

Independent Midterm Evaluation

Greening the Scrap Metal Value Chain through Promotion of BAT/BEP to Reduce U-POPs Release from Recycling Facilities

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ACRONYMS

BAT	Best Available Techniques
BEP	Best Environmental Practices
BISW	Bangkok Iron and Steel Works
BMA	Bangkok Metropolitan Administration
CBO	Community-based organizations
CFC	Chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs)
CIPAH	Chlorinated polycyclic aromatic hydrocarbons
CU	Chulalongkorn University
DAIKI	Daiki Aluminum Industry (Thailand) Co., Ltd
DEQP	Department of Environmental Quality Promotion
DIW	Department of Industrial Works
DLA	Department of Local Administration
DPA	Department of Provincial Administration
DPIM	Department of Department of Primary Industries and Mines
EEC	Eastern Economic Corridor
FC	Factory Code
GDP	Gross Domestic Product
GEF	Global Environment Facility
HBCD	Hexabromocyclododecane
HFC	Hydrofluorocarbons
HCFC	Hydrochlorofluorocarbons
HSM	Center of Excellence for Hazardous Substance Management
IEAT	Industrial Estate Authority of Thailand
INC	Intergovernmental Negotiating Committee
ISIT	Iron and Steel Institute of Thailand
I-TEQ	International Toxic Equivalents for dioxins and furans
LOW	List of Waste
MOA	Ministry of Agriculture and Cooperative
MOC	Ministry of Commerce
MOE	Ministry of Energy
MOF	Ministry of Finance
MOI	Ministry of Interior
MOIn	Ministry of Industry
MNRE	Ministry of Natural Resources and Environment
MOPH	Ministry of Public Health

NIP	National Implementation Plan
NGO	Non-governmental organizations
NO _x	Nitrogen oxides
TSMT	Tata Steel Manufacturing (Thailand) Public Co., Ltd
PBB	Polybrominated biphenyls
PBDD	Polybrominated dibenzo-p-dioxins
PBDF	Polybrominated dibenzofurans
PBDE	Polybrominated diphenyl ethers
PBP	PBP Polybrominated phenols
PCB	Polychlorinated biphenyls
PCD	Pollution Control Department
PCDDs	Polychlorinated dibenzo-p-dioxins
PCDFs	Polychlorinated dibenzofurans
PCDD/Fs	Polychlorinated dibenzo-p-dioxins and dibenzofurans
PCP	Pentachlorophenol
PFOS	Perfluorooctane sulfonic acid
PFOSF	Perfluorooctane sulfonyl fluoride
PMU	Project Management Unit
POPs	Persistent Organic Pollutants
PRTR	Pollutant release and transfer register
PSC	Project steering committee
PVC	Polyvinyl chloride
SC	Stockholm Convention
SO ₂	Sulphur dioxide
TBBPA	Tetrabromobisphenol A
TCDD	2,3,7,8-tetrachlorodibenzodioxin
	Thai Metal Thai Metal aluminum Co., Ltd.
TRI	Toxic Release Inventory
TWG	Technical working group
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
U-POPs	Unintentionally Produced Persistent Organic Pollutants

EXECUTIVE SUMMARY

A. Introduction

The full-size project “Greening the scrap metal value chain through promotion of BAT/BEP to reduce U-POPs releases from recycling facilities” is designed for Thailand **to meet its obligations under the Stockholm Convention on Persistent Organic Pollutants** and for the implementation of the **identified priority action plans in its NIP that need urgent actions**. The project, in general, seeks to abate serious environmental threats caused by U-POPs releases from the metallurgical sector. It aims to make an **in-depth assessment of the scrap metal value chain** from generators, collectors and users and provide measures that would make the processes involved in each link more environmentally-compliant and sustainable.

B. Evaluation findings and conclusions

Due to the Covid19 pandemic, no field visits were undertaken. The evaluation was mainly based on in-depth review of project documentation, zoom interviews, and email communications. Based on the findings of the review and the discussions held, the evaluation came to the following findings.

Relevance: The Project is significant in terms of contributing towards solving of the emission U-POPs problems in the country. Project achieved objectives correspond with national strategy and regulation on hazardous chemicals, Stockholm Convention on POPs measures and is consistent with the GEF6 strategy on Chemicals and Waste.

Efficiency: Due to good project management is an actual project efficiency is high, the planned results are obtained and the objective are achieved in the reasonable timeframe with the respect of complicated actual conditions due to the pandemic situation.

Effectiveness: Project efficiency is high, the planned results were obtained, all outputs report adequate progress in the realization of the outputs targets. Project objectives for the evaluation period within the reasonable timeframe affected by the pandemic situation, but with reasonable quality. The assessment of this criteria was done at three levels: the achievement of outputs and outcomes and the likelihood of impact (behavioral change). The assessment of outputs and outcomes was based on the availability of their respective indicators. The project has performed quite satisfactorily regarding achievement of outputs. The ratings for the 9 outputs are as follows: highly satisfactory: 2 outputs; satisfactory: 7 outputs. For the 5 project outcomes, the ratings are highly satisfactory: 1 outcome; satisfactory 4 outcomes.

Sustainability: There is no any significant risk identified for socio-political, institutional and governance, and environmental situation, some potential financial risks identified regarding future financial sustainability.

Monitoring and evaluation: Project has an adequate design with appropriate and suitable indicators, M&E system is suitable and effective as far as project management. The monitoring was continued throughout the project implementation and was used to optimize activities and ensure effective use of financial resources. Budget is used effectively for M&E activities.

Project coordination and management: Project is being effectively coordinated, project management is well organized and effective, supervision of UNIDO effective part of the project realization.

Gender mainstreaming: Project very fully complies with gender mainstreaming strategies.

Assessment of the project		
Evaluation criteria		Rating
A	Project Design	HS
B	Implementation performance	
1	Relevance	S
2	Effectiveness	S
3	Efficiency	S
4	Sustainability of project outcomes	MS
5	M & E systems	S
6	Monitoring long-term changes	S
7	Project coordination & management	S
C	Gender mainstreaming	HS
Overall assessment		S

Recommendations

To UNIDO:

1. Project represents good example for other countries, experiences can be used during the preparation and implementation of this type of project concerning to the U-POPs emission reduction and elimination.

To UNIDO, PSC:

2. One of the important project outputs was the development of pilot projects to demonstrate new technologies to reduction of emissions of U-POPs in Thailand. The pilot projects have shown potential to attract investments for development of applicable environmental technologies to reduce U-POPs emissions and chemical pollution. A mechanism should be developed to catalyze investments in order to meet the targets of the National Implementation Plan of the SC on POPs and other relevant national strategic documents and approaches.

3. It is necessary to continue the identification and inventory of all U-POPs emission sources. The inventory needs to be closely connected with similar inventories in other parts of the country and the on-going national inventory on persistent organic pollutants under the Stockholm Convention on POPs.

4. The project has delivered a set of useful results valuable for future projects concentrated on tackling the environmental problems of Thailand. To make the project results and the positive experiences gained from its implementation available, the project management needs to ensure that

results are communicated to all stakeholders, decision makers, the scientific community and the broader public.

5. The project management should ensure, to the extent possible, that the project results, conclusions and recommendations are used in the development of the National Implementation Plan of the Stockholm Convention on Persistent Organic Pollutants for Thailand.

6. As very useful tool of this project was the networking of academia and public institutes, it will be very useful to continue in this especially as far as continuation of the proposed training activities. Education and awareness raising are key elements of the successful implementation of the project conclusions and the Stockholm Convention on POPs measures.

I. EVALUATION OBJECTIVES, METHODOLOGY AND PROCESS

1. This **midterm evaluation** (MTE) was undertaken during June and July 2021 by a team of two independent external evaluators based on the terms of reference (TOR) provided by the United Nations Industrial Development Organization (UNIDO) (see Annex 1 for the TOR of this MTE). It covered the implementation period of 60 months from July 2018 to July 2023.

2. **The evaluation team** was the international consultant Prof. Dr. Ivan Holoubek, Czech Republic and national consultant Dr. Ampai Harakunarak, Thailand.

3. **The mid-term evaluation** was conducted in accordance with the UNIDO Evaluation Policy¹, the UNIDO Guidelines for the Technical Cooperation Programme and Project Cycle², the GEF Monitoring and Evaluation Policy³ and the GEF Minimum Fiduciary Standards for GEF Implementing and Executing Agencies⁴.

4. It was carried out as **an independent in-depth evaluation using a participatory approach** whereby all key parties associated with the project are kept informed and regularly consulted throughout the evaluation. The evaluation team cooperated with the UNIDO project manager (PM) on the conduct of the evaluation and methodological issues.

5. **The primary purpose of the MTE** was to assess the likelihood of the project achieving its intended outcomes and impacts, including their likelihood of sustainability. It also analyzed the project performance against the criteria: relevance, effectiveness, efficiency, likelihood of sustainability, and impact. The MTE provided an overview and analysis of the likelihood of attainment of the project objective(s) and the technical components or outputs.

6. The evaluation was focused to **determination of project achievements** against the expected outputs, outcomes, and impacts. The evaluation used the different methods to ensure that data gathering and analysis deliver evidence-based qualitative and quantitative information, based on the different sources such as desk studies and literature review, individual interviews. **The interviews** were realized based on the own guidelines and due to the pandemic situation using **on-line connection** with key projects persons and stakeholders/partners including UNIDO Project Manager (PM), the National Project Manager (NPM). In general, all project documentation was made available to the evaluation (See Annex 2). The list of basic questions and list of persons interviewed is given in Annex 3.

II. COUNTRY AND PROJECT BACKGROUND

II.1 Brief country context

II.1.1 Introduction

¹ UNIDO (2015). Director General's Bulletin: Evaluation Policy, (UNIDO/DGB/(M).98/Rev.1)

² UNIDO. (2006). Director-General's Administrative Instruction No. 17/Rev.1: Guidelines for the Technical Cooperation Programme and Project Cycle (DGAI.17/Rev.1, 24 August 2006)

³ GEF (2010) The GEF Monitoring and Evaluation Policy (Evaluation Office, November 2010)

⁴ GEF (2011). GEF Minimum Fiduciary Standards: Separation of Implementation and Execution Functions in GEF Partner Agencies (GEF/C.41/06/Rev.01, 3 November 2011, prepared by the Trustee)

7. In most countries, including Thailand, **the metallurgical sector still has very limited technical knowledge on the U-POPs issues and related BAT/BEP.** Several factors act as **barriers for a wide implementation of BAT/BEP** in the metals producing industry. Among these we can indicate: (i) insufficient stakeholder awareness on health and environmental pollution and, in particular, on the local and global hazard posed by U-POPs; (ii) lack of information/technical knowledge on best practice and technologies; (iii) absence of a knowledge network for the exchange of technical know-how and dissemination of information on environmental management systems; (iv) lack of effective training systems to provide qualified human resources for BAT/BEP evaluation and selection; (v) lack of first mover companies and first example facilities; (vi) lack of external pressure from authorities, environmental organizations or the general public.

8. The metallurgical sector is **an important part** of Thailand's economy. This sector produces ferrous and non-ferrous metals such as steel, copper alloys, lead and aluminum, which are needed for the development of the country's infrastructure. While accounting only to 4.7 % of the manufacturing industry and about 1.4 % of the country's GDP, the metal industry is important to Thailand's economy. It supports many downstream industries such as automotive, construction, electrical and electronic industry etc.

9. **Awareness on the environmental issues among scrap metal recyclers** is substantially absent. Information and statistics on the availability of different types and categories of scrap, recycling capacities, technology status etc. are usually not available. The growing markets on this sector and accompanying economic development have further added to the complexity of instituting a robust baseline on scrap recycling value chain.

10. Taking into account **the magnitude of the U-POPs problem** and given the absence of appropriate countermeasures, the releases to the environment of U-POPs and other pollutants of concerns from the secondary metallurgical industry is expected to increase substantially in the future. As a consequence of the expected increase of secondary metals production, the Government of Thailand places **priority to the implementation of BAT and BEP measures to reduce U-POPs releases** from the national metallurgical industry and efforts will include, review of the regulatory framework and capacity building. Likewise, awareness on the environmental issues among scrap metal recyclers is substantially absent.

11. Thailand signed **the Stockholm Convention on POPs** on 22 May 2002 and ratified it on 31 January 2005. As a party of the Stockholm Convention, Thailand has developed a **National Implementation Plan (NIP)** in 2007. The NIP provides policy and strategy frameworks as well as action plans and activities to meet objectives specific to Thailand. A second NIP covering the period from 2015 to 2019 is under development.

12. In accordance with national policies on natural resources and environment, issues and activities foreseen for Thailand are **the management of new industrial POPs and POPs in products** by using tools such as green industry, eco-factory concept, waste exchange and industry-urban symbiosis, the use of clean technology, development of alternatives to POPs and disposal of POPs, the application of best available techniques (BAT) and best environmental practices (BEP) to reduce or eliminate the unintentional release of POPs from sources and the synergy of chemicals and waste conventions and synergy with climate change.

13. Currently, **five sectors are regulated in terms of U-POPs releases in Thailand.** They include municipal waste incinerators, kilns that burns waste or hazardous residues from the industry, medical waste incinerators, industrial plants that use processed used-oil or synthetic fuels,

and cement plants. However, no regulatory standards has been issued specific to U-POPs for the ferrous and non-ferrous metal production industry. It is envisaged that the project will contribute to the development of the regulatory standards on U-POPs for the ferrous and non-ferrous sectors.

II.1.2 Overview of the metallurgical industry in Thailand

14. A detailed report on the metallurgical industry of Thailand was done by the Iron and Steel Institute of Thailand. The rapid economic and social growth of Thailand was supported by a rapid acceleration in the development of infrastructure facilities such as water, electricity, and transportation facilities, in the advancement of the manufacturing industry and in the export of technology-based manufactured products. Recently, the Government launched an infrastructure investment programmer, aimed at modernizing the country's land transport and logistics systems, as part of an investment plan running until 2020.

15. Being an emerging economy as well as a newly-industrialized country, Thailand needs to produce and consume large amount of steel and non-ferrous metals. Thailand does not have an integrated iron & steel industry and all the steel produced in the country comes from the recycling of ferrous scrap in electric furnaces. Steel production from secondary resources will grow even more in the future if the steel production capacity in Thailand will be expanded to reduce its high import dependency), with a production capacity of 10.0 million ton/year.

16. SEAISI reported that the construction sector was the largest consumer of steel in 2015, accounting for 59.7% of total steel consumption, followed by the automotive sector (19.0%) and the machinery industry (6.6%). Thailand does not produce primary aluminum due to the lack of bauxite deposits. Moreover, the import and processing of bauxite is not favored because of the high electrical energy requirements in the production of primary aluminum. Therefore, the aluminum industry in Thailand mainly uses imported unwrought aluminum and recycled aluminum scrap.

17. The information gathered during the PPG phase has identified 54 major factories that can be divided into 6 groups:

- Aluminum smelting industry
- Aluminum casting industry
- Aluminum profile industry
- Aluminum sheet and foil industry
- Aluminum packaging industry
- Aluminum cable industry.

18. Factories in the aluminum smelting industry can be divided into two subgroups: producers of aluminum ingots that sell their product to downstream factories and manufacturers of aluminum cast products that recycle their scrap inside the factory in melting furnaces. The aluminum industry in the country continues to grow continually as a result of high consumption demand of related industries such as the automotive industry, construction industry, packaging industry, and electrical appliance industry.

19. Production of secondary aluminum from both post-consumer scrap (discarded aluminum products) and new (manufacturing) scrap is expected to increase in Thailand in the coming years to support the ongoing industrialization process and the economic growth and to substitute import of unwrought aluminum. The economic incentives for recycling aluminum are currently more

important than environmental considerations. In Thailand, secondary aluminum producers still need to implement production techniques to enhance performance and reduce environmental impacts.

II.1.3 U-POPs inventory

20. According to **the most recent PCDD/Fs emission inventory for Thailand**, which was carried out in 2005, relevant releases of PCDD/Fs come from the metallurgical sector. Potential national releases of PCDD/Fs emission to air, water, land, product and residue were estimated at 1075.88 g I-TEQ/year as reported in the Thai National Implementation Plan (NIP). The total release from the ferrous and non-ferrous metal production was estimated at 119.84 g I-TEQ/year, accounting for 11.14 % of the total national release. The currently available information on PCDD/Fs releases from ferrous and non-ferrous metal production is summarized in the Table 1 below.

Table 1: Annual releases of PCDD/Fs in Thailand from source category 2 – Ferrous and non-ferrous metal production (Base year: 2004)

Annual releases of PCDD/Fs (g TEQ/year)				
Production (ton/year)		Air	Residues	Total
Iron and steel production	6,583,739	19.773	98.756	118.529
Iron and steel foundries	3,562	0.0025	0.021	0.0235
Secondary copper production	1,200	0.060	0.756	0.816
Secondary aluminum production	258	0.009	0.103	0.112
Secondary lead production	24,072	0.193	ND	0.193
Brass and bronze production	500	0.0005	ND	0.0005

II.2 Project summary

21. The project “Greening the scrap metal value chain through promotion of BAT/BEP to reduce U-POPs releases from recycling facilities” is designed for Thailand **to meet its obligations under the Stockholm Convention on Persistent Organic Pollutants** and for the implementation of the **identified priority action plans in its NIP that need urgent actions**. The project, in general, seeks to abate serious environmental threats caused by U-POPs releases from the metallurgical sector. It aims to make an **in-depth assessment of the scrap metal value chain** from generators, collectors and users and provide measures that would make the processes involved in each link more environmentally-compliant and sustainable.

22. The project aims to **identify, implement and demonstrate state-of-the-art technologies for reducing U-POPs releases from scrap metal recycling facilities** according to the obligations of the Stockholm Convention and to promote and introduce best available techniques/best environmental practices (BAT/BEP) measures to reduce U-POPs emissions in SMEs and large enterprises involved in metallurgical processes. The guiding principles are for **fulfilment the collaboration** between the **national legal framework** regarding to sound management scrap metal recycling, and **the Stockholm Convention mandates** by further strengthening and harmonizing its existing regulatory frameworks, awareness raising and capacity building on U-POPs and BAT/BEP in metallurgical industry, and the selection of the

demonstration facilities as well as the techniques/technologies to be deployed during the demonstration project will be the technical viability, the economic sustainability, the replicability of the demo results; cost-effectiveness in terms of reduction of U-POPs releases; and, of course, the level of support from the industry sector.

23. **The project covers the incremental costs** required to address and remove many of the technical and institutional barriers that until now have hindered the spread of environmentally sustainable approaches for a sound management of the recycling of scrap metal along the entire value chain. In line with this objective, **the project aims** to strengthen the institutional capacity (decision makers and private sector), to improve the legislative and regulatory framework, and to identify, implement and demonstrate, at selected demonstration sites, state-of-the art techniques which could be applied along the entire scrap metal value chain (collection, treatment, end-use) for reducing U-POPs formation and releases from the secondary metals production processes. The project will address these problems through an **integrated approach that combines awareness raising, capacity building, technical assistance and investment.**

24. **The overall objective of the project is to promote and introduce (BAT/BEP) measures** in scrap recycling facilities in order to reduce or eliminate U-POPs releases by (i) supporting the Government of Thailand with the necessary technical and financial assistance in order to meet its obligation under Article 5 of the Stockholm Convention and implement its priority actions indicated in the NIP; (ii) Strengthening the institutional capacity (decision makers and private sector), to improve the legislative and regulatory framework, and; (iii) to identify, implement and demonstrate, at selected demonstration sites, state-of-the art techniques which could be applied along the entire scrap metal value chain (collection, treatment, end-use) for reducing U-POPs formation and releases from the secondary metals production processes.

II.3 Project design

25. Following the GEF-UNIDO standard project document template (e.g., PIF, STAP review, social and environmental safeguards, project document with all supporting annexes, and GEF CEO Endorsement request), the project documentation during the design and preparation (PPG) stage provides the background and context of the project design. This includes the project rationale, objectives and goals, component outcomes and outputs, implementation and M&E activities, budgets, and co-financing links to GEF outcomes.

26. **The project document includes** the project’s strategy and results framework which integrate gender analysis, stakeholder identification and engagement, capacity development, and knowledge management in the project components.

Table 2: Project target

Corporate Results	Expected at Endorsement/Approval stage
Increase in phase-out, disposal and reduction of releases of POPs, ODS, mercury, and other chemicals of global concern	Reduction of not less than 23 g TEQ/year of PCDD/Fs released from demonstration facilities

Table 3: Project Components

The project has 4 components, 5 outcomes and 10 outputs. Project Strategy

COMPONENT 1: Policy and regulatory framework

Outcome 1: Policy and regulatory framework strengthened and enhanced for the implementation of a sound management of metal recycling in compliance with the Stockholm Convention requirements

Output 1.1: One (1) database capturing various aspects of the metal recycling chain, as a new tool for policy makers, compiled

Output 1.2: Specific guidelines on environment, health and safety measures in the metal recycling chain value developed

Output 1.3: Improved and harmonized national policies and regulations for environmental and health protection from metal recovery activities

COMPONENT 2: Information dissemination and capacity building

Outcome 2.1: Increased awareness on U-POPs and BAT/BEP concepts by relevant stakeholders

Outcome 2.2: Improved national capacity in the sound management of the recycling chain of scrap metal

Outcome 2.3: Improved national capacity in the sound management of the recycling chain of pre-consumer and post-consumer scrap metal

Output 2.1: Awareness raising materials and awareness raising workshop developed and implemented

Output 2.2: Technicians and operators of the scrap metal sector are trained on BAT/BEP

COMPONENT 3: Pilot project for the demonstration of BAT/BEP in selected metal recycling facilities

Outcome 3: State-of-the-art primary and secondary measures for U-POPs release reduction in selected facilities identified and deployed

Output 3.1: BAT/BEP measures identified and implemented for scrap collectors and scrap consumers

Output 3.2: Training of technical staff and other potentially interested local stakeholders (environmental authority, SMEs, scrap collectors, etc.) in the management of BAT/BEP undertaken

Output 3.3: Policy and regulatory framework

COMPONENT 4: Monitoring and evaluation; knowledge management and dissemination

Outcome 4: Effective monitoring and evaluation of project impact and sustainability implemented

Output 4.1: Project M&E designed and implemented

Output 4.2: Lessons learnt disseminated

Table 4: The project factsheet

Project Title:	Greening the Scrap Metal Value Chain through Promotion of BAT/BEP to Reduce U-POPs Release from Recycling Facilities
GEF ID:	9222
UNIDO SAP ID:	150186
GEF Replenishment Cycle:	GEF- 6
Country(ies):	Thailand
Region:	SA- South East Asia
GEF Focal Area:	Chemicals and Waste
Integrated Approach Pilot (IAP) Programs:	N/A
Stand-alone / Child Project:	N/A
Implementing Department/Division:	Department of Environment (ENV), Industrial Pollution Mitigation Division (IPM)
Co-Implementing Agency:	N/A
Executing Agency(ies):	Department of Primary Industries and Mines, Ministry of Industry (DPIM-MoI), Pollution Control Department, Ministry of Natural Resources and Environment (PCD-MoNRE), Iron and Steel Institute of Thailand (ISIT)
Other Project Partners:	N.T.S. Steel Group Public Company Limited (NTS) Daiki aluminum Industry Thailand Co., Ltd. (DIK) The Bangkok Iron and Steel Works Co., Ltd. (BISW) Thai Metal aluminum Co., Ltd. (TMA)
Project Type:	Full-Sized Project (FSP)
Project Duration (months):	60 months
Extension(s):	0
GEF Project Financing:	USD 4 500 000
Agency Fee:	USD 427 500
Co-financing Amount:	USD 33 714 786
Date of CEO Endorsement/Approval:	01/11/ 2018
UNIDO Approval Date:	02/02/2018
Actual Implementation Start:	06/06/ 2018
Cumulative disbursement as of 30 June 2020:	USD 1 161 300.32
Expected Mid-term Review Date (MTR):	06/01/2021
Expected Completion Date:	06/06/ 2023
Expected Terminal Evaluation Date (TE):	03/01/2023
Expected Financial Closure Date:	12/30/2023
UNIDO Project Manager:	Carmela CENTENO

II.4 Project implementation arrangements and implementation modalities

27. **The institutional arrangement** for project implementation was following. UNIDO was the GEF Implementing Agency (IA) for the project. A project officer was appointed in UNIDO HQ to oversee the implementation of the project, assisted by a support staff and supervised by a senior professional staff engaged in the management and coordination of UNIDO's Stockholm Convention Programme. The UNIDO Regional Office in Thailand also played a significant role in the supervision and monitoring of the project. UNIDO country-level monitoring provided as part of the in-kind contribution of the organization to the project.

28. **The Department of Primary Industries and Mines (DPIM)** was the lead executing agency for the project. Co-executing institutions included the:

- **Pollution Control Department of the Ministry of Natural Resources** and the Environment worked on NIP-POPs and the revision of Thai emission standard in the metallurgical sector.
- **Department of Environmental Quality Promotion (DEQP)** supported the dioxin monitoring and public awareness raising and capacity building on U-POPs management in Thailand.
- **Iron and Steel Institute of Thailand** provided coordination and technical services to the pilot facilities.

29. **The Project Management Unit (PMU)** has been established on 6th floor of the DPIM building. Deputy Director-General of DPIM has been appointed as National Project Director (NPD) from DPIM and he also chair the Project Steering Committee since October 11, 2018. PSC chair also assigned Director of Innovation Raw Materials and Primary Industries Division from DPIM, as National Project Coordinator (NPC) to oversee the activities of the project since December 25, 2018. **Targets and indicators** were reviewed as part of the internal evaluation and planning processes undertaken by the PMU.

30. Since October 11, 2018, **Project Steering Committee (PSC)** was established, chaired by the National Project Director, Mr. Nirun Yingmahisaranon from DPIM and comprise of representatives from relevant ministries, UNIDO and other relevant stakeholders, namely Department of Industrial Works (DIW), the Office of Industrial Economics (OIE), Pollution Control Department (PCD), Department Environmental Quality Promotion (DEQP), Foreign Affairs Division under the Office of Permanent Secretary of Ministry of Natural Resources and Environment (Secretariat Office of Thailand-GEF Operational Focal Point), Federation of Thai Industries and Iron and Steel Institute of Thailand (ISIT) which later has vacated.

31. **For Component 3**, besides contracting Thai institution, UNIDO has engaged experts from the Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) to conduct the in-depth assessment of the facilities and monitor the interventions to be implemented.

32. **The Evaluation component** of the project will be managed by UNIDO, in coordination with its Internal Evaluation Division. For project monitoring, the budget maybe provided to DPIM or its designated institution through a contractual arrangement.

Budget information

33. The project is funded through a GEF grant amounting to USD 4,500,000; and the counterparts' co-financing of USD 33,714,786 (cash and in-kind), including a UNIDO contribution of USD 220,000 (cash and in-kind)

Table 5: The project financial description

Project Component/ Program	(in USD)	
	GEF Project Financing	Confirmed Co-financing
Component 1. Policy and regulatory framework	275,000	1,460,144
Component 2. Information dissemination and capacity building	625,000	5,507,200
Component 3. Pilot project for the demonstration of BAT/BEP in selected metal recycling facilities.	3,150,000	24,247,442
Component 4. Monitoring and evaluation; knowledge management and dissemination	250,000	1,500,000
Sub-total	4,300,000	32,714,786
Project Management Cost	200,000	1,000,000
TOTAL	4,500,000	33,714,786

III. PROJECT ASSESSMENT

34. This is the key chapter of the report and should address all evaluation criteria and questions outlined in the TOR (see section VI - Project evaluation parameters). Assessment must be based on factual evidence collected and analyzed from different sources. The evaluators' assessment can be broken into the following sections:

- A. Project design
- B. Implementation performance
 - a) Relevance and ownership (report on the relevance of project towards countries and beneficiaries, country ownership, stakeholder involvement)
 - b) Effectiveness (the extent to which the development intervention's objectives and deliverables were achieved, or are expected to be achieved, taking into account their relative importance)
 - c) Efficiency (report on the overall cost-benefit of the project and partner countries' contribution to the achievement of project objectives)
 - d) Likelihood of sustainability of project outcomes (report on the risks and vulnerability of the project, considering the likely effects of sociopolitical and institutional changes in partner countries, and its impact on continuation of benefits after the GEF project ends, specifically the financial, sociopolitical, institutional framework and governance, and environmental risks)
 - e) Project coordination and management (Report on the project management conditions and achievements, and partner countries' commitment)
 - f) Assessment of monitoring and evaluation systems (report on M&E design, M&E plan implementation, and budgeting and funding for M&E activities)
 - g) Monitoring of long-term changes

III.A Project design

35. The evaluated project was designed using **the logical framework approach methodology**, which led to the establishment of a Project Results Framework (PRF) and **the main elements of the project**, i.e., the overall objective, outcomes, outputs, as well as indicators, their means of verification, and the assumptions.

36. **The used project's design** is adequate to cover the problems at hand. A very comprehensive and detailed baseline overview of the metallurgical sector in Thailand has been done, covering related legislation, national environmental policies, and additional relevant documents.

37. The proposed PRF is a clear indication that the **design was based** on the logical framework approach methodology. It proposes a set of indicators that are adequate to monitor progress and facilitate the tracking of results at both output and outcome levels. However, many of the indicators could have been quantified.

38. **All the relevant environmental and social risk considerations have been incorporated** into the project design. In particular, an environmental and social management framework has been proposed, which provides detailed guidance on conducting the environmental and social safeguard procedures of the project, identification of environmental and social impacts of the project and its components, and developing proper mitigating measures.

39. Rating on Project Design is **Highly Satisfactory**.

III.B Implementation performance

40. **The project document describes** how consistency and relevance of the project objective and activities with the country's priorities, national policy and regulatory framework, as well as the country's commitments **under the Stockholm Convention and other relevant international agreements**, is met during the project design and preparation.

41. **The project document also elaborates on the methods and approaches** being proposed to effectively implement BAT/BEP in scrap metal facilities, the expected outputs and outcomes to be achieved in each project stage and component, and the target beneficiaries. Detailed timeline of activities, budget, and partners' co-financing commitments are described in Annex E, Annex F, and Section C respectively.

III.B.1 *Relevance and ownership*

42. **The project is consistent with the state policy** pertaining to the regulation, restriction or prohibition of the importation, manufacture, processing, sale, distribution, use, and disposal of chemical substances and mixtures that present unreasonable risk and/or injury to health or the environment.

43. The project is aligned with the **reduction of the U-POPs emissions** as one from the targets stipulated in the National Implementation Plan (NIP) of 2008 and it is aiming to enhance the country's compliance to the Stockholm Convention on POPs. The NIP is continuously upgraded depends on the SC COP conclusions. The project intends to implement the NIP-envisaged strategy for U-POPs and is fully consistent with the NIP action plan for elimination and reduction of U-POPs and newly added chemicals.

44. **Ownership of the project** is very high. This gives an indication of the importance given to the project by the Government of Thailand. All the key stakeholders are very actively involved in the project. They all confirmed the relevance of the project during the online interviews. The direct beneficiaries have also confirmed the relevance of the project and will be a very useful tool to reduce the emissions of U-POPs from the metallurgy facilities.

45. Rating on Relevance and Ownership is **Highly Satisfactory**.

III.B.2 *Effectiveness at current stage of implementation*

46. The assessment of the **effectiveness criteria** is discussed at three levels: the achievement of outputs and outcomes, and progress towards impact. Under the topic progress towards impact, the evaluation more specifically assessed the behavioral changes that have occurred among beneficiaries as a result of project interventions.

III.B.2.1 *Achievement of outputs*

47. To achieve the **goal of the project**, thirty-four activities were planned to deliver ten outputs that would contribute to five substantive outcomes. As midterm targets were not proposed in the PRF, the rating of outputs was based on whether their availability commensurate with their delivery dates as mentioned in the project document. All the stakeholders interviewed stated that the lockdown due to the Covid-19 pandemic delayed significantly the implementation process. No activities, including meetings, trainings, could be undertaken during the total lockdown period which lasted 3 months (March to June 2020). Currently, the Thailand is still under partial lockdown.

48. These constraints and limitations are still affecting project implementation, monitoring, and evaluation. For instance, the national consultant of the evaluation team could not undertake field visits at the projects, and all the interviews were done online (through Zoom mostly). Nevertheless, at midterm, the project has performed rather satisfactorily for Components 1 and 3. For Component 2, progress has been much slower for various reasons discussed below.

COMPONENT 1

The implementation of Component 1

49. **Policy and Regulatory Framework for the project** Greening the Scrap Metal Value Chain through Promotion of BAT/BEP to Reduce U-POPs Releases from Recycling Facilities by the School of Social and Environmental Development, National Institute of Development Administration (the contractor) has been completed according to ToR.

50. **The summary of each activity** is as followed. Firstly, the work team divided the work into three work groups: Survey work group, Database work group, and Academic work group in order to do each activity efficiently.

51. **The literature review** part of the project were completed earlier in the project timeline. It included the reviews of the current concerns on Stockholm Convention and scrap metal supply chain in countries with sound management of scrap metal like Japan, Taiwan, the UK, and

Germany. Countries with high consumption of scrap metal such as China, the USA, Canada, and India, as well as countries in ASEAN Economic Community were also reviewed. The literature review also gave a comprehensive examination of policies, regulations, standards and guidelines developed and applied related to the scrap metal value chain and an analysis and comparison with Thailand's current status with suggestions to policy maker regarding to scrap metal supply chain management in Thailand. The review provided the fundamental knowledge and background, which led to the developing of the policy framework and the technical guideline.

52. **The survey research and the database development** was conducted on 1 889 stakeholders within the scrap metal industry supply chain. Stakeholders' information were initially compiled from reliable public/open sources such as DBD, DPIM, DIW, etc., and categorized as recyclers/scrap collectors (A), melting/casting facilities/foundries (B), downstream industries (C), sellers/end users (D), and the public sector (E), each had its own version of the questionnaire. Questionnaires were then sent out. The stakeholders were, over the course of the survey, filtered into: **“Identified”**, **“Verified”**, or **“Surveyed”**.

- **“Identified”** were stakeholders that were still active, i.e. they had correct addresses, financial statements were properly submitted, and websites/pages clearly showed that they were part of the supply chain.
- **“Verified”** were stakeholders that were contactable by phone or walk-in (on-site) but were uncooperative in filling out questionnaires or providing other information. All **“Verified”** stakeholders had been previously **“Identified”**.
- **“Surveyed”** were stakeholders who were cooperative and returned filled out questionnaires. All **“Surveyed”** stakeholders had been previously **“Identified”** and **“Verified”**.

53. **In-depth interview** was used as the method of **qualitative survey research**. The total of **27 stakeholders** was interviewed. While most had already followed some of the recommended BAT/BEP methods, none followed all. In order to encourage stakeholders, especially those in Sector A and B, to implement more BAT/BEP methods, tax incentives were the most preferred form of government help, followed by subsidies and low-interest loans.

Table 6: Stakeholders information

	“Identified”	“Verified”	“Surveyed”
Collectors	597	316	122
Foundries/Secondary Producers	321	181	32
Fabricators/Downstream Industry Producers	449	223	24
End Users	429	276	100
Governmental Agencies/NGOs/Academia	94	94	38
Total	1 889	1 090	316

54. **The baseline survey** asked stakeholders of all categories dozens of questions regarding their awareness of the Stockholm Convention, U-POPs, and BAT/BEP as well as their opinions toward Thailand metal recycling industry. **The key analytical points of the survey** revealed that the majority of respondents were not aware of the Stockholm Convention. Many respondents did not have any knowledge of U-POPs or their effects on human health. However, after further explanation, some stakeholders seem very keen to learn more while some stakeholders stated

that the issue of persistent organic pollutants was irrelevant to the businesses. The analysis of the survey data also identifies key points about stakeholders' business operations such as:

- **The most common air pollution control systems** are 1) Bag filters at 60.00 %; 2) Hoods at 46.67 %; and 3) Cyclone at 26.67 %.
- **Most stakeholders had already observed** many environmental measures such as 'Gated, with rooftop, and steel-enforced concrete floor', 'Surrounded by trees and green space', and 'Not located too near water sources or residential areas'.
- **The majority of stakeholders** from Sector A (Collectors) (51.49 %) did not practice any metal scrap pretreatment methods at all prior to sale. Sorting by size/type and removing non-metal parts were sometimes employed at 45.05 % and 2.81 % respectively.
- A similar question about pretreatment processes or methods was asked in the questionnaires for Sector B and C where the meaning is conveyed differently. **The most practiced pretreatment methods** were 1) Sorting by size/type at 61.36 %; 2) Compressing/Size Reducing at 29.55 %; and 3) Annealing/Preheating at 18.18 %.
- For Sector B and C, the questionnaires also inquired about how each factory managed industrial waste. **The most practiced waste treatment methods** were: 1) Using Outsourced Waste
- **Management Services** at 72.73 %; 2) Sorting by size/type at 31.82 %; and 3) Compressing at 13.64 %.

Database development

55. **The objective of the database development** was to present policy makers, regulators, or anyone of interest with the information, at a point in time, emerging during the survey and in-depth interviews. The followings were **steps or life cycle the development** achieved:

- Analyzing and designing the relationship of the datasets and UI
- Creating SQL tables, linking the data, and testing the relationship
- Importing data, which included preparing appropriate data formats and taking care of their accuracy
- UI development
- Executing system test
- Preparing documentation and manual for database management
- Training the database users and admins

Training Programme

56. The academic work group has designed a **training programme on U-POPs emissions reduction** with efficient scrap metal management in the recycling scrap metal industry with the Best Available Techniques and Best Environmental Practices (BAT/BEP) under the context of the United Nations Industrial Development Organization (UNIDO) and prepared necessary learning materials.

57. On, November 12th, 2020, the Contractor organized a **seminar** at the Department of Primary Industries and Mines to **conduct the peer review of the Programme and the accompanied learning materials**. During the event, the academic work group had described the Training Programme including backgrounds, objectives, details of **all 5 modules**, and the supplementary materials, attendees were invited to give comments and suggestions, which were helpful for

the academic work group in revising the Programme.

Table 7: The Training Programme consists of 5 modules.

Module No.	Title	Topics
Module I	U-POPs	<ul style="list-style-type: none"> • What are U-POPs? • Health and environmental impacts of dioxins/furans • Management of U-POPs
Module II	Policies, Laws, and Regulations	<ul style="list-style-type: none"> • Background knowledge of UPOPs • Related international conventions (Stockholm and Basel Conventions) • Policy, laws, regulations, and standard of U-POPs emission from scrap metal industry • Overview of technical guideline
Module III	Scrap Metal Industry and U-POPs Emission	<ul style="list-style-type: none"> • Scrap metal industry and its impacts • Formation processes of U-POPs in scrap metal industry • U-POPs concentrations and emissions • Basic environmental management (all types of pollution) • Strategy for Sustainable Production, Circular Economy and Lean Manufacturing
Module IV	Management of U-POPs in Scrap Metal Industry	<ul style="list-style-type: none"> • Reviews of scrap metal industry and its environmental impacts • Technical guidelines in managing of U-POPs emitted from the scrap metal industry • Case Studies
Module V	Technical Sampling and Analysis of U-POPs	<ul style="list-style-type: none"> • Collection of U-POPs samples • Analysis of U-POPs • Reporting concentration of U-POPs • Introduction to Thailand's Dioxin Lab

58. Throughout the month of January and early February of 2021, the Department of Primary Industries and Mines and the Contractor arranged the **online learning sessions** for the Programme and the 5 modules. Participants of the online learning sessions were officials relevant to the scrap metal.

Public Policy Framework and National Guideline

59. The academic work group has drafted **Public Policy Framework on the implementation of a sound management of metal recycling in compliance with the Stockholm Convention requirements** and **National Guideline or procedure manuals based on BAT/BEP devoted to a sound management of scrap metals recycling**. Both works referred to the survey research and the literature review.

Public Policy Framework

60. **The Policy Framework** started with the introduction of POPs including its impact on human health and environment, the sources, the toxicity, as well as the importance of the Stockholm Convention on Persistent Organic Pollutants. The Contractor has outlined the scope of the framework, which were

- 1) to categorize scrap metal foundries or related factories into three groups according to the size and capacity of each facility;
- 2) to lay out the implementation timelines; and
- 3) to suggest any incentives the government should set in order to persuade players in the scrap metal industry to join the effort in reducing the generation of U-POPs.

61. The expected goals when this Policy Framework is implemented are:

- I. Thailand's emission Standard for U-POPs
- II. Reducing the risk of operators in the scrap metal recycling industry exposure to U-POPs
- III. Supporting of entrepreneurs of the scrap metal recycling industry to realize the concept of BAT/BEP application
- IV. Thailand becoming the leading nation in the application of BAT/BEP to reduce U-POPs emissions at the ASEAN level.

National Guideline

62. Ferrous and non-ferrous metals (e.g. copper, aluminum, zinc, etc.) have been **critical in driving economic growth over the past few decades**. The production of these metals is closely linked to a number of industries including construction, automotive, food and beverage, and electronics. In Thailand, the production of these metals for use as raw materials in various industrial sectors starts by melting used scrap metal into new metal. It is well known that this manner of production process has inadvertently led to the releasing of persistent organic pollutants or U-POPs.

63. **There are many types of U-POPs:** Polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), polychlorinated biphenyls (PCBs), polychlorinated naphthalenes (PCNs), hexachlorobenzene (HxCBz) and pentachlorobenzene (PeCBz). These substances have much **impact on human health**. Not only that they can cause acute and chronic effects, they are also carcinogenic. Therefore, it is imperative that management measures are taken to reduce the release of these substances into the environment.

64. The Contractor has developed the **technical guideline for the scrap metal recycling industry**, which is one of the most important sources of U-POPs, by implementing Best Available Techniques (BAT) and Best Environmental Practices (BEP) to effectively reduce the release of such pollutants. This will greatly benefit the quality of life of the people.

The Outline of Technical Guideline

Introduction

- I. Background
- II. Objectives and scope
- III. Guidelines for implementation
- IV. Basic knowledge (production process of metal, residual pollutants, etc.)
- V. Preliminary practices for reducing emissions of U-POPs

Guidelines for factories (recycled steel, recycled aluminum, recycled copper, recycled zinc, and recycled lead)

- I. Sources of scrap metals (iron/steel, aluminum, copper, zinc, lead)
- II. Production processes (iron/steel, aluminum, copper, zinc, lead)

- III. Pollution emissions from production processes (iron/steel, aluminum, copper, zinc, lead)
- IV. Prevention of U-POPs emitted during the production process (iron/steel, aluminum, copper, zinc, lead)
- V. Control of U-POPs arising from manufacturing processes (iron/steel, aluminum, copper, zinc, lead)

Annexes

- I. Types of furnace
- II. Types of best available technology
- III. Checklists of guidelines

Consultation

65. At the **‘Consultation’ seminar** on November 12th, 2020, both **1st drafts of the Public Policy Framework and the National Guideline** were presented to attendees including TWG1, governmental officials, academics, and industrial stakeholders. Many comments and suggestions were offered. The academic work group then revised the Public Policy Framework and National Guideline accordingly and presented to TWG1 the 2nd drafts for further improvement before presenting in the public hearing.

Public hearing and final revision

66. At the closing workshop titled “Recycle Well, Avoid U-POPs” on February 25th, 2021, 3rd draft of the Public Policy Framework were presented to attendees which included TWG1, governmental officials, academics, and stakeholders. A few comments and suggestions were given and taken to revision accordingly.

Closing Workshop

67. **The closing workshop** titled “Recycle Well, Avoid U-POPs” was held for the project conclusion which took place on Thursday February 25, 2021 at 09.00-16.00 at “The Sukosol Hotel”, Bangkok. The event incorporated the promotion of outputs accomplished under Component I, exhibitions, as well as panel discussion on U-POPs and various other environmental topics.

68. Component 1 – Summary

- Four demonstration facilities are fully engaged and baseline situation assessed.
- UNIDO international experts’ visited the partner facilities on 22-24 August 2018
- A survey of industrial facilities started in February 2020 and was completed in July 2020.
- The updated and in-depth information from generators, collectors, to consumers of scrap metal has been collected since December 2019 and is completed in July 2020. A comprehensive database is functional.
- Contractual services underway for the drafting of the national guidelines and technical manuals and conduct of training for national authority staff on measures and technologies to reduce U-POPs releases from the metallurgical industry.

- The Literature review on current concerns on Stockholm Convention and sound management of scrap metal supply chain in certain countries has been conducted since October 2019. The draft national technical guidelines and procedure manuals was formulated and reviewed in August 2020.
- Training programmes have been developed as a result of survey on training programs needed by the relevant national authorities and were conducted in January -February 2021.
- Revision of existing laws and regulations, identification of gaps and development of additional regulatory measures to promote the diffusion of BAT/BEP in order to reduce emissions of U-POPs from the secondary metals producing industry has been conducted since October 2019 and the output of this revision was provided in August 2020

COMPONENT 2

69. The third interim report aims at presenting progress for implementing Component 2, “Information dissemination and capacity building”, of the project “Greening the scrap metal value chain through the promotion of BAT/BEP to reduce U-POPs releases from recycling facilities” was used for the MTE.

70. The Third interim report contains the sections from TOR as follows. The background and importance, the rationale of the project and the consequence after the project accomplishment in the future, were main part of the activities of this component. The section concerning to the **legal and technical framework for implementing activities** to reduce U-POPs provided an overview of the legal instruments that already have been implemented at both international and Thai levels to control U-POPs. The section on description of scrap metal value chain provided an overall description of the Thai scrap metal value chain with key information on the stakeholders. Moreover, the section shows recycling industries which are steel, copper and aluminum industries. The attention was done also to the classification of scrap metal. This section provides the information on factory codes and waste codes, the relation of different scrap metal fractions, as well as which substances in the fraction that can potentially generate U-POPs.

71. **Awareness-raising** is one from the most important part of the project. This part provides **information on how the various information activities will be implemented** to ensure the most efficient fulfilment of the project’s overall purpose on awareness-raising. The details of each activity are as follows:

- **Campaigns** – The video contest for recycling of scrap metal was launched in the concept of “How to recycle scrap metal properly, away from U-POPs”. The video clip was clip around 3 minutes in length. There were 2 rounds of judgement: qualification and final round. The final round was held in the national event on October 30, 2020. The first prize belonged to “MNCU2” from Chulalongkorn University. The special prize, Green Youth Award, belonged to “The Seed” from Wat Sa Bua Primary School.
- **Events** – For the first event, there will be both seminars and exhibitions related to the supply chain of scrap metal. The event included MOU signing ceremony among UNIDO and 4 recycling facilities, project performance presentation, panel discussion in the title of “Direction of scrap metal recycling in Thailand” and final round of video clip contest. The event was at Pathumwan Princess Hotel on October 30, 2020. Outside the ballroom, there were various booths for entrepreneurs and interested people.
- **Training and training materials** – After, the survey and review had been conducting by a questionnaire for examination the understanding of the Stockholm Convention, U-POPs

and BAT/BEP to develop the training materials. The materials had peer reviewed by experts. Some modules had been tested and the rest have been developing.

- **Technical guidance documents** – After, the local and international existing guidelines have been surveyed and reviewed to formulate the technical guidance documents and had the peer review by expert. The guidance has been developing.
- **Videos** – The recordings are used for promoting the project. The lengths of videos are 1-minute, 3-minutes and 10-minutes for different target groups. The contents include project introduction, U-POPs, health effects and BAT/BEP. Three videos have already been approved and uploaded to the website.
- **Website** – The web page has been created to promote the project. In the current, this updated version has been completed and can use all of functions on the website. Besides, the activities can be registered for now.
- **Flyer** – The campaign was promoted by the leaflet. The A4-sized flyers were printed for 2,000 leaflets and have been distributed to PMU, schools and universities already.
- **Brochure** – The project was promoted by the booklet. The A3-sized brochures were printed for 1,000 booklets and distributed to participants in events.
- **Article** – The first article was published for the awareness-raising in www.bangkokbiznews.com within 2 pages of A4. The first article has been already submitted and published to Bangkok biznews.
- **Prototype model** – For the prototype model, the report suggests two models as one for illustrating current “bad practices” and one for “good practices” (BAT/BEP). The models should be made both in a physical version for illustrating the process of scrap metal separation and the pollution treatment. The virtual version that can be accessed via the project website. Both versions have already been completed.
- **Awareness raising merchandise** (T-shirt, Cap) – T-shirts and caps were given to those interested and participants in the event to raise awareness about U-POPs. In the current, 500 of T-shirts and 500 of caps have already been produced and distributed during project activities.

72. Component 2 - Summary

- **Contract** for this component has been awarded.
- **Project website** has been developed since October 2019 and partially completed, static information (www.GreenScrapMetalThailand.com) while 3 VDO clips were completed in Thai with English subtitle.
- **Awareness raising event and campaign** for the general public and the workers on issues related to POPs, on environment and health issues of scrap metals recycling Program has been developed and scheduled to be launched mid of 2020, however, due to COVID-19 pandemic this has been postponed to October 2020.
- **The training modules and materials** are ready in August 2020. Hence, Training on sound scrap metal management and BAT/BEP was started to be organized since December 2020.
- **A visit to the recycling facilities** with representatives from PSC members of the project was undertaken on September 17, 2019 in Rayong and Chonburi provinces in Thailand which resulted in strengthening the cooperation and experience on sound management scrap metal recycling in Thailand among relevant governmental institutions. There were 14 representatives of relevant institutions with 43 % women.
- **Study Tour on BAT/BEP Application in the Metallurgical Industries was held in Brescia, Italy** on 23 - 27 September 2019 to learn about possible BATs and BEPS being applied in different metallurgical facilities in Italy. Hence, it resulted in the increase in

awareness on U-POPs and BAT/BEP concepts among national stakeholders and project partners as well as the improvement of national capacity in the sound management of the recycling chain of scrap metal in Thailand. There were 6 facilities visited and the Study Tour group consisted of 23 participants of which 43% are women.

COMPONENT 3

73. Department of Primary Industries and Mines (DPIM) and United Nations Industrial Development Organization (UNIDO) intends to **promote the reduction of dioxin and persistent organic pollutants (POPs) releases in Thailand** by promote **introduction of Best Available Techniques (BAT) and Best Environmental Practices (BEP)**. Therefore, the project “Greening the Scrap Metal Value Chain through Promotion of BAT/BEP to Reduce U-POPs Releases from Recycling Facilities” has been initiated and implemented, emphasizing on the management of industries related to making of steel/aluminum, which are used in high amount in the country.

74. **These industries have high potential for the reduction of persistent organic pollutants (POPs) releases.** The following **four demonstration facilities** participating in the project to introduce BAT/BEP were included to the project:

- 1) Tata Steel Manufacturing (Thailand) Public Co., Ltd (TSMT), including NTS Plant/Chonburi plant and SCSC Plant/Rayong plant
- 2) Bangkok Iron and Steel Works Co., Ltd (BISW)
- 3) Thai Metal aluminum Co., Ltd (TMA)
- 4) Daiki aluminum Industry (Thailand) Co., Ltd. (DAIKI)

75. These **four selected demonstration facilities** have signed a **memorandum of understanding (MOU)** to express their intention to introduce BAT/BEP in attempt to reduce Unintentionally Produced Persistent Organic Pollutants (U-POPs) releases. The project takes **three years for implementation, being granted an amount of over 1,000 million Baht** from the Global Environment Facility (GEF) to improve production processes to be environmentally friendly and reduce Unintentionally Produced Persistent Organic Pollutants (U-POPs).

76. **The project objective of project is to define the primary and secondary standard for reducing U-POPs releases and implementing BAT/BEP** in selected demonstration facilities. The scope of work of the project for greening the scrap metal value chain through promotion of BAT/BEP is to reduce U-POPs releases from recycling facilities is comprised of nine main activities.

77. Study and formulate work plans were prepared and consisted of three sub-activities:

- 1) The formulation of the work plans in each sub-activity and detailed steps throughout the project
- 2) The preliminary study of the demonstration facilities’ current production
- 3) The study of BAT/BEP technologies that will be introduced in these four demonstration facilities.

78. **The main goal of the Component 3 is to conduct surveys, gather in-depth environmental and technical data and determine** quantifiable impact indicators.

79. **The environmental inspection** before making metallurgical process improvement by BAT/BEP was executed at the four demonstration facilities **under the normal production**

conditions. Then, the baseline data involving Unintentionally Produced Persistent Organic Pollutants (U-POPs) releases and an inspection report will be prepared.

80. **Support to and collaboration with the demonstration facilities** was done with experts from Department of Department of Primary Industries and Mines (DPIM), Iron and Steel Institute of Thailand (ISIT) and UNIDO to identify and formulate the pilot plans for the four demonstration facilities.

81. **The environmental inspection** made/make after metallurgical process improvement by BAT/BEP at the four demonstration facilities, as planned. The inspection will be made by the method similar to that before making improvement. The inspection results will also be reported.

82. **Training for staff of demonstration facilities and interested persons** is grouped into three phases. The first phase involves surveys on demand for training programs and training formula. The second phase relates to design and preparation of media/document for training and development of personnel, while the third phase proceeds with training activities.

83. Once the activities are done, Iron and Steel Institute of Thailand arranges company **visits to the four demonstration facilities and seminars to disseminate** the project success. These actions aim to provide knowledge and demonstrate the success of the project to improve and develop the environmentally friendly metallurgical process. Therefore, the stakeholders throughout the scrap supply chain and other industries will acknowledge the direction for metallurgical process improvement and will be able to apply for development and improvement of environmentally friendly metallurgical processes.

84. Ten hard copies of **the final report and executive summary** in both Thai and English languages will be prepared and consisted of full documentation of all activities implemented with output throughout the project and all of the progress reports in the appendix.

85. **Collection of detailed technical and environmental data at the selected demonstration facilities** and formulation of quantifiable impact indicators with consideration of socio economic data and gender dimension under the current practices

86. The working group has conducted a **preliminary study involving the production conditions of the four selected demonstration facilities and pilot plans** as preliminarily proposed. The study results have been used to formulate plans and set the direction for implementation of the project for BAT/BEP introduction in metallurgical process improvement and reduction of Unintentionally Produced Persistent Organic Pollutants (U-POPs) releases.

87. **Detailed description of current operation and processes**

88. **(1) Tata Steel Manufacturing (Thailand) Public Co., Ltd (NTS Plant/Chonburi plant)**

89. **The factory operates** an EAF (80 ton/batch), a ladle furnace, a continuous casting machine (500,000 ton/year) for the casting of billets, a rolling mill for the production of rebars (capacity 450,000 ton/year) and a rolling mill for the production of wire roads (capacity 350,000 ton/year). Downstream to the rolling mill, a Cut & Bend unit offers cutting, bending, assembly and delivery of round bars for the construction industry such as roads, bridges, buildings and houses according to the customer needs.

90. **The feedstock scrap is procured from domestic and international sources** and it is used as a raw material to produce semi-finished goods, billets, which in turn are used to produce the finished products, rebars and wire rods. The mixture of scrap charged in the furnace is approximately constituted by 50 % of new, non-coated production scrap (busheling, bundles, home scrap) and 50 % scrap generated from obsolete, often coated used items (imported or of local origin).

91. **The metallic charge of scrap steel** is melted in the EAF, a cylindrical vessel with a dish-shaped refractory hearth and electrodes that lower from the dome-shaped, removable roof. The electric arc furnace generates heat by passing an electric current between electrodes through the charge in the furnace. This energy is supplemented by oxy-fuel burners. Greening the scrap metal value chain through promotion of BAT/BEP to reduce U-POPs releases from recycling facilities (UNIDO).

92. (2) **Tata Steel Manufacturing (Thailand) Public Co., Ltd (SCSC Plant/Rayong plant)**

93. **The factory operates** an EAF (80 ton/batch), a ladle furnace, a continuous casting machine (500,000 ton/year) for the casting of billets, a rolling mill for the production of rebars. Downstream to the rolling mill, a Cut & Bend unit offers cutting, bending, assembly and delivery of round bars for the construction industry such as roads, bridges, buildings and houses according to the customer needs. This service reduces loss of steel, manpower and cost at the construction site. **The feedstock scrap is procured from domestic and international sources** and it is used as a raw material to produce semi-finished goods, billets, which in turn are used to produce the finished products, rebars. The mixture of scrap charged in the furnace is approximately constituted by 20% import (HMS2) and 80% scrap generated in domestic (pre-shredded 10%, turning 5%, local 40% and bundle 25%).

94. **The metallic charge of scrap steel is melted** in the EAF, a cylindrical vessel with a dish-shaped refractory hearth and electrodes that lower from the dome-shaped, removable roof. The electric arc furnace generates heat by passing an electric current between electrodes through the charge in the furnace. This energy is supplemented by oxy-fuel burners typed natural gas.

95. (3) **Bangkok Iron & Steel Works Company Limited (BISW)**

96. **In current configuration**, it consists of a 60 tons electric arc furnace, a 60-ton ladle furnace and a 60-ton vacuum degasser (Tenova), a 3-strand continuous casting machine for square billets up to 150x150 mm (SMS Concast) a rolling mill (Danieli) as well as a fume treatment plant.

97. **The production process** is based on the classic steps of steelmaking from scrap: sorting scrap metal, melting scrap metal in an electric arc furnace (EAF), secondary metallurgy to remove impurities in liquid steel, continuous casting of steel in billets, and final rolling of billets to produce bars and wire rods for the construction industry. The electric arc furnace is based on the Consteel technology, a specially designed scrap conveying system where the scrap is continuously fed via a horizontal conveyor system into the furnace while it is preheated by the off-gas leaving the furnace (flowing in counter-current) in order to recover energy. Through the utilization of the furnace off-gas, scrap can be preheated to a temperature of approximately 800 °C prior to the melting in the furnace vessel. This means considerable energy and cost savings with a substantial reduction in tap-to-tap times.

98. (4) **Thai Metal aluminum Company Limited (TMA)**

99. Thai Metal aluminum Co., Ltd. is a **producer of extruded aluminum profiles**. The extrusion process is performed with seven extrusion machines which cover billet diameter up to 10 inches, Greening the scrap metal value chain through promotion of BAT/BEP to reduce U-POPs releases from recycling facilities (UNIDO) 2-3 allowing the manufacture a wide variety of aluminum profiles. The aluminum billets, i.e. the raw material for the manufacture of the final extruded products, are produced internally by melting a mix of aluminum ingots (50%) and aluminum scrap (50%). Of the latter, about half (25% of the total charge) is scrap produced internally during the manufacturing cycle and the other half is imported scrap. About 10% of the scrap has some level of contamination. Annual billet production capacity is 20,000 tons and extrusion output capacity is 37,000 tons.

100. **The raw material is melted** in a 15-t gas-fired reverberatory furnace, a widely used type of furnace for the melting of a broad range of secondary raw materials including aluminum. Off-gases coming from the melting furnace are delivered through an exhaust pipe and treated by means of a cyclone and a wet scrubber, a rather weak air pollution control system (APCS) for this type of installations. The scrubber wash water is treated in the wastewater treatment plant to prevent the discharge of acid and metals to surface water. In addition, a hood connected to a bag filter is placed on top of the furnace door in order to prevent or reduce diffuse emissions during the charging of the melting furnace. Molten aluminum derived from the melting process is cast in a casting machine to produce the billets. The profiles obtained from the extrusion process can finally be anodized or colour-powder coated.

101. **(5) Daiki aluminum Industry (Thailand) Company Limited (DAIKI)**

102. Main **raw material processed in Daiki is aluminum scrap**, which may include process scrap, used beverage cans (UBCs), foils, extrusions, commercial scraps, turnings, and old rolled or cast metal. Typical process steps include pre-treatment of the scrap, charging, melting, skimming, holding, treating the molten metal, and casting. Scraps such as UBCs and turnings are de-coated and de-oiled in a turning dryer (capacity 2.5 ton/hour) to improve their melting rate (and thermal efficiency) and to reduce the potential for emissions. The dryer is equipped with an afterburner for the post-combustion of flue gases from the furnace. **Aluminum scrap is melted using rotary and reverberatory furnaces** (capacity ranging from 4 to 45 tonnes). Flue gases are treated with a suite of bag filters with capacity ranging from 36,000 m³/hour (dryer) to 90,000 m³/hour (the largest melting furnaces). One of Daiki's main problems is the diffusion of odours from the stack perceived by the local population, an effect that occurs when aluminum coated with organic layers is present in the scrap bales. Daiki has received permission from the Department of Industrial Works (DIW) under the Minister of Industry (MoI) to recycle aluminum dross as raw material for the steel industry.

103. The summary of current operation of the four selected facilities is shown in Table 8.

Table 8: Summary of current operation of the four selected demonstration facilities.

No.	Demonstration Facility	Industry	Production (tons)
1	Tata Steel Manufacturing (Thailand) Public Co., Ltd (CNTS Plant/Chonburi plant)	Steel Making	~306,000
	Tata Steel Manufacturing (Thailand) Public Co., Ltd (SCSC Plant/Rayong plant)	Steel Making	~500,000

2	Bangkok Iron & Steel Works Co.Ltd.	Steel Making	134,073
3	Thai Metal aluminum Co., Ltd.	Aluminum Making	20,000
4	Daiki aluminum Industry (Thailand) Co., Ltd.	Aluminum Making	90,000

Development of quantifiable impact indicators

104. Two indicators for **gender dimension** and three indicators for **socio-economic** were developed. All indicators are shown below

- 1) Aspect of gender dimension
 - a) At least 80 % of both men and women in the factory will know about all activities related to U-POPs release.
 - b) All participants in each project must be women at least 20 %.
- 2) Aspect of socio-economic
 - a) Increasing of employment near selected facilities
 - b) Reduction of complaint in the environmental aspects after installation of project
 - c) Satisfaction of employee after installation of project

105. All indicators were discussed and be approved by **each selected facility**. It depends on factories that they can do some point or not. After discussed with four select demonstration facilities, the aspect of gender dimension is concluded:

- (1) BISW: Due to more quantity of male than female, they might not pass this indicator.
- (2) TMA: They could pass this indicator although quantity of male more than female.
- (3) DAIKI: In general, there are more quantity of male than female in melting part. However, they have more female than male in the back office. Therefore, they possibly pass this indicator.

Remark: For TSMT, as they are steel making, similar to BISW, they might not pass this indicator.

107. **Preliminary monitoring for U-POPs releases under the current operating conditions** in the four selected demonstration facilities. For PCDDs/Fs measurement in the four selected demonstration facilities, four points followed by TOR, namely, main stack, bag filter, workplace and ambient were collected.

Table 9: Emission rate of PCDD/Fs sand PM in each factory

Company		Dioxins ($\mu\text{g-TEQ/t}$)	PM10 (g/t)	PM2.5 (g/t)
TSMT (NTS/Plant Chonburi plant)		0.212	2.034	1.380
BISW		5.025	4.120	2.908
TMA	Billet heater	1.467	9.413	8.007
	Furnace	1.847	43.652	8.712
DAIKI		2.039	15.057	8.720

108. The results indicated that the **emission rate depends on the three parameters**, namely, stack flow rate, concentration of dioxins or PM, and time/production (T/P).

109. As shown in Table 9, it can be concluded as follow,

- 1) **Emission rate of dioxins at TSMT (NTS Plant/Chonburi plant)** was low, while emission rate of PM was low. These depend on the concentration of dioxins. The stack flow rate and T/P ratio was comparatively constant and constant, respectively.
- 2) **Emission rate of dioxins at BISW** was high and the values were not different. This is due to the high concentration of dioxins.
- 3) **Emission rate of dioxins of billet heater at TMA** was low, whereas the value was high at the furnace. This is due to the flow rate of furnace was higher than that of billet heater. Besides, emission rate of PM has the same trend.
- 4) **Emission rate of dioxins at DAIKI** was low, while emission rate of PM was high. These depend on the concentration of dioxins. The stack flow rate and T/P ratio was comparatively constant and constant, respectively.

110. **Work with UNIDO experts led to improve procedures, raw material specifications and technologies to reduce production and release of U-POPs** according to the BAT/BEP implementation. It consists of three subtopics, namely. After revision of technical annex repeatedly, it was a possible to conclude the project in each selected facility as below.

111. **The work plans** for each selected facility:

- 1) Tata Steel Manufacturing (Thailand) Plc (TSMT): Equipment for ferrous scrap processing and screening (Both NTS/Chonburi and SCSC/Rayong plants)
- 2) BISW: Provision of a scrap pre-treatment system
- 3) TMA: Upgrade of the reverberatory furnace with a regenerative burner system and replacement of a billet heater.
- 4) Pre-treatment/pre-cleaning of scrap.

112: The following part describes **development of training courses and materials for the technical staff of the four selected demonstration facilities** and their partner along the scrap metal supply chain on the management of BAT/BEP.

113. ISIT team have designed and sent the **questionnaire of training program needs** for technical staff to four selected demonstration facilities. Team asked each factory for sending the questionnaire to **related person in this project**, for example, maintenance or production sectors. The topics are related to dioxins such as definition, source, etc. Besides, the case study about dioxins in other country and BAT/BEP that factory chose was included in this program. Therefore, it can be concluded that a number of person and interested topics that related person conducted the survey of training needs were as followed

- 1) There are 3 men conducted the questionnaire from the TSMT (NTS Plant//Chonburi plant). They are come from engineering sector.
- 2) There are 33 men and 2 women conducted the questionnaire from the BISW. They are come from production, maintenance, and environmental sectors.
- 3) There are 32 men and 14 women conducted the questionnaire from the TMA. They are come from production and maintenance sectors.
- 4) There are 4 men and 3 women conducted the questionnaire from the DAIKI. They are come from maintenance, quality control, and human resource sectors.

114. After the survey and review the training courses among DPIM, PMU and ISIT, and based on the comments from TWG3, it was decided that these courses should be performed as on-the-job (OJT) training. It is suitable to train the technical staff aligned with an operation of the machine. Therefore, **the details of training course** was designed as follows:

- **Training course name:** Training and development on potential of technical staff in scrap recycling facility.
 - **Course description:** To describe the BAT/BEP implementation in order to prevent generation of U-POPs from the secondary metals producing industry.
 - **Target group:** (1) Technical staff & Engineer; (2) Back officer; (3) Interested local stakeholder.
 - **Duration:** Module 1-3: 120 minutes/module
- **Detailed Course**
- **Module 1:** An introduction to generation of U-POPs in the selected facilities.
 - Subject 1: Sources of generation of U-POPs in the selected facilities.
 - Subject 2: Introduction and evaluation on collecting points of U-POPs in the selected facilities.
 - Subject 3: Implementation of BAT/BEP in the selected facilities for reducing U-POPs.
- **Module 2:** Implementation of scrap processing and screening for reducing U-POPs.
 - Subject 1: An introduction of scrap processing and screening.
 - Subject 2: Implementation of scrap processing and screening in the selected facilities for reducing U-POPs.
- **Module 3:** Reduction of U-POPs by means of other techniques.
 - Subject 1: Implementation of rapid quenching and adsorbent injection systems.
 - Subject 2: Implementation of recirculating of exhausted gas.
 - Subject 3: Implementation of regenerative burner.
 - Subject 4: Case study Greening the scrap metal value chain through promotion of BAT/BEP to reduce U-POPs releases from recycling facilities (UNIDO)

116. Details of training courses for the **four selected demonstration facilities**, were prepared. As the baseline of BAT/BEP in this project is scrap sorting and screening. Most of them, except TMA, had a method of scrap sorting and screening, involving their grant-in-aid. Therefore, the training modules for all selected facilities, were redesigned. All details are described below and are shown in Table 10.

Training course name: Training and development on potential of technical staff in scrap recycling facility.

Course description: To describe the BAT/BEP implementation in order to prevent generation of U-POPs from the secondary metals producing industry.

Target group: (1) Technical staff & Engineer; (2) Back officer; (3) Interested local stakeholder.

Time table for training of each selected facility.

- TSMT Module 1-4 Between 1-15 June 2021
- BISW Module 1-4 Between 1-15 July 2021
- TMA Module 1-4 Between 16-30 June 2021
- DAIKI Module 1-4 Between 15-30 May 2021

Table 10: Training modules for all selected facilities.

Module	Subject
1. An introduction to generation of U-POPs in the selected facilities	1.1 Sources of U-POPs generated in the selected facilities
	1.2 Introduction and evaluation on collecting points of U-POPs
	1.3 Implementation of BAT/BEP in the selected facilities for reducing U-POPs
2. Application of scrap sorting and screening for reducing U-POPs	2.1 System of scrap sorting and screening
	2.2 Process of scrap sorting and screening for reducing U-POPs in the facility
3. Reduction of U-POPs using BAT/BEP	3.1 Regenerative burner
	3.2 Preheat scrap by heat recovery
	3.3 Post-combustion + Rapid quenching
	3.4 Off-gas collecting system
	3.5 Absorption chiller
4. Measurement and analyzing of U-POPs	4.1 Monitoring and analyzing of U-POPs
	4.2 How to define drilling point and calculate sampling point on the stack
	4.3 Measurement of U-POPs from stack and in ambient air Greening the scrap metal value chain through promotion of BAT/BEP to reduce U-POPs releases from recycling facilities (UNIDO)

117. After designing the training courses, the modules and courses with each selected facility were consulted. All of them agree with these courses.

Problems and suggestions

118. According to working with four selected facilities, ISIT, DPIM and UNIDO found some **problems to cooperation with facilities**, especially breaking out of COVID-19. It delays the investment from facilities. The problems from each selected facility were recognized as follow:

119. **Tata Steel Manufacturing (Thailand) Public Co., Ltd (TSMT)**

- 1) TSMT (Chonburi plant) has an intended to not investment on System for waste heat recovery because they found that there is no value of investment.
- 2) Due to No. (1), TSMT has changed to invest another equipment for ferrous scrap processing and screening at **SCSC Plant/Rayong** plant.
- 3) At the present, TSMT (NTS Plant/Chonburi plant) has changed the plan of investment (started to implement at SCSC Plant/Rayong Plant first and then to plan to implement at NTS Plant/Chonburi Plant onward. We will follow this later.

120. **Bangkok Iron and Steel Works Co., Ltd (BISW)**

- 1) BISW has sent three projects that invested before co-finance letter. So, they cannot be involved in GEF grant. Therefore, experts from UNIDO cut them out. The rest is only provision of a scrap pre-treatment system.
- 2) At the present, BISW has delayed the plan of investment. We will follow this later.

121. **Thai Metal aluminum Co., Ltd (TMA)**

- 1) TMA reduced the number of billet heaters from seven to only one, as shown in The technical annex.
- 2) Improvement of the emission control system from the melting furnace was also cut out from technical annex because TMA has an intention to invest only wet scrubber. However, experts told that it will be better if TMA invest all system.
- 3) At the present, TMA has delayed the plan of investment. We will follow this later.

122. **Daiki aluminum Industry (Thailand) Co., Ltd. (DAIKI)**

- 1) DAIKI was reduced the number of projects from three to only one, as shown in technical annex.

New facilities suggestion

123. Due to **rest of subsidy** (1,137,652 USD), TWG3 try to invite more facilities to join the GEF Project with the aim to reduce emission of dioxin using BAT/BEP. Consequently, four new facilities, were found and visited them to discuss with an intention of investments as follow.

124. On 7 October 2020, visit a new facility named '**Panyaraksa**' at Kanchanaburi province. They are lead (Pb) maker from **recycling acid-lead battery used in the automobile**. They have two projects for investment, namely.

125. On 17 November 2020, ISIT, DPIM and UNIDO (TH) - visit a **new steel scrap recycling facility, named Trident Steel Co., Ltd.**, which would like to join the GEF project. Some updated information were collected. Trident is the company that engage in wholesale of scrap for recycling. Almost scrap come from 95 % of domestic. The rest is imported. For domestic scrap, 60 % are scrap yard gathering from anywhere. 40 % are busheling scrap. Trident have the production of approximately 120,000 tons/year, which are sent to a large number of steel-making company in Thailand.

126. **Siam Anglo Alloy Co., Ltd.** is a **factory related to aluminum ingot**, like a DAIKI but smaller. The annual production is approximately 12,000 tons. Now they have only two bag filters in the emission control system, 6,000 and 3,000 cfm respectively, as shown in the layout. However, they would like to improve the efficiency of its dust collecting system in order to reduce the emission of dioxins to the environment. So they would like to invest a new project; that is, a bigger bag filter (20,000 cfm) adding from the two bag filters.

127. On 19 February 2021, visit of **Millcon Burapa Co., Ltd.** to survey and discuss about the two projects, which they would like to join the GEF project. Millcon Burapa Co., Ltd. is a smelting steel facility using EAF. They import car bale from Australia for smelting and rolling into steel products. They would like to invest two projects, namely, investment of pre-shredder and investment of oxygen enrichment.

Table 11: Status of four new facilities

Name of facilities	Plan of investment	Comments from experts	Status
Panyaraksa Co., Ltd.	Scrap sorting and screening Emission control system	1. UNIDO experts has evaluated the emission of dioxin. They found that it is a very small amount of approximately 0.0012 ng-TEQ/Nm ³ . So, it is difficult to improve. However, it is possible to measure emission of dioxin for further considerations. 2. This project does not match with the aims of UNIDO.	Waiting for measurement of dioxin on 29-31 March 2021. We will then send the results to experts.
Trident steel Co., Ltd.	1. Scrap sorting and Screening	1. Since Trident is a scrap yard and do not have its own furnace. They should be find a place where they can try its own scrap. So, they suggest two places for testing. (1) Wisansap Charoen Group (2) UMC Metals Co., Ltd.	Waiting for Trident send the name of melting place. We will then measure emission of dioxin for further considerations.
Siam Anglo Alloy Co., Ltd.	1. A new catalytic bag filter	1. UNIDO experts request the details and type of catalytic bag filter. 2. UNIDO experts have evaluated the emission of dioxin at the stack. It is approximately 500 g/h. So, it is interesting to invest some projects at furnace instead of bag filter.	Waiting for the decision from SAA.
Millcon Burapa Co., Ltd.	1. Pre-shredder 2. Oxygen enrichment	1. This project is not related to reduction of dioxin. It just one step before shredding. The important role is shredder, which they have possessed already. 2. This project is not related to reduction of dioxin. It is related to energy saving.	UNIDO experts does not accept any projects

128. Component 3 – Summary

- **The preliminary monitoring campaigns for U-POPs and other pollutants** of concern released into the environment under the current operating conditions in the selected demonstration facilities was conducted in 4 facilities during January - February 2020.
- **Work plan for implementation** was developed and reviewed in March 2020.
- **The following training program have been developed** and are expected to be conducted in Q4 Y2020 till Q1 Y2021.

- Training programs for regulatory authorities, professionals, research institutions on technical measures based on BAT/BEP to prevent generation of U-POPs releases from the secondary metals producing industry.
- Training materials and the Draft technical guidance for The SMEs and recycling associations aimed to introduce BAT/BEP concept for sustainable scrap metal management and Industry associations and operator of industrial facilities aimed to introduce BAT/BEP concepts on measures, approaches, and technology to reduce U-POPs releases.
- Training programs of BAT/BEP management for technical staff of the selected demonstration facilities.

129. **Revision of existing laws and regulations, identification of gaps and development of additional regulatory measures to promote the diffusion of BAT/BEP** in order to reduce emissions of U-POPs from the secondary metals producing industry has been conducted since October 2019 and the output of the this revision should be provided by August 2020.

COMPONENT 4

130. **Outcome of this component** is focused on effective monitoring and evaluation of project impact and sustainability implemented.

131. **Inception workshop** was held on 29 November 2018 in Bangkok with 157 participants of which 50 % were women. **The Project Management Unit (PMU)** has been established at the DPIM building.

132. Deputy Director-General of DPIM, Mr. Nirun Yingmahisaranon, was appointed as **National Project Director (NPD)** from DPIM and he also **chairs the Project Steering Committee** since October 11, 2018. In addition to that, Mr. Nirun assigned Mr. Sakol Anunwanitcha, Director of Innovation Raw Materials and Primary Industries Division from DPIM, was designated as **National Project Coordinator (NPC)** to oversee the activities of the project since December 25, 2018. There was regular government change in 2020 in Ministry of Industry, as result Dr. Aditad Vasinonta has become the new PSC chair and Ms. Slila Yanyongsawat as NPC.

133. Since October 11, 2018, the PSC was established, chaired by **the National Project Director**, Mr. Nirun from DPIM. The PSC comprises representatives from relevant agencies including, UNIDO, Department of Industrial Works (DIW), the Office of Industrial Economics (OIE), Pollution Control Department (PCD), Department Environmental Quality Promotion (DEQP), International Affairs Division under Office of Permanent Secretary of Ministry of Natural Resources and Environment (GEF-Operational Focal Point), and Federation of Thai Industries.

134. **PMU staff were trained on project administration**, UNIDO gender policy, and procurement process from 29-31 January 2019 in Vienna, Austria.

135. Since October 2018, there has been **8 PSC Meetings for endorsing TORs**, consultant selections, budget allocation and annual workplan including establishing Technical Working Group from Component 1, 2 and 3 (TWG1, TWG2 and TWG3) including endorsement of new facilities to join the project.

136. The previous PSC Meeting was on 07 July 2021 via online platform due to COVID-19 pandemic. From 1 July 2019 to 30 June 2020, PMU has organized many **coordinating meetings** both formal and informal but not limited to

- 29 TWG meetings to quarterly monitor the implementation and review the progress reports from consultants of each Component
- 12 consultations with project partners and candidate companies at their facilities
- 3 participations the pre-monitoring dioxin emission.
- 5 coordination meetings among consultants regarding to project website, database, and training program development and conducting.

137. **Even during the COVID-19 outbreak**, March – May 2020, several IT meeting tools were used to communicate with those relevant institutions such as Zoom, MS Team, LINE, and WebEx. Applications

138. The summary of the outputs status in mid-term period is presented in Table 12.

Table 12: Status of outputs at midterm

Outputs	Indicators	Progress at midterm	Rating
Component 1. Policy and regulatory framework			
Outcome 1.1: Policy and regulatory framework strengthened and enhanced for the implementation of a sound management of metal recycling in compliance with the Stockholm Convention requirements			
Output 1.1: One (1) database capturing various aspects of the metal recycling chain, as a new tool for policy makers, compiled	Number of facilities identified/surveyed.	Four demonstration facilities are fully engaged and baseline situation assessed. UNIDO international experts' visited the partner facilities on 22-24 August 2018 A survey of industrial facilities started in February 2020 and is expected to be completed within July 2020.	S
	Number of main industrial stakeholders interviewed/consulted.	The updated and in-depth information from generators, collectors, to consumers of scrap metal has been collected since December 2019. and is expected to be completed within July 2020	
	Survey data entered and validated in the database.		
	Availability of the database as a new tool for policy makers.	A comprehensive database is under testing and improvement.	
	Number of beneficiary institutional stakeholders.		
Output 1.2: Specific guidelines on environment, health and safety measures in the metal recycling chain value developed	Number of available national guidelines and technical manuals on BAT/BEP.	Contractual services underway for the drafting of the national guidelines and technical manuals and conduct of training for national authority staff on measures and technologies to reduce U-POPs releases from the metallurgical industry.	S

		The Literature review on current concerns on Stockholm Convention and sound management of scrap metal supply chain in certain countries has been conducted since October 2019. The draft national technical guidelines and procedure manuals is being formulated and expected to be done for review in August 2020	
	Number of training programmes developed for staff authorities	Training programmes have been developed as a result of survey on training programs needed by the relevant national authorities and expected to be conducted in January - February 2021.	
Output 1.3: Improved and harmonized national policies and regulations for environmental and health protection from metal recovery activities	Number of regulatory instruments, national guidelines and technical manuals based on BAT/BEP submitted and/or undergoing adoption by national authorities.	Revision of existing laws and regulations, identification of gaps and development of additional regulatory measures to promote the diffusion of BAT/BEP in order to reduce emissions of U-POPs from the secondary metals producing industry has been conducted since October 2019 and the output of the this revision should be provided by August 2020	HS

Component 2 Information dissemination and capacity building

Outcome 2.1: Increased awareness on U-POPs and BAT/BEP concepts by relevant stakeholders

Outcome 2.2: Improved national capacity in the sound management of the recycling chain of scrap metal

Output 2.1: Awareness raising materials and awareness raising workshop developed and implemented	Development of awareness programs and materials.	Contract for this component has been awarded.	S
	Number of awareness raising initiatives.	Project website has been developed since October 2019 and partially completed, static information (www.GreenScrapMetalThailand.com) while 2 VDO clips were completed in Thai with English subtitle. Awareness raising event and campaign for the general public and the workers on issues related to POPs, on environment and health issues of scrap metals recycling Program has been developed and scheduled to be launched mid of 2020, however, due to COVID-19 pandemic this has been postponed to October 2020	
	Number of participants (male/female) in the awareness raising campaigns.		
Output 2.2: Technicians and operators of the scrap metal sector are trained on BAT/BEP	Number of institutions involved in setting up training materials and providing training sessions.	The training modules and materials are expected to be ready in August 2020. Hence, Training on sound scrap metal management and BAT/BEP is scheduled to be organized in Q4 Y2020.	S
	Number of people (male/female) trained on BAT/BEP.		
	Number of participants (male/female) to the Study Tour.	A visit to the recycling facilities with representatives from PSC members of the project was undertaken on	

	<p>Number of companies visited during the Study Tour.</p> <p>Availability of training reports.</p>	<p>September 17, 2019 in Rayong and Chonburi provinces in Thailand which resulted in strengthening the cooperation and experience on sound management scrap metal recycling in Thailand among relevant governmental institutions. There were 14 representatives of relevant institutions with 43 % women.</p> <p>Study Tour on BAT/BEP Application in the Metallurgical Industries was held in Brescia, Italy on 23 - 27 September 2019 to learn about possible BATs and BEPS being applied in different metallurgical facilities in Italy. Hence, it resulted in the increase in awareness on U-POPs and BAT/BEP concepts among national stakeholders and project partners as well as the improvement of national capacity in the sound management of the recycling chain of scrap metal in Thailand. There were 6 facilities visited and the Study Tour group consisted of 23 participants of which 43% are women.</p>	
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COMPONENT 3: Pilot project for the demonstration of BAT/BEP in selected metal recycling facilities

Outcome 3: State-of-the-art primary and secondary measures for U-POPs release reduction in selected facilities identified and deployed

<p>Output 3.1: BAT/BEP measures identified and implemented for scrap collectors and scrap consumers</p>	<p>Number of BAT/BEP identified, implemented and demonstrated.</p> <p>Amount of incremental investment made.</p> <p>Quantity of PCDD/F and other pollutant releases avoided, reduced or eliminated.</p> <p>Number of documents produced for each pilot case.</p>	<p>The preliminary monitoring campaigns for U-POPs and other pollutants of concern released into the environment under the current operating conditions in the selected demonstration facilities was conducted in 4 facilities during January - February 2020. Work plan for implementation was developed and reviewed in March 2020.</p>	S
<p>Output 3.2: Training of technical staff and other potentially interested local stakeholders (environmental authority, SMEs, scrap collectors, etc.) in the management of BAT/BEP undertaken</p>	<p>Number of people (male/female) trained on BAT/BEP.</p> <p>Availability of training reports.</p>	<p>The following training program have been developed and are expected to be conducted in Q4 Y2020 till Q1 Y2021.</p> <ul style="list-style-type: none"> - Training programs for regulatory authorities, professionals, research institutions on technical measures based on BAT/BEP to prevent generation of U-POPs releases from the secondary metals producing industry. - Training materials and the Draft technical guidance for The SMEs and recycling associations aimed to introduce BAT/BEP concept for sustainable scrap metal management and Industry associations and operator of industrial facilities aimed to introduce BAT/BEP concepts on measures, approaches, and technology to reduce U-POPs releases. 	S

		- Training programs of BAT/BEP management for technical staff of the selected demonstration facilities	
Output 3.3: Policy and regulatory framework	<p>Number of documents drafted and disseminated.</p> <p>National action plan for replication developed and approved.</p>	Revision of existing laws and regulations, identification of gaps and development of additional regulatory measures to promote the diffusion of BAT/BEP in order to reduce emissions of U-POPs from the secondary metals producing industry has been conducted since October 2019 and the output of this revision should be provided by August 2020	S
COMPONENT 4: Monitoring and evaluation; knowledge management and dissemination			
Outcome 4: Effective monitoring and evaluation of project impact and sustainability implemented			
Output 4.1: Project M&E designed and implemented	<p>Timely project implementation.</p> <p>M&E adequately conducted according to UNIDO and GEF standard.</p> <p>Timely availability of inception, annual (APRs, PIRs, AWP) and evaluation (mid-term and final) project reports.</p> <p>Documentary evidence of M&E activities including but not limited to drafting TORs, selection and recruitment consultants and staff, review of substantial report.</p>	<p>November 2018 in Bangkok with 157 participants of which 50% are women.</p> <p>The Project Management Unit (PMU) has been established.</p> <p>PMU staff were trained on project administration, UNIDO gender policy, and procurement process.</p> <p>PSC Meetings for endorsing TORs, consultant selections, budget allocation and annual workplan including establishing Technical Working Group from Component 1, 2 and 3 (TWG1, TWG2 and TWG3).</p> <p>PMU has organized 29 TWG meetings to quarterly monitor the implementation and review the progress reports, 12 consultations with project partners and candidate companies at their facilities, 3 participations the pre-monitoring dioxin emission, 5 coordination meetings among consultants regarding to project website, database, and training program development and conduction.</p> <p>Even during the COVID-19 outbreak, March – May 2020 and May – July 2021, several IT meeting tools were used to communicate with those relevant institutions such as Zoom, MS Team, LINE, and WebEx.</p>	HS
Output 4.2: Lessons learnt disseminated	<p>Implementation of a communication</p> <p>Strategy for documenting and disseminating lessons learnt and project experiences.</p> <p>Number of communications materials and dissemination events conducted.</p>	Not applicable for FY 2019	

III.B.2.2 *Achievement of outcomes*

139. **The assessment of the project outcomes** was based on the availability of the indicators proposed in the PRF of the project document. As midterm targets were not proposed in the project document, **the rating of outcomes** was based on the extent to which the project target was achieved **for those indicators that were quantified**. As for outputs, the scale of rating for outcomes ranges from HS to S and is presented in Table 13. **Achievement of outcomes** is rated **Satisfactory**.

Table 13: Status of outcomes at midterm

Hierarchy of Objectives	Indicators	Progress at midterm	Rating
Component 1. Policy and regulatory framework			
Outcome 1.1: Policy and regulatory framework strengthened and enhanced for the implementation of a sound management of metal recycling in compliance with the Stockholm Convention requirements	<p>Number of facilities identified/surveyed.</p> <p>One (1) database capturing various aspects of the metal recycling chain.</p> <p>Number of beneficiary institutional stakeholders.</p> <p>Number of available national guidelines and technical manuals on BAT/BEP.</p> <p>Specific guidelines on environment, health and safety measures in the metal recycling chain value developed</p> <p>Number of training programmes developed for staff authorities</p> <p>Number of regulatory instruments, national guidelines and technical manuals based on BAT/BEP</p>	<p>Four demonstration facilities are fully engaged and baseline situation assessed.</p> <p>Training programmes have been developed as a result of survey on training programs</p> <p>Contractual services underway for the drafting of the national guidelines and technical manuals and conduct of training for national authority staff.</p> <p>The draft national technical guidelines and procedure manuals is being formulated and expected to be done for review in August 2020</p> <p>Revision of existing laws and regulations, identification of gaps and development of additional regulatory measures to promote the diffusion of BAT/BEP in order to reduce emissions of U-POPs from the secondary metals producing industry.</p>	S
Component 2 Information dissemination and capacity building			
Outcome 2.1: Increased awareness on U-POPs and BAT/BEP concepts by relevant stakeholders	<p>Development of awareness programs and materials.</p> <p>Number of participants (male/female) in the awareness raising campaigns.</p>	<p>Contract for this component has been awarded.</p>	S
Outcome 2.2: Improved national capacity in the sound management of the recycling chain of scrap metal	<p>Number of institutions involved in setting up training materials and providing training sessions.</p> <p>Number of institutions involved in setting up training materials and providing training sessions.</p> <p>Number of people (male/female) trained on BAT/BEP.</p> <p>Number of participants (male/female) to the Study Tour.</p> <p>Number of companies visited during the Study Tour.</p> <p>Availability of training reports.</p> <p>Number of documents drafted and disseminated.</p> <p>National action plan for replication developed and approved.</p>	<p>The training modules and materials are ready.</p> <p>A visit to the recycling facilities with representatives from PSC members of the project was undertaken.</p> <p>Study Tour on BAT/BEP Application in the Metallurgical Industries was held in Brescia, Italy.</p>	S
COMPONENT 3: Pilot project for the demonstration of BAT/BEP in selected metal recycling facilities			

<p>Outcome 3: State-of-the-art primary and secondary measures for U-POPs release reduction in selected facilities identified and deployed</p>	<p>Number of BAT/BEP identified, implemented and demonstrated. Amount of incremental investment made. Quantity of PCDD/Fs and other pollutant releases avoided, reduced or eliminated. Number of documents produced for each pilot case. Number of people (male/female) trained on BAT/BEP. Availability of training reports. Number of documents drafted and disseminated. National action plan for replication developed and approved.</p>	<p>The preliminary monitoring campaigns for U-POPs and other pollutants of concern in the selected demonstration facilities Work plan for implementation. Three Training program have been developed and were/will be conducted during 2020-2021. Revision of existing laws and regulations, identification of gaps and development of additional regulatory measures to promote the diffusion of BAT/BEP in order to reduce emissions of U-POPs from the secondary metals producing industry has been done.</p>	<p>S</p>
<p>COMPONENT 4: Monitoring and evaluation; knowledge management and dissemination</p>			
<p>Outcome 4: Effective monitoring and evaluation of project impact and sustainability implemented</p>	<p>Timely project implementation. M&E adequately conducted according to UNIDO and GEF standard. Timely availability of inception, annual (APRs, PIRs, AWP) and evaluation (mid-term and final) project reports. Documentary evidence of M&E activities including but not limited to drafting TORs, selection and recruitment consultants and staff, review of substantial report.</p>	<p>November 2018 in Bangkok with 157 participants of which 50 % are women. The Project Management Unit (PMU) has been established. Project Management was established. PMU staff were trained on project administration, UNIDO gender policy, and procurement process. PSC Meetings for endorsing TORs, consultant selections, budget allocation and annual workplan including establishing Technical Working Group from Component 1, 2 and 3 (TWG1, TWG2 and TWG3). PMU has organized 16 TWG meetings to quarterly monitor the implementation and review the progress reports, 4 consultations with project partners at their facilities, 2 participations the pre-monitoring dioxin emission, 2 coordination meetings among consultants regarding to project website, database, and training program development. Even during the COVID-19 outbreak, March – May 2020, several IT meeting tools were used to communicate with those relevant institutions such as Zoom, MS Team, LINE, and WebEx. Applications</p>	<p>HS</p>

III.B.2.3 *Progress towards impact*

140. The project document provides a detailed analysis of **potential social and environmental risks** that could threaten the achievement of project results and the proposed mitigation measures. Key potential risks to project outcomes and sustainability include:

- the likelihood of financial and economic resources not being available during implementation as well as after project completion;

- the risk that the level of stakeholder ownership (including ownership by governments and other key stakeholders) will be insufficient to allow for the project outcomes/benefits to be completed and/or sustained;
- the lack of coordination and cooperation between institutional stakeholders will pose risks that the intended legal frameworks, policies, and governance structures and processes within which the project operates are not developed and adopted, which may jeopardize sustainability of the project benefits;
- a threat to the achievement and sustainability of the project outcomes due to BAT/BEP measures will not achieve the expected release reduction target and failure in achieving a long-term reduction of U-POPs releases because of the difficulty to replicate and sustain the project results.

141. Component 4 of the project addresses **the knowledge dissemination for achieving sustainability of the project activities implemented**, with Output 4.2 Lessons learned disseminated. This includes a project activity to “carry out dissemination of lessons-learned and experiences at national, regional and global level”. Annexes I and D to the project document address the potential environmental and social risks of the project and measures to avoid, mitigate and minimize adverse environmental and social impacts.

142. **Impact can be considered as the extent** to which the project has brought about changes in the human living conditions or in the quality of environment depends on implementation of the international conventions. Changes, whether intended or unintended, can be positive or negative. For this project, the evaluation did not find any evidence of negative impacts on human health or on the environment. All the project measures will lead to the decreasing of U-POPs emissions and will be a good example for other metallurgical facilities and other sectors of industry in the country. For impact, there is need for behavioral changes of the project beneficiaries in the participating organizations. Behavioral change may happen at three levels: (i) economically competitive - Advancing economic competitiveness; (ii) environmentally sound – Safeguarding environment; and, (iii) Socially inclusive – Creating shared prosperity, which are discussed in the following paragraphs.

143. **A key factor for the social and political sustainability** of project results and their future use to protect the Thailand environment is the corresponding legal basis creating the legislative environment for the use of findings of the project. Optimal and efficient use of the results necessitates a harmonization of environmental laws, and synchronization of activities and competences at the different level.

Behavioral change

144. **Economically competitive** – This aspect of change would necessarily involve the private sector, individuals or groups of individuals that would derive an increased income as a result of the project intervention.

145. All 4 facilities has to comply with Hazardous Substances Act and Factory Act regarding to their industrial waste disposal must meet national guideline and submit the report to the Thai regulators at least once a year as a critical condition to renew factory license. Implementation of the progressive methods for the reduction of U-POPs emissions significantly increases the competitiveness of the companies involved

146. Discussions with the PSC on budget reallocation and engagement of new facilities is scheduled

late September 2020.

- Following up on the progress of the survey team via online posting (Facebook group) and observe field activities of the consultants at each selected demonstrated facility.
- Provide alternative channels of participation to those who are interested to join the annual event by attending at the venue or via online meeting tools or live broadcast via internet.

147. **Environmentally sound** – For the Component 3, the key change that has occurred is that the measures concerning to the decreasing of the U-POPs emissions were discussed, evaluated and will be installed as a key factor for the reduction of these emissions.

148. All 4 facilities has to comply with Thailand National Environmental Quality Enhancement Act and Factory Act regarding to their effluence and emission must meet national standards so as the environmental impact assessment (EIA) monitoring report is required by law to submit to the Thai regulators at least once a year as a critical condition to renew business license. PMU also revisited and observed their obligations to EIA in July and November 2019.

149. During 25 January – 2 February 2020 environmental monitoring was conducted in the facilities by sampling and analyze their emission and ambient according to Thai national standards to determine concentration of dioxin, PM10 and PM2.5.

150. **Socially inclusive** – Thanks to and based on the project targets, the perception of the relevance of the emissions of the U-POPs from the metallurgical sector has slowly changed.

151. According to the Safety Occupational Health and Work Environment Act 2011 of Thailand, Section 16 requires the training of executives, supervisors and all employees on safety, occupational health and working environment.

152. In addition, facilities also have to provide training to all new employees, in the case of entering a new job, changing jobs, changing workplace, or changing machinery or equipment which may endanger the employee's life, physical, mental or health.

153. As the employers shall provide training for all employees before starting work in response to the intent of the said law. It is therefore necessary to educate all employees on safety and operations. PMU also revisited and observed their obligations in July and November 2019 and found that PPE wearing is required for all employee and visitors such as, facemask, high -visibility vest, gloves, safety helmet and shoes.

154. Based on the mid-term evaluation and the visible signs of behavioural changes, the evaluation considers that the measures under consideration and planned to reduce emissions of U-POPs will have a significant positive **impact on the quality of life and the environment and effectiveness** is rated **Satisfactory**.

III.B.3 Efficiency at current stage of implementation

155. The implementation of the project officially started on 06 June 2018 and is planned for a duration of 5 years to end on 06 June 2023.

156. Cost effectiveness was an important consideration in the design of the planned project targets. All project goals were realized in a cost-effective manner, project achieved much more ambitious results than was initially planned for its first phase.

157. Evaluation of the project efficiency is **satisfactory** due to good project management, which led to the positive effects. All project goals were realized in a cost effective way.

III.B.4 Assessment of risks to likelihood of sustainability of project outcomes

Assessment of risks to likelihood of sustainability of project outcomes

158. **Sustainability** is understood as the likelihood of continued benefits after the project ends. Sustainability is assessed in terms of the risks confronting the project; the higher the risks, the lower the likelihood of sustenance of project benefits. The four dimensions or aspects of risks to sustainability (as mentioned in the TOR, namely: financial, socio-political, environmental, and institutional frameworks and governance risks) are discussed below.

159. **Financial risks** – Based on the interviews discussion, some financial risks for the sustainability of project results have been identified. But there is a positive project reaction from the side the governmental level and also from the side of private sector and the decisions to mitigate those risks are realistic, the rating on **financial sustainability** is **Moderately Satisfactory**.

160. **Socio-political risks** – The Thailand has signed and ratified the Stockholm Convention, and has submitted its NIP as well as its updated version.

161. Ownership of the project is very high amongst the key stakeholders. This is clearly evidenced in the PSC meeting reports whereby implementation issues and challenges are discussed in depth during these meetings, and decisions are taken to overcome those challenges with the active participation of the stakeholders. The government have shown strong commitments towards the project measures implementation; there is no particular reason why future governments will not remain bound to their obligations to confirm to these agreements and continue in the process of implementation of the project and NIP measures.

162. The private sector has been fully engaged in the project. The revised policies/regulation have to be communicated to them. Target stakeholders have been fully identified and will be engaged in the capacity building and training activities of the project.

163. The risk that the BAT/BEP implementation will not be longer supported by the private sector due to reduced commitment, economic and financial reasons linked to high investment and operating costs, unforeseen technical or environmental problems, has been fully mitigated with MOUs signed between DPIM and the demonstration companies.

164. The potential for the **socio-political sustainability of the project results** was evaluated as **moderately satisfactory** due to existing **gaps in environmental legislation** that will not allow for the realization of all the planned projects in full.

165. **Institutional framework and governance risks** – The project results strongly supported the above-mentioned development of new actions concerning the Thailand as a legal base for the effective cleaning and future protection of the environment. In addition, the project played an important catalytic role in leveraging additional funds for demonstration and pilot projects.

166. Potential problem was the **lack of coordination and cooperation** between institutional stakeholders such as MoI and MONRE in the development of new or additional regulatory measures for environmental and health protection from metal recovery activities. But key **institutional stakeholders** were appointed members of the Technical Working Group assessing the outputs of this component. Thus, it is expected that all members are informed of their **tasks and responsibilities** on the revisions/improvements and enforcement of the legislation.

167. Other potential risk - **low participation and interest from the workers and the general public** in the education program, was/is a key point of evaluated project. **Public awareness** activities have been carefully designed to attract relevant and high number of participants. However, activities have been delayed due to the pandemic.

168. Problem of **low co-operation among scrap recyclers, smelter facilities and other stakeholders** was solved by the **fully engagement of the private sector**. It has inked MOUs with **4 demonstration partners** and continuous dialogue is being undertaken. Contractual agreements have been finalized with two of the demonstration facilities.

169. Based on the project documents, it is possible to say that the Project is **supported by the Government of Thailand** at all levels, by stakeholders at both regional and national levels, by concerned NGOs and local communities, as well as by the private sector. The Project served as a catalyst for the strengthening and widening of collaboration between stakeholders at all levels. But discussion with people during the mission recognized a relatively low awareness especially in the communities beyond the project team. To ensure future effective realization of project outputs, **higher involvement of local and regional authorities** and non-governmental organizations in the development of nature conservation programs and projects is absolutely necessary.

170. **The outbreak of COVID-19** has affected project implementation. Due to economic uncertainties, the investment plans of the facilities were affected and some companies reduced their investment scope. The Project Management team may need to identify and involve other companies to ensure the achievement of the global environmental benefits. Awareness raising activities and field survey for in-depth interview with stakeholders have also been postponed. **For the elimination of risk due to the Covid-19 pandemic**, a catch up plan has been devised to ensure that delays will be fully mitigated. Use of virtual platforms on project discussion has been implemented.

171. Based on this **institutional framework and governance** is rated as **moderately satisfactory**

172. **Environmental risks** - the main objectives and principal activities aimed at preventing, eliminating and reducing threats to the environment. Highest risks for the project realization are **lack of financing and existing shortfalls of environmental legislation**.

173. The results of the demonstration projects, provide valuable contributions to solve the problems of pollution, but the sustainability of the results is not currently financially secured. It requires an intensive involvement of the private sector,

174. There is, however, large potential for higher financial support in the future especially concerning other companies of the metallurgical sector.

175. The project achieved very significant results, contributed to the awareness raising concerning the protection of environment, but the level of knowledge about the results outside the concerned bodies is relatively low. The project results need to be used and reflected to the Thai **National**

Implementation Plan for the implementation of the Stockholm Convention on persistent organic pollutants.

176. The first necessary step to further solve the emissions of U-POPs from Thailand metallurgy sector is to conduct **a detailed inventory of the emission sources and sinks**. The absence of inventory data as a key point for any decision-making process, is a **serious obstacle** to the development of conceptual and strategic decisions and financial considerations concerning the environment and areal development. The potential serious obstacle for solving the problems, can be competences between laws, ministries and different levels of management, which have to be clearly defined due to the implementation of the Stockholm Convention measures.

177. Based on this **Environmental risks** is rated as **satisfactory**.

III.B.5 Assessment of monitoring and evaluation systems

178. **The project M&E** plan in the Project Document followed UNEP and GEF requirements at the time of design. Project main outputs, risks and management and reporting systems were clearly defined and an adequate budget for M&E activities was made. **The baseline analysis** was adequate and formal. The M&E plan did not include an analysis of possible sources of environmental problems in the territory.

179. **M&E Design**. The project results framework proposed in the project document (Annex A) sets out the project indicators, baseline data, and targets that allow for tracking of results and proper monitoring of progress. The monitoring and evaluation (M&E) system is planned and the process integrated in the project implementation activities through institutional arrangement and coordination.

180. Component 4 of the project specifies an outcome for **effective monitoring and evaluation (M&E) of project impact**. Project M&E designed and implemented. To ensure the M&E process, key project activities proposed under Component 4 include: establishment of a Project Steering Committee (PSC) to be met at least once a year, and subsequent technical working groups (TWGs) for the three components; carrying out a Project Inception Workshop within the first three months of project start and prepare an Inception Report; design and implementation of the monitoring and evaluation framework including the definition of impact indicators and the design of a detailed monitoring plan; undertaking day-to-day monitoring of the overall project activities as well as periodic progress reviews and associated effectiveness evaluations; development of project annual work-plans on planned project activities and outputs; carrying out an independent project mid-term external evaluation (after 30 months of implementation) and an independent project final evaluation (at project completion); and preparation of a Project Terminal report.

181. **Project monitoring and evaluation design** is evaluated as **satisfactory**.

182. **M&E Implementation**. The M&E system is in place, permanently used and is facilitating the timely tracking of progress. In particular, PMU is using all the set of indicators provided in the PRF to track results and progress towards project objectives. Targets and indicators are also being adequately reviewed annually by PMU as part of the internal evaluation and planning processes.

183. **Relevant stakeholders** have been fully engaged and committed to the delivery of project results. The project has constituted 3 TWGs, members of which are from different institutions and project partners, which contribute their input continuously. This has resulted in **most work progress achieved as scheduled**. The outbreak of COVID-19 has delayed some activities but not the main output.

184. **Project monitoring and evaluation implementation** is evaluated as **satisfactory**.

III.B.6 *Monitoring of long-term changes*

185. The project document describes anticipated **long-term changes in reducing the current and future releases of U-POPs** in the environment resulting from the project.

186. To maintain the project results in achieving a **long-term reduction of U-POPs releases through BAT/BEP implementation**, as proposed in the risk mitigation measures, the project intends to strengthening policy and regulatory framework, developing national standards, awareness raising and capacity building, knowledge transferred to the enterprises, and supporting close stakeholder consultation and active participation of the private sector. To ensure the effective and economic reduction of U-POPs releases, pilot facilities have been identified and have provided concrete co-financing commitment to the project. It is anticipated that some of Thailand's experience gained during the realization of the project can be replicated elsewhere.

187. **Project monitoring of long-term changes** is evaluated as **satisfactory**.

III.B.7 *Project coordination and management*

188. **Cooperation strategies** arranged in the context of the current project are described in the project document. Component 4 involves maintaining **coordination and transparency throughout the project cycle** – “generating and ensuring systematic support for managing all activities related to monitoring, evaluation and reporting on progresses and results of the project in order to guarantee the achievement of project objectives, as well as to promote the internal circulation of knowledge and the external dissemination of the results of the project”.

189. **A project management** structure is created “to allow coordination between project partners and the establishment of a system for monitoring & evaluation of the impact and the sustainability of the project activities”. The project provides “support to all key stakeholders, particularly DPIM, MONRE, ISIT, metal recycling companies, and SMEs, in order to strengthen the coordination and cooperation mechanisms” in the management and dissemination of the project results. The coordination with other relevant GEF-financed projects being implemented in Thailand as well as other initiatives on BAT/BEP such as the Regional BAT/BEP Forum for East and South East Asia (ESEA), is described.

190. **Cooperation with key government agencies and stakeholders in the metallurgical sector** is crucial to improve legal and regulatory framework necessary to increase control and reduce U-POPs releases from scrap metal value chain. A focus will be placed on facilitating the dialogue and engaging stakeholders in the project to improve environmental compliance and reducing pollution in the metallurgical sector.

191. **Based on the information available** from the PMU, as of June 2021, the PSC has met 1 times (19/11/2019, no other meeting report available); the TWG 1 has met 6 times (dated 14/08/2019, 20/09/2019, 23/12/2019, 25/02/2020, 25/03/2020 and 24/06/2020); the TWG 2 has met 5 times (dated 30/08/2019, 11/10/2019, 08/01/2020, 10/03/2020, 10/04/2020); and the TWG 3 has met 5 times (dated 30/08/2019, 11/10/2019, 14/01/2020, 17/03/2020, 25/06/2020). All PCS and TWGs produced official minutes of their meetings.

192. There are a number of project component **progress reports and knowledge materials** available through the official website of the project and the PMU repository. Since the project started operation (1 June 2016), a total GEF financing of USD 2,428,750 (accounting for 52.26 percent of the total budget) has been expended on project activities as reflected on the UNIDO Open Data Platform (as of 13 June 2021, or 62 percent of the planned project timeline). The balance (USD 2,219,027) of the total project budget (USD 4,647,777) is being utilized and expected to be utilized before 31 July 2024 as planned.

193. **The project currently** has 23 % implementation with a total expenditure of US\$ 1,013,523.74 as of June 30, 2020. Activities under Components 1, 2 and partly 3 were subcontracted to reputable national institutions under open competition constituting around 92 % of the current expenditures. Main expenditure envisaged is under Component 3 comprising of the subsidy to the partner companies on BAT/BEP investments in their facilities which should be the main activity for the next reporting period.

194. **Project coordination and management** is evaluated as **satisfactory**.

III.C Assessment of gender mainstreaming

195. The project document **incorporates gender sensitive project results framework**, including **gender sensitive actions**, indicators, targets, and resource allocation and project documents elaborate on how gender equality and women's empowerment issues are expected to be mainstreamed into the project implementation and monitoring. During the PPG, a **gender analysis** was conducted, with a gender analysis matrix developed and gender-sensitive indicators recommended. As part of the project activity implementation, for example, sex-disaggregated data have been collected for individuals engaged in the TWGs meetings

196. **The project fully complies with gender mainstreaming strategies** as reflected in the project document ensuring participation of both men and women in the decision-making process and reporting of gender-sensitive indicators in its activities.

197. All activities under 3 components was conducted with **gender balanced participation**, rationale rates of female, 30 – 65 percent of participants, such as PSC and TWGs members, key person of project partners and consultant teams. Project questionnaires, news and other PR media have been distributed to all stakeholders in scrap metal supply chain in Thailand by post, email, and website and telephone communication. All relevant activities will ensure **sex-disaggregated indicator reporting**.

198. **Rating on gender mainstreaming** is **Highly Satisfactory**.

III.D Overall assessment

199. The assessment of the project is summarized in the table below.

Table 4: Summary of Assessment and Ratings for the project Evaluation criteria

	Evaluator's summary comments		Rating
A	Project Design	Project design has a logical framework approach. It based on the evaluation of the actual situation and represent very good base for the solution of project problems. Adequate methods and indicators proposed to track results and monitor progress.	HS
B	Implementation performance		
1	Relevance	The Project is significant in terms of contributing towards solving of the emission U-POPs problems in the country. Project achieved objectives correspond with national strategy and regulation on hazardous chemicals, Stockholm Convention on POPs measures and is consistent with the GEF6 strategy on Chemicals and Waste.	S
2	Effectiveness	Project efficiency is high, the planned results were obtained, all outputs report adequate progress in the realization of the outputs targets. Project objectives for the evaluation period within the reasonable timeframe affected by the pandemic situation, but with reasonable quality.	S
3	Efficiency	Due to good project management is an actual project efficiency is high, the planned results are obtained and the objective are achieved in the reasonable timeframe with the respect of complicated actual conditions due to the pandemic situation.	S
4	Sustainability of project outcomes <ul style="list-style-type: none"> - Financial - Socio-political - Institutional and governance - Environmental 	There is no any significant risk identified for socio-political, institutional and governance, and environmental situation, some potential financial risks identified regarding future financial sustainability.	MS
5	M & E systems <ul style="list-style-type: none"> - M&E Design - M&E implementation - Budgeting and funding M&E 	Project has an adequate design with appropriate and suitable indicators, M&E system is suitable and effective as far as project management. The monitoring was continued throughout the project implementation and was used to optimize activities and ensure effective use of financial	S

		resources. Budget is used effectively for M&E activities.	
6	Monitoring long-term changes	The main aspect of the potential long-term problems is financial sustainability of future financial support concerning to the following activities connected with the project results.	MS
7	Project coordination & management	Project is being effectively coordinated, project management is well organized and effective, supervision of UNIDO effective part of the project realization.	S
C	Gender mainstreaming	Project very fully complies with gender mainstreaming strategies.	HS
Overall assessment		S	

IV. CONCLUSIONS, RECOMMENDATIONS

IV.A Conclusions

200. Overall, **all project tasks** have been executed efficiently and successfully achieved by national institutions contracted as service providers of the project in close collaboration with the PMU and DPIM. The PSC and TWG member provide strong support on the project implementation and meets regularly to assess and provide recommendations to ensure the timely and effective delivery of project results. The main critical problems of the Thailand in this subject were identified and a broad range of environmental risks was assessed.

201. **The main challenge** at the moment is the investment commitment of the demonstration facilities which has been heavily impacted by the economic issues associated with the Covid-19 pandemic. This has resulted to the need of engaging **more private sector partners** to ensure that the project attain its commitment in terms of the global environmental benefits.

202. **Relevant stakeholders** have been fully engaged and committed to the delivery of project results. The project has constituted 3 TWGs, members of which are from different institutions and project partners, which contribute their input continuously. This has resulted in most work progress achieved as scheduled. The outbreak of COVID-19 has delayed some activities but not the main output.

203. This **highly-relevant project** is being effectively managed by a dedicated project management unit under the adequate guidance and supervision of UNIDO. The active involvement of key partners and stakeholders is contributing to its effective implementation. At the midterm, the project has performed satisfactorily particularly for its part connected with the increasing of awareness raising and demonstration project component and it is on the right track to achieve all its objectives.

204. **The pilot and demonstration projects** proposed new technologies for solving the most significant emissions of U-POPs problems of Thailand.

205. **The results of the project** are likely to be **sustainable** and some deliverables are already being used, to some extent to solve environmental problems of the Thailand.

206. Main **risks** for project sustainability are lack of financing for environmental programmes, the current state of environmental legislation and lack of interest from private businesses.

207. **The project currently has 23 % implementation with a total expenditure of US\$ 1,013,523.74 as of June 30, 2020.** Activities under Components 1, 2 and partly 3 were subcontracted to reputable national institutions under open competition constituting around 92 % of the current expenditures. Main expenditure envisaged is under Component 3 comprising of the subsidy to the partner companies on BAT/BEP investments in their facilities which should be the main activity for the next reporting period.

IV. B Recommendations

208. For continued relevance, sustainability of the project results and impact, the following recommendations are addressed to the various key stakeholders of the project:

To UNIDO:

1. Project represents good example for other countries, experiences can be used during the preparation and implementation of this type of project concerning to the U-POPs emission reduction and elimination.

To UNIDO, PSC:

2. One of the important project outputs was the development of pilot projects to demonstrate new technologies to reduction of emissions of U-POPs in Thailand. The pilot projects have shown potential to attract investments for development of applicable environmental technologies to reduce U-POPs emissions and chemical pollution. A mechanism should be developed to catalyze investments in order to meet the targets of the National Implementation Plan of the SC on POPs and other relevant national strategic documents and approaches.

3. It is necessary to continue the identification and inventory of all U-POPs emission sources. The inventory needs to be closely connected with similar inventories in other parts of the country and the on-going national inventory on persistent organic pollutants under the Stockholm Convention on POPs.

4. The project has delivered a set of useful results valuable for future projects concentrated on tackling the environmental problems of Thailand. To make the project results and the positive experiences gained from its implementation available, the project management needs to ensure that results are communicated to all stakeholders, decision makers, the scientific community and the broader public.

5. The project management should ensure, to the extent possible, that the project results, conclusions and recommendations are used in the development of the National Implementation Plan of the Stockholm Convention on Persistent Organic Pollutants for Thailand.

6. As very useful tool of this project was the networking of academia and public institutes, it will be very useful to continue in this especially as far as continuation of the proposed training activities. Education and awareness raising are key elements of the successful implementation of the project conclusions and the Stockholm Convention on POPs measures.

ANNEXES

Annex 1: TOR of the evaluation

Annex 2: List of documents consulted

Based on the project database available in-house from UNIDO Thailand Office and PMO, as well as from UNIDO and GEF online repository, documents created through the life cycle of the project are listed as follows.

Document Type and Title	Document Source
1. Project Concept and Preparation (Backgrounds and Baselines)	
<ul style="list-style-type: none"> GEF Secretariat Review (2015) 	GEF official website: https://www.thegef.org/project/greening-scrap-metal-value-chain-through-promotion-batbep-reduce-u-pops-releases-recycling
<ul style="list-style-type: none"> GEF Project Identification Form (PIF) as submitted to GEF (2015) 	
<ul style="list-style-type: none"> GEF Council notification (2018) 	
<ul style="list-style-type: none"> STAP Review (2016) 	
<ul style="list-style-type: none"> Annex I: Environmental and Social Management Plan (ESMP) 	UNIDO Open Data Platform https://open.unido.org/projects/TH/projects/150186
<ul style="list-style-type: none"> Annex D: Environmental and Social (E&S) Screening Template – Revision.1 (2015) 	UNIDO Open Data Platform https://open.unido.org/projects/TH/projects/150186
2. Project Charter and Management Plan	
<ul style="list-style-type: none"> Project document as certified by the GEF Agency (UNIDO) (2017) 	GEF official website: https://www.thegef.org/project/greening-scrap-metal-value-chain-through-promotion-batbep-reduce-u-pops-releases-recycling
<ul style="list-style-type: none"> Project Management Plan/Annual Work Plans 	Detailed and described in the project document (2017).
3. Project Status Reports	
<ul style="list-style-type: none"> GEF project monitoring with updates on project-related documents, financials and timeline 	GEF official website: https://www.thegef.org/project/greening-scrap-metal-value-chain-through-promotion-batbep-reduce-u-pops-releases-recycling
<ul style="list-style-type: none"> Project estimated timeline and progress 	UNIDO Open Data Platform https://open.unido.org/projects/TH/projects/150186
<ul style="list-style-type: none"> Project Inception Report 	
<ul style="list-style-type: none"> Project implementation reports and technical documents – annual management and monitoring through meetings of the PSC and three WGs organized and participated by PMU, UNIDO, and project partners 	Documentations are available from PMU (a zipped folder shared through email).
<ul style="list-style-type: none"> Project component progress reports and knowledge materials – developed by respective responsible institutions (contractors), submitted and endorsed by the PSC 	Documentations are available from PMU (a zipped folder shared through email).
4. Project Communication	

Document Type and Title	Document Source
<ul style="list-style-type: none"> Project official website showcasing activities and relevant knowledge and information for project partners, project stakeholders, and the general public 	[Online] https://greenscrapmetalthailand.com/ , managed by the PMU (in Thai and English languages)
<ul style="list-style-type: none"> Project communication featuring on partner institutions' websites – demonstrating relevant information about the project, news related to activities within the project, project events and participation of project partners 	http://www.dpim.go.th/ https://www.pcd.go.th/hazards/ https://www.deqp.go.th/new/ https://news.isit.or.th:8080/isit/ https://www.unido.org/ https://www.thegef.org/topics/chemicals-and-waste https://www.biswsteel.com/ https://www.dik-th.in.th/th https://www.tatasteelthailand.com/ https://www.thaimetal.co/en/
5. Project Budget Tracker	
<ul style="list-style-type: none"> Project financial information by year 	UNIDO Open Data Platform https://open.unido.org/projects/TH/projects/150186
6. Lessons Learned Review	
To be identified	

Annex 3: Relevant stakeholder consultation documents

No.	D-M-Y	Activities/topics
1	14-Aug-2019	Technical Working group for Component 1 (TWG1) meeting with consultant
2	30-Aug-2019	Technical Working group for Component 2 (TWG2) meeting with consultant
3	30-Aug-2019	Technical Working group for Component 3 (TWG3) meeting with consultant
4	20-Sep-2019	TWG1 meeting with consultant
5	10-Oct-2019	TWG3 meeting with consultant
6	11-Oct-2019	TWG2 meeting with consultant
7	19-Nov-2019	Project Steering Committee (PSC) Annual meeting with TWGs
8	20 to 22 Nov-2019	Meeting with project partners at 4 facilities
9	23-Dec-2019	TWG1 meeting with consultant
10	24- Dec-2019	Discussion on training program development and IT system
11	8-Jan-2020	TWG2 meeting with consultant
12	14-Jan-2020	TWG3 meeting with consultant
13	25-Feb-2020	TWG1 meeting with consultant
14	10-Mar-2020	TWG2 meeting with consultant
15	17-Mar-2020	TWG3 meeting with consultant
16	25-Mar-2020	TWG1 meeting with consultant
17	20-May- 2020	Consultation on training program development for 3 Components with 3consultants
18	23-Jun-2020	TWG2 meeting with consultant
19	24-Jun-2020	TWG1 meeting with consultant
20	25-Jun-2020	TWG3 meeting with consultant

1. 9222_TWG1 meeting summary report 14 Aug 2019.pdf
2. 9222_TWG2 meeting summary report 30 Aug 2019.pdf
3. 9222_TWG3 meeting summary report 30 Aug 2019.pdf
4. 9222_TWG1 meeting summary report 20 Sep 2019.pdf
5. 9222_TWG3 meeting summary report 10 Oct 2019.pdf
6. 9222_TWG2 meeting summary report 11 Oct 2019.pdf
7. 9222_PSC meeting summary report 19 Nov 2019.pdf
8. 9222_Back to office 20to22Nov19mission report.pdf
9. 9222_TWG1 meeting summary report 23 Dec 2019.pdf
10. 9222_Discussion on Training program development and IT.pdf
11. 9222_TWG2 meeting summary report 8 Jan 2020.pdf
12. 9222_TWG3 meeting summary report 14 Jan 2020.pdf
13. 9222_TWG1 meeting summary report 15 Feb 2020.pdf
14. 9222_TWG2 meeting summary report 10 Mar 2020.pdf
15. 9222_TWG3 meeting summary report 17 Mar 2020.pdf

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16. 9222_TWG1 meeting summary report 25 Mar 2020.pdf

 17. 9222_3 Components Training Modules consultation 20 May 2020

 18. 9222_TWG2 meeting summary report 23 Jun 2020.pdf

 19. 9222_TWG1 meeting summary report 24 Jun 2020.pdf

 20. 9222_TWG3 meeting summary report 25 Jun 2020.pdf

Annex 4: List of persons interviewed

<p>Ms. Carmela Centeno Stockholm Convention Unit, UNIDO Headquarters, Vienna International Centre, Wagramerstrasse 5 P.O. Box 300, A-1400 Vienna, AUSTRIA E-mail: c.centeno@unido.org</p>	<p>Ms. Warawan Chalermot Project Manager, Greening the Scrap Metal Value Chain through Promotion of BAT/BEP to Reduce U-POPs Release from Recycling Facilities Project Management Unit (PMU) 6th Floor, Innovation in Raw Materials and Primary Industry Division, Department of Primary Industries and Mines Building, 75/10 Rama 6 Road, Phayathai, Ratchathevee Bangkok 10400 Thailand Tel +66 2 202 3906 E-mail: w.chalermot@unido.org</p>	Others
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- International technical consultant, National consultants

<p><u>International Consultant</u> Mr. Pasquale Spezzano International expert for BAT/BEP application in metal industry E-mail: pasquale.spezzano@enea.it; pasquale.spezzano@teletu.it</p>	<p><u>Contractor: Component 1 - Project Manager</u> Prof. Dr. Siwatt Pongpiachan Director of NIDA Center for Research & Development of Disaster Prevention & Management National Institute of Development Administration (NIDA), Floor 16,17 Navamindradhiraj Building, 148 Moo3, Serithai Road, Klong-Chan, Bangkokapi, Bangkok 10240 Thailand Tel: +66 2 7273113 Fax: +66 2 3750941 E-mail: pongpiajun@gmail.com</p>	<p><u>Contractor: Component 2 - Project Director</u> Assoc. Prof. Dr. Sutha Khaodhilar Director, Center of Excellence on Hazardous Substance Management (HSM), Chulalongkorn University Research Building Chulalongkorn University, 8 Floor, Phayathai Road, Pathumwan, Bangkok 10330 Thailand Tel: +66 2218 3952 to4 Fax: +66 02 219 2251 E-mail: sutha.k@chula.ac.th</p>
<p><u>Contractor: Component 3 - Project Director</u> Mr. Wirote Rotewatanachai President, Iron and Steel Institute of Thailand (ISIT) Bureau of Industries Sector Development Bldg., 1-2 Floor, Soi Trimitr, Rama 4 Rd., Prakanong, Klongtoey, Bangkok 10110, Thailand Tel: +66 2 713 6290 Fax: +66 2 713 6550 E-mail: wirote@isit.or.th</p>		

- All relevant national member of Project team mainly persons responsible for all Project components and leaders of WGs (if they are not the same)

<p><u>Former PSC Chair since project establishment and PPG development</u> Mr. Nirun Yingmahisaranon Former, Deputy Director-General, Department of Prime Industries and Mine (DPIM) Tel: +66 2 202 3165 Fax: +66 2 202 3060</p>	<p><u>Current PSC Chair and National Project Director (NPD)</u> Mr. Aditad Vasinonta Deputy Director General, Department of Prime Industries and Mine (DPIM), 3rd Floor, 75/10 Rama 6 Road, Phya Thai, Rajthevi, Bangkok, Thailand 10400</p>	<p><u>Chair of TWGs and National Project Coordinator (NPC)</u> Ms. Salila Yanyongsawat Director, Innovation Raw Materials and Primary Industries Division, DPIM, 6th Floor, 75/10 Rama 6 Road, Phya Thai, Rajthevi, Bangkok, Thailand 10400 Mobile: +66 86 535 8240</p>
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Mobile: +66 97 987 8916 E-mail: nirun08@gmail.com	Tel/Fax: +66 2 202 3715 Mobile: +66 90 880 8058 E-mail: aditad@dpim.go.th	E-mail: salila@dpim.go.th
<u>Key person/contact point of the project for Thai government; Technical Task Force for PPG development and Secretariat for PSC, TWG1 and TWG3</u> Dr. Kittiphan Bangyikhan Chief of Factory Development and Technical Support Group Department of Primary Industry and Mines (DPIM), 75/10 Rama 6 Road, Phya Thai, Rajthevi, Bangkok, Thailand 10400 Tel: +662 202 3901 Fax: +662 202 3902 E-mail: kittiphanb@gmail.com	<u>Thailand GEF OFP/NFP representative and PSC Member</u> Ms. Wacharee Chuaysri Environmental, Senior Professional Level, International Affairs Division Office of Permanent Secretary of Ministry of Natural Resources and Environment (OPS/MoNRE), Soi Phahonyothin 7, Phahonyothin Road, Phayathai, Bangkok, Thailand, 10400 Tel: +66 2 265 6236, +66 2 278 8623 Fax: +66 2 265 6192 E-mail: bee_wacharee@gmail.com	<u>TWG 3 Member (Government-DIP)</u> Mr. Arthit Pattanpongchai Policy and Planning Analyst, Senior Professional Level Division of Innovation and Industrial Technology Development Department of Industrial Promotion 6/86Soi Trimit, Rama 4rd., Klongtoey, Bangkok 10110 Thailand Tel: +66 2 2024591 Mobile: + 66 611493 692 Email: artite@gmail.com
<u>PSC Member (Government)</u> Dr. Ruchaya Boonyatumanond Environmental, Senior Professional Level, Environmental Research and Training Center Department of Environmental Quality Promotion (DEQP), Technopolis, Klong Luang, Klong 5, Pathumthani, Thailand, 12120 Tel: +66 2 577 4182 ext 1224 Fax: +66 2 577 1138 E-mail: ruchaya2007@gmail.com	<u>Technical Task Force for PPG development and Member of TWG1</u> Ms. Kanchana Suaysom Senior Professional Environmental Officer, Air Quality and Noise Management Division Pollution Control Department (PCD), 92 Phahonyothin Soi 7, Samsennai, Payathai, Bangkok, 10400 Thailand Tel: +66 2 298 2293 Fax: +66 2 298 2304 E-mail: suaysom@hotmail.com ; kanjana.s@pcd.go.th	<u>PSC Member (Private Sector)</u> Dr. Ittipon Diewwanit Representative of the Federation of Thai Industries (FTI) Millcon Steel PLC., 52 Thaniya Plaza Building, 29 th Floor, Silom Road, Suriyawongse, Bangrak, Bangkok, 10500 Thailand Tel: +66 2 652 3333 Fax: +66 2 652 9598 E-mail: ittipon_d@millconsteel.com

- Relevant stakeholders who participated on the project realization – ministerial, industry, NGO

<u>Pilot Facility (Installation the aluminum Scrap processing as BAT/BEP application in factory has completed and operated)</u> Ms. Panitchanan Chuen-arom Environmental Manager/ HR & GA Manager Daiki aluminum Industrial (Thailand) Co., Ltd., 700/99 Moo 1 Bankao, Panthong, Chon Buri 20160 Thailand Tel: +66 38 468 441 ext. 205 Mobile: +66 92 709 7272 Fax: +66 38 214 572 E-mail: personnel_007@dik-th.in.th ; safety_1@dik-th.in.th	<u>Pilot Facility (Installation the iron Scrap processing Unit1 as BAT/BEP application in factory has completed and operated. Unit2 is under procurement process.)</u> Mr. Wichan Wanna Senior Department Manager – Engineer & IT N.T.S. Steel Group PCL Co., Ltd., 351 Moo 6, Bowin, Sriracha, Chonburi, Thailand, 20230 Thailand Tel: +66 38 345 355 ext 110 Fax: +66 38 345 350 E-mail: wichanw@tatasteelthailand.com	
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Basic topics of discussion with all:

- 1) Main project goals and their performance – your Component or WG
- 2) Main project results – your Component or WG

- 3) Main problems during realization — your Component or WG
- 4) Legal background of project and effectiveness of the legal measures
- 5) How the project results will be implemented to the national environmental policy
- 6) Possible risks for results sustainability in future
- 7) Was the project cost effective?
- 8) Has the project produced results (outputs and outcomes) with the expected time frame?

Annex 5: List of on-line links for evidence of project coverage by the media

9222_ Project website (www.GreenScrapmetalThailand.com)

9222_ Project Facebook page: **โครงการจัดการเศษโลหะอย่างยั่งยืน** Green Scrap Metal Thailand Project

9222_ Videos, please access via project web site for

- Project introduction 1 minute

- Overview of Dioxin and BAT/BEP in Scrap Metal Supply Chain 3 minutes

9222_ Flyer for PR video clip contest “How to recycle the scrap metal and eliminate U-POPs” application period dated from 1 July 2020 to 31 August 2020 (9222_Flyer for VDO contest.pdf)

Annex 6: Mid-term Review (MTR) UNIDO-GEF-Thailand Greening the Scrap Metal Value Chain through Promotion of BAT/BEP to Reduce U-POPs Release from Recycling Facilities. National Expert Report on Deliverables and Inputs to the MTR Report