a skyrocket in demand for manufactured goods from other sectors. Among the sectors that demand it are the automotive industry, construction and building, medicine, electrical and electronics, food, and agriculture, among other sectors. It should be remembered that Peru is a net importer of plastic in its primary forms, 99% of the inputs are of foreign origin, according to figures from the Plastics Committee of the National Society of Industrialists (SNI). Among the 5 types of raw materials demanded by this market are polypropylene (PP), polyvinyl chloride (PVC), polyestyrene (PS), polyethylene terephthalate (PET) and others such as epoxy and allide resins.

Despite the benefits, in recent years the plastics industry has been maintaining pressures against its productive activity, mainly against the manufacture of single-use plastics, the inappropriate disposal of them, since many of them are thrown into rivers and seas by the population and in other circumstances are incinerated, negatively impacting the environment and people's health. In Peru, more than 18,000 tons of waste are generated daily, of which only 52% is properly disposed of in sanitary landfills. The rest goes to informal dumps, water bodies or is treated by informal incineration. In this context, a sustainable alternative was sought for the national production of PVC that reduces its polluting components in order it does not contaminate the environment. A case study of a PVC manufacturing company was identified. The company has evaluated the potential to reduce the use of virgin raw materials (PVC), UV stabilizers and additives as flame retardants in the manufacturing process, in addition to reducing the negative impact of the disposal and burning of PVC after use, in addition to adapting in its business model the manufacture of pipes and connections with recycled PVC.

(iv) **Serbia-Electronics**. POPs are still present in plastic products in Serbia, mainly as constituents of flame-retardants. They mostly originate from import of goods (electronic and electrical), but are then perpetually recycled (via e-waste) into feedstock for new products, which exposes the population to them in a prolonged period. Consumer products made from recycled electronic waste were tested against POPs flame retardants[1] . E-waste contains bromine compounds that are used as flame retardants in electronic equipment. The compounds include polybrominated diphenyl ethers, or PBDEs, such as OctaBDE and DecaBDE, which are passed from e-waste into recycled consumer products on sale in the European Union and Central and Eastern European markets. Out of 5 articles bought on the Serbian market, 5 contained OctaBDE (7-119 ppm), 5 contained DecaBDE (89-1494 ppm), and 2 samples contained HBCDD (4-14ppm). For the above reasons the Ministry of Environmental Protection supports the idea to systematically separate the most common flame-retardant, PBDE (Plybromodiphenyl ether) at the input channel of recycling. This forms the basis of the main pilot-project in Serbia. E-Recikla?a 2010 doo company(out of 3 major e-waste recyclers) has been selected and is willing to participate in the Project. It currently employs 210 employees, with a total annual revenue above USD 3,000,000.

(v) **Uganda- Textiles.** In Uganda, substances containing C6-perfluorinated compounds are commonly used as liquid repellants in textiles to provide protection against liquid hazards. For example, Southern Range Nyanza Limited (SRNL), a textile processing industry, uses about 6 tones/yr of a C6-perfluorinated based chemical (Tubiguard 90 ? F) as a water repellant applied in about 187.78tones/yr of fabric. Fine Spinners (U) Ltd also uses imported laminated polypropylene material, which is water resistant, in production of about 120tones of medical gowns. Recent studies have shown that use of substances containing C6-perfluorinated compounds pose an environmental concern due to their association with Perfluorohexanesulphonic acid (PFHxS)[2]. The chemicals containing PFHxS can be emitted into the environment during the chemical manufacturing process, the application of the finish to the garment, the usage of the garment, the re-application of the finish, and the final disposal of the garment. PFHxS are very resistant to chemical, thermal and biological degradation due to their strong carbon-fluorine bonds and a resistance to degradation, which makes them persist in the environment. PFHxS concentrations are found in biota and human alike and its elimination takes approximately 8 years. Effects of PFHxS in humans are found to influence on the nervous system, brain development, endocrine system and thyroid hormone. Therefore, use of 6 tones/yr of this compound by SRNL implies that about 1.32 tones/yr of Perfluorohexanesulphonic acid (PFHxS) is generated by only this industry. At an approximate annual manufacturing growth rate of 7%, use of C6-perfluorinated compounds in Uganda is expected to grow without the intervention of this project. Thus, the environmental and social impacts associated with their use is also expected to increase.

(vi) **Ukraine- Textiles.** Fabric production in Ukraine has long history and accounts for 2300 companies. According to the state statistics, Ukrainian textile industry in 2019 manufactured ca. 90 mln. m2 of different fabrics, so the possibilities for project results replication are large. Part of these products are heavy fabrics for tents, special working and protecting cloths etc. which must be impregnated by water repelling chemicals and flame retardants. POPs in textile industry are used to produce water-resistant and fire-protecting fabrics. Among fire-protecting substances, the shares of chlorine- and bromine- containing chemicals in Ukraine are 7% and 24 % correspondingly, part of which (hexabromcyclododecane) belong to POPs. Before 2013 hexabromcyclododecane was permitted to be used in Ukraine so still there is large possibility to find it and other brominated antipyrines at the stocks. The reason for wide application of hexabromcyclododecane is that it has low acute and chronic toxicity to human health, but it was banned due to its strong resistance to degradability in the environment and ability to bioaccumulation in trophic chains. Textile industry employs ca. 80 thousand workers, 90% of which are women. The successful project will have significant social effect and gender impact. The reduction of content of brominated antipyrenes in textile industry contributes to the reduction of exposure to these chemicals via skin and by inhaling during the working shifts. The toxicological properties of brominated antipyrenes are studies not sufficiently. They are suspected to have endocrine-disrupting, cardiotoxic, cancerogenic and teratogenic effect. Thus, taking into consideration Stockholm convention ratified by Ukraine in 2007 and applying precautionary principle, brominated POPs must be phased out from the textile production. Ukrainian textile industry to a large extent (by 40%) is export-oriented that could be an incentive to go for environmentally friendly solutions and implements greenchem alternatives.

94. The GC alternatives and GC principles to be applied to the sector will be found in the Project Alternative scenario.

3) The proposed alternative scenario with a brief description of expected outcomes and components of the project

95. The aim of the current project is to scale up green chemistry for POPs and mercury replacement through capacity building and innovation, and creation of a global unifying green chemistry network for implementation and uptake. Based on the problem tree analysis (see Figure 1), the project will have the following four project components (1) Green Chemistry Inclusion Network for Capacity Building, (2) Green Chemistry Accelator Programme, (3) Green Chemistry alternatives for POPs, mercury and microplastics for up-scale and replication, and (4) Monitoring and Evalution.

96. The two global components will address barriers related to capacity-buidling and setting-up an innovative global accelerator program through global cooperation and networking, while six pilot projects on the adaption of GC alternatives for Chemical&Waste-related sectors will be conducted in the countries for replication in the country and region. All three project components will be interlinked to ensure internal and external knowledge management exchange on GC and the accelerator programe in general, and in particular the assessment of GC alternatives, including the use of best environmental practices (BEP) and best alternative technologies (BAT), its lessons learned and replication potential for the participating countries and their regions.

97. The objective tree for the project is presented in Figure 5.

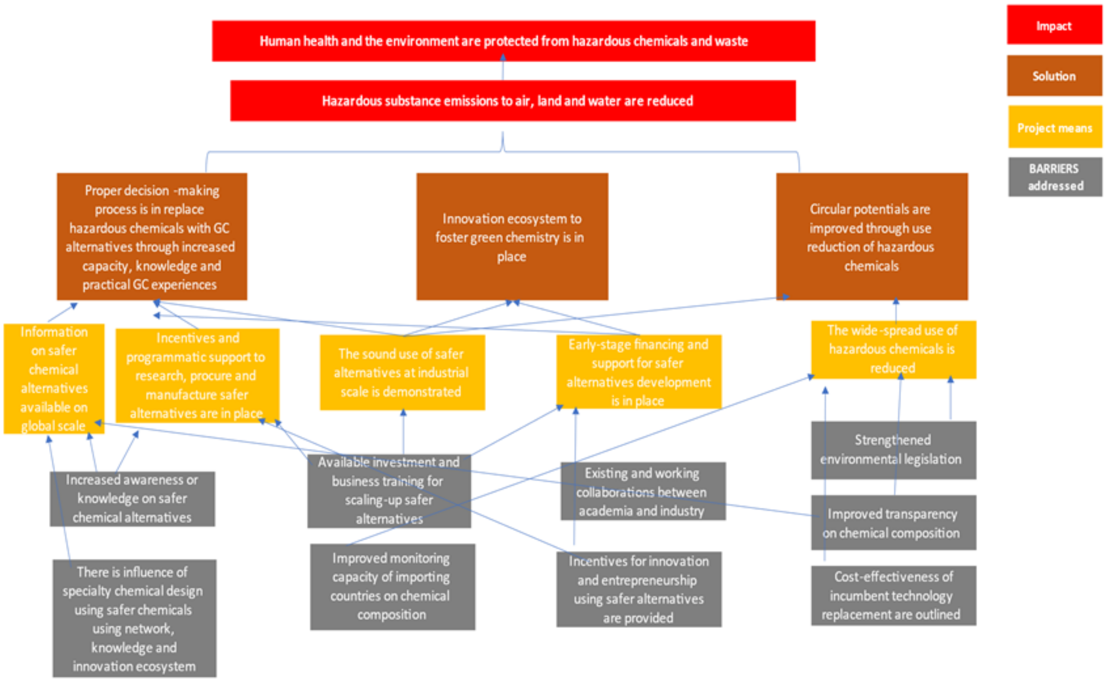


FIGURE 5: OBJECTIVE TREE

98. The project alternative scenario is proposed in response to the problem tree (Figure 1), baseline projects, and objective tree (Figure 5) and should address the identified barriers using the logic of the Theory of Change (ToC) is presented in Figure 6 (also in Annex V).

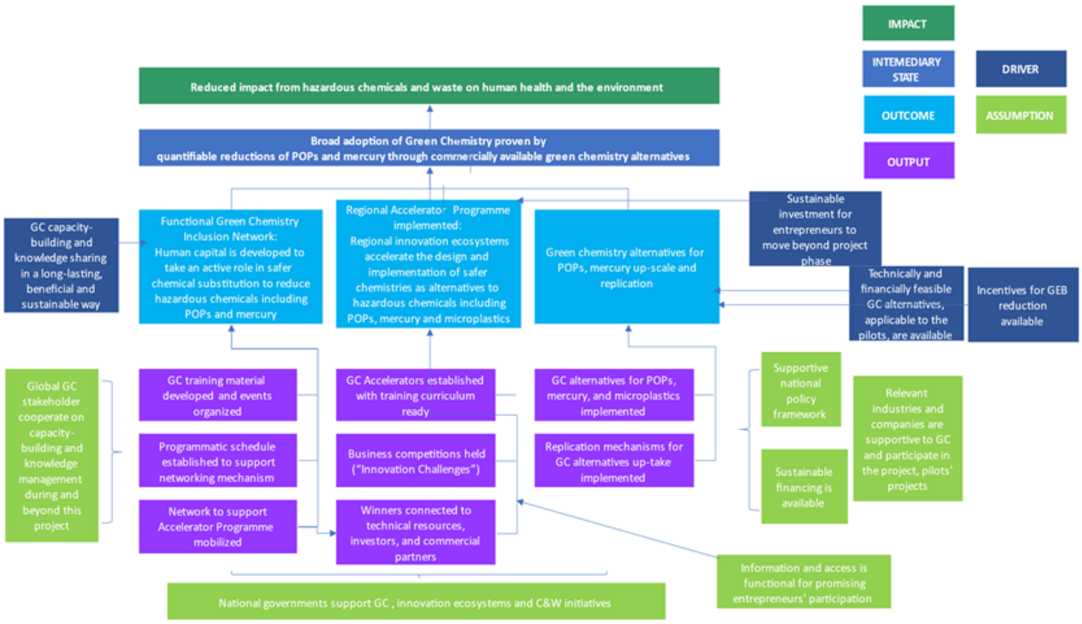


FIGURE 6: THEORY OF CHANGE

99. Entrepreneurs trying to commercialize GC solutions and companies dealing with the reduction of use of POPs and/or mercury in existing processes and/or products face several barriers, as described in the section on global environmental and/or adaptation problems, root causes and barriers that need to be addressed, as well as summarized in the above ToC. In order to alleviate the barriers, this GreenChem project focuses on the following project outputs: (i) GC training material developed and events organized; (ii) Programmatic schedule established to support networking

mechanism; (iii) Network to support Accelerator Programme mobilited; (iv) GC Accelerators established with training curriculum ready; (v) Business competition held (?Innovation Challenge?); (vi) Winners connected to technical resources, investors, and commercial partners; (vii) GC alternatives for POPs, mercury implemented; and (viii) Replication mechanism for GC alternatives up-take implemented. If the outputs are successfully executed, then each component of the project serves a different dimension towards achieving the long-term impact of the project together with the project?s key drivers (a) GC capacity-building and knowledge sharing in a long-lasting, gender-responsive, beneficial and sustainable way; (b) Sustainable investment for entrepreneurs, particularly taking into account the specific needs of male and female entrepreneurs, to move beyond project phase; (c) Incentives for GEB reduction available; and (d) Technically and financially feasible GC alternatives, applicable to the pilots, are available.

? Component 1 ensures that human capital of both women and men is developed to take an active role in safer chemical substitution to reduce hazardous chemicals including POPs and mercury, and to address the gender gaps in education and ITC through gender-responsive capacity building

? Component 2 accelerates the design and implementation of safer chemistries as alternatives to hazardous chemicals including POPs, mercury and microplastics through regional innovation ecosystems

? Component 3 is to demonstrate the ability to scale and replicate the use of safer alternatives to minimize the use or manufacture of hazardous chemicals including POPs and mercury through the implementation of green chemistry alternatives demonstrates

100. The assumptions in the TOC are: (i) Global GC stakeholder cooperate on capacity-building and knowledge management during and beyond this project; (ii) National governments support GC, innovation ecosystems and C&W initiatives; (iii) Information and access is functional for promising entrepreneurs' participation; (iv) Supportive national policy framework; (v) Relevant industries and companies are supportive to GC and participate in the project, pilots' projects; and (vi) Sustainable financing is available.

Component 1. Green Chemistry Innovation and Inclusion Network for Capacity Building

Outcome 1. Functional Green Chemistry Inclusion Network

? Human capital of both women and men is developed to take an active role in safer chemical substitution to reduce hazardous chemicals including POPs and mercury and to address the gender gaps in education and ITC through gender-responsive capacity building.

101. The principles of green chemistry will be the foundation to build human capital that can make informed decisions on the safer chemical substitutions to minimize hazardous chemicals including POPs and mercury. The terminal evaluation for *?Guidance development and case study documentation of green chemistry and technologies?* (UNIDO ID: 150185) identified the lack of a network to enable and support participation and implementation could limit long term sustainability and recommended the development of a global green chemistry network to optimize awareness and implementation for a sustainable outcome.

102. Component 1 develops a robust Global Green Chemistry Innovation and Inclusion Network that connects networks and individuals such as scientists, entrepreneurs, and representatives from government, industry, academia, and non-government organizations. A description of the stakeholders identified so far is presented in the stakeholder engagement section as well as in the stakeholder engagement plan. The Network creates a green chemistry ecosystem that fosters communication, information exchange and training, and supports green chemistry innovation. Special attention will be made to encourage female individuals and female-led organizations to attend the Network.

103. The web-based portal for the Global Green Chemistry Innovation and Inclusion Network is the core output to build human capacity while also enabling Components 2 & 3 of this project. The network will house the awareness, training, and application process to encourage innovation and pilot demonstrations to minimize the use of hazardous chemicals including POPs and mercury, and will also be the mechanism to enable global communication.

Output 1.1. Developed and provided training and awareness events

104. Output 1.1.1 of the programme creates a global, web-based portal to connect green chemists from academia and industry, entrepreneurs, and potential investors under the Green Chemistry Innovation and Inclusion Network. This output also builds green chemistry capacity in emerging nations, to enable green chemistry uptake and dissemination. The following activities will be carried out:

Activity 1.1.1. Creating the framework for the Green Chemistry Innovation and Inclusion Network (Year 1-6)

105. Existing networks will be explored to understand their challenges and opportunities, including gender-related ones, to increase the value that the Green Chemistry Inclusion Network can bring to address these issues. This will be achieved by forming the Leadership Committee from the domestic and international network members who represent industry, academia, NGOs. The Leadership Committee will also include a software expert to advise on the technical abilities of the online platform. The Leadership Committee will be invited to (i) solidify short, medium, and long term goals of the network, (ii) strategically advise on incentives to maintain the network growth and a new member recruitment, (iii) shape the ultimate role of the network to best serve its members, (iv) develop an effective communication strategy. This will be achieved through a number of virtual workshops and breakout groups in year 1 and 2 and will be led by Yale University. Once goals are established, the committee will meet in years 3-6 to assess if the established goals are met. Due to COVID-19, the leadership committee is anticipated to be convened virtually.

Activity 1.1.2. Web-based Green Chemistry Global Innovation and Inclusion Network (Year 2-6)

106. Based on the inputs from the Leadership Committee, the web-based portal will be developed in year 2. The work will be performed by the external vendor and overseen by the Yale University supported by the Leadership Committee and national partners. The portal will be intended for various stakeholders who are part of the Inclusion Network but whose needs and interests may vary. The portal will include a subsection on gender topics in GC. Special attention will be made to encourage female participants of the Network to actively use the web-based portal. The non-exhaustive list of Innovation and Inclusion Network members is provided below:

? Young entrepreneurs seeking mentors and investors to accelerate their technology

? Investors looking for a viable green chemistry technology

? Green chemistry experts and novices to network and exchange ideas

? Representatives from academia (including students) seeking additional green chemistry training and exploring new green chemistry trends

? Technical experts and trainers to contribute to green chemistry knowledge base

? Applicants for the accelerator program

? Chemists seeking sustainable ideas and inspiration to advance their work

107. The portal will reflect different needs of the Innovation and Inclusion Network members and will have five primary functions:

1. Serve as a resource for the Innovation and Inclusion Network members by offering awareness trainings, technical support, guidelines and webinars on green chemistry trends
2. Allow networking and exchanging ideas between different stakeholders
3. Be a primary platform for running the accelerator program and innovation challenges
4. Provide a coordination mechanism between six participating countries

5. Serve as a knowledge repository for all project documents and products

108. The platform will also enable information sharing and virtual office hours with green chemistry experts. This feature will be specifically relevant for accelerator participants who will need technical green chemistry mentorship. A list of green chemistry trainers is provided in the Stakeholder Identification and Engagement Plan. The web based network will be maintained and promoted among different stakeholders.

109. The portal will be continuously updated beyond the life of the program by the engaged stakeholders (trainers, mentors, presenters) and accelerator network alumni. Because of its networking potential, the portal will remain a go-to place for green chemistry experts to exchange ideas and investors seeking viable GC technologies to fund. To ensure its sustainability beyond the funding cycle, the network will seek corporate sponsorship and grants to fund the project.

Activity 1.1.3. Awareness events and training are incorporated into the Network inform and educate on green chemistry (Year 1-5)

110. The majority of programming will take place in the virtual community and will be disseminated through the Massive Online Open Course (MOOC) which will include webinar series and short awareness-raising courses. Access to the MOOC will be free of charge and directly through the web-based Innovation and Inclusion Network which will facilitate access for all countries, developed and emerging countries alike.

111. Courses will be asynchronous, and webinars will be in the synchronous format. All MOOC programming will be promoted by national partners to attract local industries and small scale businesses which are interested in green chemistry and sustainability. The training will build on the training model developed in ?Guidance development and case study documentation of green chemistry and technologies? (UNIDO ID: 150185) to develop national green chemistry capacity, which included the development of an Awareness Raising training module and a Train-the Facilitators module to enable trainees to extend their green chemistry knowledge and interests to others. After MOOC awareness-raising training, additional in-person training will be conducted in six participating countries, provided COVID-19 protocols are met. In the event COVID-19 continues to contain in-person events, modifications to the in-person training will be accommodated to allow smaller group or entirely virtual training if needed. Selected participants who have capacity to disseminate green chemistry to industry, government, NGOs, and academia will be invited for multi-day in-person training which will be modelled after the successful Global Green Chemistry Initiative (GGCI) Train-the-Facilitator workshops. The training will be designed to enable green chemistry dissemination and lay groundwork for the future green chemistry accelerator participants. Based on GGCI terminal evaluation and recommendations, Train the Facilitators is a very effective means to build the green chemistry capacity on the country scale.

Output 1.2. Networking mechanism in place through established programmatic content schedule

112. Innovation and Inclusion Network members will benefit from a number of training resources developed in Output 1.2 that will help to envision a global view of green chemistry?s principles and current trends. The program will offer awareness-raising events and training for the Innovation and Inclusion Network members. Membership in the Network will be open to the public and will be moderated by the green chemistry experts to maintain the green chemistry integrity; however, in-person training will be conducted by invitation. In-person training will be dependent on current COVID-19 protocol in the respective region, and, if in-person is permissible, all necessary safety practices will be followed to minimize exposure.

Activity 1.2.1. Programmatic content schedule (Year 1-6)

113. The Innovation and Inclusion Network members will benefit from a number of training resources that will help to get a global view of green chemistry?s principles, current trends, and alignment with the UN SDGs. The resources will include - but will not be limited to - video series, recorded interviews with the green chemistry leaders, power point presentations, case studies, workshop activities, and policy guidance and examples. Collection and development of the training materials will begin in year 1 and will continue through the entire length of the project. Gender

considerations will be mainstreamed in these training materials. Activities will be coordinated by Yale University supported by the Stakeholders listed in the Stakeholder Identification and Engagement Plan.

Activity 1.2.2. Networking for the Innovation and Inclusion Network members (Year 3)

114. Networking will be an important element of Component 1. The initiative will enable global networking between different stakeholders who join the Innovation and Inclusion Network, from students to executives in local and global organizations. The networking will not be limited to Innovation and Inclusion Network stakeholders only. Accelerator participants (see Component 2) will also benefit from the global networking opportunity as they be able to seek and connect with additional mentors and other entrepreneurs. As this is a virtual networking experience, it is expected to continue with limited impact from COVID-19. Any in-person events that may be initiated will be designed to meet all required health and safety protocols to minimize exposure to COVID-19.

Activity 1.2.3. Conference for the global members to present case studies related to green chemistry innovation (Year 1-6)

115. Conferences offer an opportunity to connect with a greater community, think about new strategies, and to share ideas and current research. There are at least 6 annual high-profile green chemistry conferences which are attended by industry, academia, and NGOs. Many of them are organized in Europe, Asia, and North America. This Initiative will host symposia at these green chemistry events, in collaboration with key stakeholders, and invite the network members to share their innovative research with the greater green chemistry community. These events will increase the network visibility, strengthen collaboration efforts, and encourage networking. Special attention will be made to encourage female participants and include female speakers at these conferences.

116. Conferences will also be intended to bring National Accelerator Winners (Component 2) together, to recognize their efforts through the Global Award ceremony, and to connect them with potential industry partners and potential investors.

117. The conference governing bodies will define the conference format and practices required to meet COVID-19 protocols in the respective regions. As a host of symposia within existing conferences, hosts will be expected to meet or exceed all-conference expectations to minimize exposure to COVID-19. Over the global pandemic period 2020-2021, conferences have made adaptations to foster networking even when events are held virtually; therefore, the project objectives will continue to be achieved and adverse impact due to COVID-19 is not anticipated.

Output 1.3. Mobilized Network to support Accelerator Programme

118. Output 1.3. ensures a mobilized network that provides continuous commercial green chemistry technology solutions to enable sustainable stakeholder engagement particularly geared towards investors to support the green chemistry demonstration and pilot projects.

Activity 1.3.1. Database of green chemistry technologies that can be transformed into the commercial green chemistry solutions. (Year 2-6)

119. There are hundreds of commercial green chemistry solutions. A comprehensive list of innovations that have been implemented and can serve as an inspiration for the newly formed network can be found in Annex K (Technology Compendium). There is also a number of green chemistry solutions that can replace POPs, Hg and microplastics. That database of the new research ideas is important for multiple reasons: 1) it brings exposure to new green chemistry solutions that require mentorship and/or funding, 2) it connects researchers and businesses, and 3) it becomes a hub for innovation. And while individual projects and research products will be invited to advertise their work in the web-based Green Chemistry Innovation and Inclusion Network (Output 1.1.), all applicants to the accelerator program and innovation competitions (Component 2) will be funneled into the Network?s technology database. This will increase the number of green chemistry solutions having an opportunity to connect with partners and potential technology scouts.

Component 2. Green Chemistry Accelerator Programme

Outcome 2.: Regional Accelerator Programmes developed and implemented for scaling and green business creation

? Regional innovation ecosystems accelerate the design and implementation of safer chemistries as alternatives to hazardous chemicals including POPs, mercury and microplastics.

120. The Global Green Chemistry Accelerator is a programmatic, multi-country startup accelerator program to promote innovation and technology transfer for green chemistry breakthroughs and implementation in existing manufacturing processes. The approach learns from previous programs to create a holistic ecosystem approach using reinforcing components to improve learnings and coordination. The program exists to reduce systemic barriers: knowledge equity issues faced by entrepreneurs, barriers in business and policy, and small-scale, patient capital for experimental technologies looking for their first pilot. For detailed information please refer to Annex P.

121. Accelerators offer financial support, business advice and complementary services offered by partner organizations. The program blends virtual and in-person programming, formally coordinated with dedicated resources internationally and locally. The virtual resources (Global Virtual Training) allow for regular systemic assessment, discussion, and comparison between countries to avoid duplication and identify cross-border opportunities. The in-person presentations (National Specific Training) address unique country issues, including legislation, policy etc. The program also includes 1-on-1 Technical Support with a business expert, who can individually discuss and provide a customized advice to Accelerator participants.

122. The goal of each Accelerator is two twofold: (i) provide each venture a comprehensive and tailored business training (ii) provide each venture with the space to create a functioning pilot with pre-identified corporate partners, so that their venture is tested in a for-profit space, allowing them to raise capital based on those outcomes.

123. It is critical that there is a continuation of ecosystem post-competition. This is embodied by creating a local and digital ?Alumni network?, invitation to networking events for entrepreneurs and funders created by Component 1.

124. This component results in the establishment of six (6) multi-year startup accelerator programmes providing business and green chemistry training to nurture regional ecosystems in the emerging nations. Component 2 identifies promising green chemistry technologies, innovators, and entrepreneurs, and develops national capacity for innovation through replicable accelerators, innovation challenges, and support for the most promising business models. The first output of Component 2 is the delivery of a replicable business curriculum (see Annex S Accelerator Framework and Annex P Accelerator Curriculum) to the promising green chemistry accelerator participants and engagement of administrators, as well as mentors and judges solicited from Component 1. The business curriculum will take into considerations the gendered challenges and opportunities of female and male-led companies in manufacturing sector. The second output of Component 2 is to run three (3) innovation challenges that engage industry (large corporations or SMEs) partners to solicit solutions using green chemistry approaches to an identified industrial problem, including elimination of hazardous materials like Mercury and POPs. The third output provides winners from the accelerator programmes and innovation challenges with additional mentorship and resources. It also connects them to the Innovation and Inclusion Network from Component 1 to encourage long-term sustainability. The winning technologies will be disseminated to the network (component 1) and evaluated for upscaling as described in Component 3.

125. Component 2 will provide education and resources to boost bench-scale green chemistry solutions into scalable business models as commercialized technology, building on lessons from

the GEF funded and UNIDO implemented Global Cleantech Innovation Programme (GCIP). Component 2 will solicit, structure, aggregate, and offer to the investment and industrial communities green chemistry solutions: alternatives to POPs, mercury; new plastics and materials to fight ocean pollution; bio-based chemicals and materials to reduce landfill waste and petroleum dependence; chemistry for carbon-reduction necessary for addressing climate change; alternatives to existing solvents; and new catalysts to reduce material and energy use. These solutions are designed to engage issues across the full life cycle including energy, resource depletion, water, and hazard reduction. Component 2 reduces systemic barriers by offering training to combat knowledge equity issues faced by entrepreneurs, identifies barriers in business and policy climates, and invites patient capital to support experimental technologies looking for their first pilot.

Output 2.1. Accelerators established with completed curriculum training for Judges, Mentors and Administrators

126. Output 2.1. delivers functioning accelerator training to green chemistry innovations. Activities aim to develop the programme and include mentor training, recruitment into the programme and the programme curriculum.

127. The Global Green Chemistry Accelerator is a programmatic, multi-country startup accelerator program to promote innovation and technology transfer for green chemistry breakthroughs and implementation in existing manufacturing processes. The approach learns from previous programs to create a holistic ecosystem approach using reinforcing components to improve learnings and coordination. The program exists to reduce systemic barriers: knowledge equity issues faced by entrepreneurs, barriers in business and policy, and small-scale, patient capital for experimental technologies looking for their first pilot.

128. Accelerators offer financial support, business advice and complementary services offered by partner organizations. The program blends virtual and in-person programming, formally coordinated with dedicated resources internationally and locally. The virtual resources (Global Virtual Training) allow for regular systemic assessment, discussion, and comparison between countries to avoid duplication and identify cross-border opportunities. The in person presentations (Nation Specific Training) address unique country issues, including legal, policy etc. The program also includes 1-on-1 Technical Support with a business expert, who can individually discuss and provide a customized advice to Accelerator participants.

129. The goal of each Accelerator is two twofold: (i) provide each venture a comprehensive and tailored business training (ii) provide each venture with the space to create a functioning pilot with pre-identified corporate partners, so that their venture is tested in a for-profit space, allowing them to raise capital based on those outcomes.

130. It is critical that there is a continuation of ecosystem post-competition. This is embodied by creating a local and digital ?Alumni network?, invitation to networking events for entrepreneurs and funders created by Component 1. A draft accelerator curriculum can be found in Annex P.

Activity 2.1.1. Develop curriculum and Accelerator Guidebook to guide in the operation of the accelerator programme. (Year 1-2)

131. To address complexity of the accelerator network across all six countries and to maintain the standards of the practical operating procedures, templates and questionnaires for mentors, and, applicant selection and judging criteria, the Accelerator Guidebook will be developed and disseminated to help inform the process. The document will outline best practices and general guidelines for the national administrators, who will be managing accelerator?s activities on a cyclical basis, and will also include recommendations for long term sustainability of the accelerator programme. The Accelerator Guidebook will be collectively developed by all partnering countries in year 1 to capture national priorities and national context. The Guidebook will be gender mainstreamed so that all operating procedures, guidelines, and activities will be sensitive and responsive to the different needs and expectations of female and male participants in the Accelerator.

Activity 2.1.2. Expert training (Year 2-3)

132. Additional mentors, coaches, administrators and judges will be sought for the accelerator program who have been identified during the PPG phase. A strong network of experts with representations of both women and men is critical to the success of the training aspect of the accelerator program. The search announcement will be disseminated through the Green Chemistry Innovation and Inclusion Network and through the national executing agencies. Once identified, experts will be provided with a virtual training on how to provide mentorship and impactful guidance to the accelerator participants. They would also receive gender sensitization training, if necessary, in order to address more effectively the different needs and expectations of female and male participants in the Accelerator. The training will also help with coordination, cohesiveness and setting expectations across all six participating countries. After completing the training, mentors, coaches, administrators, and judges will be given a certificate of completion allowing them to serve in their role. Details on the expert training will be captured in the Accelerator Guidebook and provided by Yale University in year 2.

Activity 2.1.3. Recruitment (Year 3-5)

133. Mentor, applicant, and judge recruitment will rely on the Green Chemistry Innovation & Inclusion Network (Component 1) as well as other stakeholders. To assure consistency among mentors, training will be provided outlining Accelerator Framework (Annex S) and program expectations. Gender diversity will be considered among the mentors. Recognizing COVID-19 has an impact on regional and global travel restrictions as well as personal preferences, the pool of judges and mentors will be sufficiently sized to accommodate potential limitations in travel while assuring program objectives are achieved.

134. The Accelerator participants may be first-time entrepreneurs (e.g. students from universities or from technical training institutes), established entrepreneurs (e.g. those with successful exits, or with experience starting businesses in any sector), or those looking to change careers (e.g. established business professionals or industry practitioners). Recruitment will take place through media channels such as print, outdoor advertising, radio, social media, YouTube, specialized events like conferences, as well as inbound marketing on green chemistry, circular chemicals, and impact investing. Communications products will be gender sensitized to not discourage the participation of either women or men.

135. Applicant Screening will be performed by the Accelerator staff as applications are submitted. Screening will include a due diligence for all required documents. When completed, application will be scanned for eligibility (technology, stage of development, number of people in the team) before passing to judges. Additionally, a preliminary assessment of climate risk will be considered during the selection process. Depending on the national context, gender quotas could be implemented as affirmative action to correct the traditional and ongoing gender imbalance in the chemicals industry and increase gender-balanced representation of the Accelerator participants.

Activity 2.1.4. Accelerator Programme (Year 3-5)

136. A three-month gender-mainstreamed curriculum will consist of a synchronized Global Virtual Training done amongst all six cohorts, a Nation Specific in-person Training, and 1-on-1 Technical Support with an expert. All three components provide different skillsets to the Accelerator participants and are recommended for a successful completion of the programme. After the initial 3-month curriculum, the companies will apply their learnings to present their idea internally to judges and Accelerator staff. The Mock Pitch will be an opportunity to get feedback from a friendly audience and to sharpen participant venture pitch for fundraising.

137. In-person training and technical support will follow regionally-specific COVID-19 practices and will be transitioned to a virtual format should the need arise. Recognizing COVID-19 has an impact on regional and global travel restrictions as well as personal preferences, the pool of judges and mentors will be sufficiently sized to accommodate limitations in travel while assuring program objectives are achieved.

Activity 2.1.5. Demonstration Projects (Year 3-5)

138. Accelerator staff, mentors, and entrepreneur will begin demonstration negotiations with regional partners with an aim to implement the most promising technologies in a working industrial environment. These pilots should be small, low-risk, and presented as a marketing and innovation opportunity to the corporates. Although pilot demonstrations require on-site work, virtual collaboration will minimize the time on site as needed to meet COVID-19 prototols. An understanding of corporate policies for on-site collaboration and implementation, with potential for changes due to COVID-19, will be integrated into the selection process for pilot demonstrations, and will be incorporated into the respective project plans as needed.

Output 2.2. Business competitions held (?Innovation Challenges?)

139. Output 2.2 enables development of the local entrepreurship ecosystem by providing Innovation Challenges co-developed by the industry to the green chemistry enthustasts. Innovation Challenges will be held over weekends and invite the public to participate in a problem-solving competition.

Activity. 2.2.1. Defining the challenge (Year 3-5)

140. Innovation Challenges will create targeted solutions by using a ?reverse pitch? methodology, which will invite industry and local government to generate a list of industrial chemical challenges currently faced by the organization (i.e. particular chemical processes, synthetic pathways, solvent replacements, catalysts, or other types of reagents). The list of challenges will be assessed by the global network coordinator and led by the national executing agency.

141. The solutions to the Innovation Challenge will be solicited in two ways: (i) hackathon and (ii) a formal call for abstracts/solutions. The in-person hackathon invites anyone to participate in a weekend challenge to engage the entrepreneurial ecosystem and any member of the public who wishes to contribute to proposing ideas to the solicited regional Innovation Challenge is invited. Formal call for abstracts/ solutions is a more traditional way of receiving applications that address problem with a high impact potential. A combination of both avenues activate the community?s entrepreneurial spirit and generates high quality ideas to the identified problem.

Activity 2.2.2. Business Competitions (?Innovation Challenges?) (Year 3-5)

142. Three Business Competitions (?Innovation Challenges") will be held as an open call for green chemistry entrepreneurs to propose technology innovations that can address a particular pollutant problem with high-impact potential. The innovation challenges will be held as child projects, assisted by the global programme, to engage Component 1 corporate and government partners by connecting them with operational Accelerator participants and other interested stakeholders. The format of the Innovation Challenge will be developed in the Accelerator Guidebook.

143. Innovation Challenges will solicit targeted solutions by using a ?reverse pitch? methodology, which will invite industry and local government to generate a list of industrial chemical challenges currently faced by the organization (i.e. particular chemical processes, synthetic pathways, solvent replacements, catalysts, or other types of reagents). The list of challenges will be assessed by the global network coordinator and led by the national executing agency. The Innovation Challenge will have a form of a hackaton. The hackathon allows and invites the public to participate, nurturing the entrepreneurial ecosystem with anyone who wishes to come, spend the weekend, and join an informal team of 3-5 people proposing a solution (process, chemistry, or business model) to the reverse pitch. Hackaton winners will be admitted into Accelerator Programme.

Output 2.3. Global winners connected to further technical resources, investors, and commercial partners

144. Output 2.1.3 describe a final accelerator event (National Judging Day) and a further support for the accelerator teams post accelerator training.

Activity 2.3.1. National Judging Day (Year 4-6)

145. A final national judging day (Final Judging and Awards) will be held at the end of each accelerator cycle as a culminating event, designed to connect the winners to further resources. The final day pitch will be the crowning achievement of each regional accelerator, with accelerator administrators inviting every contact they have and attempting to make it a large, high profile event celebrated by the local media. Each of the program participants will give a presentation, followed by questions by the judging panel.

146. There will be two national prizes that culminate during that final pitch: an overall winner with the most promising and scalable green chemistry technology, and an award for a women-led venture. These prizes do not have to be mutually exclusive. Many regions could have women led ventures that take both prizes. The winning venture will receive an invitation to the Global Green Chemistry Accelerator Competition event to pitch their company idea amongst the winners from the other regional accelerator programmes. This Global Green Chemistry Accelerator Competition event will be held at one of the established green chemistry conferences, like Annual Green Chemistry and Engineering Conference, Gordon Green Chemistry Conference, International Symposium for Green Chemistry or Green and Sustainable Chemistry Conference to enable finalist to connect with other green chemists, many of who are connected through Component 1. The final event may be also held at BRS or Minamata COPs or ICCM conference to broaden the green chemistry reach. Assembled audiences will include entrepreneurs, industry representatives, national representatives, academics, and investors.

147. All Accelerator activities, including National Judging Day, will be captured and gathered on the Green Chemistry Global Innovation and Inclusion Network website. Depending on COIVD-19 protools, accelerator activities including National Judging Day and the Global Green Chemistry Accelerator Competition Venue Event will be held virtually.

Activity 2.3.2. Post-Competition Support (Year 3-6)

148. Post-competition support demonstrates the final phase and promise of the Accelerator Programme. Amongst the global finalists and overall winner, consistent networking support in Component 1 will be established to continue scaling their idea after the conclusion of the Accelerator. All Accelerator participants will be funneled into the Innovation and Inclusion Network and will be invited to networking events for entrepreneurs and founders in Component 1.

Component 3: Green Chemistry alternatives for POPs, mercury and micro-plastics for upscale and replication

Outcome 3. Green Chemistry alternatives for POPs, mercury and microplastics implementation and upscaling of successful demonstrations

? Implementation of green chemistry alternatives demonstrates the ability to scale and replicate the use of safer alternatives to minimize the use or manufacture of hazardous chemicals including POPs and mercury.

149. Component 3 will demonstrate green chemistry alternatives for selected GEF chemical&waste related sectors in each of the six participating countries. During PPG, an extensive sector selection process including desk studies and national stakeholder consultations have been conducted to be able to select relevant sectors applicable to GEF-7 criteria, national priorities, GC alternatives and stakeholders willingness to cooperate. A summary of the PPG stakeholder engagement and consultations, pilot selection process and selected sectors (along GEF criteria) can be found in Annex I. Execution of the demonstrations will go along with strengthening of national legislation, technical feasibility, cost-benefit analysis, capacity-building, training and awareness-raising activities, as applicable.

150. Successful demonstration of GC alternatives will be documented based on economic, environmental and social criteria to ensure proper replication potential using established replication mechanism, including the development of financing options.

151. Occupational safety and health are important considerations for the manufacture and use of the chemicals. As pilots (Component 3) are implemented by national partners, learnings and practices, including chemical management, and occupational health and hazard will be disseminated to ensure replication potential among other companies. Dissemination will be performed by the national partner and may include OSHA professionals.

Output 3.1. Green chemistry alternatives for POPs and mercury are implemented

152. Switching to GC alternatives requires a thorough analysis of relevant sectors to be targeted, GC solutions to be applied and GEB calculations to be monitored. Coordination with the international network under Component 1 is relevant to ensure up-to-date research, testing and BAT/BEP application of GC alternatives. Synergies will also be built with Component 2 to ensure that all promising technologies that reduce or eliminate POPs and mercury can be accelerated to market. This output will built upon PPG activities in identifying relevant pilot sector and will elaborate concrete steps in assessing and implementing GC interventions in the following countries and sectors (Table 4):

TABLE 2: FOR COUNTRY INTERVENTIONS, SECTOR ? GC ALTERNATIVES

Country	Industry	Use	Alternative	Details	

Indonesia	PFOS in Paper and packaging	PFOS in food packaging, primarily as a repellant against grease and water	Resources providing lists of alternative products and coatings.	Polyfluoroalkyl substances (PFAS) are often added to fiber and paper food packaging, and often the manufacturer is not aware that PFAS were added with the raw materials. OECD report on PFASs in food packaging offer potential alternatives. Another way to ensure the product is PFAS-free it can be evaluated using tool such as GreenScreen? for Safer Chemicals, a method designed to identify chemicals of high concern and offer safer alternatives. Clean production action provides list of PFAS-free food service products and list of alternative coatings.	PFASs and alternatives in food commercial availability and cur https://www.oecd.org/chemical and-alternatives-in-food-packag GreenScreen? for Safer Chemic Hazards of PFAS fact sheet: https://www.cleanproduction.or

			Cellulose based physical alternatives - natural greaseproof paper	Naturally grease resistant paper derived from refined fibers containing microfibrillar cellulose, cellulose nanofibrils and cellulose nanocrystals. The greaseproof paper provides barrier against grease because of a dense surface structure originating from a cellulose. These materials are produced by refining cellulose using high-pressure homogenization, griding and refining which is used as a coating on paper or plastic. Nordicpaper produces Natural Greaseproof paper used for cooking, baking, and packaging based on processed cellulose. The company relies on sustainability through bio-based circular economy using renewable resources and recycling the water used in production. Twinrivers paper company produces PFOA-free grease-resistant paper Acadia? line of products used in different types of food packaging. Company was involved in several projects for the Green Transformation Program through the Canadian government.	Natural greaseproof paper: https://www.nordic-paper.com/ Packaging papers: https://www.twinriverspaper.co

			Alternatives to paper: bamboo, palm leaf, wheat fiber, PLA compostable plastic	Eco-products make products (cups, plates, containers) using post-consumer recycled materials or renewable resources. They are intent on scaling down waste through Zero Waste program, following practices that promote sustainability. Bambu is the company producing variety of products from certified organic, renewable bamboo that are also compostable. The company is committed to crating zero-waste solutions, thinking about the full life cycle of their products. BioMass Packaging? is producing compostable and nature-based products from agriculturally derived raw materials, such as palm leaves used in production of palm leaf plates and plates made from wheat fiber. Earthchoice has a line of compostable products ranging from containers, drinkware to tabletop utensils based on the recycled PET, fiber blends, PLA, and mineral filled and recycled polypropylene.	Compostable dinnerware: https://www.bambuhome.com/c Plates and platters: http://www.biomasspackaging.c Clear PLA containers: https://www.ecoproducts.com/c EarthChoice Product Catalog: https://www.pactiv.com/brochu

			Alternative coatings: Biowax, wax, clay formulations for coatings	Wax and bio-wax formulations for coatings can be used as sustainable replacements in food packaging. TopScreen? formulations are water-based synthetic biopolymers or vegetable-oil based bio-waxes free from mineral oil saturated hydrocarbons and mineral oil aromatic hydrocarbons. Dart Canada inc. produces Bare? by Solo? Eco-Forward? heavy weight clay-coated paper dinnerware. BBC cellpack packaging produces CELLWax, a bio-sourced paper coated with vegetable wax.	TopScreen TM boiwax-based b https://www.solenis.com/en/res biowax-based-barrier-coatings Foodservice products: https://www.dartcontainer.com/ BBC Cellpack Packaging Paper https://packaging.cellpack.com/

Jordan	HBCDD in Extruded polystyrene (EPS/XPS) foam	HBCDD as flame-retardant in the foam used for insulation in building and construction applications	Recycled EPS	Recycled EPS can be used rather than virgin EPS, which would be a greener alternative by displacing the manufacture of POPs for virgin EPS. Toyosu Market EPS Recycling Facility in Japan has successfully utilized onsite recycling equipment such as volume reduction machines to treat EPS boxes discarded at wholesale markets. Post-consumer products are recycled to EPS beads that are reused as raw material by Benchmark Foam Inc. to create 100% recycled eps360?. EPS recycling international provides list of resources for EPS recycling in various countries around the world.	Japanese EPS association (JEPS https://epsrecycling.org/content 2019.pdf eps360? - 100% recycled http://benchmarkfoam.com/pro Global recycling access: https://epsrecycling.org/

			Cellulose alternatives	EPS insulation can be replaced with the cellulose alternatives. CleanFiber? is a cellulose insulation containing all-borate liquid fire retardant directly infused into the fibers. Papira? by Stora Enso is a lightweight wood fiber-based cellulose foam material for protective and cushioning material in packaging. The material is biodegradable alternative to EPS that can be recycled with regular paper and board. Greenfiber provides range of insulation products based on the cellulosic fibers that can be loose-filled or spray applied.	CleanFiber?: https://www.cleanfiber.com/ Cellulose foam Papira? by Stor https://www.storaenso.com/en/ Products: https://www.greenfiber.com/pr
			HBCDD free EPS products	Owens Corning? produces Foamular? NGXTM high-performance XPS insulation uses HBCDD free flame retardant, and partially recycled foam. DuPont? produces Styrofoam? Brand XPS insulation with BluedgeTM polymer flame retardant replacing HCBD. While this is another brominated persistent flame retardant, it is a step in good direction.	Foamular? NGXTM: https://www.owenscorning.com us/insulation/residential/produc Styrofoam? Brand XPS Insulati https://www.dupont.com/brand

Peru	SCCP and UV-328 in PVC polymers	SCCP and UV-328 are used as UV stabilizers in PVC plastics	Alternative UV/stabilizers/absorbers	UV stabilizers/absorbers such as benzotriazoles are used to absorb UV light and protect the polymer materials (plastics, adhesives, coatings) from the photolytic degradation. However, these stabilizers can cause aquatic toxicity upon prolonged exposure, and are suspected carcinogens. Chitec Technology Company provides line of Chiguard? UV stabilizers based on triazines and benzotriazoles. GreenChemicals SRL is Italian based company that specializes in plastic additives in compliance with the customer requests and final application to reduce the environmental impact and develop green flame retardant solution. Hexanoic acid (2-ethyl-, 2-(4-(4,6-diphenyl-1,3,5-triazin-2-yl)-3-hydroxyphenoxy)ethyl ester (CAS 371146-04-2)) is a potential replacement for UV-328 as UV stabilizer. Clariant produces Hostavin? NOW, a chemically modified polyethylene wax as a more sustainable UV stabilizer/flame retardant additive designed for polyolefins fibers and films.	UV stabilizers ? Chiguard: https://www.chitec.com/english Chemical additives, antioxidant https://greenchemicals.eu/produ UV Absorbers / Stabilizers: https://www.afirm-group.com/w content/uploads/2019/09/afirm_ Hostavin? NOW, flame retarda https://www.clariant.com/en/Bu Additives/Hostavin-NOW https://www.clariant.com/en/So NOW-pills-XP

Serbia	POP-PBDEs in commercial electronics and consumer goods	PBDEs are used as flame retardants in electronics and consumer goods	PBDE replacements	Clean production action provides a list of non-halogen flame retardant molecules to be used as brominated flame retardant alternatives that can be used for cabinets and housings, and printed circuit/wirings boards. The screenings are based on the GreenScreen? for Safer Chemicals assessment method. Chemtura produces Firemaster 500 flame retardant ? a mixture of brominated and non-halogen flame retardants, however studies are still being conducted into hazard potential of this alternative. EPA has published a report that assess hazard profiles for reactive flame retardant alternatives tetrabromobisphenol A (TBBPA), 9,10-dihydro-9-oxa-10-phosphaphena-nthrene-10-oxide (DOPO), and Fyrol PMP; reactive flame retardant resins D.E.R 500 Series (TBBPA-based) and Dow XZ-92547 (DOPO-based); as well as additive flame retardant alternatives aluminum diethylphosphinate, aluminum hydroxide, magnesium hydroxide, melamine polyphosphate, and silicon dioxide.	A list of potential alternatives f https://www.cleanproduction.o About Firemaster? 550 Flame F http://chemturaflameretardants. EPA: Flame retardants in printe https://www.epa.gov/sites/defau 01/documents/pcb_updated_dra

Uganda	PFOS in Textile industry	PFOS in textiles as water repellant coatings in military uniforms	Fluorinated free alternative coatings	Invistas's brand Antron? introduced advanced DuraTech, made with a PFOS-free topical soil resistance formula. Tandus Centiva's products use Eco-Ensure - a highly specialized, fluorine-free soil protection technology developed by Tarkett that protects textile materials from stains. NEOSEED series from Nicca Chemical Co. are PFC-free, silicon-based water repellent agents. The CHT company offers Ecoperl 4 - fluorine-free hydrophobic agents for finishing various fabrics. It provides very good water repellency, breathability and wash efficiency.	Antron? Fiber: https://www.antron.net/fiber Eco-Ensure, Tarkett: https://www.c2ccertified.org/pr NEOSEED series: https://nctexchem.com/product/ Ecoperl 4: https://www.cht.com/cht/web.n-TUEB-AM7GYU-EN
			Alternative textile material	The company Universal Fibers? uses sulfonated nylon copolymer and amide functional waxes as an alternative polymer fiber. Thrive? line of products offer high-performance polymer fibers that are durable, stain and fade resistant, offering clear colors.	More than Fiber: https://www.universalfibers.co

Ukraine	HBCDD in Textile industry	HBCDD in textiles	Alternatives to protective clothing, carpets, upholstered fabrics, interiors of public transportation	The textiles with the back-coating containing HBCDD can be used for e.g. flat and pile upholstered furniture (residential and commercial furniture), upholstery seating in transportation, draperies, and wall coverings, bed mattress ticking, interior textiles e.g. roller blinds, automobile interior textiles and car cushions. Flame retardant use in textiles can be avoided if the material itself is non-flammable or has low flammability. Some natural materials such as wool may therefore be used as barrier materials in furniture 1. Other inherently flame retardant materials include rayon with a phosphorus additive, polyester fibers, and aramids 2.. Commercial alternative includes ammonium polyphosphate ? CAS RN 68333-79-9. While better than HBCD, there is limited data on bioaccumulation. Finally Grunlan et al. developed successful flame retardant (FR) coating systems for polyester-cotton blend,3b a 3 mm thick polystyrene plate,3aand polyurethane foam.3c One of the advantages of using LbL FR coatings on all thermoplastic-based materials is the prevention of melt	1. UNEP, 2011. Draft risk mana hexabromocyclododecane. UNI 2. Weil E.D., Levchik, S.V.. 20 Practical Applications. Hanser I 297 p ammonium polyphosphat polyphosphate[1]68333-79-9 3. (a) Guin, T.; Krecker, M.; M C. Exceptional Flame Resistanc Nanobrick Wall Thin Films. Ac 1500214; (b) Leistner, M.; Abu Water-based chitosan/melamine extinguishes fire on polyester-c 32; (c) Holder, K. M.; Cain, A. P. K.; Morgan, A. B.; Grunlan, Prevent Flame Spread on Flexil Materials and Engineering 2016 4. (a) Haile, M.; Fincher, C.; Fo polyelectrolyte complexes that as pH-cured nanocoating. Polyr (b) Leistner, M.; Haile, M.; Rol soluble polyelectrolyte complex fabric. Polymer Degradation an

153. The following activities will be executed under this output:

? Review (and strengthening) of national legislation and environmental quality standards in relation to the targeted sector (production, use, import, and export) and GC, including monitoring at customs; the review will assess gendered impacts of these documents on women and men;

? Draft a national GC plan and/or strategy and/or guidelines, including lessons learned from the demonstration projects, to operationalize the existing national chemical management regulations towards the achievement of the International Chemicals Conventions, the document will be gender mainstreamed;

? Detailed elaboration of targeted sectors and verification of pilot company; this assessment will include the GEBs, the gender and socio-economic impacts of gender-mainstreaming in the relevant sectors;

? Training of targeted stakeholders, including government, pilot companies research, on the targeted sectors, on hazardous chemicals and GC alternatives;

? Selection and verification of GC alternatives, including samples (if necessary), technical feasibility reports (if necessary for the pilot), cost-benefit analysis, GC evaluation for the GC case, and evaluation

? Execution of GC demonstration pilot, including core indicator monitoring;

? Outline GC approaches along the targeted sectors (not only the above pilot case);

? Awareness-raising of national, potential regional stakeholders about green chemistry alternatives to POPs, mercury and microplastics;

? Compile lessons learned and GC best practices for the substitution of hazardous chemicals to educate stakeholders in the same sectors on the switch to GC alternatives, including knowledge and awareness-raising materials.

Output 3.2. Replication mechanisms of green chemistry alternatives for national, regional, and global level up-take developed and implemented.

154. This output aims to replicate the GC alternatives for the targeted sectors at the national, regional and global level to achieve a broad GC application, GEB reduction and maximize knowledge management, and awareness-raising under this project.

155. Replication mechanism will include an overarching knowledge management strategy to ensure that lessons learned are disseminated to the national, regional and global level, a national strategy to achieve national replication at the targeted sector (e.g. awareness-raising, training, support with the identification of financial opportunities and elaboration of funding proposals), a regional and strategy (e.g. dissemination of lessons learned from all pilots).

156. Knowledge, experience and lessons learned from the implemented GC alternative demonstrations will be summarized and shared on the knowledge management platform, initially known as the ?Green Chemistry Technology Compendium?. This will serve as the centralized repository for case studies and templates which can be easily adopted and transferred to other regions.

157. Successful demonstration projects will also be well documented and advertised through the global network by presenting their success to commercial partners. In this context, replicable and templatized implementation procedures from the demonstration projects including narratives

and technical specifications for GC alternative adoptions will be developed along the execution phase: preparation, execution and monitoring.

158. Financial mechanism using existing loan facilities funding green procurement of safer chemicals solutions will be analyzed, followed by matchmaking needs and support for preparation of funding proposals to ensure a high replication potential. Financial mechanisms envisioned are diverse but could include bank loans, joint venture with foreign investors, foreign direct investment and domestic investment.

159. The following activities will be executed under this output:

? Compilation of knowledge management documents on the ?Green Chemistry Technology Compendium? with Yale been the overall facilitator and the six participating countries acting as technical expert source. Knowledge management documents will include lessons learned on gender mainstreaming in the project activities and success stories of female participants.

? Workshops and trainings at the national, regional and global level to ensure dissemination of lessons learned and GC practices;

? Analysize existing financial schemes to identify possible loan facilities that could be used for deployment of green chemistry technologies

? Monitoring and replication of the pilot in at least 1-2 company per sector.

4) Alignment with GEF focal area

160. The project is consistent with the GEF-7 strategy on Chemicals and Waste Program 1: Industrial Chemicals program, which aims at *?Strengthening the sound management of Industrial Chemicals and their waste through better control, and reduction and/or elimination?*. This Green Chem project address the key points of the GEF-7 Chemical&Waste program ? A) Elimination of Chemicals that are used in processes and products - This project aims to apply GC alternatives for Chemical&Waste-related sectors in compliance with the Stockholm and Minamata Conventions. The following *?Chemicals used/emitted from/in processes and products?* will be addressed:

? Introduction and use of best available techniques and best environmental practices to minimize and ultimately eliminate releases of unintentionally produced POPs and mercury from major source categories included in both the Stockholm and Minamata Conventions; here through using GC alternatives; and,

? Elimination of the use of mercury and persistent organic pollutants in products (including brominated flame retardants, PFOS and short chained paraffins) by phasing our manufacturing of the pure chemicals and introduction of alternatives in the products with a preference to non-toxic chemicals.

161. The project will also address the *?Implementation of improved material management approaches, which depend on close private-public partnership and multiple mechanisms, including green chemistry?.*

162. The GEF Industrial Chemical program also funds enabling environment and strengthening of national legislation and regulatory capacity for meeting Stockholm Convention obligations, with regard to persistent organic pollutants. This will include the removal of market access barriers for alternatives for products containing GEF relevant chemicals, and which can reduce the production of harmful chemicals.

163. This project is fully aligned with the GEF-7 principles of cost-effectiveness; sustainability; innovation; private sector engagement; promotion of GC; and building on the use of existing networks. The selected demonstration sectors will be an entry point to address the reduction of hazardous chemicals from the production and manufacturing side, rather than from an end-of-life approach, which provides a sustainable and long-lasting approach towards broad

adoption of Green Chemistry through commercially available green chemistry alternatives. Thus, reducting the risk of hazardous exposure of chemicals to human and environmental health.

5) incremental/additional cost reasoning and expected contributions from the baseline, the GEFTF, and co-financing

TABLE 3: INCREMENTAL REASONING PER COMPONENT

Baseline	**Co-financing**	**Alternative Scenario**	**GEF Grant (USD)**
Component 1: Green Chemistry Innovation and Inclusion Network for Capacity Building			

Green Chemistry focuses on the chemical properties to ensure the chemicals are benign and beneficial throughout their lifecycle. Green chemistry?s purpose is not simply to reduce pollution at the source, but also to ensure that the broad spectrum of sustainability concerns are built into the design framework through innovation and invention. Because of this goal, green chemistry has been applied in nearly all industry sectors and has touched education, environment, and the general public. Green chemistry has been growing for the past 30 years. The global market for green chemistry was projected to grow from US$ 11 billion in 2015 to nearly US$ 100 billion by 2020, representing a CAGR of 55.5%.[1] A more recent analysis anticipates the green chemicals market is expected to reach $167.1 Billion by 2027. Some of the earliest programs in green chemistry were in highly industrialized countries in North America, Europe, and Japan. Green chemistry developed throughout industry sectors (pharmaceutical, manufacture, and formulator sectors), and education, especially higher-ed. Green chemistry has also dominated academic research and led to establishment of several high profile green chemistry conferences. The growth of green chemistry in emerging economies has been more modest. A number of industries in Latin America, Africa and Asia are focusing on energy and water reduction through resource efficiency. In the absence of the GEF project, all green chemistry efforts around the world will be decentralized and	The co-financing for component 1 of the project is US$ 7,985,940 The co-financing will mainly be received from Chem Forward, Beyond benign-green chemistry education, Chemical Angel Network, LLC, Gsk GalxoSmithKline, Federal University of Sao Carlos, Brazil, Green Chemistree Foundation, Newreka, McGill, Department of Chemistry, Montreal, Canada, Addis Ababa University, Ethiopia, University of Massachusetts, Bosten, U.S.A., Chemical Society of Thailand under the Patronage of Her Royal Highness Princess Chulabhorn Mahidol, Continuing Education Programs, Seattle, U.S.A., The University of Auckland, New Zealand; Hohenstein; The George Washington University, Air Company; Max Planck Institute; Green Sciences for Sustainable Development Foundation; Raise Green	This component develops a robust and gender-sensitive Global Green Chemistry Innovation and Inclusion Network that connects networks and individuals such as scientists, entrepreneurs, and representatives from government, industry, academia, and non-government organizations. The Network creates a green chemistry ecosystem that fosters communication, information exchange, awareness and training (online and in-person) to take an active role in safer chemical substitution to reduce hazardous chemicals including POPs and mercury.	US$ 1,400,000

Component 2: Green Chemistry Accelerator Programme			
SMEs are the drivers of innovation in both emerging and developed economies. SMEs are the cornerstone to a country?s sustained and steady economic growth, and are the main source of job creation globally, accounting for over 95% of firms and 60-70% employment. Since they are smaller, less bureaucratic, and more agile than big companies, SMEs have potential to drive the transformational change that addresses some of the biggest global challenges like POPs, resource depletion, or pollution by actively developing and adopting green chemistry and engineering approaches. There are couple of programs and initiatives that support SMEs in six participating countries, but none of them are chemistry and sustainability oriented or offer long term and sustainable funding. In the absence of the GEF project, products and processes containing hazardous chemicals will be still in use. There will not be an ecosystem that encourages innovative, safer green chemistry solutions to problems related to POPs, Mercury and Microplastics. Lack of early-stage investment will prohibit new invention to enter the market and the academic-industry collaborations will still be at their infancy.	The co-financing for component 2 of the project is US$ 40,000,000 The co-financing will mainly be received from Lowell Center for Sustainable Production, On Demand Pharmaceuticals Chem Forward; Green Chemistry and Commerce Council; Noya; Millipore Sigma; Hohenstein, The George Washington University; Max Planch Institute; P2 Science, U.S.A.	Component 2 identifies promising green chemistry technologies, innovators, and entrepreneurs, and develops six multi-year startup accelerator programmes providing business and green chemistry training to nurture regional ecosystems in the emerging nations. Component 2 runs three (3) innovation challenges that engage industry (large corporations or SMEs) partners to solicit solutions using green chemistry approaches to an identified industrial problem, including elimination of hazardous materials like Mercury and POPs.	4,700,000 USD
Component 3: Green Chemistry alternatives for POPs, mercury and micro-plastics for upscale and replication			

Releases of POPs may occur during are their use in different application to be targeted under this project. The PPG phase showed that there are no specific regulation and standards for POPs identification, including missing information from private sector about the use of POPs, which makes the inventory difficult. There are also weak legislativie and regulatory frameworks, technical guidances, knowledge and incentives to apply GC solutions for the identified POPs. Although GC solutions are readily available, there has been very limited practical demonstrations in the participating countries. Without the project there will be no GC demonstrations in partnership with the relevant Governments, executing entities and private sector.	The co-financing for component 1 of the project is US$ 44,867,489.74 The co-financing will be received from Ministry of Environmental Protection, Serbia,National Environment Management Authority (NEMA), Uganda, Ministry of Environmental Protection and Natural Resources of Ukraine, Ministry of Environment (MINAM), Peru, Ministry of Environment (MoE), Jordan, Ministry of Transport (MoT), Jordan, Ministry of Industry, Trade and Supply (MIT), Jordan, Badan Pengkajian dan Penerapan Teknologi, Indonesia, E-Reciklaza (Serbia), EIDCO, Engineering Industries&Design Co, Jordan, pT Inkote Indonesia, Institute for General and Physical Chemistry, Belgrade (IGPC), Serbia, Innovation Fund of Serbia, Royal Scientifiy Society (RSS), Jordan, Jordan Customs, National Cleanar Production Centre (NCPC)s of Serbia, Ukraine, Uganda, Peru, Jordan, Innovation Holding ?Sikorsky	This project component implements GC demonstration projects to reduce the use and release of POPs in selected sectors. Sectors in the countries have been carefully chosen during PPG to ensure commitment, GC applicability and GEB reduction potential. This component will also support the replication of the implemented GC demonstrations through financial replication mechanism and lessons learned from the pilots. Reduction/elimination of POPs: See GEB section Greenhouse gas emissions mitigated: See GEB section Beneficiaries disregarded by gender: See GEB section	5,500,000 USD

6) global environmental benefits (GEFTF)

164. The project will achieve direct and indirect Global Environmental Benefits (GEBs) through all project components. Direct GEBs will be achieved through the GC demonstration projects under Component 3, Output 3.1 and their replication under Output 3.2., mainly targeting Core 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)?* (Table 6).

TABLE 4: GEBS PER COUNTRY AND SECTOR

Country	**Chemicals (*4 years of project implementation)**						
	PFOS/PFAS	PFHxS	SCCP	UV-328	HBCDDD	Deca-BDEs	POPs-containing material
Indonesia	34,4 kg						800,000 tons-of PFOs/PFAs containing materials
Jordan					4 tons		720 tons of HBCDDD-containing raw materials (EPS beads) 720 tons of HBCDDD-containing product (EPS foam)
Peru			88 tons	To be assessed during project			To be assessed during PPG
Serbia						61,2 tons	61,2 t POP-BDE containing materials
Uganda		5,28 t					751,108 tons of finished fabric-containing PFHxS

Ukraine					6 tons		60 tons of POPs/HBCDDD containing materials
Total	34,4 kg	5,28 tons	88 tons		10 tons	61,2 tons	1,552,699.2 tons of POPs-containing material
Replication factor of X during and after project implementation	Indonesia: 17,2 kg (Factor 2)	Uganda: 5,28 t (Factor 1)	To be assessed during project	To be assessed during project	Jordan 6 tons	Serbia: 15,3 t/y (Factor 1)	Indonesia: 800,000 t/y of PFOS/PFAS containing materials (Factor 2) Jordan: 1200 tons of HBCDDD-containing raw materials (EPS beads) and 1200 tons of HBCDDD containing product (EPS foam) = 2400 tons Serbia:1530 t/y of deca-BDE containing materials (Factor 1) Uganda:751,108 tons/y of PFHxS-containing materials
TOTAL (Output 3.1 and output 3.2)	60,2 kg	10,56 t	N/A	N/A	6 tons	76,5 t	1555038 tons of POPs-containing material

Total Output 1 and 2	94,6 kg	15,84	88 tons		12 tons	91,8 tons	3,107,737.2 tons of POPs-containing material

165. Indonesia:

? The NIP update (2015) listed the paper and packaging sector as priority sector to reduce PFOS and PFOS-containing products. Chemical names for PFOS in the paper and packaging sector are mono-, di- or triphosphate esters of N-ethyl perfluorooctane sulfonamidoethanol (EtFOSE) 2. N-Methyl perfluorooctane sulfonamidoethanol acrylate polymers known under the trade names of (UNEP 2010) 3M Scotchban?, Bayer Baysize S?, Ciba (BASF) Lodyne?, Clariant Cartafluor? and DuPont Zonyl?. PFOS is used to impart grease, oil and water resistance to paper, paperboard and packaging substrates, or a glossy finish.

? The potential amount of PFAS is estimated based on statistical data from pulp and paper is 1751 tonnes in total (Anonymous, 2019). The PFAS produced per year from pulp and paper manufacturing processes is estimated to be 161 kg for an average of 8 million metric tons of production (2019). The project will tackle 5%, thus 8,6 kg per year leading to 34,4 kg for 4 years of project implementation. This is equal to 400,000 metric tons/year of PFOS-containing material leading to 1,600,000 metric tons over 4 years of project implementation, however, due to the huge amount and uncertainties only 50% equalling to 800,000 metric tons-of POPs-containing amount was used for the GEF table. A replication of 2 under output 3.2., which is equal to 17,2 kg/2 companies/year and 800,000 metric tons/year.

? Additional GEBs (not listed in main list): Potential POPs in the pulp and paper industry are PCDD (polychlorinated dibenzodioxins) / PCDF (polychlorinated dibenzofurans) and PFOS (Per-Fluorooctane Sulfonic acid). According to NIP on Elimination and Reduction of Persistent Organic Pollutants in Indonesia (2008), the emission of PCDD/PCDF in pulp industries is as much as 838 g TEQ (Anonymous, 2008) at 8-million-ton production. Using a growth of 2% for the pulp and paper industry, and thus a capacity of the 11 million tonnes, the pulp sector will generate PCDD/PCDF as much as 1152 g TEQ in 2021. The project will tackle 5%, thus 57,6 gTEQ per year leading to 230 gTEQ for 4 years of project implementation, and a replication of 2 companies under output 3.2., which is equal to 114,4 gTEQ/2 companies/year.

166. Jordan: The production unit is in sqm (which is the unit of production for most construction applications) and there is no quantification/record of weight or cubic meter of production, which does not allow us to calculate per kg or ton. For our application, we considered the total chemicals used as the equivalent weight of production (Ideal mass balance), as no by-products are generated rather only pure foam.

167. In Jordan, one company on average produces 250 Tons/Year, while the largest company, namely EIDCO-Engineering Industries & Design Co. Ltd, produces around 600Tons/year of EPS FR Foam. EIDCO was established in Jordan, Marka Industrial Area in the year 1996, attributed as the inheritor of three Industrial generations and since then was the main reference for insulation solutions in the construction sector. In reference to its major EPS production lines, EIDCO has the largest production capacity for EPS Flame Retardant Foam ranging from

600-1000 Tons of annual production. EIDCO plant consists of 7 shape molding machine and 2 block molding machine. As aforementioned, due the pandemic and other market implications the company average production is stable at 600-800Tons for the past 3 years but has the potential and reaches the capacity of 1000+ Tons annually. EIDCO has provided grant co-financing to this project

168. Considering at least 600 tons/year of EPS FR foam and 0.5% HBCDDD content and 30% reduction around 1ton/ear will be released to the environment meaning 4 tons in 4 years. Equivialant to production the POPs -HBCDDD containing material (EPS Beads) of 600tons per year will reduce by 30% equivilant to 180tons/year replaced. So in 720tons will be reduced in 4 years. Same amounts apply for HBCDDD containing Products (EPS Foam) equal to 720 Tons; so total (Raw + product) = 1440 Tons.

169. For the replication factor the following calculation based on 5 existing companies in Jordan is used:

- ? Replication Factor of 4 out of 5 EPS companies and an average of 250Tons/yr Production per company ; 0.5% (HBCDDD content)*250tons/yr*30%(Reduction) =0.375tons/yr
- ? Total HBCDDD reduced per company= 0.375Tons/yr*4 years =1.5 tons

- ? Hence:
- ? 30% reduction of Total HBCDDD reduced after replication= 1.5tons*4companies= 6 tons;
- ? 30% reduction of Total HBCDDD containing material (EPS Beads) equivalent to 75 tons per year; 300 tons in 4 years; 300Tons * 4 companies= 1200tons;
- ? 30% reduction of Total HBCDDD containing product (EPS Foam) equivilant to 75 Tons per year; 300 tons in 4 years; 300Tons * 4 companies= 1200 tons;
- ? 10% CO2 emission reduction after replication equivalent to 0.154 tons * 4 companies= 0.616 tons.

170. GHG emissions, mainly CO2 is estimated based on the electricity use of one of the EPS polystyrene companies as follows: CO2 released in 2020 = Energy consumed * CO2 factor = 841.69KWH * 0.4585kg/KWH= 385.91 Kg of CO2= 0.386 tons of CO2 per yr. Equivalent to 1.544 Tons of CO2 released in 4 years. Assuming 10% reduction 0.154Tons reduction in 4years.

171. Peru: In Peru, the plastics sector and its manufactures have been becoming a good option for the Peruvian consumer. The purchase of materials and inputs to produce different kinds of plastics has led to a skyrocket in demand for manufactured goods from other sectors. Among the sectors that demand it are the automotive industry, construction and building, medicine, electrical and electronics, food, and agriculture, among other sectors. It should be remembered that Peru is a net importer of plastic in its primary forms, 99% of the inputs are of foreign origin, according to figures from the Plastics Committee of the National Society of Industrialists (SNI). Among the types of raw materials demanded by this market are polypropylene (PP), polyvinyl chloride (PVC), polystyrene (PS), polyethylene terephthalate (PET) and others such as epoxy and allide resins.

172. In 2013 and 2014, the plastics industry grew 17.3% and 7.9% respectively, influenced by an increase in demand for PVC pipes and fittings and the greater dynamism of other

industries such as those that manufacture soft drinks (bottled water, soft drinks, rehydrating beverages) which required a greater number of containers and labels.

173. It can be indicated that for every 15 TM of PVC scrap, an average of 1 TM SCCPs are emitted per year. Likewise, it stops emitting 3.1 TM of CO2eq for each MT of PVC produced on average. For the PVC industry around 2.6 tones/year of Short-chain chlorinated paraffins (SCCPs) will be avoied after the reuse of 38TM/year of scrap of PVC to transform to wood plastics composite (WPC) as a Green Chemistry alternative. About 22tones/year of SCCPs, thus 88 tons for 4 years will be avoied and 322TM/year will convert to WPC

174. Serbia:

- ? The pilot company E-Recikla?a currently handles/recycles 17,000 t of e-waste per annum (which is almost 50% of total nationally), out of which about 1530 t are plastics, potentially containing PBDE, or, as estimated, up to 15.3 t/y of PBDE. These are only estimates, based on studies carried out nationally that plastic goods on the market in Serbia still contain PBDEs. At the moment, no action is being taken to mitigate this, except regulatory work on legislation.
- ? The Project will introduce additional procedures and processes that will eliminate the PBDE problem in e-plastics. Along those lines, E-Recikla?a was selected for pilot, as the major recycling company nationally (about 50% of all e-waste recycled nationally). An additional procedure and facility on the input channel for plastics to separate the PBDE containing material will be established, including additional equipment as help from the Project. The separated material will be redirected to hazardous waste channel or, if suitable, to automotive industry feedstock, or other where exceptions apply, in consultation with the regulators. The Project will organize and carry out regular re-training and assistance in the following years while the methodology is applied. Also, alter and/or amend the procedure according to the experience that builds-up.
- ? The amount of e-waste treated per annum in Serbia is 35,000 t (official figure from 2019, SEPA Environmental Protection Agency). Out of this amount, 17,000 t passes through the recycling at E-Reciklaza company yearly. Plastic materials constitute an average of 30% in this, meaning 10500 t of plastics nationally, of which 5100 t via E-Recikla?a. Given that PBDE content in this type of plastics can be present up to 0.3%, this gives the following figures: elimination at input of up to 15.3 t/y of PBDE in E-Recikla?a plants leading to 61,2 t/4 years of project implementation. The related POPs-containing amount (10% of POPs-containing plastics will be 1530 t/y leading to 6120 t/4 year of project implementation.
- ? Considering a replication factor of 2 under output 3.2, additional 15,3 t/y and 1530 t/y of POPs-containing materials will be reduced.

175. Uganda:

- ? In Uganda, substances containing C6-perfluorinated compounds are commonly used as liquid repellants in textiles to provide protection against liquid hazards. For example, Southern Range Nyanza Limited (SRNL), a textile processing industry, uses about 6tones/yr of a C6-perfluorinated based chemical (Tubiguard 90 ? F) as a water repellant applied in about 187.78tones/yr of fabric. Fine Spinners (U) Ltd also uses imported laminated polypropylene material, which is water resistant, in production of about

120tones of medical gowns. Recent studies have shown that use of substances containing C6-perfluorinated compounds pose an environmental concern due to their association with Perfluorohexanesulphonic acid (PFHxS)[2]. The chemicals containing PFHxS can be emitted into the environment during the chemical manufacturing process, the application of the finish to the garment, the usage of the garment, the re-application of the finish, and the final disposal of the garment.

? At an approximate annual manufacturing growth rate of 7%, use of C6-perfluorinated compounds in Uganda is expected to grow without the intervention of this project. Thus, the environmental and social impacts associated with their use is also expected to increase.

? Southern Range Nyanza Ltd (SRNL) a vertically intergrated textile industry uses about 6tons/yr of Tubiguard 90 ? F, which is a Fluorocarbon compound based on C6 as a water repellant in production of about 187.777tons of fabric. The project will reduce about 1.32 tonnes/yr of Perfluorohexanesulphonic acid (PFHxS) eliminated after substituting the use of 6tones/yr of Tubiguard 90 ? F with a Green Chemistry alternative (Ecoperl 4 which is based on special functionalized polymers/waxes) 5,28 tonnes for 4 years of project implementation. This relates to 187.777tons/yr of finished fabric-containing PFHxS avoided and avoidance of 751,108 tons of finished fabric-containing PFHxS over 4 years of project implementation.

176. Ukraine:

177. POPs in textile industry are used to produce water-resistant and fire-protecting fabrics. Among fire-protecting substances, the shares of chlorine- and bromine- containing chemicals in Ukraine are 7% and 24 % correspondingly, part of which (hexabromcyclododecane) belong to POPs. Before 2013 hexabromcyclododecane was permitted to be used in Ukraine so still there is large possibility to find it and other brominated antipyrines at the stocks. The reason for wide application of hexabromcyclododecane is that it has low acute and chronic toxicity to human health, but it was banned due to its strong resistance to degradability in the environment and ability to bioaccumulation in trophic chains.

178. Fabric production in Ukraine has long history and accounts for 2300 companies. According to the state statistics, Ukrainian textile industry in 2019 manufactured ca. 90 mln. m2 of different fabrics, so the possibilities for project results replication are large. Part of these products are heavy fabrics for tents, special working and protecting cloths etc. which must be impregnated by water repelling chemicals and flame retardants. Part of these chemicals belong to persistent organic pollutants that are in the focus of Greenchem project.

179. Textile chemicals are usually applied in rather large concentrations (100-200 g/l), a significant part of them ends up in waste water and some amount becomes an important component of the final textile goods. In textile industry in Ukraine water consumption constitutes 200-300 dm3/kg of fabric. Waste water of textile industry companies is multicomponent, the removal of many chemicals is a challenging task, so the presence of halogenated antipyrenes is undesirable for the efficient functioning of waste water treatment facilities due to their high stability against chemical and biological destruction/degradation processes.

180. Textile industry employs ca. 80 thousand workers, 90 % of which are women. The successful project will have significant social effect and gender impact. The reduction of content

of brominated antipyrenes in textile industry contributes to the reduction of exposure to these chemicals via skin and by inhaling during the working shifts. The toxicological properties of brominated antipyrenes are studies not sufficiently. They are suspected to have endocrine-disrupting, cardiotoxic, cancerogenic and teratogenic effect. Thus, taking into consideration Stockholm convention ratified by Ukraine in 2007 and applying precautionary principle, brominated POPs must be phased out from the textile production.

181. Ukrainian textile industry to a large extent (by 40%) is export-oriented that could be an incentive to go for environmentally friendly solutions and implements greenchem alternatives.

182. Global Environmental Benefits are calculated for an average-size textile plant in Ukraine. An average textile production plant annually manufactures approx. 1000 thousand m2 of fabrics, one quarter of which is treated by antipyrenes. Assuming that 12% of this annual product is treated by brominated substances, and average required content of an antipyrene on a fabric is 10% by weight with variation from 2 to 15% (fabric density 500 g/m2), annual consumption of brominated antripyrenes (predominantly hexabromocyclododecane) may constitute up to 1500 kg per average textile plant. Assuming the substitution of it by more environmentally safer alternatives, annual avoided consumption of hexabromocyclododecane will be 1500 kg leading to 6000 kg over 4 years of project implementation. The related quantity of POPs-containing fabric directly avoided is 30 000 m2/year, so for 4 years of project implementation, it will be 120 000 m2/4 years. If convert to kilograms, it is 60 000 kg/4 years of POPs-containing fabrics.

183. Average textile production plant accounts arrox. 200 workers, 80% of which ? 160 ? are women. They will get direct benefits from the reduced consumption of hexabromocyclododecane.

184. The most of women in the textile sector are employed at clothes factories and they will also get benefits from the elimination of brominated antripyrenes application due to the reduced air emissions of them with textile dust.

185. Indirect GEBs will also be achieved through the execution of Component 1and 2, as outlined below:

186. Core Indicator 6 (GHG):Green chemistry technologies can contribute to reduced GHG emissions. The programme will support introduction and scaleup of green chemistry innovations into market and achieving GHG emission reductions.

187. The emission reduction calculation will be based on the Global Cleantech Innovation Programme (GCIP) methodology estimation, which was specifically developed and applied for GCIP project. The GCIP assumes that each enterprise that is admitted to the program and undergoes the training will contribute to GHG reduction between 1,800 to 3,600 tCO2e by 2032 (10-year horizon), and 9,000-18,000 tCO2e by 2027 (5-year horizon) respectively. The range has been developed based on data collected from the GCIP Alumni and the previous GCIP programme. Providing the range provides flexibility to those companies with a lower CO2 reduction potential, but contributing to other GEB benefits like POPs microplastics and mercury removal. The table below shows contributions from each country, and the total estimated GHG removal potential.

Country	Companies accepted into accelerator programme	Companies remaining on the market assuming 50% failure rate	Minimum indirect GHG emissions reduced (5 year horizon) [tCO2e]	Maximum indirect GHG emissions reduced (5 year horizon) [tCO2e]
Indonesia	30	15	13,500	27,000
Jordan	30	15	13,500	27,000
Peru	30	15	13,500	27,000
Serbia	30	15	13,500	27,000
Ukraine	30	15	13,500	27,000
Uganda	30	15	13,500	27,000
Total	**180**	**90**	**81,000**	**162,000**

188. During the accelerator, further training will be provided as part of the curriculum regarding estimating GEBs of green chemistry solutions, and how to monitor and capture actual impact versus estimates.

189. Similar resources will be provided to the Network (Component 1) where network participants will be encouraged to calculate their own GHG emissions and seek opportunities for reductions.

190. Core Indicator 9 (Chemical and Waste): Component 2 of the programme will contribute to the direct POPs, mercury and microplastics reductions through the green chemistry accelerator programme. Each accelerator round will solicit a category which seeks green chemistry solutions to persistent organic pollutants, mercury or microplastics. When implemented, these technologies will either (i) provide an alternative solution to existing POPs/mercury/microplastics containing product or a process or (ii) use products that are free of POPs, mercury, microplastics therefore avoiding contributions to POP/mercury/microplastics emissions. The assessment of these alternative solutions/technologies will be done at the accelerator application stage. All companies entering the accelerator will be asked to calculate their anticipated contribution to GEBs during application process. The number provided by the applicants will offer additional information which is difficult to obtain otherwise.

191. Given that the green chemistry accelerator programme does not exist, the quantification of GEB benefits for Component 2 at the CEO endorsement stage has a number of assumptions and can only be done by estimation.

? While each accelerator round will have 60 spots available (10 per country), the number of companies applying to accelerator Programme in the POP/mercury/microplastic category is not known.

? The type of POPs targeted by the submitted green chemistry technology for acceleration will not be identified until the application round.

? As seen from Component 3 description, different products contain different % of POPs (0.3% PBDE in plastics, 0.8% of HBCDD in EPS beads, 22% PFHxS in military uniforms, etc.). Direct global environmental benefit calculation will depend on the product, technology and application type.

- ? Companies that apply to the Programme will likely target one of three hazards: (i) alternative solutions will either reduce/eliminate POPs, (ii) offer an alternative to mercury, or (iii) microplastics.
- ? While the accelerator supports small businesses, medium businesses or individual teams can also apply to the program. The size of the company and capacity of the production will not be known until the application round.

192. For CEO endorsement purposes, the following assumptions have been made:

- ? At least one company that applies to the programme per country will offer an alternative solution to POPs, microplastics or mercury. This means that 1 out of 10 companies per accelerator round will target POPs/Mercury/Microplastic. The total number of companies accepted into programme is 18 (1 company x 6 countries x 3 years of accelerator = 18 companies)
- ? Considering the startup failure rate at 50%[3]6 by year 5 from formation, 9 companies will remain on the market (18 companies x 50% = 9 companies)
- ? Small business (3 people per team) will apply into the program with technology targeting either POPs, mercury or microplatics.
- ? It is assumed that the 9 remaining companies will likely double the GEB estimations for Component 3 for each of the targeted POPs.

193. Core Indicator 11 (Beneficiaries): The Global Green Chemistry Innovation and Network Programme will impact a number of people across the world during the project inception phase. It is estimated that the Programme will benefit directly 2965 people though awareness trainings, webinars and networking. This is a conservative estimate and likely to increase as the network continues to grow. Another 2265 people will benefit from accelerator related activities and training, totaling the number of beneficiaries to 5230. The beneficiaries by component and activity are presented below:

Component 1 (Years 1-6)	
Webinars	2200
Train the Facilitator	100
Online networking	345
Conference registration networking/speaking	310
Component 2 (Years 1-6)	
Mentor/judge/expert training	120
Accelerator trainees	540
Business competition/hackathon participants	480
Registrants for National Judging Days	900

Global Green Chemistry Accelerator Competition registrants	225
TOTAL	**5230**

194. The current green chemistry network (people who follow green chemistry news and are subscribed to the green chemistry newsletter, The Nexus through the Green Chemistry Institute) is between 18,000-20,000. The majority of subscribers is US based, but there is also a large international community. The global interest in green chemistry is also reflected by the Yale Green Chemistry website data (greenchemistry.yale.edu) which is visited by 2000 people per month. The top 10 international visitors come from India, Philippines, China, Indonesia, Australia, Germany, United Kingdom and Brazil. The number of beneficiaries calculated for this project only assumes people identified through the stakeholder engagement plan and who expressed interested in the programme. However, based on the above data, the number of beneficiaries may be much higher.

195. The programme also assumes 1330 women and 3900 men (corresponding to 25% and 75% respectively) and is consistent with percent distribution of women in green chemistry in US.

7) innovativeness, sustainability and potential for scaling up.

Innovation

196. GC is defined as ?the design of chemical products and processes that reduce or eliminate the use and generation of hazardous substances? and offers a novel way to think about the production and use of chemicals so that they are inherently safer and more efficient. This philosophy aligns with the concept of sustainability, which has become a prominent goal of many industry sectors around the world. The power of green chemistry comes through the holistic design across all life stage stages of the product, which is intentional and requires novelty, planning, and systematic conception.

197. GC can be applied to developed and emerging nations as it provides an intellectual and technological framework to shift away from hazardous and nonrenewable resources toward safer and/or renewable materials while minimizing material and energy inputs. At the same time, these new technologies are economically competitive and their implementation is affordable. This is why green chemistry offers a lot of potential to entrepreneurs and small and medium businesses which drive innovation in developed and emerging economies.

198. The global GC network through the GGINP is designed to create a global ecosystem that allows green chemists around the world to connect and create an environment that supports GC innovation and entrepreneurship which can have a transformative impact on emerging nations. Currently, the green chemistry networks are dispersed and uncoordinated even though the majority strives to achieve a similar goal: to advance green chemistry through research, innovation, and education. The network under the GGINP program offers a unique opportunity to create network of networks and to unify these efforts under umbrella of innovation and entrepreneurship.

199. At the global level, the network members will benefit from trainings, guidelines, webinars, and other resources that inform about novel green chemistry trends in academic and industry research. At the national level, members will receive multi-day in person training opportunity which will be modelled after a successful the Global Green Chemistry Initiative (GGCI) Train-the-Facilitator workshops. All activities will be available through a novel global green chemistry platform and coordinated by Yale University.

200. The accelerator component through the GGINP will support and catalyze innovation and entrepreneurship in green chemistry where the ecosystem is weak but presents opportunity to thrive and have transformational impact if implemented. To date, a green chemistry accelerator network does not exist, and most of chemistry focused innovations can only apply to technology or cleantech based programs and competitions. These competitions and accelerator programs create an important support network for young entrepreneurs and SMEs, but they are quite general and lack training, expertise, and laboratory space which is relevant for a chemistry-oriented startup. GGINP offers training, lab facility access, and access to the green chemistry network which can (i) advance early stage green chemistry innovations that can be transformed into market ready enterprises and (ii) connect and strengthen relationships between national stakeholders and connect them to the global inclusion network.

201. The innovation of the GGINP accelerator program also comes from its unique design. On a national level the accelerator will support early stage entrepreneurs whose solutions address global environmental issues like persistent organic pollutants and use of mercury. The support will be across innovation value chain, including development and implementation, and will be guided by national experts. On the global level, all accelerators will be connected and coordinated, share best practices, and create ecosystem that strengthens green chemistry innovation at large.

Sustainability

202. Sustainability of the GGINP is an important consideration which needs to build into the overall design of the program so the initiative can self-sustain beyond the funding cycle. All three components of the project are developed to lead to a broader adoption of GC technologies and initiate a strong green chemistry innovation ecosystem on a national and global level.

203. The Inclusion Network will be centered around the web portal, a gateway to GC innovation. The portal will be continuously updated beyond the life of the program by the engaged stakeholders (trainers, mentors, presenters) and accelerator network alumni. The content will also continue to attract practitioners, including academic community seeking additional GC training. Because of its networking potential, the portal will remain a go-to place for green chemistry experts to exchange ideas and investors seeking viable GC technologies to fund. Network will seek corporate sponsorship and grants to fund the project beyond the funding cycle.

204. Sustainability of the program requires a continuation of ecosystem post accelerator, which depends on (i) mainaining a strong and engaged Alumni Network and (ii) securing an alternate funding to support the program beyond the project period.

(i) Maintaining a strong and engaged Alumni Network is embodied by creating a local and digital ?Alumni Network? that ensures invitation to networking events for entrepreneurs and founders in Component 1. Furthermore Alumni will be also invited to participate as a mentor or a judge in the future accelerator cycles. Engagement of Alumni who successfully completed a program can further strengthen the programme; and,

(ii) Securing an alternate funding to support the program beyond the project period will be pursued through a number of avenues. As the project begins, executing agencies will be asked to develop individual sustainability plans according to the provided template. Plans will be country specific and will include information to best position accelerators for exit strategy. Ideas for the long-term accelerator support include, but are not limited to:

a. Partnership with governmental body whose mandate is to support innovation and entrepreneurship;
b. Partnership with National Funds (see Serbia);
c. Development of long-term partnerships with the private sector through sponsorship of national events, and demonstration projects; and,
d. Seeking synergies with other organizations that support innovation, sustainability or GC.

205. Development of long-term partnerships with the private sector will be important in securing sources of funding at national and global levels for accelerator and innovation competitions. This support could provide mentors, co-funders, opportunities to pilot different technologies, as well as partners to scale-up, if the technology is successful. To encourage and institutionalize this corporate support, accelerators will invite companies to co-develop ?Innovation Challenges? about problems in their respective industry. The Innovation Challenges will spark new research and pull green chemistry solution creators to the accelerator. This will create market-driven creation of GC alternatives, will help ensure industrial uptake, and will also create effective impact through demand-driven solution generation

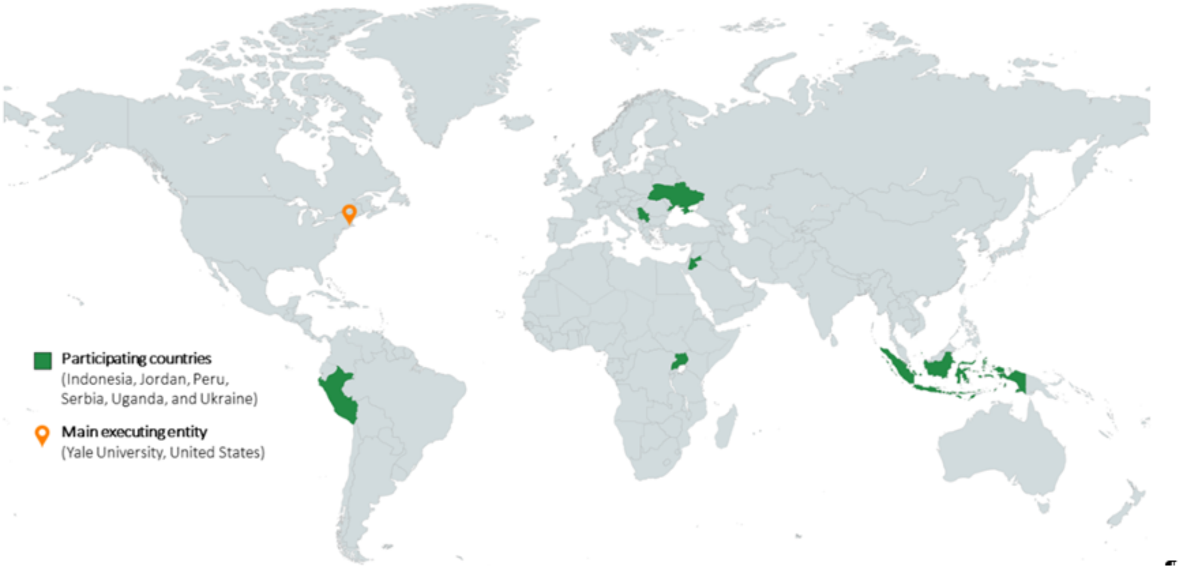
206. During the PPG phase, each national partner identified between 20-50 companies that fits green chemistry innovation profile. Out of that cohort, several companies offer expressed interest to be involved in component 2 of the GGINP.
207. On the global scale, programme will seek support from corporate sponsors to fund the Global GC Accelerator Competition. Program may explore companies with a strong Corporate Social Responsibility (CSR) programs.

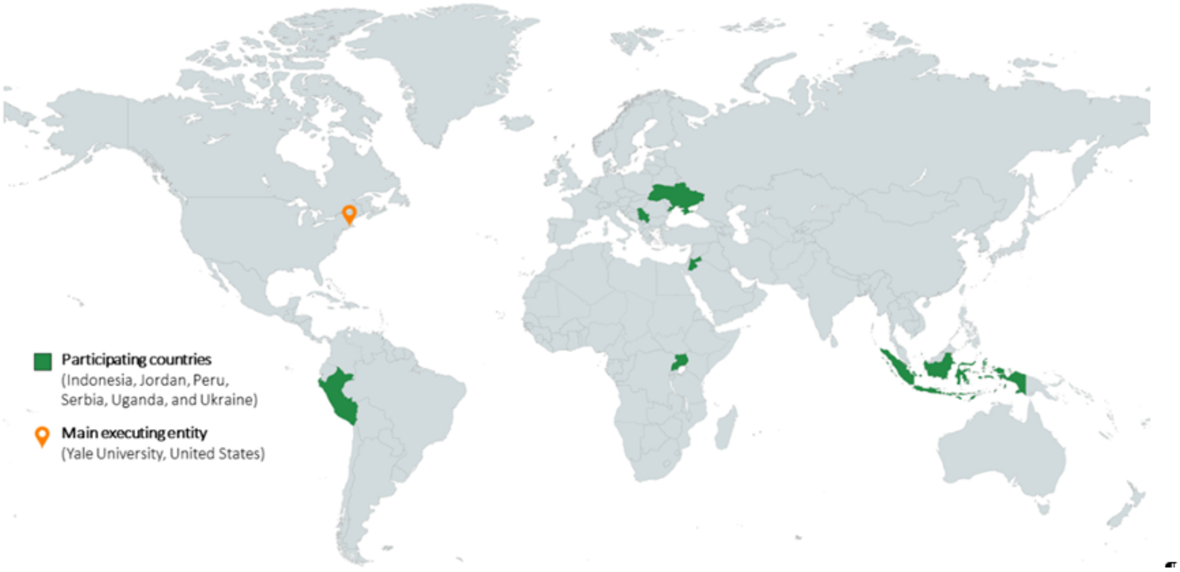
Scaling up
208. Upscaling can be achieved by funding replicable case studies that demonstrate viable GC alternatives to the current chemical production processes that create hazardous exposure pathways. These replicable case studies are designed to be conveyed openly, through a complementary network established in the GGINP, so that they can be rapidly uptaken and scaled in different regions with minimal modifications.

209. The demonstration projects are intended as replicable templates, that can be easily adopted in similar industries in different regions, based on the accelerator work under component 2 and successful GC demonstration projects under component 3. Successful demonstration projects will be presented as case studies to network members who will be invited to adopt the technology, connect with experts who can help to deploy the pilot, and potentially receive financing. Results of the financial availability analysis in the respective regions will connect identified loan facilities as well potential investors interested in financing GC deployment. These identified financial resources and connections will be introduced through the network and serve as support for uptake throughout the region as well as transfer demonstrations to other regions in the programme.

1b. Project Map and Coordinates

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





1c. Child Project?

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

Not applicable

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.

211. As outlined in Annex M, Stakeholder Engagement plans have been prepared for Component 1 and 2, and for each of the six countries under Component 3. While stakeholders for components 1 and 2 will undertake global outreach and greenchem acceleration functions, national a stakeholder from the private sector and industry will play an important role for the execution of project component 3. In summary, the stakeholder engagement plans are based on the following items:

? Stakeholder identification. During the PPG phase, stakeholders who will be directly or indirectly involved in the project were identified through a mapping exercise. Mapping included assessing the role of different stakeholders together with their respective levels of influence and interest in the project. Information collected during mapping was used to draft a stakeholder engagement plan.

? Stakeholder consultation. Based on the stakeholder engagement plan, consultations were held with the identified stakeholders of the project to introduce to them the project, inform them their roles and understand their interests and concerns. Stakeholder engagement process will be an ongoing process throughout the life of the project and will include formal scheduled consultations and meetings.

? Stakeholder engagement plan. Information collected in the stakeholder engagement plan during the PPG phase was used to develop a stakeholder engagement plan, including potential roles and responsibilities, as well as type and frequency of information disclosure.

212. Components 1 and 2, the main discussions with the stakeholders centered around the following discussions, whose detailed stakeholder table can be found in Annex M:

? Gathering data on green chemistry status, including existing relevant activities in Serbia, Indonesia, Peru, Jordan, Ukraine, and Uganda.

? Identification of gaps in the research, public awareness, alternative technologies that relate to green chemistry and POPs removal in six selected countries as compared to EU and USA.

? Identification of gaps and opportunities in green entrepreneurship, venture capital, investment and funding status of startups. Understanding access to local and international talent that can accelerate the development of the innovation.

? Identification and mobilizing of relevant stakeholders through informal communication who will fulfill the identified gaps.

? Gathering data on existing accelerators and incubators that can serve as a space for green chemistry accelerator.

? Consultation on curriculum modules that will be most useful to include in the accelerator training.

? Development of designed programs approaches and strategies to carry out capacity building measures which will help create a global interconnected network which would be desirable for the new members.

? Development of the framework for the accelerator set-up which will reflect countries? needs.

? Selection of the relevant pilot project which will target POP reduction and phaseout using a commercial green chemistry technology.

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

213. A summary of stakeholder engagement for the global activities under Component 1 and 2 are described in the following table 7.

TABLE 5: SUMMARY STAKEHOLDER ENGAGEMENT FOR COMPONENT 1 AND 2

Consultation	Purpose	Participants/Contributors	Reporting	Schedule
Collaborate on capacity building	Create a global network of scientists and researchers from academia, industry and non-profits to synchronize research and green chemistry development. Network of networks will aim to identify opportunities and prioritize solutions that reduce the release of POPs, mercury, and microplastics through commercially available technologies. The network should attract new members from emerging nations.	Training Centre for Green Chemistry in Manufacturing at Monash University Asia-Oceania Green and Sustainable Chemistry; University of Auckland Pan-African Chemistry Network Green Chemistry Network Centre (India) Chulalongkorn University; Council of Science and Technology Professionals of Thailand Green Chemistry Centre of Excellence Oregon University McGill University Naya Guilding Green Beyond Benign Raise Green	Existing members: Online platform, e-mails, online announcements, Future members: communication strategy to recruit new members via newsletters, social media, expo booths, green chemistry conference advertising (hosting sessions and giving presentations on the project). Yearly report to all members.	Every 1-2 months, depending on the time of the year. Social media, every 2-3 weeks. Yearly report- once a year.
	Develop an online platform that supports the global network.	Yale University		
Collaborate on awareness-raising and outreach sessions (online)	Provide content for the online awareness-raising events, webinars invited talk series to educate and	Aachen University, Germany Green Chemistry Centre of Excellence GreenCentre Beyond Benign	Online presentations, agendas, training materials, webinars, online announcements, online surveys	Every 6 months

	strengthen the newly formed network.	Naya AirCO Lovoloop P2Science Oregon University Warner Babcock Institute Guilding Green McGill University BOTTLE Consortium		
	Communicate and follow up with participants to obtain feedback and strengthen the engagement.	Yale University		
Empower through training (in person, online), expert workshop conferences	Participate and provide in-person training in green chemistry using the Train-the-Trainer model so green chemistry can be catalytically disseminated.	The George Washington University The Bridgewater State University Warner Babcock Institute GreenCentre Beyond Benign AirCO	In-person presentations, seminars, meeting minutes, agendas, participant lists, training packs, toolkits, learning materials and case studies, workshop-style content	Year 2-3
	Recruit participants on the country level	NCPCs		
Component 2				
Accelerator set-up	Further, develop and refine curriculum for the accelerator which was collected in the PPG phase	Yale University	Emails, in-person meetings	Weekly check-ins

	Assist in setting up accelerator network, create Accelerator Guidebook	Raise Green	Emails, zoom calls, in-person meetings	Weekly check-ins
	Select regional administrators, judges, mentors for the accelerator program.	as per NCPCs recommendation		Year 1: monthly check-in, Years 2-6 every year before accelerator program starts
	Companies to co-develop innovation challenges to secure a corporate support to drive innovation and ensure industry uptake.			Year 1-6, every two years, before Innovation Challenge
	Identify Local investors			
Mentorship and technical expertise consultation	Provide mentorship and technical knowledge to startups that are funneled into the network and accelerator program.	Aachen University, Germany, Finding XY, Chemical Angels Network, Millipore Sigma, Boehringer-Ingelheim, TCG GreenChem	1 on 1 online consultation	During the duration of the accelerator, every 2-3 weeks

214. During PPG phase, over 70 green chemistry networks were identified around the world. Many of these institutions have very strong green chemistry research, while the others are engaged in education and outreach. When combined under the Green Chemistry Inclusion Network they offer a robust and diverse green chemistry ecosystem that can support green chemistry innovation. The list of networks and their strengths are included in the Stakeholder Identification and Engagement Plan. The list of stakeholders will continue to grow, as more networks, centers and individual participants will join the Inclusion Network to benefit from the benefits outlined below. Ultimately the Inclusion Network is intended to create an ecosystem that will foster open collaboration through technology transfer and robust entrepreneurial activity.

215. Component 1: Green Chemistry Innovation and Inclusion Network for Capacity Building, stakeholders will help to unify the global green chemistry community, both academic and industrial, and assist with capacity building for new members of the green chemistry community in emerging nations. Other activities will include:

? Communication and outreach

? Maintaining current network and connecting networks to expand global reach

? Preparing and submitting webinars/research/learnings/publications to be shared across the network.

? Organizing conference/session to share sharing case studies/learnings

216. Component 2: Stakeholders will support Component 2: Green Chemistry Accelerator Programme through developing a local ecosystem that supports innovation and entrepreneurship. The activities will include:

? Identification and convening green chemistry leaders that can help with commercialization of GC technology

? Supporting the green chemistry accelerator program as mentor, judge, share technology needs

? Helping to bridge academia and industry.

? Considering the accelerator program as a source for identifying new technologies

217. For component 3, national stakeholders, including government, industry organization and private sector, academies, and public organizations, were held for the six participating, mainly on the following points:

? Identification of relevant stakeholders and planning their engagement during PPG and project implementation;

? Verification and completion of the national baseline related to Component 3;

? Gathering of information from relevant stakeholders related to POPs and Hg sectors, identify and select a company for the projects pilot phase;

? Gathering from information about an Environmental and Social Management Plan (ESMP), Global Environmental Benefits, Gender, and socio-economic benefits;

? Obtaining national co-financing letters.

218. Detailed stakeholder table per country can be found in Annex L.

Select what role civil society will play in the project:

Consulted only; Yes

Member of Advisory Body; Contractor; No

Co-financier; No

Member of project steering committee or equivalent decision-making body; No

Executor or co-executor; No

Other (Please explain)

Civil society will be engaged through the awareness-raising and knowledge management activities throughout the components.

3. Gender Equality and Women's Empowerment

Provide the gender analysis or equivalent socio-economic assesment.

219. UNIDO is at the forefront regarding gender mainstreaming in environmental management activities. The organization uses a systematic guid to promote gender equality and women?s economic empowerment when designing and implementing projects. The Global Greenchem Innovation and Network Programme will therefore benefit from lessons learnt and best practices of gender inclusivity demonstrated in currently operational and operationally closed projects executed by UNIDO. The field offices and previous UNIDO Environment projects in the targeted countries will share relevant local context knowledge with the project specifically related to the development and support of gender responsive policies, programs and capacity development.

220. Accessible as an Annex Q to this project document contain findings of full gender assessment studies which have been conducted in the respective countries as part of the project preparatory stage. In all reports, gender have been considered from the local context as well as utilizing provisional guidance on gender mainstreaming as stipulated in the GEF?s, UNIDO?s and national legislations on gender in respective countries. A snapshot of the gendered employment structure and gender parity in access to resources (public life and decision making, education, finance and ICT, and business and law) of six participating countries is available in the below table.

TABLE 6: NATIONAL DATA ON GENDER GAPS IN EMPLOYMENT, DECISION MAKING, EDUCATION, FINANCE AND ICT, AND BUSINESS AND LAW

Indicator (Data as of 2019, unless otherwise noted)	Global	Indonesia	Jordan	Peru	Serbia	Uganda	Ukraine
Gendered employment structure in industry sector[3] [4]							
Industry, value added (% of GDP)	24.7	39	24.5	30.6	25.6	26.3	22.6
Female population (% of total population)	49.5	49.7	49.4	50.3	51	50.7	53.7
Female labor force participation rate (% of female population ages 15+)	47.3	54.0	13.4	70.0	47.1	41.4 (as of 2017)	49.2

Male labor force participation rate (% of male population ages 15+)	74.3	82.4	61.2	84.8	62.7	56.1 (as of 2017)	64.8
Female employment in industry (% of female employment)	15	17	13	8	19	3	14
Male employment in industry (% of male employment)	27	26	27	21	34	10	35
Female employment in subsector (% of female employment) Indonesia: Pulp and paper industry (ISIC Paper and paper products); Jordan: XPS foam; Peru: PVC related sector (ISIC Chemicals and chemical products); Serbia: Electronics (ISIC Fabricated metal products); Uganda and Ukraine: Textiles (ISIC Textiles)		23% (as of 2013)	20% (as of 2016)	22% (as of 2017)	17.7% (as of 2017)	70% (as of 2017)[5]	75% (as of 2020)[6]

Gender Development Index (Group 1 = closest to gender parity; Group 5 = furthest to gender parity)		0.94 Group 3	0.87 Group 5	0.95 Group 2	0.97 Group 1	0.86 Group 5	1 Group 1
Gender parity in public life and decision making							
Female shares of employment in senior and middle management positions (%)[7]		19.4 (as of 2010)	62	28.3 (as of 2010)	33.6	25.4 (as of 2010)	41.3
Women?s share of government ministerial positions (as of 2021)[8]8		17.1	9.4	42.1	43.5	34.5	13.6
Percentage of female judges[9]9		16[10]10	22[11]11	23[12]12	71.8	28[13]13	52.3
Gender parity in education[14]14							
Female shares of graduates from STEM programmes in tertiary education (%)		37.4 (as of 2018)	40.3 (as of 2007)	47.8 (as of 2007)	42.6 (as of 2018)	25.4 (as of 2014)	28.8 (as of 2018)
Gender Parity Index of school life expectancy in secondary education		1.02 (as of 2018)	1.03	0.94	1.01	0.78 (as of 2007)	0.98 (as of 2014)

Gender Parity Index of school life expectancy in post-secondary non-tertiary education		NA	NA	NA	0.24	0.81	0.65
Gender parity in finance and ICT[15] 15 [16] 16							
Number of women-owned loan accounts of the household sector with commercial banks (per 1,000 female adults)		NA	64.8	218.1	NA	41.9	NA
Number of men-owned loan accounts of the household sector with commercial banks (per 1,000 male adults)		NA	271	245.9	NA	89.7	NA
Borrowed from a financial institution or used a credit card, female (% age 15+)		18	14	16	20	14	22
Borrowed from a financial institution or used a credit card, male (% age 15+)		19	21	22	20	16	21

Made digital payments in the past year, female (% age 15+) (in 2017)		29	7	18	51	44	47
Made digital payments in the past year, male (% age 15+) (in 2017)		25	19	31	49	59	48
Used a mobile phone or the internet to access an account, female (% age 15+)		8	2	4	13	38	17
Used a mobile phone or the internet to access an account, male (% age 15+)		7	6	7	11	57	20
Percentage of women using the Internet[17]17	48.3	50.8	NA	62.5	76	NA	68.2
Percentage of men using the Internet	55.2	56.7	NA	68	81.8	NA	72.4
Gender parity in business and law[18]18 (data as of 2021)							
Women, Business and the Law Index		64.4	46.9	95	93.8	73.1	79.4
Can a woman travel outside her home in the same way as a man?		Yes	No	Yes	Yes	Yes	Yes
Are there criminal penalties or civil remedies for sexual harassment in employment?		No	No	Yes	Yes	Yes	Yes

Can a woman work in an industrial job in the same way as a man?		Yes	No	Yes	Yes	Yes	No
Does the law mandate equal remuneration for work of equal value?		No	Yes	Yes	Yes	Yes	No
Can a woman obtain a judgment of divorce in the same way as a man?		No	No	Yes	Yes	No	Yes
Is dismissal of pregnant workers prohibited?		Yes	No	Yes	Yes	Yes	Yes
Does the law prohibit discrimination in access to credit based on gender?		No	Yes	Yes	Yes	No	Yes
Do sons and daughters have equal rights to inherit assets from their parents and do male and female surviving spouses have equal rights to inherit assets?		No	No	Yes	Yes	No	Yes
Indicator (Data as of 2019, unless otherwise noted)	**Global**	**Indonesia**	**Jordan**	**Peru**	**Serbia**	**Uganda**	**Ukraine**

221. More specifically, considerations will be given to women in STEM, especially when training mentors for the program and every aspect of program implementation, monitoring and evaluation. In targeted country context, gender aspects will be integrally streamlined when hiring, tailoring communications materials for the program and trainee recruitment.

222. A succinct overview of all gender assessment conducted within countries associated with the GGINP project highlights that the six focal countries are at very different levels in regards to governmental support towards recognizing and mainstreaming gender nationally. For example, since the UN 1981 Convention on the Elimination of all Forms of Discrimination Against Women

(CEDAW), the **Ukrainian** government had just developed a Government Priority Action Plan in 2018 for the first time. It advocates developing a barrier-free public space, ensuring equal opportunities for maternity leave, combating domestic and gender-based violence, and ensuring ***comprehensive integration of gender equality principles in education***.

223. Conversely, for the case of **Uganda**, national government has established multiple legal frameworks by enshrining gender in Uganda?s vison 2040, having constitutional provisions (Article 36(6),1995) on gender and through environmental undertakings. However, there remains disconnect between Uganda's very positive legal framework and effective implementation or enforcement of gender-positive laws.

224. In **Serbia** however, after full gender analysis it can be concluded that men are far exposed to POPs and its side effects because of the gender disparity in the industrial sector having 80:20 ratio of male to females whilst the inverse is true for mercury waste exposure. In the nation?s informal waste sector, men and women are in unfavorable position, both because of exposure to mercury and due to general working and living conditions.

225. The **Indonesian** Government also recognizes the need to address and advance gender equality and women?s economic empowerment through initiatives such as the Presidential instruction no. 9, Pancasila- the state?s philosophy (KKG law) and the SDGs nationally termed as *Tujuan Pembangunan Berkelanjutan* (TPB). In the logging sector, women face greater risks and have heavier burden in relation to their ability to respond and adapt to effects of exposure to toxic chemicals specifically Persistent Organic Pollutants (POPs) usage. Poverty also heightens these disparities, for example, low-income populations typically reside in neighbourhoods considered undesirable, such as areas adjacent industrial zones, which are major sources of toxic chemicals, originating from factories, landfill sites, incinerators, and/or hazardous waste dumps. Women and children residing in these environments are at extremely high exposure risks ? sometimes even having to scavenge in landfills. Additionally, female staff working in garment production and textiles sector has no access to PPEs thus increasing vulnerability to POPs.

226. In **Peru**, Law No. 28983 on Equal Opportunities for Women and Men was promulgated in 2007, establishing the regulatory, institutional, and public policy framework to ensure that women and men can exercise their rights to have equality, dignity, free development, welfare, and autonomy. In addition, the Multisectoral Strategic Plan for Gender Equality of the National Gender Equality Policy (DS 002-2020-MIMP) was approved in 2020 to eradicate discrimination against women and change deeply-rooted traditional norms and gender stereotypes. However, there is no gender action plan or standards in the chemical industry of Peru, which is an important export sector of the country.

227. At the policy level, the Government of **Jordan** is a signatory to many international agreements and conventions related to gender equality and women's rights. Even though the constitution includes the principle of equality before the law in rights and obligations for all Jordanians, it doesn?t specifically mention the prohibition of discrimination based on sex or gender. Several measures have been conducted in the past years to reduce discrimination against women such as the amendment of the Penal Code in 2010 in relation to what is called ?honor crimes? and withdrawing of Jordan reservation to Article 15 (4) of CEDAW. However, the social perception of gender roles and women?s capability to work is one of the most persistent challenges for women?s economic empowerment in Jordan. The employment rates of men in industries requiring physical strength and in decision-making positions are much higher than that of women.

228. All these efforts countering challenges made by countries are a great start towards breaking down stereotypes and creating equal opportunities for everyone. Access to training on occupational health and safety, Resource Efficient & Cleaner production, and Green Chemistry concept can help close the gender gaps by making information, new technologies, skills, and knowledge more relevant and accessible to women. The sound waste and chemicals management will support the production of safer end-products and protection of the living environment, which benefit everyone in the society, including women, as end-users of the value chain. This is precisely where the GGNIP intervenes.

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 Yes

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.

229. Private sector engagement provides the opportunity for industry to demonstrate the importance of green chemistry to their company and business sector.

230. The development of human capital of both women and men to take an active role in safer chemical substitution to minimize the use of hazardous materials is of particular interest to the private sector. An educated and connected staff can make more effective and informed decisions related to the reduction of hazardous chemicals in their products and processes. The private sector can encourage their employees regardless of gender and position to participate in the Green Chemistry Innovation and Inclusion Network by making the Network accessible and increasing awareness through company outreach. Additionally, the private sector may contribute content to the Network demonstrating their expertise and successes such as presentations, webinars, and publications. In some cases, the private sector has developed tools to facilitate green chemistry decision-making, and the reach of those tools could be expanded by inclusion on the Network. Finally, the private sector may also be an active participant in the network as a mentor to more novice members in the Network to help address questions and provide support to those seeking assistance.

231. The development of regional innovation ecosystems to accelerate the design and implementation of safer alternatives provides ample opportunities for the private sector to engage. Startup companies may apply to be accepted into the accelerator program to bring an innovation to market. Additionally, there are multiple roles for more established companies to contribute. The private sector may be a trainer, mentor, or judge for the accelerator program providing expertise in a given subject or general business skills. Additionally, the private sector will play an essential part in contributing ideas for the business challenges. Industry would help generate a list of industrial chemical challenges currently faced by the organization. They may also participate in developing solutions to the Innovation Challenge by participating in a hackathon to propose ideas to the solicited regional Innovation challenges. The private sector may also be a potential funder of a promising technology identified by the accelerator programme.

232. The project will also built upon a strong private sector involvement for the demonstration project such as capacity-building, technical support for GC applications and utterly to ensure project commitment and co-financing. During PPG, national stakeholder consultations have been informed about the project, potential project involvements and for preliminary interest. Final selection will be done, e.g based on nationally published invitations for participation, including signing of aide memos (as required), for some countries followed by a selection of replication companies.

233. The participation of the private sector (other industries) in project events (i.e. capacity building, detailed evaluation, technical support) and dissemination of case studies (which provide replicable implementation procedures and promotion of demonstration projects) will maintain the technical capacity required for the deployment of green chemistry. Likewise, it is important to

identify adequate financing mechanisms that support the deployment of green chemistry, which will allow industries to implement medium- and high-cost green chemistry alternatives (or in principle subsidized by national funds) that have proven to be profitable with a recovery period achievable through loans from financial institutions that use the identified financing mechanisms. This will offer an instrument to minimize the risk of lack of funding to implement green chemistry alternatives.

234. Since the adoption of green chemistry alternatives for POPs in industries will result in the achievement of GEBs and the reduction of GHG emissions to the environment, the roles of industries in the area of corporate social responsibility to ensure a healthy environment and the life of society/community around the location of PVC sector factories will be strengthened.

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):

Table 7: Potential Risks

Risk	Rating (L/M/H)	Potential Barrier	Mitigation Strategy
Poor institutional coordination	M	Any project involving 6 nations (from 3 continents) including institutions of higher learning from geographically different regions who are at different developmental stages is envisaged to have coordination risks stemming from over diversity.	Mitigating this risk, UNIDO has set in place a coordination team with Yale University and local implementing agencies. Building on other projects at UNIDO in this field (such as Chemical Leasing), UNIDO could reach out to a growing network of national and international partners, particularly in the private sector, while the Yale University could leverage their connections with higher education institutions. Technical meetings will take place regularly (at least monthly). The project?s web-based portal will build in functions to facilitate sharing of documents, news, and in-time online conversation among partners across countries. Lessons learned from previous GEF-UNIDO implemented projects on POPs in each participating country will be taken into account. Coordination with other GEF-funded projects on the topic of waste and chemicals management, pollution, or green economy will be strengthened whenever possible.
Business failure of startups and companies supported by the Accelerator Programme	M	Business viability would be seriously threatened by the pandemic economic recession its uncertainties.	The Accelerator Programme will support startups and SMEs in developing robust business plans which account for as much variability as possible. The plans should take roots in the local economic ecosystem which could be adapted to be more independent in the context of global economic crisis. Besides, businesses with high potentials for success will be prioritized.

Possible re-instatement of COVID-19 con tainment measures limits available capa city or effectiveness of project execution / implementation	H	New variants outbreaks and slow vaccination rollout would lead to new or prolonged national lockdowns, travel barriers, or social distancing measures, which would delay the implementation phase, limit the possibility to conduct some activities, and/or lower their impacts. For example, field visits to pilot factories or networking events would yield better results when conducted in-person than virtually. Moving all events to virtual platforms could allow more participants from remote areas to connect to and benefit from the activities. However, technology illiteracy and lack of equipment and internet infrastructure will worsen the knowledge gaps and social exclusion. The COVID-19 economic recession is still ongoing while the threat of new variants and outbreaks could freeze manufacturing activities and trade again.	The GreenChem project has designed all of the project activities with the pandemic as a constant threat in the context. The core activities of this project, including events and training, have been revised to take place on online platforms or in-person at the reduced capacity following local COVID-19 guidelines. Integration of tools supporting virtual collaboration has been made to engage with all stakeholders so far and it is envisaged to be the same situation in the first years of the project. The Accelerator Guidebook and training will include a section on operational risk management when health crisis like COVID-19 emerges. The project will also capitalize on national vaccination campaign, testing and future health regulations to ensure full implementation in participating of countries.
Gender gaps and inequalities further exacerbated by the project activities	L	Women representation in STEM fields is particularly more limited than in other fields. Compared to men, they also have lower technology literacy rate, which prevent them from accessing online events and training. Low number of female participants in project activities (awareness raising events, training, networking, network of practitioners (Leadership Committee, Innovation and Inclusion Network), and business competition). Curriculum and guidebook, experts, mentors, and judges in the Accelerator Programme are not gender-sensitive or responsive to the specific needs of female entrepreneurs.	The project has paid special attention to mainstream gender perspectives in the project design and will regularly review the situation to identify potential issues during the implementation phase. The project will build on the results of the gender analysis conducted in all participating countries and formulate a Gender Action Plan taking into account the national differences. The non-exhaustive list of key gender mainstreaming activities include: consultation with relevant stakeholders (Ministries of Women Affairs, women business associations, female researcher associations, and so on), collecting sex-disaggregated data, and gender-sensitizing communications materials and training curriculum. Participants in events, training, and the Accelerator programme will receive an introduction on gender inequalities and women?s economic empowerment liking to unsafe chemicals and climate change. Female-owned businesses will be encouraged to apply to join in the national start-up competition.

National stakeholders involvement in implementation	L	The project teams in participating GGNIP countries are envisaged to encounter objection from chemical producing industries (textiles, PFOs, POP-PBDEs). National stakeholders in country specific sector as part of the program requires training and information regarding socio-economic benefits of green chemistry	To mitigate this risk, provision is made for national workshops, awareness campaigns and discussions fora opened to consultatively set and agree, national plans as part of the program and implementation actions in each nation the GGNIP project is ongoing. The dissemination of information on clean production and consumption of chemicals to industries, SMEs, ministries of environment et al, will spur stakeholder?s involvement in the execution of the program nationally.
Change in national priorities or low political buy-in	L	The project might lose national focal points in the mid of implementation phase if the governments or institutions have high turnover rate of staff. It takes time for new focal points to familiarize themselves and thus slow down the implementation phase. Within the lifecycle of this project, there might be political changes after which new governments might roll back the progresses on waste and chemicals management.	To mitigate this risk, the project have requested implementing agencies to engage institutions (government, academia and chemical industry) to seek their commitments, especially from the Ministry of Environment, Industry, and STEM educational institutions. So far, key government stakeholders have been mobilized and committed to the project. If there are changes in the governmental priorities, close consultation with the participating national institution will enable the project team to navigate such unseen hurdles. Where needed, UNIDO will assign experts liaisons, who will aid national dedicated teams to support the project objectives. In parallel, awareness raising activities will be carried out at national levels highlighting the benefits brought to the participating countries through the GGNIP project to strengthen public support and political buy-in. Political and economic pressure from influential countries, the international community, and the consumers would expectantly incentivize the national stakeholders to fully participate in the project. Plus, there will be technical backstopping and frequent reporting/storing of data/information to avoid institutional memory loss.

Climate Risks	L	Some participating countries of this project are more vulnerable to extreme weather events than the others due to their geographic locations and capacities to address climate change challenges, such as Indonesia, Uganda, and Jordan. In countries where people?s livelihoods largely depend on agriculture production and fisheries, drought, flooding, and unusual weather changes threaten food and energy security, force people from disaster prone areas to migrate, cause social and political unrest, and dwarf economic growth. In this context, MSMEs, which are not as well-equipped as large corporations to invest in preventive and mitigation measures, are key beneficiaries of this project. Component 2 and 3 include supporting services to the MSMEs and set up pilot demonstrations in selected factories to implement green chemistry alternatives for POPs and mercury. There is a low chance that these activities might be delayed/changed if the companies and their production activities are negatively impacted by extreme weather events in their regions (damaged facilities, loss of consumers or the main source of energy like hydropower, and so on). However, each country will also implement an Environmental and Social Management Plan (ESMP), including resilance to climate change.	The project will pay special attention to the development of weather events in the participating countries, particularly in areas where pilot factories are located, in order to timely revise the planned activities. . For example, an assigned worker from the pilot companies shall assess whether there is climate risk and whether it affects the execution of the project, submitting then the information to the national service provider. Strengthening the climate resilience of the project activities will involve all project stakeholders from government to private sector through the below-mentioned capacity-building and knowledge-sharing events, climate risk monitoring (as part of the ESMPs), including the availability of contingency plans. The project will closely monitor new findings from researches on climate risks in the participating countries and their regions to timely update the training materials and activities. The awareness raising events, training, and materials produced by the project will highlight the links between climate change and hazardous waste and chemicals and emphasize the importance of a sound management system to strengthen the business case for green chemistry alternatives.
Non-delivery of committed co-financing contributions	L	The project depends on its vast network of local partners to implement all three components. As private institutions could change their priorities or have financial problems, they would not be able to deliver the co-financing contributions.	UNIDO and the implementing partners will make sure that the importance of the planned interventions is thoroughly explained to the local partners. The project has collected confirmation letters of co-financing contributions from local partners. In case of non-delivery due to economic crisis, alternative sources of funding will be identified.

Low interest to join the project from the higher education institutions and the private sector	L	Companies might not join the programme due to fear of legal implications of using toxic chemicals. The initial costly investment of adopting new technologies may discourage companies to participate.	UNIDO and the local implementing agencies will make sure that companies understand the long-term benefits of the projects, which outweigh the initial costs of switching to new technologies. For example, companies could access bigger markets where consumers pay more attention to health and environment consequences and thus are willing to pay more for safer, eco-friendlier products. Extensive communication between the implementing partners and the stakeholders have started at early state of the PPG phase, thus we expect to receive continuous support from the stakeholders.
Lack of ownership after the project lifecycle	L	The sustainability of the project?s results will not last without GEF funding.	The project has planned for ownership and sustainability after the project life cycle. For example, all centers joining the Network are self-sustained, financially stable and independent. The key sustainability factors of this project are developing capacity for partners, making training materials publicly available on the web-based portal, and creating an enabling policy environment through centers of the Network.
Coordination among the components and especially among the six participating countries might be challenging	L	There are 6 participating countries and due to different technical, administrative capacity, different regulations/approval processes etc. some countries might advance faster than others. This would led to complications in monitoring of outputs and simulanteously	As part the execution contract, Yale University will closely monitor, technically advice and support the national executing project entities in execution of national activities.

COVID-19 Risk and Opportunity Analysis

235. The participating countries struggle with the COVID-19 crisis and its severe health and socio-economic impacts, prospects of recurring pandemic waves and associated partial lockdowns and the need to support those who have lost their jobs and livelihoods. However, the COVID-19 crisis and containment measures did not have the same impact on different countries and its private sector, e.g. vulnerable manufacturing sectors such as textiles might have impacted more than the manufacturing sector, which do not relate to the production of consumable products, such as the construction or PVC sectors. The ongoing pandemic also imposes new risks and at the same time provides new opportunities to the project. The COVID 19 associated risks and opportunities
are tabulated below.

Risk	**Rating**	**Mitigation**
Possible re-instatement of COVID-19 containment measures limits available capacity or effectiveness of project execution / implementation	Medium risk	The capacity of stakeholders, especially in the six participating countries, towards remote-work and online interactions will be strengt hened through regular online meetings.The current design of some the activities under component 1 and 2 will be carried out through online webinars, and therefore CO VID-19 is not expected to pose a significant risk to most of the activities.
Some project supporters, co-financiers or beneficiaries may not be able to continue with project execution/implementation	Medium risk	The situation will be closely monitored in order to identify alternate supporters or co-financiers, or to readjust the list of beneficiaries if needed.
Price increases for procurement of goods/services	Medium risk	The project team will undertake efforts to support the identification of alternative providers and make sure that competitive pricing is maintained
COVID-19 Opportunities Analysis		
New business opportunities to build back better for business continuity and economic recovery post-COVID-19.	High opportunity	This GreenChem project will engage with the private sector to promote and scale up GC solutions for POPs, mercury and microplastics, and business models Information on relevant new business opportunities as well as policy/regulations will be added to the GC programme.
Green and blue recovery from COVID-19 (?Building back better?)	High opportunity	The project contributes to green and blue recovery because countries have the opportunity to unleash GC innovation, learn from wider GC reaching and fundamental GC applications in critical industrial sectors through making use of a global network, additional to an accelterator program.

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.

236. The project management structure is given below (Figure 8).

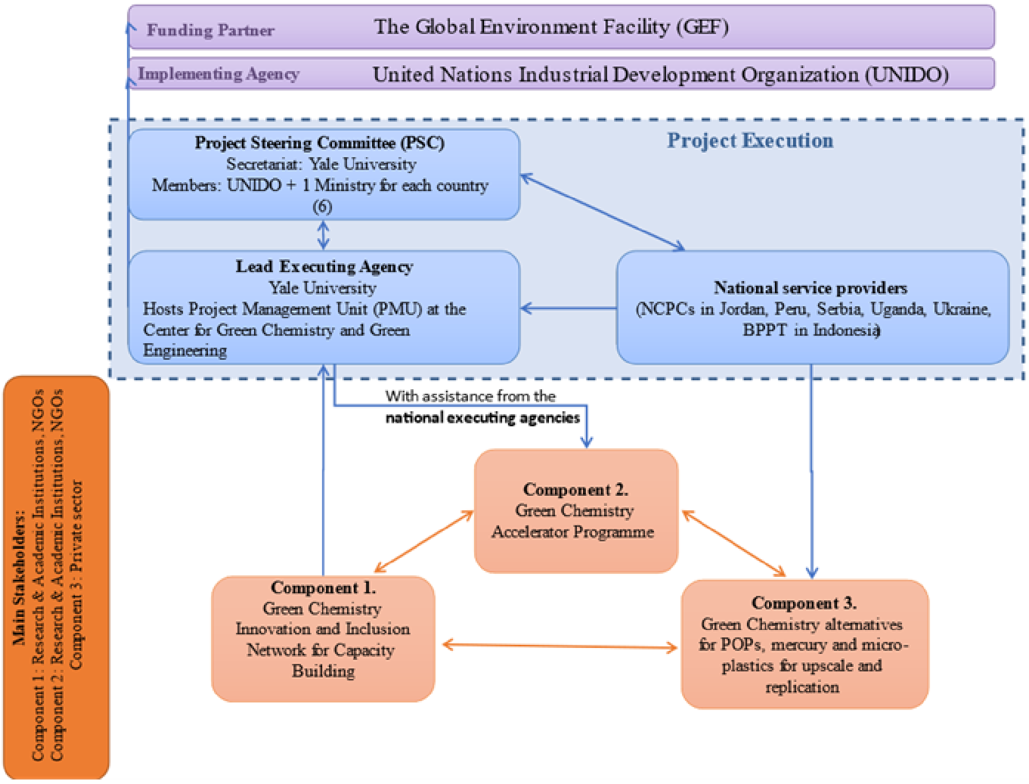


FIGURE 8: PROJECT MANAGEMENT STRUCTURE

Project Implementation

237. UNIDO is the GEF Implementing Agency (IA) for the project. As the GEF IA, UNIDO will maintain oversight on the project implementation, manage the overall budget and supervise project execution. A project officer will be appointed in UNIDO HQ to oversee the implementation of the project and the UNIDO Country Offices for the six participating countries may also provide assistance in country level project monitoring.

Project Execution Entity (PEE)

238. Project executing will be led by Yale University as the main executing entity. Based 2021-updated HACT questionnaire completed for the UNDP in 2016, it was determined that Yale University would meet the requirements as Project Executing Entity (PEE). Yale will be responsible for the full execution of the project under a contractual arrangement with UNIDO as the IA. Annex H. Annex R provides the Terms of Reference for the contractual agreement between UNIDO and Yale University.

239. A Project Management Unit (PMU) will be set up in Yale to run the project on a day-to-day basis. The PMU function will end when the final project terminal evaluation report, and other documentation required by the GEF and UNIDO, has been completed and submitted to UNIDO (including operational closure of the project). The PMU?s responsibilities will include (i) assignment and supervision of project activities; (ii) recruitment of national and international consultants; (iii) providing guidance to national sub-contractors; (iv) coordination with stakeholders, donors, the IA, relevant national agencies and the private sector; (v) preparation of

terms of reference (TORs) for project activities, (vi) review of project progress reports submitted by to national sub-contractors, (vii) supervising project procurement and financial resources (viii) organizing and convening project coordination stakeholder meetings, and (ix) review of project outputs and other tasks as required by the project.

240. Yale University will report on project progress related to Component 1, 2, and 3 to the Project Steering Committee (PSC) and UNIDO. Yale will set up a Project Management Unit (PMU) for project execution of all components, including sub-contracts for national project execution related to Component 2 and 3 (see National Service providers, NSP).

Project Steering Committee (PSC)

241. The Project Steering Committee (PSC) will review and monitor project execution progress, provide strategic advice, facilitate co-ordination between project partners, provide transparency and guidance, and ensure ownership and sustainability of the project results. PSC will be chaired rotational by the six countries through the representation in the next paragraph.

242. The PSC will include representation from the GEF, UNIDO, Ministry of Industry of Indonesia, Ministry of Environment, Jordan , Ministry of Environment of Peru, Ministry of Environmental Protection of Serbia, National Environment Management Authority of Uganda, Ministry of Energy and Environmental Protection of Ukraine.

243. The primary roles of the PSC are: (1) to provide overall guidance to the execution of the project; (2) to ensure good coordination among participating agencies and other organizations; and (3) to approve any substantial change or addition of new project outputs in response to the emerging issues, including the annual workplan. The PSC will meet at least once yearly to review and monitor the progress of the project implementation and to approve the work plan for subsequent years.

244. GEF Operational Focal points of the six participating countries will also be invited to the PSC meetings and will be regulary informed about the project progress.

National Service Providers (NSP)

245. For the execution of the national activities under Component 2 and Component 3, National Service Providers (NSP) were selected for the six participating countries, which are the following: BPPT Indonesia, Royal Scientific Society (RSS); Jordan, Centro de Ecoeficiencia y Responsabilidad Social (CER), Peru; Faculty of Technology and Metallurgy, Cleaner Production Centre, University of Belgrade, Serbia; Uganda Cleaner Production Centre; Resource Efficient and Cleaner Production Centre, Ukraine. These NSP will enter into contractual arrangements with Yale University and will coordinate national day-to-day activities based on a Terms of Reference (ToR).

246. The NSP responsibilities will include (1) assignment and supervision of national project activities related to Component 2 and 3 (as per Terms of References (ToR) through contractual arrangements with Yale); (2) sub-contracting of national entities for specific tasks, including recruitment of national consultants; (3) coordination with national stakeholders, Yale (being the project?s main executing entity) and the private sector; (4) review of national project progress reports and ESMP data, (5) supervising potential project procurement and financial resources (as

per ToR) (6) organizing and convening project coordination stakeholder meetings, and (7) review of project outputs and outcomes, and other tasks as may be required by the project.

Project stakeholder?s and other aspects

247. As outlined in the Stakeholder Engagement Plan (SEP, see Annex M), private sector stakeholders will be engaged throughout the project, especially for the capacity building, accelerator and pilot project activities and will provide the necessary co-financing support to the project activities.

248. The Midterm Review of the project will be under the responsibility of Yale, including recruitment of consultants, as the executing partner, in coordination with UNIDO while the final Independent Evaluation will be managed by UNIDO, in coordination with its Independent Evaluation Division. The allocated budget for the project evaluation is USD 400,000, of which USD 50,000 is budgeted for the Midterm review and USD 80,000 for the Final Evaluation. As the final evaluation falls under UNIDO's responsibility, the budget for this activity will be managed by UNIDO.

249. Full or partial ownership of equipment/assets purchased under the project may be transferred to national counterparts and/or project beneficiaries during the project implementation as deemed appropriate by the government counterpart in consultation with the UNIDO Project Manager.

Coordination with other GEF-financed projects and other initiatives

250. This project will be coordinated with lessons learned and/or knowledge management from relevant sector projects and/or country projects focusing on the GEF Chemical& Waste focal area, including the following:

? Green Chem: UNIDO-GEF 9373 ?Guidance Development and Case Study Documentation of Green Chemistry and Technologies?;
? Textile: UNIDO-GEF ID 10683 ?Promotion of circular economy in the textile and garment sector through the sustainable management of chemicals and waste in Ethiopia?;
? Textile: UNIDO-GEF 10543 ?Promotion of circular economy in the textile and garment sector through the sustainable management of chemicals and waste in Lesotho, Madagascar and South Africa?;
? Textile: UN Environment-GEF 10523 ?Reducing uses and releases of chemicals of concern, including POPs, in the textiles sector?;
? EPS/XPS foam UNIDO-GEF 10163 ?Improvement of the environmental performance of the foam sector: Phase out and management of hexabromocyclododecane (HBCDD) in China?;
? EPS/XPS foam UNIDO-GEF 10082 ?Enhancing environmental performance in the expanded and extruded polystyrene foam industries in Turkey?; and,
? Peru C&W UNIDO-GEF 9206 ?Capacity building on sustainable industrial zone planning and demonstration of clean and low carbon technologies in Peru? (SIZ Peru).

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.

251. The GGINP is a global project and the thrust of work aligns with national priorities, indicated as signatories to the international treaties of the Stockholm Convention and Minamata Convention. Additionally, the the project will align with multiple Sustainable Development Goals (SDGs): Good Health and Well Being (SDG 3), Gender Equality (5), Clean Water and Sanitation (6), Decent Work and Economic Growth (8), Industry, Innovation and Infrastructure (9), Reduced Inequalities (10), Responsible Consumption and Production (12), Climate Action (13), and Partnerships for the Goals (17).

252. The project is consistent with the countries National Implementation Plans (NIP) or the National Implementation Plan updates (NIP update) under the SC on POPs, as follows:

253. **Indonesia:** NIP update (October 2014) with main objectives: a Strengthen institutional and capacity building as well as improve coordination between relevant institutions and stakeholders regarding POPs; b. Establish a comprehensive and integrated measurement, monitoring and knowledge management system and infrastructure; c. Strengthen policy, regulation, and guidelines for initial POPs, develop policy, regulation and guidelines for newly listed POPs, harmonize relevant policies, regulation and guidelines regarding POPs; d. Enhance awareness-raising of POPs issues to all relevant stakeholders as well as POPs users and the general public, including improving stakeholders? participation on POPs management; e. Effective management of POPs through their life cycle (production, import, export, utilization, transportation, and disposal), providing POPs alternatives and environmentally sound management (ESM) as well as best available techniques/best environmental practices (BAT/BEP) of POPs.

254. Technically, the selected sector of paper is the priority sector related to PFOS reduction (1) specialized paper industries, (2) firefighting foam, (3) textile/apparel and (4) synthetic carpets and synthetic carpet manufacturers.

255. **Jordan:** NIP update from October 2014 with the following key objectives (i) Strengthen institutional and capacity building as well as improve coordination between relevant institutions and stakeholders regarding POPs; (ii) Establish a comprehensive and integrated measurement, monitoring and knowledge management system and infrastructure; (iii) Strengthen policy, regulation, and guidelines for initial POPs, develop policy, regulation, and guidelines for newly listed POPs, harmonize relevant policies, regulation,s and guidelines regarding POPs; (iv) Enhance awareness-raising of POPs issues to all relevant stakeholders as well as POPs users and the general public, including improving stakeholders? participation on POPs management; (v). Effective management of POPs through their life cycle (production, import, export, utilization, transportation and disposal), providing POPs alternatives and environmentally sound management (ESM) as well as best available techniques/best environmental practices (BAT/BEP) of POPs.

256. **Peru**: NIP update: Mystery of the Environment (MINAM) developed the NIP update for the SC on POPs, which was pre-published in the official journal "El Peruano" by Ministerial Resolution n.? 390-2019-MINAM. The NIP update was prepared to take as a reference the level of execution of the first Stockholm Convention National Implementation Plan (2007), the significant changes in national circumstances considering that more than 10 years have passed since the publication of the the first plan, as well as the new persistent organic pollutants (POPs) listed under the Convention annexes for which the country is committed to apply management measures.

257. The NIP update consists of 4 general objectives, 13 specific objectives and 43 activities, with their respective goals and institutions in charge and an implementation schedule, which was developed with the relevant sectors through the development of bilateral meetings, as well as a multisectoral meeting (23/09/19), in order to achieve a consensus document. The aforementioned Plan is aimed at the development of progressive implementation activities in order to optimize compliance with the commitments derived from the Stockholm Convention and reduce risks due to exposure to POPs, covering different aspects such as: (i) Strengthening the regulatory framework on pesticides in the health sector; (ii) Optimizing the control and supervision of POP pesticides and others in disuse, (iii) Develop specific standards and technical documents for the control of POPs for industrial use throughout their life cycle, as well as articles, equipment, or waste that contain them, (iv) Develop technical instruments to strengthen the control and reduction of unintentionally generated POP emissions and releases; (v) Maintain updated national inventories on POPs for informed decision-making.

258. **Serbia**: Republic of Serbia ratified the Stockholm Convention on POPs chemicals in 2009. As an EU candidate country, Serbia has transposed the EU Regulations on persistent organic pollutants

(POPs) to national legislation through the adoption of the Rulebook on Restrictions, Banning Production, Placing on the Market And Use of Chemicals (?Official Gazette of the Republic of Serbia?, No. 44/17) and the Rulebook on the List of POPs, Manner, and Procedure for POPs Waste Management and Limit Value of POPs Concentrations Related to Disposal of Waste Containing POPs or Contaminated With POPs (?Official Gazette of the Republic of Serbia?, No. 17/17). The bans and restrictions of POPs are regularly harmonized with the EU with a ?lag phase? around one year later (depending on the specific chemical).

259. National Implementation Plan identified industrial chemicals such as flame retardants, PFOA and PFOS as mostly used in semi-products. Some estimates are: the sum of tetra-,penta-,hexa-and heptaBDE in commercial mixtures is estimated at 37,944 ? 86,553 kg in 9 years, the sum of Hexabromocyclododecane (HBCDD) in imported expanded and extruded polystyrene granulate 37.272 tonnes (in one year). Perfluorooctane sulfonate (PFOS) in products is often found in concentrations lower than 0.1%, meaning that these chemicals are often unlisted in the safety data sheets. This chemical has been used in Teflon-based semi-products and products. The estimate of imported Teflon based products in Serbia during 2004-2013 (excluding PTFE) is 132 527 kg. Also, PFOS can be found in water-resistant products, imported in the period 2004-2013, estimated at ~ 400,000kg. The estimates are rough, due to many gaps in data.

260. The analysis of the market shows that some of the problems are the lack of knowledge in the business community about these chemicals in potentially contaminated semi-products on import, and lack of testing methods for recognizing the contaminated material. A Serbian NGO Safer Chemicals Alternative (Alternativa za bezbednije hemikalije ? ALHem) participated in the market investigation ?Toxic Loophole? organized by a Czech Republic NGO Arnika, where consumer products made from recycled electronic waste were tested against POPs flame retardants. E-waste contains bromine compounds that are used as flame retardants in electronic equipment. The compounds include polybrominated diphenyl ethers, or PBDEs, such as OctaBDE and DecaBDE, which are passed from e-waste into recycled consumer products on sale in the European Union and Central and Eastern European markets. Out of 5 articles bought on the Serbian market, 5 contained OctaBDE (7-119 ppm), 5 contained DecaBDE (89-1494 ppm), and 2 samples contained HBCD (4-14ppm).

261. **Uganda**: Uganda implements the NIP in 10 years (2016 ? 2025) through a multi-stakeholder approach. The NIP assists the country in meeting its reporting to the Stockholm Convention on POPs in order to inform the Conference of the Parties and the general public and other obligations, which the government ratified and acceded to on 20th July 2004. Some of the strategic areas of intervention prioritized under the revised NIP (NIP II) which are consistent with the project interventions include;(i)Development of national awareness creation and educational programs on the effects of POPs and other hazardous chemicals on human health and the environment. (ii) Strengthening of the regulatory framework and institutional capacities for the management of POPs and other chemicals. (iii) Introduction of cleaner management practices for products, articles, and wastes containing PFOS and other hazardous chemicals wastes. (iv) Reduction of emission of unintentionally produced POPs from dumpsites, open burning of wastes, metal production processes, waste incineration amongst others. (v) Introduction of environmentally sound management practices for sites and equipment contaminated by POPs. The revised NIP (NIP II) was developed in line with the National Development Plan (NDPII 2015-2020), which is the second in a series of six 5-year Plans aimed at achieving Uganda Vision 2040. NDP major objective is ?to promote and ensure the rational and sustainable utilization, development, and effective management of the environment and natural resources for socio-economic development of the country? Therefore, the proposed project actions are also in line with NDP II and NDP III (2021 ? 2025) and will support the country in achieving its Vision 2040 of ?A Transformed Ugandan Society from a Peasant to a Modern and Prosperous Country within 30 years?

262. **Ukraine:** Report from 2012 titled preliminary data on new POPs in Ukraine indicate that PBDEs, PFOS, HBDF, PCB were never manufactured in Ukraine and additional measures are needed to assess their potential presence and framework for elimination. The Cabinet of Ministers of Ukraine approved the National Implementation Plan for the Stockholm Convention with a list of activities by 2028. It is the main an instrument for implementing this convention at all levels has a clear definition of responsible executors at both the national and local levels. This Plan includes (i) the development of the register of stationary sources of pollutants? emissions, (ii) the organization of analyses conducted for specification of quantitative emission factors, (iii) the organization of a the monitoring system of emissions? sources, and (iv) the development of a legislative framework and establishment of a regulatory system, which will stipulate the implementation of best-available techniques at new and redesigned facilities.

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.

263. Knowledge management (KM) is the critical component of the programme and will be established through the web-based Green Chemistry Global Innovation and Inclusion Network. The portal will capture all knowledge generated through the programme on the national and global level and will act as a knowledge repository for all project documents and products. Specific web platform functionality is described below:

- o The web platform will be used to manage accelerator-related processes in Indonesia, Jordan, Peru, Uganda, Ukraine and Serbia. It will act as a repository for reports, updates, new innovations and announcements. Accelerator Guidebook, training tools and materials will be also available through the website. Website will also showcase accelerator winners to highlight winning green chemistry technologies.Web platform will enable communication between different stakeholders around the globe interested in green chemistry and innovation. It will build a community of practice between entrepreneurs, educators, industry and investors. Networking and exchanging ideas through the network will be encouraged.
- o The platform will host novel green chemistry resources such as videos, interviews, short courses so it becomes a hub to learn and educate.
- o Web platform will be used to collect various data over the length of the programme. Each country will track and record their own metrics to assess the impact of the programme. Collected information will be extracted by the main executing agency and used for promotional purposes to further promote the programme. Materials can include brochures, infographics, reports and briefs that can be shared with relevant stakeholders.

264. The programme will also actively disseminate knowledge through different avenues to capture various audiences. For younger audience (students, entrepreneurs), social media will be used. In addition to its own Twitter account/handle, the program will also use the Center for Green Chemistry and Green Engineering, Yale School of the Environment social media networks that have a reach of 15,000 followers. For investors, and technical experts, reports will be disseminated as print and distributed at the conferences. To engage the general public, commentaries, opinion pieces and short articles will be developed and shared through the website. To further enhance the outreach, information on materials generated through the program will be disseminated through the Green Chemistry Institute who has access to 18,000 subscribers.

265. The web portal will also highlight existing resources that are beneficial to the green chemistry community, for example Green Chemistry Toolkit, Global Green Chemistry Initiative, Green Economy, Industrial Ecology, Circular Economy and more. The portal is intended to create bridges and opportunities with other existing initiatives.

266. Knowledge management will also capture lessons learned from component 3 of the program, to ensure that generated content is disseminated on the national, regional, and global levels to achieve national replication at the targeted sector (e.g. awareness-raising, training, support with the identification of financial opportunities and elaboration of funding proposals), a regional and strategy (e.g. dissemination of lessons learned from all pilots).

267. This Green Chem involves institutional strengthening, capacity building, stakeholder engagement, gender mainstreaming, dissemination of project results, publication of project results in print and online media and networking among stakeholders as strategic knowledge management services that can address any legal, institutional, market, and gender-based risks that could hinder adoption of green chemistry alternatives for replacement of POPs in the industrial sectors.

268. For the first steps to knowledge management (KM) consists to work with targeted key stakeholders and addressing priority technical knowledge needs as strategically and efficiently as possible to improve the enabling environment for the adoption of green chemistry technologies. The objective of this KM implementation plan is to define an approach to enable consistent integration of knowledge management activities across the life of the project. Specifically, this plan aims to do the following:

(i) Outline goals and considerations for KM under the project.

(ii) Define key activities to enable consistent management of project information across the entire project implementation period.

(iii) Ensure project activities can support exchange of knowledge and learn from relevant projects and initiatives and between key audiences using a range of formats.

269. The plan highlights illustrative opportunities and innovative approaches to promote the exchange of knowledge across key audiences and priority topics for the project to improve the enabling environment for the adoption of green chemistry technologies. The plan offers a framework for evaluating potential project activities and effectively integrating KM into all assignments. Finally, the plan proposes ways to ensure KM work stays up-to-date and contributes to current best practices in knowledge management.

270. Knowledge management approach

The GGINP project will use an integrated and a multi-pronged approach to KM to:

1. Create technical knowledge and strengthen the evidence base to link them to national programs,
2. Facilitate the exchange of knowledge among key stakeholders to improve the state of the art of the green chemistry concept,
3. Support the project teams in the use of evidence to design and implement programs for the greatest impacts in environments conducive to the adoption of green chemistry alternatives.

271. The project will keep these goals at the forefront of decision-making around the selection and development of KM activities. A key factor driving this KM approach is that it positions the project to leverage and coordinate with other ongoing/planned government initiatives in the area of chemicals and waste management. The KM activities will fall under one of three action areas including:

i) KM operational and infrastructure; which involves the implementation of activities, which develop and maintain foundational resources to catalyze project KM, collaborative learning and adaption. The planned activities under GGINP project include; awareness-raising, training, and development of guidelines to operationalize the chemicals management regulations and facilitate promotion of BAT/BEP for chemicals management in the industry.

ii) Technical evidence base; which consider the generation of new knowledge and highlighting existing knowledge into accessible and actionable resources for priority stakeholders as well as influencer and technical partners. In this phase it includes the development of inventories of POPs use in selected industries, detailed assessment of green chemistry deployment potential in selected industries, technical evaluation, case study development, analysis of existing financial schemes and procurement of equipment for detecting POPs in chemicals and articles.

iii) Knowledge exchange; streghten and supporting relationship in atakeholders, facilitating technical network development and maximizing opportunities to exchange knowledg. The activities under this section include: provision of technical support to various industries and dissemination of project results.

272. Successful demonstration projects and lessons learned from the implemented GC alternative demonstrations will be summarized and shared on the GGINP web platform. This will serve as the centralized repository for case studies and templates that can be easily adopted and transferred to other regions.

9. Monitoring and Evaluation

Describe the budgeted M and E plan

273. An effective monitoring and evaluation process of project impact and sustainability will be designed and implemented, including setting a periodic review process to monitor the quality and the state of progress of the project, including progress and results in gender equality and women?s empowerment. The main purpose of the M&E program will be to measure and document implementation progress towards outcomes and objectives according to verifiable indicators and related means of verification. Evaluation of performances will assist in monitoring effectiveness and results, identifying underperforming activities and suggesting remediating actions, monitoring project risks and flagging project risks early on, refining further work in order to ensure a coherent, coordinated and timely achievement of project objectives in accordance with the project results framework. At the same time, it will support the communication and coordination mechanism of the project network, the compilation of lesson learned from the project and the dissemination to the primary stakeholders as well as the international community of the knowledge and experience acquired during the project lifetime. Gender issues and environmental and social safeguards will be fully integrated in the monitoring and evaluation of the project.

274. The Monitoring and Evaluation (M&E) Work Plan and Estimated Associated Budget are presented below (Table 9):

TABLE 8: MONITORING AND EVALUATION (M&E) WORK PLAN AND ESTIMATED ASSOCIATED BUDGET

M&E activity	Responsible Parties	Indicative costs to be charged to the Project budget (USD)		Time frame
		GEF grant	Co-financing	
Design and implementation of M&E system	Yale as PEE in consultation with UNIDO	0	50,000	Within the first six months
Monitoring indica tors and project progress, including ESMP and gender	Yale as PEE and UNIDO	50,000	80,000	Regularly, with an annual review prior to the finalization of APR/PIR
Visits to pilot project sites to monitor progress and assessdelivery of services	Yale, national and international consultants as needed	120,000	570,000	As required, minimum once a year.
Annual GEF-PIR report	Yale in consultation with the six participating countries	0	100,000	Annually

Annual work-plans on planned project activities and outputs	Yale in consultation with the six participating countries	0	100,000	Annually, on the basis of APR/PIR outputs
Independent mid-term review (external)	Yale and independent external evaluators.	50,000	200,000	Midpoint of project implementation
Independent final evaluation (external)	UNIDO, Yale and independent external evaluators.	80,000	400,000	At least two months before end of project
Knowledge management (technical reports, lessons learned, dissemination activities, etc.)	Yale in consultation with the six participating countries	100,000	500,000	As appropriate
Total indicative cost		**400,000**	**2,000,000**	

275. According to the Monitoring and Evaluation policy of the GEF and UNIDO, follow-up studies including Country Portfolio Evaluations and Thematic Evaluations can be initiated and conducted. All project partners and contractors are obliged to (i) make available studies, reports and other documentation related to the project and (ii) facilitate interviews with staff involved in the project activities.

276. The project results, based on the agreed logical framework, will be monitored annually and evaluated periodically during project implementation as part of the planning processes undertaken by the project team in accordance with established GEF and UNIDO monitoring and evaluation procedures. The evidence of outputs such as the number of participants in training activities, the release of reports and manuals, site visits at demonstration facilities, etc. will confirm the congruence of outcomes and objectives.

277. Day to day monitoring of project execution progress will be performed by the project team according to the work plan and identified indicators reported in the project's Annual Work Plan. The Project Team will inform UNIDO of any delays or difficulties faced during execution so that the appropriate support or corrective measures can be adopted in a timely manner. Periodic monitoring will be performed through site visits at the project demonstration facilities in the 6 countries by UNIDO and the PEE, as required. A field visit report will be prepared to ensure adherence to the agreed work plan.

278. Annual monitoring will be done through PSC meetings which will take place once a year with a UNIDO representative present. Yale as PEE may also organize additional PCS meetings, as required. The first of such meetings will be held within 12 months of the start of full project implementation or as agreed during the Inception Meeting. The final evaluation will be performed at the end of project life and will consider the implementation of the project as a whole, paying attention to whether the project has achieved its stated objectives and contributed to the global environmental objective.

?*Reportorial Requirements*

279. Regular reporting of the achievement of the project objectives and activities forms part of the monitoring and evaluation process.

Inception Report (IR)

280. An Inception Workshop (IW) will be held within the first 3 months of project start. The IW will serve as the official launch of the project to and to provide relevant stakeholders and project partners of the overview of the project, the the first year Annual Work Plan (AWP) including appropriate indicators and related means of measuring performance. A detailed schedule of project review meetings and related M&E requirements and reporting activities, including the scheduling of the mid-term review and final evaluation, will also be developed during the IW. Subsequent meetings of the PSC will be planned and scheduled, too. The first PSC meeting should be held within the first 12 months following the IW. As an overall objective, the meeting will provide an opportunity to all partners to better understand and assimilate the goals and objectives of the project and take ownership of the project.

281. A Project Inception Report (IR) will be prepared at the beginning of project implementation and immediately following the Project Inception Workshop (IW). It will include: (i) a detailed Annual Work Plan (AWP) for the activities of the first year of the project; (ii) a fine-tuning of verifiable indicators and corresponding means of verification to effectively measure project performance during the targeted 12-month timeframe of the AWP; (iii) a detailed project budget for the first year of implementation, prepared on the basis of the AWP. The Inception Report has to be prepared by Yale and agreed with UNIDO.

Project Implementation Report (PIR)

282. The Project Implementation Report (PIR) is an annual management and monitoring process. It is an essential monitoring tool for project managers and offers the main vehicle for extracting lessons from ongoing projects. Once the project will be under implementation for a year, the project team shall complete the PIR. The annual PIR is the main tool used by the GEF for monitoring its portfolio and reviews financial status, procurement data, impact achievement and progress in implementation. Final PIR will be submitted to GEF as per standard procedures.

Project Terminal Report

283. During the last three months, the PEE will prepare the Project Terminal Report (PTR), which will be the last PIR. It will be a comprehensive report summarizing the results achieved, areas where results may not have been achieved and lessons learned. The Project Terminal Report and the final evaluation (FE) report will form the final project documentation package to be discussed with the PSC during the Terminal Project Workshop.

284. The Terminal Project Workshop (TPW) will be held in the last month of project implementation. The TPW will be aimed at assessing the implementation of the project as a whole and if it has achieved its stated objectives and contributed to the broader environmental objective. Particular focus will be given to lesson learned and opportunity for sustainability and replicability of the project?s results.

285. The Project Terminal Report (PTR) will be the definitive statement of the Project?s achievements. This comprehensive report will be the overall evaluation of the project and will summarize all activities, outputs and outcomes of the Project, objectives met (or not met), structures and systems implemented, etc., paying particular attention to whether the project has achieved its immediate objectives and contributed to the global environmental objective. It will also serve as a source of lessons learned and will lays out recommendations for follow-up activities that may need to be taken to ensure sustainability and replicability of the Project?s activities. The PEE will prepare the PTR during the last three months of the project lifetime. It shall be prepared in draft sufficiently in advance to allow review and technical clearance prior to the final PSC meeting.

Thematic Reports

286. As and when called for by UNIDO, the project team will prepare specific Thematic Reports, focusing on specific issues or areas of activity. The request for a Thematic Report will be provided to the project team in written form by UNIDO and will clearly state the issue or activities that need to be

reported on. These reports will be used as a form of lessons learned exercise, specific oversight in key areas, or as troubleshooting exercises to evaluate and overcome obstacles and difficulties encountered.

Technical Reports

287. Technical Reports are detailed, comprehensive documents covering specific areas of research within the framework of the overall project. The key areas where Technical Reports are expected to be prepared during the course of the Project will be individuated during annual PSC meetings. Technical Reports may also be prepared by external consultants and will be used as working documents for the Project implementation as well as to disseminate relevant information at local, national and international levels.

Project Publications

288. Project Publications in the form of articles in academic and peer-reviewed journals, multimedia publications, informational texts or other forms of distribution, will represent a method for a widely dissemination of relevant results and achievements of the Project. Publications can be based on Technical Reports, or may be summaries or compilations of a series of Technical Reports and other research. The project team will determine if Technical Reports merit formal publication, and will also (in consultation with UNIDO, the governments and other relevant stakeholder groups) plan and produce these Publications in a consistent and recognizable format. Publications setting out methodologies adopted in this project, achieved results and lessons learnt will be distributed to the industry, governments, Parties to the Convention. Any publication will observe UNIDO and GEF advocacy guidelines.

Independent Evaluations

Midterm Review

289. The mid-term review (MTR) will be undertaken at mid-term (end of year 3 of project implementation) by an independent consultant to review the progress of each project activity and assess effectiveness of implementation according to the project?s indicators presented in the Project Results Framework. The Terms of Reference for this mid-term review will be prepared UNIDO.

290. The MTR will assess the effectiveness, efficacy and timeless of project execution, evaluate the effectiveness of the Partnership composition and of the interaction between partners, identify potential issues which could prevent optimal development of the project. This assessment will be extended to the administrative aspects and will also consider the provision of financial resources and co-financing provided by the project partners. The MTR findings could propose recommendations and remedial actions to be incorporated as improvement in the implementation strategy and execution for the remainder of the project?s duration, if necessary. This review will also highlight initial technical achievements, achievement of GEBs and lessons learned derived from project implementation. The final MTR report will be reviewed by UNIDO and presented to the PSC.

Final Evaluation

291. The final evaluation (FE) is under the responsibility of UNIDO and will, ideally, begin three months before the completion of the project and after the end of the main planned project activities. This will allow the independent consultant to carry out the evaluation when major activities are already completed but with the project team still in charge. The final evaluation will focus on the same issues as the mid-term evaluation. However, since all the planned project activities set-out in the Project Results Framework will be completed at the start of the evaluation, a greater focus on identifying and extracting project impacts including the contribution in building local capacity, the achievement of global environmental goals, lesson learned, sustainability and replicability of project results will be reserved. This evaluation will be performed on the basis of the delivery of the project?s results as initially planned, eventually as corrected after the mid-term evaluation, if any such correction took place. The FE will also provide recommendations on how to disseminate products and outputs of the project most efficiently within and outside the country. The Terms of Reference for this evaluation will be prepared by UNIDO in accordance with the generic TORs developed by its Independent Evaluation

Division. The PMT and other stakeholders will be involved and consulted during the terminal evaluation process.

Legal Context

292. Legal clause for global projects: ?It is expected that each set of activities to be implemented in the target countries will be governed by the provisions of the Standard Basic Cooperation Agreement concluded between the Government of the recipient country concerned and UNIDO or ? in the absence of such an agreement - by one of the following: (i) the Standard Basic Assistance Agreement concluded between the recipient country and UNDP, (ii) the Technical Assistance Agreements concluded between the recipient country and the United Nations and specialized agencies, or (iii) the Basis Terms and Conditions Governing UNIDO Projects?.

293. Indonesia (Republic of) ?The Government of the Republic of Indonesia agrees to apply to the present project, mutatis mutandis, the provisions of the Revised Standard Technical Assistance Agreement concluded between the United Nations and the Specialized Agencies and the Government on 29 October 1954 and as amended on 17 November 1966.?

294. Jordan (Hashemite Kingdom of) ?The Hashemite Kingdom of Jordan agrees to apply to the present project, mutatis mutandis, the provisions of the Standard Basic Assistance Agreement between the United Nations Development Programme and the Government, signed and entered into force on 12 January 1976.

295. Peru (Republic of) ?The Government of the Republic of Peru agrees to apply to the present project, mutatis mutandis, the provisions of the Revised Standard Technical Assistance Agreement concluded between the United Nations and the Specialized Agencies and the Government on 30 March 1956.?

296. The Government of the Republic of Serbia agrees to apply to the present project, mutatis mutandis, the provisions of the Standard Basic Framework Agreement between the United Nations Development Programme and the Government of Socialist Federal Republic of Yugoslavia (SFRY), signed on 24 March 1988. SBFA is with the Government of the Socialist Federal Republic of Yugoslavia, signed on 24 March 1988 and entered into force on 19 December 1988 or BASIC TERMS AND CONDITIONS GOVERNING UNIDO PROJECTS.

297. Uganda (Republic of) ?The present project is governed by the provisions of the Standard Basic Cooperation Agreement between the Government of the Republic of Uganda and UNIDO, signed on 27 May 1994.?

298. Ukraine ?The Government of Ukraine agrees to apply to the present project, mutatis mutandis, the provisions of the Standard Basic Assistance Agreement between the United Nations Development Programme and the Government, signed and entered into force on 18 June 1993.?

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)?

299 The GGNIP programme is expected to yield the following socioeconomic benefits at the national and local levels:

300. Knowledge management and capacity building for local beneficiaries which has a snowballing effect on impacting public support towards Global Greenchem project and usage of green chemicals allowed by international environmental standards. The Programme also provides immense benefits in terms of educating industries, enterprises, factory owners, workers, and primary users of toxic chemicals on greenchem alternatives. As well as promoting the production of less toxic waste streams even in traditional manufacturing processes.

301. The Greenchem program is designed to promote clean manufacturing and production in industrial processes such as textiles, metallurgy, foam production, paper, and packaging. With the project?s global primary focus on reducing emissions of POPs, it will therefore have co-benefits of reducing mercury which has been acknowledged by all targeted countries of the program.

302. Addressing the environmental and health hazards associated with POPs PFOS, HBCDs, SSCP, and mercury is crucial to ensure that highly desired development gains in thematic sectors are not compromised. The GEF-funded GreenChem project will define at-risk populations across participating countries, together with the development of national priority actions to address such risks. Project activities in specific project components will involve consultation with at-risk communities with the aim of increasing their understanding about the dangers of POPs and mercury exposure, providing vulnerable communities with clear, practical information to protect themselves. This will likely involve, but not limited to, communities living in close proximity to paper, pulp, garment, insulation, and textile manufacturing industries including waste management plants in participating countries.

303. The productive sectors in participating countries, including employees working within these processing industries will also be key project beneficiaries as the project will work closely with industry partners to improve understanding of risks arising from POPs and mercury usage, management, and release, as well as implementing green chemistry technologies available that can replace traditional technologies which use POPs. It is envisaged that the elimination of hazardous chemicals by this the project will also lead to improved working conditions for employees currently at occupational risk of POPs and/or mercury exposure.

304. Access to training on Occupational health and safety, Resource Efficient and Cleaner Production and Green Chemistry concepts, including BAT/BEP, information on new technologies, skills and knowledge sharing are benefits which the participating entriprises, industries and countries will attain from the project.

305. Most importantly, the socio?economic benefits of the proposed project will be the reduced amount of POPs and mercury releases in the environment and consequently the reduction of human exposure. The sound management of chemicals such as POPs and Hg at the national level will contribute towards the mitigation of global environmental problems associated with heavy metals and POPs environmental pollution. In concrete terms, these benefits translate to the achievement of global environmental commitments made in the Stockholm Convention on POPs (articles 3, 5, 6 and correlating articles). Some Global GreenChem programmatic aspects proliferate and directly support the Minamata Convention on mercury.

Effects of unsound chemical and waste management in participating countries

306. The need and urgency for programs such as the GreenChem is especially essential in countries like **Ukraine,** where there has been unsound disposal of PCBs and outdated prohibited pesticides. Issues regarding POPs are the unintentional generation of dioxins and furans that widely take place during the burning of chlorine-containing materials. In Ukrainian industries like pesticides, metalworking, textile, leather, plastics, paint production POP-containing compounds is still utilized for running industrial processes in an outdated manner.

307. The **Ugandan** textile industry relies on POPs (Perfluorohexanesulphonic acid (PFHxS) and C6-perfluorinated compounds). C6-perfluorinated compounds are commonly used as liquid repellants in textiles and in electrical cables insulation.

308. **Indonesia?s** POP release is accounted for in the pulp and paper industries as well as the paint industry emitting PCDD/PDCF and (per- and polyfluoroalkyl substances (PFAS)). As an alternative to the status quo, the GreenChem pilot proposes the usage of fluorine-free green chemicals addressing PFOS in paper, textiles, and paint industries in Ukraine, Uganda, and Indonesia.

309. Insulation in **Jordan**, is challenging in the construction, chemical & manufacturing industries with the unsound use of HBCD in EPS/XPS. After the survey, companies leading the insulation sector confirm that Flame retardant (FR) Expanded Polystyrene (EPS) Foam production is frequently used in the local Construction/building insulation sector due to its commercial viability, and ease of production. EPS however is associated with the HBCCD flame retardant additives. Industrial POPs such as HBCDD is of major concern due to its bioaccumulation and detrimental effects that extend through food chains. HBCDD is also used in the production of FR/EPS.

310. For the case of **Serbia,** PBDEs, PCBs POPs are especially utilized and released from electrical equipment, automotive, and production of energy for heating. Significant unintended sources of POP industrial chemicals?polychlorinated biphenyls (PCBs), hexabromocyclododecane (HBCDD), polybrominated diphenyl ethers (PBDEs), and perfluorooctanesulfonic acid (PFOS) are emitted in Serbia through open burning processes. PBDEs in vehicles in Serbia were around 13 tons, while cathode ray tube casings in electrical and electronic equipment were approx. 136.9 tons. Similarly, HBCDD on the Serbian market was around 37.3 tons in 2019. The GreenChem program intends to support these countries to drastically reduce the usage of these POPs and transition to cleaner alternatives.

311. In **Peru**, the plastics sector and its manufactures have been becoming a good option for the Peruvian consumer. The purchase of materials and inputs to produce different kinds of plastics has led to a skyrocket in demand for manufactured goods from other sectors. Among the sectors that demand it are the automotive industry, construction and building, medicine, electrical and electronics, food, and agriculture, among other sectors. It should be remembered that Peru is a net importer of plastic in its primary forms, 99% of the inputs are of foreign origin, according to figures from the Plastics Committee of the National Society of Industrialists (SNI). Among the types of raw materials demanded by this market are polypropylene (PP), polyvinyl chloride (PVC), polystyrene (PS), polyethylene terephthalate (PET) and others such as epoxy and allide resins. The plastics industry represents 4% of the industrial GDP and generates approximately 200 000 jobs in Peru. In 2013 and 2014, the plastics industry grew 17.3% and 7.9% respectively, influenced by an increase in demand for PVC pipes and fittings and the greater dynamism of other industries such as those that manufacture soft drinks (bottled water, soft drinks, rehydrating beverages) which required a greater number of containers and labels. In the first four months of 2019, the industrial production of plastics products grew 4.2% compared to the same period of the previous year. This higher production activity was mainly explained by mainly due to the increase in demand for plastic pipes (PVC) and the higher production of plastic plates, sheets, and tapes.

312. As part of the Green chem program, shifting to the use of clean chemicals is associated with numerous benefits which have been categorized into environmental, social, regulatory, and economic. Envisaged risks or potential drawbacks stemming from enterprises and industries are also being considered.

313. **Social Benefits**

Below mentioned are direct social benefits of the Green chem program:

•- Less release of hazardous chemicals to land, air, and water will have an immediate positive impact on the health of local communities, at-risk populations (community in close proximity to factories), workers, and end consumers

•- Reduce risks associated with handling, storage and transportation of hazardous chemicals

•- Positive effect on woman?s and children?s health, for example, the Ukrainian textile industry accounts for more than 2300 plants wherein approximately 90% women are employed.

•- Increasing safety for workers: less use of toxic materials, less personal protective equipment required, less severe consequences in case of accidents arising from occupational hazards.

•- Safer products will become available for customers.

•- Enhance safe and responsible management of hazardous chemicals, will ensure employees protection, safer and healthier job environments

•- Reducing/eliminating POPs will simultaneously reduce accidents and near misses leading fewer downtimes due to investigations and less insurance liability.

314. Environmental Benefits

- Highlighted below are the environmental benefits of the Green chem program:

•- Reduction in hazardous waste to be treated or disposed of, reducing the application of landfills and their adverse impacts (leachate & LFG) on the environment (water resources & climate change)

•- Reduction of airborne pollutants from building insulations containing in case of fire incidents and its negative impacts on water sources, land, human and wildlife

•- Emissions reduction in PFHxS: Example, in Ugandan textile industry alone, approximately 375 tons/year of PFHxS containing material is produced and 1.41 tons/year emitted to the environment.

•- Eliminating the use of PFHxS containing substances and their salts which have been identified as candidate POPs and proposed to be listed under the Stockholm Convention.

•-Reducing POP in wastewater: In textile industry, water consumption constitutes 200-300 dm3/kg of fabric, the application POPs eminently makes it a component of waste water. It significantly complicates wastewater treatment process as these substances are nonbiodegradable in the environment and hardly removed by other treatment methods.

316. **Standards and Regulatory Benefits**

•The GreenChem program is expected to positively trigger new environmental policies and standard in countries and sectors, it?s implemented.

•-Creation of a stronger community of practices in the implementation of green chemicals

•- Development of guidelines to operationalize the chemicals management regulations and facilitate the promotion of BAT/BEP for chemicals management in targeted sectors

•- Dissemination of results of the successfully the implemented pilot, and capacity building for institutions involved in managing POPs, which is required for upscaling and replication of piloted project initiatives

317. **Economic Benefits**

•318. The accelerator programme will support start-ups and SMEs, local businesses equipped with better knowledge, technology, and funding. Greenchem project intends to develop a green chemistry innovation network, with keen focus on innovation accelerators and start-up incubators. The elimination of POPs involves various set of activities such as import control, rigorous lab analysis (e.g. XRF/LCMS analysis for EPS beads), national monitoring plan, annual tests etc. All this translate to resources and workforce thereby flourishing the national economy of participating countries

•319.A huge network of beneficiaries such as new suppliers (equipment, raw material), importers, and other green startups will focus on safe green materials.Companies implementing Green Chemistry alternatives (Green FR EPS foam) will have a competitive edge which opens export lines to USA & Europe where stringent environmental importations restrictions are applied. By deploying GreenChem solutions, enterprises become resilient against state environmental regulations whilst at the same time attracting more customers that prefer doing business with eco-responsible enterprises.

•320. The GreenChem project solutions supports sustainable production & purchasing, which motivates suppliers to activate the green raw-material production lines thereby encouraging competitiveness towards a green economy.

•Energy reductions are direct benefits from the use of green-based raw materials as the extraction, operation will be less costly. Ideally, this should be less expensive for the implementing companies, whilst reducing CO2 emissions and contributing to a green economy.

•321. The integration of Green Chemistry solutions and its associated capacity building, nurturing of green researchers & entrepreneurs create job opportunities which in turn promote economic development.

•322. For the case of Serbia, the benefit-cost the ratio of eliminating and subsequently phasing out PBDE-a POP chemical its estimated that more than ? 68million over 5years could be saved from medical treatment on carcinogenic and non-carcinogenic diseases arising from occupational hazards. And about 24.5 million is estimated as the cost of disposal and de-contamination scenario for a 5-year phase-out.

•323. Elimination of toxic substances in raw materials and waste means no special requirements for storage, handling and waste of chemicals. This translate in costs reduction for waste management and disposal of POPs.

324. Envisaged Challenges/ Drawbacks

325. In different sectorial markets (textiles, paper, pulp, paints, insulation, etc.) where GreenChem alternatives will be demonstrated, some drawbacks from participating enterprises are envisaged:

•326. Replacement of POPs by GreenChem alternatives may affect the final product quality:

•- Safer end products could however be more expensive which is offset by the lower cost of treating health problems, additionally meet the high international standards and reaching more health-concerning markets like EU who pays more for better products implementation of a GreenChem alternative most likely may result in an increased production cost which may offset prices for consumers;

●- High price tag set for the GreenChem alternatives hinder the purchase and supply process especially for SMEs;

●- GreenChem alternative non-compliance with performance and product specifications;

●- Delayed formalization of Orders and import process due to detailed internal procedures and delayed delivery of raw materials from the supplier

●- Consider trials for all available fluorine free alternatives so as to ensure that customer needs for repellence in the final product is not lost as a result of eliminating the use of PFHxS containing substances.

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.

ESMPs are provided in Annex I.

Supporting Documents

Upload available ESS supporting documents.

Title	Module	Submitted
Annex I Pilot information and ESMPs_20211123	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).

Project Narrative	Indicator	UNIDO IRPF indicators	Baseline	Target	Sources of Verification	Assumptions/ Risks
Project objective: To scale up green chemistry for POPs, mercury and microplastics replacement through capacity building and innovation, and creation of a global unifying green chemistry network for implementation and uptake.						
	Component 1. Green Chemistry Innovation and Inclusion Network for Capacity Building					
Outcome 1.1. Functional Green Chemistry Inclusion Network	Functional Green Chemistry Inclusion Network: Human capital is developed to take an active role in safer chemical substitution to reduce hazardous chemicals including POPs and mercury.	TCO.1: Number of capacity building activities provided ENV.5: Number of new or improved green products made available or used TEC.2: Number of countries showing the adoption of new technologies	Functional global Green Chemistry Inclusion Network not available	See below	See below	Yale University, national executing agencies and stakeholders eager to develop a strong and inclusive green chemistry ecosystem that supports innovation and entrepreneurship
Output 1.1.1. Developed and provided training and awareness events						

Project Narrative	Indicator	UNIDO IRPF indicators	Baseline	Target	Sources of Verification	Assumptions/ Risks
Activity 1.1.1.1. Creating the framework for the Green Chemistry Innovation and Inclusion Network (Year 1-6)	Diverse Leadership Committee formed. ? # of female leaders on the leadership committee	See above	No Leadership Committee exists	Leadership Committee formed in Year 1 with a minimum of eight (8) members representing academia, industry and NGOs, with gender consideration.	Meeting agendas and minutes Meeting participants (female/male)	Yale University, national executing agencies and stakeholders eager to develop a strong and inclusive green chemistry ecosystem that supports innovation and entrepreneurship
Activity 1.1.1.2. Web-based Green Chemistry Global Innovation and Inclusion Network (Year 2-6)	Number of network members (f/m) Number of countries represented by the membership. ? # of female experts in the web-based network ? # of female entrepreneurs and women-led organizations in the web-based network ? # of female researchers/experts in the web-based network ? # of female-led investors in the web-based network ? # of mentoring sessions initiated by female participant in the web-based network	See above	No online portal present	Online network opens in Year 2. The number of network members increases at least 10% each year (Year 3 ? 6). 20 countries are represented by the membership.	Network membership (female/male) Website analytics data	

Project Narrative	Indicator	UNIDO IRPF indicators	Baseline	Target	Sources of Verification	Assumptions/ Risks
Activity 1.1.1.3. Awareness events and training are incorporated into the Network inform and educate on green chemistry (Year 1-5)	# of awareness events # of female instructors for virtual and in person training % of women participating in the (in-person) trainings % of women participating in the (in-person) events # of webinars # of Train-the Facilitators workshops including gender considerations	See above	Trainings on green chemistry not dispersed and not coordinated	At least (5) five online awareness events. At least (4) four webinars in Year 1 At least 8 webinars total in Years 2-5. 5 Train-the-Facilitators workshops (1 workshop each in Jordan, Indonesia, Peru, Ukraine, and Uganda) with at least (20) twenty attendees each.	Meeting participants (female/male) Webinar schedule (female/male) Event schedule (female/male)	
Output 1.1.2. Networking mechanism in place through established programmatic content schedule						
Activity 1.1.2.1. Programmatic content schedule (Year 1-6)	# of resources in the online portal	See above	Materials for capacity building dispersed throughout individual centres. Materials through GGCI need additional content, for example policy.	# of resources in the online portal increases annually by 15 % Years 3 to 6.	Resources in the online portal Website analytics	Yale University, national executing agencies and stakeholders eager to develop a strong and inclusive green chemistry ecosystem that supports innovation and entrepreneurship

Project Narrative	**Indicator**	**UNIDO IRPF indicators**	**Baseline**	**Target**	**Sources of Verification**	**Assumptions/ Risks**
Activity 1.1.2.2. Networking for the Innovation and Inclusion Network members (Year 3)	# of members with repeat visits to the online network (f/m)	See above	No adequate networking support to ensure Inclusion Network growth	# of members with repeat visits to the online network per quarter increases ever year.	Meeting participants (female/male)	
Activity 1.1.2.3. Conference for the global members to present case studies related to green chemistry innovation (Year 1-6)	# green chemistry symposia hosted by the network # of case study led by women # of female participants in the conferences	See above	Symposia on international green chemistry case studies not present	At least one (1) green chemistry symposium per year hosted for the inclusion network members	Speaker invitations (male/female) Speaker presentations Conference agenda	
Output 1.1.3. Mobilized Network to support Accelerator Programme						
Activity 1.1.3.1. Expert training (Year 2-3)	# of judges, administrators, and mentors trained (f/m)	See above	No experts trained in philosophy and methodology of the accelerator programme	At least (20) twenty judges, administrators, and mentors (total) trained in each of the 6 countries.	Training records (male/female)	

Project Narrative	Indicator	UNIDO IRPF indicators	Baseline	Target	Sources of Verification	Assumptions/ Risks
Activity 1.1.3.2. Database of green chemistry technologies that can be transformed into the commercial green chemistry solutions. (Year 2-6)	# of green chemistry technologies added to the database	See above	Technology compendium from global Green Chemistry Initiative	Twenty (20) green chemistry technologies added to the database	Comparison of database versions	Yale University, national executing agencies and stakeholders eager to develop a strong and inclusive green chemistry ecosystem that supports innovation and entrepreneurship
	Component 2: Green Chemistry Accelerator Programme					

Project Narrative	Indicator	UNIDO IRPF indicators	Baseline	Target	Sources of Verification	Assumptions/ Risks
Outcome 2.1.: Regional Accelerator Programmes developed and implemented	**Regional Accelerator Programmes developed and implemented** : Regional innovation ecosystems accelerate the design and implementation of safer chemistries as alternatives to hazardous chemicals including POPs and mercury.	TCO.1: Number of capacity building activities provided ENV.2: Cumulative tons of pollutants reduced or phased out TEC.2: Number of countries showing the adoption of new technologies				
Output 2.1.1: Accelerators established with completed curriculum training for Judges, Mentors and Administrators						

Project Narrative	Indicator	UNIDO IRPF indicators	Baseline	Target	Sources of Verification	Assumptions/ Risks
Activity 2.1.1.1. Develop curriculum and Accelerator Guidebook to guide in the operation of the accelerator programme. (Year 1-2)	Curriculum and Accelerator Guidebook established. # of curriculum and training materials which are gender responsive	See above	No green chemistry accelerator and guidebook available	Curriculum and Accelerator Guidebook established by end of Year 2.	Curriculum, (1) one Accelerator Guidebook	Yale University, national executing agencies and stakeholders eager to develop a strong and inclusive green chemistry ecosystem that supports innovation and entrepreneurship
Activity 2.1.1.2. Expert training (Year 2-3)	# of female expert trained	See above	No expert	At least 30% of the experts are female	Expert selection documentation	
Activity 2.1.1.3. Recruitment (Year 3-5)	# of accelerator applications # of applications from women-led ventures # of ventures receive gender sensitization training or materials	See above	No applications	At least fifteen (15) applications per country (Jordan, Peru, Indonesia, Serbia, Ukraine, Uganda) each year of the accelerator program At least 30% of all submitted applications should be women-led ventures.	Accelerator selection documentation	

Project Narrative	Indicator	UNIDO IRPF indicators	Baseline	Target	Sources of Verification	Assumptions/ Risks
Activity 2.1.1.4. Accelerator Programme (Year 3-5)	# of ventures accepted into accelerator program (f/m led) # of ventures receiving Global Virtual Training (f/m led) # of ventures receiving Nation Specific in-person Training (f/m led) # of ventures receiving 1-on-1 Technical Support (f/m led)		No existing accelerator program that enables ventures to receive training and participate in demonstration project negotiations	(10) ten ventures accepted into accelerator programme per country per accelerator round Ten (10) ventures receiving Global Virtual Training per country per accelerator round Ten (10) ventures receiving in Nation Specific in-person Training per country per accelerator round 10 (Ten) ventures receiving 1-on-1 Technical Support	Accelerator cohort documentation Training records	

Project Narrative	Indicator	UNIDO IRPF indicators	Baseline	Target	Sources of Verification	Assumptions/ Risks
Activity 2.1.1.4. Demonstration Projects (Year 3-5)	# of negotiations initiated between startups and entities about demonstration project (f/m led startups)	See above	No existing accelerator program that enables ventures to receive training and participate in demonstration project negotiations	At least 2 (two) negotiations initiated between startups and entities about demonstration project per country per accelerator round.	Email documentation Meeting requests/agendas	
Output 2.1.2: Business competitions held (?Innovation Challenges?)						
Activity 2.1.2.1. Defining the challenge (Year 3-5)	# of ?challenge? submissions from industry/government # of female participants in the Innovation Challenges	See above	No challenge submissions present	Five (5) ?challenge? submissions from industry/government per country	The list of challenges	
Activity 2.1.2.2. Business Competitions (?Innovation Challenges?) (Year 3-5)	# of registrations per hackathon (f/m) # of idea submissions to each challenge (f/m)	See above	No submission ideas to the established challenge	Forty (40) registrations per hackathon Five (5) idea submissions for challenge	List of hackathon registrants (female/male) Idea submission documentation	
Output 2.1.3. Global winners connected to further technical resources, investors, and commercial partners						

Project Narrative	Indicator	UNIDO IRPF indicators	Baseline	Target	Sources of Verification	Assumptions/ Risks
Activity 2.1.3.1. National Judging Day (Year 3-5)	# of ventures finishing the program in Years 3-5 (f/m led) # of registrants for each regional accelerator?s National Judging Day in Years 3-5 (f/m) # of registrants for the Global Green Chemistry Accelerator Competition in Years 3-5 (f/m) # letters of intent to enter into potential negotiations for investment after each National Judging Day in Years 3-5 (f/m led) # of letters of intent that enter into negotiations for potential investment after each Global Green Chemistry Accelerator Competition in Years 3-5 (f/m led) # of winners who are female or women-led companies	See above	No ventures finish the programme No Judging Day present No startup negotiations present	(7) eight ventures per country successfully finishing the programme per accelerator round. Fifty (50) registrants for each regional accelerator?s National Judging Day Seventy-five (75) registrants for the Global Green Chemistry Accelerator Competition At least one (1) letter of intent to enter into negotiations for potential investment after each National Judging Day. At least one (1) letter of intent to enter into negotiations for potential investment after each Global Green Chemistry Accelerator Competition.	List of hackathon registrants (female/male) Idea submission documentation	Yale University, national executing agencies and stakeholders eager to develop a strong and inclusive green chemistry ecosystem that supports innovation and entrepreneurship

Project Narrative	Indicator	UNIDO IRPF indicators	Baseline	Target	Sources of Verification	Assumptions/ Risks
Activity 2.1.3.2. Post-Competition Support (Year 3-6)	# of ventures still operational 3 years after the National Judging Day (f/m led) # of participating entrepreneurs in accelerator alumni network after 1 year (f/m)	See above	Demonstration projects not present or accelerated	Two (2) two businesses per country still operational 3 years after the National Judging Day (20) twenty entrepreneurs in alumni network per country after 1 year.	List of operational business available	
	Component 3: Green Chemistry alternatives for POPs, mercury and micro-plastics for upscale and replication					
Outcome 3.1. Green Chemistry alternatives for POPs, mercury and microplastics implementation and upscaling of successful demonstrations						
Output 3.1.1. Green Chemistry alternatives for POPs, mercury and microplastics implemented	? # of the demonstration projects implemented; ? Amount of POPs production reduced (tons/year;) ? Amount of POPs-containing material reduced (tons/year) ? # of demonstration companies which are female-led ? # of female employees in the pilot companies ? # of policies or standards reviewed from gender perspectives	ENV.2: Cumulative tons of pollutants reduced or phased out ENV.5: Number of new or improved green products made available or used	GC has not been applied for POPs demonstration at a large scale	At least 6 demonstration projects (1 per participating country) GEB targets as outlined in the Core Indicator sheet	Demonstration reports, progress reports	Governments are supporting GC alternatives for POPs reduction and private sectors are committed to support the demonstration projects

Project Narrative	Indicator	UNIDO IRPF indicators	Baseline	Target	Sources of Verification	Assumptions/ Risks
Output 3.1.2. Replication mechanisms of green chemistry alternatives for national, regional and global level up-take developed and implemented	? # of developed case studies, which include replicable and templatized implementation procedures from the pilot demonstrations ? # of the GC replication strategies se-up ? # of the companies replicating GC demonstrations under output 3.1.2. ? # of the enterprises that now use GC alternatives supported by the project ? # of female participants in workshops and training on lessons learned and GC practices ? # of knowledge management documents which are gender responsive ? # of women-led companies in the replication phase	See above	GC has not been applied for POPs demonstration at a large scale	At least one case study/per country developed 6 GC replication strategies (1 per country) outlined and implemented Replication of GC to achieve additional GEBs, as outlined in GEB CEO endorsement	Demonstration case study reports, progress reports	

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).

Comments	Response
Comments from the GEF Council	

Japan Comments The below comments from Japan were provided prior to the Council meeting. An initial agency response was provided and can be found in the list of documents specific to the project in the GEF Portal. Japan Comment 1 ? Programs and Projects in Chemicals and Waste focal area are barred from producing the global environmental benefits indicated in the Project Identification Forms (PIF) due to the COIVD-19 outbreak, as many developing countries have suspended recycling and waste treatment, in an effort to reduce the risk of waste-treatment workers against COVID-19 virus infections. As a result, wastes including single-use plastic, medical wastes and hazardous materials have surged, resulting in widespread and illegal dumping and storage (a phenomenon which does not happen in Japan). According to our own experts, these problems are caused by a lack of technology and infrastructure (including automated intermediate treatment technology and Waste-to-Energy facilities such as incinerators), weak regulatory systems and low awareness among stakeholders. From this context, Projects (GEF ID: 10353, 10519, 10523, 10543) should be based on developing alternative scenarios that focus on sustainable recycling and waste treatment practices, taking into account pandemic risks arising from the COVID-19 outbreaks, to achieve the Global environmental benefits envisioned in the PIF. We recommend that programs in this focal area build stronger partnerships with various relevant stakeholders to address such root causes under the COVID-19 outbreak.	**Japan Comment 1** For GEF ID 10353 the focus is on t POPs and/or Hg at the production not on recycling and waste tre However, the COVID-19 situation i alternative scenario with following c Activity 1.1.1.1. Creating the fr Green Chemistry Innovation and In The leadership comitee will convene Activity 1.1.1.3. Awareness events incorporated into the Network infor green chemistry - In-person tra Facilitator) will be provided if CO are met. Training will be accomm smaller groups, or will be perfo necessary. Activity 1.1.2.2. Networking for th Inclusion Network members (Year 1 events that may be initiated will be all required health and safety prot exposure to COVID-19. Activity 1.1.2.3. Conference for th to present case studies related to nnovation (Year 1-6) - Over the period 2020-2021, conferences have to foster networking even when virtually; therefore, the project continue to be achieved and adve COVID-19 is not anticipated Activity 2.1.1.2. Recruitment Recognizing COVID-19 has an in and global travel restrictions as preferences, the pool of judges and sufficiently sized to accomm limitations in travel while assuring p are achieved. Activity 2.1.1.3. Accelerator Progra In-person training and technical su regionally-specific COVID-19 prac transitioned to a virtual format shou Activity 2.1.1.4. Demonstration Pr Although pilot demonstrations req virtual collaboration will minimize needed to meet COVID-19 understanding of corporate poli collaboration and implementation, changes due to COVID-19, will be selection process for pilot demonstr incorporated into the respective needed **Japan Comment 2**

Comments from the Minamata Convention Secretariat	
Minamata Convention Secretariat Comment 1 The description of efforts related to mercury in this project does not provide sufficient information for us to determine consistency with the Convention obligations or with GEF Guidelines for the Convention. In particular, it is unclear what sectors relevant to mercury use or mercury emissions and releases would be targeted. There is a brief mention of mercury use in mining, but since mercury use in mining is generally found only in ASGM, it is difficult to understand how industrial green chemistry approaches would be applied.	**<u>Minamata Convention Secretariat</u>** Hg will be included in compo capacity-building) and compon accelerator) ASGM are not part of this project.
Minamata Convention Secretariat Comment 2 Two of the project countries, Serbia and Ukraine, are not Parties to the Minamata Convention.	**<u>Minamata Convention Secretariat</u>** Yes, the reviewer?s comment is ack won?t be Hg interventions in these 2
Minamata Convention Secretariat Comment 3 The proposal discusses potential green chemistry deployment of replacement alternatives for mercury and microplastics in industry which would be evaluated during the project preparation stage. We note that for mercury-containing products and mercury use in industrial processes listed in the Convention, non-mercury alternatives are available.	**<u>Minamata Convention Secretariat</u>** Thank you for pointing that out. Yes offers non-mercury solutions to mer products.
Comments from STAP	

Minor issues to be considered during project design STAP welcomes the Global Greenchem Innovation and Network Programme, which aims to scale up green chemistry applications for POPs (HBCDD, SCCPs, and PFOs), mercury, and microplastics replacement through capacity building and innovation globally, starting with six developing countries. The project will create a network of green chemistry researchers and practitioners in the participating countries, build their capacity, and link them to relevant organizations and stakeholders. STAP has the following comments on the proposed project: STAP has the following comments on the proposed project:	- - - - - - - - - -
STAP Comment 1 ? The project objective on page 4 of the PIF is to scale up green chemistry for POPs, mercury and microplastics replacement through capacity building and innovation, and creation of a global unifying green chemistry network for implementation and uptake. However, paragraph 81 states that the project aims to prevent exposure of POPs, mercury, and microplastics in humans and the environment through the implementation of conscious design for inherently nonhazardous alternatives using green chemistry principles. It is suggested that these should be reconciled, and the objective and aim of the project should be consistent throughout the project document.	**STAP Comment 1** Thank you for pointing out that sm The objective of the project is to: To scale up green chemistry for P replacement through capacity innovation, and creation of a glob chemistry network for implementati
STAP Comment 2 ? Barriers: The PIF listed several barriers, including financial, regulatory, organizational, and cultural. Some of these barriers are significant. The project developer should provide information on how these barriers will be overcome.	**STAP Comment 2** The barriers to a wide spread imple chemicals have been revised and up Causes and Barriers section of the Barriers have been mapped to main barrier will be addressed with an ac the alternative scenario. Please ref tree, solution tree and theory of char **STAP Comment 3** The Theory of Change has been recommendation.
STAP Comment 3 ? It is good that a theory of change was included; however, the current version does not provide all of the necessary information expected in a functional theory of change. For example, the key assumptions, planned interventions, causal pathways, and outcomes are not clearly defined. 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).	
STAP Comment 4 ? While the proposed intervention of establishing a mechanism for consistent networking within the GGINP program is useful, the project should consider how small-scale businesses and the informal sectors will be engaged in the proposed network. It is also important to consider how the MOOCs can be designed to be accessible to these sectors. These actors are sometimes a major part of the chemical industries in many developing countries. Yet, they may not necessarily have the technical tools, financial capacity, and academic know-how to participate or access the useful information to be provided.	**STAP Comment 4** Thank you for this insightful comr programming will take place in the and will be disseminated through th Open Course (MOOC) which wil series and short awareness raising the MOOC will be free of charge an the web-based Innovation and In which will facilitate access fo developed and emerging countries a be asynchronous, and webinars

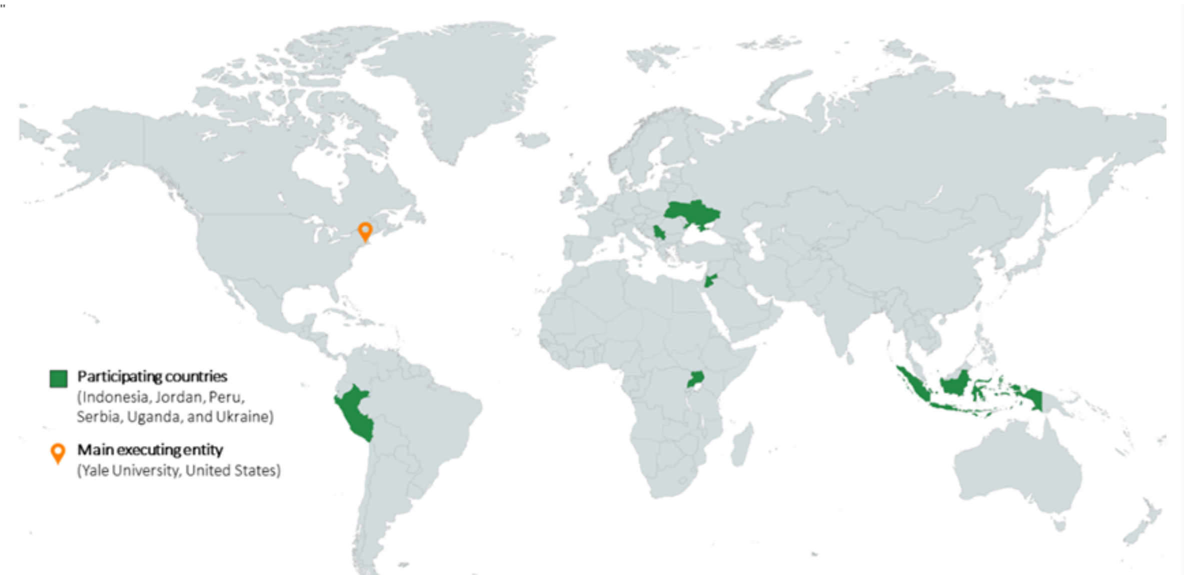
ANNEX C: Status of Utilization of Project Preparation Grant (PPG). (Provide detailed funding amount of the PPG activities financing status in the table below:

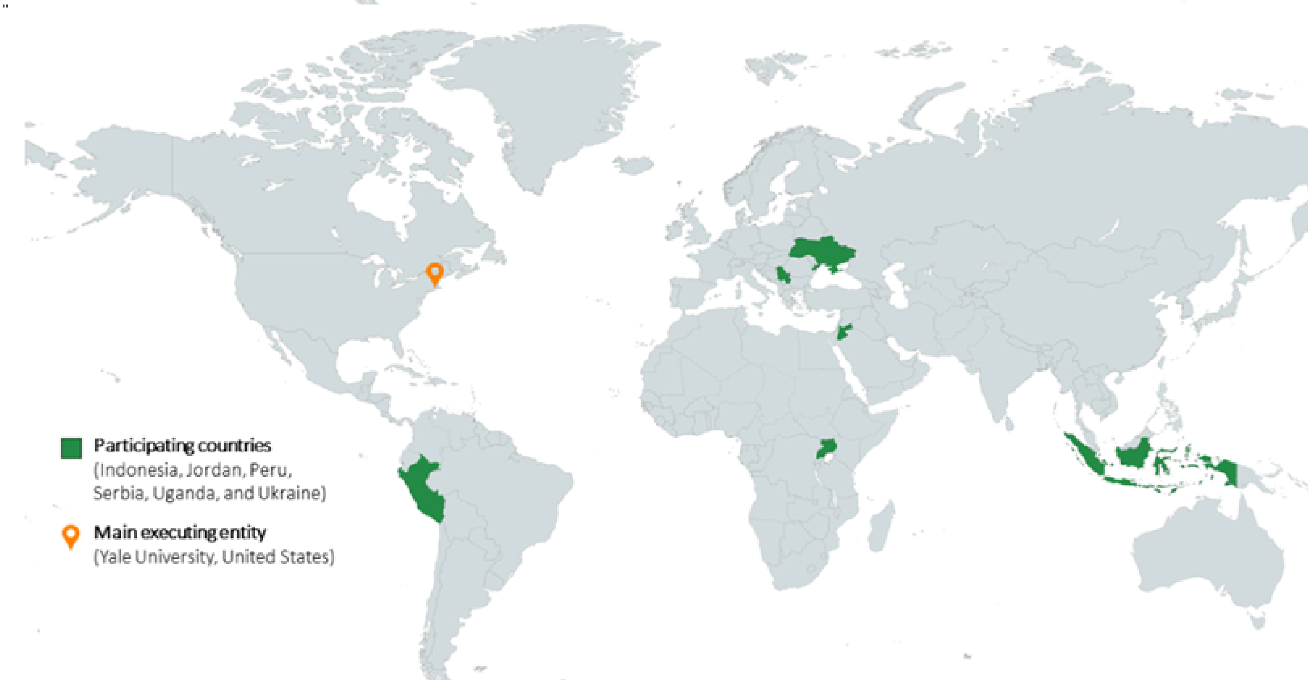
PPG Grant Approved at PIF: US$ 287,616			
Project Preparation Activities Implemented	***GETF/LDCF/SCCF Amount ($)***		
	Budgeted Amount	***Amount Spent Todate***	***Amount Committed***
Elaboration of Component 1 and 2 (1 contract)	112,000	112,000	0
Elaboration of Component 3 (6 contracts)	135,000	135,000	0
CEO support (technical and administrative)	40,616	39,078	
Total	287,616	286078	

PPG Grant Approved at PIF: US$ 287,616			
Project Preparation Activities Implemented	***GETF/LDCF/SCCF Amount ($)***		
	Budgeted Amount	***Amount Spent Todate***	***Amount Comm***
Elaboration of Component 1 and 2 (1 contract)	112,000	112,000	
Elaboration of Component 3 (6 contracts)	135,000	135,000	
CEO support (technical and administrative)	40,616	39,078	
Total	287,616	286078	

ANNEX D: Project Map(s) and Coordinates

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





ANNEX E: Project Budget Table

Please attach a project budget table.

Please see Annex U.

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.

Not applicable

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.

Not applicable

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).

Not applicable