 MOIT		

United Nations Development Programme

Project Document template for nationally implemented projects financed by the GEF/LDCF/SCCF Trust Funds

Project title: Application of Green Chemistry in Viet Nam to support green growth and reduction in the use and release of POPs/harmful chemicals		
Country: Viet Nam	**Implementing Partner: Ministry of Industry and Trade (MOIT)**	**Management Arrangements: National Implementation Modality (NIM)**
UNDAF/Country Programme Outcome*:* ***Outcome 2.1: Low-carbon, climate and disaster resilient development:*** By 2021, Viet Nam has accelerated its transition to low-carbon and green development, and enhanced its adaptation and resilience to climate change and natural disasters, with a focus on empowering the poor and vulnerable groups. ***Outcome 2.2: Sustainable management of natural resources and the environment:*** By 2021, Viet Nam has enhanced sustainable management of natural capital, biodiversity and ecosystem services and improved the quality of the environment, while contributing to the implementation of multilateral environmental agreements.		
UNDP Strategic Plan Output: **Output 1.3**: Solutions developed at national and sub-national levels for sustainable management of natural resources, ecosystem services, chemicals and waste. ***Indicator 1.3.1***: Number of new partnership mechanisms with funding for sustainable management solutions of natural resources, ecosystem services, chemicals and waste at national and/or subnational level. **Output 2.5:** Legal and regulatory frameworks, policies and institutions enabled to ensure the conservation, sustainable use, and access and benefit sharing of natural resources, biodiversity and ecosystems, in line with international conventions and national legislation. ***Indicator 2.5.1:*** Extent to which legal or policy or institutional frameworks are in place for conservation, sustainable use, and access and benefit sharing of natural resources, biodiversity and ecosystems.		
UNDP Social and Environmental Screening Category: Low risk	**UNDP Gender Marker:** GEN 2	
Atlas Project ID/Award ID number: : 00088146	**Atlas Output ID/Project ID number: 00094924**	
UNDP-GEF PIMS ID number: 5723	**GEF ID number: 9379**	

Planned start date: 2018	**Planned end date:** 2020
LPAC date: 31 March 2017	

Brief project description:

The project aims to create the enabling environment for the introduction of Green Chemistry in Viet Nam and introduce Green Chemistry applications in productive sectors with the purpose of reducing the use and release of chemicals controlled under Stockholm and Minamata Conventions. The project also expects to result in a reduction in the use and release of chemicals of concern not covered under the MEAs, as well as improve energy and natural resource efficiency and generate Green House Gas (GHG) release reduction co-benefits in the sectors and industries supported by the project.

The project will reduce the use of Persistent Organic Pollutants (POPs) and release of Unintentional Persistent Organic Pollutants (U-POPs) through the introduction of green chemistry approach in six industrial sectors in Viet Nam: chrome plating, pulp and paper manufacturing, plastic manufacturing, textile, pesticides and solvents. Specific guidance for each sector will be developed, and the green chemistry approach will be streamlined into the relevant legislation. Two industrial facilities from 2 different sectors (out of the above six sectors) will be selected for the practical demonstration of the green chemistry approach. The project is structured in 3 components:

1. Developing the enabling environment for Green Chemistry in Viet Nam;
2. Promote awareness on Green Chemistry and the benefits of the application of Green Chemistry and its guiding principles; and,
3. Introduce Green Chemistry approaches into priority sectors and at least 2 entities.

FINANCING PLAN	
GEF Trust Fund *or LDCF or SCCF or other vertical fund*	USD 1,999,800
UNDP TRAC resources	USD 0
Cash co-financing to be administered by UNDP	USD 0
(1) Total Budget administered by UNDP	**USD 1,999,800**
PARALLEL CO-FINANCING (*all other co-financing that is not cash co-financing administered by UNDP)*	
UNDP	USD 200,000
Government	USD 700,000
JICA	*USD 1,500,000*
Private Sector	*USD 6,000,000*
(2) Total co-financing	**USD 8,400,000**
(3) Grand-Total Project Financing (1)+(2)	**USD 10,399,800**
SIGNATURES	

Signature: print name below	**Agreed by Government**	**Date/Month/Year:**
Signature: print name below	**Agreed by Implementing Partner**	**Date/Month/Year:**
Signature: print name below	**Agreed by UNDP**	**Date/Month/Year:**

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Acronym

Acronym

ADB	Asian Development Bank
AITVN	Asian Institute of Technology in Viet Nam
ASTDR	Agency for Toxic Substances and Disease Registry
BAT/BEP	Best Available Technique / Best Environmental Procedure
CBA	Cost Benefit Analysis
COD	Chemical Oxygen Demand
CSR	Corporate Social Responsibility
CW	Chemicals and Waste
deca-BDE	Deca-Bromo Diphenyl Ether
DONRE	Department of Natural Resources and Environment
GC	Green Chemistry
GEF	Global Environmental Facility
GGAP	Green Growth Action Plan
GHG	Greenhouse Gas
HBB	Hexa Bromo Biphenyl
HPPMG	Harmonized Program and Project Management Guidelines
IRIS	Integrated Risk Information System (U.S. Environmental Protection Agency)
LCA	Life Cycle Assessment
LCM	Life Cycle Management
LEP	Law on Environmental Protection
LPAC	Local Project Appraisal Committee
M&E	Monitoring and Evaluation
MEA	Multi Environmental Agreement
MIA	Mercury Initial Assessment
MOF	Ministry of Finance
MOIT	Ministry of Industry and Trade
MONRE	Ministry of Natural Resources and Environment
MOST	Ministry of Science and Technology
MPI	Ministry of Planning and Investment
MSDS	Material Safety Data Sheet
N/A	Not Available or Not Applicable
NAP	National Action Plan
NGO	Non-Governmental Organization
NIP	National Implementation Plan of the Stockholm Convention on POPs
NSEP	National Strategy on Environment Protection
ODS	Ozone Depleting Substances
PBB	Poly Brominated Biphenyls
PBDE	Poly Brominated Diphenyl Ether
PCDD/F	Polychloro Dibenzo Dioxin/Furan
PD	Project Director
PFAS	Perfluorinated Alkylated Substances
PFC	Perfluorinated Compounds

PFOS	Perfluoro Octane Sulfonate
PIC	Prior Informed Consent
PIR	Project Implementation Review
PM	Project Manager
PMU	Project Management Unit
POPs	Persistent Organic Pollutants
POPP	Programme and Operation Policies and Procedures
POPTT	Persistent Organic Pollutant Tracking Tool
PPG	Project Preparation Grant
PSC	Project Steering Committee
PVC	Poly-vinyl chloride
R&D	Research and Development
REACH	Regulation on Evaluation, Authorisation and Restriction of Chemicals (EU regulation 1907/2006)
RF	Result Framework
RIVM	Dutch National Institute for Public Health and the Environment
ROHS	Restriction of Hazardous Substances
SCCP	Short Chain Chlorinated Paraffin
SDS	Safety Data Sheet
SESP	Social and Environmental Screening Procedure
SMC	Sound Management of Chemicals
SME	Small and Medium Enterprise
TA	Technical Assistance
TOC	Theory of Change
TRAC	Target for Resource Assignment from the Core
UNDP	United Nations Development Programme
UNDP CO	UNDP Country Office
UNEP	United Nations Environment
UNIDO	United Nations Industrial Development Organization
U-POPs	Unintentional Persistent Organic Pollutants
USAID	United States Agency for International Development
USEPA	United States Environmental Protection Agency
VASEP	Viet Nam Association of Seafood Exporters and Producers
VGGS	Viet Nam Green Growth Strategy

II. DEVELOPMENT CHALLENGE

In Viet Nam, while the chemical and manufacturing sectors play a very important role in the development of the national economy and in the industrialization and modernization of the country, certain chemicals, which are potentially hazardous/toxic, their production processes and products containing such chemicals are becoming of increasing concern because of their impact on human health, the local and global environment and ecosystems.

Because of various legacy issues, surveys in Viet Nam (1999 – 2010) indicated higher levels of chemicals of concern in soil, water, human milk than those measured in most other countries.

This situation is further aggravated by chemical pollution and releases, industrial related accidents and spills caused by the national chemicals and manufacturing industry, which is predominantly using old technologies, outdated production processes and/or end of pipe solutions. This is a cause of great concern and puts a significant burden on the Government of Viet Nam and local authorities, as these impacts are further jeopardizing the health of the country's population as well as its ecosystems.

The low concern and awareness of the environmental risk associated with obsolete industrial processes and the consumption, release or storage of hazardous chemicals in any stage of industrial manufacturing has often resulted in serious environmental accidents.

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

POPs and Mercury are both persistent substances that do not readily break down in the environment, bio-accumulate in the food chain and humans, and are able to travel long distances far away from the place where they were produced. Because of their detrimental impact on human and environmental health, they are considered a global threat and are covered under the Stockholm Convention on POPs and the Minamata Convention on Mercury.

Through the application of green chemistry in industry, the project intends to reduce the use or releases of Perfluoro Octane Sulfonate, (PFOS), Poly Bromo Diphenyl Ethers (PBDEs), Polybrominated Biphenyls (PBBS), Short Chain Chlorinated Paraffins (SCCPs), HexaBromoBenzene (HBB), UPOPs (Unintentionally produced POPs), and mercury in specific industrial sectors in Viet Nam.

Mercury releases will be mostly reduced through the implementation of energy efficiency activities. This will reduce the consumption of coal, which in Viet Nam is the most used fuel for the production of electricity.

The industrial use, environmental and toxic properties of POPs and Mercury are described in Annex L.

Root causes and barriers that need to be addressed.

Among the root causes for the continued use of toxic chemicals, including POPs, in manufacturing processes in Viet Nam, the following are the most important:

1) The presence of a relatively high number of small manufacturing factories, or informal manufacturing hubs (like craft villages) where most of the environmental costs are externalized.

2) The low awareness and willingness to invest in environmental friendly processes and technologies, due to the limited size of most of the manufacturing factories and their associated financial capability.

3) The limited knowledge on POPs issues at local level, on both the side of the private sector and competent authorities.

4) The limited integration and enforcement of POPs related requirements in the national and local legislation.

5) The lack of information related to the use of POPs in the manufacturing sector, particularly for very small enterprises;

To address these causes there are a number of barriers that the project will strive to remove:

1) **Financial barriers**. The limited financial viability of the sectors targeted by the project prevents the adoption of procedures / technologies aiming at reducing the environmental and health impact of the industry. This barrier will be removed by demonstrating that the adoption of the Green Chemistry principle may also result in a better efficiency and reduced cost of the manufacturing process and in a reduced liability of the enterprises. Financial barriers will also be removed through the development of financial incentives for the adoption of Green Chemistry approaches.

2) **Regulatory barriers**. Although in recent years the environmental regulatory framework in Viet Nam made substantial progress, in specific with respect to the mainstreaming of POPs related provisions into the environmental and chemical regulation, there are still a number of gaps preventing an effective enforcement of the regulation. For instance, some POPs are not yet included in the list of substances restricted or banned for import; BAT/BEP and are only compulsory for new processes, and are on a voluntary basis only adopted by a limited number of large enterprises; environmental control is often bureaucratic and not effective, requiring a number of forms or questionnaires to be filled out by the enterprises, which often fail in identifying the key source of risks (like poor water treatment from chrome plating factories). The project will undertake to solve regulatory barriers by promoting and assisting the joint efforts of relevant ministries in developing a regulatory basis for the implementation of Green Chemistry in key industrial sectors.

3) **Information barriers**. Limited information on processes and substances used in industrial manufacturing sectors is both a cause and barrier of the limited implementation of Green Chemistry. The project intends to address this barrier by undertaking an analysis of six manufacturing sectors (pulp and paper, textile, plastic, chrome plating, pesticide, solvent) through site visits to a relevant number of factories, gathering of information related to the use of hazardous substances (including POPs) in industrial processes. Based on this analysis, guidance for the implementation of GC in the six selected sector will be developed and disseminated; GC technologies and procedures will be demonstrated in two out of the six selected sectors.

4) **Technical barriers**. In several cases, low attention is paid to the environmental and health impact when a specific manufacturing process or substance is selected. This is mainly due to the lack of knowledge of alternative processes or substances, as well as the lack of technical capacity for the implementation or design of alternative industrial processes. The project intends to solve the technical barriers by promoting international technology exchange in the relevant sectors targeted (pulp and paper, textile, plastic, chrome plating, pesticide, solvent), demonstrating Green Chemistry actions to prevent the use and release of POPs substances in selected factories, providing technical training for both the private sector/industry operators and environmental authorities.

2. The baseline scenario or any associated baseline projects

2.1. Application of Green Chemistry in Viet Nam

Green Chemistry is defined as "the design of chemical products and processes that reduce or eliminate the use and generation of hazardous substances ". The green chemistry approach has been standardized in 12 general principles: 1. Prevent waste; 2. Maximize atom economy; 3. Design less hazardous chemical syntheses; 4. Design safer chemicals and products; 5. Use safer solvents and reaction conditions; 6. Increase energy efficiency; 7. Use renewable feedstocks; 8. Avoid chemical derivatives; 9. Use catalysts, not stoichiometric reagents; 10. Design chemicals and products to degrade after use; 11. Analyze in real time to prevent pollution; 12. Minimize the potential for accidents[1].

Although many of the Green Chemistry principles have not yet been applied in Viet Nam, their application could play an important role in reducing the potential for toxic releases or emissions from processes and products that continue to use or emit POPs. The Viet Nam Green Growth Strategy (2012) supported the creation of an enabling environment for greening production sectors by adjusting existing sectoral master plans to ensure economic and efficient use of natural resources; encouraging the development of green industry based on environmental friendly technologies; and, proactive prevention and treatment of pollution. This provides a positive entry point for green chemistry development even though the concept might still be unfamiliar to many stakeholders.

[1] Anastas, P. T.; Warner, J. C. Green Chemistry: Theory and Practice, Oxford University Press: New York, 1998, p.30.

2.1.1 Current situation of key manufacturing sectors in Viet Nam and their potential release of POPs and Mercury

With specific concern to the consumption, release and unintentional generation of POPs and mercury, the following manufacturing or chemical sectors are the ones that based on international experience and available specific information for Viet Nam have been preliminarily identified as key sectors for green chemistry implementation as these may need a significant improvement in their process to reduce their impact:

1. Electro plating industry, due to the potential use of PFOS as etching agent and mist suppressant;
2. Plastics manufacturing, due to the potential use of brominated flame retardants and short chain chlorinated paraffins;
3. Textile and leather, due the potential use of PFOS and PFAS for water – repellency purposes and the for the generation of U-POPs in final products ;
4. Pulp and paper, for the potential release of chlorinated compound to water, which may result in the formation of PCDD/Fs;
5. Pesticides, due to the not completely discontinued use of some POPs substances,;
6. Solvents and Paints, due to their widespread application, the possible generation of U-POPs at their end of life stage, and the use of short chain chlorinated paraffins and some paint formulations.
7. Improvement of Energy efficiency in all the sectors will have the direct (pulp and paper) and indirect effect on the reduction of the release of mercury associated with coal consumption.

A short description of these industries and their use or release of POPs and Mercury presented in annex M.

2.2 Associated baseline projects

The below sub-section on Associated Baseline Projects provides an overview of a number of initiatives and activities that combined constitute the baseline of the proposed project. As certain of these baseline projects/initiatives aim for the same or similar objectives as the proposed project, some of these (fully or partially) will be considered as a co-financing source for the project.

A. Institutional capacity and regulatory and policy framework baseline projects related to Green Chemistry:

1) **Regulatory Framework pertaining to POPs/SMC**. GEF-funded POP projects, and project related to the Sound Management of Chemicals (SMC) have supported Viet Nam in putting into place a sound basic legislative and regulatory framework for the Sound Management of Chemicals and Wastes in general and POPs in specific. Stockholm Convention requirements have been, for the most part, integrated into national environmental legislation including plans for the remediation and reduction of POPs

releases. Although GEF projects did not directly support the Law on Environmental Protection (2014), GEF support has ensured government commitment towards POPs management and phase-out. As a result, aspects such as "environmental protection against chemicals, pesticides and veterinary medicines", "environmental remediation and rehabilitation of contaminated sites", "Prevention of and response to environmental incidents", "remediation and rehabilitation of environmental incidents", and "risk assessments" were included in the 2014 revised Law on Environment Protection (LEP).

2) The Viet Nam Master Plan for Development of the Chemical Industry by 2020, Vision towards 2030 [MOIT, 2014]. The plan has taken up three key environmental considerations which are: i) Give approval priority to chemical investment projects that apply new technologies with less waste and effective control of wastes; ii) Re-locate chemical production facilities to industrial zones and clusters to minimize environmental pollution; which allows for cost-effective treatment and disposal/destruction iii) Phase-out outdated technologies to limit and eventually eliminate pollution.

3) The National Strategy on Environment Protection (NSEP) to 2020, with Visions to 2030 [MONRE, 2012]. The strategy includes, among others, the following SMC related objectives: i) Prioritize pollution prevention and control; ii) Identify polluted sites and remediate deteriorated and/or contaminated areas/hotspots to improve people's living conditions and their health; iii) Minimize deterioration and use of natural resources; iv) Strictly apply the registration of chemicals, especially toxic chemicals; v) Enhance, finalize and apply technical standards and requirements related to chemicals.

4) Viet Nam Sustainable Development Strategy for 2011-2020 [MPI, 2012]. The SD Strategy is built on three axes: i) Economic aspects; ii) Social aspects; and iii) Resources and environment. Among its priorities: Achieving sustainable economic development; Implement Green Growth through a step by step approach; Develop clean and renewable energy and implement sustainable production and consumption. Based on the Viet Nam SD strategy, MOIT has developed its owned SD strategy with priorities for action for the period 2013 – 2015 that are related to chemical management/green chemistry, which include: Training and capacity building, including awareness raising, on sustainable development, management and implementation; Mainstreaming SD principles into ministerial strategies, planning, policies and national target programs; Develop SD models and tools (e.g. green growth strategy, development of technical capacity for industrial cleaner production, sustainable industrial production); Reducing air and noise pollution in industrial zones; Centralize production; and, Manage industrial wastes.

5) Viet Nam Green Growth Strategy (VGGS) [MPI, 2012]. The VGGS's main emphasis is on greening production and greening people's lifestyle and promoting sustainable consumption, by implementing the following measures: i) Communication and awareness raising; ii) Changing the fuel structure in industry and transportation; iii)

Review and adjust master plans for the production sectors and gradually limit the development of economic sectors that generate large amount of waste, significant environmental pollution and degradation of natural resources, while creating favorable conditions for the development of new green production sectors; iv) Economic and efficient utilization of natural resources; v) Promote fast development of green economic sectors to create jobs, increase income and enrich natural capital; vi) Promote technological innovation and wide application of cleaner production; vii) Promote sustainable consumption and building green lifestyles; and viii) Human resource training and development.

6) National Action Plan (NAP) on Green Growth (2014 – 2020) [MPI, 2014]. The NAP prioritizes (a) Reducing GHG emissions and promoting the use of clean and renewable energy; (b) Green production; and (c) Green lifestyle and promotion of sustainable consumption. The NAP's 66 priority actions include: i) Encourage and support rapid development of eco-products; ii) Widely apply cleaner production approaches in industries; iii) Implement the campaign "Enterprises achieving sustainable development standards"; iv) Build networks of technical capacity for green growth management, support enterprises in establishing cleaner and greener production processes; v) Raise enterprises' awareness and share their experience on green growth; and vi) Provide guidance and encourage general public initiatives on sustainable consumption.

7) MOIT Action Plan on GG (2015 – 2020) for the industrial sector has been approved by the Minister in 2015 to contribute to the national efforts in the implementation of VGGS and GGAP. A core item of the MOIT GGAP is to set forth quantitative GHG emission reduction targets for the sectors and industries under MOIT's mandate. Energy saving and energy efficiencies is a target of the plan to reduce GHG emission.

8) National Strategy on Cleaner Industrial Production to 2020 [MOIT, 2009]. The strategy emphasizes "Perfecting the system of mechanisms, policies and laws to boost cleaner industrial production; Reviewing, revising, supplementing and promulgating mechanisms, policies and laws on cleaner industrial production …." to "…. improve the rational use of natural resources, materials, and fuels; minimize emission and curb pollution; protect and improve the quality of environment, human health and secure sustainable development" by implementing the following solutions: i) Communication and awareness raising on cleaner production; ii) Enhance and finalize the policy and legal framework for CP; iii) Build necessary capacity; and, iv) Secure necessary investment and funding.

9) National Action Program on Sustainable Production and Consumption up to 2020 with a vision toward 2030. The program sets objectives to gradually change production and consumption in a way that enhances efficiency of natural resources and energy; increases the use of environmentally-friendly raw materials, renewable energy and products; reduces, reuses and recycles waste; maintains the sustainability of the ecosystem at all stages in the product life cycle from exploitation, supply of raw

materials to production, processing, distribution, consumption and disposal of products. The government of Viet Nam allocated 900 million of Viet Nam Dong under this strategy. With specific reference to this NAP, the following targets are synergic to the project and are considered as co-financing as these are at the same time compliant with GC principles and Stockholm Convention requirements:

a. Increase number of industries applying cleaner technologies, eco-innovation activities, and green industries.
b. Minimize waste generation in distribution activities.
c. Develop and gradually scale up the model of sustainable supply chains, green value chains for some product groups.
d. Raise and promote environmentally-friendly products and services for key export items in Viet Nam.

Among others, the NAP will include the following prioritized activities, which are also compliant with GC and POPs:

- Eco Innovation.
- Develop production of environmentally friendly products and services.
- Implement plans for the minimization, reuse and recycle of waste.

B. Technical Assistance Baseline Projects related to Green Chemistry:

1) **NIP development and update** (GEF/UNDP, GEF ID: 1450 and 4838). The country's first National Implementation Plan (NIP) for the implementation of the Stockholm Convention was submitted in 2007, the NIP has been recently updated to include new POPs requirements and submitted to the Government for endorsement.

2) **Strengthening Capacity on Climate Change Initiative in the Industry and Trade Sectors - CCIT** (2013 – 2016, UNDP Low Emission Capacity Building/UNDP TRAC/One UN Plan/MOIT). The project's objective was to strengthen the capacity of policy makers and industry sector stakeholders to reduce GHG emissions, enhance climate resilience and exploit associated green trade opportunities. The project aimed to remove barriers restricting industrial enterprises in Viet Nam to adopt technologies, industrial processes, business and trade practices to improve resource efficiency, which resulted in reduced GHG emissions, enhanced resilience to climate change impacts and improved productivity and competitiveness in national and international markets. The CCIT project supported steel, chemical fertilizer and coal-fired thermal power generation industries to set forth GHG emission reduction targets in 2014 and supported the pulp and paper industry in 2015 to specific quantitative GHG emission targets up to 2020 and preliminary targets by 2030.

3) **Strengthening Capacity and Institutional Reform for Green Growth and Sustainable Development in Viet Nam** (2015 – 2018, UNDP/USAID/EU). The project's objective is to build capacity to advance green growth by strengthening policies, regulations and technical guidance for the implementation of the Viet Nam Green Growth Strategy and Action Plan. The project expects to achieve its objectives by realization of (i)

strengthening capacity of Ministry of planning and Investment (MPI), Ministry of Finance (MOF), Ministry of Ministry of Industry and Trade (MOIT) and provinces for effective implementation and monitoring of the VGG/AP; (ii) Developing policies and regulations for GG investment and sustainable development; and (iii) improving access to GG financing and piloting green projects including involvement of the private sector. MOIT has been involved in the project components related to training and communication on green growth and climate change.

4) **Strengthening Chemicals Management in Viet Nam** (2015 – 2018, MOIT/JICA). The project aims at supporting the Government of Viet Nam in developing an industrial chemicals management system (undertaking an inventory, developing a database including an emergency response database to facilitate first responders knowing what Personal Protection Gear (PPG) to wear, and what chemical hazards they may be facing when responding to an emergency at a chemical incident). The project focuses on surveys of the industrial chemicals management situation in Viet Nam, undertakes a national inventory of industrial chemicals; updates the chemical management database system using a risk based management approach; and raises awareness on chemicals management.

5) **Implementation of Eco-Industrial Park Initiative for Sustainable Industrial Zones in Viet Nam** (2014 - 2017, MPI/GEF/UNIDO/SECO, GEF ID: 4766). The project aims to transfer, apply and disseminate technologies and cleaner production methods to minimize hazardous waste, greenhouse gas emissions and water pollutants and properly manage chemicals by supporting 45 enterprises through training and capacity building, which are located in three Eco-Industrial Zones (EIZ), namely Khanh Phu (Ninh Binh), Hoa Khanh (Da Nang), Tra Noc 1&2 (Can Tho). The project is expected to develop policies and guidelines for EIZ criteria for particular sectors; Strengthen capacity for EIZ planning and management; Increase technical competence of EIZ state management agencies and enterprises for transfer of technologies and application of clean and low-carbon technologies; and, Identify potential enterprises that are capable of participating in applying clean and resource-efficient technologies.

6) **POPs related Baseline Projects**. The Government of Viet Nam, with funding from the GEF, and technical assistance provided by UNDP, UNEP, UNIDO and the World Bank has implemented a multitude of POPs related projects since completion of the country's first NIP. GEF/POPs projects in Viet Nam have worked on developing the national policy and legal framework pertaining to POPs and SMC, POPs management and treatment and capacity strengthening, knowledge management and awareness raising. Projects included eliminating and destroying stockpiles of obsolete POPs, monitoring, managing and remediating POPs contaminated sites, introducing BAT and BEP to reduce releases of UPOPs from open burning, and the monitoring of POPs.

7) **Energy Efficiency and Cleaner Production related Baseline projects**. The Government of Viet Nam, with funding from the GEF, and technical assistance provided by UNEP,

UNIDO and the World Bank has also implemented a multitude of projects that have supported the promotion of energy efficiency in industry through technology transfer, resulting in reduced ODS and GHG emissions.

8) **Mercury related Baseline Projects**. Viet Nam initiated actions to undertake activities for the early implementation of the Minamata Convention, including (i) GEF/UNDP project entitled: "Viet Nam POPs and Sound Harmful Chemicals Management" (GEF ID: 5067) with the objective to support the development of a baseline source and release inventory of mercury, and conducting outreach workshops to disseminate information on the outcomes of the baseline study; and (ii) GEF/UNIDO "Mercury Initial Assessment (MIA) Enabling Activity" project (GEF ID: 5870) (2015 – 2016) with the objective to implement pre-ratification activities under the Minamata Convention to enable policy and strategic decision making and prioritize areas for future interventions. The project focuses on policy and institutional analysis, an initial mercury inventory, preparation of a national mercury profile, and identification of key sectors for intervention and awareness raising.

9) Viet Nam/UNDP/UNEP Partnership Initiative for the Integration of Sound Management of Chemicals in Development Planning and Processes (2012 – 2014). The project aimed to raise awareness about the Strategic Approach to International Chemicals Management (SAICM), including lifecycle management (LCM) of chemicals; strengthening institutional capacity to integrate SMC priorities into economic planning and decision making processes; and establishing cross –societal partnerships for SMC mainstreaming.

C. Bilateral projects. The following bilaterally supported activities/projects, relevant to the Green Chemistry sector, are currently being implemented in Viet Nam:

1) **Asian Institute of Technology in Viet Nam (AITVN) and Viet Nam Learning Center on Environmental and Social Responsibility (LC)**. The Viet Nam Learning Center on Environmental and Social Sustainability (LC) was established in April 2015 under a Memorandum of Understanding (MoU) between the AITVN and its development partners, including the World Bank Group, the Asian Development Bank (ADB), the United States Agency for International Development (USAID) and the Department of Foreign Affairs and Trade (DFAT) of the Australian Embassy. The center is being established with initial funding support from the Australian Government. Other development partners have committed to provide technical support. The mission of the LC is capacity building of relevant stakeholders of Infrastructure Projects in the short term and strengthening of the Environmental and Social Impact Assessment Process in Viet Nam and the region in the long-term.

2) **European Trade Policy and Investment Support Project (EU-MUTRAP)** (Project implementation period: Sep 2012 – Jan. 2018) . The European Trade Policy and Investment Support Project (EU-MUTRAP) aims to support the Ministry of Industry and Trade in facilitating sustainable international trade and investment through improved

capacity for policy making, policy consultation and the negotiations and implementation of related commitments, particularly vis-à-vis the EU. MUTRAP's support to Viet Nam in the area of chemicals includes, among others, the following initiatives which can be considered related to this project: Support the Viet Nam industry in upgrading production methods to adapt to EU technical regulations and standards in chemical safety in order to position Viet Nam better in exporting products to the EU, like the Development of a "Manual for chemical products" specifying obligations of Viet Nam chemical exporters based on EU legislation. , the improvement of the inspection of environmental impact assessment (EIA) reports. , the Improvement of knowledge of EU quality management systems for light industrial products (textile, leathers, shoes, plastics) and analysis of Viet Nam shortcomings. , Support research on export control by WTO members and recommendations for Viet Nam. The research report will specify requirements for compliance with multi-environmental agreement (MEAs) such as the Rotterdam Convention on the Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals and Pesticides in International Trade; and the Basel Convention on the Control of Transboundary Movement of Hazardous Waste and Their Disposal.

3) **Eco Innovation project (EU/UNEP supported)[2]:** This project aims at promoting resource efficiency and eco-innovation in many developing and transition economies by encouraging businesses to reduce their environmental footprint. In Viet Nam, the project concern the agricultural and food sector, and the implementation period is 2014 – 2016. It focuses on policy review and recommendations for change towards sustainable development and the implementation of five (5) pilot eco-innovation projects in the agri –food sector (for SMEs).

3. Consistency of the project with national policies

The Government of Viet Nam signed the Stockholm Convention on May 23, 2001 and ratified the Convention on July 22, 2002. The country's first National Implementation Plan (NIP) for the implementation of the Stockholm Convention was prepared with the assistance of UNDP and submitted to the Stockholm Convention Secretariat in November 2007. The strategic objectives and main programmes of the NIP completed in 2007 are presented in the Table 1 below.

Table 1 Lists of 15 National Priority Programs on Persistent Organic Pollutants (NIP, 2007)

National Priority Programmes	
1.	Development and Finalization of Policies, Legislation and Institutions for POPs Management.
2.	Sound Management, Disposal and Phase-Out of POPs Pesticides Stockpiles.
3.	Thorough Isolation and Treatment of Hotspots Contaminated with Dioxins and Toxic Chemicals used by the American Army during the War in Viet Nam.

2 The Eco-Innovation Project. http://www.unep.org/resourceefficiency/Business/CleanerSaferProduction/Eco-InnovationTheUNEPApproach/TheEco-InnovationProject/tabid/106016/Default.aspx

4.	Management of Healthcare Wastes to Reduce POPs and other Toxic Releases.
5.	Thorough Treatment of PCBs and POPs Pesticides Contaminated Hotspots.
6.	Sound Management, Disposal and Phase-out of PCBs and PCB containing Electrical Equipment and Industrial Products.
7.	Development of Technical Capacity for POPs Monitoring and Analysis; Establishment of the Network of Standardize Laboratories for assessing Pollution and Impacts of POPs on Human Health and the Environment.
8.	Assessment, Study, Promotion, Assistance and Managemen on Application of Best Available Techniques and Best Environmental Practices to Reduce and Finally Eliminate the Unintential Production of POPs from Production and Living Activities.
9.	Survey and Study the Impacts of POPs-Contaminated Environment on Human Health in Viet Nam.
10.	Education, Training and Awareness Raising on POPs Issues.
11.	Enhancement of Technical and Financial Support to Implementation of the Stockholm Convention in Viet Nam.
12.	Strengthening Capacity for Managing and Controlling the Production, Import-Export, Use and Transport of Prohibited Chemicals Including POPs in Viet Nam.
13.	Study and Development of Emission and Technological Standards Associated with POPs in Line with Development and Integration Needs.
14.	Development of National Information System, Working Network on POPs and Promotion of Stakeholder and Public Participation in the Sound Management of POPs.
15.	Assessment of POPs Management in the whole Country.

The proposed project is entirely in line with the Viet Nam 2007 NIP and addresses 6 of the 15 priorities taken up in the NIP (Priorities No. 8; 11; 12; 13; 14; and 15). Therefore, it can be concluded that the proposed project is entirely consistent with Viet Nam's National Strategies pertaining to POPs.

Furthermore, the project is fully in-line with national strategies and plans, such as the:

1) National Strategy on Environment Protection (NSEP) to 2020, with Visions to 2030
2) Viet Nam Sustainable Development Strategy (2011- 2020)
3) Viet Nam Green Growth Strategy (VGGS)
4) National Action Plan (NAP) on Green Growth for the period of 2014 – 2020
5) National Socio-Economic Development Plan (2011-2015)
6) National Strategy on Cleaner Industrial Production to 2020
7) National Strategy on exports and imports for 2011-2020
8) National Action Plan on Sustainable Production and Consumption to 2020, with vision towards 2030

The Government of Viet Nam is currently endorsing the reviewed and updated National Implementation Plan for the Stockholm Convention on POPs (with financial support provided by the GEF and technical assistance by UNDP) The proposed project is in line with the strategy identified in the NIP updated and reviewed, with particular reference to the provisions of the Article 7(3) of the Stockholm Convention, "Parties shall endeavor to utilize and, where necessary, establish, the means to integrate national implementation plans for persistent organic pollutants in their sustainable development strategies where appropriate". With this respect the NIP states that *"One key is the substitution of POPs and other hazardous chemicals by more benign substances. Here Viet Nam aims for an assessment of alternative chemicals considering green and sustainable chemistry principles for protection of the health and for improving the recyclability and therefore supporting the waste hierarchy and SCP. Viet Nam considers the use of green/sustainable alternatives to POPs and hazardous chemicals as a business opportunity."*

The Government of Viet Nam signed the Minamata Convention on Mercury on October 11, 2013. The GEF/UNDP project "Viet Nam POPs and Sound Harmful Chemicals Management Project" will support the country in developing a baseline source and release inventory, while the UNIDO Mercury Initial Assessment (MIA) Enabling Activity is being implemented to prepare the country for ratification of the Convention. Both these projects are expected to result in the identification and setting of national priorities pertaining to Mercury release reductions.

III. STRATEGY

General strategy and theory of change for the project. The proposed project aims to create an enabling environment for the introduction of Green Chemistry in Viet Nam, which would lead to redesigning or adapting industrial processes or chemical products, with the objective to reduce or eliminate the use and generation of hazardous substances, in particular those controlled by MEAs. More specifically, the project aims to address two global environmental problems, the release of POPs as its main priority and the release of mercury as a second priority.

The general strategy of the project is described below:

1) **Data gathering and surveys.**
    a. **Issues:** As in Viet Nam industrial manufacturing is often fragmented in a large number of small enterprises, the information concerning the industrial processes adopted within each sector, and of the composition of substances or mixtures used in these sectors is also fragmented and often unavailable.
    b. **Proposed solutions:** Therefore, the first step to be undertaken will be an assessment of industrial processes, through surveys, questionnaires and interviews to quantify the use or release of POPs and to assist industries in identifying proper green chemistry interventions. Industries may even be unaware of the real composition of the mixtures they are using/purchasing, therefore the surveys shall include gathering of Material Safety Data Sheets

(MSDS and trade names of the chemicals purchased for industrial processes, with the purpose to build a database of the substances and mixtures used in each sector and their alternatives.

2) **Stakeholder engagement, awareness raising and incentive mechanism.**
    a. **Issues.** Due to the structure of the targeted industrial sectors in Viet Nam, largely based on SMEs, the willingness to invest in environmental protection (including technologies for the prevention or reduction of POPs and adoption of Green Chemistry principles) is limited or at the best fragmented and not well coordinated.
    b. **Proposed solutions.** To increase the willingness of the industrial sector to adopt GC principles, the project will work simultaneously on different sides: stakeholder engagement, increase of awareness of Governmental bodies, industry, general population, NGOs; assistance in the development and enforcement of regulations aimed at preventing the use and release of POPs from industrial sectors; training on the implementation of green chemistry processes in specific industrial sectors; development of incentive mechanisms for enterprises adopting Green Chemistry principles aimed at reducing POPs. All these activities together will ensure that the shift towards a greener approach in the manufacturing and chemical sectors is effective and sustained. Moreover, the cost/benefit assessment of the proposed GC measures to be adopted in the relevant industrial sectors will ensure that these measures are intrinsically sustainable.

3) Development of guidance and training in six industrial sectors.
    a. Issue. There is no guidance available that is tailored to specific industrial sectors in order to implement Green Chemistry initiatives with the purpose of reducing the use and releases of POPs and mercury.
    b. Proposed solution. The project will initially develop technical guidance and provide training for six industrial sectors (chrome-plating, plastic manufacturing, textile, pulp and paper, pesticides, solvents and paints) which have been selected based on their relative importance in the country's economy, evidence of the release of POPs from these sectors through environmental monitoring data, and information from official sources on the use or release of POPs in these sectors.

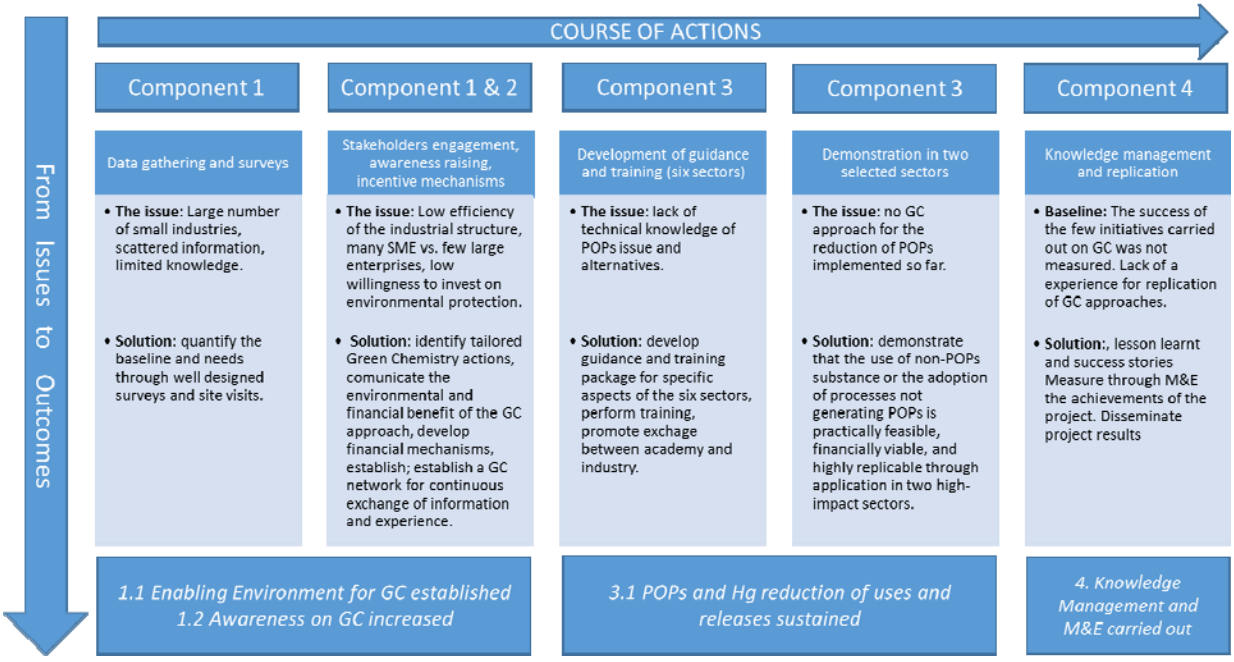
4) Demonstration in two selected sectors.
    a. The issue. The lack of guidance and limited exchange of information hampers the replication of the few good practices implemented by industries on a voluntary basis. In the absence of practical examples and case studies, the industrial operator are not willing to risk their capital to implement new technologies they are not very familiar with.
    b. Proposed solution. Two priority sectors will be selected for the practical demonstration of GC approaches. These GC approaches could simply mean the replacement of POPs substances in priority industrial processes (like, for instance, alternatives to water-repellent PFOS substances in the textile sector), where in other cases the adoption of green chemistry principles may also affect

the manufacturing process itself (for instance, shifting from open to closed-loop processes). The demonstration of the effectiveness of the green chemistry principle in two selected industrial facilities will be one of the key outputs of the project. The demonstration has two purposes: 1) to prove that GC principles can be effectively adopted with good environmental results, without harming product quality, the business or the manufacturing process; 2) Through the demonstration of GC principles in two selected sectors, a number of environmental, process, and financial parameters will be monitored to measure the effectiveness of the adopted Green Chemistry measures.

5) **Knowledge Management and replication.**
   a. **The issue.** In the absence of careful project monitoring and sound management and dissemination of project results, the risk that project results are not sustained and lessons are not learnt is high.
   b. **Proposed solution.** Continuous communication of the environmental and financial benefits of the application of Green Chemistry approach in the selected sectors will be ensured throughout the duration of the project. Support will be provided through the establishment of a Green Chemistry cell of experts, and a Green Chemistry Network will be established to facilitate exchange of information among potential and actual stakeholders.

The above is summarized in the below Figure 1, where reference to project Components and Outcomes is also included.

Figure 1 Theory of Change (ToC) for the project.



Financial strategy for the project

One of the key aspect which has been considering during the development of this project concern the financial strategy to be adopted to ensure the project success.

The project relies on a GEF grant of USD 1,998,000. To ensure that the desired changes are achieved, this budget will be supported by substantial co-financing and incentive schemes. This is important also considering under Component 3 of the project, practical intervention in 2 sectors, implying demonstration of technologies or procedures, will be undertaken. Therefore, besides the co-financing which has been committed and secured during the project preparation stage, the project will leave the door open to further donors willing to support at a later stage specific Green Chemistry interventions in one or more of the industrial sectors identified.
"Impact fund", i.e. loans with competitive interest rate to be provided to beneficiaries on the basis of demonstrable Green Chemistry targets will be designed. Moreover, the feasibility studies for the implementation of Green Chemistry initiatives under Component 3 will be carried out taking into consideration as starting point the financial sustainability of these initiatives, to pave the way for the support of possible investors.

It is also important that any fund managed under the project is properly accounted and used in a sustainable way. As for other projects supported by the GEF, a detailed accounting system for co-financing will be properly monitored and reported by the project.

Linkage and coordination with other GEF projects

Under the framework and spirit of "One UN initiative" in Viet Nam, the project will seek coordination with other GEF/UN projects which share with this project similar objectives. More specifically, the project will coordinate its effort with the UNIDO project "Implementation of Eco-industrial Park Initiative for Sustainable Industrial Zones in Viet Nam " (GEF ID 4767), of which closure is expected in 2017. The synergy will be established as following:

- The project team in charge of mainstreaming Green Chemistry principles into the Viet Namese environmental regulation, will duly consider the output concerning Outcome 1 of the UNIDO project (1. Improvement of policy and guidelines to facilitate the transformation of industrial zones into eco-industrial parks) to ensure that any official guidance or amendment of the regulation proposed by the two projects is well integrated and does not overlap.
- The project will also seek coordination with the activity carried out by UNIDO under Component 4 (Implementation of pilot projects in industrial zones) to verify the opportunity for possible synergies, understand lesson learnt and avoid unnecessary duplication.

Coordination will also be ensured with the ongoing UNIDO project "Guidance Development and Case Study Documentation of Green Chemistry and Technologies" (GEF 9373) in the following ways:

- A mutual exchange will be sought in the development of the Green Chemistry guidelines, being developed under component 3 of the UNIDO project (Output 3.1.2 Technical tools and guidance developed for introduction of Green Chemistry in priority

sectors) and under compo”nent 1 of the UNIDO Project (Output 1.2. Guidance document on GC developed and globally promoted)

- A mutual exchange will be also proposed in the documentation of green chemistry case studies, with particular reference to the case being demonstrated under component 3 of the UNIDO project (Output 3.3 Green Chemistry approaches introduced in at least 2 entities) and Output 2.1. of the UNIDO project (Green chemistry cases study, including required policy framework conditions, in selected countries documented).
- An exchange of experiences and ideas will also be sought in the development of incentives for the promotion of Green Chemistry (This project’s Output 1.1.4 - Green Chemistry incentives introduced following Cost-Benefit Analyses (CBAs)) and UNIDO’s project Output 2.2. (Partnerships and business models (e.g. incentives) set up to further promote green chemistry).

4. The proposed alternative scenario

The proposed alternative scenario intends to support the country with the necessary technical and financial assistance to boost the implementation of Green Chemistry in key manufacturing sectors in the country, with the aim to reduce the use and release of POPs and mercury containing substances and mixtures.

The project will be implemented side by side with the relevant institutional and industrial stakeholders, i.e. the Ministry for Natural Resource and the Environment (MONRE) and their provincial departments (DONRE), the Ministry of Industry and Trade and its provincial department (DOIT), enterprises, industry associations, partner industries and NGOs.

Although the project is mainly a demonstrative project, it aims at developing highly sustainable and replicable initiatives, which will support chemical risk reduction, and increase quality and competitiveness of the Vietnamese industry.

The project consists of the following three (3) components:

- Component 1: Developing the Enabling Environment for Green Chemistry in Viet Nam.
- Component 2: Promote Awareness on Green Chemistry and the benefits of the application of Green Chemistry and its guiding principles
- Component 3: Introduce Green Chemistry approaches into priority sectors and at least 2 entities

The description of the project by component, outcome and output is presented in the section “Result and Partnership” below.

The Monitoring and Evaluation component is described in detail in Section VII (Monitoring and Evaluation Plan).

GEF Focal Area Strategies

The project is fully consistent with the GEF-6 Chemicals and Waste Focal Area Strategy.

In support of the Chemicals and Waste Strategic Objective 1 (CW 1): "Develop the enabling conditions, tools and environment for the sound management of harmful chemicals and wastes", the project will support Program 1 "Develop and demonstrate new tools and economic approaches for managing harmful chemicals and waste in a sound manner", through the promotion of Green Chemistry particularly in the context of SAICM.

In support of Strategic Component 2 (CW 2): "Reduce the prevalence of harmful chemicals and waste and support the implementation of clean alternative technologies/substances", the project will support Program 3: "Reduction and elimination of POPs" through: Phase-out of POPs; Reduction of emissions of unintentional POPs (UPOPs); Introduction of non-chemical alternatives; Application of green industry, or sound chemicals management along the supply chain; and the Design of products and processes that minimize the use and generation of hazardous substances and waste.

In support of CW 2, the project will support Program 4: "Reduction or elimination of anthropogenic emissions and releases of mercury to the environment" through the reduction, phase out or elimination of mercury used in certain industrial processes.

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

Without the support of the proposed project and financial support provided by the GEF to: i) Create awareness on GC; ii) Build technical capacity for the application of GC; iii) Share experiences from other countries on achieved successes; iv) Demonstrate in priority sectors the potential of GC to ensure the country is ready for replication; and v) Develop and put in place the necessary policy and regulatory framework as well as establish financial and non-financial incentives for GC adoption, it would be very unlikely that the country would start promoting and applying GC, resulting in communities at local, regional and global level to continue to be exposed to harmful releases and substances. The incremental / additional cost reasoning for the project is summarized in the Table 2:

Table 2 Baseline project components and Incremental cost reasoning.

Baseline project components	**Incremental reasoning as from alternative scenario (GEF project components)**
The government of Viet Nam has developed and funded a "Master Plan for Development of Chemical Industry by 2020, Vision towards 2030 [MOIT, 2014]" The plan has taken up three key environmental	Component 1: Developing the Enabling Environment for Green Chemistry in Viet Nam. To integrate and sustain the activities envisaged under the baseline project, the project will

Baseline project components	Incremental reasoning as from alternative scenario (GEF project components)
considerations which are: i) Give approval priority to chemical investment projects that apply new technologies with less waste and effective control of wastes; ii) Re-locate chemical production facilities to industrial zones and clusters to minimize environmental pollution, which allows for cost-effective treatment and disposal/destruction; and, iii) Phase-out outdated technologies to limit and eventually eliminate pollution. In addition, the Government has funded the National Action Plan (NAP) National Action Program on Sustainable Production and Consumption up to 2020 with a vision toward 2030 with 900,000,000 VD (around 40,000 USD).. "The NAP prioritizes (a) Reducing GHG emissions and promoting the use of clean and renewable energy; (b) Green production; and (c) Green lifestyle and promotion of sustainable consumption. Co- Financing: USD 400,000	undertake the following • *Assess the national institutional capacity for Green Chemistry.* • *Conduct a gap assessment of the current regulations and policies pertaining to Green Chemistry and POPs.* • *Strengthen capacity of the institutions and entities to develop, improve and operationalize the regulatory and policy framework for Green Chemistry and POPs.* • *Introduce Green Chemistry incentive following Cost Benefit Analyses (CBAs).* *Establish a network of Green Chemistry experts* GEF budget: USD 250,000
There a number of training initiatives related to green development. AITVN (supported by the World Bank, Australian Aid and Asian Development Bank) provides training on Environmental Impact Assessments, Green Supply Chain Management, Green Growth Management, and Environmental Management for Sustainable Development, Environmental Education and Communication, Sustainable Consumption and Production, Green Manufacturing and Management for SMEs and Green Lifestyle. The Industrial Safety Techniques and Environment Agency (MOIT) provided some basic training on green chemistry (in 2011 – 2012) to fertilizer and basic chemical production sectors. A simple manual on GC (with 12 principles) has been developed by the agency for training purposes. The agency also organized some workshops on GC with the Hanoi Industrial University, with funding allocated by the state budget. The Viet Nam Chemical Association, in cooperation with a Korean partner, has so far organized several workshops for relevant sectors to introduce and exchange information on GC. Awareness on GC in Viet Nam is still limited and GC is not yet institutionalized (no official definition of GC is	Component 2: Promote Awareness on Green Chemistry and the benefits of the application of Green Chemistry and its guiding principles The project will undertake a number of awareness raising and training activity, which will ensure the sustainability of Green Chemistry actions in the Vietnamese Industry and will have the potential to create high level jobs for experts in Green Chemistry in each specific sector. The promotion of awareness on Green Chemistry will target: The general population and the consumers, to create the demand of Green Chemistry products) The industry, to make available the know-how on Green Chemistry in specific manufacturing process and promote the concept of reduced cost and reduced environmental liability of GC compared to traditional technologies the authorities, to facilitate the understanding of GC benefits also in term of reduced needs of environmental control The alternative scenario envisages: *Creating awareness on Green Chemistry among decision makers and stakeholders.*

Baseline project components	Incremental reasoning as from alternative scenario (GEF project components)
mentioned in the Vietnamese legislation. There are currently no training or awareness raising initiatives specifically tailored to the implementation of Green Chemistry in the industry in Viet Nam. Therefore, without the GEF technical and financial support, the opportunity to disseminate the Green Chemistry principle and train the relevant industrial sectors on the practical application of GC to their plants will be missed. Jica is supporting MOIT in carrying out the parallel project "Strengthening Chemical Management in Viet Nam (2015 – 2018, MOIT/JICA)". The project aims at supporting the Government of Viet Nam in developing an industrial chemicals management system. The project focuses on surveys of the industrial chemicals management situation in Viet Nam, undertakes a national inventory of industrial chemicals; updates the chemical management database system using a risk based management approach; and raises awareness on chemicals management. UNDP is providing direct technical and financial support on the implementation of the Green Growth strategy in Viet Nam, (160,000 USD) with activities related to development of roadmap to implement a renewable energy strategy, and delivery of a communication plan on Green Growth week. Co-financing JICA through MOIT: USD 1,500,000 and UNDP: USD 160,000	*Start initiatives related to Corporate Social Responsibility (CSR) on Green Chemistry.* GEF budget: USD 200,000
The Vietnamese Environmental Protection Fund (VEPF) has the function of receiving financial resources from the state budget; sponsors, contributions, commissions from domestic and international organizations and individuals to support environment protection activities throughout the country. The VEPF can allocate up to 2,000,000 USD as a soft loan to promote Green Chemistry initiatives in the six sectors identified by the project, including equipment for manufacturing enterprises and investments associated with the implementation of GC technologies (among else). Private initiatives in the six reference sectors have been identified. One industry in the chrome-plating sector is	Component 3: Introduce Green Chemistry approaches into priority sectors and at least 2 entities The alternative scenario will provide technical guidance and training to all the six sectors identified, as follows: Chrome plating; Textile; Plastic; Pulp and Paper; Solvent and Paint; and, Pesticides. The project goal is to reduce 15 g-TEQ/a of UPOPs releases, 1 ton of POPs, 0.002 tons of Mercury through the introduction of GC in priority sectors. In specific sectors the project implementation could also achieve a significant reduction of GHG releases. The project will:

Baseline project components	Incremental reasoning as from alternative scenario (GEF project components)
currently shifting from CrVI plating to alternative technologies, not requiring the use of CrVI or PFOS. The estimate investment is 2,000,000 USD. Key Lab Petrochemical and Refining Technologies contributes with investment co-financing in the sector of biofuels and bio-solvent with an investment of 1,000,000 USD. Bai Bang pulp and paper are investing around 1,000,000 USD for technologies aimed at further reducing the chlorine in bleaching. Finally, UNDP – is directly supporting the paper sector through the energy audit of the Bai Bang pulp and paper factory (40,000 USD) Co-financing: USD 6,040,000	*Perform In-depth GC assessments of priority production/manufacturing sectors.* *Develop technical tools and guidance for introduction of Green Chemistry in priority sectors.* *Introduce Green Chemistry approaches in at least 2 entities.* GEF budget: USD 1,200,000

The government of Viet Nam already established initiatives which are a critical step in the advancement of the chemical production sector and provide an excellent baseline for advancement of the R&D and chemicals sector. However, it is important for the country to start initiating a shift towards the introduction and application of more sustainable chemistry – Green Chemistry - to allow for the design of chemical products and processes that would allow the country and its production industry to further advance in reducing or eliminating the use or release of hazardous substances, i.e. pollution prevention, rather than exclusively focusing on the optimization of existing processes and the introduction of end-of-pipe solutions to reduce waste streams.

IV. RESULTS AND PARTNERSHIPS

6. Expected Results:

Component 1: Developing the Enabling Environment for Green Chemistry in Viet Nam. *Outcome 1.1 – Enabling Environment for Adoption of Green Chemistry Practices Established*

This project component's objective, as reflected in the associated Outputs 1.1.1 – 1.1.5, is to support Viet Nam creating an enabling environment that would facilitate the adoption of Green Chemistry practices. This project component will support this objective by strengthening public entities starting with an assessment of institutional capacity for GC adoption; sector analyses to identify GC opportunities for demonstration/application; assessment and subsequent improvement of the existing SMC policy and regulatory framework through taking up Green Chemistry aspects (through e.g. mainstreaming or adapting/developing policies and regulatory

measures) followed by putting in place incentives (based on outcomes of Cost Benefit Analyses - CBAs) that would encourage priority sectors to start adopting GC practices.

Furthermore, this project component will also aim to overcome one of the main barriers to GC adoption which is the absence of experience/expertise in the area of GC, and the limited access of national companies to GC expertise/knowledge. The project therefore aims to build technical capacity among government entities and industry, increase capacity of existing institutions and partnerships for Cleaner Production and Green Chemistry and establish a network of trained experts, consultants and firms who in the long term can provide advice and services to industry in adopting Green Chemistry practices.

Output 1.1.1 National institutional capacity for Green Chemistry adoption assessed

Firstly, this output, in partnership with national and international recognized institutions on Green Chemistry, international and national manufacturers, research institutions, industry associations and government entities, will undertake a comprehensive assessment of the existing institutional and technical capacity of national stakeholders for the adoption of Green Chemistry approaches.

The assessment will also review Green Chemistry best practices and experiences from other countries – in particular those with a similar development context as the one in Viet Nam – from which the country might be able to benefit, and determine the feasibility of potential incentives (financial and non-financial) for the adoption of GC, which have proven successful in other countries and could potentially be introduced in Viet Nam.

An assessment report will be prepared that provides an overview of current institutional and technical capacity of national stakeholders and presents recommendations to improve their capacity to enable the uptake of GC in Viet Nam. Secondly the assessment report will also make recommendations towards the introduction of potential incentives for GC uptake.

Output 1.1.2 Regulatory and policy assessment pertaining to Green Chemistry and POPs completed and gaps identified.

This project output will assess the legislative and policy framework in place, for the Sound Management of Chemicals (SMC) in general and Green Chemistry and Stockholm Convention related national requirements in particular.

Presently no legal requirements regarding Green Chemistry exists, nor does a Green Chemistry strategy. At the same time, some inconsistencies pertaining to regulatory measures necessary for the adequate implementation of the Stockholm Convention persist (unclear and inadequate classification, non-inclusion of new POPs, among others).

An assessment report will be prepared that will present an overview of the regulatory and policy environment, and which will present recommendations for the establishment of a policy and regulatory framework pertaining to Green Chemistry in each of the six industrial sectors targeted, improvements of the policy and regulatory framework governing POPs management and recommendations for the introduction of regulatory incentives for Green Chemistry adoption (also building upon outcomes of Output 1.1.1).

Output 1.1.3 Specific standards and regulations on Green Chemistry, including incentive scheme, prepared.

Based on detailed information and recommendations resulting from the regulatory gap/needs assessment conducted as part of Output 1.1.2, the project will support the government of Viet Nam in the preparation of technical standards and/or regulations on Green Chemistry in the six identified sectors.

Furthermore, the project will identify and propose regulatory measures deemed necessary to put in place incentives (financial, regulatory and non-financial incentives), promote market based and consumer driven policies to encourage readiness for the adoption of Green Chemistry technologies. Impact funds (for instance, financial facilities providing loans at competitive interest rate upon compliance with certain environmental requirement) will be designed and proposed as part of these measures.

All the activities related to the regulation of waste releases from industry will be developed in the coordination with MONRE/VEA, MOST, MARD.

Output 1.1.4 Green Chemistry incentives introduced following Cost-Benefit Analyses (CBAs).

In order to encourage manufacturers/producers and importers/distributors to engage in a shift towards green chemistry, it will be key to introduce feasible and sustainable incentives and instruments at national level. To this end, a list of eligible Green Chemistry initiative in specific industrial sectors will be developed and officially approved.

As part of Output 1.1.1 the assessment will provide recommendations on potential incentives for specific industrial sectors that could be introduced in Viet Nam to further advance the adoption of GC. As part of Output 1.1.4, each of these incentives will be subject to a basic Cost-Benefit Analysis (CBA) to determine their feasibility and long-term financial consequences and benefits.

Incentives that will be analyzed will include financial as well as non-financial ones (e.g. regulatory and voluntary incentives) such as tax benefits that could cover part of the incremental costs of GC technology transitions, the establishment of a GC fund/Green Impact Fund/financial institutions offering a Green Fund in combination with regulatory measures (*This*

activity will be direct implemented by UNDP in coordination with UN Social Impact Fund in Bangkok). Voluntary incentives that would be analysed, could include the establishment of GC recognition programmes (similar to the USEPA Presidential Green Chemistry Challenge and the American Chemical Society (ACS) Green Chemistry Awards, which would encourage GC R&D at Vietnamese universities and GC application at an industry level) and the introduction of green public procurement and certification/standards similar to the Green Screen for Safer Chemicals. The Roadmap to Zero Discharge of Hazardous Chemicals in the apparel industry, the Plastics Scorecard and others, which can present useful tools for industries and enterprises in brand image building for their domestic and export markets.

Results from the CBAs will be presented to the project board and project stakeholders for their approval after which the project will support the development and introduction of these incentives (when regulatory actions are required, these will be supported as part of Output 1.1.3).

Output 1.1.5 A network of GC experts and institutional expertise created through capacity building and training. This output will aim to overcome one of the main barriers to GC adoption which is the absence of experience/expertise in the area of GC, and the fact that in particular national companies (as opposed to international enterprises) do not have easy access to GC expertise/knowledge. This project output therefore aims to build technical capacity among government entities and industry, increase capacity of existing institutions and partnerships for Green Chemistry, and establish a network of trained experts, consultants and firms who will work as a help desk to provide advice to industry in adopting Green Chemistry practices. In practical term this will be established through a blog platform or a Green Chemistry line which can be accessed by the industry to ask specific question on the implementation of Green Chemistry.

The project will further build the capacity of institutions and partnerships that have already undertaken some work related to Cleaner Production and Environmental Protection to enable them to also offer services related to GC as well as work closely with GEF implementing agencies such as UNEP and UNIDO that already support such structures (e.g. Cleaner Production Centers Programme and Green Industry Platform (GIP) members). Potentially, the project might establish a "Green Chemistry Cell" which would work primarily on the promotion of green chemistry in the country and link interested enterprises to information and expertise, while providing them with guidance on making use of various existing incentives.

Additionally, the project aims to build technical capacity for GC in other institutions, such as universities (in coordination with Output 2.1.3), research institutions, consultancy firms and the like to expand the national knowledge base on GC. Initially by training individuals, to subsequently engage them as trainer of trainers (ToTs) on GC awareness building and finally to build their knowledge base through hands-on practical application of GC in industry as part of Output 3.1.3.

The ToT training will be carried out in collaboration with the Viet Nam Cleaner Production Center and/or with the Viet Nam Learning Center on Environmental and Social Responsibility. Ultimately trained experts will be engaged to apply GC hand-on as part of the project's demonstration component (Component 3). At least one training session for each one of the six industrial sectors identified will be carried out. It is anticipated that each training session will train at least 10 trainers, for an overall number of 60.

Component 2: Promote awareness on Green Chemistry and the benefits of the application of Green Chemistry and its guiding principles (Implemented by MOIT and MONRE)

Outcome 2.1 – Awareness on GC and its guiding principles increased to a level necessary to support a shift to GC application.

A first step in bringing about growth in the application of Green Chemistry and its principles, is to promote awareness among government entities, industry and the general public on the potential environmental, economic and social benefits of Green Chemistry applications.

Awareness raising will target the general public, the industrial sector and the environmental control authorities with specific messages.

On the side of the general public, the benefits of green chemistry in term of safety of products and reduced environmental burden will be explained. This will help in establishing a demand for green chemistry products.

On the side of the industry, the message to be conveyed is that green chemistry is not just a further obligation to comply with; it is indeed an opportunity to enter in a wider and higher quality market. The adoption of GC does not necessarily imply an increase in manufacturing cost: indeed, when coupled with resource-saving initiatives (reduced use of chemicals, raw materials and energy, reduced environmental liability, etc.) it may end up in reduced production cost.

On the side of the government, the adoption of green chemistry may lead to less controls to be performed on industries adopting GC, allowing the authority to focus on higher environmental priorities

In order to create the necessary confidence and readiness for entities to adopt GC, it is key to share experiences on the successful application of Green Chemistry from national and/or international GC efforts, as part of awareness raising efforts.

Success stories help demonstrate that GC can lead to reduced pollution, job creation, cost savings, increased competitiveness, among many other benefits. Therefore, this project component will invest in outreach and visibility activities at national level as well as collect Green Chemistry success stories specific to the six reference sectors and disseminate such

examples to create awareness among decision makers at government, industry and consumer level on the importance, potential and application of Green Chemistry.

Output 2.1.1 Awareness on Green Chemistry created among decision makers and stakeholders.

Due to the very low level of awareness on GC and its application, raising awareness on GC among decision makers in government, industry, R&D, end-users, importers, retailers and distributors on GC benefits and its application is a crucial activity.

The first activity to undertake to achieve this output will be, therefore, to prepare a sound communication plan/strategic communication plan, based on the assessment of the awareness and communication needs at all level. This activity will be direct implemented by UNDP.

Awareness raising will be in form of workshops, development and dissemination of tailored guidance for priority sectors, provision of GC information materials including experiences from Viet Nam and other countries on GC successes, social media outreach (including website development) and collaboration with Viet Nam Television Channel II. Currently the Viet Nam Television CII broadcasts 3 programs weekly: “Clean and Dirty (5 minutes)”, “Sustainable Development (15 minutes)” and “Environmental Angle (10 minutes). The project will collaborate with VT on the development of Green Chemistry material to be inserted in the above programs.

Two (2) workshops for each of the 2 selected industrial sectors will be held in the course of the project (a total of 4 workshops).

- The first workshop will introduce green chemistry in the two sectors selected for demonstration. Here, potential green chemistry interventions/actions will be described and proposed including their cost and benefits; potential incentive mechanism will be introduced, and modalities for exchanging of information and knowledge with the industries involved in the demonstration will be established. The methodology for the evaluation of GC benefits and costs will also be introduced at this stage. This workshop has to be carried out soon after the selection of the two demonstration sectors.
- The second workshop will be a “problem solving” workshop. During this workshop, the experience on the application of green chemistry in the 2 demonstration sectors will be discussed and solutions to practical problems will be identified. In this second workshop, the methodology for the evaluation of environmental benefits with a focus on POPs will be refined and applied. This workshop should report on the benefits of the approach for industry and the general public, discuss the way forward and share success stories and lesson learned.

These workshops will be organized in collaboration with the South Korea Institute (KRICT) and other interested development partners and research institutes.

The project will also develop, in coordination with and in support of the existing industrial association, an on-line support network/forum for the exchange and sharing of experiences,

knowledge and best practices on Green Chemistry for entities seeking more guidance on the subject (including CSR, energy efficiency and cleaner production) of which its management would most likely become the responsibility of the "Green Chemistry Cell" (see Output 1.1.5), the Cleaner Production Center or other support structures.

The creation of awareness on GC, will be a critical aspect of creating necessary confidence to initiate a shift towards GC (jointly implemented with incentives and a market and/or regulatory driven process, as transformation is not expected to happen in one step).

Output 2.1.2 Corporate Social Responsibility (CSR) Green Chemistry initiatives initiated.

In close coordination with project Component 3, the project will work with a number of demonstration companies that have a CSR policy in place and are willing to support the project's cause in gaining further momentum for GC. These companies will showcase the feasibility and benefits of GC (making use of incentives developed under project Output 1.1.3) and will commit to sharing information (to the extent possible) of GC decision making and application in procurement, production/manufacturing, supply chain management, among else.

The project anticipates to collaborate with a limited number of high profile enterprises that would be interested to showcase/apply GC (as part of their CSR) to further build their brand in the eye of the client and the wider public for either domestic or export markets. This might lead to an important market force and transformation as these companies can use the application of GC as a competitive edge, which consequently might inspire other enterprises to do the same.

At this stage, the assumption is made that enterprises with a CSR policy in place might predominantly be foreign investment companies, however the project aims to work with both Vietnamese and international companies throughout this output.

The following criteria will be adopted for the development of suitable CSR initiatives under the project:

1) The CSR initiative has to be sustainable and sustained. In other word, the CSR on Green Chemistry should be adopted as a standard practice by the industry, and possibly reflected in the ISO standards (ISO 9001 or ISO 14000) adopted by the industry.
2) Eligible CSR on Green Chemistry under the project will be the ones which implement Green Chemistry compliant actions within a specific sector or industry, even in the absence of a regulation, providing then a concrete example which may be considered by the GoV in the development of specific regulation
3) "One shot" actions, like donations, or economic support to local communities without a clear relationship with the GC principles should not be considered as Green Chemistry CSR initiatives.

Output 2.1.3 Green Chemistry extra-lecture integrated in the universities and MOIT training institutes.

As part of Output 1.1.5, a network of GC experts and expertise will be created through capacity building and Training of Trainers.

The project aims to develop, with the support of people trained under Output 1.1.5 (some of them can be researchers or professors from MOIT universities) a Green Chemistry cycle of training courses to be coordinated by MOIT and carried out in partnership with AITVN Learning Center.

For this purpose, training stages will be organized at manufacturing facilities selected among the six reference sectors. At least 20 trainees for each sector will be trained in this training cycle. This will allow trainees to base their knowledge on practical experience rather than only on theoretical classroom training.

The project also anticipates to facilitate establishing partnerships between higher education institutions in Viet Nam and countries where R&D on GC has significantly advanced, to ensure that students as well as institutions become part of international knowledge and exchange networks and information on new developments in this field becomes more easily accessible.

Output 2.1.4. Commercial/trade promotion of advance technologies

Identify relevant channels and platforms to introduce new technologies, aiming for the implementation of Green Chemistry in the six identified manufacturing industrial sectors (MOST-led Infor Tech exhibition can be a good option) will be provided by bilateral donors and embassies in Viet Nam.

Component 3: Introduce Green Chemistry approaches into priority sectors and at least 2 entities

Outcome 3.1 : 15 g-TEQ/a of UPOPs releases, 1 tonne of POPs, 0.002 tonnes of mercury reduced and at least 65 tons of CO2 through the introduction of GC in priority sectors

Currently, there is official information concerning the import of 10 tons of Deca-BDE in Viet Nam in 2016. In the plastic industry, Deca-BDE is contained as a flame retardant in plastics at a level which may exceed 5% of the product's weight. Therefore, the substitution of Deca-BDE for the production of 20 tons of plastic would already imply the achievement of the target envisaged at PIF stage. It should be noted that the incremental cost for the replacement of deca-BDE with alternative chemicals is in the order of 1 USD/kg, while the cost of replacement of moulds could range between 90,000 and 180,000 USD each.[3]

The project intends to also tackle the use of PFOS as well as other POPs (PBDEs) in certain manufacturing sectors, including for instance the chrome plating and textile sectors. Due to the

[3] Deca-BDE and alternatives in Electrical and Electronic equipment, Lassen C, Havelund S, Leisewitz A, Maxson P, Danish Ministry of the Environment, available at http://www2.mst.dk/Udgiv/publications/2007/978-87-7052-349-3/pdf/978-87-7052-350-9.pdf.

high replicability aspects of this project, the limited amount of POPs reduction which may be achieved in 2 demonstration plant can be achieved in much larger amount in the replication stage of the project. It is expected that a replication target of at least 5 times the demonstration target can be achieved through the introduction of measures capable to ensure a reduction in manufacturing cost, the implementation of the impact funds, and the development and enforcement of regulatory measures.

The mercury reduction will be mostly achieved through the increase of the energy efficiency in the target industries. For this, it has to be pointed out that:

1) in Viet Nam, electricity production relies for around 30% on coal fired power plant
2) the mercury content in coal in Viet Nam is in the range of 0.06 to 0.16 mg/kg
3) some sectors (like pulp and paper) are direct consumers of coal for the generation of heat and power. For instance, the Bai Bang pulp and paper plant consumes around 70,000 tons of coal per year. For Bai Bang, the establishment of mild energy saving measures capable to allow a reduced consumption of coal in the order of 0.5% would entail a reduction of mercury emission in the order of 21kg/yr, and of CO2 in the order of 65t/yr. The direct or indirect coal consumption reduction will be assessed

As part of this component, the project will work closely with national and international stakeholders that are on the forefront of promoting GC (e.g. MOIT, VINACHEMIA, CPC, industry associations, and research institutions, among others). Initially, this project component will help identify detailed demonstrative interventions, based on the baseline assessment for the six reference sectors. The detailed baseline assessment for the six sectors to be conducted during project implementation will provide information on current environmental releases and use of chemicals, with specific reference to POPs and mercury, and potential for GC adoption that would be the best fit to function as demonstration of Green Chemistry approaches. This would be followed by criteria setting and identification/selection of two (2) production facilities and/or manufacturers in these sectors that will function as pilot demonstration sites for Green Chemistry. This project component will also support the development of technical tools and guidance to facilitate the adoption of GC for each of the six sectors, and will provide direct support to 2 sectors in demonstrating and adopting GC practices.

Output 3.1.1 In-depth GC assessments concluded of priority production/manufacturing sectors.

This project output will support the assessment of industrial and production sectors that present opportunities for the introduction of Green Chemistry. Based on the preliminary outcomes achieved during the PPG phase, the following shortlist of priority sectors for the application of GC principles has been identified:

1) **Electro-plating industry**, due to its use of PFOS as etching agent and mist suppressant;
2) **Plastic manufacturing industry**, due to its use of deca-BDE (which has the potential to be degraded into POPs-PBDE) as well as PBBs (flame retardant) used in many plastic polymers and due to the use of short chain chlorinated paraffins;

3) **The textile industry**, due to the potential release U-POPs into products associated with contaminated raw materials (i.e. dyes), the potential use of PFOS and PFAS for water – repellency purposes, the potential use of deca-BDEs as flame retardant, and the use of chlorine as bleaching agent;
4) **The pulp and paper industry**, due to the use of chlorine-based bleaching agents that may result in the secondary formation of chlorinated compounds in the environment (including PCDD/F);
5) **The pesticide sector,** due to the continuation of the import and use of some restricted chemicals including POPs, and for the use of mercury in some pesticide or biocide formulations
6) **The solvent and paint sector**, due to the use of chlorinated solvents and short chain chlorinated paraffins in paints, as well as the use of mercury in some paint formulations.
7) **In addition, the project will identify energy saving measures** for each sector which will ultimately result in the saving of at least 2kg/year of mercury release, either through the direct reduction of the coal consumption or through the reduction of electricity consumption.

Studies undertaken as part of this output will allow for the establishment of baselines and identify opportunities for green chemistry introduction on a sector based approach. Assessment results will be presented in sector-specific reports.

This output will be achieved through the following means:

1) Site visit and environmental audit in a number of manufacturing plants in each sector. The expert group established under component 1.1.5 will perform site visits to a number of plants in each sector, with the purpose of determining:
   - Manufacturing process adopted;
   - The chemical profile of the enterprise: list quantities of substances / mixtures consumed and relevant MSDS, to identify POPs or POPs precursors;
   - Releases to water, soil, air and listing the technologies applied for the reduction of these releases.
   - The generation and management of wastes, including hazardous waste.
   - The energy balance and potential energy-saving interventions.

   It is expected that at least 8 manufacturing plants from each sector will be visited (a total number of 48 factories). The factories to be visited will cover both SMEs and large scale plants. During each visit, the expert group will also discuss with the plant managers the possible GC interventions for the sector in order to raise awareness and collect advice on the practical application of these interventions.
2) Conduct an analysis of information based on MSDS and trade names of mixtures/substances. In many cases, the manufacturers are not aware of the possible content of the mixture they use, simply because this information is not made fully

available through MSDSs. For this reason, the experts will make an assessment of the MSDSs to identify missing information and understand whether, based on their knowledge, some mixtures may contain POPs, POPs precursors, mercury or other hazardous substances. Based on this analysis, a list of possible chemical alternatives to these toxic substances will be proposed.

3) Identification of key areas of demonstration in the six reference sectors and associated costs.

Output 3.1.2 Technical tools and guidance developed for introduction of Green Chemistry in priority sectors.

In support of Output 3.1.3, to encourage replication of best practices and success stories and to provide a platform for continuous capturing and sharing of GC experiences, the project will, for each of the six reference sectors, prepare technical tools and technical guidance on the introduction of Green Chemistry. Initially these tools and guidance documents will be applied and tested throughout the training and capacity building of entities that are participating in the demonstrations activities as part of Output 3.1.3. However these documents will be considered as living documents into which experiences, lessons-learned and success stories will be integrated as they become available.

Output 3.1.3 Green Chemistry approaches introduced in at least 2 entities.

The most significant project component in terms of technical and financial assistance will be Output 3.1.3 during which at least 2 selected entities will introduce various GC practices, depending on the opportunities identified as part of Output 3.1.1.

In the Table 3 to Table 8 below, potential GC interventions in the 6 reference sectors and their relevance in term of POPs are summarized.

In addition to the implementation of specific Green Chemistry interventions capable to reduce POPs, as listed in Table 3 to Table 8 , a number of general intervention for the 2 pilot sectors will be selected for implementation, as following:

1) Development of a database of substances and mixtures used in the demonstration sector for a more easy identification of non-toxic, non-POPs alternative substances;
2) Promote, whenever possible, the use of environmentally friendly biocides in industrial processes (for instance in the textile and pulp and paper sectors);
3) Promote the use of substances alternative to POPs, with specific reference to PFOS, C-PBDE, SCCP;
4) Promote, whenever possible, alternatives to chlorinated solvents in industrial processes;
5) Minimize water discharge and establish automatic control of water quality.

Technical assistance will be provided by the project team (made up of national and international experts, some of whom will have been trained as part of Component 1) in close partnership with MOIT, the management of industrial zones, research institutions, the CPC and other partners on GC. Prior to GC introduction, each enterprise will undergo an in-depth plant assessment, after which a detailed Green Chemistry intervention plan will be drafted, including

a financial investment and operation plan. After approval of the Green Chemistry intervention plan, the project will support the introduction of GC approaches and GC technologies.

This component will ensure close coordination with the MPI/GEF/UNIDO/SECO project "Implementation of Eco-Industrial Park Initiative for Sustainable Industrial Zones in Viet Nam". Even though the proposed project will not focus on priority zones, but on priority sectors instead, it will be able to benefit from the lessons-learned and experiences resulting from the MPI/GEF/UNIDO/SECO project and vice-versa.

Table 3 Electro-Plating Sector - Green Chemistry interventions capable to reduce the use and releases of POPs.

Green Chemistry principle	Situation in the Chrome Plating industry in Viet Nam	Potential GC intervention	Relevance to POP
1. Prevent waste:	Waste slug and wastewater containing POPs and toxic metal are a common issue of the Chrome Plating Industry in Viet Nam.	Increase the number of closed-loop processes to prevent the release of contaminants in wastewater, including PFOS. Ensure rinse water is treated before release. Improve waste treatment processes. Reduce CrVI to CrIII before discharge.	Yes, direct
2. Maximize atom economy:	Most small scale chrome-plating plants use basic processes without automated control of bath conditions.	Reduce/optimize the use of etching agents. Adopt Direct Current (DC) rectifiers and automated control of the chromium bath to reduce the loss of the plating agent (chromium).	Yes, direct
3. Design less hazardous chemical syntheses:	Chrome plating processes making use of PFOS as etching agent and mist suppressant.	Use alternative non-PFOS mist suppressant -see below	Yes, direct
4. Design safer chemicals and products:	N/A	N/A	N/A
5. Use safer solvents and reaction conditions:	PFOS based mist suppressants used for the prevention of chrome-contaminated mists in the workplace.	Use non chemical mist-suppressants (like poly-propylene floating balls) or non PFOS mist suppressants. Introduce alternative chrome-plating processes (under development: trivalent chromium, spray and PVD coatings).	Yes, direct
6. Increase energy efficiency:	Most chrome-plating small-scale plants use basic processes without process control to reduce energy consumption.	Introduce process control to reduce energy use for heating baths (e.g. insulation of plating baths to prevent energy losses).	Yes, indirect (U-POPs)
7. Use renewable feedstocks:	N/A	N/A	N/A
8. Avoid chemical derivatives:	N/A	N/A	N/A
9. Use catalysts, not stoichiometric reagents:	Sulfuric acid mostly used as catalytic agent	Use of less toxic, more balanced, mixtures of catalysts to reduce toxicity of the bath.	No
10. Design chemicals and products to degrade after use:	N/A	N/A	N/A
11. Analyse in real time to prevent pollution:	No real-time monitoring of effluent implemented in most of the small scale plants	Real time monitoring of air and wastewater effluents.	Yes, indirect
12. Minimize the potential for accidents:	Airborne release of chromic acid in the workplace is one of the major causes of worker illness. However, the use of PFOS as mist suppressant introduces a new source of risks in case of non-closed loop processes.	Use of non-chemical mist suppressant like poly-propylene floating balls on the bath surface. Use of chromic acid scrubbers.	Yes, direct

Table 4 Plastic manufacturing sector - Green Chemistry measures and prevention of POPs use and releases.

GC category	Situation in the polymer industry In Viet Nam	Potential GC interventions	Relevance to POP
1. Prevent waste:	Waste from polymer production may contain flame-retardants.	Better control of waste effluent. Reuse/recycle plastic wasted during manufacturing.	Yes, direct
2. Maximize atom economy:	Optimization of processes in a few advanced factories.	Improvement of the polymerization process. Reduce the amount of additives through optimized processes.	Yes, direct
3. Design less hazardous chemical syntheses:	Deca-BDEs are still being imported and used as additives in a number of plastic polymers.	Replace brominated flame retardants with non-brominated non-POPs flame-retardants.	Yes, direct
4. Design safer chemicals and products:	Deca-BDEs are not produced in Viet Nam.	Restrict / control the import of deca-BDE in the country.	Yes, direct
5. Use safer solvents and reaction conditions:	Deca-BDEs are still imported and incorporated as part of a number of plastic polymers.	Improve design of articles so that Flame Retardants are not necessary (introduce alternative measures to reduce fire risk).	Yes, direct
6. Increase energy efficiency:	Adoption of energy saving measures is currently very limited.	Reduce heating through better process control and insulation of reactors.	Yes, direct
7. Use renewable feedstocks:	The plastic sector in Viet Nam often recycles plastic without checking for the content of PBDEs.	Introduce quality criteria for plastic manufacturing, including the use of recycled plastic.	Yes, direct
8. Avoid chemical derivatives:	Not relevant for this type of industry	Not relevant for this type of industry	N/R
9. Use catalysts, not stoichiometric reagents:	Not relevant for this type of industry	Not relevant for this type of industry	N/R
10. Design chemicals and products to degrade after use:	No biodegradable plastics are being produced in Viet Nam.	Production of bio-degradable/bio-plastics, which may prevent the release of U-POPs as a result of accidental combustion.	Yes, direct
11. Analyze in real time to prevent pollution:	Few plants are adopting real time monitoring.	Real time monitoring of air and wastewater effluents introduced.	Yes, indirect
12. Minimize the potential for accidents:	Storage of hazardous chemicals may represent a potential risk.	Improve the storage of hazardous chemicals, by optimizing and reducing the quantities stored, and by establishing surveillance.	Yes, indirect

Table 5. Textile sector - Green Chemistry measures and prevention of POPs use and releases.

GC category	Situation in the polymer industry in Viet Nam	Potential GC intervention	Relevance to POP
1. Prevent waste:	Waste from polymer production may contain flame retardants.	Quality management of incoming fibers. Better control of waste effluent. Avoid processing fibers contaminated with hazardous chemicals, such as pesticides, unless an analytical certificate has been provided. Optimize water consumption and online control of wastewater quality.	Yes, direct and indirect
2. Maximize atom economy:	Optimisation of processes has only been introduced in a few advanced factories.	Improve the quality and quantity of chemicals used, including regular revision and assessment of the recipes, optimal scheduling in production, etc.	Yes, direct
3. Design less hazardous chemical syntheses:	PFOS or PFAS may be used in the finishing process to provide water-repellent features to the fibers.	Replace PFOS and PFAs with other water–repellent substances. Replace PBDEs flame retardants with other FR substances. Build a database of the chemicals and mixtures used in the textile sector to facilitate the identification of alternatives.	Yes, direct
4. Design safer chemicals and products:	PFOS or PFAS are not produced in Viet Nam.	Restrict/control the import of PFOS and PFAS substances in the country. Restrict/control the import of PBDEs flame retardants in the country. Adopt Hydrogen Peroxide bleaching as a substitute of Sodium Hipochlorite bleaching.	Yes, direct
5. Use safer solvents and reaction conditions:	PFOS are still used in a number of textile application. No data is available on the use of PBDEs.	Identify / develop alternative to PFOS as water - repellent substances. Identify / develop alternatives to PBDEs as flame retardants.	Yes, direct
6. Increase energy efficiency:	The adoption of energy saving measures is very limited.	Reduce heating through better process control and insulation of vessels.	Yes, indirect (U-POP)
7. Use renewable feedstocks:	The textile sector already makes wide use of natural fibers.	Introduce quality criteria for natural fibers, including verification of organic residues. Perform testing of intermediate and final products to verify the presence of hazardous substances.	Yes, direct and indirect
8. Avoid chemical derivatives:	Not relevant	Not relevant	Not Relevant
9. Use catalysts, not stoichiometric reagents:	N/A	N/A	Not Available
10. Design chemicals and products to degrade after use:	Many substances used are not biodegradable and are released in the environment during / after manufacturing processes.	Promote the use of surfactants that may easily degrade after release without forming toxic metabolites. Use of non-PFOS antifoaming agents. Develop bio dyes for the replacement of toxic dyestuff	Yes, indirect and direct
11. Analyse in real time to prevent pollution:	Most plants are of small scale and do not adopt real time monitoring.	Real time monitoring of air and wastewater effluents. Adopt automated control of process parameters (e.g. temperature, liquor level, chemicals feed) to reduce the use of chemicals and auxiliaries.	Yes, indirect
12. Minimize the potential for accidents:	Storage of chemicals, including bleaching substances, represent a substantial risk.	Improve the storage of hazardous chemicals, by optimizing and reducing the quantities stored, and by establishing surveillance.	Yes, direct and indirect

Table 6. Pulp and Paper Sector - Green Chemistry measures and prevention of POPs use and releases.

GC category	Situation in the pulp and paper industry In Viet Nam	Potential GC intervention	Relevance to POP
1. Prevent waste:	Poor recycling of the lignin residue from pulping results in a very high organic load released to wastewater, which when associated with high chlorine content (derived from chlorine bleaching) results in a high level of chlorinated compounds released to wastewater.	Improve recycling of lignin from the wastewater process. Improve wastewater treatment. Assess and implement water reuse in various processes.	Yes, indirect
2. Maximize atom economy:	Optimisation of processes has only been introduced in a few advanced factories.	Improve the recycling of lignin before bleaching may lead to a reduction of chemicals needed for bleaching.	Yes,, indirect
3. Design less hazardous chemical syntheses:	Very often there little knowledge about chemicals used. PFOS or PFAS may be used in the finishing process to provide water- repellent features to the paper.	Build a database of chemicals used in the pulp and paper sector to increase awareness. Replace PFOS and PFAs with other water-repellent substances.	Yes, direct and indirect
4. Design safer chemicals and products:	PFOS or PFAS are not only being produced in Viet Nam.	Restrict/control the import of PFOS and PFAS substances in the country. Adopt Hydrogen Peroxide bleaching or ozone bleaching as a substitute to Sodium Hypochlorite bleaching.	Yes, direct and indirect
5. Use safer solvents and reaction conditions:	PFOS is still used in a number of water or grease repellent paper applications.	Identify / develop alternatives to PFOS as water -repellent substances.	Yes, direct
6. Increase energy efficiency:	Adoption of energy saving measures is very limited.	Reduce heating through better process control and insulation of vessels.	Yes, indirect (U-POPs)
7. Use renewable feedstocks:	Pulp and paper is made from natural fibers, however deforestation and sustainability of plantations for the pulp and paper industry remains an issue.	Introduce quality criteria for natural fibers, including verification of organic residues. Test the final product for the presence of chemical residues, including POPs.	Yes, direct and indirect
8. Avoid chemical derivatives:	Not relevant.	Not relevant.	N/R
9. Use catalysts, not stoichiometric reagents:	Only applicable to large plants.	Using a solid metal catalyst and a hydrogen peroxide solution as an 'activator' to kill microorganisms by oxidation.	N/R
10. Design chemicals and products to degrade after use:	Paper is mostly biodegradable, However it may contain additives or trace chemicals, which are persistent or not easily biodegradable.	Develop a database of chemicals used in the pulp and paper industry. Test final product for the presence of POPs and other hazardous substances.	Yes, direct and indirect
11. Analyse in real time to prevent pollution:	Most plants are small scale and have not adopted real time monitoring.	Real time monitoring of all process modules. Real time monitoring of air and wastewater effluents. Adopt automated control of process parameters (e.g. temperature, liquor level, chemicals feed) to reduce applied chemicals and auxiliaries.	Yes, indirect
12. Minimize the potential for accidents:	Storage of chemicals including acid tanks and chlorine may represent a serious risk in the pulp and paper sector.	Improve the storage of hazardous chemicals, optimizing and reducing the quantities stored, and establishing surveillance.	Yes, direct and indirect

Table 7. Solvent and Paint Industry - Green Chemistry measures and prevention of POPs use and releases

GC category	Situation in the solvent and bio-solvent industry in Viet Nam	Potential GC intervention	Relevance to POP / mercury
1. Prevent waste:	N/A	N/A	
2. Maximize atom economy:	N/A	N/A	
3. Design less hazardous chemical syntheses:	The petro-chemical industry and the chlor-alkali process, produce most of the solvents used in Viet Nam.	Firms manufacturing non-harmful bio-solvents are emerging. Promote the development of industries in the bio-solvent sector.	Yes, direct and indirect
4. Design safer chemicals and products:	The use of chlorinated and halogenated solvents is widespread in industrial processes. Some solvents produced by the petro-chemical industry (BTEX series) are also commonly used and known for their toxicity. SCCP are used in the formulation of paints.	Design solvents, which can replace halogenated solvents or BTEX solvents commonly used in products. Redesign paint mixtures to avoid the use of SCPP.	Yes, direct and indirect
5. Use safer solvents and reaction conditions:	N/A	N/A	
6. Increase energy efficiency:	N/A	N/A	
7. Use renewable feedstocks:	As the petro-chemical industry and the chlor-alkali process produce most of the solvents used in Viet Nam, feedstocks are non-renewable. A limited number of firms are currently investing in bio-solvents.	Production of solvents from the distillation of vegetable, renewable feedstock.	No – however reduce GHG
8. Avoid chemical derivatives:	N/A	N/A	
9. Use catalysts, not stoichiometric reagents:	N/A	N/A	
10. Design chemicals and products to degrade after use:	Chlorinated solvents and aromatic solvents are usually hard to degrade. Most of the solvents used in Vietnamese industry are imported chlorinated or aromatic solvents. Some paint formulation are still based on the use of SCCP.	Develop the production and promote the use of bio-degradable solvents to replace chlorinated, non-degradable solvents. Develop the production of paints not containing SCCP.	Yes – direct and indirect
11. Analyse in real time to prevent pollution:	N/A	N/A	
12. Minimize the potential for accidents:	N/A	N/A	

Table 8. Pesticide Production and Application - Green Chemistry measures and prevention of POPs use and releases

GC category	Situation of the pesticide production and application in Viet Nam	Potential GC intervention	Relevance to POP / mercury
1. Prevent waste:	As in many other countries, the issue of pesticide waste containers is serious and not addressed yet.	Reduce the amount of pesticide containers. Ensure that after use containers are not dumped in the environment.	
2. Maximize atom economy:	Pesticides are not manufactured in Viet Nam. In most cases pesticides are re-formulated.	Promote the use of bio-pesticides. As bio-pesticides are synthetized by living organisms, the promotion of their use will ensure maximum atom economy in their synthesis.	Limited – indirect
3. Design less hazardous chemical syntheses:	As historically demonstrated, the design of pesticides is linked to the production and release of many POPs as intermediate substances or impurities in the final product.	Replace the production of traditional pesticides with bio-pesticides, as the biosynthesis of pesticide is intrinsically safe and extremely efficient.	Yes – indirect relevance
4. Design safer chemicals and products:	Most pesticides are imported in Viet Nam.	Bio pesticides - although in some cases they may be very effective like conventional pesticides - in general do not exhibit the properties of POPs and are biodegradable. In Viet Nam, 49 bio-pesticides have been registered as active ingredients, however these are in the early stages of commercialisation. Promoting the use of bio-pesticide would limit the use of conventional pesticides including POPs pesticides.	Yes - Indirect
5. Use safer solvents and reaction conditions:	No specific action in Viet Nam has been taken to introduce the use of safer solvents in pesticide production.	Promote the use of bio-solvents in the formulation of bio pesticides.	Yes – indirect
6. Increase energy efficiency:	Synthetic chemistry may require high energy processes.	The active ingredients of bio-pesticides have been synthetized by plants. Energy may be required for extraction – concentration. Promoting the use of bio-pesticides would limit the use of energy as compared to the manufacturing of synthetic pesticides.	No
7. Use renewable feedstocks:	Most pesticides are synthetic pesticides manufactured abroad.	Bio-pesticides are always extracted from natural, renewable materials.	No
8. Avoid chemical derivatives:	Most pesticides are synthetic pesticides manufactured abroad.	Not relevant	No
9. Use catalysts, not stoichiometric reagents:	Most pesticides are synthetic pesticides manufactured abroad.	Not relevant	No
10. Design chemicals and products to degrade after use:	Most pesticides are synthetic pesticides manufactured abroad. Some of the synthetic pesticides recently imported in Viet Nam are designed to ensure biodegradability.	Bio-pesticides are normally biodegradable, therefore do not exhibit POPs characteristics.	Yes
11. Analyse in real time …	N/A	N/A	
12. Minimize the potential for accidents:	N/A	As bio-pesticides are generally biodegradable, accidental releases would be easier to remediate.	Indirect

Component 4: Project Monitoring and Evaluation and Dissemination of Project Results, Lessons Learned and Experiences

This component's overall purpose as reflected in the associated Outcome 4.1 and Outcome 4.2 is to ensure the monitoring of project results, the extraction of lessons-learned and the dissemination of project experiences at national, regional and global level.

Outcome 4.1 - Project results monitored, adaptive management applied in response to needs identified and findings extracted.

Output 4.1.1 Adaptive management applied in response to needs, annual and PIR findings.

As a standard practice for every UNDP project, continuous monitoring of project results and achievements will be ensured, while the application of adaptive management of the project after conclusion of the Mid Term evaluation will be warranted. More details on Monitoring and Evaluation are provided in Chapter VII (Monitoring and Evaluation Plan)

Outcome 4.2 - Lessons-learned, experiences, and best practices extracted and disseminated at national, regional and global level.

Output 4.2.1 Lessons-learned, best practices and experiences collected and disseminated at national, regional and global level to support replication.

The project aims to collect lessons-learned, best practices and project experiences and capture them in easy to update, share and understandable communication materials (in Vietnamese and English) to facilitate national, regional, and international replication of project results.

In addition, the project anticipates conducting a limited number of cost-effective workshops (potentially co-organized with other chemistry/MEA events) to engage stakeholders from universities, industry, and governments to disseminate to the region, experiences on what was done, results to date, challenges/lessons learned, and future plans.

7. Partnerships:

On the governmental side, the main partner of the project is the Ministry of Industry and Trade (MOIT), which is the government body in charge of the legislation on chemicals, coordination and implementation of the Law on Chemicals (LOC). MOIT, through VINACHEMIA, is the focal point for the negotiation, ratification and implementation of the Minamata Convention on Mercury, as well as the Rotterdam Convention on the Prior Informed Consent of Procedure for certain hazardous chemicals and pesticides in International trade and the Strategic Approach to International Chemicals Management (SAICM). In addition, the Ministry of Natural Resources and Environment (MONRE), is also an important project partner, for all the matters related to the state management of environmental protection, as well environmental quality standards, environmental monitoring, remediation and prevention. MONRE is in charge of the implementation of the Law on Environmental Protection and hosts the focal point for international Conventions on chemical management and prevention like the Stockholm Convention, the Basel Convention, and the Montreal Protocol.

In addition to MOIT and MONRE, a list of the main stakeholders of the project, with their respective roles, is presented in the below Table 9.

Table 9. List of project stakeholders and their respective roles

Stakeholder	Role
Government Stakeholders	
Ministry of Industry and Trade (MOIT)	**Role and functions:** MOIT is a Ministry of the Government, performing the function of state management on industry and commerce. With regard to Chemical Management, MOIT/VINACHEMIA is responsible for defining government policies, proposing legislative frameworks for management and use of chemicals in industrial production and manufacture as well as imported chemicals. MOIT/SDO is responsible for coordinate and monitor Green Growth Action Plan in Industrial Sectors and Sustainable Consumption and Production Action Plan, which is guiding nation direction for Green Chemistry application in industrial production and manufacture. **Role in the project:** MOIT will be accountable for the Government of Viet Nam in cooperation with UNDP for ensuring (1) the successful execution of the Project; (2) mobilization of all resources including the needed co-financing for project implementation; and (3) the coordination among all related ministries, agencies, provinces (if necessary) and stakeholders involved in project execution. MOIT is the national implementing partner (NIP) and will chair the PSC meeting for guiding PMU on project execution and correct its course, if required. The PSC will also oversee the work done by the PMU in line with MOIT function and responsibility on a regular basis.
Ministry of Natural Resources and Environment (MONRE)	**Role and functions:** The Ministry of Natural Resources and Environment (MONRE) is a government ministry in Viet Nam, performing state management functions in the areas of land, water resources; mineral resources, geology; environment; hydrometeorology; climate change; surveying and mapping; management of the islands and the sea. MONRE is the focal point for the Stockholm Convention on POPs and in charge of issuing waste release and emission standards and regulations for industry sectors as well as monitoring the level of hazardous chemicals release to environment by industrial production and manufacturing. **Role in the project:** MONRE is a member of Project Steering Committee (PSC). The ministry, in coordination with MOIT and UNDP, will be in charge of state reviewing for national standards and regulations on waste emission and release; implement the activities on the development of regulations and standards in relation to waste release and emission, with specific reference to emission level of POPs for the project-selected industry sectors in air, water, sediment and solid waste (*where required*).
Ministry of Science and Technology (MOST)	**Role and functions:** The Ministry of Science and Technology (MOST) is a government ministry in Viet Nam responsible for state administration of science and technology activities, including technology transfer and import of new technology; development of science and technology potentials; intellectual property; quality control of national standards.

	Role in the project: MOST is a member of Project Steering Committee (PSC). The ministry has 2 functions: one concerning the support on quality control for waste release standards, and the second concerning introduction of new technology/solution for the project –selected industrial sectors/sub-sectors and new technology import (*where required*) in component 3, including involvement in the Infor Tech exhibition in component 2.
Ministry of Labor Invalids and Social Affairs (MOLISA)	**Role and functions:** The Ministry of Labor, Invalids and Social Affairs (MOLISA) is a government ministry in Viet Nam responsible for state administration on employment, occupational safety, social insurances and vocational training; social protection and prevention of social evils; child care and gender equality. **Role in the project:** MOLISA is a member of Project Steering Committee (PSC). The ministry will be in charge of collaboration, provision of policy advices and monitoring activities related to the improvement of environment quality at workplace and mainstreaming of gender issue.
Viet Nam Environment Protection Fund (VEPF), managed by MONRE	**Role and functions:** VEPF is a state financial institution responsible for financial support through soft loans provision for the implementation of programmes, projects, activities in environmental protection, natural resources and biodiversity conservation, and reduction of pollution and reduction of environmental risks. VEPF also provides finance (grant) for the preparation and implementation of some selected projects under World Bank support. **Role in the project:** **VEPF** is a member of Project Steering Committee (PSC). VEPF will provide the soft-loan for the enterprises applying Green Chemistry solution and will be in charge of assessing enterprise application to the fund based on VEPF criteria established in the course of project implementation. **VEPF** will also expected to contribute to the initiative of a green impact fund in collaboration with UN/DP.
National Foundation for Science and Technology Development (NAFOSTED), managed by MOST	**Role and functions:** NAFOSTED is a state financial institution responsible for promoting researches in technology development in Viet Nam; building research capacity for young scientists; enhancing research quality; linking research activities to enterprises, investors; etc. **Role in the project:** **NAFOSTED** and its scientific network will be involved and play supporting role in the establishment of the Green Chemistry network.
Viet Nam Institute of Industrial Chemistry (VIIC)	**Role and functions:** VIIC is a national research institute under Ministry of Industry and Trade (MOIT), established in 1956. VIIC conducts R&D researches in chemical technology and provides technical knowledge for strategies, national standards for chemicals, chemical policies, and planning for the chemical industry in Viet Nam. The research fields in VIIC include the development of chemical technologies for fine chemicals, bio-solvents, catalysts, nano-materials, bio-pesticides, drugs and polymers. VIIC achieved remarkable achievements on research and development of technology for production of bio-solvents and bio-pesticides through coordinating several units, among which are the Key Laboratory for Petrochemical and Refining Technologies (Key lab PRT) and Center for Research and Development of Bioactive Substances. **Role in the project:**

	VICI and its units will have knowledge and expertise, specifically on bio-pesticides and bio-solvent sub-sectors, can provide data of national paint production sector and support feasibility studies of bio-solvent and bio-pesticides (*where relevant*). **VICI** will also be a member and involved in the initiative of the Green Chemistry network.
Local Government Agencies at provinces (DOIT, DONRE and DOLISA)	**Role and functions:** These are the respective provincial level departments of MOIT, MONRE and MOLISA. **Role in the project:** Local ministry departments will be involved in the activities conducted at provincial level (*when relevant*).
Associations and NGOs	
Chemical Society of Viet Nam (CSV) (so call Viet Nam Chemical Association)	**Role and functions:** **CSV** is a NGO and a professional association in the field of chemistry. Formed in 1970s, CSV members are enterprises, universities, research institutes and scientists in Viet Nam working and doing business in the field of chemistry and chemical technology. CSV main function is to make connection among chemical enterprises, universities and research institutes as well as chemists for promoting sustainable development of Vietnamese chemical sectors through chemical education, research work, chemical production and doing business together. CSV is working for protecting chemical industries rights, supporting modernization as well as privatization processes for chemical industries located in Viet Nam. CSV is supporting chemical industries and scientists to understand and to compliance with Viet Nam laws and regulation as well as international agreements in the field of chemistry and chemical production, importation and exportation via providing appropriate consultation, training activities and expertise. CSV is supporting local chemical industries in the field of Health, Safety and Environment (HSE) and development researches and application of Green Chemistry. The association has the function to promote knowledge exchange among its member and to support the implementation of research into practical applications; to promote the development of chemical sector; and to deliver training to their members. **Role in the project:** **CSV** is a supporting organization in identifying national experts for studies and assessments on chemical use and release in project–selected industrial sectors and project activities; one of potential agencies to collaborate in awareness raising activities and an institution to be involved and collaborate in the establishment of Green Chemistry Network.
Sector Associations (i.e., Viet Nam Textile Association, Plastic Industry Association, etc. Vietnamese Pulp and Paper association, etc.)	**Role and functions:** All the industrial associations aim at protecting rights and legal benefits of their members in compliance with the relevant Vietnamese legislation. The associations also examine and propose to the Government regarding issuances of policies and strategies for the development of their industrial sector. Some associations – like for example the Viet Nam Pulp and Paper association and the Viet Nam Textile Association – also performs research on the manufacturing technologies and provides trainings to their members. **Role in the project:** The Associations will be key partners in facilitating the activities to be conducted in the respective industrial sector such as collating sectorial information, disseminating information related to the project, providing support to the

	assessment and implementing awareness raising activities, specially to trainings to enterprises in each sector, CSR initiatives by enterprises, Infor Tech exhibition, etc.
Asian Institute of Technology in Viet Nam (AIT VN) / Learning Centre (LC)	**Role and functions:** AITVN is one of the first international education centers in Viet Nam support technology transfer for the national development through providing high-quality postgraduate and short-term training, information services, research and consultancy. The services of AIT-VN are based on the country's needs. AITVN has provided numerous capacity development programs to promote CSR (Corporate Social Responsibility) on environmental and social sustainability. The LC was established in April 2015 under the Memorandum of Understanding (MoU) between the Asian Institute of Technology in Viet Nam (AITVN) and its development partners, including the World Bank, Asian Development Bank (ADB), USAID, the Australian Embassy. The center is being established with initial funding support from the Australian Government. Other development partners have committed to provide technical support. The mission of the LC is strengthening the Environmental and Social Impact Assessment Process in Viet Nam and the region in the long-term. Some other relevant projects of LC are: "Sustainable Consumption and Production (SCP) Policy Mainstreaming for Eco-Innovation", "Get Green Viet Nam", and "Sustainable Product Innovation" and several training courses are Green Supply Chain Management, Green growth Management, Environmental Management for Sustainable Development, Environmental Education and Communication, Sustainable Consumption and Production, Green Manufacturing and Management for SMEs, Green Lifestyle and Education and Training. **Role in the project:** The AITVN Learning Center is a potential partner in providing trainings. The specific training content and collaboration modality will be further identified during inception phase.
Viet Nam Cleaner Production Centre (VN CPC)	**Role and functions:** VNCPC is a Public Service Ltd Co. established in 1998 with the mission to bring added values to clients through advanced scientific and technological services to contribute to the promotion of sustainable production and consumption. VNCPC plays a focal role in Viet Nam for disseminating the "Cleaner Production" (CP) concept and promoting its adoption into the industry of Viet Nam. VNCPC is providing training service to various bilateral and multilateral-funded projects on technology and cleaner production and developing a network of experts and specialist working in cleaner production areas **Role in the project** The VNCPC is a potential partner for training and establishment of the Green Chemistry Network.
Private Sector	
Korean Research Institute of Chemical Technology **(KRICT**)	**Role and Functions** KRICT is a South Korean Research Institute having functions of developing green chemical technologies and materials for sustainable society and chemical industries by providing comprehensive solutions. The four (4) key research fields pursued by the KRICT are development of eco-friendly green chemical process technology and environmental protection technology, development of high value-added green chemical materials,

	acquisition of new drug pipelines for disease treatments, development of green convergence chemical technology to support chemical safe society and future sustainable growth. KRICT-ASEAN Chemical Technology Cooperation Center(KA-CTC Center) in Hanoi is one of the two abroad offices of KRICT, having functions of sharing information regarding chemical technology, and conducting feasibility research on the key chemical technology related topics of ASEAN countries, and planning international cooperative research projects with ASEAN partners. KA-CTC Center also contributes cooperative research project implementations and pilot technology demonstrations utilizing KRICT-proven technologies. **Role in the project** KRICT is a potential partner for trainings, awareness raising workshops, identification of international experts for feasibility studies and establishment of the Green Chemistry Network, with reference to specific sectors like pesticide and plastic.
Plant & Food Research (PFR)	**Role and Functions** PFR is a New Zealand government-owned Crown Research Institute, providing research and development that adds value to fruit, vegetable, crop and food products. PFR goal is to underpin the growth of plant and marine-based industry through the successful application and commercialization of research-based innovation. PFR science supports the design and development of new and novel functional foods that offer benefits to human health and wellbeing. PFR develop new methods of monitoring and managing plant pests that have minimal environmental, biodiversity and social impacts: Importation and release of new natural enemies, Insect rearing, Measuring the impact of natural enemies, Biodiversity conservation and improvement, semi-chemical identification, synthesis, formulation and development. PFR has working experience with research institutes in Viet Nam under MARD on bio-pest control. **Role in the project** PFR is a potential technical pool resource for implementing project activities on bio-pesticides through open bidding.
Bai Bang Pulp and Paper Company / Viet Nam Paper Corporation (Bai Bang company)	**Bai Bang Company** is a state enterprise. The corporation is home to the largest paper mill in Viet Nam funded by Sweden since 1970s. Bai Bang Pulp and Paper company has a closed process system from tree planting, raw material processing, electricity and chemicals producing, pulp and paper producing to maintenance and transportation stages. The main products are writing and printing paper. Since 2004, Bai Bang Paper Company has upgraded and expanded production to an annual output of 100,000 tonnes of paper and 61,000 tonnes of pulp. The company leader and technical staff express their concern to international competitive quality and production in line with the national standards on environment. **Bai Bang Company** is potential partner in project implementation (*to be confirmed during inception and project implementation*)
PLATO company	Plato is a company providing surface treatment processes for many kinds of material, decorative Nickel-Chrome, Zinc, Hard chromium, etc. Plato serves several national and international customers. **PLATO Company** is potential partner in project implementation (*to be confirmed during inception and project implementation*)
Hoa Phat Group (HPG)	**HPG** is a Joint Stock Company and has 16 member companies with the major businesses on steel production, mining, coke production, real estate, furniture

	manufacturing, construction accessories and equipment with many factories across the country. They have plating factory for furniture, construction accessories and equipment. HPG shows their interest to the project. Plating factories of Hoa Phat Group will be reviewed and HPG might be a potential demonstration partner (*to be confirmed during inception and project implementation*)
Viet Nam Textile Corporation (VINATEX)	VINATEX – the stock textile and apparel production corporation – working in the area of spinning, knitting, weaving, dying, garment making with purpose of modernizing production technology, changing production methods towards generation of highly value-added textile products. VINATEX is a potential demonstration partner (*to be confirmed during inception and project implementation*)
Plastic manufacturing industries.	Need to look for potential demonstration partner (*to be confirmed during inception and project implementation)*

ii. Stakeholder engagement:

The main beneficiaries of the project activities are the workers in industries adopting GC interventions, as well as consumers and communities who may be exposed to chemicals (POPs, other persistent and toxic chemicals like mercury) possibly contained in products or released to the environment.

The chemical and manufacturing industry are also key beneficiaries and interested stakeholders, as they will receive benefit in term of incentives, technical assistance and training. The chemical and manufacturing industry will have the opportunity to have their views and needs considered in the course of law making activities related to the implementation of the regulation and guidance pertaining to the implementation of Green Chemistry in specific sectors.

The project will ensure the engagement of key stakeholders through specific awareness raising activities, more specifically, a Green Chemistry awareness raising plan/communication strategy will be implemented to disseminate the general principles of GC, application of GC in the six reference sectors identified, and relationship between GC and POPs.

The key private and public stakeholders will work together in the definition of the incentive mechanisms that can effectively sustain the development of Green Chemistry in the country. As explained in the description of the alternative scenario, the project will also develop an on-line support network/forum for the exchange and sharing of experiences, knowledge and best practices on Green Chemistry for entities seeking more guidance on the subject.

8. Mainstreaming gender:

With the purpose to respond to gender issues within the scope of project interventions, the following aspect**s** have been assessed in a brief survey which is attached as Annex N

- The Vietnamese context, in term of legislation, access to resources, education and knowledge.
- Inequality in the division of labor, and any differential risk associated with the different roles and responsibilities of men and women in labor.
- Prejudice of “women should be prevented from dangerous working environment, which using and potentially producing toxic chemicals”.

Based on the evidence gathered during said survey, although the Vietnamese society can be considered as a favorable environment for the promotion of gender equality, there are still gaps which should be taken into account and which have to be duly considered in project implementation. Therefore, the project will strive to ensure that the following criteria will be respected:

- Equal opportunity to jobs. The project will ensure that equal opportunity will be given to males and females in accessing all the job opportunities originated by the project and project-targeted industrial sectors.
  Assessment of the exposure to dangerous chemicals in the targeted industrial sectors with the aim to identify differences in the risks between male and females and to identify specific measures to reduce these risks at workplace through the design of green chemistry interventions.
  Encourage conditions for women being member of Green Chemistry network and promotion of CSR by enterprises/factories to improve safety conditions at workplace to ensure health of workers. By that, the project is expected to change the gender prejudice of “the job for men”.
- Equal rights to access of information and training. Specific activities dedicated for the training and awareness raising of women will be carried out. At the design and implementation stage, it will be ensured that equal opportunities will be given to women and men for the participation to workshops and trainings.
- Development of awareness raising materials specifically developed for male and female workers.

Therefore, the following specific indicators will be adopted to monitor gender mainstreaming in the project:

(1) Number of male and female employed in project implementation, for each category of work.
(2) Percentage/ratio of male and females attending workshops and training courses.
(3) Gender differential risk is considered in the chemical risk assessments and sector feasibility studies, which plan to conduct for project-targeted industries. Counter-measures will be identified, with the specific objective to establish proper risk management measure and personal protective equipment (PPEs).

The above will translate in the following Gender Mainstreaming Action Plan (Table 10), which has been duly integrated into the Project Result Framework:

Table 10. Gender Mainstreaming Action Plan

Objective	Action	Indicator	Responsible Institution
Outcome 1.1: Enabling Environment for Adoption of Green Chemistry Practices Established			
Ensure equal access by women and men to training on POPs and Green Chemistry. Include gender related aspects in training materials	*Selection of Trainee and Trainers will encourage the participation of women* *Training material will include gender related aspect of POPs, including differential risks.*	*Percentage of males and females working as teachers in training.* *Percentage of males and females successfully attending training.* *Availability of gender related training materials on POPs and Green Chemistry.*	*UNDP, PMU, MOIT, MOLISA and entreprises*
Ensure equal access and participate by women and men to GC network	*Encourage conditions and training to female experts and university students to be member of the GC network*	*Percentage of female members in the network Target of 30%*	
Outcome 2.1 Awareness on GC and its guiding principles increased to a level necessary to support a shift to GC application.			
Include gender related needs and views in awareness raising initiatives on POPs and Green Chemistry	*Green chemistry awareness raising material prepared for each relevant sector taking into account specific needs for male and female workers/staff.*	*Availability of gender related awareness raising material on POPs and Green Chemistry.*	*UNDP, PMU, MOIT, MONRE, MOLISA and entreprises*
	At least two awareness raising workshops/events with the participation of at least 30 representatives from 2 industrial sectors carried out with a proper gender ratio.	*Percentage of males and females participated in awareness raising activities.* *Percentage of males and females working on awareness raising activities.*	
	Green Chemistry trainings designed and approved with equal access opportunities among the two genders.	*Percentage of males and females attending training or working as teachers.*	
	CSR initiatives by enterprise and promote by sector associations aim to ensure safety environment at workplace	*Number of CSR initiatives provided better safety environment at workplace*	
Outcome 3.1 15 g-TEQ/Y of UPOPs releases, 1 tonne of POPs, 0.002 tons of mercury reduced through the introduction of GC in priority sectors.			
Ensure equal opportunities to males and females in the	*Equal opportunity for male and female experts and technicians in GC introduction for priority sectors*	*Percentage of males and females involved in the introduction of GC in priority sectors.*	*UNDP, PMU, MOIT, MONRE, and*

study, development and the implementation of GC action plan in priority industrial sectors.	*Gender issues are taken into account when proposing Green Chemistry solutions for specific sectors/pilot entities (where relevant), with specific reference to occupational safety in chemical and manufacturing industry.*	*Number of recommendations taking into account gender issues where relevant*	*enterprises*

V. FEASIBILITY

9. Cost efficiency and effectiveness:

The wide collaboration with stakeholders which is envisaged under this project will ensure that some of the project activities can be carried out with external resources, or at very low cost, bringing therefore significant saving and cost efficiency to the project. This is for instance the case of the collaboration with Viet Nam Television, which will work through the participation of project experts into environmental related programmes which are already part of the TV broadcasting programmes. Other example is the collaboration with the already ongoing InforTech initiative, which is a consolidated program which otherwise would require a significant organisational and financial effort.

In general, however, cost efficiency and effectiveness will be ensured at each stage of the project by adoption of tender-based (quality for affordable costs) UNDP procurement procedures for all the activities, including the selection of consultancy services, and testing and procurement of technologies, based on the best quality/cost ratio.

UNDP Viet Nam has accumulated significant experience on the procurement and testing of technical services (for instance, management of international consultancies, testing of equipment, disposal services for POPs contaminated materials). This approach always resulted in very high quality/cost ratio.

10. Risk Management

As per standard UNDP requirements, the Project Manager will monitor risks quarterly and report on the status of risks to the UNDP Country Office. The UNDP Country Office will record progress in the UNDP ATLAS risk log. Risks will be reported as critical when the impact and probablity are high (i.e. when impact is rated as 5, and when impact is rated as 4 and probability is rated at 3 or higher). Management responses to critical risks will also be reported to the GEF in the annual PIR.

i. <u>Social and environmental safeguards:</u>

The project wil intervene in industrial sectors which are characterised by the presence of Small and Medium Enterprises with limited capacity to invest in environmental protection measures.

Although the interventions are planned for a limited number of industral sectors only, it is expected that the demonstration of Green Chemistry intiatives in representative industrial processes, sustained by capacity building, awareness raising and incentive mechanisms, will be

catalytic and will promote a shift towards a safer and more competitive manufacturing sector, with evident benefit for the environment, society and the economy.

As all the interventions envisaged by the project will be small scale interventions aiming for environmental and health risk reduction, there will be no need to undertake Environmental Impact Assessments at any stage. However all the interventions in the demonstration factories will be assessed at the design stage to identify any possible unwanted risks or impacts. None of the envisaged intervention will result in major industrial reorganizations, job losses or resettlements. On the contrary, the intervention once replicated and sustained should represent an opportunity for the creation of jobs.

The project will create awareness on the links between better manufacturing processes, use of non-hazardous substances, human health and competitiveness.

For the above reasons, the overall risk rating under the Social and Environmental Screening Procedure (SESP) is "Low" for this project. EIA procedures will, in general, not be necessary, however regular communication with MPU/Chemicals on key project milestones, such as recruitment of international expertise, step-by-step project implementation, and oversight missions are all advised. A thorough tendering process to select qualified sub-contractors with a good track record and performance of similar contracts with UNDP or other GEF implementing agencies is strongly recommended.
For all components, capacity building and training programmes will ensure the provision of internationally available expertise and advisory support, specifically targetting local personnel involved in work on project sites.

Due to the general objective of this project, which is to introduce Green Chemistry with the main purpose of reducing the use, generation and releases of POPs, mercury and other hazardous substances, it is not expected that environmental disputes or grievances may arise during project implementation. In any case, environmental and social grievances will be reported to the GEF in the annual PIR.

iv. Sustainability and scaling up:

The project design is focused mainly on the development of a sustainable system, with a limited direct demonstration of Green Chemistry approaches in two key sectors. The project paradigm is therefore to create, through capacity building, development and enforcement of regulation, communication, technical guidance, financial incentives and demonstration, a critical mass, which will become self-sustaining in a short time. The self-sustainability will derive from the evidence that through the implementation of Green Chemistry approach it is also possible to optimize industrial processes and reduce not only the external costs, but also the direct, internal manufacturing costs. The key objective of the project is to ensure the scaling up of Green Chemistry initiatives capable of reducing the use and generation of POPs, through technical support and training in all the six sectors targeted by the project.

VI. PROJECT RESULTS FRAMEWORK

This project will contribute to the following Sustainable Development Goal (s): SDG 12: Responsible Consumption and Production, SDG 13: Climate Action, SDG 9: Industry, Innovation and Infrastructure, SDG 5: Gender Equality

This project will contribute to the following country outcomes included in the UNDAF/Country Programme Document:

Outcome 2.1: Low-carbon, climate and disaster resilient development: By 2021, Viet Nam has accelerated its transition to low-carbon and green development, and enhanced its adaptation and resilience to climate change and natural disasters, with a focus on empowering the poor and vulnerable groups.

Outcome 2.2: Sustainable management of natural resources and the environment: By 2021, Viet Nam has enhanced sustainable management of natural capital, biodiversity and ecosystem services and improved the quality of the environment, while contributing to the implementation of multilateral environmental agreements.

This project will be linked to the following output of the UNDP Strategic Plan

Output 1.3: Solutions developed at national and sub-national levels for sustainable management of natural resources, ecosystem services, chemicals and waste.
Indicator 1.3.1: Number of new partnership mechanisms with funding for sustainable management solutions of natural resources, ecosystem services, chemicals and waste at national and/or subnational level.
Output 2.5: Legal and regulatory frameworks, policies and institutions enabled to ensure the conservation, sustainable use, and access and benefit sharing of natural resources, biodiversity and ecosystems, in line with international conventions and national legislation.
Indicator 2.5.1: Extent to which legal or policy or institutional frameworks are in place for conservation, sustainable use, and access and benefit sharing of natural resources, biodiversity and ecosystems.

	Objective and Outcome Indicators	Baseline	Mid-term Target	End of Project Target	Assumptions
Project Objective: *Reduce the use and release of chemicals controlled under MEAs, other hazardous chemicals, improve energy and natural resource efficiency and reduce (GHG) emissions through the application of Green Chemistry principles in Viet Nam.*	***Mandatory Indicator 1*** *UN SP Indicator 1.3.1: Number of new partnership mechanisms with funding for sustainable management solutions of natural resources, ecosystem services, chemicals and waste at national and/or subnational level.*	*1) No partnership or financial mechanism in place for the implementation of Green Chemistry in Viet Nam*	*1) Green Chemistry network designed and partially implemented.*	*1) Green Chemistry network in place participated by private and institutional experts. An impact fund established to provide soft loan for implementation of Green*	*The identified sectors are available in implementing Green Chemistry principle in their process.* *The continued use of Green Chemistry is sustained by the improved efficiency of industrial processes and to improved marked opportunities associated with Green*

	Mandatory Indicator 2 *UN SP Indicator 2.5.1: Extent to which legal or policy or institutional frameworks are in place for conservation, sustainable use, and access and benefit sharing of natural resources, biodiversity and ecosystems.*	*2) GoV adopted a number of Strategies and Policy on Green Growth and Sustainable Development, NAP for sustainable production and consumption, no regulation and incentive policies exists which mentions or promotes Green Chemistry* *Only basic Green Chemistry principles applied in few industrial sector in Viet Nam*	*2) Green Chemistry assessed for specific demonstration in selected industrial sectors.*	*Chemistry* *2) Legal documents and technical standards developed and endorsed by the government to regulate GC implementation*	*Products* *There will be continuity of political will, even in the event of changes in Government to make the changes to the legal framework, regulations, incentives etc., as envisioned.*

	Indicator 3: *Amount of POPs, U-POPs and mercury uses and release avoided at project implementation and predicted at replication.*	*3) Vietnamese standards and regulations for chemical release in industrial sectors (paper, textile, …) currently don't include POPs/dioxin/mercury parameter. Therefore the release into the environment of these pollutants from industrial sources is currently not controlled.* *Gender issues currently not fully understood in industrial organizations*	*3) Demonstration activities potentially reducing the use or releases of one ton of POPs (PFOS, C-PBDE, SCCP, and pesticides), 15 gTeq/yr U-POPs and 2 kg of mercury designed.* *A gender mainstreaming action plan agreed and started*	*3) Reduction of the use or releases of one ton of POPs (PFOS, C-PBDE, SCCP, pesticides), 15 gTeq/yr U-POPs and of 2 kg of mercury* *Equal opportunity for male and female in manufacturing and chemical industry through the implementation of safer workplace environment*	*The resource allocated for gender mainstreaming*

					will allow a higher and more sustainable efficiency and greater impact of project core actions aimed at implementing GC and reducing POPs.
Component/Outcome 1 **Component 1. Developing the Enabling Environment for Green Chemistry in Viet Nam** *Outcome 1.1: Enabling Environment for Adoption of Green Chemistry Practices Established*	***Indicator 1:*** *Availability of an assessment report and feasibility study and of a Green Chemistry incentives scheme introduced following Cost-Benefit Analyses (CBAs).* ***Indicator 2:*** *Number of trainings successfully performed and , number of people (male and female) attending the training*	*1) Similar study/ report not yet available. Incentives for GC currently not available* *2) GC mentioned in several training initiatives by MOIT but not yet recognized as a key strategy for POPs reduction and*	*1) Assessment and feasibility reports drafted and approved at midterm. GC incentive schemes assessed and proposed* *2)6 Trainings of Trainers sessions completed involving at least 60 trainees, encouraging female participation*	*1) Assessment and feasibility reports and CBA of incentive scheme published and disseminated A GC incentive scheme adopted* *2) all TOT training completed before MTR*	*The institutions are committed to provide information and analysis on the current regulatory framework on GC and its implications on POPs and mercury. Trainer will have outstanding experience on the development and implementation of GC initiative in relevant industrial sectors.* *A fruitful cooperation among project staff, government, and key stakeholders on technical, legal and financial matter is ensured so that the incentive mechanism to promote GC is implementable and sustainable*

	Indicator 3: *Existence of a network of GC experts with equal opportunities among genders and institutional expertise created under the project*	*sustainable production* *3) A network of GC experts and institutional expertise does not exist yet*	*3) List of the GC experts and institution. Operating mode of the GC network (blog or a dedicated line) identified and designed.*	*3) A network of GC expert established, encouraging participation of women, and operating as an help desk through a blog platform or a dedicated line.*	
Component/ Outcome 2 **Component 2. Promote Awareness on Green Chemistry and the benefits of the application of Green Chemistry and its guiding principles** Outcome 2.1 Awareness on GC and its guiding principles increased to a level necessary to support a shift to GC application.	***Indicator 1:*** *Level of Awareness on Green Chemistry among decision makers and stakeholders disaggregated by gender.* *(1-very low; 2-low; 3-average; 4-good; 5-very good*)	*1) Awareness on green chemistry is very low among enterprises and manufacturers Public media dedicating very little broadcasting time, If any to Green Chemistry in Viet Nam.*	*1)Green chemistry awareness raising material, including broadcasting material for public media (TV) prepared for each relevant sector taking into account specific needs for women TV broadcasting started in coordination with Viet Nam Television.*	*1)At least one additional awareness raising workshop with the participation of at least 30 representatives from the 2 remaining industrial sectors carried out taking into account specific needs for women TV broadcasting*	*A fruitful cooperation among project staff, representatives of the relevant industrial sectors, and governmental institutions and public media (including Vietnamese Television) is ensured so that the awareness raising initiative on GC can be effectively developed and implemented.* *A fruitful cooperation with University and academic institutions can be established to integrate GC modules in the MOIT*

			At least one awareness raising workshop with the participation of at least 30 representatives from 2 industrial sectors carried out with a proper balance among genders	*continued in coordination with Viet Nam Television.*	*Technical Center* *Viet Nam is currently an interesting market for advanced countries willing to promote their technologies, due to the safety of the country and the fast economic and infrastructural development.*
	Indicator 2: *Availability of reports from initiatives on Corporate Social Responsibility on Green Chemistry.* ***Indicator 3:*** *Availability of reports and material generated by Green Chemistry extra-curricular lectures, and from the exhibition and technology workshop on GC technologies promoted by Embassies in Hanoi*	*2) No CSR initiative on Green Chemistry exists* *3) Training on Green Chemistry is not systematic and not integrated in MOIT universities.* *Exhibition and workshop on GC technologies never carried out before*	*2) CSR initiative designed by at least one industrial sector.* *3) Green Chemistry training, based on extra-curricular lectures, designed and approved with equal access opportunities among gender Planning and design of one exhibition including*	*2) CSR initiative implemented by at least one industrial sector.* *3)Training on Green Chemistry carried out including onsite training in selected industries from the six sectors, encouraging female participation both as teachers and*	

			workshop on GC technologies with bilateral support started.	*trainees.* *One exhibition including workshop on GC technologies with bilateral support completed.*	
Component/ Outcome 3 **Component 3. Introduce Green Chemistry approaches into priority sectors and at least 2 entities** Outcome 3.1: 15 g-TEQ/Y of UPOPs releases, 1 tonne of POPs, 0.002 tonnes of Mercury reduced through the introduction of GC in priority sectors**.**	***Indicator 1:*** *Number of priority sectors and entities selected for demonstration* ***Indicator 2:*** *Availability of criteria for POPs / mercury baseline assessment and calculation of POPs/mercury reduction*	*1)In the shortlisted selected sectors there are no significant actions aimed at reducing the use or release of POPs* *Limited opportunities for women to access jobs in the selected industrial sectors..* *2) Criteria for baseline assessment in the priority sectors not yet*	*1) Two (2) demonstration sectors and two (2) factories selected for demonstration.* *Gender mainstreaming plans discussed in the relevant industrial sectors* *2) Baseline for the 2 sectors and criteria for the evaluation of POPs/mercury reduction*	*1) Selection of priority sectors completed at Mid Term* *Equal opportunity given to male and female experts in the GC and POPs area.* *2) Baseline assessment completed at Mid Term*	*Through technical cooperation with the relevant industrial sectors it will possible to design specific intervention aimed at reducing the amount of POPs used or released, particularly through substitution of POPs with other chemicals (i.e. in the chrome plating and plastic sector), through the modification of process that can lead to POPs precursors (non-chlorine bleaching in textile and papers) or introduction of quality criteria of raw material (textile) etc.* *It is assumed that the factories implementing GC chemistry intervention will disclose the information that will allow to estimate*

		developed	*assessed*		*the amount of POPs used, and/or release reduced*
	Indicator 3:*Amount of the reduction of the use / release of POPs, U-POPs and mercury (both at project implementation and predicted at replication stage)*	*3) Zero Reduction of POPs or mercury in the selected sectors*	*3) Plan for reducing mercury and POPs use / releases (including U-POPs) from selected industries with cost-effectiveness analysis and targets*	*3) At least 1 ton of POPs (C-PBDE, PFOS, SCCP, pesticides) and 2 kg of Mercury reduced from selected industries* *15 g TEq/y of U-POPs reduced from selected industries.*	
Component/ Outcome 4: Project M&E, Dissemination of project result, lesson learned and experience	***Indicator 1:*** *number of monitoring activities have been carried out*	*N/A*	*Inception activities carried out*	*Financial auditing and other monitoring activities carried out.*	*All the relevant stakeholders well aware on GEF/UNDP rules as well as National Legislation, and willing to cooperate in the timely establishment of project management structures.* *Project reporting and planning mechanisms and templates timely communicated and agreed with project management staff at all level.*
	Indicator 2: *number of Evaluation activities have been carried out.*	*No evaluation of project implementation till terminal evaluation*	*Project reporting and planning established and implemented*	*Project reporting and planning continued until project end* *-Terminal Evaluation carried out and submitted to GoM, UNDP*	

				and GEF.	*Project stakeholders actively cooperating in all evaluation and auditing activities.* *Evaluation and auditing are carried out in an independent and professional way, with the purpose to enhance project activities and generate recommendations for project success and sustainability after project closure.*
	Indicator 3: *availability and sustainability of knowledge management in place (including project materials and experience sharing)*	*Project result, lessons learned and experience have not been available for disseminating*	*Project management structure implemented, KM system including project website supporting the green chemistry cell established under output 2.1.1. established (to be completed in the 1st year of project implementation)*	*Project result, lesson learned and experience widely disseminated*	

VII. MONITORING AND EVALUATION (M&E) PLAN

The project results as outlined in the project results framework will be monitored annually and evaluated periodically during project implementation to ensure the project effectively achieves these results.

Project-level monitoring and evaluation will be undertaken in compliance with UNDP requirements as outlined in the UNDP POPP and UNDP Evaluation Policy. While these UNDP requirements are not outlined in this project document, the UNDP Country Office will work with the relevant project stakeholders to ensure UNDP M&E requirements are met in a timely fashion and to high quality standards. Additional mandatory GEF-specific M&E requirements (as outlined below) will be undertaken in accordance with the GEF M&E policy and other relevant GEF policies.

In addition to these mandatory UNDP and GEF M&E requirements, other M&E activities deemed necessary to support project-level adaptive management will be agreed during the Project Inception Workshop and will be detailed in the Inception Report. This will include the exact role of project target groups and other stakeholders in project M&E activities including the GEF Operational Focal Point and national/regional institutes assigned to undertake project monitoring. The GEF Operational Focal Point will strive to ensure consistency in the approach taken to the GEF-specific M&E requirements (notably the GEF Tracking Tools) across all GEF-financed projects in the country. This could be achieved for example by using one national institute to complete the GEF Tracking Tools for all GEF-financed projects in the country, including projects supported by other GEF Agencies.

M&E Oversight and monitoring responsibilities:

Project Manager: The Project Manager is responsible for day-to-day project management and regular monitoring of project results and risks, including social and environmental risks. The Project Manager will ensure that all project staff maintain a high level of transparency, responsibility and accountability in M&E and reporting of project results. The Project Manager will inform the Project Board, the UNDP Country Office and the UNDP-GEF RTA of any delays or difficulties as they arise during implementation so that appropriate support and corrective measures can be adopted. **The National Project Coordinator** will develop annual work plans based on the multi-year work plan included in Annex A, including annual output targets to support the efficient implementation of the project. The National Project Coordinator will ensure that the standard UNDP and GEF M&E requirements are fulfilled to the highest quality. This includes, but is not limited to, ensuring the results framework indicators are monitored annually in time for evidence-based reporting in the GEF PIR, and that the monitoring of risks and the various plans/strategies developed to support project implementation (e.g. gender strategy, KM strategy etc..) occur on a regular basis.

Project Board/Project Steering Committee (PSC)**:** The Project Board/PSC will take corrective action as needed to ensure the project achieves the desired results. The Project Board will hold project reviews to assess the performance of the project and appraise the Annual Work Plan for

the following year. In the project's final year, the Project Board will hold an end-of-project review to capture lessons learned and discuss opportunities for scaling up and to highlight project results and lessons learned with relevant audiences. This final review meeting will also discuss the findings outlined in the project terminal evaluation report and the management response.

National Implementing Partner: The Implementing Partner is responsible for providing any and all required information and data necessary for timely, comprehensive and evidence-based project reporting, including results and financial data, as necessary and appropriate. The Implementing Partner will strive to ensure project-level M&E is undertaken by national institutes and agencies, and is aligned with national systems so that the data used by and generated by the project supports national systems.

UNDP Country Office: The UNDP Country Office will support the Project Manager where needed, including through annual supervision missions. The annual supervision missions will take place according to the schedule outlined in the annual work plan. Supervision mission reports will be circulated to the project team and Project Board/PSC within one month of the mission. The UNDP Country Office will initiate and organize key GEF M&E activities including the annual GEF PIR, and the independent terminal evaluation. The UNDP Country Office will also ensure that the standard UNDP and GEF M&E requirements are fulfilled to the highest quality.

The UNDP Country Office is responsible for complying with all UNDP project-level M&E requirements as outlined in the UNDP POPP. This includes ensuring the UNDP Quality Assurance Assessment during implementation is undertaken annually; that annual targets at the output level are developed, and monitored and reported using UNDP corporate systems; the regular updating of the ATLAS risk log; and, the updating of the UNDP gender marker on an annual basis based on gender mainstreaming progress reported in the GEF PIR and the UNDP ROAR. Any quality concerns flagged during these M&E activities (e.g. annual GEF PIR quality assessment ratings) must be addressed by the UNDP Country Office and the Project Manager.

The UNDP Country Office will retain all M&E records for this project for up to seven years after project financial closure in order to support ex-post evaluations undertaken by the UNDP Independent Evaluation Office (IEO) and/or the GEF Independent Evaluation Office (IEO).

UNDP-GEF Unit: Additional M&E and implementation quality assurance and troubleshooting support will be provided by the UNDP-GEF Regional Technical Advisor and the UNDP-GEF Directorate as needed.

Audit: The project will be audited according to UNDP Financial Regulations and Rules and applicable audit policies on NIM implemented projects.[4]

[4] See guidance here: https://info.undp.org/global/popp/frm/pages/financial-management-and-execution-modalities.aspx

Based on the result of HACT micro assessment in 2014 for VINACHEMIA/MOIT is "moderate risk", the Green Chemistry project will have one independent audit per year.

Additional GEF monitoring and reporting requirements:

Inception Workshop and Report: A project inception workshop will be held within two months after the project document has been signed by all relevant parties to, amongst others:

a) Re-orient project stakeholders to the project strategy and discuss any changes in the overall context that influence project implementation;
b) Discuss the roles and responsibilities of the project team, including reporting and communication lines and conflict resolution mechanisms;
c) Review the results framework and finalize the indicators, means of verification and monitoring plan;
d) Discuss reporting, monitoring and evaluation roles and responsibilities and finalize the M&E budget; identify national/regional institutes to be involved in project-level M&E; discuss the role of the GEF OFP in M&E;
e) Update and review responsibilities for monitoring the various project plans and strategies, including the risk log; Environmental and Social Management Plan and other safeguard requirements; the gender strategy; the knowledge management strategy, and other relevant strategies;
f) Review financial reporting procedures and mandatory requirements, and agree on the arrangements for the annual audit; and
g) Plan and schedule Project Board meetings and finalize the first year annual work plan.

The National Project Coordinator will prepare the inception report no later than one month after the inception workshop. The inception report will be cleared by the UNDP Country Office and the UNDP-GEF Regional Technical Adviser.

GEF Project Implementation Report (PIR): The National Project Coordinator, the UNDP Country Office, and the UNDP-GEF Regional Technical Advisor will provide objective input to the annual GEF PIR covering the reporting period July (previous year) to June (current year) for each year of project implementation. The National Project Coordinator will ensure that the indicators included in the project results framework are monitored annually in advance of the PIR submission deadline so that progress can be reported in the PIR. Any environmental and social risks and related management plans will be monitored regularly, and progress will be reported in the PIR.

The PIR submitted to the GEF will be shared with the Project Board. The UNDP Country Office will coordinate the input of the GEF Operational Focal Point and other stakeholders to the PIR as appropriate. The quality rating of the previous year's PIR will be used to inform the preparation of the subsequent PIR.

Lessons learned and knowledge generation: Results from the project will be disseminated within and beyond the project intervention area through existing information sharing networks

and forums. The project will identify and participate, as relevant and appropriate, in scientific, policy-based and/or any other networks, which may be of benefit to the project. The project will identify, analyse and share lessons learned that might be beneficial to the design and implementation of similar projects and disseminate these lessons widely. There will be continuous information exchange between this project and other projects of similar focus in the same country, region and globally.

GEF Focal Area Tracking Tools: The following GEF Tracking Tool(s) will be used to monitor global environmental benefit results:
The baseline/CEO Endorsement GEF Focal Area Tracking Tool(s) – submitted in Annex D to this project document – will be updated by the Project Manager/Team and shared with terminal evaluation consultants before the required review/evaluation missions take place. The updated GEF Tracking Tool(s) will be submitted to the GEF along with the completed Terminal Evaluation report.

The UNDP Country Office will include the planned project terminal evaluation in the UNDP Country Office evaluation plan, and will upload the final terminal evaluation report in English and the corresponding management response to the UNDP Evaluation Resource Centre (ERC). Once uploaded to the ERC, the UNDP IEO will undertake a quality assessment and validate the findings and ratings in the TE report, and rate the quality of the TE report. The UNDP IEO assessment report will be sent to the GEF IEO along with the project terminal evaluation report.

Final Report: The project's terminal PIR along with the terminal evaluation (TE) report and corresponding management response will serve as the final project report package. The final project report package shall be discussed with the Project Board/PSC during an end-of-project review meeting to discuss lesson learned and opportunities for scaling up.

Mandatory GEF M&E Requirements and M&E Budget:

GEF M&E requirements	Primary responsibility	Indicative costs to be charged to the Project Budget[5] (US$)		Time frame
		GEF grant	Co-financing	
Inception Workshop	UNDP Country Office, consultants	USD 20,000	0	Within two months of project document signature
Inception Report	National Project Coordinator	None	None	Within one month of inception workshop
Standard UNDP monitoring and reporting requirements as outlined in the UNDP POPP	UNDP Country Office (High and medium management level USD 20,000 *3 years)	None	None	Quarterly, annually
Monitoring of indicators in project	Project Manager and	Per year: USD	0	Annually

[5] Excluding project team staff time and UNDP staff time and travel expenses.

GEF M&E requirements	Primary responsibility	Indicative costs to be charged to the Project Budget[5] (US$)		Time frame
		GEF grant	Co-financing	
results framework	UNDP Country Office	4,000		
GEF Project Implementation Report (PIR)	National Project Coordinator and UNDP Country Office and UNDP-GEF team	None	None	Annually
NIM Audit as per UNDP audit policies	UNDP Country Office, consultants	Per year: USD 5,000	0	Annually, 1 independent audit per year and other frequency as per UNDP Audit and M&E policies
Lessons learned and knowledge generation	Project Manager, consultants, UNDP CO including communication team	USD 10,000	0	Annually
Monitoring of environmental and social risks, and corresponding management plans as relevant	National Project Coordinator, UNDP CO	None	0	On-going
Addressing environmental and social grievances	Project Manager UNDP Country Office BPPS as needed	None for time of project manager, and UNDP CO	0	
Project Board/PSC meetings	Project Board UNDP Country Office Project Manager	None	None	At minimum annually
Supervision missions	UNDP Country Office	None[6]	0	Annually
Oversight missions	UNDP-GEF team	None[6]	(To be identified)	Troubleshooting as needed
Knowledge management as outlined in Outcome 4	National Project Coordinator, consultants, UNDP CO	USD 20,000	0	On-going
GEF Secretariat learning missions/site visits	UNDP Country Office and National Project Coordinator and UNDP-GEF team	None		To be determined.
Terminal GEF Tracking Tool to be updated by (add name of national/regional institute if relevant)	Project Manager, consultant	USD 10,000		Before terminal evaluation mission takes place
Independent Terminal Evaluation (TE) included in UNDP evaluation plan, and management response	Consultants, UNDP Country Office and Project team and UNDP-GEF team	USD 40,000 -	0	At least three months before operational closure
Translation of TE reports into English	Consultants and UNDP Country Office for	USD 5,000	0	

[6] The costs of UNDP Country Office and UNDP-GEF Unit's participation and time are charged to the GEF Agency Fee.

GEF M&E requirements	Primary responsibility	Indicative costs to be charged to the Project Budget[5] (US$)		Time frame
		GEF grant	Co-financing	
	proofreading			
TOTAL indicative COST Excluding project team staff time, and UNDP staff and travel expenses		*USD 114,000*	*USD 0*	

VIII. GOVERNANCE AND MANAGEMENT ARRANGEMENTS

Roles and responsibilities of the project's governance mechanism: The project will be implemented following UNDP's national implementation modality, according to the Standard Basic Assistance Agreement between UNDP and the Government of Viet Nam, and the Country Programme.

National Implementing Partner (NIP) for this project is the Ministry of Industry and Trade (MOIT) in coordination with the Ministry of Natural Resources and Environment (MONRE) and other participating agancies and organisations to ensure the project inputs and outputs as well as avoid duplication of activities undertaken in Viet Nam (both national and donor-funded).
UNDP is GEF implementing agancies responsible and accountable for managing this project, including the monitoring and evaluation of project interventions, achieving project outcomes, and for the effective use of GEF and UNDP resources.

National Project Director (NPD) and **National Project Coordinator (NPC)** will be assigned by MOIT. The National Project Director represents MOIT to guide PMU in project implementation and the National Project Coordinator responsible for coordinating and implementing project activities at national level.

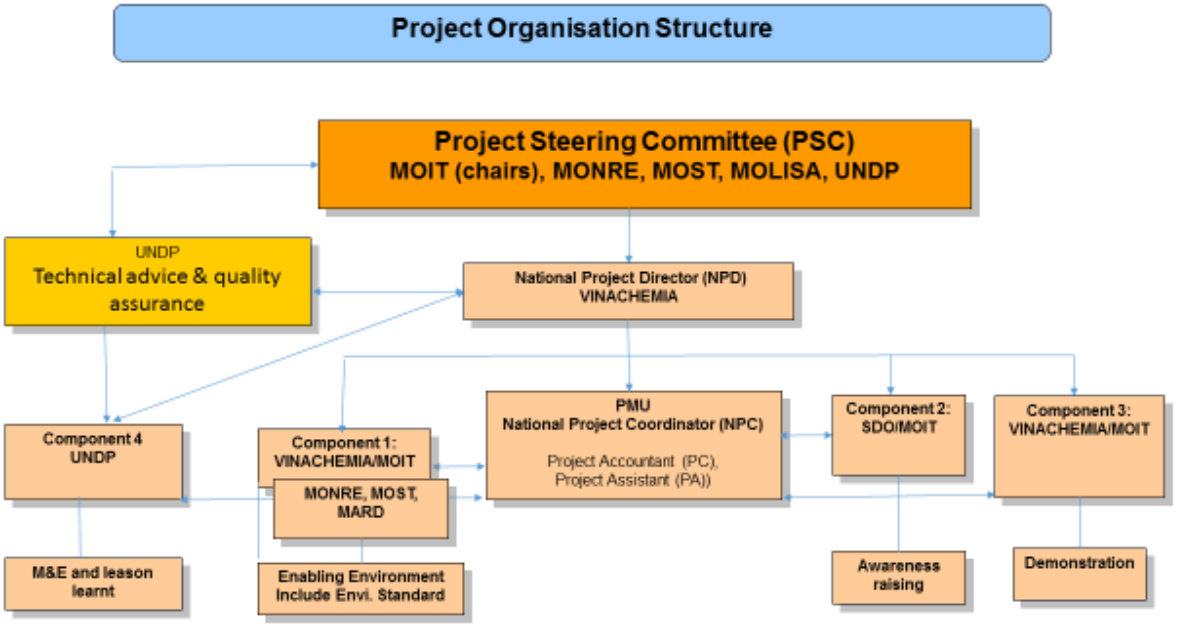
Project Board /Project Steering Committee (PSC) is responsible for making by consensus, management decisions when guidance is required by the Project Manager, including recommendation for UNDP/Implementing Partner, approval of project plans and revisions. In order to ensure UNDP's ultimate accountability, Project Board/PSC decisions should be made in accordance with standards that shall ensure management for development results, best value money, fairness, integrity, transparency and effective international competition. In case a consensus cannot be reached within the Board, final decision shall rest with the UNDP Project Manager.

Project Management Unit (PMU) will be established by UNDP and MOIT. The PMU responsible for the overall operational management and execution of the project activities. The PMU will comprise of National Project Director, National Project Coordinator, Project Accountant and Project Assistant. The National Project Director and National Project Coordinator will be

assigned by MOIT/Government of Viet Nam using Government Co-financing Budget. Other staff of PMU will be recruited by UNDP and MOIT follow UNDP rules and regulations.

The **National Project Coordinator** will run the project on a day-to-day basis on behalf of the National Implementing Partner, reporting to Implementing Agency/UNDP, within the constraints laid down by the Board.

The project organisation structure is as follows:



Project Manager will monitor the project on a day-to-day basis on behalf of the Implementing Agency/UNDP. The Project Manager function will end when the final project terminal evaluation report, and other documentation required by the GEF and UNDP, has been completed and submitted to UNDP (including operational closure of the project).

UNDP as GEF implementing agency will be responsible for **project assurance** and provide technical advice. This will be done by the UNDP Country Office (UNDP CO) specifically. Additional quality assurance will be provided by the UNDP Regional Technical Advisor as needed.

For smoothly implementation of initiatives to ensure collaboration between MOIT and MONRE, project sustainability and disseminate project impacts and lesson learn sharing, UNDP will direct manage and implement several researches and specific activities in coordination with MOIT .

National and International experts and entities will be recruited as subcontractors to support the PMU and implement project activities (when needed and required).

Governance role for project target groups and stakeholders: see Table 9, page 43

Estimated UNDP Direct Project Services as requested by Government (DPC cost) : $ 27,716 *(see Annex : K)*

UNDP Direct Project Services (DPS) as requested by Government: The UNDP, as the GEF Agency for this project, will provide project management cycle services for the project as defined by the GEF Council. In addition the Government of Viet Nam may request UNDP direct services for specific projects, according to its policies and convenience. The UNDP and Government of Viet Nam acknowledge and agree that those services are not mandatory, and will be provided only upon Government request. If requested, the services would follow the UNDP policies on the recovery of direct costs. These services (and their costs) are specified in the Letter of Agreement (Annex K). As is determined by the GEF Council requirements, these service costs will be assigned as Project Management Cost, duly identified in the project budget as Direct Project Costs. Eligible Direct Project Costs should not be charged as a flat percentage. They should be calculated on the basis of estimated actual or transaction based costs and should be charged to the direct project costs account codes: "64397- Services to projects – CO staff" and "74596 – Services to projects – GOE for CO.

Agreement on intellectual property rights and use of logo on the project's deliverables and disclosure of information**:** In order to accord proper acknowledgement to the GEF for providing grant funding, the GEF logo will appear together with the UNDP logo on all promotional materials, other written materials like publications developed by the project, and project hardware. Any citation on publications regarding projects funded by the GEF will also accord proper acknowledgement to the GEF. Information will be disclosed in accordance with relevant policies notably the UNDP Disclosure Policy[7] and the GEF policy on public involvement[8].

IX. FINANCIAL PLANNING AND MANAGEMENT

The total cost of the project is USD 10,399,800. This is financed through a GEF grant of USD 1,999,800 and USD 267,000 in kind co-financing to be administered by UNDP and *USD 8,200,000* in parallel co-financing. UNDP, as the GEF Implementing Agency, is responsible for the execution of the GEF resources and the cash co-financing transferred to UNDP bank account only.

[7] See http://www.undp.org/content/undp/en/home/operations/transparency/information_disclosurepolicy/

[8] See https://www.thegef.org/gef/policies_guidelines

Follow IP capacity assessment minutes, SDO/MOIT hasn't yet had IP HACT micro assessment and no previous experience on ODA project management, activities in charge by SDO will apply direct payment by UNDP.

Parallel co-financing: The actual realization of project co-financing will be monitored during the terminal evaluation process and will be reported to the GEF. The planned/indicative parallel co-financing will be used as follows (Table 11):

Table 11. Project co-financing

Source	Co-financier	Type	Amount (USD)
GEF agency	UNDP	Grant/ parallel	200,000
Government	MOIT	In kind and in cash / parallel	700,000
Donor	JICA	Grant/ parallel	1,500,000
Private sector	Plato	Equity	2,000,000
Private sector	Key Lab	In-kind	1,000,000
Private sector	Bai Bang Pulp and Paper	Equity	1,000,000
Other	VEPF	Loan	2,000,000
Total			**8,400,000**

Co-financing source	Co-financing type	Co-financing amount	Planned Activities/Outputs	Risks	Risk Mitigation Measures
UNDP	*Grant/ parallel*	200,000	*Component 2 and 3*		
MOIT	*In kind and in cash / parallel*	700,000	Component 2 and Component 3		
JICA	*Grant/ parallel*	1,500,000	Component 2 and Component 3		
Plato	*Equity*	2,000,000	Component 1, 2, 3		
Key Lab	*In-kind*	1,000,000	Component 3		
Bai Bang Pulp and Paper	*Equity*	1,000,000	Component 1,2,3		
VEPF	*Loan*	2,000,000	Component 3		

Budget Revision and Tolerance: As per UNDP requirements outlined in the UNDP POPP, the project board will agree on a budget tolerance level for each plan under the overall annual work plan allowing the National Project Coordinator to expend up to the tolerance level beyond

the approved project budget amount for the year without requiring a revision from the Project Board. Should the following deviations occur, the Project Manager and UNDP Country Office will seek the approval of the UNDP-GEF team as these are considered major amendments by the GEF:
a) Budget re-allocations among components in the project with amounts involving 10% of the total project grant or more;
b) Introduction of new budget items/or components that exceed 5% of original GEF allocation.

Any over expenditure incurred beyond the available GEF grant amount will be absorbed by non-GEF resources (e.g. UNDP TRAC or cash co-financing).

Refund to Donor: Should a refund of unspent funds to the GEF be necessary, this will be managed directly by the UNDP-GEF Unit in New York.

Project Closure: Project closure will be conducted as per UNDP requirements outlined in the UNDP POPP. On an exceptional basis only, a no-cost extension beyond the initial duration of the project will be sought from in-country UNDP colleagues and then the UNDP-GEF Executive Coordinator.

Operational completion: The project will be operationally completed when the last UNDP-financed inputs have been provided and the related activities have been completed. This includes the final clearance of the Terminal Evaluation Report (that will be available in English) and the corresponding management response, and the end-of-project review Project Board meeting. The National Implementing Partner through a Project Board decision will notify the UNDP Country Office when operational closure has been completed. At this time, the relevant parties will have already agreed and confirmed in writing on the arrangements for the disposal of any equipment that is still the property of UNDP.

Financial completion: The project will be financially closed when the following conditions have been met:
a) The project is operationally completed or has been cancelled;
b) The National Implementing Partner has reported all financial transactions to UNDP;
c) UNDP has closed the accounts for the project;
d) UNDP and the National Implementing Partner have certified a final Combined Delivery Report (which serves as final budget revision).

The project will be financially completed within 12 months of operational closure or after the date of cancellation. Between operational and financial closure, the national implementing partner will identify and settle all financial obligations and prepare a final expenditure report. The UNDP Country Office will send the final signed closure documents including confirmation of final cumulative expenditure and unspent balance to the UNDP-GEF Unit for confirmation before the project will be financially closed in Atlas by the UNDP Country Office.

X. TOTAL BUDGET AND WORK PLAN

Total Budget and Work Plan			
Atlas Proposal or Award ID:	00088146	Atlas Primary Output Project ID:	00094924
Atlas Proposal or Award Title:	Application of Green Chemistry in Viet Nam to support green growth and reduction in the use and release of POPs/harmful chemicals		
Atlas Business Unit	VNM10		
Atlas Primary Output Project Title	Application of Green Chemistry in Viet Nam to support green growth and reduction in the use and release of POPs/harmful chemicals		
UNDP-GEF PIMS No.	5723		
Implementing Partner	Ministry of Industry and Trade (MOIT)		

GEF Component/Atlas Activity	Responsible Party (Atlas Implementing Agent)	Fund ID	Donor Name	Atlas Budgetary Account Code	ATLAS Budget Description	Amount Year 1 (USD)	Amount Year 2 (USD)	Amount Year 3 (USD)	Total (USD)	See Budget Note:
Component 1: Developing the Enabling Environment for Green Chemistry in Viet Nam. Outcome 1.1: Enabling Environment for Adoption of Green Chemistry Practices Established	MOIT	62000	GEF	71200	International Consultants	$40,000	$40,000	$20,000	$100,000	1
				71300	Local Consultants	$10,000	$30,000	$10,000	$50,000	2
				72100	Contractual services – companies	$10,000	$25,000	$5,000	$40,000	3
				75700	Training, workshop, meetings	$10,000	$15,000	$15,000	$40,000	4
				71600	Travel	$4,500	$5,500	$5,500	$15,500	5
				74500	Miscellaneous	$1,500	$1,500	$1,500	$4,500	6
					Sub total	$76,000	117,000	57,000	**$250,000**	
Component 2. Promote Awareness on Green Chemistry and the benefits of the application of Green Chemistry and its guiding principles	MOIT	62000	GEF	71200	International Consultants	$20,000	$20,000	$0	$40,000	7
				71300	Local Consultants	$15,000	$10,000	$5,000	$30,000	8
				72100	Contractual services – companies	$10,000	$30,000	$30,000	$70,000	9

Outcome 2.1 Awareness on GC and its guiding principles increased to a level necessary to support a shift to GC application.				75700	Training, workshop, conferences	$5,000	$25,000	$15,000	$45,000	10
				72500	Travel	$5,000	$3,000	$2,000	$10,000	11
				74500	Miscellaneous	$1,000	$2,000	$2,000	$5,000	12
					Sub total	$56,000	$90,000	$54,000	**$200,000**	
Component 3. Introduce Green Chemistry approaches into priority sectors and at least 2 entities Outcome 3.1 15 g-TEQ/a of UPOPs releases, 1 tonne of POPs, 0.002 tonnes of Mercury and X tonnes of GHGs reduced through the introduction of GC in priority sectors.	MOIT	62000	GEF	71200	International Consultants	$50,000	$200,000	$200,000	$450,000	13
				71300	Local Consultants	$20,000	$40,000	$40,000	$100,000	14
				72100	Contractual services – companies	$0	$300,000	$300,000	$600,000	15
				75700	Training, workshop, conferences	$4,500	$4,500	$4,500	$13,500	16
				71600	Travel	$5,000	$6,500	$5,000	$16,500	17
				74500	Miscellaneous	$6,000	$10,000	$4,000	$20,000	18
					Sub total	$85,500	$561,000	$553,500	**$1,200,000**	
Component 4: Monitoring and Evaluation, Dissemination of Project Results, Lessons Learned and Experiences	MOIT	62000	GEF	71200	International Consultants	$25,000		$45,000	$70,000	19
				71300	Local Consultants	$5,000	$20,000	$30,000	$55,000	20
				72100	Contractual services – companies	$3,000	$3,000	$4,000	$10,000	21
				75700	Training, workshop, conferences	$8,000		$20,000	$28,000	22
				72500	Miscellaneous	$1,000	$2,000	$2,000	$5,000	23
					Sub total	$42,000	$25,000	$101,000	**$168,000**	

Project Management	MOIT	62000	GEF	71300	Local Consultants	$46,000	$46,000	$47,284	$ 139,284	24
				72500	Supplies	$3,000	$3,600	$3,400	$10,000	25
				74500	Miscellaneous	$1,000	$1,800	$2,000	$4,800	26
	UNDP			74596	UNDP DPC	$9,000	$9,000	$9,716	27,716	27
					Sub total	$59,000	$60,400	$62,400	**181,800**	
					Total	**$ 318,500**	**$ 853,400**	**827,900**	**1,999,800**	

Budget Notes:

1. International experts to assist in the review of international best practices, gap analysis, CBAs and in the development of regulatory and policy framework on GC in the targeted sectors. This will include two (02) missions of an International consultants to provide technical support on training and on the development of AR material.
2. National experts to assess local capacity for Green Chemistry, development of economic incentives, development of regulatory and policy framework on GC in the targeted sectors.
3. Contractual services /Firm contract for training, survey and data collection
4. Trainings and workshops and establishment of Green Chemistry network
5. Travel and accommodation for national and international project staff and consultants
6. Miscellaneous expenses, including unforeseen expenditures and communication cost, for implementation of Component 1
7. International experts to build a communication plan and key messages, identify and support CSR initiatives, review extra-GC lectures and set up connection for science technology exhibitions
8. National consultants to develop a strategic communication plan and specific communication events/action, compose extra-GC lectures/activities and support CSR initiatives and exhibitions
9. Contractual services /Firm contract to develop TV programme, communication materials and GC website
10. Awareness raising events, trainings and workshops for each industrial sector
11. Travel and accommodation for national and international project staff and consultants
12. Miscellaneous expenses, including unforeseen expenditures and communication cost, for implementation of component 2
13. International consultants to lead feasibility studies, design green chemistry demonstration in selected sectors, provide technical contents in TORs, and provide technical quality assurance toward project main objective.
14. National consultants to participate in feasibility studies, liaise with industries, provide onsite technical assistance on specific industrial sectors for the implementation and assessment of Green Chemistry Practices, participate in the actual implementation of Green Chemistry

15. Purchase equipment, chemicals and required materials to demonstrate green chemistry application in selected factories in two selected demonstration sectors (chrome plating, bio-pesticide, plastic, …)
16. Trainings and workshops on feasibility studies and demonstration
17. Travel and accommodation for national and international project staff and consultants
18. Miscellaneous expenses, including unforeseen expenditures, for implementation of Component 3
19. International consultant for Inception and terminal evaluation, develop materials of lessons-learned and best practices, including travel
20. National consultants to support inception and termination evaluation, ensure continuous monitoring of the project and measure project indicators, disseminate project lessons-learned and best practices, including travel
21. Project annual audit and spot check per UNDP rule and regulations
22. Inception workshop, terminal project meetings and dissemination of project lessons-learned and best practices, including participate in international forum to advocate for project results
23. Miscellaneous expenses, including unforeseen expenditures and communication cost, for implementation of component 4
24. PMU staff salary
25. Office supplies
26. Miscellaneous expenses, unforeseen expenditures for project management cost, including translation service
27. UNDP direct support costs to National Implementation Modality

Summary of Funds:

	Amount Year 1	Amount Year 2	Amount Year 3	**Total**
GEF	**$318,500**	**$ 855,400**	**$ 825,900**	**$1,999,800**
UNDP	**$100,000**	**$100,000**	**$ 0**	**$200,000**
Government/MOIT **- In kind (Govt. staff)** **- Other parallel activities by Govt budget**	**$200,000**	**$200,000**	**$300,000**	**$ 700,000**
JICA	**$1,500,000**	**0**	**0**	**$1,500,000**
Plato		**$1,000,000**	**1,000,000**	**$2,000,000**
Key Lab	**$400,000**	**$300,000**	**300,000**	**$1,000,000**
Bai Bang Pulp and Paper		**$500,000**	**$500,000**	**$1,000,000**
VEPF		**$1,000,000**	**$1,000,000**	**$2,000,000**
TOTAL	**$2,518,500**	**$3,955,400**	**$3,925,900**	**$ 10,399,800**

XI. LEGAL CONTEXT

Viet Nam signed Standard Basic Assistance Agreement (SBAA) in 1977

Consistent with the Article III of the Standard Basic Assistance Agreement (SBAA), the responsibility for the safety and security of the National Implementing Partner and its personnel and property, and of UNDP's property in the National Implementing Partner's custody, rests with the National Implementing Partner. To this end, the National Implementing Partner shall:

a) put in place an appropriate security plan and maintain the security plan, taking into account the security situation in the country where the project is being carried;
b) assume all risks and liabilities related to the implementing partner's security, and the full implementation of the security plan.

UNDP reserves the right to verify whether such a plan is in place, and to suggest modifications to the plan when necessary. Failure to maintain and implement an appropriate security plan as required hereunder shall be deemed a breach of the National Implementing Partner's obligations under this Project Document [and the Project Cooperation Agreement between UNDP and the National Implementing Partner][1].

The National Implementing Partner agrees to undertake all reasonable efforts to ensure that none of the UNDP funds received pursuant to the Project Document are used to provide support to individuals or entities associated with terrorism and that the recipients of any amounts provided by UNDP hereunder do not appear on the list maintained by the Security Council Committee established pursuant to resolution 1267 (1999). The list can be accessed via http://www.un.org/sc/committees/1267/aq_sanctions_list.shtml. This provision must be included in all sub-contracts or sub-agreements entered into under/further to this Project Document".

Any designations on maps or other references employed in this project document do not imply the expression of any opinion whatsoever on the part of UNDP concerning the legal status of any country, territory, city or area or its authorities, or concerning the delimitation of its frontiers or boundaries.

XII. MANDATORY ANNEXES

A. Multi-year Workplan
B. Monitoring Plan
C. Evaluation Plan
D. GEF Tracking Tool (s) at baseline
E. Terms of Reference for National Project Director, National Project Coordinator, Senior Technical Advisor, Accountant
F. UNDP Social and Environmental and Social Screening Template (SESP)
G. Environmental and Social Management Plan (ESMP) for moderate and high risk projects only (*not applicable for this project*)
H. UNDP Project Quality Assurance Report
I. UNDP Risk Log
J. Results of the capacity assessment of the project implementing partner and HACT micro assessment
K. Letter of Agreements for UNDP Direct Project Costs
L. Letter of Endorsement
M. Letter of Co-financing
N. LPAC minutes
O. PBDEs, PFOSs, SCCPs, HBB, U-POPs and Mercury: industrial use, environmental and toxic properties.
P. Presence of POPs and mercury in six prioritized industrial sectors in Viet Nam
Q. Gender status in Viet Nam

Annex A. Multi Year Work Plan:

Task	Responsible Party	Year 1				Year 2				Year 3			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Component 1: Developing the Enabling Environment for Green Chemistry in Viet Nam. Outcome 1.1 – Enabling Environment for Adoption of Green Chemistry Practices Established	UNDP, PMU												
Output 1.1.1 National institutional capacity for Green Chemistry adoption assessed													
Output 1.1.2 Regulatory and policy assessment pertaining to Green Chemistry and POPs completed and gaps identified.													
Output 1.1.3 Specific standards and regulations on Green Chemistry, including incentive scheme, developed.													
Output 1.1.4 Green Chemistry incentives introduced following Cost-Benefit Analyses (CBAs).													
Output 1.1.5 A network of GC experts and institutional expertise created through capacity building and training.													
Component 2: Promote Awareness on Green Chemistry and the benefits of the application of Green Chemistry and its guiding principles Outcome 2.1 – Awareness on GC and its guiding principles increased to a level necessary to support a shift to GC application.	UNDP, PMU												
Output 2.1.1 Awareness on Green Chemistry created among decision makers and stakeholders.													
Output 2.1.2 Corporate Social Responsibility (CSR) Green Chemistry initiatives initiated.													
Output 2.1.3 Green Chemistry extra-lecture integrated in the universities and MOIT training institutes.													
Output 2.1.4. InfoTech exhibition: MOST and commercial/trade promotion of advance tech countries.													
Component 3: Introduce Green Chemistry approaches into priority sectors and at least 2 entities Outcome 3.1 - 15 g-TEQ/a of UPOPs releases, 1 tonne of POPs, 0.002 tonnes of Mercury reduced through the introduction of GC in priority sectors.	UNDP, PMU												
Output 3.1.1 In-depth GC assessments concluded of priority production/manufacturing sectors.													
Output 3.1.2 Technical tools and guidance developed for introduction of Green Chemistry in priority sectors.													
Output 3.1.3 Green Chemistry approaches introduced in at least 2 entities.													
Component 4- Monitoring and Evaluation, Dissemination of Project Results, Lessons Learned and Experiences													
Outcome 4.1 - Project results monitored, adaptive management applied in response to needs identified and findings extracted.	UNDP, PMU												
Output 4.1.1 Adaptive management applied in response to needs and Mid-term Evaluation (MTE) findings.													
Outcome 4.2 - Lessons-learned, experiences, and best practices extracted and disseminated at national, regional and global level.	UNDP, PMU												
Output 4.2.1 Lessons-learned, best practices and experiences collected and disseminated at national, regional and global level to support replication.													

Annex B: Monitoring Plan

The Project Manager will consolidate results data with MOIT support according to the following monitoring plan.

Monitoring	Indicators	Description	Data source/Collection Methods	Frequency	Responsible for data collection	Means of verification	Assumptions and Risks
Project objective from the results framework *Reduce the use and release of chemicals controlled under MEAs, other hazardous chemicals, improve energy and natural resource efficiency and reduce (GHG) emissions through the application of Green Chemistry principles in Viet Nam.*	***Mandatory Indicator*** *UN SP Indicator 1.3.1: Number of new partnership mechanisms with funding for sustainable management solutions of natural resources, ecosystem services, chemicals and waste at national and/or subnational level.*	*Indicates whether the expected partnership have been established and effectively lead to an enabling environment for GC*	*Baseline reports* *Project progress reports* *MOIT reports* *Others*	Annually	*UNDP CO* *MOIT* *PMU*	*Assessment of the report and comparison with qualitative and quantitative targets.*	***Assumption**: Institutions and private stakeholders aware of the social, economic and environmental importance of GC.* ***Risks**: GC enabling partnerships not fully sustainable or documented separately but under umbrella of larger national programmes like Green Growth or Sustainable Production and Consumption.*

	Indicator 2 *Mandatory Indicator* *UN SP Indicator 2.5.1: Extent to which legal or policy or institutional frameworks are in place for conservation, sustainable use, and access and benefit sharing of natural resources, biodiversity and ecosystems.*	*Number of legislation and guidance documents pertaining to the implementation of Green Chemistry, developed, drafted and endorsed by the government*	*Baseline reports* *Project progress reports* *Memorandum of Understanding signed with selected industries* *CSR statements*	Annually	*UNDP CO* *MOIT* *PMU*	*Assessment of the report and comparison with qualitative and quantitative targets.* *Verification of the authenticity of MOU and CSR statements and comparison with the required GC principles.*	***Assumption****: comprehensive report drafted and made available, structured in such a way that the assessment can be easily made.* *MOU drafted in such a way to clearly identify GC initiatives and their linkage with POPs issue.* ***Risks****: lack of baseline data. Lack of quantitative data on the implementation of GC and CSR initiatives.*
	Indicator 3 *Amount of POPs, U-POPs and mercury uses and release avoided at project implementation and predicted at replication*	*Measured or estimated reduction of POPs, U-POPs and mercury based on the comparison with the baseline, adopted recognized monitoring or estimation procedures.*	*Baseline reports* *Project progress reports* *Interviews and site survey*	Annually	*UNDP CO* *MOIT* *PMU*	*Assessment of the reports and comparison with qualitative and quantitative targets.*	***Assumption****: data on POPs and mercury reduction and relevant indicators available and reliable.* ***Risks****: social and economic benefits not fully developed within project timeframe*

Project Outcome 1.1 *Enabling Environment for Adoption of Green Chemistry Practices Established*	***Indicator 1*** *Availability of an assessment report and feasibility study and of a Green Chemistry incentives scheme introduced following Cost-Benefit Analyses (CBAs).*	*Availability an assessment report of regarding the national institution capacity, the gaps of the current regulatory framework with relevance to the specific MEAs, and the level of adoption for Green Chemistry in Viet Nam, the CBA of incentive schemes and their introduction*	*Draft and final version of the assessment report.* *Meeting minutes* *Mission reports of the national and international consultants.* *Outcome of interviews and questionnaire surveys if any.* *CBAs of selected incentive schemes* *Report on the introduction of an incentive scheme*	Annually	*UNDP CO* *MOIT* *PMU*	*Assessment of the reports and comparison with qualitative and quantitative targets.*	***Assumption**: comprehensive report drafted and made available, structured in such a way that the assessment can be easily made.* ***Risks:** low percentage questionnaire and interviews answered.*
	***Indicator 2**)* *Number of trainings successfully performed and , number of people (male and female) attending the training*	*Number of training aimed at strengthening the capacity of Institutions and entities to develop, improve and implement the regulatory and policy framework for Green Chemistry and POPs carried out, and number of persons (male*	*Training reports.* *Training materials.* *Training test results.* *Attendance sheets.*	Annually	*UNDP CO* *MOIT* *PMU*	*Assessment of the reports and comparison with qualitative and quantitative targets.* *Assessment of the training materials and test results.*	*Assumption: comprehensive training report drafted and made available, structured in such a way that the assessment can be easily made.* *Risks: limited attendance of training – trainees not fully interested in the training. Training material not made available. Training test not reliable.*

		and female) trained for each training					
	Indicator 3 *Existence of a network of GC experts with equal opportunities among genders and institutional expertise created under the project*	*This indicator measures whether a network of GC expert has been actually developed and is functional*	*GC network website* *List of GC network members.* *Meeting minutes* *Mission reports of the national and international consultants.* *Records / reports of the exchange of information between industries and the GC Network.*	Annually	*UNDP CO* *MOIT* *PMU*	*Assessment of the reports and comparison with qualitative and quantitative targets.* *Assessment of the wotk of the GC network and their compliance with GC and project objectives.*	*Assumption: reports and records on the GC network activity drafted and made available, structured in such a way that the assessment can be easily made.* ***Risks****: records of information exchange between the GC network and the beneficiaries not updated regularly*
Project Outcome 2 *Awareness on GC and its guiding principles increased to a level necessary to support a shift to GC application.*	***Indicator 1*** *Level of Awareness on Green Chemistry among decision makers and stakeholders.*	*This indicator measures the increase on awareness based on questionnaire surveys and interviews.*	*Awareness raising event reports* *Awareness raising materials.* *Questionnaire surveys at beginning and end of the project*	Annually	*UNDP CO* *PMU*	*Assessment of the reports and comparison with qualitative and quantitative targets.* *Assessment of awareness raising materials and their compliance with GC and project objectives.*	***Assumption:*** *awareness raising reports, questionnaire survey reports, and awareness materials and made available, structured in such a way that the assessment and comparison with project target can be easily made. Interviews and questionnaire surveys carried out on a sufficient number of persons.* ***Risks:*** *answers from interviews and questionnaire incomplete or inconsistent.*
	Indicator 2 *2) Availability of reports from initiatives on Corporate Social Responsibility on Green Chemistry.*	*This indicator measures the whether a CSR initiative which has been effectively developed, endorsed and funded*	*Official CSR statements from industry / firm adopting the CSR* *CSR reports from industry / firm* *Meeting minutes* *Project reports*	Annually	*UNDP CO* *MOIT* *PMU*	*Assessment of CSR for their sustainability and compliance with GC and project objectives.* *Assessment of the reports and comparison with qualitative and quantitative targets set by the project.*	***Assumptions****: officially endorsed CSR statements and CSR report made available and written in such a way that comparison with GC objectives can be easily carried out.* ***Risks.*** *CSR implementation not fully monitored or implemented by the*

							participating firms
	Indicator 3 *Availability of reports and material from Green Chemistry extra-curricular lectures carried out, and from the exhibition and technology workshop on GC technologies promoted by Embassies in Hanoi*	*This indicator measures the quality and quantity of extra lectures on GC and whether exhibition on GC (InfoTech) have been effectively held. .*	*Agenda and reports concerning the extra-curricular course* *Attendance sheets* *Meeting minutes* *Project progress reports*	Annually	*UNDP CO* *PMU*	*Assessment of the extra-curricular lectures held in MOIT by the participating universities or technology centers in Viet Nam through attendance of some the lectures, and interviews. .* *Assessment of the infortech initiative through attendance verification of the available reports and interviews.*	*Assumptions: training material text of the lectures, minutes made available and structured in such a way that the comparison with GC target can be easily made.* *Risks: lectures and Infotech initiative not approved or implemented within the project timeframe; low participation to the initiatives*
Project Outcome 3 3.1 15 g-TEQ/y of UPOPs releases, 1 tonne of POPs, 0.002 tonnes of Mercury and reduced through the introduction of GC in priority sectors**.**	***Indicator 1*** *Number of priority sectors and entities selected for demonstration*	*This indicator is aimed at confirming that factories from 2 priority sectors effectively agreed to participate in the demonstration of GC initiatives,*	*Memorandum of Understanding signed with selected industries* *Meeting minutes* *Project progress reports*	Annually	*UNDP CO* *MOIT* *PMU*	*Assessment of MOU with reference to GC, SC and project target. Verification of the authenticity of MOU and signature.*	*Assumptions: officially endorsed MOU and reports on green chemistry implementation made available and written in such a way that comparison with GC objectives can be easily carried out.* *Risks. MOU not signed / not fully implemented or monitored by the participating firms*
	Indicator 2 *Availability of criteria for POPs / mercury baseline assessment and calculation of POPs/mercury reduction*	*This indicator specifically whether sound criteria and scientifically based methodologies for the estimation of GC benefit compared to the baseline*	*Sector – specific methodological reports* *Reports from GC experts* *Site visit reports*	Annually (first year)	*UNDP CO* *MOIT* *PMU*	*Methodologies based on direct evidence or proper consumption factors and proxy values.* *Assessment of project progress reports*	*Assumption: methodology for the assessment and the measurement of the improvement compared to the baseline are made available in due time and based on limited number of assumptions* *Risks: industry not providing basic information for the calculation of the baseline.* *Uncertainty associated to the*

		have been developed and agreed.					*use of proxy value for U-POPs*
	Indicator 3 *Amount of the reduction of the use or release of POPs, U-POPs and mercury (both at project implementation and predicted at replication stage)*	*This indicator specifically measures the amount of POPs UPOPs (PCDDs/Fs) releases reduced, in g/TEq per year and the amount of mercury releases reduced in kg/yr.*	*Site visit reports* *Baseline reports from the pilot industries* *Reports from the pilot industries on the adoption of GC actions* *Project progress reports*	Annually	*UNDP CO* *MOIT* *PMU*	*Comparison among the baseline reports and the GC implementation reports. Estimates based on consumption factors and proxy values.* *Assessment of project progress reports*	*Assumption: baseline reports and GC implementation reports made available in due time and containing quantitative information on proxy values and / or the amount of POPs uses* *Risks: high uncertainty of quantitative estimates. Baseline information incomplete (i.e. information on the composition of raw materials missing or unclear)*
Project Outcome 4	***Indicator 1:*** *Monitoring activities have been carried out*	*Measures whether project monitoring activities have been carried out and project management structures have been established.*	*Collection of minute and reports during inception and meetings of the PSC. Collection of project management report at UNDP or PMU offices. Direct interviews with persons in charge..*	Quarterly	*Project Steering Committees, UNDP, MOIT, PMU*	*Inception report, PIRs, AWP and QWP, APR and QPR, meeting minutes*	*Assumption: Key project management and monitoring steps carried out timely. Project started within expected deadline. Project Steering Committee and Project Management Unit established timely and working effectively.* *Risk: delay in project approval, signature and starting. PSC and PMU not effective in the day to day management and monitoring of the project.*
	Indicator 2: *Evaluation activities have been carried out.*	*Measures whether TE has been properly carried out.*	*Independent consultants*	After 2nd PIR submitted to GEF and after final PIR submitted	*PMU, UNDP, Project Steering Committees.*	*Terminal evaluation report.*	*Project activities carried out within the timeframe set. Independent evaluators and auditors will carry out their evaluation task timely, effectively and independently.* *Risks: delay in project activities and in carrying out evaluations. Terminal*

							valuation reports not available.
	Indicator 3: *Knowledge management system established and sustained*	*Measures whether the Knowledge Based System has been implemented.*	*Providers of web based services, PMU, UNDP*	*Annually*	*PMU, UNDP, Project Steering Committees.*	*Website, information system.*	*Assumptions: Website and information system, including inventory, have been developed and are available. Potential Partners for managing the Green Chemistry cell and the Green Chemistry network have been identified Risks: delay in setting up the Green Chemist cell, network and associated website. Incompleteness of reporting,*
Terminal GEF Tracking Tool	N/A	N/A	Standard GEF Tracking Tool available at www.thegef.org Baseline GEF Tracking Tool included in Annex.	After final PIR submitted to GEF	Project Manager UNDP CO	Completed GEF Tracking Tool	
Environmental and Social risks and management plans, as relevant.	N/A	N/A	Updated SESP and management plans	Annually	Project Manager UNDP CO	Updated SESP	

ANNEX C EVALUATION PLAN

Evaluation Title	Planned start date Month/year	Planned end date Month/year	Included in the Country Office Evaluation Plan	Budget for consultants	Other budget (i.e. travel, site visits etc…)	Budget for translation
Terminal Evaluation	06/2020	12/2020	Yes	USD 30,000	USD 10,000	USD 5,000
			Total evaluation budget	USD 45,000		

Annex D **GEF Tracking Tool (s) at baseline**

Annex E **Terms of Reference for National Project Director, National Project Coordinator, Senior Technical Advisor, Accountant**

Annex F **UNDP Social and Environmental and Social Screening Template (SESP)**

Annex G **Environmental and Social Management Plan (ESMP) for moderate and high risk projects only (*not applicable for this project*)**

Annex H **UNDP Project Quality Assurance Report**

ANNEX I. UNDP RISK LOG.

Project risks					
Description	**Type**	**Impact & Probability**	**Mitigation Measures**	**Owner**	**Status**
Lack of Coordination among bodies with different mandates may hinder project result	*Management*	*I 3 P 3*	*The participation of MOIT, MONRE, industrial associations, NGOs and local institutions (e.g. DOIT and DONRE) will be ensured in Project Steering Committee (PSC)and critical project steps.*	*UNDP, PMU*	*Evidence of potential misalignment already identified at project preparation.*
Lack of participation of key players in workshops and training.	*Management*	*I3 P3*	*The training and workshop events will be preceded on a thorough need analysis. Interested participants will be contacted in due time to ensure their participation.*	*PMU*	*Risk mitigation measures already undertaken at project preparation stage.*
Lack of effectiveness of training	*Management*	*I3 P3*	*Training will be preceded and followed by the assessment of the knowledge of the trainees. The trainees will provide feedback on the trainers through questionnaires.*	*UNDP, PMU*	*Not available at this stage*
Financial resources will be not available to demonstrate and sustain Green Chemistry in the selected sectors as planned.	*Financial*	*I3 P3*	*The selection of the demonstration activity will prioritize intervention with a high effectiveness / cost ratio. Intervention requiring high infrastructure investments will be undertaken only in the presence of significant co-financing.*	*UNDP, PMU, Co-financing partners*	*Not available at this stage*
Gender issues not effectively mainstreamed in the project.	*Policy*	*I3 P3*	*The project established 3 criteria to enhance gender mainstreaming which will be strictly fulfilled at all stages of project implementation.*	*UNDP, PMU.*	*Risk for poor gender mainstreaming can be classified as moderate at project implementation stage*
Moderate or low Global Environmental Benefit achieved	*Technical / Financial*	*I3 P2*	*The GEB, which may be directly obtained through demonstration during project implementation, is unavoidably low. However the potential for scaling up is very high. The project will enhance the GEB by raising the awareness and ensuring sustainability of Green Chemistry intervention beyond project timeframe through properly designed incentive schemes.*	*UNDP, PMU*	*Risk already identified at project preparation stage as moderate.*
Lack of capacity on adequate project financial management and	*Management /Financial*	*I3P3*	*On-The-Job training and guidance provided (by UNDP to PMU and staff of Govt. implementing partners) on UNDP project financial management and*	*UNDP*	*Identified at project preparation stage as*

procurement by Government implementing partner to utilize the project fund effectively			*procurement rules and regulations based on Harmonized Program and Project Management Guidelines (HPPMG).* *Closely monitor project procedures and implementation on finance and procurement.*		*moderate.*
An adequate partner to manage the Green Chemistry Cell and Green Chemistry network is not found	*Management / Communication*	*I3 P3*	*Training institutions with a significant capacity on communicating environmental issues have already been identified during project preparation stage*	*UNDP* *PMU*	*Identified at project preparation stage as low*

Annex O: PBDEs, PFOSs, SCCPs, HBB, U-POPs and Mercury: industrial use, environmental and toxic properties.

- **PBDEs and HBB:** The manufacturing of plastic articles, or in general of articles which may be exposed to risk of fire, requires the use of flame retardants as an additive. The commercial Polybrominated diphenylethers (octa and penta PBDEs) and hexabromobiphenyl (HBB) were added to the list of the Stockholm Convention by the Conference of the Parties in 2009. Other flame retardants containing compounds with POPs characteristics, like deca-BDE, have been recently considered by the POP review committee, as fulfilling the criteria set by annex D of the Stockholm convention.

- PBDEs are a class of structurally similar brominated hydrocarbons, in which 2–10 bromine atoms are attached to the diphenyl ether molecule. Similarly to PCB molecules, the 209 possible compounds for PBDEs are called "congeners". However, the number of PBDE congeners that actually exist in commercial PBDE mixtures are much lower compared to PCBs. Commercial PBDEs are always made by mixtures of different PBDEs molecules, out of which only a limited number have POPs properties. However, Deca-BDEs may degrade in less brominated PBDEs which are classified as POPs. PBDEs are used as flame retardants in a wide variety of products, including plastics, furniture, upholstery, electrical equipment, electronic devices, textiles and other household products (ATSDR 2004; EPA 2009). Concerning their toxicity properties, several studies demonstrated that these substances may cause neuro-developmental toxicity, weight loss, toxicity to the kidney, thyroid and liver and dermal disorders, can act as endocrine system disruptors and also tend to deposit in human adipose tissue (ATSDR 2004; Birnbaum and Staskal 2004; EPA 2009). The IARC has not classified the carcinogenicity of any PBDEs. However, according to a number of EPA studies, evidence of carcinogenic potential is suggested for decaBDE (EPA 2009; EPA IRIS 2008a). Due also to their persistence in the environment and to their potential for long range transport, a number of PBDEs (namely, commercial penta-PBDE and commercial Octa-PBDE) have been listed in the Stockholm Convention for elimination of their production and use, whilst deca-BDEs are being phase out since 2013 in the USA and since 2008 cannot be anymore used under the ROHS directive.

- **PFOS and its related substances (Perfluoro Octane Sulfates):** include Perfluorooctane sulfonic acid (CAS No: 1763-23-1), its salts and perfluorooctane sulfonyl fluoride (CAS No: 307-35-7). PFOS is very persistent and has substantial bioaccumulations and biomagnifying properties. It also fulfils the toxicity criteria of the Stockholm Convention. Studies have indicated adverse effects of PFOS-related substances on reproductive health for humans, and the risk of developmental effects. PFOS and related substances have the capacity for long-range transport (UNEP 2006b) and PFOS and PFOS-

related substances can be released to the environment from manufacturing processes and during their use in industrial and consumer applications, as well as from disposal of the chemicals or products and articles (Bossi et al., 2008; Oliaei et al., 2011; UNEP, 2006b; Weber et al., 2011). PFOS-related substances have a number of industrial uses, related to the fact that these substances are at the same time grease and water repelling. They are typically used for surface treatment, and are common in non-stick products, stain-resistant fabrics and all-weather clothing. Due to their surface-active properties, they have historically been used in a wide variety of applications, including firefighting foams and surface resistance/repellence to oil, water, grease or soil. Although PFOS production has been discontinued in Europe and USA, PFOS are still being produced in Asia, and the use of PFOS in some specific industries (like etching agents or mist suppressant in chrome-plating) is still common.

- **Short Chain Chlorinated Paraffin (SCCPs):** Based on their potential for bio-accumulation, the potential long-range environmental transport, persistence and toxicity, Short Chain Chlorinated Paraffins have been recently considered by the POP review committee, as fulfilling the criteria set by annex D of the Stockholm convention. SCCP are used as pressure lubricants, as flame retardants in plastics and textiles, as plasticizer for polyvinyl chloride in polyethylene sealants, and in detergents.

ANNEX P: Presence of POPs and mercury in six prioritized industrial sectors in Viet Nam

Mercury and energy efficiency. *Emission of coal from the electric power generation.* Based on IEA data[9], in 2010 Viet Nam produced 94,903 GWh of electricity, out of which 19,687 GWH were produced using coal and peat. IEA also reports that Viet Nam consumed around 7.95 million metric tons of coal for electric power generation. The concentrations of mercury in different coals in Viet Nam ranges from 0.06 to 0.18 mg/kg (MONRE, 2009). This is consistent with figures for coal in other countries (for instance, USGS[10] reported an average concentration of mercury in coal from 0.04 to 0.24 mg/kg. Based on the above figures, the amount of mercury which can be released in the environment by the electric power sector would range from 0.48 to 1.44 tons per year. This amount is thought to increase due to the availability of coal in the country and the expected increase in electricity demand: According to QĐ 110/2007/QĐ-TTG: electricity demand by 2020 compared to 2005 is expected to increase of 17-20%.

2.1.1.1 The electro-plating industry.

Plating is a surface coating process in which a metal is deposited on a conductive surface of a product. Electro plating can be classified in the following categories:

- Metal layer for which the following metals are often used: Cr, Ni, Zn, Sn, Cu, Pb, Cd, Ag, Au and Pt;
- Alloy layer which could be: Cu-Ni, Cu-Sn, Pb-Sn, Sn-Ni, Ni-Co, Ni-Co, Ni-Cr and Ni-Fe.; and
- Composite layer made by small and dispersed solid particles such as Al.

Electroplating involves the use of hazardous chemicals during pre-treatment (solvent degreasing, alkali cleaning and acid dipping), during plating to the final buffing, grinding and polishing of the product. Electroplating uses metals including chromium, nickel, cadmium, zinc, copper, silver and gold, dissolvable salts, cyanide and sulfate salts, acids and alkaline solution. The electro-plating process requires also etching agents and mist suppressant, which may be both based on PFOS-related substances. In Viet Nam, most of the chemicals used by the plating sector are imported from China and Taiwan.

Due to the involvement of different hazardous chemicals, including toxic metals, cyanide, and strong acids and base solutions, these processes present a high risk to the environment and human health. Wastewater released by electro-plating plants may contain heavy metals (Cu, Zn, Cr, Ni, etc.), acids, alkalis, surface activated substances, oil, etc. Depending on the type of metal salts used for plating process, the wastewater could also contain toxic chemicals such as cyanide, sulfate, ammonia, chromate, as well as POPs like PFOS.

POPs and chrome-plating industry. The chrome-plating process releases in the workplace a significant amount of acid mists containing chromium. This represents a severe health risk for the workers. Chemicals used as mist suppressant are then added to the plating bath to avoid the releases of such gases. One of the most popular categories of mist suppressants in the electro-plating industry has been the PFOS based mist suppressant. Based on data from U.S. industries, a PFOS-based mist suppressant reduces chromium emissions by over 98 percent and is used by the bulk of the U.S. plating industry. In the U.S.A., in September of 2012, the EPA announced stringent new chromium emission limits and a ban on the use of PFOS mist suppressants. Existing PFOS suppressants will need to be replaced with non-PFOS suppressants. Under the Stockholm Convention, the use of PFOS in metal plating industry is allowed only in closed loop systems.

[9] http://www.iea.org/

[10] http://pubs.usgs.gov/fs/fs095-01/fs095-01.html

Plating sector in Viet Nam. Presently there are about 150 enterprises working on metal plating in Viet Nam.[11] Among those, only a few are large scale enterprises, the remaining being private SMEs scattered throughout the country. Most of the plating SMEs operate in small workshops with outdated equipment/machines and technologies[12] and with limited investments on pollution control or environmental protection measures. The plating SMEs are often located in big cities such as Hanoi, Ho Chi Minh, Binh Duong and Bien Hoa.

In general, environmental aspects at many plating enterprises are poorly managed. The plating SMEs release in the environment significant amounts of hazardous waste, wastewater and sludge that contain heavy metals (Cr, Ni, Fe, Zn, dust). Examples are the Dinh Phong Plating facility (Binh Duong Province) that discharged in 2008 wastewater directly into the environment (without treatment) and this caused serious pollution to water sources used for domestic consumption which resulted in the immediate death of 11 cows after they drunk polluted wastewater with high cyanide levels discharged from the facility[13].

At many plating enterprises, waste water is not treated but directly released into the environment, or released after minimal pH neutralization. In Ho Chi Minh City for example, more than 80% of the wastewater from plating industries/facilities are discharged to the environment without treatment and this badly affects the quality of the Saigon and Dong Nai River.[14] Unavoidably, when PFOS-based mist suppressants are used, these also are released with the wastewater. Analytical results of wastewater from a number of plating facilities in Ho Chi Minh City, Binh Duong and Dong Nai show a similar status, i.e. high concentrations of organic substances, concentrations of heavy metals exceeding many times the stipulated MAC values, CODs fluctuating between 320 – 885 mg/liter due to the presence of paints, oils, and diesel.[15] Similarly analytical results of wastewater from a number of mechanical factories in Hanoi show that concentrations of heavy metals such as chrome, nickel and copper are much higher than national MAC values stipulated by the Viet Nam regulation (QCVN). At a number of electroplating enterprises, which dispose of wastewater treatment facilities, these are not efficiently operated.

Solid waste generated by the plating sector often includes empty packages of chemicals (plastics, paper packaging, etc.), empty cans previously containing liquid chemicals, sludge from wastewater treatment processes that potentially contains oxide, hydroxide, salts and various metals. The sludge, even in small amounts, is often highly toxic because of the presence of a combination of various heavy metals and other toxic chemicals discharged from plating processes. Presently it's estimated that about 30 tons/day of sludge is generated by the plating sector[16].

No information about the use of POPs (PFOS, PFOA, PFC, etc.) used by the plating sector is available. However, analytical results of wastewater and sludge samples taken from a number of foreign investment plating enterprises located in Song Khe – Noi Hoang Industrial Zone, Van Trung Industrial Zone and Dinh Tram Industrial Zone in Bac Giang province indicate the presence of PFOS in the plating process. The concentration of PFOS measured in waste- and surface- water are much lower than the MAC concentration indicated by the US EPA for drinking water. Concerns may however arise for PFOS in surface water, which in some cases was found at a concentration exceeding the value recommended by RIVM for the consumption of fish (0.65 ng/L).

11 Trang Vàng Việt Nam 2015

12 Study and propose measures to improve management of hazardous waste at Hung Long Plating company, Lai Thieu Town, Binh Duong. http://doc.edu.vn/tai-lieu/do-an-nghien-cuu-va-de-xuat-bien-phap-nang-cao-hieu-qua-quan-ly-chat-thai-ran-nguy-hai-tai-cong-ty-xi-ma-hung-long-thi-50245/

13 Dong Thu Van. 2011. Study of treatment technologies of wastewater from plating industry located in Phung industry, Hanoi City.

14 Plating technology. http://dulieu.tailieuhoctap.vn/books/khoa-hoc-ky-thuat/khoa-hoc-moi-truong/file_goc_779717.pdf

15 Report of environmental toxicity in plating sector. http://text.123doc.org/document/1328184-bao-cao-doc-hoc-moi-truong-de-tai-xi-ma.htm

16 Dong Thu Van. 2011. Study of treatment technologies of wastewater from plating industry located in Phung industry, Hanoi City

Although most of the electro-plating factories in Viet Nam are small enterprises which employ between 4-10 people, there are a number of large enterprises adopting more advanced processes:

- **Italisa Plating.** Italisa Ltd. Viet Nam was founded in Viet Nam in 2008. It's located in Song Khe – Noi Hoang Industrial Zone in Bac Giang City, Bac Giang Province. Italisa Viet Nam is an investment by the Bowat Corporation specialized in the manufacturing of sanitary ware and equipment for bathroom and luxury kitchens, with a size of more than 1000 employees. The entire manufacturing process of a product is done by the company, including design, creating molding, sand core mold, product body casting, processing, polishing, electroplating, function testing and final assembly. The company has imported State-of-Art equipment for its production process, such as an IMR gravity casting machine imported from Italy, a low-pressure casting machine, processing lines imported from Japan, 104 electroplating production lines imported from Taiwan, and spectrum SPEAK equipment imported from Germany. The plating lines which include chrome plating, multilayer plating (Copper – Nickel – Chrome), zinc plating, gold plating, and copper plating are all modern plating lines, meeting international certification. The company has a production capacity of 200,000 products/day.
- **EMW.**[17] Ltd Viet Nam is located in the Van Trung Industrial Zone in Viet Yen District, Bac Giang Province with a size of 350 – 500 employees. The company started its operation in Viet Nam in June 2014. This is a 100% Korean investment specialized in the production of antenna and electronic parts of telecommunication equipment and mobile phones.
- **Viet Nam Surteckaria Company (Japanese Ltd).** Location: Dinh Tram Industrial Zone, Viet Yen district, Bac Giang Province, in operation since 2011. Key production of the Surteckaria Factory is surface treatment and metal processing based on orders from other companies. The factory uses Japanese machines and equipment, mainly automatically operated. The factory has two (2) separate processing and plating workshops. The plating workshop include copper plating, silver plating and other precious metal plating such as gold and titan.

2.1.1.2 Manufacturing of plastic polymers and articles.

Plastic polymers are a wide range of chemical products sharing common building principles. They consist of long chain molecules, containing large numbers of smaller constitutional repeating units.

There are different types of plastic polymers: half synthetic polymers (natural polymers which are chemically modified, for example casein plastics, or cellulose plastics) and synthetic plastic polymers.

Monomers used for plastic polymer synthesis may belong to the group of large volume organic products usually produced from petrochemical feedstock (crude oil or gas), or cellulosic materials which are produced from cotton or wood fibers or biodegradable products produced from renewable raw materials.

Plastic manufacturing and POPs. The manufacturing of plastic products may be divided in two large processing technologies, which are usually entirely separate:

1) Manufacturing of polymeric pellets; this process usually requires three steps: preparation, reaction and separation. Reactive flame retardants are usually added during the polymerization process and become an integral part of the polymer.
2) Manufacturing of final products. The second step, which is the most common in Viet Nam may involve different technologies such as blow, compression or injection moulding, extrusion, pressing, etc. Additives

17 EMW: Electro Magnetic Wave

may in some cases also be added during the preparation step of these processes, i.e. when preparing the mixtures. Additive flame retardants are incorporated into the plastic at any stage of the process, but more frequently following polymerization. They are most often used in thermoplastics. PBDEs are among the most commonly used flame retardants. As these additives are only physically bonded to the polymer molecule, they are more susceptible of being released when plastic articles or plastic wastes are exposed to the environment.

As of 2013, among Brominated Flame Retardant (BFR) mixtures, deca-BDE is the most widely used commercial additive in the polymer industry and the use of deca-BDE is currently not subject to any restrictions in China. Although China is one of the main exporter of chemical products to Viet Nam, in Viet Nam there are currently no restrictions to the import of deca-BDE. Based on the information provided by MOIT (email from MOIT dated 11/11/2016), Viet Nam is still officially importing Deca-BDE. Although deca-BDE is not yet listed under the Stockholm convention, it has been recommended for listing by the POP-REC. It easily degrades to less chlorinated PBDE which have POPs features. For this reason, the use of deca-BDE is currently restricted in Europe under the ROHS directive, and is proposed for a more general restriction under the REACH regulation.
Deca-BDE is not manufactured in Europe, however it is jointly registered for import under REACH by five companies, for a combined tonnage spanning from 10,000 to 100,000 tons per year.

The proportion of deca-BDE used in the EU in plastics (as opposed to textiles and other uses) has decreased from 81.7% (EU RAR, 2002) to 48% (VECAP, 2012). The use of deca-BDE in textiles occurs predominantly in the UK, due to stringent fire safety standards (SVHC SD, 2012).
In general, deca-PDE flame retardants may be used in the manufacturing of articles made with different plastic polymers, like polyolefin, polystyrene, PVC, ABS, Styrene acrylonitrile, polyphenylene oxide, unsaturated polyester, epoxy ester and polyurethane. The use of deca-BDE is usually higher with products or articles subjected to strict fire protection standards. A number of alternatives to deca-BDE are already available which may effectively replace deca-BDE substances in plastics manufacturing. As of now, the amount of deca-BDE used in plastic manufacturing in Viet Nam is unknown.

In addition to deca-PDE, short-chain chlorinated paraffins (SCCPs) have also been included as candidate POPs to be listed in Annex A. Under the EU REACH regulation, SCCPs are classified as persistent, toxic and bio-accumulative (PTB) and are listed on the European Candidate list of substances of priority concern. Based on their potential for bio-accumulation, the potential long-range environmental transport, persistence and toxicity, Short Chain Chlorinated Paraffins have been recently considered by the POP review committee, as fulfilling the criteria set by Annex D of the Stockholm Convention. SCCPs are used as pressure lubricants, as flame retardants in plastics and textiles, as plasticizer for polyvinyl chloride in polyethylene sealants, and in detergents. SCCPs include all individual chemicals or mixtures that contain: $C_xH_{(2x-y+2)}Cl_y$ where x = 10-13; y = 3-12; and the average chlorine content ranges from approximately 40 to 70 percent with the limiting molecular formulas set at $C_{10}H_{19}Cl_3$ and $C_{13}H_{16}Cl_{12}$. SCCPs are used as lubricants and coolants in metal cutting and metal forming operations and as secondary plasticizers and flame retardants in plastics.

Plastic manufacturing in Viet Nam. In Viet Nam, the plastic products industry is one of the fastest developing sectors, with an average annual growth rate in the order of 15 – 20% over the period 2000 – 2010. The plastics sector in Viet Nam is however almost entirely dependent on imported plastic pallets. In 2010, while only about 300,000 tons of plastic material was produced in Viet Nam (mainly polyvinyl chloride (PVC) and

Polyethylene Terephthalate (PET)) the sector had to import around 1.6- 1.7 million tons of plastic material as well as a large amount of additives to meet the plastic production's demands.

In the country the plastic sector is therefore mainly composed by factories undertaking post-polymerization processes, namely:

- Injection technology: used for production of parts/elements for electronic equipment, motorbikes, automobile, etc.
- Blow- extrusion Technology: for production of plastic bags (PE, PP) and PVC membrane
- Profile Technology: for production of wastewater pipes (PVC), water supply pipes (PE), door (PVC) roof sheets, etc.

The structure of the sector is highly fragmented: as of 2010 about 2,000 plastic enterprises were operating, most of them (90%) SMEs. The plastic enterprises are mainly located in Ho Chi Minh City and neighboring provinces (80%) such as Dong Nai, Binh Duong and Long An. The number of plastic enterprises in the North and Central part of Viet Nam account respectively for 15% and 5%.

Large plastic companies are few, and include the Vina TPC Company and the Phu My Plastic and Chemicals Company (with a total production capacity for the two companies of 200,000 tons of PVC/year), Formosa Viet Nam Company (with a capacity of 145,000 tons of PET production/year)[18]

The structure of the plastic manufacturing sector in Viet Nam is not competitive due to the on average small size of the industries and the limited investments to improve the quality of the sectors.[19]
The fast development, the fragmentation and the limited environmental investments are the key causes of the environmental problems generated by the plastic sector which are now becoming critical. Gas emissions (VOC, NO, CO, U-POP, etc.), odor (polycarbonate, substances that contain benzene, etc.) and dust seem to be the most serious environmental and health problems caused by the plastics production sector. Although information on the use of POPs and POPs precursors is limited, monitoring of water and sediment reveal the presence of PFOS and PBDEs in the environment surrounding plastic and recycling villages. The measured concentrations of PFOS in wastewater and surface water are much lower than the concentrations indicated by the US EPA for drinking water. Also in this case, concerns may however arise for PFOS in surface water, which in some cases was found at a concentration exceeding the value recommended by RIVM for consumption of fish (0.65 ng/L).

Concerning PBDEs, analysis of sediment samples taken from an area of electronic waste recycling in Hung Yen revealed a PBDE concentration in the range of 1.31 - 1715 ng/g. PBDEs in sediments near a plastic recycling village in Hanoi were in the range of 22.53 - 863.61 ng/g.[20]

2.1.1.3 Manufacturing and finishing of textile products

[18] Overview of Plastic sector in Viet Nam, part II, 2010. http://www.vietrade.gov.vn/nha-cht-do-va-cao-su/1498-tong-quan-nganh-hang-nhua-viet-nam-phan-2.html

[19] Development of plastic sector – needs of synchronized solutions. http://vinpas.vn/Default.aspx?pageid=1&mid=19&breadcrumb=85&intSetItemId=85&action=docdetailview&intDocId=912

[20] NIP update, 2015

The textile industry is composed of a wide number of sub-sectors, covering the entire production cycle from the production of raw materials (man-made fibers) to semi-processed (yarn, woven and knitted fabrics with their finishing processes) and final products (carpets, home textiles, clothing and industrial use textiles).
The main environmental concern in the textile industry is related to the amount of water discharged and the chemical load it carries. Other important issues are energy consumption, air emissions, solid wastes and odors, which can be a significant nuisance caused by certain processes.

Textile industry and POPs. The textile industry is a highly chemical intensive industry. It uses large amount of different chemicals, including basic chemicals (alkaline, detergents), dyes, bleaching chemicals, inks, mordant, detergent, aromatic compound, final processing chemical (such as flame retardants or water repellent substances) and other substances. A large percentage of the total emission load from textile industry activities is attributable to substances that are already on the raw material before it enters the finishing mill (e.g. impurities and associated materials for natural fibers, preparation agents, spinning lubricants, sizing agents, etc.). All these substances are usually removed from the fibre during the pretreatment process before coloring and finishing. The removal of auxiliaries such as, spinning lubricants, knitting oils and preparation agents by wet treatment may lead not only to the discharge of hard-to biodegrade organic substances such as mineral oils, but also of hazardous compounds such as polyaromatic hydrocarbons, APEO and biocides. Typical COD loads are in the order of 40 - 80 g/kg fiber. Trace chemicals, including POPs, may be found in natural fibers derived from plants treated with pesticides, or in contaminated dyes.

Import data revealed that finishing chemicals imported by the textile industry or other similar industries has increased from 1998 to 2013.

Literature review shows that POPs especially PFOS may be used in the textile sector as water/oil proofing agents. PFOS are used to give sport water repellency features to sport clothes, cover cloth, synthetic carpets, etc.

The textile industry in Viet Nam. The textile and garment sector is one of the key sector producing consumer products. It encompasses fiber production, textile production and dying, product design, and garment making. The sector had an impressive development over the last 20 years, with an average growth rate of about 15% per year. It is currently a leading economic sector in the country, with an export value contributing up to 15% of to the country's annual GDP.
According to statistics provided by the Viet Nam Textile and Garment Corporation (VINATEX), there are currently about 5,982 textile/garment companies operating in Viet Nam, with a labor force accounting for 20% of the entire industrial sector's and about 5% of the national labor force. Most of the textile/garment companies are located in the South (62%), the remaining are located in the North (30%) and in the Central Part (8%) of the country. Out of the 5,982 companies, garment companies account for 70%, textile companies for 17%, fiber for 6%, dying for 4% and supportive facilities account for 3%.

The National Plan for Textile and Garment Development by 2020 and vision towards 2030 (approved by MOIT) has set a target to achieve an average growth rate in the order of 10 – 12% per year in the coming years.

Viet Nam is one of the five countries leading in the garment export, with a share of 4% - 5% of the global market. Key garment export markets are USA, EU and Japan, representing up to 75% of the national annual export value[21].

21 VietinBank Sc. 2014 – Vietnam Textile and Garment Sector Report

2.1.1.4 Pulp and paper industry

The papermaking process is based on natural vegetal fibers (mostly wood, but in some countries also grass) to produce paper with different uses and characteristics.
The process of papermaking starts from the treatment of wood logs, which as a first step are debarked and shredded. Then, the wood is separated into individual fibers in a wet and mechanical process (pulping) followed by clarification (bleaching). During the pulping, lignin and other organic substances (representing more than 25% of the solid fraction of wood) are separated from the cellulosic fibers and recovered to different extents for energy recovery. After screening, cleaning and refining, the fibers are mixed with water. Then this pulp slurry is sprayed onto a flat wire screen which moves very quickly through the paper machine. Water drains out, and the fibers bond together. The web of paper is pressed between rolls, which squeeze out more water and press it to make a smooth surface. Heated cylinders then dry the paper, and the paper is slit into smaller rolls, and sometimes into sheets.

Pulp and paper industry and POPs. The pulp and paper industry has been traditionally considered as a major consumer of energy, natural resources (water and wood) and a chemical intensive process. In Europe, the use of molecular chlorine for bleaching (responsible for most of the organic chemical releases to water) decreased drastically since 1990. Due to the fact that the release of chlorinated organics in the water may lead to the formation of very toxic compounds like PCDD/Fs, many countries established strict control for the release of Adsorbable Organic Halides AOX in water which are indicator of potential PCDD/F generation. This lead to the industry adopting different strategies like molecular oxygen, hydrogen peroxide, ozone for bleaching, as well as non-chemical measures like increased delignification before bleaching, efficient washing, etc.
The direct use of POPs in the paper- making process is virtually absent or limited to the production of paper with special characteristics. To give paper grease or water repellent properties, Perfluorinated compounds (e.g. based on fluorocarbon resins (FC) and perfluoropolyether (PFPE)) are applied to impregnate some papers; for adhesive labels, fluorocarbon resins are used to prevent the penetration of the adhesive. The fluorochemicals are designed so that they bind to the fibers.

The Pulp and Paper sector in Viet Nam. In Viet Nam, three pulping processes are currently applied: bleached chemical pulp (BHKP), unbleached chemical pulp (UHKP) and semi-chemical pulp. The process of mechanical pulp ceased in 2012. Bleaching in Viet Nam is entirely based on chlorine chemicals.
The Pulp and Paper sector is one of the key industrial sector in Viet Nam. It developed significantly in recent years, with an average yearly growth rate of 15-16% over the period of 2005-2010, and about 13.5% per year during period from 2011 – 2015. The industry has contributed 1.85 – 2.01% to the gross industrial output in the recent 8 years (2005 - 2013), generating 86,160 jobs accounting for 2.08% of total employment in the manufacturing sector and 0.95% of total employment nationwide[22]. The sector is expected to further develop by 2025, adopting state-of-the art technologies to reduce environmental pollution, GHG emissions and increase energy efficiency in compliance with the Pulp and Paper Industry Master Plan. The phasing out of the existing obsolete plants with nominal capacity (lower than 10,000 tons/year by 2025[23]) is also one of the objectives of the Pulp and Paper Master Plan.

22 UNDP CCIT project. 2015. Primary assessment report of the pulp and paper industry

23 Decision 10508/QD-BCT dated November 18th 2014 approving Master Plan for pulp and paper industry development in Viet Nam by 2020, vision to 2025.

Presently, about 302 Pulp and Paper enterprises are operating in Viet Nam, with a nominal total pulp production capacity of 445,000 tons/year and paper production of 2,658,000 tons/year[24]. Among those, 81.8% of the enterprises have a production capacity below 10,000 tons/year and are classified as small-scale; very few are considered as large-scale facilities, i.e. 3.3% of the total enterprises having capacities above 50,000 tons/year, such as (1) Bai Bang Pulp and Paper Mill with a capacity of 53,000 tons of pulp/year and 55,000 tons of paper/year, (2) Hong Kong – Chinese Lee & Man Pulp and Paper Factory with a capacity of 330,000 tons of pulp/year and 420,000 tons of hard packaging paper/year, (3) Vinh Phu and Phu Giang Pulp & Paper and packaging factories with a capacity of 50,000 tons of paper/year. The remaining 14.9% of the total number of the pulp and paper enterprises having production capacities ranging from 10,000 - 50,000 tons/year[25] and are considered as medium size enterprises, e.g. Dong Nai pulp and paper factory with a capacity of 20,000 tons/year, Tan Mai pulp and paper factory with a capacity of 48,000 tons/year, etc. The distribution of pulp and paper enterprises and their contribution to the sector's production volume are presented in Table 12 below[26].

Table 12: Distribution of pulp and paper enterprises by production capacity

Size of factory	Capacity (tons/year)	Number of factories	Percentage %
Small scale enterprises	<10000	247	81.8
Medium scaled enterprises	10000 - 50000	45	14.9
Large scale enterprises	>50000	10	3.3
Total		302	100

Source: UNDP CCIT project. 2015. Primary assessment report of the pulp and paper industry

Although the number of large-scale factories is very small, their share of production capacity is the highest, i.e. at 45.5% of the sector's total production. The second-highest share is that of medium-scale factories, amounting to 32.9% of the entire production capacity. Despite of a large number of small-scale factories, they represent only 21.6% of the total production capacity, less than half of that of large-scale factories.

Pulp production factories in Viet Nam are few. Pulps products include chemical bleached pulp used for the production of writing and printing paper (Viet Nam Paper Corporation, An Hoa Paper Company and some other small companies), unbleached pulp used for the production of industrial packaging paper (Lam Son Paper Company, Muc Son Paper Company, Song Lam (Nghe An) paper company), and mechanical pulp used for the production of export paper (Hai Phong JSC Corporation HAPACO, Yen Son JSC, Tuyen Quang Paper JSC)

Most of the technologies and equipment used in the pulp and paper industry in Viet Nam are obsolete, entailing low water and energy efficiency and poor quality control. A survey carried out in 2010 showed that only 13% of the industries have modern production lines, mostly in packaging and sanitary paper manufacturing; 25% adopt upgraded production lines; and the remaining 62% of industries use outdated and obsolete technologies such as cold caustic extraction pulping with chemical recovery. For this reason, actual paper production can only reach 60-70% of the nominal capacity[27] and is causing several environmental

24 UNDP CCIT project. 2015. Primary assessment report of the pulp and paper industry

25 UNDP CCIT project. 2015. Primary assessment report of the pulp and paper industry

26 UNDP CCIT project. 2015. Primary assessment report of the pulp and paper industry

27 UNDP CCIT project. 2015. Primary assessment report of the pulp and paper industry

problems. It is worthwhile to notice that in Viet Nam 31.9% of the pulp is produced in cool soaking tanks of which the use has been ceased in the rest of the world.

The application of BAT/BEP in the pulp and paper sector in Viet Nam is limited. The fast development of this sector, characterized by the prevalence of SMEs and obsolete technologies caused serious environmental pollution, including the release to water of lignin, ligno sulfates and chlorinated chemicals which may end up as dioxin or dioxin precursors. The release of air contaminants from boilers, solid waste from cooking processes, and sludge from wastewater treatment facilities are also among environmental concerns related to the pulp and paper sector.[28] In addition, procedures for Environmental Impact Assessments in Viet Nam still have limited power in imposing the adoption of BAT/BEP technologies and do not consider at all the implementation of Green Chemistry, therefore concerns are often raised by affected stakeholders on possible impacts on the environment even when it concerns new plants. There are for instance concerns, raised by the Viet Nam Association of Seafood Exporters and Producers (VASEP), on the impact that a new, large pulp and paper facility (Lee & Man Pulp and Paper factory) may have on the water quality of the Hau River and the associated aquaculture industry. Although this plant is expected to start operation soon, the wastewater treatment is not considered compliant with existing regulations.[29]

Another typical example is the Phong Khe paper recycling village. The village discharges every day about 4500m3 wastewater into the river without treatment. The wastewater is characterized by a high content of heavy metals, lignin, color dyes, alkalines, chlor contained compounds, etc. and with parameters (BOD, COD, coliform, etc.) 4-6 times higher than these stipulated I Vietnamese Water Quality Standard. Paper dust and exhaust gas from paper facilities in the village seriously affect the air quality in Phong Ke Village. Wastewater from the paper recycling factories in Phong Khe village has seriously polluted agricultural lands and due to this, currently no crops are cultivated on these fields.[30]

Currently, no information about POPs used in or released from the pulp and paper production is available. However, results from the PFOS inventory in Viet Nam reported in the updated and reviewed NIP shows the presence of PFOS and PFOA in the environment surrounding paper recycling villages. The concentration of these substances in surface water is lower than the recommended US-EPA values for drinking water, however ir is higher than the value in water recommended by RIVM for the consumption of fish.

A typical example of the condition of the pulp and paper industry in Viet Nam is the Bai Bang factory. The plant produces both pulp and paper, and relies for around 60% of it woods needs on a wood management enterprise specialized in plantation. The plant is an integrated system encompassing all the stages of pulp manufacturing and recovery.

All the chemicals for pulping are produced inside the factory. The plant produces around 70000t/y of pulp and 120,000 tons per year of printing paper.

The plant uses elemental chlorine for bleaching, but since 2004 it has adopted a process to reduce the amount of chlorine used in the process: currently it is using 27-28 tons of Cl_2 per ton of pulp, whilst previously they were using 50 to 55 kg of CL_2. For the production of chlorine, the factory relies on a chloralkali plant using the membrane process.

2.1.1.5 Solvent and Paint industry.

28 Pulp and Paper industry is the most polluted sector. 2007. http://cand.com.vn/Kinh-te/Nganh-cong-nghiep-san-xuat-giay-gay-o-nhiem-nhat-45567/

29 MONRE directs inspection of Vietnam Lee & Man Paper Ltd Company. June 2016. http://laodong.com.vn/moi-truong/bo-tai-nguyen-moi-truong-chi-dao-thanh-tra-cong-ty-tnhh-giay-lee-man-viet-nam-566579.bld

30 Pulp and Paper industry is one of the industries that cause the most serious environmental pollution www.yeumoitruong.vn/attachments/hau_xulyntgiay-doc.1413/

Paint is any liquid, liquefiable, or mastic composition that, after application to a substrate in a thin layer, converts to a solid film. It is most commonly used to protect, color, or provide texture to objects. Major components of paint include pigment/color substances, auxiliary powder, binder, solvents and some additives.

Presently, there are the following categories of paints:

- Water-Based Coatings
- Solvent-Based Coatings

Solvent–based paints, sometimes referred to as "oil-based" or "alkyd" paints, contain a significantly higher level of organic solvents than water-based coasting. These solvent compounds evaporate and release Volatile Organic compounds (VoCs) into the atmosphere resulting a strong odor. VOCs are toxic and hazardous to both human health and the environment.

Water-based paints typically referred to as waterborne acrylics, are far less odorous and have lower VOCs. Currently, water-based coatings account for approximately 80% of paint sold for the residential market. This class of paints has been taken up in all sorts of industrial applications, including maintenance coatings for steel and concrete.

Solvent and paint industry and POPs

Except for the use of PCBs in ship paints[31], which has been prohibited since several years, none of the POPs currently listed under the Stockholm Convention are used in paint or solvent production. However, a substantial use of short chain chlorinated paraffins is reported in solvents and paints. Euro Chlor (1999) reported that the typical level of a chlorinated paraffin in a formulated paint would be 4-15% by weight. After drying (evaporation of solvent) the chlorinated paraffin content of the coating would be around 5-20% by weight. This type of paint is likely a small – although not negligible – part of the total amount of paints produced worldwide.

Solvent and paint industry and mercury.

Phenyl mercuric acetate (PMA) and similar mercury compounds have been widely used as water-based paint additives until around 1990, and may still be used in some countries. These compounds were used as "in-can" preservatives to extend the shelf life by controlling bacterial fermentation in the can (biocides), as well as to retard fungus attacks on painted surfaces under damp conditions (fungicides). Mercury sulphide has been incorporated into organic pigments used to make paints and inks. The mercury was mainly used in the red (vermilion) colour family.

Solvent and paint industry in Viet Nam.

Paints and inks, as one of the 10 chemical industrial sub-sectors in Viet Nam, grew at an average rate of 15-20%/year in the last 10 years. Among various types of paints (oily paint, synthetic resin paints, coating paints, etc.), decorative paints account for a large proportions (51% by volume and 43% by value, with average growth rate of 25%/year), while other paints such as ship protective and industrial paints, powder paints, etc. are produced in Viet Nam based on market demand.

As a paint product protects surfaces and contribute to decoration, paints play an important role in the country's national economic development. As a result, the number of paint enterprises has increased considerably during last years (from 120 enterprises in 2004 to 168 enterprises in 2006, 187 enterprises in 2008, 250 enterprises in 2009, and 274 enterprises in 2016).

[31] Shipbreaking and recycling industries in Bangladesh and Pakistan, World Bank, December 2010.

The sector is to reach an average growth rate of 12 – 13% by 2020, and 14% by 2030. The sector is also targeted to gradually eliminate outdated technologies and equipment by application of advanced technologies, equipment and limiting the use of hazardous materials and chemicals that have advert impacts on ecosystems and people's health while creating qualified products.

Most of the paint enterprises are located in Hanoi, Ho Chi Minh City and in the Mekong Delta river area. Leading in the Paint and Ink sector are Bach Tuyet Paint and A Dong Paint as domestic companies and Nippon, Akzonobel, Jotun, etc. as foreign companies.

2.1.1.6 Pesticide industry.

POPs Pesticides

The following pesticides are listed under annex A of the Stockholm Convention:

Aldrin, Chlordane, Chlordecone, Dieldrin, Endrin, Heptachlor, Hexachlorobenzene, Alpha hexachlorocyclohexane, Beta hexachlorocyclohexane, Lindane, Mirex, Pentachlorophenol, Endosulfan. These pesticides are also banned for import in Viet Nam. A certain amount of POPs pesticides, which are still produced abroad (Lindane and Endosulfan) were however imported illegally until recently.

Pesticide industry and pesticide application in Viet Nam

In Viet Nam, due to tropical monsoon humidity, pests and diseases develop easily, causing extensive damage to crops. Demand for plant protection chemicals (pesticide, fungicides and herbicides) is therefore high and on the increase, not only by quantity but also the types of plant protection chemicals. If before 1985, only around 6,500 tons – 9,500 tons of pesticides/year were used, usage has increased to around 20,000 – 30,000 tons/year[32] for the period 1991 – 2000, and 35,000 - 75,000 tons/year for the period 2001 – 2010. The import value of plant protection chemicals has significantly increased, from U$ 472 million in 2008 to U$ 537 million in 2010.(MARD, 2014[33]

The types and numbers of plant protection chemicals registered for use has also considerably increased over the last decades, 77 active ingredients and 96 commercial names before 2000, 197 active ingredients and 722 commercial names in 2000, 1202 active ingredients and 3108 commercial names in 2011. Other countries in the region only use around 400 – 600 (for example, 630 in China, 400 – 600 in Thailand and Malaysia)[34]. The average use of plant protection chemicals in China is 1,2 kg/person, in Viet Nam it is 0.95 kg/person (2010)[35].

Most of the plant protection chemicals used in Viet Nam are imported. According to the 2014 MARD report, quoted above Viet Nam imported around 70,000 – 100,000 tons of plant protection chemicals. Of these, pesticides accounted for 20.4%, fungicides accounted for 23,4%, herbicides accounted for 44.4%, and other plant protection chemicals accounted for 12%.[36]

Farmers still use chlorinated organic and organophosphate based pesticides. Endosulfan, for instance, although it has been banned since 2005[37] is still illegally used in Viet Nam. This has been recently confirmed by

32 Situation of using plant protection chemical s of farmers. http://rausachvuonnha365.com.vn/thuc-trang-su-dung-thuoc-bao-ve-thuc-vat-cua-nguoi-nong-dan-doi-voi-rau-sach/a1134473.html

33 Situation of using plant protection chemicals in agriculture in Vietnam, 2013. http://www.vusta.vn/vi/news/Thong-tin-Su-kien-Thanh-tuu-KH-CN/Thuc-trang-su-dung-thuoc-bao-ve-thuc-vat-trong-nong-nghiep-o-Viet-Nam-47911.html

34 Situation of using plant protection chemical s of agriculture in Vietnam. http://www.vusta.vn/vi/news/Thong-tin-Su-kien-Thanh-tuu-KH-CN/Thuc-trang-su-dung-thuoc-bao-ve-thuc-vat-trong-nong-nghiep-o-Viet-Nam-47911.html

35 Situation of using plant protection chemicals in agriculture in Vietnam, 2013. http://www.vusta.vn/vi/news/Thong-tin-Su-kien-Thanh-tuu-KH-CN/Thuc-trang-su-dung-thuoc-bao-ve-thuc-vat-trong-nong-nghiep-o-Viet-Nam-47911.html

36 VEA, 2015. Status of environmental pollution in Vietnam by POP pesticide stockpiles (Building capacity to eliminate POPs pesticides Stockpiles project)

37 Phan Van Toan, 2013. Situation of use of plant protection chemicals and a number of solutions for mitigation of the inappropriate application of chemicals in rice cultivation in Mekong River. Can Tho University Journalist

the fact that endosulfan (41 bottles with a quantity of 100g/bottle) has been seized in a trade shop in Melinh district (Hanoi) in 2015 by the Hanoi DARD[38]

Presently, Viet Nam does not produce plant protection chemicals. Most of the enterprises import raw materials to produce plant protection chemicals, pack and/or bottle them and then offer them on the domestic market and export a part to neighboring countries. Each year, around 50,000 tons of plant protection chemicals (equivalent to about U$ 500 million) are imported into Viet Nam, mainly from China (85% of the total imported plant protection chemicals)[39]. Of these, 60% of the import value is spent on pesticides[40]. In addition, significant amounts of plant protection chemicals have been illegally imported to Viet Nam (mostly from China). In 2013 for example, Lang Son Province seized and disposed of 9,514 tons of plant protection chemicals and 2,046 plant protection chemical packages, which were not on the list of registered chemicals; Lao Cai Province seized 4,223 kg plant protection chemicals and 130 kg packages.[41]

According to data from the Plant Protection Agency, by 2010 more than 200 companies were involved in the processing and trading of plant protection chemicals (PPCs), 93 enterprises and facilities were involved in the processing of PPCs and 28,750 shops/agents functioned as retailers.[42]

To provide an alternative to synthetic chemical pesticides, research on "bio-pesticides" has been undertaken. Although the acute toxicity of bio-pesticides may be high for some biotoxins, these substances never exhibit POP properties, as they are biodegradable by definition.

Research and studies on bio-pesticides started in Viet Nam in 1990, using various oil plants with high bioactive substances. A number of bio-pesticides have been successfully registered for application in the field. Whilst in 2000 only two active ingredients were registered, the number increased to 57 in 2005, 193 in 2007, and 374 in 2010. In 2016, based on information provided by Vinachemia, 49 out of 1744 listed active ingredients are used for bio pesticides, while 247 out of 4068 listed pesticide trade names are bio pesticides (see Table 13 below).

Table 13. List of active ingredients of biological origin used as bio-pesticides in Viet Nam

No.	Name of active ingredients	Quantity			Effect
		Single active ingredient	Compound	Total	
1	Artemisinin	1	0	1	Pesticide
2	Acrylic acid 4 %	0	2	2	Fungicide
3	Annonin (min 95%)	1	0	1	Pesticide
4	Ascorbic acid 2.5%+ Citric acid 3.0% + Lactic acid 4.0%	1	0	1	Fungicide
5	Azadirachtin	21	22	43	Pesticide
6	Brassinolide	0	1	1	PGR
7	Cafein	3		3	Snail traps
8	Carvacrol	0	3	3	Fungicide
9	Chitosan (Oligo-Chitosan)	10	10	20	Fungicide
10	Citrus oil	1	0	1	Fungicide
11	Copper citrate (min 99.5%)	2	0	2	Fungicide
12	Corilagin	0	1	1	Fungicide

38 VEA, 2015. Status of environmental pollution in Vietnam by POP pesticide stockpiles (Building capacity to eliminate POPs pesticides Stockpiles)

39 Vietnam spent VND 9,000 billion for importation of pesticide and raw materials. http://baodatviet.vn/kinh-te/bao-ve-nguoi-tieu-dung/viet-nam-chi-9000-ty-nhap-thuoc-tru-sau-va-nguyen-lieu-3279059/

40 Analysis of plant protection chemicals. http://finance.tvsi.com.vn/News/201029/82439/phan-tich-nganh-thuoc-bao-ve-thuc-vat.aspx

41 VEA, 2015. Status of environmental pollution in Vietnam by POP pesticide stockpiles (Building capacity to eliminate POPs pesticides Stockpiles project)

42 Situation of using plant protection chemicals in agriculture in Vietnam, 2013. http://www.vusta.vn/vi/news/Thong-tin-Su-kien-Thanh-tuu-KH-CN/Thuc-trang-su-dung-thuoc-bao-ve-thuc-vat-trong-nong-nghiep-o-Viet-Nam-47911.html

13	Cucuminoid 5% + Gingerol 0.5%	1	0	1	Fungicide
14	Cotton-seed oil 4% + Clove oil 20% + garlic oil 10%	1	5	6	Pesticide
15	Corn oil 30% + cotton-seed oil 30% + garlic oil 23%	1	0	1	Fungicide
16	Botanic oil + potassium salts	1	1	2	Pesticide
17	Esterified vegetable oil	2	0	2	Support substances
18	Esters of botanical oil	1	0	1	Support substance
19	Eucalyptol	1	0	1	Pesticide
20	Eugenol	4	1	5	Fungicide
21	Extract of Cashew nut shell oil (min 97%)	2	0	2	Termiticide
22	Garlic juice (Garlic extract)	2	0	2	Pesticide
23	Garlic oil 2%	0	1	1	Fungicide
24	Karanjin	1	0	1	Pesticide
25	Matrine (Croton extract)	16	29	45	Pesticide
26	Methyl eugenol	0	8	8	Insect lure
27	Methyl Eugenol	1	6	7	Insect lure
28	Nicotine Sulfate		1	1	Snail
29	Nicotine Sulfate 0.2%		1	1	Snail poison
30	Oligo - Alginate	1	0	1	Fungicide
31	Oligoglucan	1	0	1	PGR
32	Oligosaccharins	2	0	2	Fungicide
33	Oxymatrine (Croton extract)	1	1	2	Pesticide
34	Pentadecadienyl resorcinol		1	1	Fungicide
35	Polyphenol - *Oroxylum indicum* extract and willow leaf and trunk extract (*Salix babylonica)*	1	0	1	Fungicide
36	Polyphenol – sophora japonica extract (Sophora japonica L. Schott)	1	0	1	PGR
37	Polyphenol: Extracted from Soapberries *Gleditschia australis*, *Siegesbeckia orientalis*, *Bidens pilosa*, and P*arthenium hystherophorus*	1	0	1	Fungicide
38	Polyphenol extracted from peat and litchi tree trunk and leaves (Litchi chinesis sonn)	1	0	1	PGR
39	Polyphenol extracted from peat and mango tree trunk and leaves (Mangifera indica L)	1	0	1	PGR
40	Protein amylose	1	0	1	Fungicide
41	Pyrethrins	3	1	4	Pesticide
42	Rotenone	9	5	14	Pesticide
43	Salicylic acid	2	7	9	Fungicide/ PGR
44	Saponin	31	10	41	Pesticide/yellow snail
45	Vegetable oil compound (a combination of May Chang, lemongrass, basil, rose and lemon oil)	1	0	1	Fungicide
46	*Metarhizium anisopliae* var. *anisopliae* M2 & M5	7	2	9	Pesticide/termiticide
47	*Bacillus subtilis*	2	0	2	Pesticide
48	*Bacillus thuringiensis* var.kurstaki	32	8	40	Pesticide
49	*Beauveria bassiana*	3	2	5	Pesticide
Total		130	117	247	

Annex Q. Survey on the status of gender mainstreaming in Viet Nam

With the purpose to respond to gender issues within the scope of project interventions the following aspect**s** have been assessed in the brief survey reported in this annex

- The Viet Namese context, in term of legislation, access to resources, education and knowledge.
- Inequality in the division of labor, and any differential risk associated with the different roles and responsibilities of men and women in labor.

Viet Nam and CEDAW. Viet Nam was one of the first countries to sign the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW) in 1980 and ratified it in 1982. Over the past decade, the country has made great efforts in reforming its legal and policy framework to guarantee equality and non–discrimination between men and women in line with CEDAW.[43] Specifically, the Law of Gender Equality (2006) and the law on the Prevention and Control of Domestic Violence (2007) have been adopted for this purpose.

Basic principles of the Vietnamese constitution. The Vietnamese constitution (Articles 52, 63 Constitution of the Socialist Republic of Viet Nam) states that *"All citizens are equal before the law." "All citizens regardless of their sex have equal rights in all respects, political, economic, cultural, and social and in family life. Any discrimination against women and violation of women's dignity are strictly prohibited."*

Access to public institutions and decisional political roles.
In the Vietnamese parliament[44], in the last two terms, 2008-2011 and 2011-2016, women are mostly present in committees on nationality and education. Only a third of the women in the parliament can be found in committees on justice and budget, which tend to have greater political weight. Similarly, the presence of women in the executive branch of government is larger at the Ministry of Labour, Invalids and Social Affairs (MOLISA), Ministry of Health (MOH), and Ministry of Education and Training (MOET) in terms of the percentage of women among directors, deputy directors and provincial leaders. In MOLISA, women make up 22 percent across the three leadership posts. The other departments where there appears to be promising women participation include the Ministry of Science and Technology (MOST) and the Ministry of Justice (MOJ), where women constitute 12-15 percent of deputy directors and provincial leaders.

Access to resources. In Viet Nam, women's access to land is often limited by legal ambiguity, lack of access to legal services, and limited awareness and understanding of the law. Too often, land rights are still determined by traditional practices of kinship, patrilineal inheritance and succession. In a 2011 study, women-only land use certificates made up for only 20%. Rural women laborers have less access to vocational training, and female-headed households also struggle to access information. Even though poor women-headed households are entitled to loans, they still find it difficult to access services. Poverty comes with many risks, and gender discrimination makes women more vulnerable. In an economic downturn, poor women are less likely to have savings or able to make up for lost income. Poor girls are more than twice as likely to marry in childhood as those who are wealthy.

[43] UN Women Viet Nam . Towards gender equality in Viet Nam: Making inclusive Growth of Women. http://vietnam.unwomen.org

[44] Transforming the Power of the Podium, Advancing Women's Political Participation. (Regional Meeting on Promoting Women's Leadership and Political Participation in ASEAN Published 1st edition 2015 Copyright © United Nations Entity for Gender Equality and the Empowerment of Women (UN Women)

Access to education. Although gender gaps in primary and secondary education in Viet Nam have largely been closed[25], women still face many challenges. In Viet Nam, based on World Bank data (World Bank data bank, Gender statistics) in 2009 at least 71.2% of 25 years old males have completed at least the lower secondary school, in comparison with 59.4% of women. Concerning the upper secondary school, this was completed by 30.4% of males and 21.4% of women.

Women and girls of ethnic minority groups and poor households have fewer opportunities, and have higher rates for school dropout and illiteracy. One in ten women still marry before their 18th birthday, mostly in remote ethnic minority areas. This exposes them to the risks of becoming pregnant at a too young age, and reduces their access to education. Combined with a heavy burden of household work, their options are limited, trapping them in poverty.[45]

Division of labor and equality of right in the workplace. With about 45 million females (accounting for 50% of the total country population and more than 47% of the labor force), women play an important role in the economic development of Viet Nam, especially in agricultural sector (accounting more than 50%), textile and apparel sector (about 70%), food and seafood processing (about 80%); banking sector (50%); education (teachers at kinder gardens and primary and secondary schools - around 70%) [46], healthcare sector (63%) and leather (85%)[47].

Based on World Bank statistical data, 10.5% of females in the age 7 to 14 and 11.5% of males were already working. In 2014, 72.4% of females older than 15 year, and 80% of males were employed. Agriculture is still the main livelihood provider, as 44.9% of male workers and 48.8% of female workers work in this sector. On the contrary, only 17% of female workers are employed in the industrial sector, in comparison with 25.2% of males in the year 2013. In the same year, 29.9% of males and 34.2% of females were employed in the service sector. 3.4% of males are employers against a percentage of only 1.5% of women.

According to ILO, about 72% of women participate in the labor force in Viet Nam and this rate is higher than in other countries. However, the wage gap between men and women is increasing[48], which is the opposite in other countries. According to 2011 data from the General Statistics Office, women's income is 13% less than men's. Another survey from the Viet Nam Trade Union in 2012 also shows that wages of female laborers is about 70 – 80% of the wages of male laborers.

Female laborers in Viet Nam also have less opportunities for the selection of suitable jobs[49]. Although accounting for about 47% of the workforce, female laborers are still discriminated against compared to male laborers, especially in the private sector with regard to employment opportunities, income as well as opportunities for training and promotion[50]. Compared to males, female employees often work more time but get paid less. Recent research, entitled "Gender equality in practices of employment and promotion in Viet Nam" conducted by ILO in cooperation with the largest employers, showed that 1/5 of the 12,300 job advertisements has gender requirements, of which 70% prefer males, while only 30% wishes to employ female

[45] Women and Sustainable Development Goal in Vietnam.

[46] Female is accounted for 47% of the labor force (11/2014). http://www.bhxhlamdong.gov.vn/component/content/article/45-tin-2/5667-n-gii-vit-nam-chim-47-lc-lng-lao-ng-xa-hi-.html

[47] Healthcare for female workers in industries (03/2015). http://moh.gov.vn:8086/pcbenhnghenghiep/pages/tintuc.aspx?CateID=9&ItemID=874

[48] ILO. 2013. Rate of women involving in labor force is increasing but their incomes are less than this of man. http://www.ilo.org/hanoi/Informationresources/Publicinformation/Pressreleases/WCMS_206105/lang--vi/index.htm

[49] Female labors have few opportunities for selection of their jobs. http://careerbuilder.vn/vi/talentcommunity/lao-dong-nu-it-co-hoi-lua-chon.35A50C7B.html

candidates[51]. Most of the jobs prioritized for men require higher skills and as a result receive higher pay as compared to jobs employing female laborers.

Within the manufacturing sector, women are mainly employed in the textile and apparel sector (employing about 6 per cent of the total female labour force – 80% of the laborers are female), while in other sectors such as basic metals, motor vehicles, etc. only about 30 per cent or less are female laborers).[52]

Women also have fewer opportunities than men to receive training and be promoted, especially for those who live and work in rural or remote areas such as the Northern Midlands and Central Highlands regions. Like many other countries, women in Viet Nam also spend disproportionately more time on unpaid domestic work than men and this limits women's access to economic opportunities and capacity to engage in paid work.

In the industrial sector, significant progress in gender equality has been achieved in Vietnam, concerning working conditions and maternity leave, allowances and safety. Women who work in industries, especially import – export industries however have to work under high stress (physically and mentally) working conditions, and are often exposed to noise, dust, high temperatures and chemicals in the production environment. In industrial zones, female workers often have to live in small and narrow inns where basic living conditions are still poor (poor sanitation, lack of healthcare centers, lack of minimum conditions for communication/media, which hinder workers health and social awareness).[53]

Gender issues in agriculture. Agriculture and safe vegetable production in particular is perceived in Viet Nam as the work of both women and men. While most government and donor projects have focused on ensuring women are included as beneficiaries (and some very successfully) most have failed to include women effectively throughout the entire value chain.

For instance, concerning the pesticide sector, Information gathered through the Binh Dinh Sustainable Rural Livelihood project, semi-structured interviews and workshops held during the design mission, as well as anecdotal information provided by the Department of Agriculture and Rural Development (DARD) staff, show that while women and men generally assume different responsibilities in the use of agrochemicals, there is significant cross-over. Women are increasingly involved in mixing, spraying and the purchasing of agrochemicals and most day-to day planting and maintenance of crops is performed by women where they undergo exposure to chemicals, often weeding crops immediately after spraying.

Gender mainstreaming in chemical and manufacturing industry. As emerged in the course of the workshops held during project preparation[54], one of the issue is that there are no specific rules ensuring the safety of women in the chemical and manufacturing industry. As a consequence, very few women work in these sectors, as the common thinking is that women should be "protected" from potential hazard. However a proper implementation of proper risk management measures and PPE in the workplace, as well as the establishment of specific benefits (for instance during pregnancy) could instead ensure that women benefit the proper level of protection, at the same time enjoying equal access to work opportunities. The proper balance between occupational safety and equal opportunities will be therefore one of the key aspect to be considered in the implementation of this project.

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[50] Gender discrimination in employment: How to push back? (08/2015). http://baobaohiemxahoi.vn/vi/tin-chi-tiet-phan-biet-gioi-trong-lao-dong-cach-nao-day-lui-ae49dde4.aspx

[51] Gender discrimination in employment: How to push back? (08/2015). http://baobaohiemxahoi.vn/vi/tin-chi-tiet-phan-biet-gioi-trong-lao-dong-cach-nao-day-lui-ae49dde4.aspx

[52] World Bank, Towards Gender Equality in Vietnam: Making inclusive Growth Work for women

[53] Healthcare for female workers in industries (03/2015). http://moh.gov.vn:8086/pcbenhnghenghiep/pages/tintuc.aspx?CateID=9&ItemID=874

[54] November 1st, 2017. UNDP/GEF Green Chemistry project introductory Workshop, Hanoi. March 1st, 2017. UNDP/GEF Green Chemistry project validation workshop, Hanoi.

Gender in the Bai Bang Pulp and Paper Plant. A specific survey has been conducted in one of the plant visited during the PPG preparation, the Bai Bang Pulp and Paper plant, with the assistance of the human resource department of the company. In the table below, the number of male and female employees by year has been reported.

Year	Average number of employees	Male	Female	% Male	% Female
2003	3594	2185	1409	60.8	19.2
2004	4585	2943	1641	64.2	35.8
2005	3904	2494	1410	63.9	36.1
2006	2144	1381	763	64.4	35.6

It can be seen that the percentage of female employees in Bai Bang Pulp and Paper Factory is about 19 – 36% of the total number of the factory's employees. The data is consistent with evidence gathered during a recent visit to the plant. At the Bai Bang Pulp and Paper plant, female workers often work in administration, control and finishing departments while the heavy manufacturing machineries are mostly operated by men.