

The Republic of the Philippines
Department of Environment and Natural Resources

**The Project for Capacity Development on
Improving Solid Waste Management through
Advanced/Innovative Technologies
in
The Republic of the Philippines**

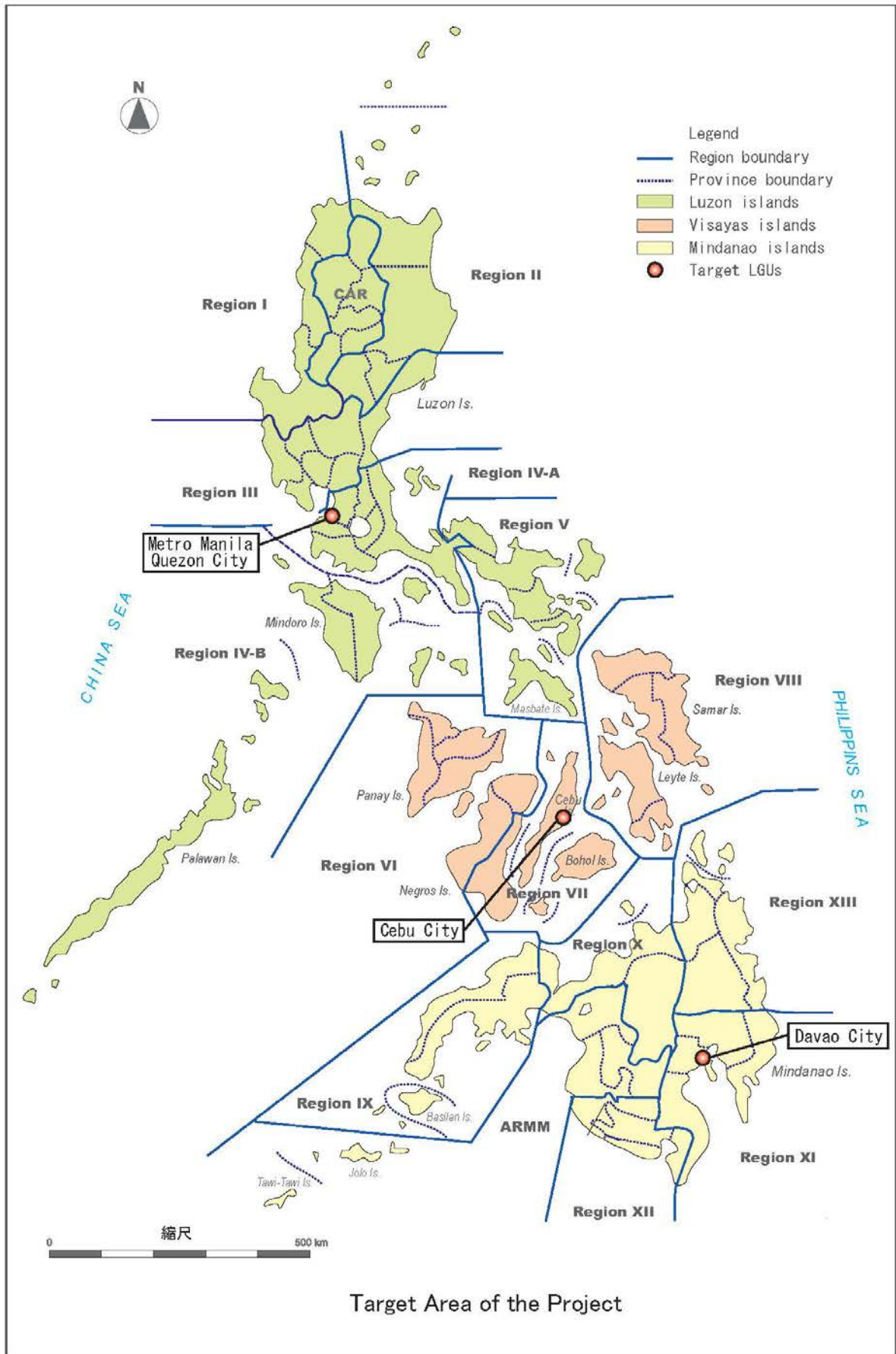
**Project Completion Report
Volume1: Main Report**

March 2023

Japan International Cooperation Agency (JICA)

Nippon Koei Co., Ltd.
Eight-Japan Engineering Consultants Inc.

GE
JR
23-002



**Project Photos
Output1**



Meeting with EMB(PMO) and FASPS
(March, 2019: DENR)



Kick-off meeting at DENR
(April, 2019: DENR)



Meeting with DOST
(June, 2019)



ITWG Sub-Group meeting for OP1
(February, 2020: DENR-EMB)



Meeting with PMO about PMS (Ver.2)
(March, 2020: DENR-EMB)



3rd Sub-group Meeting for OP1
(June, 2020)



DOE Closure Meeting
(October, 2022)



Meeting with MMDA
(November, 2022)

Output2



Meeting with Assistant City Administrator of Davao City
(March, 2019: with Sewage project team in Davao City)



Meeting with Davao City ENRO about the project overview
(March, 2019: Davao City)



Meeting with Cebu City ENRO and EMB Region VII
(March, 2019: Cebu City)



Courtesy Call to Assistant City Administrator
(September, 2019: Cebu City)



Meeting with Quezon City-EPWMD
(October, 2019: Quezon City)



Meeting with PPP Center
(November, 2019: PPP Center)



San Pablo City SLF (Category 3)
(May, 2022)



Davao City New Carmen SLF
(July, 2022)

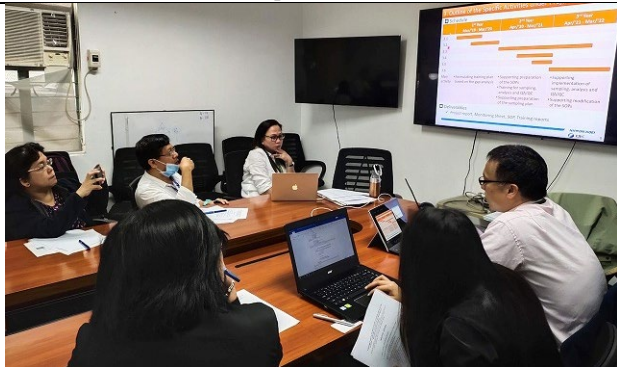
Output3



Meeting with EQMS
(April, 2019)



Training on Analysis Method of Dioxin Test Results
(October, 2019: ERLSD)



ITWG Sub-Group Meeting for OP3
(February, 2020: DENR-EMB)



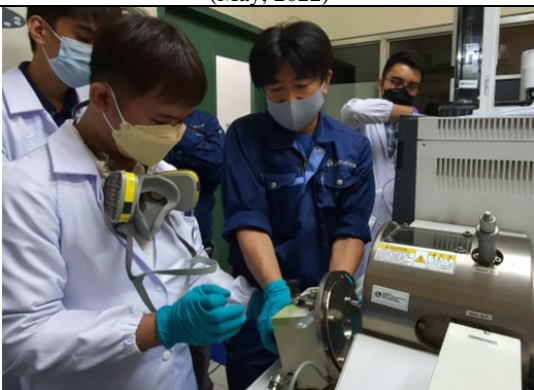
Training at ERLSD
(May, 2022)



Training at ERLSD
(May, 2022)



Training at ERLSD
(May, 2022)



Training at ERLSD
(May, 2022)



Training at ERLSD
(May, 2022)

Output4



**Eco-Fence Made of Used PET bottles
(March, 2019: Cebu City)**



**Site Visit to a Composting Facility
(March, 2019: Cebu City)**



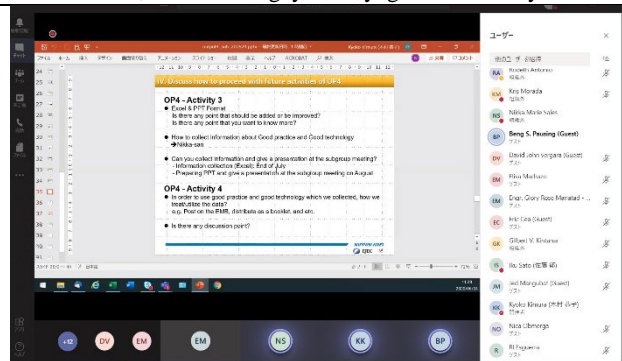
**Meeting with Quezon City
(April, 2019: DENR)**



**Site Visit to MRF
(June, 2019: Barangay Mahayag in Davao City)**



**ITWG Sub-Group Meeting for OP2 & 4
(February, 2020: DENR-EMB)**



**2nd Sub-group Meeting for OP4
(June, 2020)**

Others (JCC and Seminar)



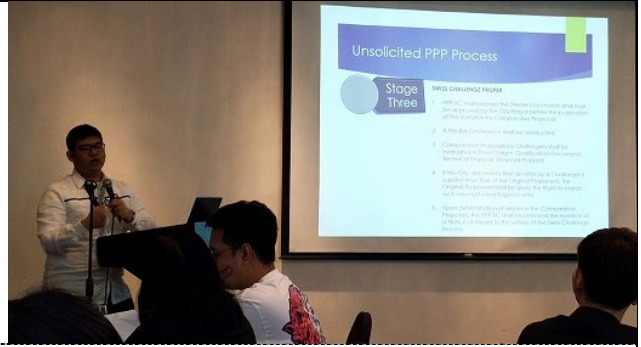
**JCC Preparatory Meeting
(June, 2019)**



**Panel Discussion on "PPP WTE Project"
(August, 2019: RE/WTE forum by PPPC/ADB)**



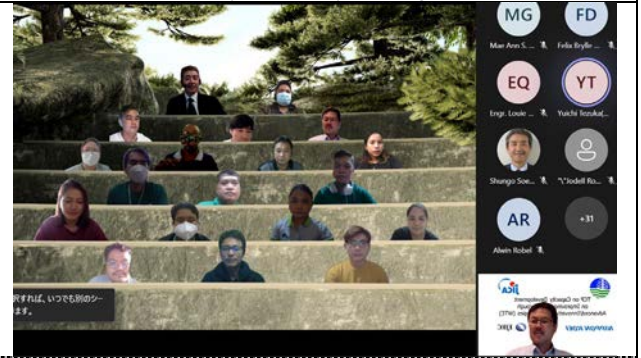
1st ITWG Meeting
(January, 2020: Sulo Riviera Hotel)



Kick-off Seminar Presentation of Quezon City
(February, 2020: Joy Nostalg Hotel)



1st JCC Meeting
(February, 2021)



Online Training
(November, 2021)



1st Technical Dissemination Seminar
(June, 2022)



2nd Technical Dissemination Seminar
(September, 2022)



3rd JCC Meeting
(December, 2022)



Final Seminar
(December, 2022)

Executive Summary

Chapter 1. Introduction

This technical cooperation project was implemented from March 2019 to December 2022¹ by the Department of Natural Resources and Environment (DENR) of the Republic of the Philippines as the implementing agency, with the Project Purpose of "National government. It targeted local government units (LGUs') capacity for improving solid waste management utilizing Waste to Energy (WTE) and other solid waste management SWM technologies is enhanced."

The project team, consisting of the government agencies of the Philippines and the JICA Expert Team (JET), implemented the activities for four outputs based on the Project Design Matrix (PDM) to achieve the above Project Purpose over the project period of approximately four years. The results of each project activities are reported in this Project Completion Report (PCR).

The project is unique in that, in addition to the Joint Coordination Committee (JCC), which is the decision-making body for the project, an Inter-Agency Technical Working Group (ITWG) was organized by the relevant agencies of the Philippines. The progress and deliverables of output activities were discussed at the Sub-Group (SG) meetings, followed by the ITWG meetings, and then the JCC meeting for final decisions.

Chapter 2. Results of Project Activities

2.1. Activities Related with All Outputs

This chapter summarizes the results of the JCC, ITWG, and SG meetings, the deliverables prepared and submitted by the project team, the process of preparing and revising the PDM and PO, and the results of publicity activities, seminars, capacity assessments, and online training.

Originally the project planned to conduct training in Japan twice, however, due to the global spread of COVID-19, it became difficult to conduct the training in Japan, so the training was replaced by 1time online training in November 2021.

In addition, the DENR Administrative Order (DAO) on WTE approved on 26th November 2019, which provides the institutional framework for the introduction of WTE technologies in the Philippines, and the WTE Bills, which are still being proposed and discussed in the Senate and House of Representatives of the Philippines, were reviewed and studied over the project period to examine consistency with the project activities and deliverables.

2.2 Activities for Output 1

In Activity 1-1, based on the National Solid Waste Management Commission (NSWMC) Resolution No. 669 issued in June 2016, the case study analysis for the Best Available Technologies and Best Environmental Practice (BAT/BAP) guideline was conducted utilizing the information of good practices and technical information on WTE in the preceding neighboring countries. The "Case Study Analysis Report on BAT/BEP Guidelines" compiled through this activity was approved at the 2nd JCC meeting and is appended to this PCR. This deliverable will be useful as reference material for LGUs that are planning or conceptualizing WTE projects in the Philippines, and the DENR Environmental Management Bureau (EMB) will compile the "BAT/BEP Guidelines" as required by NSWMC Resolution No. 669 based on the results of this analysis.

In Activity 1-2, WTE policies and mechanisms including cost-sharing schemes in the neighboring countries were studied. The major sources of income for LGUs and possible funding sources for SWM

¹ According to Record of Discussion (R/D) agreed between JICA and DENR, the project period is until December 2022. For compilation and editing of the PCR based on the comments by the Philippine CP organizations on the report, the submission date of the report was March 2023.

improvement were investigated since additional funding by LGUs is required to improve SWM including WTE. In addition, the cost-sharing schemes for WTE introduction in the neighboring countries were investigated, and the schemes of Japan and Indonesia were identified as reference cases for the Philippines. Feed-in Tariffs (FIT) for WTE projects in Southeast Asian countries were investigated as well. DENR-EMB and LGUs will need to proceed with the establishment of a system to ensure the financial viability of WTE projects based on these information.

In Activity 1-3, Technology Dissemination Seminars were held twice in June and September 2022 to disseminate information on WTE technology to the stakeholders in the Philippines. The seminar was held in a hybrid mode due to the COVID-19 pandemic, with over 100 people participation in each session, sharing the results of the project activities and engaging in active discussions on the introduction of WTE technology in the Philippines.

Activity 1-4 developed technical standards for appropriately controlled combustion with power generation facilities, so called WTE-ACC. The WTE guidelines (NSWMC Resolution No. 669 and DAO 2019-21) developed in the Philippines in the past recent years do not specify in detail the technical requirements for WTE-ACC facilities and other WTE technologies. For quality control of WTE facilities, it is essential that the DENR-EMB develop minimum technical standards. The project team has compiled a draft of "Technical Standard for WTE-ACC" following discussions and deliberations at the SG and ITWG meetings. This draft technical standard was approved at the 2nd JCC meeting and was appended to the PCR. It is expected that the adoption of this technical standard will lead WTE projects with appropriate technical quality in the Philippines.

In Activity 1-5, the management of incinerator ash generated from WTE facilities was studied and discussed. Since waste incinerator ash, especially fly ash, generated from the operation of WTE facilities may contain hazardous substances, it is essential to establish standards and procedures for the proper management, treatment, and disposal of residual ash. The handling of hazardous waste in the Philippines is regulated by the "Hazardous Waste Management Act" (RA 6969) and the "Revised Procedures and Standards for Hazardous Waste Management" (DAO 2013-22). This activity reviewed these relevant regulations and conducted a comparative analysis with how they operate in Japan. Since the revision of DAO2013-22 is currently underway at DENR-EMB, the management standards for incineration ash were incorporated into the " Technical Standard for WTE facilities focused on WTE-ACC" established in Activity 1-4.

In Activities 1-6 and 1-7, "the manual for planning, formulation, evaluation, and contract management (PFEC)" for WTE Facilities" was developed as a guide for the LGUs that have no experience in procuring WTE facilities. The manual also includes a "Model Procedures to Introduce WTE Facility ". This manual consists of six (6) chapters and appendix, and summarizes the items that LGUs should consider and pay attention to along the series of project flow such as planning, formation, evaluation of private proposals, contract management, and dismantling of WTE projects. The manual was approved at the 3rd JCC meeting and attached to the PCR. It is expected that this deliverable will be used as reference material for LGUs that conceive and plan WTE projects.

Activity 1-6 made recommendations to update the existing evaluation criteria for the 10-year SWM Plan, which all LGUs are required to prepare. The NSWMC has developed "Guidebook for Formulation of Solid Waste Management Plan" and "Annotated Outline for 10-year SWM plan" as references for the preparation of the 10-year SWM plans by LGUs. Since this guidebook and checklist were developed on the assumption that WTE technology would not be applied, the project team recommended to update the annotated outline which is being used as evaluation criteria of SWM 10-year plan by the EMB, assuming the possibility of adopting WTE technology.

Activity 1-8 reviewed the current legal framework and regulations for final disposal and the need to revise it for the disposal of WTE ash. Since, under the current legal system of sanitary landfills in the Philippines, there are inconsistencies in the structural standards required for sanitary landfills depending on the regulations to which they conform. the project team proposed modifications to the structural standards

of sanitary landfill for the disposal of incinerator ash, dividing them into two categories: those for landfill disposal of non-hazardous waste and those for landfill disposal of hazardous waste.

The achievement status of Output 1 is as follows.

- The delayed appointment of the counterpart personnel and COVID-19 pandemic had caused the changes in the scheduled implementation of some activities which resulted in the revision of the plan of operation.
- The meeting agenda including technical presentations for SG meetings were initiated by JET during remote communication among the project team members due to the COVID-19 Pandemic. and t
- The case study analysis for BAT/BEP guidelines were initiated also drafted by JET with substantial inputs from DENR and sub-group members.
- The deliverables of the project such as the technical standards and the case study analysis for BAT/BEP guidelines, which have been approved by the ITWG and JCC and endorsed to DENR, would be beneficial recognized as improvement of instructional capacity of the national government.
- It is also believed that the SG members obtained information and knowledge of WTE project and its facilities through discussion in the meeting.

Objectively Verifiable Indicators	Status
1-1.BAT/BEP guideline and Technical Standard for WTE facility (including Standard for O&M of WTE facility) is endorsed by the Project to DENR-EMB for adoption.	Achieved
1-2. Manual for planning, evaluation, formulation and Supervision of WTE project is endorsed by the Project to DENR-EMB for adoption	Achieved

2.3. Activities for Output 2

Activity 2-1 summarized the current status and progress of WTE projects in the target LGUs, which are Quezon City, Davao City, and Cebu City. It was confirmed that the discussion and preparation of WTE projects in each LGU have been suspended due to the change of city administration and the impact of COVID-19.

In Activity 2-2, the 10-year SWM plans provided by the target LGUs were reviewed and analyzed with a focus on waste material flow and waste reduction targets. The plans as a whole were found to have some issues, such as the WTE projects planned by LGUs not being properly reflected in the plans, the lack of clarity on what, when, and to what extent the plans are to be implemented, and the inability to assess the feasibility of the waste diversion rate target value.

In Activity 2-3, the consistency between WTE project plans and land use plans in the target LGUs were examined. The WTE Guideline (NSWMC Resolution No. 669) stipulates the necessity of consistency between the WTE facility location and the land use plan (CLUP) of the LGUs. While the CLUPs of Quezon City and Davao City take SWM facility development into consideration, it was confirmed that the CLUP for Cebu City has not yet been developed. The project team reiterated that WTE project implementation requires the preparation and approval of a 10-year SWM plan that shows WTE location compatibility in the CLUP.

Activity 2-4 analyzed and reviewed the existing feasibility study (FS) reports and project proposals for WTE projects in the target LGUs. In Quezon City, no updated FS was conducted after the WTE project that was in the procurement process as of 2019. In Cebu City, the city received an unsolicited proposal in 2019 and JET reviewed the proposal, provided comments, and recommended that the City should develop

a plan for the City's desired WTE facility. Since the F/S for the WTE project in Davao City was being implemented under Japan Grant Aid², it was difficult for LGU to disclose the information to the project team.

In Activity 2-5, based on the results of Activities 2-1 through 2-4, the points and issues to be considered in the formation of WTE projects in the LGUs were summarized. Issues and challenges associated with WTE projects in the target LGUs include: insufficient tipping fee (T/F), misunderstanding of profitability of SWM PPP projects including WTE projects, understanding of SWM responsibilities of municipalities, need for the technical expertise of SWM in LGUs, the applicability of solicited approaches, clarification of waste category definitions and segregation obligations in the RA9003, data accumulation of municipal solid waste quantity and quality, communication with various stakeholders, long-term and consistent SWM plans, and handling of ETV descriptions and reports were pointed.

Activity 2-6 summarizes the roles and responsibilities of LGUs in WTE projects under PPP schemes. In the formation of WTE projects under the existing PPP scheme in the Philippines, there have been many cases where projects have failed due to inappropriate role-sharing between LGUs and private companies. Optimal risk sharing means that the risk should be shared so that the entity that can better manage the risk bears it. From this perspective, the project team has developed a standard demarcation of tasks between LGUs and private companies for DBO and BOT schemes, respectively.

Due to the suspension of preparations for the WTE projects in the target LGUs and the delay in concluding the Memorandums of Understanding (MOUs) between DENR and the target LGUs on the project implementation, there were some difficulties in the activities with the target LGUs under the Output 2 activities. Therefore, the project team collaborated with the PPP Center (PPPC), a member of the ITWG and the governmental agency providing support for LGUs in their PPP projects, conducted technical reviews and made recommendations for the SWM PPP projects, participated in PPPC's knowledge-sharing sessions, and supported reviewing of the SWM PPP Guide and the Unsolicited WTE-ACC project proposal evaluation guidelines.

In Activity 2-7, the project team continuously visited the target LGUs to identify their technical assistance needs for the formation of WTE projects through consultations, as the WTE projects in the target LGUs did not suitable to prepare draft technical specifications. In Quezon City, the WTE project did not progress after the change of the city administration in 2019, but the officers of Quezon City constantly participated in the JCC and ITWG meetings. In Cebu City, from the end of 2019 to March 2020, the project team provided technical assistance in reviewing of private proposals and setting the basic conditions of the WTE facility, i.e., solid waste amount to be fed to the WTE. In addition, the project team's assistance was requested in reviewing the draft agreement between the LGU and the private proponent, but the activity was suspended due to the COVID-19 pandemic and the change of mayors. Davao City requested the project team's support for the development of a sanitary landfill for the disposal of WTE incineration ash in 2022 when the COVID-19 pandemic had subsided and JET's site work were resumed. The project team provided an example table of contents of the technical specifications for sanitary landfill.

In Activity 2-8, the points to be noted, issues to be addressed, and appropriate methods for the WTE project supervision of the target LGUs were summarized. The procedures for supervision and monitoring organized in this activity and points to be carefully monitored throughout the project were summarized in the PFEC manual prepared in Activity 1-6.

The achievement status of Output 2 is as follows.

² The Project for the Development and Construction of Waste-to-Energy Facilities in Davao City (Grant amount JPY5,013million): By developing and operating waste treatment and power generation facilities in Davao City, it is possible to ensure proper disposal of waste and effective use of the energy contained in waste (Waste to Energy), thereby ensuring safety. Realize hygienic life and contribute to sustainable economic growth through building social infrastructure and promoting investment in the Philippines.
https://www.mofa.go.jp/mofaj/press/release/press4_005826.html

- The restriction in providing information on WTE projects by the target LGUs was a barrier for achievement of the output.
- It is believed that the inputs by the project regarding the WTE project such as suggestions and recommendations must be helpful for LGUs' WTE project. However, the real WTE projects of LGUs were not discussed due to the restriction mentioned above. So, the extent of capacity development of LGUs was limited.
- The WTE projects of LGUs were not progressed as assumed before the project. Accordingly, the status of WTE projects of target LGUs were not appropriate to conduct some activities of the project such as "Activity 2-7. Preparation of technical specification of the WTE project".

Objectively Verifiable Indicators	Status
2-1. Updated 10-year SWM plan which reflected the waste volume reduction target and plan is approved by NSWMC in each Target LGU.	Partially achieved
2-2. Compiled experiences of target LGUs' WTE project in PPP scheme are reported to NSMWC.	Partially achieved

2.4. Activities for Output 3

In Activity 3-1, a review of the current capacity and activities of the central and regional EMB's analytical laboratories was conducted. Based on the equipment owned and the items that can be analyzed, the review covered the EMB Air Quality Management Section (AQMS) and regional offices (units in charge of sample collection) for sampling, and the Environmental Research and Laboratory Services Division (ERLSD) of the central EMB for analysis. It was confirmed that isokinetic sampling of stationary sources, which requires sophisticated technology for dioxin and furan sampling, is already being conducted at AQMS and regional offices, and that ERLSD has implemented highly skilled pretreatment for POPs analysis and appropriate QA/QC.

In Activity 3-2, the training plan was developed to strengthen the monitoring and analytical capacity of the EMB central analytical laboratory for dioxins and furans. As a result of the gap analysis on monitoring plan, sampling, pretreatment, analysis, QA/QC, common issues, and monitoring continuity, the training plan was prepared for developing Standard Operating Procedures (SOP), conducting training on sampling, analysis, and QA/QC, and developing a sampling plan for ambient air.

In Activity 3-3, draft SOPs for QA/QC for ambient air and stationary sources were prepared. Since ERLSD had already prepared a draft SOP based on the US-EPA method for other matrices, this project team reviewed the draft, identified important modifications, and recommended items to be considered when preparing the SOP. The project team also checked the consistency of the draft SOP for ambient air and stationary sources prepared by ERLSD with the reference standard (EPA method) and confirmed its validity by preparing a comparison table. The SOPs finalized through these activities were approved at the 3rd JCC meeting, and the explanation material for the JCC meeting is appended to this PCR.

In Activity 3-4, the training on dioxin and furan sampling, analysis, and QA/QC was conducted with a particular focus on the tuning of the dioxin analyzer (GC/HRMS), customization of measurement conditions, and operation of the software dedicated to data analysis, where ERLSD was having difficulties. During the training process, there were times when it was difficult to proceed with analytical activities due to the impact of COVID-19 pandemic, and there was also a long period of equipment outage due to the failure of the uninterruptible power supply of GC/HRMS, which significantly stalled activities. In addition, an unexpected breakdown occurred in the transfer line of GC/HRMS, but JICA covered the repair cost excluding the cost of parts, which minimized the activity delay. During the training, practical guidance was provided at the ERLSD analysis laboratory on items such as confirmation of standard analysis procedures, analysis equipment maintenance, sampling (preparation of adsorbent/ capturing materials), GC/HRMS

operation verification, standard solution measurement, sample pretreatment, and measurement of certified reference materials in fly ash, etc.

In Activity 3-5, the project team supported the development of a sampling plan for dioxin and furan for air quality. Since the EMB had experience in developing sampling plans and prepared manuals that included instructions on how to set up sampling locations, the project team collected, organized, and provided AQMS with Japanese technical guidelines and environmental impact assessment case studies as reference information for the development of sampling plans for the future introduction of WTE facilities in the Philippines.

In Activity 3-6, the project team supported the implementation of sampling, analysis, and QA/QC for dioxins and furans. Sampling and pretreatment works had initiated for ambient air samples, but analysis of actual samples could not be conducted due to time constraints in this project. Thus, the project team summarized cases requiring reanalysis by using the chromatograms obtained from analyses conducted in Japan and provided explanations to ERLSD. The calculation method of toxicity equivalents was also advised. ERLSD is expected to continue strengthening its capacity to make decisions regarding reanalysis when ideal chromatograms cannot be obtained, as this capacity can only be improved through actual analytical experience and trial-and-error.

The achievement status of Output 3 is as follows.

- Since the COVID-19 pandemic, there was a period of sparse communication with JET, partly due to the urgent tasks assigned to ERLSD, and partly due to force majeure such as GC/HRMS malfunctions. During two years that JET was unable to enter the Philippines, ERLSD proceeded to renovate the EMB central office the laboratory which included incorporating items from the recommendations from JET. Since the resumption of JET visits to the ERLSD lab in March 2022, active communication resumed.
- JICA provided immediate support for the repair of GC/HRMS, which made possible to continue the remaining activities. Even so, the delay due to suspension of the analysis work affected the extent of activities completion such as Activity3-5 and 3-6.
- The operational verification of the GC/HRMS was completed, which enabled to start activities to establish analytical methods through GC/HRMS measurements. The verification through the measurement of standard solutions preparation of the calibration curve and setting of the measurement conditions of the apparatus were completed too. Then, an analytical method through a series of validation experiments, including a sample pretreatment process, shall be established.
- ERLSD and AQMS have started discussions for actual sample measurement and have drawn up a sampling plan. Preparations for sampling have started as well. Once the analytical method is established, the measurement of actual samples shall be started accordingly.

Objectively Verifiable Indicators	Status
3-1. Standard Operation Procedure (SOP) for monitoring, analyzing and QA/QC of Dioxins and Furans in ambient air and source emission gas is endorsed by the Project to DENR-EMB for adoption.	Partially achieved

2.5. Activities for Output 4

In Activity 4-1, the current status of SWM in the Philippines and the target LGUs was confirmed. The National SWM Strategy (2012-2016) and the 10-year SWM plan of the target LGUs were reviewed, and the departments in charge of SWM in the LGUs and related facilities such as composting facilities, MRFs,

and final disposal sites were visited. Based on the results, the issues of SWM in the target LGUs were summarized in Activity 4-2.

In Activity 4-3, information on good practices and appropriate technologies for SWM other than WTE technologies in Japan and third countries was collected to provide reference information for the target LGUs for selecting and introducing technologies other than WTE. The "Booklet of Good Practice and Good Technology for SWM other than WTE" compiled through this activity was approved at the 3rd JCC meeting and is appended to this PCR. It is expected that this deliverable will be used as reference for LGUs working on SWM improvement in the Philippines in terms of financial measures, composting, recycling, final disposal, and environmental education for communities.

In Activity 4-4, the target LGUs evaluated SWM technologies suitable for their LGUs based on characteristics and current SWM status, systems, and challenges in the LGUs, by using the information in the booklet compiled in Activity 4-3. In Activity 4-5, the booklet developed in Activity 4-3 and the results of Activity 4-4 were presented and shared at the technology dissemination seminars held in June 2022 and September 2022.

The achievement status of Output 4 is as follows.

- Activities 4-1, 4-2, 4-3 and 4-4 were implemented as scheduled.
- In Activity 4-3, a lot of information of good practice and good technology was collected and compiled into a booklet. This booklet will be referred to as a reference by Philippines CP and LGUs for improving their SWM plan. At activity 4-4, for each technology, the target LGUs examined the impact and adaptability of implementing the technology in their LGUs. The personnel of LGUs were somehow capacitated on how to evaluate and try the SWM technologies for their SWM.

Objectively Verifiable Indicators	Status
4-1. Report of identified issues and recommendation/suggestion is prepared.	Achieved

3. Measures, Issues, and Lesson Learned in the Project

In the project implementation, actions taken as ingenuity (measures), difficulties in implementation/dealing with (issues), knowledge for future implementation (lessons learned) are shown in the table below. These are categorized into matters related to WTE, SWM, as well as dioxin analysis.

Table Measures, Issues, and Lesson Learned in the Project

	Waste to Energy (WTE)	
(1)	Cooperation with the institution that supports LGUs (PPPC) for the introduction of WTE projects through PPP	Measures
(2)	Recommendations to the Sanitary Landfill Regulations to complete WTE project operations without environmental impact	Measures
(3)	Addition of relevant institution to ITWG subgroup	Measures
(4)	Impact of change of LGU Mayor on policy and 10-year plan of SWM	Issue
(5)	Need for the National Government supports for LGUs (technical and financial aspects)	Issue
(6)	Supervision and guidance for proper disposal and recycling by DENR	Issue
(7)	Projects stagnation through unsolicited approach	Lesson
(8)	Need for careful evaluation of business profitability and support system and mechanism for LGUs	Lesson
	Solid waste management (SWM)	
(9)	Strengthening mechanisms to support insufficient capacity (technical and financial capacity) of LGUs and barangays	Issue

(10)	Clarification of the role of the NSWMC and the function of the SWMD, which serves as the NSWMC Secretariat	Issue
(11)	Promote sharing of SWM good practices in the Philippines	Lesson
	Dioxin analysis	
(12)	Continued capacity building on incomplete activities	Issue
(13)	Identification of appropriate training needs based on gap analysis results (software operation capability enhancement)	Measures
(14)	Training to compensate for the lack of capacity of the local service provider	Measures
	General	
(15)	Continuation of activities under the COVID-19 pandemic through web communication	Measures

4. Achievement of Project Purpose

The degree of achievement of the project purpose “SWM using WTE and other SWM technologies is improved at the central government level and target local governments.” is evaluated referring to the objectively verifiable indicators set in the PDM, based on the following and the achievement status of each output.

- It is believed that the personnel of National government and target LGUs had opportunities to gain the knowledge of WTE and other SWM technologies to improve their SWM situation.
- Delays due to the pandemic of COVID-19 and change of the conditions situation of LGU’s WTE project caused incomplete achievement of the project output and activities such as Activity2-7, Activity3-6.

Of the three indicators of the project purpose, one was evaluated as "achieved" and two as "partially achieved." Two indicators with a rating of 'partially achieved' are one concerned with Output 2, which was rated 'partially achieved' at the output level, and one for output 3, where some of the activities were not completed during the project period.

Objectively Verifiable Indicators	Status
1. Recommendations are made for the National SWM strategy (2023-28) based on the Project’s output.	Achieved
2. Formulation of WTE project is promoted in target LGUs.	Partially Achieved
3. The dioxins analysis is periodically implemented.	Partially achieved

5. Project Evaluation

The project evaluation by the six criteria of OECD-DAC, namely relevance, consistency, effectiveness, efficiency, impact and sustainability, is described in the table below.

Table Evaluation by OECD-DAC 6 Criteria

Evaluation	Description
Relevance: High	The Philippines' development policy, development needs, and the Japanese government's assistance policy toward the Philippines have not changed since before the start of the project. Therefore, the relevance is "High". However, it was actually difficult for some institutions of the target groups to participate in the project activities.
Coherence: Very high	There is a strong linkage with the ongoing projects of JICA and the Japanese government. Coherence is "Very high" as it also relates to donor projects underway in the Philippines.
Effectiveness: Mostly achieved as planned	The effectiveness of the project is "Mostly achieved as planned" because some of the objectively verifiable indicators of the project purpose were not achieved within the project period.
Impact: High	Inputs to the project were properly utilized and project purpose are mostly achieved (about 70%). Therefore, the efficiency is "High" even there were the following circumstances:
Efficiency: Mostly achieved as planned	The prospect of the project' impact is "Mostly achieved as planned" because it highly depends on the continuation and strengthening of project activities after the project period. To achieve the overall goals, it is necessary to utilize project outputs in LGUs, share knowledge and update project deliverables with relevant national and local government institutions, and maintain and strengthen the functions of the ITWG.
Sustainability: Mostly achieved as planned	The overall evaluation of sustainability is "Mostly achieved as planned" because more improvements were expected based on the anticipated capacity level.

6. Recommendations for Achieving Overall Goal

It is considered possible to achieve the three indicators of the overall goal by utilizing the project deliverable and continuing activities by the DENR and concerned institutions. Although there is uncertainty as to whether or not WTE projects can be formed and implemented in LGUs depends on the policy decisions of the LGUs, recommendations for achieving each of the three indicators are made as follows.

Overall Goal	Objectively Verifiable Indicators
Improvement of Philippine SWM system through the adoption of WTE and other SWM technologies	1) The outputs of the Project are utilized by more than one LGU. 2) Recommendation by the Project is reflected in the National SWM strategy (2023-28). 3) Result of dioxins analysis is reported in the annual report of EMB.

1) Utilization of the technical deliverables for the WTE in LGUs

The feedback of findings through the formation of WTE projects in the target LGUs, which was envisioned in this TCP, could not be implemented due to various circumstances. In order to utilize the above-mentioned technical cooperation deliverables as better suited to the society of the Philippines, LGU support by national government agencies to obtain feedback and collaboration with LGUs are essential.

For this purpose, it is recommended that the ITWG formed for the implementation of this TCP maintain its function and use it as a platform for discussions among relevant national institutions and target LGUs on WTE project formation and its management. Although the NSWMC includes many of the member institutions of the ITWG, it does not include DOE and PPC, which have an important role in the implementation of WTE projects in LGUs. It is necessary for the continuation of the project that the function of evaluation and advice on WTE project formation and proposals (referring and utilizing technical cooperation deliverables) be added and maintained in the ITWG, where the progress of project activities and deliverables is discussed.

2) Reflect recommendations of the project in the National Waste Management Strategy (2023-28)

Input is needed from the implementing agency, DENR, into the NSWMC on the update of a national strategy with respect to the following recommendations from the project;

- i) Reflection in the national strategy of the following and other benefits of waste treatment by WTE
 - Sanitary waste treatment
 - Waste volume reduction in particular in metropolitan areas to extend the life of final disposal facilities and reduce final disposal capacity requirements
 - Possible application of PPP scheme
 - Effectiveness in combating plastic waste runoff
- ii) Reflection of conditions of WTE applicability
 - Conditions under which WTE can be applied, such as waste disposal scale, dominant technology, etc. (formulate BAT/BEP guidelines by utilizing information from case studies)
 - Appropriate amount of waste tipping fees
 - Waste management options in the cities where the above benefits (a) outweigh the cost burden

3) Publish the result of dioxins analysis in the annual report of EMB

- i) Continuation and accomplishment of incomplete project activities

Sampling and analysis of dioxins from the fixed emission sources, as well as the regular implementation of these tasks, was not accomplished in the project period. While the concept of the environmental monitoring plan was presented by JET, it is essential to put it into practice in monitoring for WTE or similar fixed sources for actual planning and monitoring operations.

- ii) Establishment and publication of annual plan for dioxin analysis project

On the assumption that dioxin analysis will be possible to be carried out stably, dioxins and furans shall be identified as regular parameters for the annual monitoring plan. Furthermore, it is necessary to establish a system to publicize the results.

- iii) Monitoring and publication of the monitoring results based on the above annual plan (Annual report)

Periodic dioxin analysis results shall be published in an annual report to enable the EMB as well as the public to understand how the data has changed over time.

In addition, as actions to be taken by the relevant organizations of the Philippine after the end of the project, JET made recommendations on the "monitoring plan" and the "plan of operation" after the end of the project period. It is hoped that these recommendations will be useful to formulate "the sustainability plan" by the DENR for the continuation of its activities in the future.

The Project for Capacity Development
On
Improving Solid Waste Management through Advanced/Innovative Technologies
In
The Republic of The Philippines

Project Completion Report

Volume 1: Main Report

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³ Appendix 2,3, 4, 5 approved by JCC have been in the procedure to officialize by DENR.

Acronym

Technical Term

Acronym	Appellation
3R	Reuse, Reduce, Recycle
ACC	Appropriately Controlled Combustion
AP	Availability Payment
ASE	Accelerated Solvent Extractor
ASS	Accredited Stack Sampler
BAT/BAP	Best Environmental Practice/ Best Available Technology
BOO	Build-Own-Operate
BOT	Build-Operate-Transfer
CAPEX	Capital Expenditure
CF	Conceptual Framework
CHP	Combined Heat and Power
CLUP	Comprehensive Land Use Plan
COD	Chemical Oxygen Demand
CP	Counterpart (personnel and/or agency)
CRM	Certified Reference Materials
D&F	Dioxins and Furans
DAO	Department Administrative Order
DBO	Design-Build-Operate
DIOK	Dioxin Analysis Program
DL-PCB	Dioxin-Like PCB
E/N	Exchange of Note
ECC	Environmental Compliance Certificate
ECQ	Enhanced Community Quarantine
EIA	Environmental Impact Assessment
EPC	Engineering, Procurement and Construction
ERQ	Employer's Requirements
FBP	Facility Basic Plan
FIT	Feed-in-tariff
FS	Feasibility Study
GCA	Government Contracting Agency
GC/HRMS	Gas Chromatograph / High-Resolution Mass Spectrometry
GC/MS	Gas Chromatograph – Mass Spectrometry
GC-MS/MS	Gas Chromatograph - Tandem Mass Spectrometry
HB	House of Representatives
HDPE	High Density Polyethylene
I/C	Independent Certifier
ICR	Inception Report
IEC	Information, Education, and Communication

Acronym	Appellation
IRR	Implementing Rules and Regulations
JV	Joint Venture
JVA	Joint Venture Agreement
JVSC	Joint Venture Selection Committee
KPI	Key Performance Indicator
KSS	Knowledge Sharing Session
LC/MS/MS	Liquid Chromatography with tandem mass spectrometry
LCRS	Leachate Collection and Removal System
LCV	Lower Calorific Value
LOI	Loss of Ignition
M/M	Man-month
MBT	Mechanical Biological Treatment
MC	Memorandum Circular
MOU	Memorandum of Understanding
MPSS	Minimum Performance Standards and Specifications
MRF	Materials Recovery Facility
MSW	Municipal Solid Waste
NSWMF	National Solid Waste Management Fund
O&M	Operation and Maintenance
OIC	Officer in Charge
OPEX	Operation Expenditure
OP	Output of the Project
OPS	Original Proponent Status
PCB	Polychlorinated Biphenyl
PCR	Project Completion Report
PDM	Project Design Matrix
PFI	Private Finance Initiative
PO	Plan of Operation
POPs	Persistent Organic Pollutants
PPP	Public-Private Partnership
PUF	Polyurethane Foam
QA/ QC	Quality Assurance/ Quality Control
RA	Republic Act
R/D	Record of Discussion
RDF	Refused Derived Fuel
RE	Renewable Energy
RfP	Request for Proposal
SAT	Sampling Assessment Team
SG	Sub-group
SB	Senate Bill
SGOP#	Sub-group of Output #
SLF	Sanitary Landfill

Acronym	Appellation
SMR	Self-Monitoring Report
SO	Special Order
SOP	Standard Operating Procedure
SPC	Special Purpose Company
SSO	Source Separated Organics
SWM	Solid Waste Management
T/F	Tipping Fee
TA	Technical Assistance
TCLP	Toxicity Characteristic Leaching Procedure
TCP	Technical Cooperation Project
TeCDD	Tetrachlorodibenzo-p-dioxin
TSD	Treatment, Storage, and Disposal
UPS	Uninterruptible Power Supply
VGF	Viability Gap Funding
WACS	Waste Analysis and Characterization Study
WTE	Waste to Energy
WTF	Waste Treatment Facility
WTV	Waste to Value

Organization and Position

Acronym	Appellation
AD	Assistant Director
ADB	Asian Development Bank
AQMS	Air Quality Management Section
BEMD	Biomass Energy Management Division
BEO	Barangay Environmental Officers
BLGS	Bureau of Local Government Supervision
BOI	Boards of Investments
CA	Crown Agents
CENRO	City Environment and Natural Resources Office
CEMSI	Clean-way Environmental Management Solutions, Inc.
CPI	Cleanaway Philippines, Inc.
DBP	Development Bank of the Philippines
DENR	Department of Environment and Natural Resources
DILG	Department of the Interior and Local Government
DOE	Department of Energy
DOH	Department of Health
DPS	Department of Public Services
EMB	Environment Management Bureau
EPA	Environmental Protection Agency of United States of America
EPPB	Energy Policy and Planning Bureau
EPWMD	Environment Protection and Waste Management Department
EQMD	Environmental Quality Management Division
ERLSD	Environmental Research and Laboratory Services Division
FASPS	Foreign Assisted and Special Projects Service
HPI	Holcim Philippines, Inc.
HWMS	Hazardous Waste Management Section
ICC	Investment Coordination Committee of NEDA
IIGF	Indonesian Infrastructure Guarantee Fund
IPG	Investment Programming Group
ITDI	Industrial Technology Development Institute
ITWG	Inter-Agency Technical Working Group
JCC	Joint Coordinating Committee
JESI	Jorm Environmental Services, Inc.
JET	JICA Experts Team
JICA	Japan International Cooperation Agency
LGU(s)	Local Government Unit(s)
MCWMC	Metro Clark Waste Management Corporation
MMDA	Metropolitan Manila Development Authority
MOEJ	Ministry of Environment Japan
MPIC	Metro Pacific Investments Corporation
NEC	National Ecology Center

Acronym	Appellation
NEDA	National Economic and Development Authority
NGO	Non-Government Organization
NMI	National Measurement Institute
NSEPI	New Sky Energy Philippines, Inc.
NSWMC	National Solid Waste Management Commission
PASSI	Pollution Abatement System Specialist Inc.
PDS	Project Development Service
PFPEMS	Policy Formulation and Project Evaluation and Monitoring Services
PMO	Project Management Office
PPPC	Public-Private Partnership Center
PPPDD	Planning, Policy and Program Development Division
RCB	Republic Cement - Batangas
RCBMI	Republic Cement & Building Materials, Inc.
REMB	Renewable Energy Management Bureau
SRS	Science Research Specialist
SWMD	Solid Waste Management Division
TFSWM	Task Force on Solid Waste Management
UNEP	United Nation Environment Program
UNIDO	United Nations Industrial Development Organization
WB	World Bank

1. Project Summary

1.1 Background and Purpose of Project

The issue of Solid Waste Management (SWM) has become a serious social problem in Metro Manila and in major urban cities in the Republic of the Philippines (hereinafter “Philippines”) and is recognized as one of the top priority issues to be solved. The Government of the Philippines enacted the Ecological Solid Waste Management Act (RA 9003) in 2000 that stipulates that open and controlled dumpsites shall be closed, phased out, and rehabilitated. Additionally, alternative sanitary landfill sites shall be developed and operated as final disposal sites. It also aims to reduce the amount of waste to be disposed at the final disposal sites by reducing wastes at the generation source and by recycling wastes. While SWM is a responsibility of the Local Government Units (LGUs), the number of LGUs with the capacity to conduct appropriate management is still limited because of technical and economic difficulties such as incomplete source segregation and insufficient financial resources on SWM. The number of landfills which have been converted into sanitary sites from open dumping is also limited.

On the other hand, waste incineration was recognized to be prohibited because of the Clean Air Act (RA 8749) enacted in 1999. However, in July 2002, the Department of Environment and Natural Resources (DENR) notified that only incineration emitting hazardous and toxic gas was prohibited after ruling of a decision by the Supreme Court of the Philippines in January 2002. With this, the National Solid Waste Management Commission (NSWMC), in cooperation with the Ministry of Environment Japan (MOEJ), has developed and issued “Guidelines Governing the Establishment and Operation of Waste to Energy (WTE) Technologies for Municipal Solid Waste (MSW)” as part of the NSWMC Resolution 669 in 2016 which eventually was converted into a Department Administrative Order (DAO) by the DENR. The DAO provides for the environmentally-sound evaluation, establishment, operation and decommissioning or closure of WTE technologies for MSW management. However, technical standards as well as design criteria for the technologies are not indicated since DENR cannot promote specific technologies. It has to be noted that DENR and the Environment Management Bureau (EMB) do not have sufficient knowledge in reviewing, monitoring, and evaluating of WTE-related projects since they have not yet been engaged in any WTE project.

Under these circumstances, DENR requested the Japanese Government for a technical cooperation project for Capacity Development on Improving Solid Waste Management through Advanced/Innovative Technologies (hereinafter referred to as "the Project"). Upon the request, JICA mission was dispatched twice to make an agreement for the basic framework of the Project. Based on the Record of Discussion (R/D) signed by both parties on November 7, 2017, this Project was implemented from March 2019 to December 2022.⁴

1.2 Project Design

(1) Project Design Matrix (PDM)

This Project aims to manifest the outputs and the Project purpose by implementing activities based on the R/D and the Project Design Matrix (PDM). PDM (Ver.0) is attached to the R/D as part of the draft framework for the Project and was updated as PDM (Ver.1) for Project implementation and again updated for the project period extension and adding activity1-8.

⁴ According to Record of Discussion (R/D) agreed between JICA and DENR, the project period is until December 2022. For compilation and editing of the PCR based on the comments by the Philippine CP organizations on the report, the submission date of the report was March 2023.

Table 1.1 Overall Goal, Project Purpose, Outputs, and Objectively Verifiable Indicators in PDM (Ver.2)

<p>[Overall Goal] Improvement of the Philippine SWM system through the adoption of WTE and other SWM technologies</p>	<p>[Objectively Verifiable Indicators] 1.The outputs of the Project are utilized by more than one LGU. 2.Recommendations from the Project is reflected in the National SWM strategy (2023-28). 3.Result of the dioxin analysis is reported in the annual report of EMB.</p>
<p>[Project Purpose] National government and target LGUs' capacity for improving solid waste management utilizing WTE and other SWM technologies is enhanced.</p>	<p>1.Recommendations are made for the National SWM strategy (2023-28) based on the Project's output. 2.Formulation of WTE project is promoted in target LGUs. 3.The dioxin analysis is periodically implemented.</p>
<p>Output 1. National Government's capacity for supporting and coordinating of LGUs' WTE project is enhanced.</p>	
<p>Output 2. Target LGUs' capacity in Planning, Evaluation, Formulation, and Supervision of WTE project is enhanced.</p>	
<p>Output 3. National Government's capacity of environmental monitoring for WTE project is enhanced.</p>	
<p>Output 4. National Government and target LGUs' capacity to identify issues and provide suggestion/recommendation for other SWM technologies and WTE project is enhanced.</p>	

Source : PDM(Ver.2)

As agreed in R/D, target WTE technology in main activities of the project (Activities 1-2, 1-4 to 1-7, 2-3 to 2-8) shall be "an appropriately controlled combustion with power generation".

(2) Target Area

Nationwide (Quezon City, Davao City, and Cebu City were selected as target LGUs)

(3) Duration of the Project

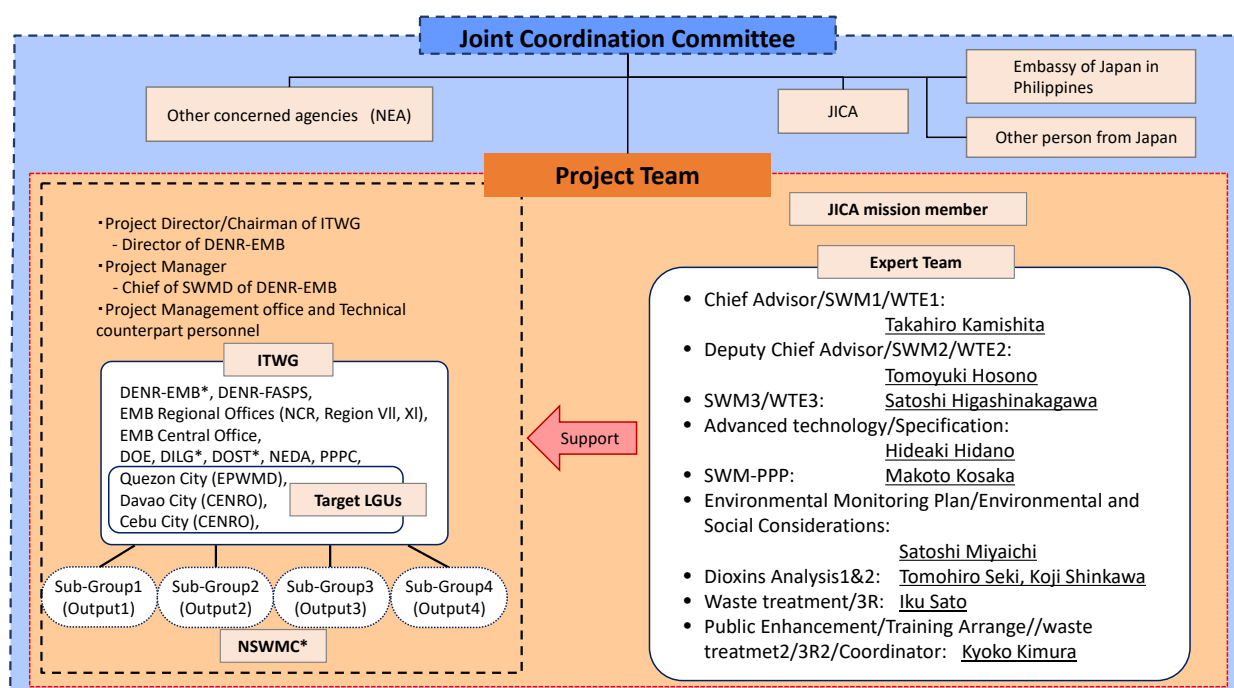
March 2019 – December 2022

The duration was extended by 9 months at the 2nd Joint Coordinating Committee (JCC) held in February 2021 because of the impact of the COVID-19 pandemic.

(4) JICA Expert and Counterpart of Philippines

The main Philippine counterparts are as follows:

1. Implementing Agency : DENR; Lead Office: EMB
2. Target LGUs : Quezon City, Davao City, Cebu City
3. Cooperating Agency : NSWMC



*NSWMC: DENR, DOH, DA, MMDA, DOST, DILG, DPWH, DTI, TESDA, PIA, LCP, LMP, LPP, LnP, NGO, Recycling Industry, Manufacturing and Packaging Industry

Source : DENR & EMB Special Orders Approved and Issued

Figure 1.1 Implementation Structure of the Project

Inter-Agency Technical Working Group (ITWG) and its subgroups members for each project output are shown below:

Table 1.2 List of ITWG Members per Approved EMB Special Order No. 2019-347

AGENCY	DESIGNATED MEMBERS	
	PRINCIPAL	ALTERNATE
DOE- Energy Policy and Planning Bureau (EPPB)	Ms. Lilian C. Fernandez, Chief, Energy Cooperation and Coordination Division (ECCD) Ms. Ruby B. Guzman, Chief Biomass Energy Management Division (BEMD), REMB	Mr. Romeo M. Galamgam, Supervising SRS, BEMD, REMB Ms. Letty G. Abella, Senior Science Research Specialist, ECCD Ms. Charisse Jane D. Pascual, SRS II, BEMD, REMB
DILG- Bureau of Local Government Supervision (BLGS)	Atty. Odilon L. Pasaraba, CESO IV, Director IV	Atty. Maria Rodora R. Flores Division Chief, Policy Compliance Monitoring Division Mr. Carlo Mari Crisregionald C. Tan, PDO IV, Manila Bay Clean-up, Rehabilitation and Preservation Program
DOST- Industrial Technology Development Institute (ITDI)	Engr. Reynaldo I. Esguerra OIC- Deputy Director, Research & Development and Chief, Environment & Biotechnology Division	Engr. Rochelle I. Retamar OIC, Senior SRS, Cleaner Production Section
NEDA- Investment Programming Group (IPG)	Ms. Kathleen P. Magune, Director IV, IPG	Mr. Francis Bryan C. Coballes, OIC-Director III Mr. Aldwin U. Urbina, chief Economic Development Specialist

AGENCY	DESIGNATED MEMBERS	
	PRINCIPAL	ALTERNATE
Public- Private Partnership Center (PPPC)	Atty. John Dominic Z. Zafe, Director, Project Development Service (PDS)	Atty. Phebean Belle A. Ramos-Lacuna, Director, Policy Formulation, Project Evaluation and Monitoring Service Ms. Aislyn Yao, Division Chief, Policy Formulation, Project Evaluation and Monitoring Service Ms. Gee Maurene G. Manguera, PDO, PDS Ms. Justine E. Padiernos, PDO, PDS
City ENRO LGU Davao City	Atty. Dwight Domingo, Assistant Administrator	Ms. Eliza Madrazo, Head WTE Project
City ENRO LGU Cebu City	Atty. John Jigo Dacua, OIC-CCENRO	EnP. Rhoderick Enolpe, Assistant Department Head Engr. Glory Rose C. Manatad, EMS II
City ENRO LGU Quezon City	Mr. Vincent Ferdinand, PDO III, EPWMD	Mr. Paul G. Vinarao, PDO III Engr. Luis S. Sabater, Planning Officer III
EMB Central Office Focal Persons		
EMB-Environmental Quality Management Division (EQMD)	Mr. Renato T. Cruz, Chief, EQMD	Engr. Marcelino Rivera, Supervising EMS
EMB-Air Quality Management Section (AQMS)	Engr. Jundy T. Del Socorro, Chief, AQMS	Engr. Wyona Kay Rativo, EMS II
EMB- Planning, Policy and Program Development Division (PPPDD)	Ms. Consolacion P. Crisostomo, Chief, PPPDD	Ms. Mary Esther D. Ofiaza, PO III
EMB- Environmental Research and Laboratory Services Division (ERLSD)	Ms. Ma. Fatima Anneglo R. Molina, Chief, ERLSD	Mr. Sammy L. Aytona, SRS II
EMB- Solid Waste Management Division (SWMD)	Engr. Nolan B. Francisco, Chief, SWMD	Ms. Elvira S. Pausing, Supervising EMS, PPDS
EMB- Legal Division (LD)	Atty. Carmelo R. Segui, Chief, LD	Atty. John Edward T. Ang, Attorney III
EMB Regional Offices Focal Persons		
EMB- NCR	Engr. Alma p. Ferrareza, Senior EMS	Mr. Mikko M. Clemente, Jr. EMS II, Planning & Information System Management Unit (PISMU)
EMB-Region VII	Mr. John Roy Kyamko, Senior EMS & OIC- SWM Regional Coordinator	Ms. Angelli Marie Jacynth Egar, EMS I, SWM Section
EMB Region XI	Ms. Virginia B. Lobaton, Senior EMS	Mr. Allan P. Justo, EMS
DENR- Foreign Assisted and Special Projects Service (FASPS)		
DENR-Foreign Assisted and Special Projects Service, FASPS	Mr. Angelito Fontanilla, Director, FASPS	Mr. Conrado Bravante, Chief Project Management Division Ms. Marianica Philina Obmerga, PEO II

Source : DENR-EMB Special Order, 2019-347, Minutes of 1st ITWG meeting held on January 24, and updates in March 2021

The ITWG shall serve as the Core Group to undertake the following specific tasks:

- Provide technical and operational guidance to the Project;
- Review and assess Project reports and provide inputs to the reports submitted;
- Review the reports submitted by JICA Experts and endorse to JCC for approval;
- Review the suitability of the PDM including the Plan of Operation (PO) in the course of the Project and provide recommendations; and
- Attend JICA missions and other project related meetings.

Table 1.3 List of ITWG Subgroup Members per Project Output

Subgroup for Output 1	Subgroup for Output 2 and 4	Subgroup for Output 3
<ul style="list-style-type: none"> - DOST-PCIEERD (Energy Division): Mr. Nonilo Peña - DOE (Renewable Energy Management Bureau): Mr. Romeo Galamgam - DILG (Bureau of Local Government and Supervision): Atty. Ms. Rhodora Flores, Alternate: Mr. Carlo Mari Crisregionald C. Tan - EMB Central Office (PPPDD): Ms. Consolacion Crisostomo - LGU Quezon City - PMO (EMB-SWMD) Coordinator: Engr. Nolan, Alternate: Ms. Elvira Pausing - FASPS - JET: Mr. Takahiro Kamishita 	<ul style="list-style-type: none"> - DOST(ITDI): Engr. Reynaldo Esguerra - DILG: Mr. Carlo Mari Crisregionald C. Tan - PPPC: Ms. Justine Padiernos - DOE: Ms. Ruby De Guzman - EMB Central Office: Engr. Jundy T. Del Socorro - LGU Quezon City (TBA) - LGU Cebu City: Atty. Junine Aragon - LGU Davao City: Atty. Dwight Domingo - PMO(EMB-SWMD) Coordinator: Engr. Nolan Francisco, Alternate: Ms. Elvira Pausing - FASPS - JET: Mr. Takahiro Kamishita 	<ul style="list-style-type: none"> - EMB-ERLSD: Ms. Ma. Fatima Anneglo R. Molina - SWMD: Engr. Nolan B. Francisco - DOE-ECCD: Ms. Letty Abella - DOST(ITDI): Engr. Reynaldo Esguerra - EMB Region VII: Engr. John Roy Kyamko - EMB Region XI: Engr. Virginia Lobaton - EMB NCR: Ms. Alma Ferrarezza - EMB-CO AQMS: Engr. Jundy T. Del Socorro - EMB-EQMD: Engr. Marcelino Rivera, Jr. - PMO(EMB-SWMD) Coordinator: Engr. Nolan, Alternate: Ms. Elvira Pausing - JET: Mr. Takahiro Kamishita, Alternate: Mr. Satoshi Miyaichi

Source : Minutes of 1st ITWG meeting held on January 24, 2020

The Sub-Groups shall take the lead in the implementation of the Project on a per output basis and undertake the following specific tasks and shall meet at least once a month⁵:

- Implement activities together with assistance by the JICA Experts Team (JET) during data gathering and preparation of the project requirements per Project output basis;
- Review and assess the reports including technical guidelines and standards submitted by JET and provide technical comments, recommendations, and inputs as required;
- Endorse to the ITWG technical reports for further review prior to its endorsement to the JCC for approval; and
- Attend the regular sub-group meetings and other Project related activities.

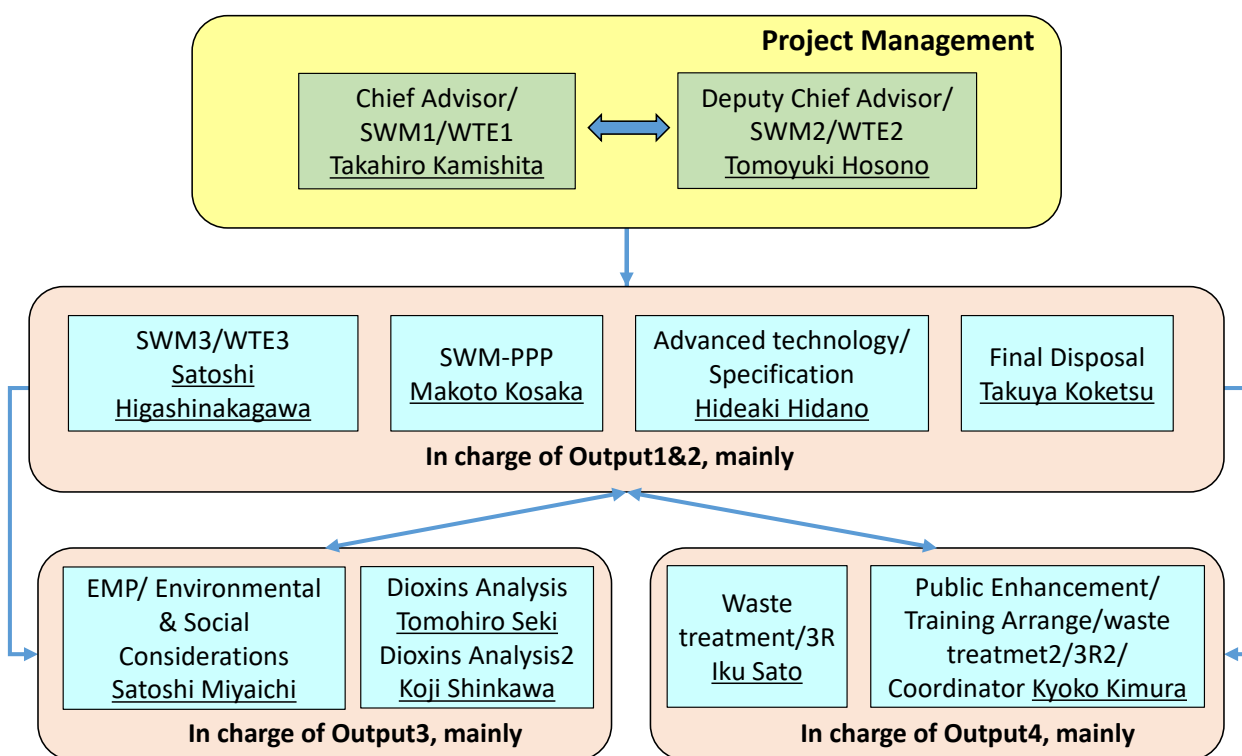
The JET shall serve as Project Output Coordinators and Resource Persons during the sub-group meetings.

⁵ After remote communication required by the COVID-19 pandemic, the sub-group meetings were not held every month. The meetings were conducted when it was necessary.

Pursuant to Special Order No. 2019-341, the Project Management Office (PMO) was created under the Solid Waste Management Division (SWMD) of the Environmental Management Bureau (EMB) which shall serve as the Secretariat to the four sub-groups with the following specific tasks:

- Prepare and organize the sub-group meetings, in coordination with JET and DENR-FASPS;
- Prepare the necessary documents for distribution to the members of the sub-groups prior to the meetings;
- Maintain records of all Project related documents;
- Assist JET in the preparation of the minutes of the meetings for distribution to the members for comments and adoption in the next sub-groups meetings; and
- Perform related activities as may be deemed necessary.

Team structure of the JICA Expert Team is shown in Figure 1.2. The Chief Advisor and Deputy Chief Advisor will manage and instruct all other experts to support the counterpart personnel for the Project, as well as execute the Project activities associated with their positions.



Source : Project Team

Figure 1.2 Structure of JICA Expert Team

(5) Mobilization of JICA Experts

Field: 42.94 man-month (M/M), Home: 57.45 M/M

(6) Equipment Provided

The Japanese did not provide any equipment for the Project.

Equipment for dioxins and furans analysis (GC/HRMS) was procured in 2018 by DENR before the Project period and utilized the activities for Output 3.

(7) Mobilization of Resources of the Philippines

1) The assigned counterpart personnel

- The assigned counterpart personnel (i.e., EMB-SWMD-PMO, DENR-FASPS, ITWG, and JCC members) for the implementation of the Project under the three Special Orders issued on November 2019, have participated and assisted in conducting the series of sub-group meetings for the four Project Outputs.

2) Provision of office space and other necessary facilities

- The office space at the EMB Executive Building was officially turned over to JET on May 19, 2022. In the time between the team's dispatch and the turnover of the room, EMB provided the meeting room of AD Osorio to host the team while the office space is being prepared for the team.

3) Budget including operational cost for the Project

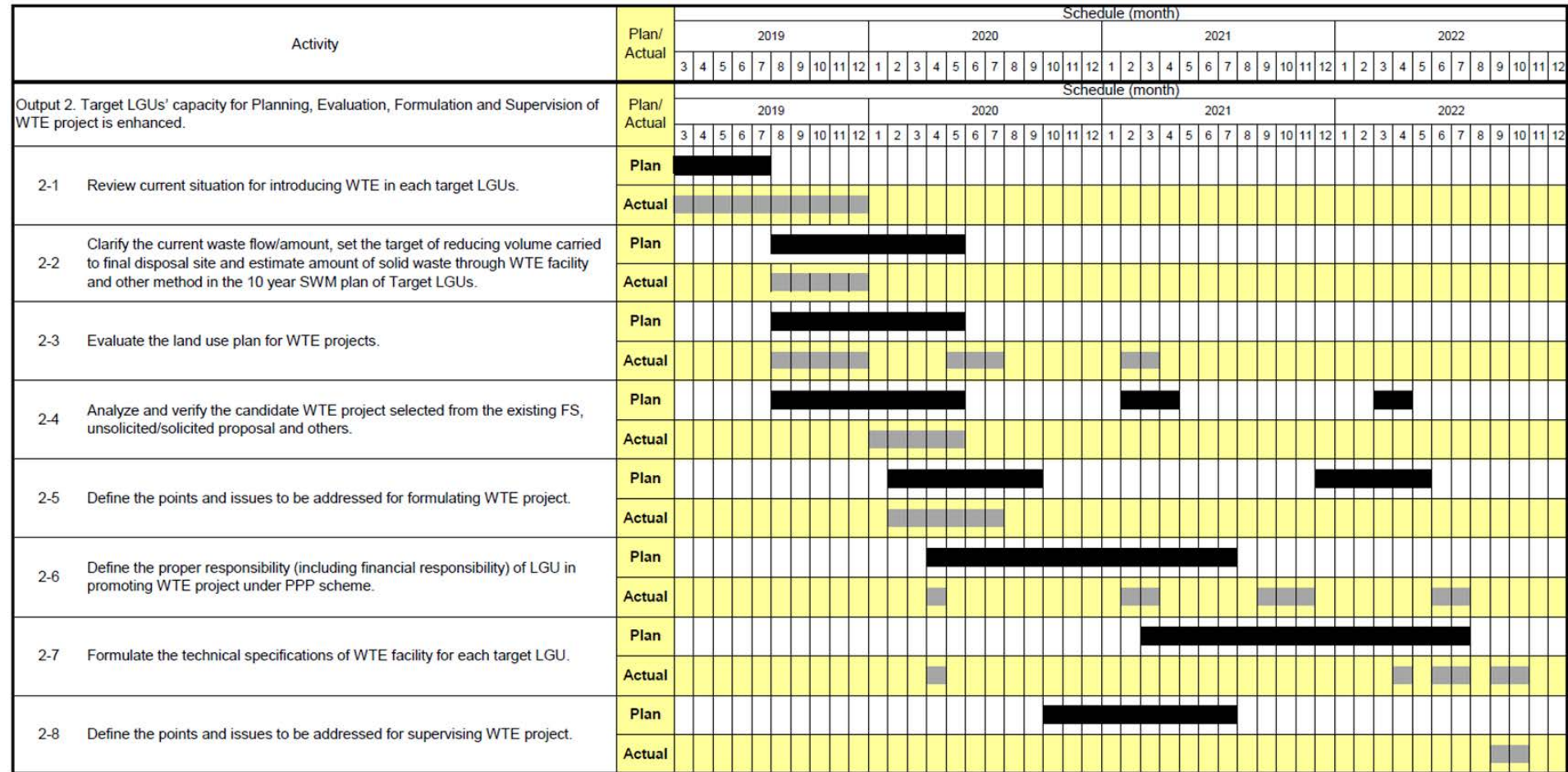
- Budget was allocated under the SWMD funds for CY 2021 and 2022 relative to the implementation of the Project.

1.3 Timeline and Work Flow of the Project

The Project was commenced in March 2019 with the first site work of JET in the Philippines. A preliminary meeting with EMB/SWMD, FASPS and JET regarding the Project and the discussion on the draft inception report were conducted.

It was originally agreed in the R/D for a duration of 36 months to complete the Project. However, it was unavoidably extended due to the COVID-19 until December 2022.

The timeline of the Project is shown in Figure 1.3 to Figure 1.6. The overall work flow of the Project is shown in Figure 1.7.



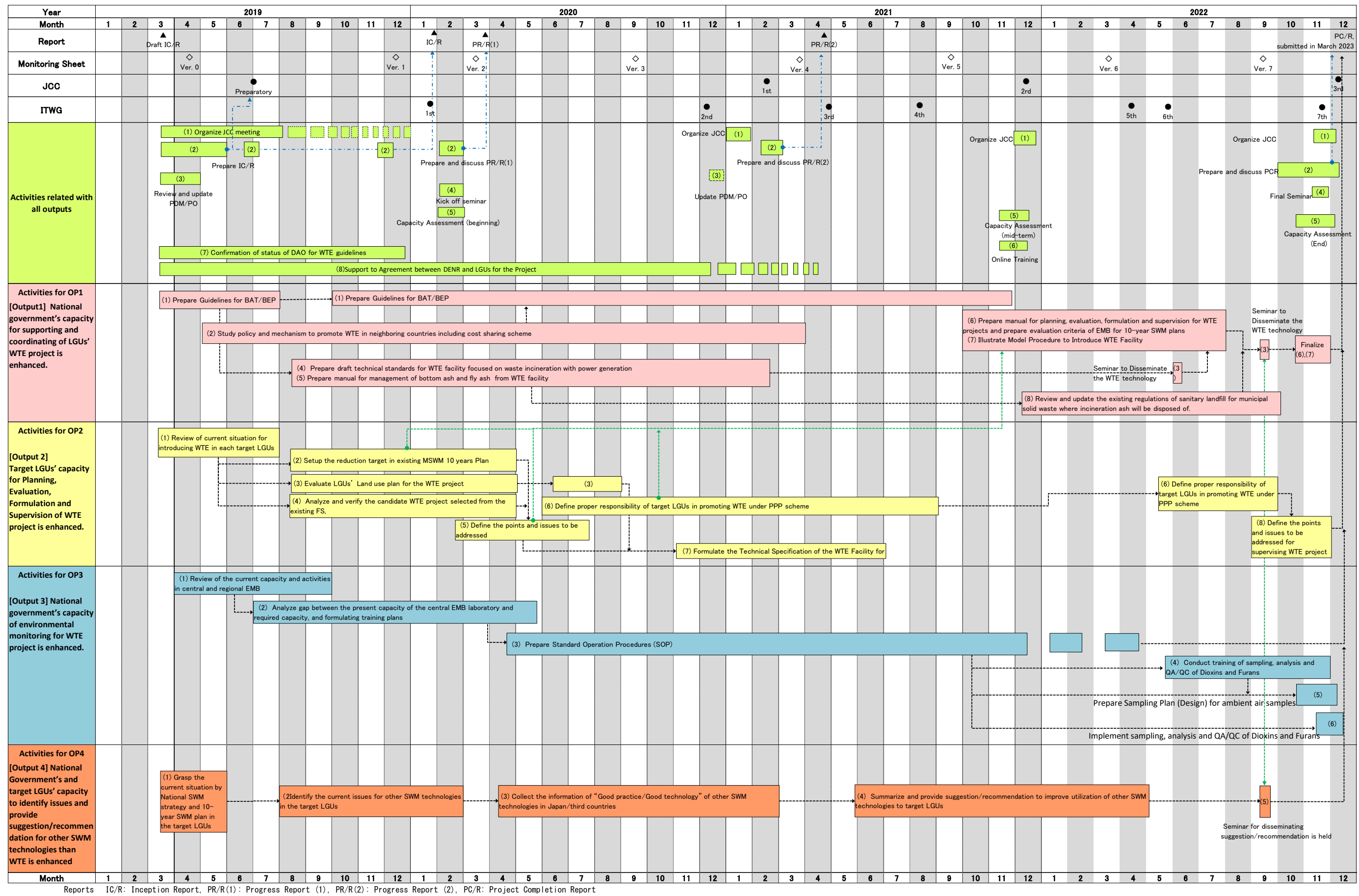
Source : Project Team

Figure 1.4 Timeline of the Project (Activities for Output 2)

Activity	Plan/ Actual	Schedule (month)																																															
		2019												2020												2021												2022											
		3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12		
Output 3. National government's Capacity of environmental monitoring for WTE and other SWM technologies is enhanced.	Plan/ Actual	Schedule (month)																																															
		2019												2020												2021												2022											
		3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12		
3-1 Review the current capacity/activities for monitoring/analysis/QA/QC of Dioxins and Furans in ambient air, and other media (Soil/Surface water/Sediments) in central and regional EMB.	Plan	█																																															
	Actual	█																																															
3-2 Analyze gap between the present capacity of the central EMB and required capacity for proper monitoring/analysis/QA/QC of Dioxins and Furans in ambient air, source emission gas and other media (Soil/Surface water/Sediments) and formulate the training plan.	Plan	█																																															
	Actual	█																																															
3-3 Prepare Standard Operation Procedure (SOP) for sampling, analyzing and QA/QC of Dioxins and Furans in ambient air and source emission gas.	Plan													█																								█											
	Actual	█												█												█												█											
3-4 Conduct training of sampling, analyzing and QA/QC of Dioxins and Furans in ambient air and source emission gas in central EMB.	Plan																									█																							
	Actual	█												█												█												█											
3-5 Prepare Sampling Plan (Design) for the collection of Dioxins and Furans in ambient air samples.	Plan																									█																							
	Actual	█												█												█												█											
3-6 Implement sampling, analyzing and QA/QC of Dioxins and Furans in ambient air and source emission gas by central EMB at existing SWM facilities based on SOP in 3-3.	Plan																									█												█											
	Actual	█												█												█												█											

Source : Project Team

Figure 1.5 Timeline of the Project (Common and Activities for Output 3)



Source : Project Team

Figure 1.7 Work Flow of the Project

2. Project Activities

Just after the first ITWG meeting held in January 2020, where ITWG members were officially appointed, a virus emerged that brought about an unprecedented social crisis in the world. The COVID-19 pandemic affected the implementation of the Project activities in terms of progress, schedule, mode of implementation, Japanese expert's site work, and communication between members. The table below shows the affected dates of the planned meetings for Feb. 2020 – Feb. 2021 and the achieved meetings due to the pandemic.

Table 2.1 Date of Planned and Achieved Meetings of JCC and ITWG (Feb. 2020 to Feb. 2021)

Year	2020											2021	
Meeting	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
ITWG													
Planned			23			16		16				24	
Actual											3		
Subgroup													
Output 1													
Planned	18	5		15			20		12	5			
Actual	18	5			4	7	20		14				
Output 2													
Planned	13		16			9		10					
Actual	13					16							
Output 3													
Planned	10			14					8				
Actual	10												
Output 4													
Planned	13				16								
Actual	13				24			3					
JCC													
Planned					18				15				
Actual													9

Note: Meetings after April 2020 were held in the form of online conferences. For 2021 and 2022, the fixed meeting schedule was not prepared because of continuation of the pandemic.

Source: JICA Expert Team

Under such circumstances, Project activities were implemented by the efforts of all members involved in the Project. Examples of restrictions that the Project faced and struggled with are the following:

- WTE projects of LGUs had been suspended and delayed in the schedule. Anticipated activities for WTE project of Cebu City have not progressed in 2020.
- All activities, decisions, and communication from the government institution was slow. It took a longer time to receive responses from the institutions.
- The daily communication was continued mainly by email and occasional conference calls. The communication was sometimes difficult because of weak internet connection especially in Cebu, Davao, and other regions.
- Preparation of documents and presentations were mostly executed by JET. Although, the usual practice in the Philippines for Technical Cooperation Projects (TCPs) is that Filipino counterparts take the main role in the implementation of project activities including the documents and presentations. Since these counterparts were not able to deliver, JET prepared the outputs.
- Interview of institutions and other parties whom JET tried to contact for the first time were difficult to conduct due to incidents of no or delayed response to contact by JET requesting interviews to them. It was not possible to visit their office for face-to-face interview and obtain information as the alternative form of communication other than through letter and email.

- Even under the pandemic, EMB officers such as ERLSD were engaged in a lot of different tasks and assignments. So, communication and continuation of activities were difficult. Thus, sub-group meeting for Output 3 has not been held for a year since February 2020.
- JCC meeting was not held in 2020. Quarterly ITWG meeting was held only twice (January and December) in 2020.

Site work of JET members resumed in March 2022 after 2 years of their absence in the Philippines. Careful measures to prevent infection were required in the implementation of activities even after March 2022.

Some of the following advantages of online conferences at the same time were identified:

- More members could participate in the meetings regardless of distance between the members.
- There was no need to arrange and prepare a conference room.
- JET members in Japan could participate in the meetings and members in the Philippines could facilitate discussions between the counterpart (C/P) personnel of the Philippines and JET members in Japan (after March 2022).

2.1 Activities Related with All Outputs

(1) Organize and Hold the JCC Committee Meetings

1) Preparatory meeting for JCC

The Preparatory Meeting for the first JCC Meeting was held on June 26, 2019 to confirm the roles of the JCC members and the C/P. Identified government institutions, target LGUs, representatives from FASPS and the EMB Central and Regional offices participated in the said preparatory meeting.

At the JCC Preparatory Meeting, it was agreed that JCC members would be decided after confirming the willingness of the identified concerned government agencies as members of the JCC. The EMB SWMD-PMO sent the signed letter by the EMB Director to the identified government agencies and target LGUs requesting for principal and alternate representatives as members of the JCC. Upon confirmation, DENR Special Order No. 2019-963 for the creation of the JCC was approved and issued by the DENR Secretary on November 28, 2019. DENR, represented by EMB Assistant Director, JICA Philippines, and JET exchanged the minutes of the meeting stating these agreements which is approved by both parties on October 30, 2019.

2) 1st JCC meeting

Although it was agreed in the Preparatory Meeting that the first JCC Meeting would be held in June 2020, it was held on February 9, 2021 because of the COVID-19 pandemic through online conference.

At the first JCC Meeting, the additional activity, reinforcement in activities, and extension of the Project period were proposed and agreed. These changes shown in Table 2.2 are recognized as modification of R/D. A memorandum between JICA and DENR would be signed to officialize these changes in the Project. At the same meeting, the technical standards for the WTE facility prepared by sub-group 1 was introduced and approved for endorsement to the DENR.

Table 2.2 Modification of the Project Period and Activities Proposed and Approved at 1st JCC Meeting

Item	Output	Activity	Modification
Addition and reinforcement of activities	Output 1	Activity 1-8 (Additional activity)	Review and modification of Sanitary Landfill regulations considering possible disposal of incineration ash <ul style="list-style-type: none"> ● Review of present operation of sanitary landfill Review and suggestion on the modification of the requirement in terms of the following: <ul style="list-style-type: none"> - Facility [function] - Management/operation - Environmental aspects such as effluent standards of leachate
	Output 2	Activity 2-6 (Cooperation reinforcing)	Define the proper responsibility (including financial responsibility) of the LGU in promoting WTE project under PPP (Public-Private-Partnership) scheme. <u>Support to SWM PPP projects to clarify responsibilities of LGUs under PPP scheme</u> <ul style="list-style-type: none"> ● Review SWM PPP projects to check responsibilities of LGUs under PPP scheme ● Evaluate SWM PPP projects in terms of technology, finance, and social/environment
	Output 3	Activity 3-4 (Cooperation reinforcing)	Conduct training of sampling, analyzing, and QA/QC of Dioxins and Furans in ambient air and source emission gas in central EMB. <u>Reinforce software operation of Dioxin/Furans analysis equipment</u> <ul style="list-style-type: none"> - Incorporate the contents of software operation in the training
Project period	-	-	A 9-month extension of the Project period The factors forcing the extension are the following: <ul style="list-style-type: none"> - Delay in the commencement of the Project (formulation of JCC/ITWG, appointment of ITWG members) - Influence of the COVID-19 pandemic <ul style="list-style-type: none"> - WTE projects suspended in LGUs - Difficult close communication for activities between C/Ps and JET - Delayed activities such as seminar(s) and preparation for trainings - Reinforcement and addition in activities are desired

Source: Project Team

3) 2nd JCC meeting

The second JCC Meeting was held on December 9, 2021 and the project team made presentations regarding the Project outputs such as the Case Study Analysis for BAT/BAP Guideline based from the information of good practices and technologies of WTE in neighboring countries and the draft Technical Standards for WTE Facility focused on waste incineration with power generation, as well as progress of the Project activities for each output. The upcoming activities were confirmed and the issues and countermeasures on implementing Project activities were discussed among the JCC members.

4) 3rd JCC meeting

At the third and final JCC Meeting held on December 14, 2022, the manual for planning, evaluation, formulation, and supervision for WTE projects including a model procedure to introduce WTE facilities, which was discussed and prepared by sub-group 1, and the booklet of good practices of SWM technologies, other than WTE, were introduced and approved for the endorsement of DENR. The achievements of the Project purpose and Project output are also shared and agreed.

In addition, JET gave recommendations on the monitoring plan from the end of the project and the plan of operation to achieve the overall goal so that these would be helpful for DENR to prepare their sustainability plan.

(2) ITWG and Subgroup Meeting

Two Special Orders (SOs) were approved and issued by the Director of EMB on November 20, 2019, which are, the creation of the Inter-agency Technical Working Group (ITWG) and the creation of the Project Management Office (PMO) within the EMB-Solid Waste Management Division (SWMD).

Upon issuance of the said SOs, the first ITWG meeting was held on January 24, 2020. Four sub-groups (SG) were created and members were appointed per Project output. The specific activities and requirements as well as the possible approaches in implementing the said activities under the approved Inception Report (ICR) were presented and discussed during the meetings.

The track record of ITWG meetings and each output SG meetings are summarized in Table 2.3. Although the Project faced difficulty in conducting regular ITWG and SG meetings due to the COVID-19 pandemic and the Enhanced Community Quarantine (ECQ) enforced, the project team managed to hold 7 ITWG meeting and 26 SG meetings in total.

Table 2.3 Record of ITWG and SG Meetings

Group	Accomplished Meeting
ITWG meeting (7 times)	<ol style="list-style-type: none"> 1. 20 November 2019 2. 03 December 2020 3. 26 April 2021 4. 02 August 2021 5. 05 April 2022 6. 01 June 2022 7. 18 November 2022
Output 1 SG meeting (13 times)	<ol style="list-style-type: none"> 1. 18 February 2020 2. 05 March 2020 3. 04 June 2020 4. 07 July 2020 5. 20 August 2020 6. 14 October 2020 7. 23 April 2021 8. 16 June 2021 9. 04 November 2021 10. 12 January 2022 11. 22 February 2022 12. 17 May 2022 13. 07 October 2022
Output 2 SG meeting (3 times)	<ol style="list-style-type: none"> 1. 13 February 2020 2. 16 July 2020 3. 25 May 2021
Output 3 SG meeting (4 time)	<ol style="list-style-type: none"> 1. 10 February 2020 2. 31 May 2021 3. 24 March 2022 4. 25 October 2022
Output 4 SG meeting (6 times)	<ol style="list-style-type: none"> 1. 13 February 2020 2. 24 June 2020 3. 03 September 2020 4. 25 March 2021 5. 27 October 2021 6. 18 February 2022

Source: Project Team

(3) Preparation and Submission of the Deliverables

Following the PO, the project team has prepared and submitted the progress reports and deliverables as shown in Table 2.4.

Table 2.4 The Reports Submitted

Report and Monitoring Sheet	Delivery Time	Number of Sets
Inception Report	January 2020	English 2 sets, Japanese 2 sets, E-files 1 set
Monitoring Sheet Ver.1	December 2019	English 1 set, E-files 1 set
Monitoring Sheet Ver.2	March 2020	English 1 set, E-files 1 set
Progress Report (1)	March 2020	English 2 sets, Japanese 2 sets, E-files 1 set
Monitoring Sheet Ver.3	September 2020	English 1 set, E-files 1 set
Monitoring Sheet Ver.4	March 2021	English 1 set, E-files 1 set
Progress Report (2)	April 2021	English 2 sets, Japanese 2 sets, E-files 1 set
Monitoring Sheet Ver.5	September 2021	English 1 set, E-files 1 set
Monitoring Sheet Ver.6	March 2022	English 1 set, E-files 1 set
Monitoring Sheet Ver.7	October 2022	English 1 set, E-files 1 set
Project Completion Report	March 2023	English 17 sets, Japanese 6 sets, E-files 1 set

Source: Project Team

(4) Discussion and Update of PDM and PO

The Project Design Matrix (PDM) and Plan of Operation (PO) were updated in line with the various discussions of the draft ICR with the PMO and the revised version of PDM was attached to the ICR. The order of the activities of Output 1 under the PDM (Version 1) was changed in chronological order without changing the overall goal, Project purpose, as well as the Project outputs and specific activities.

The updated PDM and PO (Version2), reflecting the reindorsements and addition of activities, and extension of the Project period, was approved in the 1st JCC held on February 9, 2021. The minutes of the meeting to amend the R/D was signed and closed in October 2021.

(5) Newsletter

In the first newsletter prepared at early 2021, an overview of the Project and activities related to Output 1, 2, and 3 were presented. The second newsletter provided an overview of the draft technical standards for the WTE facility, and the waste management policies and activities of Quezon City, Davao City, and Cebu City related to Output 4.

The second newsletter was submitted to DENR for review in December 2021. After modification based on the comments from EMB, it was submitted again to DENR. It will be posted on the DENR website for the general public as soon as it is approved by DENR.

Table 2.5 Contents of the First Newsletter of the Project

Title	Description
Cover	- What's TCP?
Project outline	- Project Background - About PDM and PO - Implementation Structure - JCC Members - ITWG Members
Role of governmental institutions	- DENR-EMB, LGUs, DOE, NEDA
On-going effort in the target LGUs	- Quezon City Project
Environmental monitoring with output3	- EMB-ERALS - What is Dioxin? - Source Emission Testing in the Philippines
Achieved events and meeting in the project	- Meeting Schedule

Source : Project Team

Table 2.6 Contents of the Second Newsletter of the Project

Title	Description
Cover	- What's TCP?
Technical Standards for Waste-to- Energy (WTE) Facility on Appropriately Controlled Combustion	- The Outline of the Technical Standards for Waste-to-Energy (WTE) Facility
SWM in 3LGUs	- Quezon City - Davao City - Cebu City
Achieved Events and Meeting in the Project	- Meeting Schedule

Source : Project Team



Source : Project Team

Figure 2.1 Second Newsletter (Left: Cover; Right: Quezon City's activities on SWM)

(6) Kick off and Final Seminar

1) Kick off seminar

The project team discussed holding the kickoff seminars in Metro Manila and each target LGU at the beginning of the Project. However, after the first ITWG meeting held in January 2020, considering the sensitive and transition status of the each WTE project in the target LGUs, which is described below, and its circumstances, the kick-off seminar was held only in Metro Manila by inviting three target LGUs instead of holding seminars at each LGU.

Quezon City (as of February 2020):

- The private consortium submitted an unsolicited proposal on the WTE project in Quezon City. The consortium was authorized as the “Original Proponent.”
- In October 2018, Quezon City launched the Swiss/Competitive Challenge for the Project based on Quezon City PPP Code, following the end of negotiation with the Original Proponent and the approval of the Project by the PPP Selection Committee,
- Since no comparative proposal was submitted to Quezon City by the bid deadline in February 2019, it was believed that the Original Proponent would be awarded shortly. However, due to the change of the government administration after the national and local election in May 2019 wherein a new mayor in Quezon City was elected, the Original Proponent has not yet been awarded.

Davao City (as of February 2020):

- A Japanese company submitted a proposal to Davao City in 2017 based on a study on the WTE project conducted in 2015 under the JICA scheme. Upon the proposal, Davao City applied for a Japan Grant Aid for the WTE project to the Government of the Philippines.
- After the Exchange of Note (E/N) between the two Governments, the procedure of the Grant Aid Project for the Construction of Waste-to-Energy Facilities in Davao City is being developed. The tasks of the procurement agent, where the Government of the Philippines contracted and appointed a consultant, is to conduct FS, tender assistance, and construction supervision. The Special Purpose Company (SPC) will have a contract with Davao City through the procurement agent for the operation and maintenance. The consultant team has been implementing the FS.

Cebu City (as of February 2020):

- Cebu City was supported by ADB’s Technical Assistance (TA) for the evaluation of unsolicited proposals and provided the Original Proponent Status (OPS) in May 2019 to Metro Pacific Investments Corporation (MPIC) who proposes Mechanical Biological Treatment (MBT) technology, not waste incineration technology.
- However, after the transition to a new administration in June 2019, the decision of choosing the waste incineration technology was made based on the suggestion of the previous ADB-TA on evaluation of

WTE proposals from private companies, while the OPS for MPIC was cancelled.

- The new administration of Cebu City terminated the ADB-TA as well.
- The city was evaluating and negotiating with a private company, New Sky Energy Philippines Inc. (NSEPI), for their proposal of an Incineration WTE.

The Kick-off Seminar was held on February 27, 2020 at Joy Nostalg Hotel, Pasig City, Metro Manila where the designated members of ITWG and Sub-groups, i.e., NEDA, DOE, DOST, PPC, LGU Quezon City, EMB NCR, EMB Central office, representatives of JICA Philippines, and UNIDO were the participants. In addition, Mr. Renato T. Cruz, Chief of the EMB-Environmental Quality Management Division (on behalf of the EMB Director), and Mr. Yo Ebisawa, Senior Representative of JICA Philippines, were able to grace the activity. The seminar also served as a public relations activity for the Project, as it was attended by other donors and other non-project members.

The concerned government agencies presented and discussed their existing framework in supporting WTE projects such as WTE guidelines, DOE policies, and PPP supporting schemes. Quezon City presented and discussed the history and status of its WTE project while JET explained WTE projects based on Japan's experience. The program of the Kick-off Seminar is shown in Table 2.7.

Table 2.7 Program of Kick-off Seminar

TOPIC	SPEAKER
OPENING CEREMONIES Invocation National Anthem Welcome Remarks Opening Remarks	SWMD-PMO/Secretariat SWMD-PMO/Secretariat Engr. William P. Cuñado OIC-Director, EMB Mr. Yo Ebisawa Senior Representative JICA Philippine Office
Project Overview: Technical Cooperation Project (TCP) for Capacity Development on Improving SWM Through Advanced/Innovative Technologies in the Philippines	Ms. Elvira S. Pausing Supervising EMS & Assistant Project Manager, EMB-SWMD/PMO
DENR Administrative Order 2019-21: Guidelines Governing Waste-To-Energy (WTE) Facilities for the Integrated Management of Municipal Solid Wastes	Engr. Nolan B. Francisco OIC-Chief, SWMD & Project Manager, EMB-SWMD/PMO
Updates n EMB Laboratory for Sampling of Dioxins and Furans	Engr. Jundy T. Del Socorro Chief, AQMS, EMB-EQMD
Government Controls on Waste-To-Energy (WTE) in Japan	Mr. Takahiro Kamishita JICA Expert Team
Public-Private Partnership (PPP) Implementation of Solid Waste Management (SWM) Projects	Ms. Justine E. Padiernos, OIC-Director III, PDS, PPP Center
Policy to Support the Renewable Energy Including Waste-To-Energy (WTE)	Ms. Ruby B. De Guzman Chief, Biomass Energy Management Division (BEMD)
Updates of Waste-To-Energy (WTE) Project in Quezon City	Ms. Andrea Valentine A. Villaroman LGU Quezon City
Updates on EMB Laboratory Capability for Dioxins and Furans Analysis	Ms. Ma. Fatima Anneglo R. Molina Chief, ERLSD, EMB
Outline of Waste-To-Energy in Japan	Mr. Satoshi Higashinakagawa JICA Expert Team

TOPIC	SPEAKER
Closing Remarks	Engr. Reynaldo L. Esguerra Chief, Science and Research Specialist, Environment & Biotechnology Division, DOST-ITDI

Source : Project Team

2) Final seminar

The Final Seminar was held on December 14, 2022 at Joy Nostalg Hotel in Pasig City, Metro Manila. The Final Seminar was organized in a hybrid mode where some participated physically at the venue while the others participated virtually same as the technical dissemination seminars held after the COVID-19 pandemic. The number of attendees, such as the EMB regional offices, LGUs and private companies concerned with SWM participated in addition to the ITWG members and representatives of JICA Philippines is shown in Table 2.8.

In addition, Ms. Osorio, Assistant Director of the EMB (on behalf of the EMB Director), and Mr. Soichiro Ide, Senior Representative of JICA Philippines, were able to grace the activity.

All deliverables and achievements were reported by the ITWG subgroup members including DOST, PPPC, Cebu City LGU, Davao City LGU, EMB-ERLSD and JET. The members of the Philippines institutions expressed their appreciation for technical cooperation of JICA, also introduced what they learned through project activities as the recipient of technical assistance and indicated perspective for future utilization of the deliverables.

Table 2.8 Attendees of the Final Seminar

	Institutions of ITWG	Regional EMB	LGUs	Private agency	JICA	JET	Total
Physical attendees	9	0	4	4	2	6	33
Online attendees	19	14	22	11	0	2	70
Total	28	14	26	15	2	8	93

Source: Project Team

Table 2.9 Program of Final Seminar held on December 14, 2022

CONTENT/TOPIC	SPEAKER
Opening Ceremonies (National Anthem / Opening Prayer)	--
Welcome Remarks	Mr. Soichiro Ide Senior Representative, JICA Philippines
Opening Remarks / Discussion about the Seminar	Ms. Osorio Assistant Director, DENR - EMB
Report on TCP Summary and Accomplishments 1.) Video Presentation 2.) Project Completion Report	Mr. Takahiro Kamishita JICA Expert Team
Coffee break / AM Snacks	
TCP Involvement of Target LGUs: Accomplished activities, Lessons learned, and future SWM Plans	Engr. Lakandiwa Orcullo Davao City LGU
TCP Involvement of Target LGUs: Accomplished activities, Lessons learned, and future SWM Plans	Engr. Arlie Gesta Cebu City LGU
Output 1	Mr. Makoto Kosaka JICA Expert Team

Manual for Planning, Formulation, Evaluation and Contract Management (PFEC) of WTE projects in the Republic of the Philippines	Engr. Reynaldo Esguerra DOST-ITDI
Joint Administrative Order (JAO) on the Guidance Document for the Operation of the WTE Facility on Appropriately Controlled Combustion (ACC)	Mr. Takahiro Kamishita JICA Expert Team
Case Study Analysis for the Guideline of Best Available Technique/ Best Environmental Practice (BAT/BEP)	
Output 2 Support to SWM PPP Projects to Clarify Responsibility of LGUs under PPP Scheme	Atty. Lerma Advincula PPP Center
Output 3 Standard Operating Procedures and Other Activities on the Dioxins Analysis Component	Mr. Roger Evangelista ERLSD, EMB, DENR
Coffee break / PM Snacks	
Output 4 Enhancement of National Government's and target LGU's capacity to identify issues and provide suggestion/recommendation for SWM technologies other than WTE	Engr. Glory Rose Manatad Cebu City LGU
Closing Remarks	Ms. Ruby De Guzman DOE-REMB

Source : Project Team

(7) Capacity Assessment

Capacity assessments of the project team were conducted thrice, i.e., pre-assessment, mid-assessment, and post-assessment.

A self-evaluation of the capacity assessment sheet (checklist) for each Project output was requested to SG members on February 2020 for the pre-assessment, on August 2021 for the mid-assessment, and on October 2022 for post-assessment. SG members who participated in the SG meetings more than 50% in terms of number of meetings were considered valid for the capacity assessment. The number of members requested to do self-assessment decreased as time passed by, because many people in the ITWG member institutions had been replaced during the project period.

The number of members who submitted their results of self-evaluation is shown in Table 2.10.

Table 2.10 Respondents of the Capacity Assessment

Item		Output 1	Output 2	Output 3	Output 4
Pre-assessment	Respondents (% to total)	5 (45%)	7 (35%)	6 (55%)	8 (35%)
	Total number of members requested to respond	11	20	11	20
Mid-assessment	Respondents (% to total)	6 (100%)	11 (92%)	7 (100%)	8 (89%)
	Total number of members requested to respond	6	12	7	9
Post-assessment	Respondents (% to total)	4 (57%)	5 (50%)	5 (63%)	5 (71%)
	Total number of members requested to respond	7	10	8	7

Source : JICA Expert Team

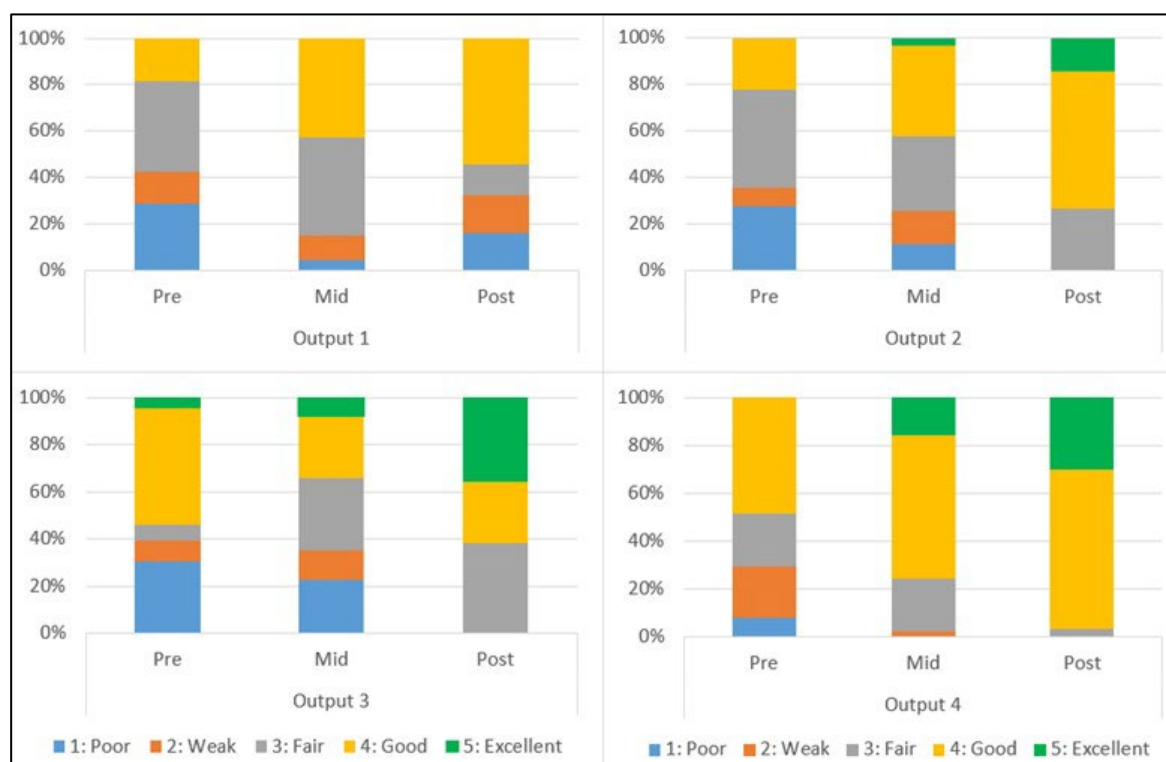
Assessment of self-evaluation is summarized in Figure 2.2. It can be evaluated that the self-evaluation of C/Ps' abilities improved as a whole during the course of the Project. It could be considered that the confidence of C/P members for the related knowledge and skills became better after the project implementation. It is expected that their capacity development will be continued and maintained through the actions to sustain project outcomes.

At the post evaluation, “poor” and “weak” were not selected at all by the respondents except output1. On the other hand, the output1 respondents who chose “poor” increased than those at the mid-assessment. It is afraid that some members were not confident in the understanding of technical detailed discussed in the SG of output1 after the mid assessment.

About Output 3, there was a tendency for some C/Ps to lower their self-evaluations compared to those at the beginning of the Project. This may be due to the fact that C/Ps' self-evaluation of their dioxin analysis skills was high at the beginning of the Project, but at the mid-assessment, their understanding, knowledge, experience, and skills have been deepened which made them realize of their deficiency and incompetence to the practice. However, at the post evaluation, the highest evaluation “excellent” significantly increased, this may be because the resumed training at the ERLSD laboratory after suspended period by the COVID-19 pandemic effectively worked to improve the confidents of ERLSD.

In addition to the capacity of individual level discussed above, the following deliverable from the project activities are considered as improvements of the social and organizational capacity:

- Technical standards for WTE including ash management: Activity 1-4, 1-5
- Manual for Planning, Formulation, Evaluation and Contract Management of WTE project: Activity1-6
- Standard Operation Procedures (SOP) for Dioxin Analysis: Activity 3-3
- Information of Good Practices of SWM technologies other than WTE: Activity4-3, 4-4



Source : JICA Expert Team

Figure 2.2 Ratio of Answers in Capacity Assessment

(8) Online Training

1) Modification of the Training in Japan to Online Training

It was discussed in early 2020 among PMO and JET that the training in Japan would be organized and implemented in May-June 2020.

However, due to the impact of COVID-19 pandemic, the training in Japan was not possible to be conducted. At the beginning of this Project, the training was supposed to be implemented twice, but it was changed to be conducted only once through online training to cope with the difficult condition of international flight and arrangement of facilities in Japan receiving trainees from the Philippines in the post COVID-19 pandemic society. As a result, the online training was arranged and conducted in November 2021.

2) Objective of Online Training

The objective of this training is to share Japanese technologies and practices on Solid Waste Management (SWM) and Dioxin Analysis with the trainees who are involved in the project activities.

It was expected that the knowledge obtained through the training will be helpful for implementation of the activities in the remaining project period and future development of WTE and its management.

3) Program of Online Training

The title of lecture/training, lecturer, and number of Filipino participants are shown in Table 2.11. The training theme covered the SWM, WTE, and dioxin analysis that correspond to the activities of the output of the Project. The training material of and result are given in Appendix 10.

Table 2.11 Program of Online Training

Schedule (PST)	Category	Lecture/Training	Lecturer	Number of Participants
November 15, 2PM-4PM	SWM	<ul style="list-style-type: none"> Solid Waste Management /Legal Framework and Roles of Each Entity in Japan 	Nippon Koei Co., Ltd.	38
November 16, 10AM -12NN	Dioxin Analysis	<ul style="list-style-type: none"> Pre-conditioning of Capturing/ Adsorbent Materials and Sampling Train 	Eurofins Nihon Kankyo K.K.	24
November 17, 10AM -12NN		<ul style="list-style-type: none"> Procedure of Sample Recovery from the Sampling Train 		20
November 18, 10AM -12NN		<ul style="list-style-type: none"> Initial setup of GC/HRMS and DIOK Operation 		19
November 26, 9AM -11AM	WTE	<ul style="list-style-type: none"> PPP for Waste to Energy (WTE) project 	Eight-Japan Engineering Consultants Inc.	24
December 3, 9AM -11AM		<ul style="list-style-type: none"> Online Visit to Sugunami Incineration Plant Environmental Consideration in the WTE Facility 	Clean Authority of Tokyo	26
December 6, 9AM -11AM		<ul style="list-style-type: none"> Outline of Solid Waste Management in Tokyo 23 Wards Public Consultation and Consensus Building Suitable Waste Segregation and Promotion Operation of Waste to Energy Facilities 	Clean Authority of Tokyo	22
December 10, 9AM -11AM		<ul style="list-style-type: none"> Outline of WTE Technology Requirements of WTE Projects 	Eight-Japan Engineering Consultants Inc.	25

Source : Project Team

(9) Approval of the DAO for WTE Guidelines

Since March 2019, JET was following up on the approval of the DAO 2019-21 for WTE guidelines through FASPS and PMO. Updates on its approval was shared by FASPS and PMO during the kick-off meeting and the preparatory meeting for the first JCC meeting.

The DAO was finally approved by the former DENR Secretary, Roy A. Cimatu on November 26, 2019, approximately eight months after the start of the project. It was published in two major newspapers on December 26, 2019 and submitted to and received by the Office of the National Administrative Registry at Law Center of the University of the Philippines on January 7, 2020.

Part of the EMB-SWMD programs for CY 2020 was to conduct the Capacity Development Training of the Regional DENR and EMB field offices on the implementation of the newly approved DENR AO on Guidelines Governing WTE Facilities for the Integrated Management of Municipal Solid Wastes.

(10) Support to Agreement between DENR and LGUs for the Project

Prior to implementation of the Project, it was agreed between JICA and DENR-EMB that DENR-EMB would sign MOUs with each target LGU in order to ensure smooth coordination and operation for the Project. Although EMB, through its concerned regional offices continuously following-up on the LGUs, the MOUs with the 2 target LGUs was only signed in the last year of the Project.

The MOU between the DENR-EMB and Cebu City was signed on November 11, 2021 and the MOU between the DENR-EMB and Davao City was signed on February 17, 2022.

However, the MOU between the DENR-EMB and Quezon City was not signed during the Project period due to internal concerns within the LGUs.

(11) WTE Bills

Recently, several WTE bills are being proposed to institutionalize WTE development and expand the allowed WTE technologies in the Philippines, particularly to remove the ban on incineration. Since the WTE bills, if approved, will be the fundamental law for WTE project in the country, the project team continuously studied the status of the WTE Bills and confirmed consistency of the activities and the deliverables of the Project.

Several bills were submitted to the Senate and House of Representatives in the Republic of the Philippines as listed in Table 2.12. The bills filed in the Senate have been consolidated into the Senate Bill (SB) 1789 “Waste-to-Energy Act” with the complete title of “An Act Establishing a National Energy Policy and Regulatory Framework for Facilities Utilizing WTE Technologies”, filed by Sen. Gatchalian last August 25, 2020. This SB consolidates SB 363, 401, and 1011 which contains the following pertinent provisions:

- Favoring Waste-to-Energy over other waste treatment technologies
- Promotion of clustering through cooperation of Provincial and City/Municipal SWM Boards
- Extension of incentives for WTE facilities, and its inclusion in the strategic investments priority plan of Boards of Investment (BOI).

It also stipulates that NSWMC shall determine standards, criteria, and guidelines for the following:

- Characterization and composition of solid waste utilized as WTE feedstock for WTE facilities to ensure emissions are compliant with Republic Act No. 8749 and other relevant laws, rules, and regulations,
- Transport, storage, and pre-processing of WTE feedstock,
- Pre-operation, siting, design, operation and maintenance of WTE facilities,
- Quality control and operational control of WTE facilities,
- Management of residue from WTE facilities, if any,
- Pollution abatement, emissions monitoring, environmental monitoring, and public health and safety monitoring in relation to WTE facilities, and
- Decommissioning, closure, and abandonment of WTE facilities.

SB 1789, as of October 2022, has still not been scheduled for a second reading until now. After going through and passing the second reading, a third reading will be facilitated and once voted favorably, it will be forwarded to the House of Representatives for further review and approval.

On the other hand, the bills filed in the House of Representatives (HB 618, 933, 1938, 3174, 3423, 4419, 5401, 5706, and 7045) relating to WTE were consolidated into HB 7829: Waste Treatment Technology Act. This House Bill has passed the review of the House of Representatives and has been sent to the Senate last November 2020. Among its primary stipulations include the following:

- Classification of WTE as a renewable energy resource
- Agreement for WTE facility to treat waste using incineration technologies, provided that it shall not emit toxic or poisonous fumes
- Promotion of clustering between LGUs through NSWMC
- Inclusion of WTE in the NSWMC Framework, SWM Plans from the City/Municipal Level until the National Level, and the DOE Energy Plan
- Involvement of DOH as one of the key government offices for its implementation, particularly for the implementation of the Health Impact Assessment to analyze the effects of WTE facilities and disposal sites on public health.

Once both HB 7829 and SB 1789 have passed the review of both the Senate and House of Representatives, these two bills will be consolidated into a joint resolution where it will have to undergo another review by the House of Representatives and then the Senate before it is sent to the Office of the President for approval and signature.

The current drafts of these bills have been reviewed by the team in the intent to harmonize it with the TCP outputs under Activity 1-4: Prepare draft technical standards for WTE facility focused on waste incineration with power generation and Activity 1-6: Prepare manual for planning, evaluation, formulation, and supervision for WTE projects.

Although the review and approval of these bills may result further revisions to the bill, the current drafts do not have any conflicts with the TCP outputs and can be implemented harmoniously with the WTE bill once adopted.

Table 2.12 List of Bills on Waste to Energy Act (As of October 2022)

Bill No.	Description	Filed Date	Filed by
HB 3174	An Act Allowing the Use of Waste-to-Energy Technology in Electricity, Fuel and Heat Generation and for Other Purposes	July 30, 2018	Representative Abraham "Bambol" N. Tolentino
HB 618	An Act Regulating the Use of Treatment Technology for Municipal and Hazardous Wastes, Repealing for the Purpose Section 20 of Republic Act No. 8749, Entitled "The Philippine Clean Air Act of 1999"	July 1, 2019	Representatives Carlito S. Marquez and Carlos O. Cojuangco
HB 933	An Act Promoting and Permitting the Use of Waste-to-Energy Technology, amending for this Purpose Republic Act No. 8749, Otherwise Known as the Clean Air Act of 1999	July 2, 2019	MAGDALO Party-List Representative Hon. Manuel DG. Cabochan
HB 1938	An Act Regulating the Use of Treatment Technology for Municipal and Hazardous Wastes, Repealing for the Purpose Section 20 of Republic Act No. 8749, Otherwise Known as "The Philippine Clean Air Act of 1999"	July 10, 2019	Representative Enrico Pineda and Michael Odylon Romero
SB 363	An Act Establishing a National Energy Policy and Regulatory Framework for Facilities Utilizing Waste-to-Energy Technologies	July 11, 2019	Senator Sherwin T. Gatchalian
SB 401	An Act Allowing the Use of Waste-to-Energy Technology in Electricity, Fuel and Heat Generation and for Other Purposes	July 11, 2019	Senator Francis N. Tolentino
HB 3423	An Act Establishing a National Energy Policy and Regulatory Framework for Facilities Utilizing Waste-to-Energy Technologies	August 5, 2019	Representative Alfred Vargas
SB 1011	An Act Amending Republic Act No. 7160, Otherwise Known as the Local Government Code of 1991, for the Purpose of Enhancing the Power of Local	September 4, 2019	Senator Francis N. Tolentino

Bill No.	Description	Filed Date	Filed by
	Government Units in Waste Management and For Other Purposes		
HB 4419	An Act Promoting the Use of Waste-to-Energy, amending for the Purpose Republic Act No. 8749, Otherwise Known as the Clean Air Act of 1999	September 5, 2019	Representatives David "Jay-Jay" C. Suez and Anna Marie Villaraza-Suarez
HB 5401	An Act Regulating the Use of Treatment Technology for Municipal and Hazardous Wastes, Repealing for the Purpose Section 20 of Republic Act No. 8749, Entitled "The Philippine Clean Air Act of 1999"	November 11, 2019	Representative Jocelyn Sy Limkaichong
HB 5706	An Act Promoting and Establishing the Use of Waste to Energy Technologies and Facilities as an Alternative Source of Renewable Energy Technologies and For Other Purposes	December 4, 2019	Representative Eric L. Olivarez
HB 7045	An Act Regulating the Use of Treatment Technology for Municipal and Hazardous Wastes, Repealing for the Purpose Section 20 of Republic Act No. 8749, Entitled "The Philippine Clean Air Act of 1999"	July 1, 2020	Representative Rodrigo Abellanosa
SB 1789	An Act Establishing a National Energy Policy and Regulatory Framework for Facilities Utilizing Waste-to-Energy Technologies	August 25, 2020	Senator Sherwin T. Gatchalian
HB 7829	An Act Regulating the Use of Treatment Technology for Municipal and Hazardous Wastes, Repealing for the Purpose Section 20 of Republic Act No. 8749, Entitled "The Philippine Clean Air Act of 1999"	October 5, 2020	Representatives Carlito S. Marquez, Carlos O. Cojuangco, Manuel D. Cabochan III, Enrico A. Pineda, Michael Odylon L. Romero

Source: Project Team

2.2 Activities for Output 1

Activities 1-1 : Prepare Guidelines for Best Available Technique (BAT) / Best Environmental Practice (BEP)

(1) Background and Objectives

According to the requirement described in Section 12 in the NSWMC Resolution 669 issued on June 2016, the National Solid Waste Management Commission (NSWMC) through National Ecology Center (NEC) shall prepare the Best Available Technologies/Best Environmental Practices (BAT/BEP) Guideline. However, NEC has not yet been established as of 2019 when the project started. Since SWMD is involved in the operations of NEC, JET supported SWMD in preparing the BAT/BEP Guideline as planned and stated in the inception report.

In this context, the Case Study Analysis for the Guideline of BAT/BEP has been prepared through case studies in various countries which have WTE facilities with more detailed technical, institutional, and financial information of WTE for future utilization in the Philippines.

(2) Methodology

The survey was conducted mainly by utilizing secondary information. The case studies used as references were gathered from the internet, professional journals, official websites of the facilities, and academic magazines. In the secondary information gathered, many facilities did not disclose details on the project costs, operating costs, and technologies accordingly such information were not obtained. To supplement such information, JET sent official request letters through DENR-EMB to the operators and managers of

WTE facilities in the case study. The survey yielded responses on two WTE facilities⁶, which were reflected in this case study analysis.

(3) Schedule

The case study was conducted during the period indicated below.

- Literature and other information survey: March 2020 - March 2021
- Questionnaire survey (via EMB letter): December 2020 - March 2021

(4) Scope of Work

1) Waste Technology

WTE technology generally refers to the technology which uses thermal energy to generate energy in the form of electricity or heat from waste. In DAO 2019-21, WTE is defined as the process of converting wastes with various technologies, usually the conversion of non-recyclable waste materials into useable heat, electricity, or fuel through a variety of processes.

Though there are various types of WTE technologies such as pyrolysis, refused derived fuel (RDF), and biogas, combustion technology is one of the most popular⁷ and reliable WTE technologies at this moment with a long history of application. In this BAT/BEP Guideline, the case studies would be primarily targeted for the WTE facilities utilizing combustion technology.

2) Countries and Region

The WTE track record of waste combustion and the characteristics of the Philippines are considered to decide the countries and region for the case study. According to World Bank data⁸, the track record is dominated by North America, Europe, and Asia; therefore, WTE cases in these three regions were included in this Study.

3) Treatment Capacity

a. Range of the Capacity of WTE

The minimum treatment capacity of case studies to be collected and analyzed in this guideline has been set as 100 t/day based on the two reference documents of waste combustion facility.

- Pre check list for Feasibility Study of Waste Power Generation Plant (2019, JICA)

One of the most important items to be checked for the target municipality is that the target city population is 100,000 or more or plant capacity is 70 t/day or more).

- Municipal Solid Waste Incineration -A Decision Maker's Guide- (2000, World Bank)

One of the keys for incineration economy is given that to be economically feasible, the individual incineration units should have capacities of at least 240 t/day (10 t/hr), and there should be at least two separate units.

⁶ Klemetsrud Combined Heat and Power (CHP) plant (ID302, Norway), Palm Beach Renewable Energy Facility 2 (ID318, USA) responded to the EMB letter.

⁷ <https://www.uncclearn.org/wp-content/uploads/library/unep23092015.pdf>

⁸ What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050, World Bank, 2018)

Although 100 t/day is larger than the 70 t/day indicated in the JICA Pre-checklist, the target capacity of the case study is set at a slightly larger scale, referring to the World Bank (WB) document.

On the other hand, the maximum capacity was not set for data collection because giga size facility is not so common and such information is limited.

b. Waste Amount Estimate for LGUs in the Philippines

In order to get the approximate treatment capacity of WTE for LGUs in the Philippines, waste amount is estimated based on the LGU's population and waste generation unit set by the NSWMC.

It is analyzed that about 80% of primary LGUs including provinces do not generate more than 300 t/day but 23 municipalities do. This opens the possibility of the 23 municipalities to consider WTE facilities with more than 300 t/day capacity which satisfies at least 240 t/day, the benchmark given by the WB document.

c. Clustering of LGUs

A clustering of LGUs can be a way to set the bigger capacity of WTE facility which may give not only more and efficient electricity generation. This can also be a solution to support small LGUs which does not have the capacity in terms of financial, technical, and human resources unlike the bigger LGUs as recommended in RA 9003 for even conventional management of solid waste such as MRFs. This is because it has been promoted in the experienced countries such as Europe and Japan. In case of the Philippines, it will be possible to develop a bigger capacity of WTE in the future after smooth implementation of clustering of LGUs.

Based on the discussion above, the target treatment capacity of WTE facility has been determined as more than 100 t/day.

4) Survey Contents

The survey contents are shown in Table 2.13.

Table 2.13 Survey Contents of Case Studies of WTE Project

Survey Item	Survey Contents
Profile	
Implementing Body	- Name of local government unit (LGU) - Name of association by multiple LGUs in case of cluster waste management - Name of public service corporation or special purpose company (SPC) in case of PPP project
Site	- Name of country and location - Area/footprint (ha) - Land Use
Planned and actual schedule	- Schedule of planning, design, construction, and operation - Their planned and actual schedule
Coverage (Scope)	- Scope of implementation body (only WTE or including waste collection, transportation, energy recovery and distribution, ash disposal, etc.)
Technical Aspect	
Target Waste	- Type of target waste is described such as municipal solid waste or industrial waste - If target waste includes hazardous waste or not - If target waste includes sewerage sludge or not
Capacity/Quantity	- Plant capacity of daily or annual quantity of "Target Waste"
Processing Type	- Type of incineration facility like stoker type or fluidized bed combustion, Refused Derived Fuel (RDF), etc.
Lower Calorific Value (LCV) of the target waste	- Lower calorific value of "Target waste" - Information on range of lower calorific value
Heat Utilization	- Power generation for electricity utilization

Survey Item	Survey Contents
	- Heating value by utilizing heating for community or other hot water utilization
Pollution Control	- Management of exhaust gas, wastewater, etc. - If national standards on emissions are observed or are imposing stricter standards
Ash Management	- Treatment and disposal procedure of bottom ash including separation process of recyclable material in the bottom ash - Treatment and disposal procedure of fly ash
Technical Provider	- EPC contractor or manufacturer of WTE facility
Institutional Aspect	
Business Scheme (Implementation Framework)	- Public Own & Operate, Public Own & Private Operate (separate), - BOO, BOT, BTO, etc. under Private Finance Initiative (PFI)
Development Approach	- Solicited approach which is proposed by local government, or unsolicited approach which is proposed by private service providers.
Citizen Involvement	- Public consultation process including explanatory meeting - Information dissemination to public
Project income and / cost	- Government tax, power sales, gate fee (tipping fee), other government subsidies for initial/annual, etc. - Capital expenditure (CAPEX), operation expenditure (OPEX)

Source: Project Team

(5) Survey Results and Utilized Points for the Philippines

Through the analysis of case studies, the trend of best available techniques and best environmental practices have been grasped. The detail results are given ⁹in Appendix 3. In addition, the following points can be mainly utilized for WTE development process in the Philippines as good practices.

1) Target Waste

The LGUs shall decide or check the target waste to be treated in their WTE facility according to their municipal solid waste management plan so that the responsibility of managing the municipal solid waste generated and collected in their jurisdiction can be taken.

Same stipulation with DAO 2019-21, nowadays, the waste segregation is practiced commonly before treatment by WTE facility. The segregation practice, methodology, and technology in the countries where WTE facilities are already operated can be references for the LGUs in the Philippines. The LGUs will have to evaluate if such ways are appropriate for their municipal solid waste management.

2) Combustion Technology and Treatment Capacity

Stoker (moving grate) is the most commonly adopted because of its track record, historical success, and variety of treatment capacity. This technology is more reliable due to long term experience and can handle a large amount of solid waste. Since the operation period of WTE facility is long as 20 years or more, the technology shall be evaluated carefully.

One thousand tons of solid waste per day can be treated by a single furnace of stoker type. The treatment capacity of a combustion furnace of fluidized bed combustion is much smaller (200 t/day of treatment capacity is confirmed in the case study) than stoker type while it has strong point in a smaller space requirement than stoker type. The LGUs shall evaluate which type of furnace is appropriate for their municipal solid waste amount.

⁹ Described from page 20 to page 48, Table 5.1 in Appendix 3.

3) Area

The area can be minimized according to availability of land and the conditions of the surrounding area. Although it is confirmed that the area of 2 ha per 1,000 tons/day is necessary, it is also confirmed that the WTE facilities have been constructed and operated in the populated and urbanized area.

4) Energy Recovery

The electricity generation efficiency has been improved as the treatment capacity of WTE facilities become bigger. However, to achieve very high efficiency of electricity generation, higher cost could be required. The following could contribute to improve the efficiency of energy recovery:

- Increase of exchange capacity such as utilization of low temperature economizer
- Increase of boiler temperature and pressure results effective utilization of steam
- Increase of the efficiency of steam turbine system such as introduction of steam condensing turbine and combined cycle with thermal power plant, etc.
- Increase of thermal energy by increasing waste quantity and low calorific value (LCV).

5) Pollution Control

Environmental standards of WTE facility are usually set as stricter than the national standards in the case of the developed countries. It means that such stricter standards can be implemented by installing appropriate pollution control technology and eases making public consensus for its development.

6) Ash Handling

Bottom ash and fly ash shall be separately handled and treated. In the case of bottom ash, after the separation of recyclable, the residue of bottom ash may be utilized as the cement aggregate, or other construction use such as backfilling material, roadbed after its melting, baking and aging. While the amount of solid waste for disposal can be reduced by these utilizations, these sometime requires additional cost. Because fly ash contains heavy metal or other toxic materials, it should be stabilized by cement solidification, chemical treatment, and disposal at hazardous waste landfill site.

7) Business Scheme

During the planning and design stage, LGUs should prepare or evaluate their overall plans for the WTE facility, along with the technical specifications. It was confirmed that a solicited approach was adopted in almost all cases in the case study. This is because WTE projects could reach to the construction and operation stage. Proposals from the private sector are based on their technical and financial capacity, which may not be best for the improvement of solid waste management in the LGUs unless appropriately oriented before preparation of the proposal.

8) Public Involvement and IEC

During the planning process, public consultation should be implemented. The EIA including public consultation are executed during the WTE development, which facilitates the citizen's understanding on the Project as well as the situation of the municipal solid waste management of their LGUs.

As practiced in the developed countries, environmental monitoring reports for WTE operations should be regularly prepared and disclosed. The information relevant to WTE operations, such as air quality monitoring of exhaust gas or water quality monitoring of wastewater are to be reported.

(6) Endorsement to DENR by 2nd JCC Meeting

JET presented and discussed the following contents during the 2nd JCC Meeting:

- Overview of previous meetings regarding the preparation of the Case Study Analysis for Guideline of BAT/BEP
- BAT/BEP Guideline in the TCP
- The Case Study Analysis for the Guideline of BAT/BEP to prepare BAT/BEP Guidelines: (1) structure and scope, (2) results, and (3) findings

During the JCC Meeting, there are no further comments on the Case Study Analysis. With no further comments/objections from the members, the Case Study Analysis was officially adopted and approved for endorsement to DENR/EMB by the JCC.

According to SWMD, the BAT/BEP Guidelines shall be finalized based on the Case Study Analysis and currently the finalization of the BAT/BEP Guidelines is under process by SWMD.

Activities 1-2: Study policy and mechanism to promote WTE in neighboring countries including cost sharing scheme

It is generally necessary for LGUs to allocate additional funds to improve their SWM, including WTE promotion. For this reason, the project team investigated revenue and funding sources of LGUs for SWM in the Philippines.

(1) Revenue Sources of LGUs

There are three major revenue sources for LGUs, which are outlined below:

1) Local taxes, fees, and charges

- Taxes on transfer of real property ownership; business of printing and publication; sand, gravel and other quarry resources, etc.
- Toll fees for the use of public roads, bridges, waterways, etc.

2) Internal revenue allotment

- As mandated in RA 7160, LGUs are entitled to have a share in the national revenue taxes.
- This allotment varies from one LGU to another depending on the population, land area, and equal sharing criteria.

3) Commercial loans

- RA 7160 vested the LGUs with the power to avail of credit facilities to finance local infrastructure and other development projects as approved in their respective local development plans and public investment programs.
- However, the use of this fund for a large-scale infrastructure investment is not recommended due to shorter pay back periods or unrealized return of investments.

(2) Funding Sources of LGUs for SWM

The project team could identify the following four funding sources that LGUs can leverage for the improvement of SWM.

1) National Solid Waste Management Fund (NSWMF)

- Financing of SWM initiatives is embodied in RA 9003 as reflected by the establishment of the NSWMF.
- This fund is available to LGUs upon NSWMC’s approval on their given set of conditions and criteria
- Eligible activity and its criteria are summarized in Table 2.14.
- However, the NSWMF is not functional because the source of this fund is not yet secured.

2) Development Bank of the Philippines (DBP)

- DBP is the country’s premier financial institution supporting the national government’s different key development programs.
- DBP assists and aids in development of infrastructure, logistics, social services, micro-small and medium enterprises, and environment.
- The outline of DBP’s Green Financing Program is summarized in Table 2.15.

3) Public-Private Partnership Center (PPPC)

- Any local implementing agencies currently undertaking PPP projects may notify the Project Development and Monitoring Facility (PDMF) to provide support and assistance.
- There is a revolving fund managed by the PPP Center used to engage consultants for project preparation and transaction support to conduct FS, project structuring, preparation of tender documents, management of the bid process, and assistance until financial close.
- The fund can also be utilized to engage probity advisor for the bidding process and consultants for the monitoring of project implementation.

4) Grant and Concession Loans

- LGUs can accept donations directly from donors, without approval of the National Government but it’s required to inform both the Congress and President.

Table 2.14 Eligible Activity and Criteria of NSWMF

Acceptable initiative/activity	<ul style="list-style-type: none"> · SWM projects which shall catalyze investment from the private sector and/or other investors · Innovative SWM approaches · Prototyping SWM models
Criteria/Conditions	<ul style="list-style-type: none"> · A proponent LGU shall have an approved 10-year SWM Plan. · Funding request should not exceed PHP1,500,000. · The LGU may avail of the SWM Fund once every three years, but not for the same project/activity. · The LGU has no existing foreign/outside foreign source. · The LGU is committed to put in counterpart funds, the computation of which shall be provided by the Commission per LGU classification. · The process for availing the fund is completed.

Source: RA 9003 and DAO 2001-34

Table 2.15 Summary of DBP’s Green Financing Program

Maximum loanable amount	<ul style="list-style-type: none"> · Private entities: Up to 80% of the total project costs · LGUs/GOCCs/GA: Up to 90 % of the total project costs
Equity participation	<ul style="list-style-type: none"> · Private entities: Up to 20% of the total project costs · LGUs/GOCCs/GA: Up to 10 % of the total project costs
Interest rate	<ul style="list-style-type: none"> · Prevailing market rate
Repayment terms	<ul style="list-style-type: none"> · Up to 15 years with maximum of five years grace period
Basic documentary requirements	<ul style="list-style-type: none"> · Letter of intent · Company information/profile audited financial statements (past three years) · Feasibility study/project proposal · Applicable environmental permits (e.g., ECC/CNC)

Note: GOCC (Government-owned and controlled corporation)

Source: AECOM (2019) “Financial Mechanisms and Incentive Systems for the Implementation of Open Burning Prevention and Minimization Programs in the Philippines”

Among the above funding sources, the NSWMF is the only fund that has been established with the direct purpose of improving SWM in LGUs. However, it is assumed the maximum amount of funds to be provided to LGUs (PHP1.5M per activity) will not be so attractive for large LGUs such as Quezon City, where their annual budget for SWM is PHP873~1,032M (2015-2017)¹⁰, and this amount will not be enough to promote WTE projects which will require significant investment for construction and operation.

(3) Cost-Sharing Scheme for Promotion of WTE in Neighboring Countries

JET investigated the cost-sharing scheme for promotion of WTE in neighboring countries and identified Japanese and Indonesian cases as good references for the Philippines.

1) Funding support for SWM facilities by National Government in Japan

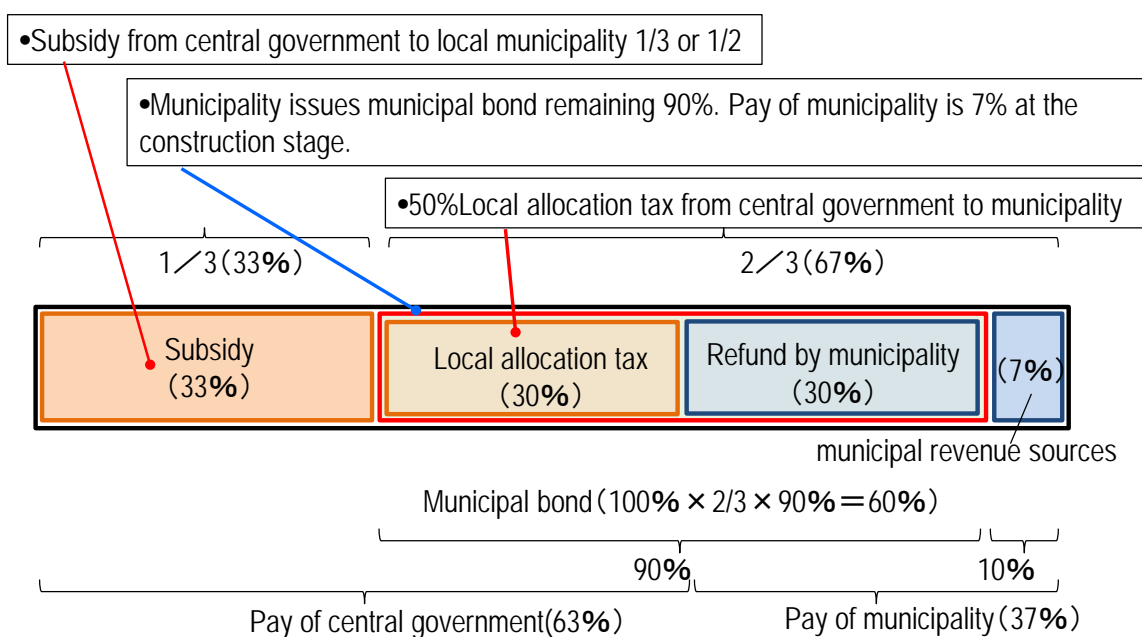
In Japan, to promote a sound material cycle society, the National Government grants one third of the initial investment if SWM facilities including WTE facility satisfies certain conditions. The outline of the Japanese funding support scheme for SWM facilities is summarized in Table 2.16. In addition, half of the portion funded by municipal bonds will also be reimbursed by the local allocation tax from the National Government as shown in Figure 2.3 Funding Support Scheme for SWM Facilities in Japan.

Table 2.16 Summary of Japanese Funding Support Scheme for SWM Facilities

Objective	<ul style="list-style-type: none"> · Support municipalities in establishing a sound material-cycle society
Eligible facilities	<ul style="list-style-type: none"> · Material recycling facility Incombustible and plastic recycling facilities, stockyards, etc. · Energy recovery type waste treatment facility Waste power generation facilities, heat recovery facilities, biogas facilities, etc. · Organic waste recycling facility Facilities for recycling human urine and organic waste · Septic tank · Final disposal site
Grant rate	<ul style="list-style-type: none"> · 33% of facility construction cost (50% in case of advanced facility)

Source: JICA Expert Team by referring to the website of Ministry of Environment Japan

¹⁰ Source: Ten-year solid waste management plan of Quezon City



Source: JICA Expert Team

Figure 2.3 Funding Support Scheme for SWM Facilities in Japan

2) WTE project promotion by PPP scheme in Indonesia

The Government of Indonesia declared the promotion of WTE projects in their country and designated the 12 priority areas for development of WTE facilities by the Presidential Decree No. 35 enacted in 2018. Although the WTE facility is not yet operational in Indonesia, some local governments are currently preparing to develop WTE projects.

The following policy instruments were installed in Indonesia to promote WTE projects by PPP scheme:

- i) Viability Gap Funding (VGF): Government's subsidy for investment cost of PPP projects

A financial support funded by the Ministry of Finance, to support the establishment of PPP projects by providing a portion of the construction cost for projects with high social benefits but low profitability.

- Form of payment: Cash
- Coverage for payment: Portion of construction cost
- Schedule of payments: stipulated in PPP project agreement (Certain stages during construction period and commercial operation date).
- PPP projects implemented by LGUs can be funded from LGUs' fund in addition to VGF.

- ii) Availability Payment (AP): Government's subsidy for operational cost of PPP projects.

A system whereby Government Contracting Agency (GCA) promises a fixed payment to the private operator in exchange for the provision of infrastructure services at a specified quality under a PPP contract. Adequate return on the investment for PPP projects involving operation & maintenance of infrastructure over a long term can be guaranteed from private operator's perspective.

- iii) Feed-in-tariff

Set at US¢13.35/kWh

iv) Indonesian Infrastructure Guarantee Fund (IIGF): Government's guarantee for PPP project

IIGF is a public guarantor established and 100% owned by the Ministry of Finance. IIGF guarantees the performance of GCA in PPP projects and promises financial compensation on behalf of GCA. In case GCA fails on its obligations, consequently making a significant contribution to reducing risk of private operators. In PPP projects where IIGF guarantee contracts are signed, three types of contracts namely: (a) PPP project contract, (b) guarantee agreement, and (c) recourse agreement, are signed by the private sector, GCA, and IIGF. Figure 2.4 illustrates the business model process of IIGF.

(a) PPP Project Contract:

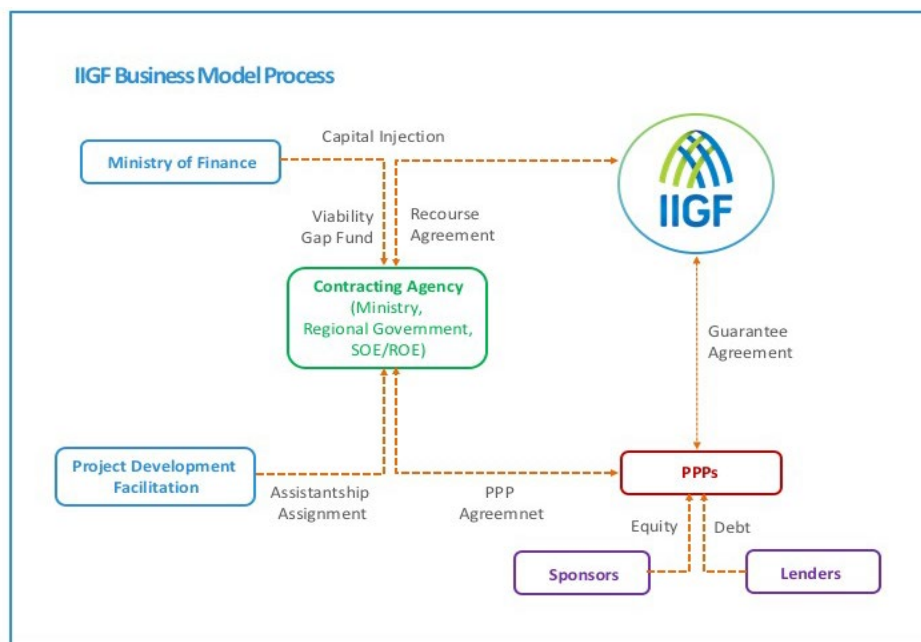
A PPP project contract is concluded between Private Operator and GCA, which stipulates rights and obligations related to a PPP project.

(b) Guarantee Agreement:

IIGF and Private Operator will conclude a guarantee agreement for a PPP project. This agreement will guarantee performance of a PPP project contract by GCA.

(c) Recourse Agreement:

In addition to the above, IIGF will enter into recourse agreement with GCA. If certain requirements are met, IIGF will make payments to Private Operator on behalf of GCA in response to payment requests by Private Operator. Then, IIGF will collect recourse payments from GCA under this Recourse Agreement.



Source: IIGF

Figure 2.4 IIGF's Business Model Process

3) Feed-in-tariff (FIT) for WTE in the Southeast Asian countries

Feed-in-tariff scheme, a policy mechanism designed to accelerate investment in renewable energy technologies by offering long-term contracts to renewable energy producers, is also an effective policy tool to improve financial feasibility of WTE projects.

The project team could identify the FIT scheme applied for WTE projects in the Southeast Asian countries as summarized in Table 2.17.

It is noted that the Republic of the Philippines had applied the FIT scheme for renewable energy such as wind, biomass (including WTE), solar, and run-off river hydropower by enacting DC 2013-05-0009, application of the FIT for WTE project as one of the biomass energy is already expired as the set installation target was achieved.

Table 2.17 FIT applied to WTE Project in the Southeast Asian Countries

Country	Enforcement	Tariff (US cent/kWh)	Condition, Remarks
Indonesia	2018	13.35	Capacity: < 20MW
		14.54 – (0.076 * [Capacity])	Capacity: > 20MW
Thailand	2015	20.9	Capacity: < 1MW
		19.2	Capacity: 1~3MW
		16.8	Capacity: > 3MW
Vietnam	2014	10.05	Applied for incineration
		7.28	Applied for landfill gas
Malaysia	2011	6.5 – 7.4	Applied for biomass/biogas
Philippines	2013	13.3 (-0.05% deduction per year)	Already expired
Japan	2019	23.8	

Source: Project Team

Activities 1-3: Implementation of the Seminar to Disseminate the WTE technology

The first and second technical dissemination seminar of WTE technology was held twice in June and September 2022, respectively, inviting the relevant stakeholders of the Philippines. The seminars were conducted in a hybrid mode where some participated physically at the venue while the others participated virtually, which is common for such events after the COVID-19 pandemic.

The programs of each seminar are shown in Table 2.18 and Table 2.19, respectively.

The first seminar was held after preparation of the final version of BAT/BEP Guidelines because it was intended to share the collected information of WTE for the case study. The technical, institutional, and financial features and information of WTE were shared. The WTE technical standards in the advanced countries in terms of application of the technologies and the draft standard discussed in SG meetings and endorsed by JCC was also shared. In addition to the information related with the activities of Output 1, activity of Output 4 dealing with the technologies other than WTE was introduced to the attendees.

In the second seminar, a procedure of the planning, evaluation, formulation, and supervision of WTE project was explained. The shared information was based on the discussion of the manual for WTE project which was being prepared by sub-group of Output 1. JET also explained the recommendations to improve the present conditions of sanitary landfills in the Philippines. The shared information was one of the results of Activity 1-8. Same as the first seminar, the input was given from the results of the activity for Output 4. For every presentation by JET, members of ITWG/Sub-group gave the synthesis remarks to facilitate the understanding of the attendees.

The number of attendees is summarized in Table 2.20 and Table 2.21.

Table 2.18 Program of the First Technology Dissemination Seminar (June 3, 2022)

Venue: Clermont Function Hall, Discovery Suites Hotel	
Time: 1:00PM to 5:00PM	
TOPIC	SPEAKER
Registration	-
OPENING CEREMONIES	
Invocation, National Anthem	JICA Expert Team
Welcome Remarks	Engr. William P. Cuñado OIC-Director, EMB, DENR
Opening Remarks	Mr. Yo Ebisawa Senior Representative JICA Philippines Office
Introduction of the TCP and the Program of seminar	Mr. Takahiro Kamishita JICA Expert Team
PRESENTATIONS	
SWM Planning for WTE	Mr. Takahiro Kamishita JICA Expert Team
Technical Features of Appropriately Controlled Combustion Technology	Mr. Satoshi Higashinakagawa JICA Expert Team
Institutional and Financial features of WTE	Mr. Makoto Kosaka JICA Expert Team
WTE related technical standards	Mr. Makoto Kosaka JICA Expert Team
Good practice of SWM other than WTE	Ms. Kyoko Kimura JICA Expert Team
CLOSING CEREMONIES	
Closing Remarks	Ms. Elvira Pausing Assistant Project Manager EMB-SWMD/PMO

Source: Project Team

Table 2.19 Program of the Second Technology Dissemination Seminar (September 8, 2022)

Venue: Nostalg Room1&2, Joy Nostalg Hotel	
Time: 10:00AM to 4:30PM	
TOPIC	SPEAKER
Registration	-
OPENING CEREMONIES	
Invocation, National Anthem	JICA Expert Team
Opening Remarks	Mr. Yo Ebisawa Senior Representative, JICA Philippines Office
Introduction of the TCP and the Program of seminar	Mr. Takahiro Kamishita JICA Expert Team
PRESENTATIONS	
Remarks on WTE projects 1. As a treatment facility in entire SWM of LGU (Guidebook)2. As a PPP project	Mr. Takahiro Kamishita JICA Expert Team Synthesis by PPPC
Lunch Break	
Procedure of the Planning, Evaluation, Formulation, and Supervision of WTE project	Mr. Makoto Kosaka JICA Expert Team Synthesis by DOST-ITDI
Recommendations to Improve the final disposal site	Mr. Takuya Koketsu JICA Expert Team
Tea Break	
Introduction of the Booklet of Good Practices and Good Technologies other than WTE Good practice of SWM other than WTE to be adopted in the partner LGUs	Ms. Kyoko Kimura JICA Expert Team Cebu City Davao City
Q&A CLOSING CEREMONIES	
Closing Remarks	Ms. Ruby De Guzman REMB, DOE

Source: Project Team

Table 2.20 Attendees of the First Technology Dissemination Seminar

	Institutions of ITWG	Regional EMB	LGUs	Donor (UNIDO)	JICA	JET	Total
Physical attendees	13	4	5	0	2	5	29
Online attendees	30	14	35	2	3	5	89
Total	43	18	40	2	5	10	118

Source: Project Team

Table 2.21 Attendees of the Second Technology Dissemination Seminar

	Institutions of ITWG	Regional EMB	LGUs	Private SDF operator	JICA	JET	Total
Physical attendees	5	0	8	2	2	6	23
Online attendees	20	12	40	3	2	3	80
Total	25	12	48	5	4	9	103

Source: Project Team

Activities 1-4: Prepare draft technical standards for WTE facility focused on waste incineration with power generation

The WTE Guidelines such as NSWMC Resolution 669-2016 and DENR DAO 2019-21 do not specify detailed technical requirements for the WTE technologies. Structural requirements as well as operation and maintenance requirements for WTE facility are originally indicated in the draft WTE Guidelines of NSWMC, however, almost all these provisions are removed in both NSWMC Resolution 669-2016 and

approved DENR DAO 2019-21. Since LGUs, who has the authority to procure WTEs, don't have enough knowledge and experience of WTE development, it is necessary for DENR-EMB to setup minimum technical standards for the purpose of controlling the quality of WTEs.

Table 2.22 shows the development progress in ITWG Sub-group of Output 1 (SGOP-1) of Technical Standards.

Table 2.22 Development Process of Technical Standards

Date	Occasion	Development of Technical Standards												
February 18, 2020	1 st SGOP-1	<ul style="list-style-type: none"> ✓ Introduction of activities, timeline of Output 1, ✓ Selection of SWMD-EMB as leader and DOST-ITDI as sub-leader of activity 1-4, 												
March 5, 2020	2 nd SGOP-1	<ul style="list-style-type: none"> ✓ Introduction of Japanese structural standards and operation & maintenance standards for waste incineration facilities, 												
June 4, 2020	3 rd SGOP-1	<ul style="list-style-type: none"> ✓ Due to travel limitation caused by COVID-19, progress of this activity was also affected. From this time, all SGOP-1 meetings were held through web conference. Accordingly, crafting technical standards are initially being done by JET instead of leader/sub-leader, ✓ SGOP-1 members discussed how to apply the technical standards in present permitting system, then it is concluded that these technical standards will be developed as Memorandum Circular (MC) to supplement existing DAO2019-21, ✓ It was suggested that draft MC shall be consistent with 3 Waste-to-Energy bills which are proposed and deliberated by the Technical Working Group of Senate under the numbers of SB363, SB401, and SB1011, ✓ While waiting for the formulation of Senate bills, it was also agreed that the leader, sub-leader, and JET is to draft the MC based on Japanese Standards for waste treatment facilities, 												
July 7, 2020	4 th SGOP-1	<ul style="list-style-type: none"> ✓ JET shared a comparison table of Japanese Structural Standards, Japanese Operation and Maintenance Standards, and Europe Directive, ✓ JET raised 15 discussion points to SGOP-1 members for discussion, then, it was agreed that the leader, sub-leader, and JET will have another meeting to deliberate these discussion points then share to the SGOP-1 members in the next SGOP-1 meeting, 												
August 20, 2020	5 th SGOP-1	<ul style="list-style-type: none"> ✓ JET presented the first draft MC and the participants had a discussion about it. ✓ EMB MC2020-23, named "Clarification on the Requirements of Waste-to-Energy (WTE) projects relative to Environmental Compliance Certificate (ECC) application pursuant to DAO2019-21" issued on May 28, 2020, requires all WTE project to secure ECC regardless on the power generation capacity. Therefore, it is also agreed that the drafting of technical standards is needed for ECC approval, ✓ At the same time, the following components are concluded in SGOP-1 which are lifted from the separate discussion among the leader, sub-leader, and JET: <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 5%;">#</th> <th style="width: 60%;">Discussion points</th> <th style="width: 35%;">Conclusion in SGOP-1</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td>Authority of WTEs construction and operation, <ref: MC2020-23></td> <td>Upon the construction, ECC shall be secured. For the air, water, and hazardous waste generation, respective permit shall be secured and renewed every year.</td> </tr> <tr> <td style="text-align: center;">2</td> <td>Inclusion of intermittent running or small capacity WTEs,</td> <td>So far MC doesn't exclude these WTEs while it is recognized as they're not economically realistic.</td> </tr> <tr> <td style="text-align: center;">3</td> <td>Loss of Ignition (LOI),</td> <td>LOI shall be less than 5%. LOI sampling and/or analytical standards should be presented.</td> </tr> </tbody> </table>	#	Discussion points	Conclusion in SGOP-1	1	Authority of WTEs construction and operation, <ref: MC2020-23>	Upon the construction, ECC shall be secured. For the air, water, and hazardous waste generation, respective permit shall be secured and renewed every year.	2	Inclusion of intermittent running or small capacity WTEs,	So far MC doesn't exclude these WTEs while it is recognized as they're not economically realistic.	3	Loss of Ignition (LOI),	LOI shall be less than 5%. LOI sampling and/or analytical standards should be presented.
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Date	Occasion	Development of Technical Standards																					
		4	Temperature of combustion gas, Temperature of combustion gas shall be more than 850 degrees Celsius for 2 seconds or more.																				
		5	Hazardous waste intake Excluded from the scope of this MC																				
		6	RDF/RPF production facility Excluded from the scope of this MC																				
		7	Gas reforming facility Excluded from the scope of this MC																				
		8	Composting facility Excluded from the scope of this MC																				
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		11	Waste sorting facility Excluded from the scope of this MC																				
		12	Animal feed production Excluded from the scope of this MC																				
		13	Methane recovery facility Excluded from the scope of this MC																				
		14	Biodiesel fuel production Excluded from the scope of this MC																				
		15	Waste material production Excluded from the scope of this MC																				
October 12, 2020	6 th SGOP-1	✓ The updated draft MC was presented by JET to get feedback from SGOP-1 members. The following are the points of discussion:																					
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		✓ JET asked for the SGOP-1 members to submit their comments on the file on or before October 28 by formal request letter.																					

Date	Occasion	Development of Technical Standards
November 5, 2020	Comments from SGOP-1 members	<ul style="list-style-type: none"> ✓ 8 governmental agencies, DENR-FASPS, EMB-SWMD, EMB-HWMS, DOST, NEDA, PPPC, DOE, and Quezon City LGU provided comments on the draft MC,
December 3, 2020	2 nd ITWG meeting	<ul style="list-style-type: none"> ✓ An updated draft was presented to the ITWG members for further review and/or comments, ✓ Co-chair Ms. De Guzman of DOE discussed that the draft MC has to be reviewed more thoroughly by the ITWG members first prior to endorsement to JCC. ITWG members are expected to give comments on the draft provided, to allow JET to incorporate their comments in the revision, ✓ These feedbacks will be considered in updating the draft MC and an updated version will be routed again to the ITWG members for their final confirmation.
December 28, 2020	Request to further comments from ITWG members	<ul style="list-style-type: none"> ✓ JET reflected all comments/suggestions of SGOP-1 members in the draft MC after bilateral consultations with DOST, NEDA, PPPC, DOE, QC, and DENR on December 28, 2020 as agreed previously, ✓ PMO requested ITWG members for further comments/inputs on January 5, 2021, and set the deadline on January 13, 2021.
January 13 to 20, 2021	Reflection of the comments from ITWG members	<ul style="list-style-type: none"> ✓ By January 13, 2021, HWMS and NEDA were able to extend their comments, while DOE sent an email confirming their agreement to the Technical Standards. The rest of the ITWG members did not reply nor send their comments, ✓ JET has reviewed the comments from NEDA and HWMS, updated the file accordingly, and had the commenters verify and approve the updates JET added in. On January 14, HWMS has confirmed the updates to the file. On January 20, JET met with the NEDA Infrastructure Staff where the concerns were settled and confirm the changes JET added, ✓ With this, the current update to the Technical Standards is approved by the ITWG members. Latest draft MC is attached as Appendix3 of this report. ✓ Following this, as of February 1, PMO is in preparation of the document to ITWG Chair and Co-chair for their review and endorsement to the JCC.

Source : JICA Expert Team

Table 2.23 shows the comments and inputs from SGOP-1 members and responses from JET. After the several times of bilateral consultation, most of comments are reflected or addressed accordingly. Some of the most important discussions during the development of Technical Standards are summarized below;

(1) Title of technical standards as draft MC

Whether the word “incineration” will be used in this draft Memorandum Circular (MC) or not; this is one of the most discussed issues because there is an “incineration ban,” as stated in Section 20 of the Clean Air Act in the Philippines. Since there are other waste-to-energy technologies such as RDF, biogas, etc., JET’s recommendation was to clearly explain that this MC is made solely for the incinerator, however, it was tentatively omitted.

(2) Definition of WTE feedstock

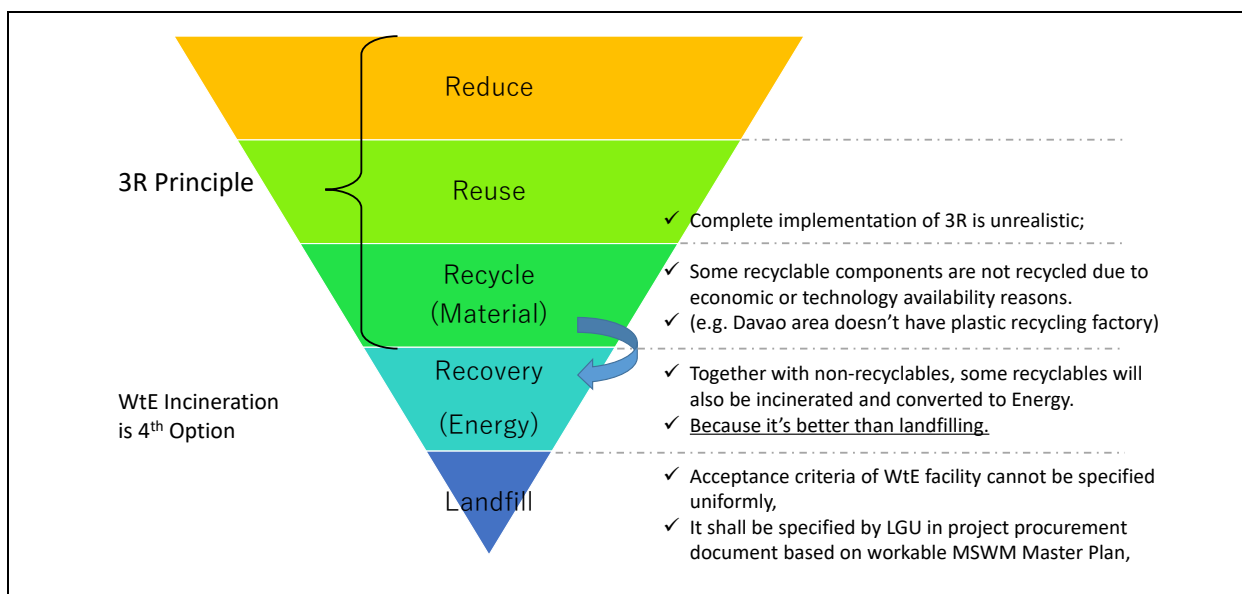
With regard to the terminology, in DAO 2019-21, waste to be fed to WTE is defined as “feedstock”. By this wording, it can be seen that the WTE is recognized as a type of power plant in the Philippines. In Japan, it is called as “target waste” and WTE is primarily recognized as waste treatment facility. The following are the definitions in SECTION 4. DEFINITION OF TERMS of DAO 2019-21;

- **Feedstock** refers to the segregated biodegradable or residual waste materials supplied to the WTE facility to generate heat or electricity
- **Residual Waste** shall refer to any material generated after the implementation of 3Rs (Reduce, Reuse, Recycle) with fuel value.

Generally, “residual waste” can be used in wider meanings and it should not be limited only for the fuel usage as defined in DAO2019-21. For the “feedstock”, since energy recovery from waste is a subordinated option to 3Rs (Reuse, Reduce, Recycle) in the waste management hierarchy, LGUs have to implement and maximize 3Rs before considering energy recovery in WTE. On the other hand, 100% of segregation and recovery of reusable, recyclable materials from MSW are indeed impossible, and in reality, paper, plastics, and other items which deemed as recyclable have to be mixed and found in the feedstock. Therefore, to avoid such impossible requirement for the feedstock, “at optimum economical extent by LGU” is proposed to add in the new definition of “WTE feedstock”. By this, when LGUs intends to introduce WTE, they have to demonstrate how much level of 3R activities LGU is implemented to reduce the amount of WTE feedstock. It is also encouraged to understand that the primary purpose of WTE is sanitary treatment of MSW, secondly is reduction of volume, and thirdly is energy recovery.

Based on these concepts, the following revision for both words are proposed in the draft MC;

- **Residual Waste** shall refer to remaining waste after the implementation of 3Rs by LGUs at maximum extent in economical and institutional regardless of its disposal mode such as utilized in WTE facility or disposed of in the Sanitary Landfill.
- **WTE Feedstock** shall refer to any residual waste after the implementation of 3Rs by LGUs at optimum economical extent to be supplied to the facility for the purpose of waste sanitation, waste reduction, and energy recovery.



Source: JICA Expert Team

Figure 2.5 Waste Management Hierarchy for LGUs

(3) Consistency with Senate Bill 1789

On August 25, 2020, Senate Bill 1789 named “An Act Establishing a National Energy Policy and Regulatory Framework for Facilities Utilizing Waste-to-Energy Technologies (Waste-to-Energy Act)” is proposed by the Committee on Energy, Committee on Environment, Natural Resources and Climate Change, Committee on Ways, and Means of Senate by integrating previously proposed SB 363 and SB 401.

As discussed in the definition above, this draft MC shall consider the consistency with these Senate Bills. Proposed mandates to NSWMC in Section 6 of SB 1769 has many overlaps with this JICA TCP as shown

in Figure 2.6. It is recommended that the project is to have close discussion with NSWMC. Unfortunately, JET did not have chance to discuss this issue with NSWMC while JET requested such opportunities of discussion.

Section 6. NSWMC shall (cont. from page 7);

1 (b) Act as the lead agency in ensuring streamlined standards, criteria, and
 2 guidelines for WTE facilities to avoid inconsistent and conflicting issuances;

3 (c) Regularly determine, review, and publish the following:

4 (i) Standards, criteria, and guidelines for:

5 1. Characterization and composition of solid waste utilized as WTE
 6 feedstock for WTE facilities to ensure emissions are compliant
 7 with Republic Act No. 8749 and other relevant laws, rules, and
 8 regulations,

9 2. Transport, storage, and pre-processing of WTE feedstock,

10 3. Pre-operation, siting, design, operation, and maintenance of
 11 WTE facilities,

12 4. Quality control and operational control of WTE facilities,

13 5. Management of residue from WTE facilities, if any;

14 6. Pollution abatement, emissions monitoring, environmental
 15 monitoring, and public health and safety monitoring in relation
 16 to WTE facilities,

17 7. Decommissioning, closure, and abandonment of WTE facilities,
 18 and

19 8. Other guidelines pursuant to relevant laws, rules, and
 20 regulations, and

21 (ii) Minimum standards, criteria, and guidelines, in determining a fair,
 22 equitable, and reasonable processing fee for WTE facilities taking into
 23 consideration, among others, the cost of construction, operation, and
 24 maintenance of the facility as well as the potential revenue from the
 25 sale of energy output, in consultation with relevant government
 26 agencies, experts, and stakeholders;

No.3 & 7 will be guided in **Activity 1-6**
**"Prepare manual for planning, evaluation,
 formulation & supervision for WTE projects",**

No. 4, 5 & 6 are presently prepared in **Activity 1-4**
**"Prepare draft technical standards for WTE facility
 focused on waste incineration with power
 generation",**

Source: JICA Expert Team

Figure 2.6 Overlaps of Proposed NSWMC mandates in SB 1769 and JICA TCP Activities

Table 2.23 Major Comments Raised from SGOP-1 Members

Category	Items	Commenter	Comments	Responses / Actions
Title	Waste-to-Energy Facilities on Waste Incineration <u>Appropriately Controlled Combustion (ACC) with Power Generation</u>	DOST-ITDI, EMB-SWMD	As the conclusion of the 6th SGOP-1 on October 12, 2020, the term "incineration" was removed and substituted by "Appropriately controlled combustion" instead to avoid controversies.	Keep the conclusion of SGOP-1 and newly define "WTE-ACC (Waste-to-Energy Facilities on Appropriately Controlled Combustion)".
		NEDA-IPG	<u>Suggest to clearly delineate the types of WTE technologies (e.g., incineration)</u>	
		DOE-REMB	On October 14, 2020, it was concluded not to use the term incinerate/incineration in the draft due to the social acceptability of the said term. <u>However, the said term is used in Senate Bill No.1789.</u>	
		PPPC	Suggest to define "appropriately controlled combustion with power generation"	
		DOE-REMB	WTE facility involves not only power applications but also for non-power and other emerging WTE technologies.	Removed "with Power Generation".
Purpose/ Objective	Insertion of objective and scope	NEDA-IPG DENR-FASPS	To clarify the overarching objective and scope of the proposed guidelines	Objectives are updated.
Scope	Scope of T/S	DENR-EMB-SWMD, DOE-REMB	Discussed the scope of WTE technologies then concluded to limit only WTE Incineration	Consult with EMB-SWMD and DOE.

Category	Items	Commenter	Comments	Responses / Actions
			Technology to align with Annex 3 of R/D.	
Definition of "residual waste"	Definition	DENR-EMB-SWMD, DOE-REMB, Quezon City	JET recognizes the necessity to define "residual waste" because this word is frequently used but in different level of residuals e.g., in DAO2019-21, it is defined as " <u>Residual Waste</u> shall refer to any material generated after the implementation of 3Rs (Reduce, Reuse, Recycle) <i>with fuel value</i> ."	New "Residual Waste" definition is proposed in draft MC.
Definition of "WTE Feedstock"	Definition	PPPC	Define the meaning of "optimum economical extent"	Consult with PPPC. Optimum economical extent means that the 3Rs being exhaustively done by LGU to recover materials that can still be sold, reused, and recycled.
		NEDA-IPG	Acceptance criteria, at the minimum, the guidelines could enumerate the types/classification of waste, which may not be incinerated in the WTE facility, such as but not limited to the following: a) Medical waste, b) Radioactive waste; c) Asbestos; d) Liquid and oily waste; e) Waste with halogen content greater than 1%; f) Highly corrosive or toxic liquids or gases such as strong acids, chlorine, or fluorine; g) Industrial waste; and, h) Dewatered bio solids/sewage, sludge and biomass.	The basis of this draft MC is DAO2019-21, so, the target waste is only MSW. On the other hand, even MSW, house medical waste, liquid, oil, and biomass will be contaminated with MSW same like the discussion of recyclables because such waste cannot be completely segregated, therefore, JET defined "WTE feedstock" as "any residual waste after the implementation of 3Rs (Reduce, Reuse, Recycle) by LGUs at optimum economical extent to be supplied to the facility for the purpose of recovering its thermal energy".
		DOE-REMB	Consistency with Senate Bill 1789	Defined in MC draft.
Record of intake waste	Additional requirement	DOE-REMB	This is already in 6.1 Waste delivery control of DAO 2019-21 so this will no longer be included in MC. *but no Annex A of DAO2019-21 is provided.	Consult with DOE.
Incinerated ash (bottom and fly ash)	Management (storage, treatment, and disposal) of ash	DENR-EMB-HWMS NEDA-IPG JET	Suggestions to insert determination of hazardous waste or not by TCLP then refer to RA6969 for hazardous waste and RA9003 for non-hazardous waste.	Draft MC was revised as suggested.
		DOE-REMB	Suggest to specify the responsibility of ash management of WTE operator.	Inserted LGU's primal responsibility of ash management.
		DOE-REMB	Suggest to include operational/ structural standards in the in-house temporary ash storage facility.	This mandatory MC should be minimum standards. JET can introduce additional requirements for ash pit, etc. so that LGU can specify additionally.
Monitoring	Frequency of exhaust gas monitoring (Aside of CEMS)	DENR-EMB-SWMD, DENR-EMB-AQMS	It is not yet clarified by AQMS of EMB on this "mandatory" monitoring frequency of air pollution items such as SOx, NOx, HCL, dioxins and others through PMO. Present draft MC is keeping measurement frequency required in Japan.	PMO to ask AQMS to validate the frequencies.

Category	Items	Commenter	Comments	Responses / Actions
			DAO2003-27 requires quarterly submission of Self-Monitoring Report (SMR) but it doesn't specify monitoring frequency for air pollution (while water pollution requires quarterly data).	
Variance of exhaust gas standard	Allowance for start-up/shut-down	DOST-ITDI, DENR-EMB-AQMS,	There is no allowance of emission limits during start-up/shut-down according to AQMS.	Clarified.
Operators' qualification	Operators' qualification specific for WTE incinerator	DOST-ITDI	To clarify what type of qualifications are specifically needed to operate WTE.	JET shared list of qualification in Japan to DOST-ITDI to consider whether these are adoptable to the Philippines situation.
Fire Code of the Philippines	To refer Fire code of the Philippines	NEDA-IPG	Suggested to introduce Fire Code and its Implementing Rules and Regulations (IRR) in this draft MC.	Reflected.
Occupational Safety and Health Standards	To refer Occupational Safety and Health Standards	DOE-REMB	Suggested to introduce Occupational Safety and Health Standards in this draft MC.	Reflected.
Capacity of WTE facility	For expansion of the capacity	PPPC	To clarify the necessity to obtain ECC again for expansion of the capacity (t/day) in Japan.	The capacity expansion is usually required to obtain another ECC in Japan because it needs re-design of combustion and gas treatment system.
	To require power generation capacity for the application of ECC	DOE-REMB	Since power capacity (MW) is calculated from waste quality (LCV, kcal/kg) and tonnage (t/d or kg/hour), power gen efficiency (20-25%) with conversion factor. WTE can guarantee receiving capacity as t/day and power generation efficiency while it cannot control waste quality (LCV) because it is provided by and shall be guaranteed by LGUs. Therefore, Japan doesn't require WTE project to guarantee power generation capacity in MW in the procurement stage (MW can be evaluation criteria).	Consulted with DOE. No change is required in this draft MC. This should be detailed in DOE's application process and not in this MC
Other	Standards for waste transfer, storage and pre-treatment, Siting of WTE, Dismantlement of WTE	NEDA-IPG	These suggestions are because of Senate Bill 1789.	These matters will be addressed in the activity 1-6 of this TCP named "Prepare manual for planning, evaluation, formulation, and supervision for WTE projects". So, this draft MC is focusing on "structure and operational mandate" for the MSW incineration facility.

Source: Project Team

Activities 1-5: Prepare manual for management of bottom ash and fly ash from WTE facility

A manual or guide for ash treatment and disposal of WTE ashes generated by operation of WTE facility is urgently needed because the target LGUs such as Davao City is preparing the procurement of WTE facility. In 2019, under the previous administration of LGU, the preparation of WTE project in Quezon

City was very advanced and was at the negotiation stage with the WTE proponent. While the negotiation was suspended for some reasons, once resumed, the LGU might need such guide for ash disposal.

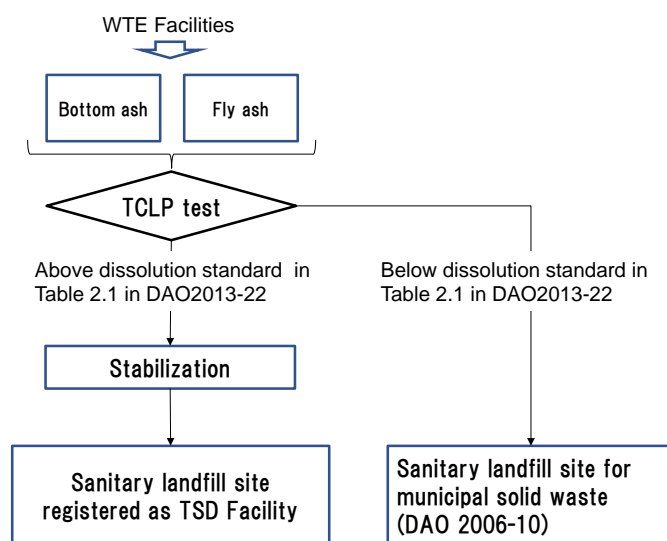
The requirements on the handling of hazardous wastes in the Philippines are stipulated in the "Revised Procedures and Standards for Hazardous Waste Management" (DAO 2013-22), which is based on the Hazardous Waste Management Act (RA 6969) and its Implementing Rules and Regulation (DAO 1992-29).

DAO 2013-22 stipulates that domestic waste (excluding special waste) provided for in RA 9003, shall be exempted from the application of RA 6969. However, pursuant to DAO 2013-22 and the relevant regulations is necessary to determine the toxicity of the bottom and fly ash from WTE facilities and to select appropriate treatment methods.

HWMS which is in charge of these regulations were invited to the Project since 2020 as an additional member of the ITWG sub-group to discuss how to approach and regulate the generated fly ash and bottom ash from WTE.

(1) Requirements in Handling Procedure of WTE ashes as Hazardous Waste

The handling procedure of WTE ashes is illustrated in Figure 2.7 based on the requirements of DAO 2013-22. Both of the bottom and fly ash shall follow the same procedure. The toxicity is evaluated by TCLP test.



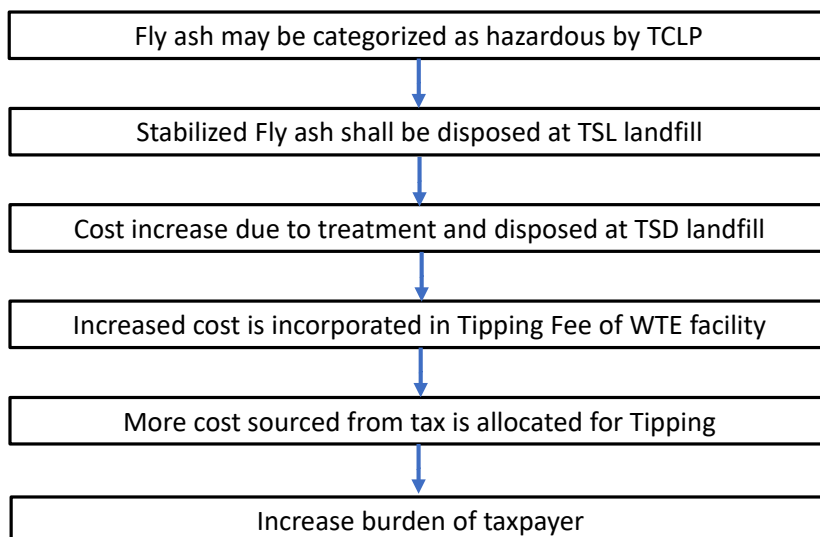
Note: TCLP= Toxicity Characteristic Leaching Procedure, TSD=Treatment, Storage and Disposal

Source : Prepared by JICA Expert Team refereeing to DENR AO2013-22

Figure 2.7 Test, Treatment, and Disposal Flow of WTE Ashes regulated by DAO2013-22

The result of the TCLP test of some fly ash from WTE may exceed the standards of toxicity stipulated by DAO 2013-22 according to experiences of WTE operation in other countries. On the other hand, bottom ash could be disposed at sanitary landfills for municipal solid waste because the result of the test may not exceed the same standard. It means that fly ash of WTE should be stabilized before final disposal. It shall be highlighted that, pursuant to DAO 2013-22, wastes classified as hazardous by TCLP test must be disposed at the sanitary landfill of the Treatment, Storage, and Disposal (TSD) facility in EMB even after stabilization which is a process to stop elution of toxic substances from the waste. This may increase the financial burden because more TSD facilities would be required to receive these wastes. The requirements for TSD landfill are given in Table 2.24 and the cause-and-effect logic is illustrated in Figure 2.8.

The double leachate collection and removal system required for TSD landfill is not common even in the developed countries. It is not clear how complicated the design and how much cost would be required for the sanitary landfill for municipal solid waste. Even so, it is obvious that this facility requires more cost than ones for municipal waste.



Source : JICA Expert Team

Figure 2.8 Increasing Burden of Taxpayer due to Waste Disposal to TSD Facility stipulated by DAO 2013-22

Table 2.24 Requirements for Sanitary Landfill as TSD Facility

Facility	Specifications
Double Liner	Must consist of a top liner to prevent migration of hazardous constituents into the liner and a composite bottom liner consisting of a synthetic geo membrane and three feet of compacted soil material
Double Leachate Collection and Removal System (LCRS)	<ul style="list-style-type: none"> - Primary LCRS must be located above the top liner, while secondary LCRS must be located between the liners immediately above the bottom composite liner - Secondary LCRS, which also serves as the leak detection system, must be: <ul style="list-style-type: none"> - Designed with a bottom slope of at least one percent - Made of materials chemically resistant to the wastes placed in the unit - Able to remove the liquids - Must be designed to collect liquids in a slump and subsequently pump out those liquids
Others	Must have storm water run-on and run-off controls to prevent migration of hazardous constituents for at least a 25-year storm and a cover to prevent wind dispersal

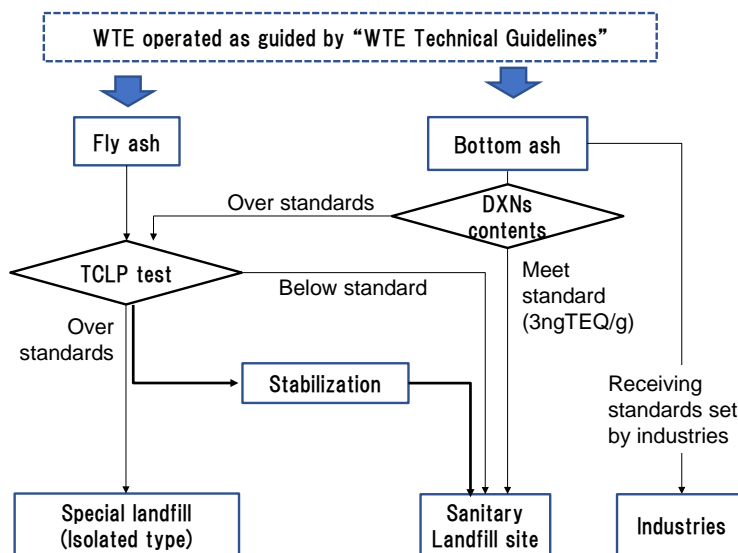
Source : JICA Expert Team

(2) Comparison with the Practice in Japan

The procedure of test, treatment and disposal of WTE ashes regulated in Japan is illustrated in Figure 2.9. The bottom ash is actually disposed of at the sanitary landfill for municipal waste because it does not

contain much toxic substances as classified to hazardous wastes. A part of bottom ash is diverted to industrial use such as production of cement same as the practice recommended in Philippines.

It must be noted that the requirement in TCLP test is slightly different between that of DAO 2013-22 and Japan. The standard values used to decide the toxicity for each substance are shown in Table 2.25. It can be seen that some standard values of Japan case are stricter than the values of DAO 2013-22. It could be a reason why the disposal method is different after stabilization of wastes. These values shall be reviewed and evaluated again in the discussion of procedural requirements for WTE fly and bottom ashes in Philippines.



Source : Prepared by JICA Expert Team according to Japanese Regulations

Figure 2.9 Test, Treatment, and Disposal Flow of WTE Ashes in Japan

Table 2.25 Standard Value to Decide Hazardous Waste

Parameter	Unit	DAO2013-22	Japan
Selenium	mg/L	1.0	0.3
Arsenic	mg/L	1.0	0.3
Cadmium	mg/L	0.3	0.09
Chromium	mg/L	5.0	1.5*
Lead	mg/L	1.0	0.3
Mercury	mg/L	0.1	0.005

Note: * as hexavalent chromium

Source : Prepared by JICA Expert Team according to DAO 2013-22 and Japanese Regulations

(3) Inclusion of Procedure of Ash Treatment in the Technical Guidelines of WTE

During communication with HWMS, it was relayed that the amendment of DAO 2013-22 was being discussed by their section. Since the management of WTE ashes shall follow the amended regulation (DAO) by HWMS under RA6969, it was concluded that requirements of WTE ash management is to be reflected in the technical standards which was being prepared in Activity 1-4. The WTE Technical Standards Activity 1-4 has a clause for WTE ash management. This clause may be considered as a guide for the WTE operation until the amended DAO 2013-22 is issued. If there would be discrepancies between the manual to be created in the Project and the amendment of DAO, it might cause confusion to the LGUs and WTE operators.

(4) Survey of Current Practice of Ashes Treatment and Disposal

The JET needed the following information to be considered for better understanding on the actual practice of treatment and disposal of WTE residual ashes:

- Timing and frequency of TCLP that industries (ex. coal power plant) conduct and report to EMB regional offices
- Report of the result of TCLP test submitted by industries
- The design structure of the existing sanitary landfill as TSD facility
- Monitoring report of such landfill operation

To obtain this information, JET contacted the regional office of EMB which is in charge of instruction, guide, and regulating operation of industries. However, it was not possible to have access to such information due to difficulty in communication and actual visit to the said office under restriction of the COVID-19 pandemic in 2020 and 2021.

From early 2022, JET conducted online interview to the regional office and private operators of TSD facilities and ash generating powerplants.

The criteria of selection of the region and facilities are shown below:

- Regions with registered category A and/or C TSD facilities.¹¹
- All four registered Category C TSDs.
- Category A TSD Facilities identified by EMB Regional Offices that accepts ash wastes.
- Ash Generating Facilities (Powerplants)

1) Meeting Arrangement

i) EMB Regional Offices

JET met representatives of EMB Regions III, IVA, VIII, and X. JET also collected filled-out questionnaires and necessary supporting documents from all regional offices.

Table 2.26 Meeting with the Selected EMB Regional Offices

EMB Region	Meeting date	Questionnaire
CAR	N/A (No Ash-Accepting TSD)	Received (Jan 7, 2022)
Region III	Jan 19, 2022	Received (March 22, 2022)
Region IVA	Jan 14, 2022	Received (Jan 31, 2022)
Region VIII	Jan 11, 2022	Received (Jan 25, 2022)
Region X	Jan 18, 2022	Received (Jan 31, 2022)

Source : JICA Expert Team

¹¹ Category A: Facilities that conduct on site treatment and disposal of hazardous wastes generated within the Facility, Category C: Landfills that only accept hazardous waste for final disposal

ii) Treatment, Storage, and Disposal (TSD) Facilities

The representatives of Metro Clark Waste Management Corporation (MCWMC) met with JET members last Jan. 13, 2022. JET also received an earlier declination and referral from the Pollution Control Officer of Cleanaway Philippines Inc. (CPI) on Dec 20, 2021. Nonetheless, JET received filled out questionnaire from CPI through EMB Regional Office last March 29, 2022.

The meeting with CEMSI was conducted on Feb. 21, 2022. While some questions were entertained by JESI through phone calls e.g., negotiations on meeting scheduling which fell through.

Additional Category A TSD facilities were identified by interviewed Regional Offices to process/receive ashes. All three were coincidentally Cement Manufacturing Corporations. These facilities were also later invited to participate in the Study. JET met with representatives of Republic Cement Batangas on March 15, 2022.

Table 2.27 Status of Meeting and Questionnaire for Treatment, Storage, and Disposal (TSD) Facilities

TSD Facility	Location/Region	Meeting	Questionnaire
Cleanaway Philippines Inc. (CPI)	Leyte/ Region VIII	N/A (Pollution Control Officer Declined; TSD Facility is NOT managing/accepting ash wastes; Submitted a filled-out questionnaire following a direct request from EMB R8 last March 29, 2022)	
Metro Clark Waste Management Corporation (MCWMC)	Tarlac/ Region III	Jan 13, 2022	Received (Feb 2, 2022)
Cleanway Environmental Management Solutions Inc. (CEMSI)	Cavite/ Region IVA	Feb 21, 2022	Received (Feb 28, 2022)
Jorm Environmental Services Inc. (JESI)	Cavite/ Region IVA	N/A (Entertained a few questions over the phone because online meeting fell through)	
Republic Cement – Batangas (RCB)	Batangas/ Region IVA	Mar 15, 2022	Received (Mar 15, 2022)

Source : JICA Expert Team

iii) Industrial Ash Generator

Contact list of ash generating powerplants were gathered through interviewed EMB Regional Offices, as well as the DOE-REMB-Biomass Energy Management Division. On April 11, 2022, JET met and discussed with the Environmental Management Officer/Pollution Control Officer of Pagbilao Power Station. The filled-out questionnaire and other requested documents were received on May 27, 2022.

2) Summary of Collected Data

i) Summary of Information provided by EMB Regional Offices

The respective Chemicals and Hazardous Waste Management Sections of the EMB ROs are the primary responsible units in monitoring and regulating TSD facilities regionally. Regions IV-A and X have identified two ash-accepting TSD facilities within their regions respectively. These facilities are all cement-processing plants.

In addition, EMB is also receiving Compliance Monitoring and Validation Reports (CMVRs) semi-annually from the Multipartite Monitoring Team (MMT), an independent entity formed during EIA phase

of the Project. MMT is composed of various public and private stakeholders. The report is primarily to verify and validate the records of CMRs submitted by the proponent.

In the case of Region III, the RO identified the only TSD that accepts ash is Metro Clark Waste Management Corporation, noting that the facility only accepts ash that the passed the TCLP, Reactivity, Ignitability, Corrosivity Tests. Nonetheless, the RO also listed two companies that accepts fly ash: Eagle Cement Corporation and Republic Cement & Building Materials, Inc., both are in Bulacan. It is however noted that Republic Cement & Building Materials, Inc.- Bulacan has two registered TSD facilities in Region III, according to the list published by EMB as of March 31, 2021.

Table 2.28 Summary of Response from EMB Regional Offices (1)

EMB Region	Section Regulating/ Monitoring TSDs	Ash Accepting TSDs	Reports and Frequency of Reporting
CAR	Chemicals and Hazardous Waste Management Section	N/A (No Ash-Accepting TSDs)	
Region III		Metro Clark Waste Management Corporation (MCWMC) C	Self-Monitoring Report (SMR) – Quarterly
		Republic Cement & Building Materials, Inc., Bulacan Plant (RCBMI –Bulacan) A, B, D	Self-Monitoring Report (SMR) – Quarterly
Region IVA		Republic Cement & Building Materials, Inc., Batangas Plant (RCBMI – Batangas) A, B, D	Self-Monitoring Report (SMR) – Quarterly Compliance Monitoring Report (CMR) – Semi-Annual
Region VIII		N/A (No Ash-Accepting TSDs)	
Region X		Republic Cement Mindanao, Inc. (RCMI) A, B, D Holcim Philippines, Inc. Lugait Plant (HPI – Lugait) A, B,D	Self-Monitoring Report (SMR) – Quarterly Compliance Monitoring Report (CMR) – Semi-Annual

Source : prepared by JICA Expert Team based on the collected responses

Table 2.29 Summary of Response from EMB Regional Offices (2)

	Frequency of TCLP	Parameters in TCLP	List of SLFs employing 2015 TSD Guidelines
Region III	Depends on what is indicated in the TSD's ECC or Every batch for Disposal	Arsenic, Barium, Cadmium, Fluoride, Lead, Mercury, and Selenium (Toxicity) and all applicable parameters.	AES Masinloc SMC Bataan Metro Clark Waste Management Corporation
Region IVA	Depends on generation of residual wastes.	Toxicity, Flammability, Corrosivity, and Reactivity	None
Region VIII	N/A (No Ash-Accepting TSD)		Cleanaway Philippines Inc. (Existing) *
Region X	Depends on ECC review committee's recommendation (once or twice a year)	Arsenic, Barium, Cadmium, Fluoride, Lead, Mercury, and Selenium (Toxicity)	Cagayan de Oro SLF (Proposed) *

Source : prepared by JICA Expert Team based on the collected responses

Note : * It was confirmed that these facilities do not employ Double Leachate Collection and Removal System through direct contact to these TSD facilities.

ii) Identification of Toxicity from the TCLP Test

In principle, the costs of performing Toxicity Characteristics Leaching Procedures (TCLPs) are borne by TSD facilities. Prior to disposal, each transport batch of treated wastes from TSDs of any form (ash, liquid, solid, etc.) should have an accompanying waste manifest and treatment certificate. According to the Technical Guidelines for TSDs (2015), all by-products of waste treatment must be disposed in a TSD Sanitary Landfill or Surface Impoundment.

Ash waste is not included in Table 2.1 of DAO 2013-22, and hence must undergo TCLP to determine its classification. Non-hazardous ash wastes may be reutilized or disposed on municipal wastes the site. Whereas hazardous ashes must be sent to and stabilized on appropriate TSD facilities based on test results and subsequent classification.

iii) Ash acceptance by TSD facilities

The nature of acceptance of ash waste from Category A and Category C TSDs was noted to be different. Category C facilities accept ash wastes for final disposal, whereas Category A facilities, which are all coincidentally cement-manufacturing plants, are receiving ashes as an alternative raw material.

Category C facilities accept waste treatment residuals/by-products from other TSDs, regardless of solid form (dehydrated wastes, ash, solidified materials, etc.). By-products are accepted as long as they are accompanied with a treatment certificate and are within the waste codes included in their respective permits. It is also noted that none of the Category C TSDs confirmed to accept ashes from other industry sources (power plants, boilers, etc.).

On the other hand, Category A facilities may accept both hazardous and non-hazardous ash from industry sources, so long it is permitted by their co-processing permit and TSD permit. The acceptance criteria of the ash are arranged by the facilities' management, in consideration of the cement plant's responsibility to attain the minimum requirements set for alternative ash fuel and/or alternative ash in cement kilns (DAO 2010-06), as well as internal guidelines based on the workability of ashes. The same guideline also lists a number of feedstocks that are prohibited for co-processing. In the case of cement manufacturing facilities, ash is currently utilized as cement alternative raw materials as long they are non-hazardous.

While cement factories may accept hazardous ash within the virtue of their TSD permit, Republic Cement Batangas and other Republic Cement Plants in the Philippines, does not accept hazardous ashes. Republic Cement facilities are primarily accepting ash as an alternative raw material/additive to cement which is regulated by their co-processing permit; ashes are directly added without undergoing treatment and processing. Their co-processing permit specifies that only non-hazardous wastes are allowed to be used as an alternative fuel or alternative raw material. Handling of hazardous materials entails additional costs. Ash also has low calorific value, making it more unideal as feedstock for TSD.

Table 2.30 Purpose and Requirements for Ash Acceptance

TSD Facility	Purpose of Acceptance	Acceptance Requirements
Metro Clark Waste Management Corporation (MCWMC)	Final Disposal	Treatment Certificate for ashes from other TSDs. TCLP results for ashes from other sources.
Cleanway Environmental Management Solutions Inc. (CEMSI)		
Jorm Environmental Services Inc.		
Republic Cement & Building Materials, Inc., Batangas Plant (RCBMI – Batangas)	As raw material for cement manufacturing.	Cement factories must satisfy Heavy Metal and Ash Content Requirements set by DENR along with internal requirements set on the quality of the final product.
Republic Cement Mindanao, Inc. (RCMI)		
Holcim Philippines, Inc. Lugait Plant (HPI – Lugait)		

Source : prepared by JICA Expert Team based on the collected responses

iv) Air and water quality parameters for monitoring

The air and water quality parameters were checked for point sources and ambient quality monitoring based on Self-Monitoring Reports (SMRs), Compliance Monitoring Reports (CMRs), and Compliance Monitoring Validation Reports (CMVRs).

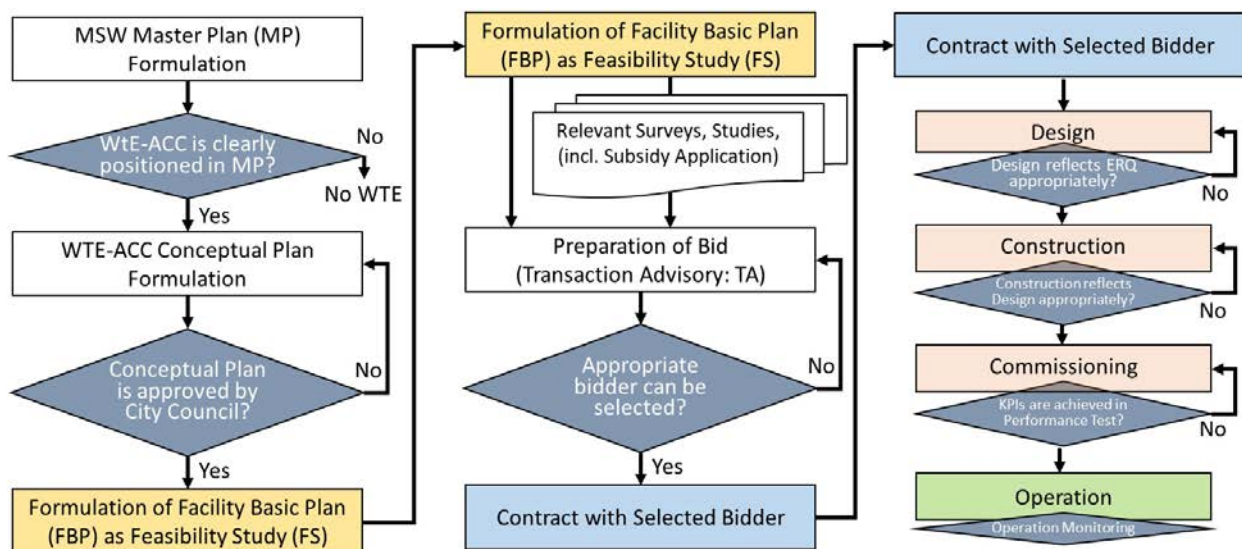
The monitored parameters vary among facilities despite the similarity of nature. This is mainly due to the influence of additional requirements for ECC compliance.

Activities 1-6: Prepare manual for planning, evaluation, formulation and supervision for WTE projects and improve evaluation criteria of EMB for 10-year SWM plans

(1) Structure of Planning, Formulation, Evaluation and Contract Operation (PFEC) Manual¹² and Model Procedure

The LGUs in the Philippines have limited expertise on WTE technology. Experts are needed to evaluate proposals which have insubstantial claims and unrealistic approaches. Before implementing WTE technology and other proposed PPP projects, LGUs need the technical readiness before undertaking these endeavors. LGUs that do not have the technical capability tend to contract out managing MWS project. Because of the high reliance and dependency on one private firm, the halt of operation without prior notice and consultation to concerned parties if no significant profit is generated. Also, private companies tend to increase the T/F of their operation for personal gain where the LGUs have no other choice but to agree. As a result of this, a manual for planning, formulation, evaluation, and contract management for the WTE facility is to be provided as a guide for inexperienced LGUs.

The Model Procedure for WTE Project development under Activity 1-7 is also included in this manual.



Source : Prepared by JICA Expert Team

Figure 2.10 Model Procedure to Introduce WTE-ACC Facility

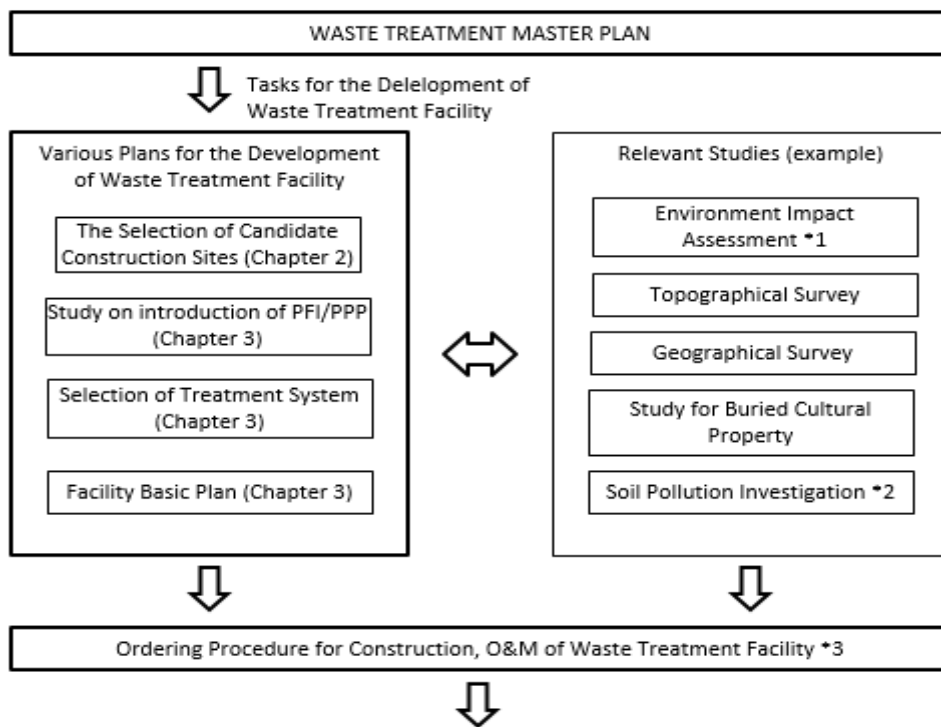
The structure of the manual is divided into six chapters and appendices. The following explains each section and structure of the manual:

- **“Chapter 1 Rationale”** provides the background and objective of formulation of the manual.

¹² Title of this manual was changed in accordance to the chronological order of the project based on the suggestion in the Subgroup meeting under Output1.

- **“Chapter 2 Planning Phase”** explains the process of implementing WTE/WTF (waste treatment facility) projects. This chapter includes long-term MSW management master plan (10-year SWM plan), project conceptual plan, and budgeting plan. Also, the selection of a candidate site for WTE/WTF, is discussed.
- **“Chapter 3 Formulation Phase”** covers factors associated with the project formulation. Technology selection, target waste quantity/quality identification as the technical aspects, financial model and business scheme formulation as financial aspects, appropriate public-private role demarcation and value chain analysis are to be sorted in the Feasibility Study (FS) before the bidding process. Success of the bidding process depends on the quality of FS.
- **“Chapter 4 Evaluation of Unsolicited Proposal”** is a discussion on how to evaluate one or more unsolicited proposals raised from private entities.
- **“Chapter 5 Contract Management Phase”** discusses the supervision of the design, construction works to be done, and monitor the operational performance. Considering most of WTE projects will be done by BOT/BOO scheme, it is important to know how much intervention can be appropriate for the investor’s specification to the EPC/O&M contractors.
- **“Chapter 6 Dismantlement”** shows the explanation of disassembling the WTE facility. Previous Japanese Projects will be showed as an example because WTE facility have not been developed in the Philippines.
- **Appendix** contains a lot of examples and suggestable issues associated in the development of this manual.

The chapters in the manual are those intended to specify the measures related to WTF development flow from the LGU’s MSW Treatment Master Plan as showed in the figure below. It is called as 10-year SWM Plan in the Philippines according to RA 9003 known as the Ecological Solid Waste Management Act of 2000 which discusses the Institutional Mechanism of the Act. Then, Study on PFI and other PPP schemes, Selection of the waste treatment system are compiled into the FS. Additional surveys and studies may be necessary such as topographical and geological surveys, etc.



Note 1) Required in EIA rule and regulation both national and provincial government,
 Note 2) Investigation required by Soil Pollution Control Law,
 Note 3) There are cases combined and/or separate contract of construction and O&M

Source : Prepared by JICA Expert Team

Figure 2.11 Positioning of the Master Plan, FS and Other Activities for the Development of WTFs

(2) Development Timeline of PFEC Manual

The progress and timeline of the preparation of the manual in fulfillment of “Activity 1-6: To prepare the manual for planning, formulation, evaluation and contract management of WTE project” is presented in Table 2.31. Also, during the 11th Sub-group Meeting for Project Output 1, various government agencies gave their insights and comments to be incorporated in preparation of the manual. The comments of these offices are presented in Table 2.32.

Table 2.31 Development Timeline of the preparation of Manual

Timeline	Updates
November 4, 2021	9 th OP1 Subgroup Meeting, Introduction of “Japanese WTF dev. Guide”
January 12, 2022	10 th OP1 Subgroup Meeting, Request SGOP members to review “Japanese WTF dev. Guide”
January 31, 2022	Deadline for accepting comments to Sections 1 and 2
February 22, 2022	11 th OP1 Subgroup Meeting / Obtained comments - JET was required to adopt Philippines context.
May 17, 2022	12 th OP1 Subgroup Meeting / Shared v4.0 (Converted to adopt Philippines Context) and solicited comments – No comments
October 7, 2022	13 th OP1 Subgroup Meeting / Refined v5.0 (Restructured by chronological order). It was endorsed to ITWG subject to address NEDA comments #1 ~ 9.
November 2, 2022	Bilateral meeting between NEDA and JET / NEDA agreed JET’s revision plan to v.6.0 and differed item #2 selection method of the consultant to ITWG.
November 18, 2022	7th ITWG Meeting / JET proposed PEFS Manual ver. 6.0 (NEDA comments except #2 are reflected) and further revision plan for ver.6.1 (to reflect remaining NEDA comment #2) to ITWG. ITWG approved ver.6.0 as well as revision plan for ver.6.1.
December 13, 2022	3rd JCC / PEFS Manual ver. 6.1 was proposed by JET and approved by JCC.

Source: JICA Expert Team

Table 2.32 Comments from SG members on the draft Manual

Members	Comments
DENR-SWMD	No comments for Japanese Guideline; Comments will be reserved for the Philippine Guidelines once ready
DOE	No comments so far; shall focus their comments on the utilization of energy produced by WTE plants
NEDA	Comments on the services, selection method, criteria of Waste Treatment Consultant, Target Waste Quantity Identification Procedure, Scoring sheet for suite suitability analysis, etc.
DOST, QC	No comments received
PPPC	Harmonization with 10-year Plan, differentiate scope of each plan, technology finalization phase, review on current regulation, restructuring to ease flow of discussion to chronological order, siting requirements could be itemized, list of regulations should be localized, etc.

Source: JICA Expert Team

(3) Summary of each chapter

1) Rationale

Table 2.33 shows the typical timeline for the introduction of WTE facility in the case of Japan. Based on the Long-term MSW Management Plan of LGU, Facility Conceptual Plan, and FS is formulated to shape the project outline to obtain approval from LGU and relevant authorities. Construction of WTE usually takes 3-4 years including the design, construction, and commission stages. Afterwards, commercial operation can start. The total process from preparation of the Master Plan to commercial operation usually takes 10 years. However, if necessary, surveys, studies, and decisions can be done in parallel and appropriately, some part of time can be shortened. It should also be noted that the plans and studies stipulated here shall be approved by the Local Government Council or appropriate authority to keep the Project attractive for the international/local private players as well to avoid wasting time by the unnecessary step-back of the Project.

Table 2.33 Standard Timeline for the Development of Waste to Energy Facility

Year	1	2	3	4	5	6	7	8	9	10	11	Remarks
New Facility	MSW Treatment Master Plan (MP) (10 year SWM Plan - Chapter 2)		1. Planning Phase									Reviewed once every 5 yrs
	Facility Conceptual Plan											Decision on renewal & site
	F/S (Facility Basic Plan - Chapter 3)											Decision on processing method
	Business Scheme Study (PFI/PPP Applicability Study - Chapter 3)											Decision on business scheme
	Topographic Survey											Reflected in facility basic plan
	Geological Survey											Reflected in facility basic plan
	Environmental Impact Assessment											1.5-4 yrs
	Bid/ Selection of Winning Bidder											standard 2 yrs
	Construction Work (Chapter 5)											standard 3-4 yrs
	Operation (Chapter 5)											Start

+ Unsolicited Proposal

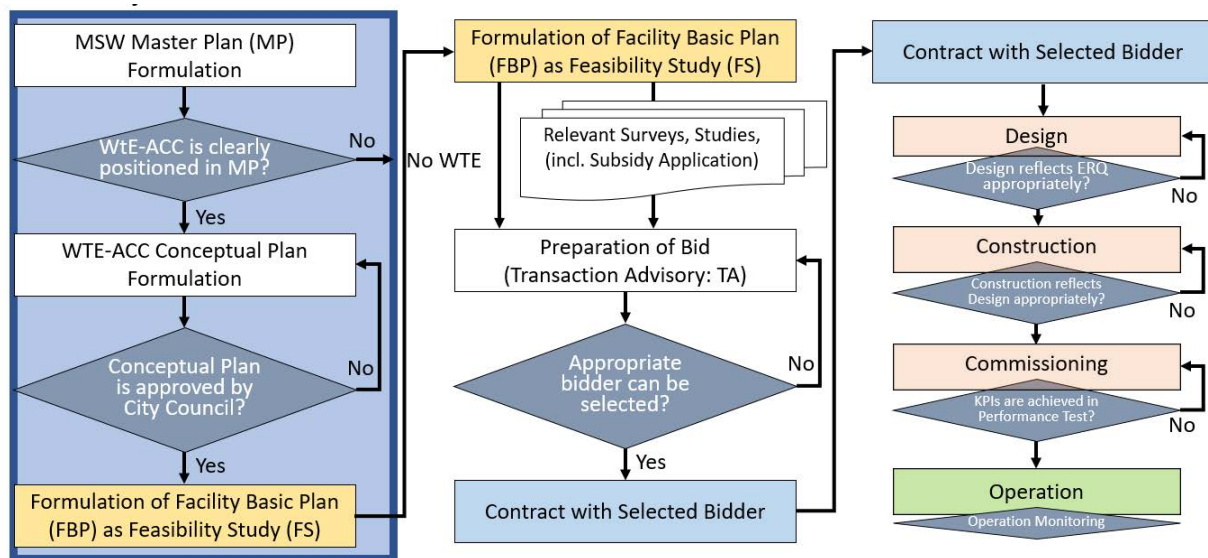
3. Contract Management Phase

2022/10/16

Source: JICA Expert Team

2) Planning Phase

The diversification of waste treatment systems in recent years, along with the introduction of business schemes that involve private sectors has spread more widely as an option for facility development in waste treatment operations at LGU levels. On the other hand, demands for the accountability and sustainability of such choices have strongly increased, and technology for the development of WTFs with objectivity, transparency, and reasonability is also strongly sought after. The figure below shows the procedure and diagram of the planning phase.



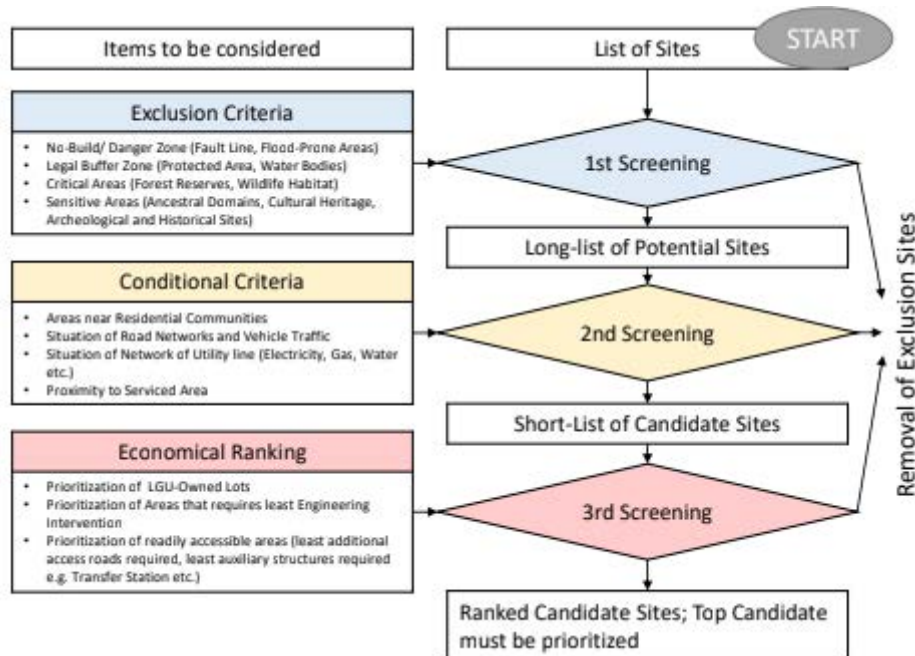
Source: JICA Expert Team

Figure 2.12 WTE Project Procedure and Position of Planning Phase

Since the Law clearly stipulates that “Local government is responsible for Waste treatment”, even if LGUs contract out some parts to private companies, LGUs are still primarily responsible for waste treatment. Therefore, WTE Project shall be led by the local governments. The WTE-ACC conceptual plan must be approved by the City Mayor/Council.

The figure below explains the procedure for the selection of the sites for the WTE projects. JET combined the WTE site selection procedures used in Japan and the SLFs site suitability assessment flow of NSWMC 2013-64 as shown in the figure below. From the list of candidate sites, areas which are prohibited by law

for the WTE-ACC construction are excluded in the 1st screening as mandatory exclusion criteria, supported by GIS, etc. After that, some conditions set force by the LGU and local residents will be removed in the 2nd screening. Finally, the evaluation of cost attached to the shortlisted sites will be carried out. An additional iteration of screening considering cost/financial aspects prior to the final site ranking is recommended. Transparent and public involved process shall be required because WTE may cause NIMBY.

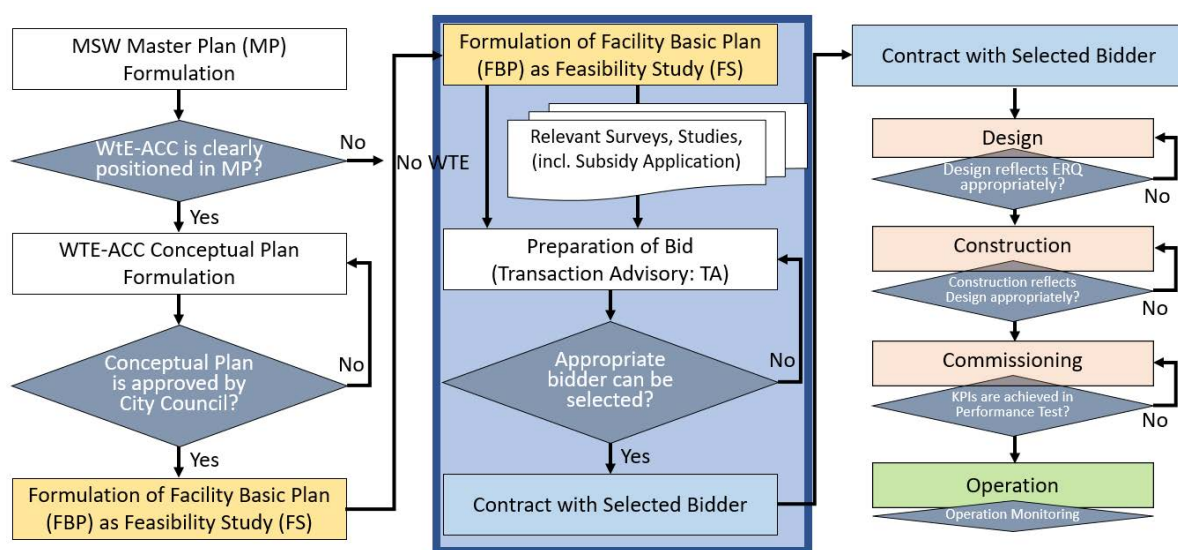


Source: JICA Expert Team

Figure 2.13 Sample Procedural Flow for the Selection of Candidate Site

3) Formulation Phase

The FS shall be conducted at the end of the formulation phase for the preparation of the bidding document and construction order. Its main purpose is to determine the conditions of the order for the company performing the facility construction and operation. In addition, procurement of a WTF/WTE system usually employs a performance-based ordering system (Design-Build Contract) because a WTF/WTE system is an aggregate of wide-ranged technologies, complex and huge sized controlling system, and its unique structure, patents, know-hows which are usually belonging to the plant manufactures. The Facility Basic Plan as LGU oriented FS is displayed in the figure below.



Source: JICA Expert Team

Figure 2.14 WTE Project Procedure: Formulation Phase

Since there are not any “Zero T/F” WTE-ACC BOT projects in the World, the LGU shall concept out what they can provide and their expectations from the Private Operator, in such aspect, security of annual expenditure for T/F through project period must be the most important point. The table below displays the decisions that are needed to be made by the LGUs during the FS phase.

Table 2.34 What to be Decided by LGU in the Formulation Phase

Technical	• Treatment Technology Selection	⇒ Thermal (Stoker, fluidized bed or gasification, etc.), or Non-thermal (Biomethanation, etc.)
	• Quantity / Quality of WTE Feedstock	⇒ How much MSW can be “continuously” supplied to WTE? ⇒ How much LCV can be guaranteed? (This is out of control of private proposer)
	• Pollution Control Standards (Exhaust gas, Wastewater, Residues, etc.)	⇒ Under Clean Air Act (National Standards), International Standards, and/or Stricter Voluntary Standards? ⇒ Monitoring frequency shall also be identified.
Financial	• Business Scheme	⇒ Study on applicability of PPP modality (BOT, BOO or DBO, Concession, JV, etc.)
	• Project cost estimation (Capex/Opex), Financial Model, Financing Plan	⇒ Total cost, amount of funds to be procured ...
Project Boundary	• Role demarcation (Scope of Work)	⇒ Basic concept of task demarcation shall be identified at this phase so that gov. budget can be forecasted .
	• Value Chain Analysis (Treatment Process flow for upstream/ downstream)	⇒ Upstream arrangement (Segregation classification, pretreatment, how to deliver segregated waste, etc.), ⇒ Downstream arrangement (Handling of bottom ash and fly ash, disposed at TSD? Monofill?)

Source: JICA Expert Team

4) Evaluation Phase

Unsolicited proposals from private entities are usually the project based on the private entities’ interest in terms of their scope of work, capital size, applied technology, etc. Since existing situation and effort/achievement of LGUs in MSW management is different for each LGU, it is quite difficult to evaluate whether the proposal fits with the LGUs needs or not if there is no WTE-ACC plan from the LGUs. Simple comparison of different schemes / types / technologies of private proposals does not make sense. Each LGU

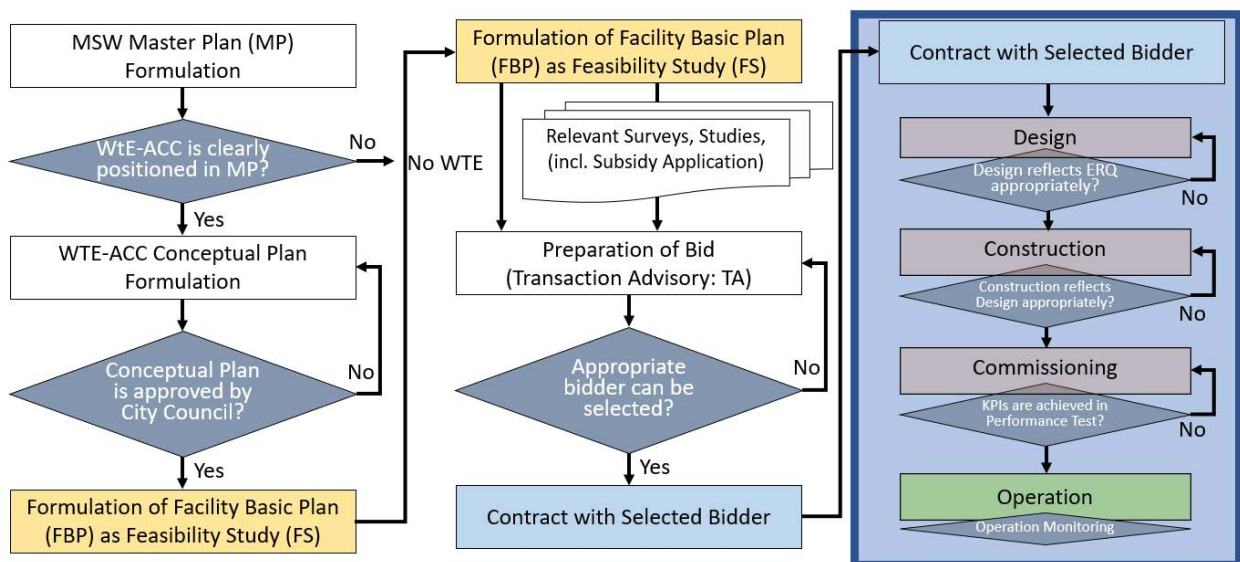
shall have their own MSW Master Plan-based FS or even WTE-ACC Conceptual Plan as needed to ease the evaluation and/or selection of the best private proposal.

Solicited approach is widely applied for the WTE-PPP project development in the world. If unsolicited approach is adopted, the WTE-ACC Conceptual Plan should be at least formulated beforehand. JET strongly recommends LGUs to materialize the determination of the LGU by drafting a WTE-ACC plan using the information shown in the manual. By doing this, the questions to be raised are conceptualized and answered better which will result in an efficient FS formulation and private proposal evaluation. The following are possible questions that may arise in the formulation of conceptual plan using the manual:

- Will there be garbage collection vehicles available in the LGU?
- Will SLF still be active in the next 10-15 years?
- Does the LGU only need the WTE-ACC or a private partner needs to be considered for wider ranged SWM system?
- How much is the expected capacity of WTE-ACC?

5) Contract Management Phase

Contract monitoring starts with the bidding process and the extent to which it is written in the Request for Proposal (RfP) in the bidding document, especially in the Employer’s Requirement (ERQ), is critical. If it is unclear, disputes may arise later. After the contract is awarded, LGUs will check whether the requirements written in the ERQ is reflected in the design, construction, and commission. Intervention level in design/construction supervision can also be designed in the RfP/ERQ. The figure below shows the position of the Contract Management Phase through the lifetime of the Project.



Source: JICA Expert Team

Figure 2.15 WTE Project Procedure: Contract Management Phase

Contract management (monitoring) is conducted by the LGU to monitor and confirm whether the services provided by the private partner (private operator) are properly and reliably performed in accordance with the PPP agreement, RFP, and the project proposal submitted by the proponent for the Project.

6) Dismantling of WTE-ACC

The dismantling of WTE-ACC will be necessary in the Philippines after 15 to 20 years from the commissioning of WTE facility, so the manual only shows a reference from Japan.

(4) Recommendations on the evaluation criteria of EMB for 10-year SWM plans

NSWMC has formulated the “Guidebook for Formulation of Solid Waste Management Plan” and “Annotated Outline (10-year SWM plan)” as a reference document and checklist for the preparation of the 10-year SWM plans. It was confirmed at the meeting with EMB/SWMD, who are supporting the evaluation procedures, that the annotated outline (10-year SWM plan) has been practically used to evaluate the plans prepared by the LGUs.

These guidebook and checklist are formulated based on RA 9003 which was enacted on the premise that WTE technology shall not be applied. Therefore, evaluation criteria for the 10-year SWM plan should be updated by including criteria concerning the WTE projects.

JET reviewed the annotated outline and gave comments on the following viewpoints. JICA Expert Team explained the comments and recommendation at the NSWMC executive committee on May 31, 2022. The recommendations were received by the executive committee and the committee would consider those recommendations in updating the outline.

Table 2.35 Recommendations on the Annotated Outline (10-year SWM plan) by JET

General Review Comments	Recommendation of additional descriptions due to WTE introduction into MSWM
<ul style="list-style-type: none"> - Better to describe “Waste Flow Diagram” clearly - Detail explanation of 10-year SWM plan will be necessary, though only 5 years data is required in the parts of investment cost, annual cost and funding option - Definition of “Diverted Waste” and “Diversion Rate” (should not include self-disposal, which is potential illegal dumping) 	<ul style="list-style-type: none"> - Description of WTE facility in “SWM System” - Waste Flow including receiving waste in WTE facility and residue from WTE facility - Description of WTE components in Environmental and Social Consideration

Source: JICA Expert Team

Activities 1-7: Illustrate Model Procedure to Introduce WTE Facility

Since MSW management is obliged to LGUs by RA 9003, this procedure is made in the viewpoint of LGUs as same as the manual for planning, formulation, evaluation, and contract management of WTE-ACC discussed in Activity 1-6. The following shows the explanation of each item in Figure 2.16.

- Master Plan: When LGU plans to develop WTE-ACC, necessity of such project shall be clearly stipulated/positioned in the 10-year SWM Plan of LGU in terms of LGU’s direction on how to achieve the RA 9003 target, waste mass balance flow from generation to final disposal in reducing waste by 3Rs, intermediate treatment, and disposal of the remaining waste into the sanitary landfill, and timeframe.
- Conceptual Plan: Then, LGU has to prepare a Facility Conceptual Plan which summarizes the project idea such as its objective, applicable technology/ies, capacity of facility (as t/day), candidate sites, and timeframe (target COD year) in line with the 10-year SWM Plan so that the LGU can proceed to further deliberate in the formulation phase. LGUs can outsource to develop this Facility Conceptual Plan to

Waste Treatment Consultants or do it by themselves. The deliberation level can be lighter touch than the upcoming Feasibility Study, however, the commitment of LGU's council for the concept is crucial.

In a case if such WTE-ACC or WTF projects are outsourced to private entities, LGUs are still primarily responsible for the appropriate treatment/disposal of MSW, therefore, selection of WTE-ACC must be carefully chosen and managed by the LGUs. In the world, there are a lot of failed cases which the Project is suspended in the contract phase, construction phase, and in early operation phase. Many private proponents have exited the project/asset based on the contract, as a result, the LGU shall continue the project/asset by themselves or by finding a successor. Because of the complexity and patents in WTE-ACC facility, it is usually difficult to find a successor and, in some cases, the Project starts from the beginning.

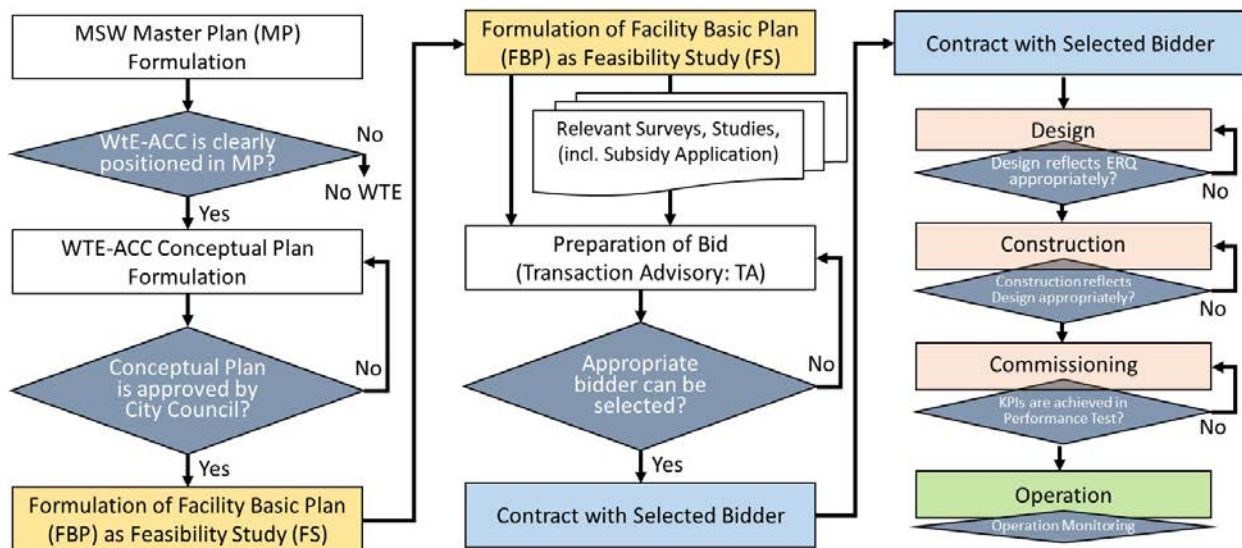
Because of such circumstances, reputable private investors, national/international financing institutes, and international donors always expect the LGU's strong interest and continuous policy commitment for the Project, so again, it is important that Facility Conceptual Plan to be authorized and approved by the LGU's council.

- FS Stage: The FS, in Japan, called as Facility Basic Plan (FBP), shall be formulated for the approval of the LGU and other supporting agencies prior to the preparation of the bidding document and construction order. Another of its main purpose is to determine the conditions of the order for the company performing the facility construction and operation. The development of the FS must be in consistency with the higher plans, such as the LGU's development master plan, MSWM Master Plan, and must be based on selection processes of the construction site, treatment method, business scheme, etc. as well as survey results of geology and topography of the construction site. Additionally, how to conduct studies for these is stipulated in the manual for planning, formulation, evaluation, and contract management of WTE-ACC developed Activity 1-6 under this TCP.
- Preparation of Bid: In addition, procurement of a WTE-ACC usually employs performance-based ordering system (Design-Build Contract) because a WTE-ACC system is an aggregate of wide-ranged technologies, complex and huge sized controlling system, and its unique structure, patents, know-hows which are usually belonging to the plant manufactures. Therefore, it is necessary to keep in mind that the FS should also follow the performance-based ordering system and set appropriate ordering conditions (input specifications and output performance requirements) to make sure no shortage will occur.
- Contract Management: For the contract management of WTE-ACC under PPP Project, the LGU is considered as the implementation agency to efficiently and effectively supervise each work in the construction and operation of the Project based on the PPP Agreement to be concluded by the successful bidder.

Under the BOT business scheme, the local government entrusts the private company with the full responsibility for the design and construction of the facility as well as financing. However, it tends to

be unclear how to supervise the design, construction, and operation of the facilities to ensure that they are designed, constructed, and operated according to the quality and functions specified in the RfP.

Contract monitoring starts with the bidding process and the extent to which it is written in the RfP in the Bidding Document, especially in the ERQ, is critical. If it is unclear, disputes will arise later. After the contract is awarded, LGUs will check the requirements whether what is written in the ERQ is reflected in the design, construction, and commission. Intervention level in the design/construction supervision can also be designed in the RfP/ERQ.



Source : Prepared by JICA Expert Team

Figure 2.16 Model Procedure to Introduce WTE-ACC Facility
(Same figure with the one appeared in Activity 1-6)

Activities 1-8: Review and update the existing regulations of sanitary landfill for municipal solid waste where incineration ash will be disposed of

When the WTE facility operates, the incineration ash generated from the WTE facility will be disposed of in SLF for MSW if it is classified as non-hazardous waste. Until now the Philippines has directly disposed of MSW that cannot be used, so after the WTE facilities go into operation, the landfilled materials will change. If the landfilled materials are changed, the quality of leachate generated from the SLF will also change.

Therefore, JET reviewed the existing laws and regulations related to SLFs for the purpose of considering the impact on SLFs when incineration ash is disposed of and identified the necessity of the revision of the existing laws and regulations. If revisions to existing laws, etc. are necessary, JET proposes the details of those revisions.

(1) Laws and regulations for SLFs and Final Disposal Sites.

Table 2.36 lists the summary of the laws and regulations for SLFs and final disposal sites in the Philippines. In 2010, the NSWMC, with support from JICA, prepared a Technical Guidebook on Solid Wastes Disposal Design, Operation, and Management; National Solid Waste Management Commission Japan International Cooperation Agency (hereinafter referred to as "JICA Technical Guidebook"). This Technical Guidebook should also be consulted when revising existing regulations.

Table 2.36 Laws and Regulations for SLFs and Final Disposal Sites and their Summary

Laws and regulations	Title	Summary of laws and regulations
DAO 1998-49	Technical Guidelines for Municipal Solid Waste Disposal	This is a technical guideline for municipal solid waste disposal. Final disposal sites are classified into four types: open dumping, controlled dumping sites, sanitary landfill level 1, and level 2, and the characteristics and criteria for each are presented.
DAO 1998-50	Adopting the Landfill Site Identification and Screening Criteria for Municipal Solid Waste Disposal Facilities.	The report presents evaluation items, criteria, considerations, and data sources for selecting a site for a final disposal facility.
RA 9003	Ecological Solid Waste Management Act of 2000	This is a law on solid waste management and for final disposal sites, it prohibits open dumping (all open dump sites must be converted to controlled dump sites within three years and be operational within five years) and establishes criteria for the suitable location, design, and operation of sanitary landfills.
DAO 2001-34	Implementing Rules and Regulations of RA 9003	IRR promulgated pursuant to Article 59 of RA 9003. For final disposal sites, the IRRs provide detailed rules for site selection, design, and operation of SLFs.
DAO 2006-10	Guidelines on the Categorized Final Disposal Facilities (Sanitary Landfill)	Final disposal sites are classified into four categories according to the amount of waste delivered per day and technical standards are specified for each category.
DAO 2013-22	Revised Procedure and Standards for the Management of hazardous Wastes (Revising DAO 2004-36)	This is a revision of DAO 2004-36, Procedures and Standards for the Management of Hazardous Waste. It classifies hazardous waste by type and specifies categories. A through H for facilities that treat, store, and dispose of hazardous waste. Final disposal sites are classified as Category C. Technical guidelines for Categories A-G were issued in January 2016.

Source: JICA Expert Team

(2) Structural regulations for SLFs

As a result of the TCLP test, incineration ash classified as non-hazardous waste would be disposed in SLFs, while those classified as hazardous waste would be disposed in treatment, storage, and disposal (TSD) landfills.

Structural regulations for SLFs are specified in DAO 2006-10 and divided into four categories based on the amount of waste delivered per day, as shown in Table 2.37.

Table 2.37 Classification of SLFs in DAO 2006-10

	Category 1	Category 2	Category 3	Category 4
Daily disposal volume	≤15 TPD	>15 TPD ≤75TPD	>75 TPD ≤200TPD	< 200TPD

Source : DAO 2006-10

On the other hand, the treatment and management of hazardous waste stipulated by DAO 2013-22 and the criteria for specific hazardous waste TSD facilities include the "Technical Guidelines for Specific Categories of TSD Facilities 2015 EMB" (hereinafter referred to as "TSD Facilities Technical Guidelines"). Under the TSD Facilities Technical Guidelines, SLFs are classified as Category C.

Table 2.38 provides a comparison of the structural standards of the DAO 2006-10 and the TSD Facility Technical Guidelines for the main facilities of SLFs.

(3) Issues with existing laws and regulations regarding SLFs

The laws and regulations of SLFs and their summaries are given in Table 2.36. The structural standards for each facility, such as liners, have different specifications required by each regulation. The following are the main inconsistencies in the existing regulations:

- DAO 9003 and DAO 2001-34 permit liners with only one geomembrane, but DAO 2006-10 does not permit liners with only one geomembrane.
- The regulations for Category 1 clay liner in DAO 2006-10 specifies thickness of 60 cm and permeability of 1×10^{-5} cm/sec, whereas the regulations for clay layer in DAO 2001-34 specify thickness of 75 cm thickness and permeability of 1×10^{-6} cm/sec.

In addition, as shown in Table 2.38, DAO 2006-10 divides SLFs into four categories based on the amount of disposal volume per day. However, the structure of SLFs should be classified by the type of landfilled waste, which is determinant of the risk of wastes flowing out of the landfill or the leachate leakage due to damage to the liners. The leachate treatment method is also specified by the amount of daily waste per day, which must be determined by the types of landfilled waste.

(4) Revision of existing rules and regulations for SLFs

As noted above, there are inconsistencies in the existing structural regulations for SLFs, and JET proposes to revise the structural standards for SLFs for incineration ash. The structural standards are proposed separately for SLFs for the disposal of non-hazardous and TSD landfills for hazardous wastes.

Table 2.39 shows SLFs proposed structural regulations for non-hazardous waste. The proposed structural regulations are based on the regulations for Category 4 of DAO 2006-10, the structural regulations for SLFs, and add regulations for leachate collection facility, rainwater collection facility, and landfill gas venting facility.

In addition, Table 2.40 shows the proposed structural regulations of TSD landfills for hazardous waste. The proposed structural regulations are based on the TSD Facilities Technical Guidelines and additional regulations for landfill gas venting facility and leachate treatment facility. While Double Leachate Collection and Removal System (LCRS) is not commonly practiced in other countries. JET refrained from suggesting on easing rules respecting the policy of the Philippines.

Table 2.38 Existing Structural Standards for SLFs and TSD Landfills (Category C)

Facilities	Category 1 ≤ 15TPD	Category 2 > 15TPD ≤ 75TPD	Category 3 > 75TPD ≤ 200TPD	Category 4 < 200TPD	Category C-Disposal Facilities
Order and Guidelines	DAO 2006-10				Technical Guidelines for Specific Categories of Treatment, Storage, and Disposal (TSD)Facilities 2015
Drainage Facility	Regulated to set, but no design criteria	Regulated to set, but no design criteria	Regulated to set, but no design criteria	Regulated to set, but no design criteria	Must have storm water run-on and runoff controls to prevent migration of hazardous constituents for at least a 25-year storm and a cover to prevent wind dispersal
Leachate Collection	Regulated to set, but no design criteria	Regulated to set, but no design criteria	Regulated to set, but no design criteria	Regulated to set, but no design criteria	<p>Double Leachate Collection and Removal System (LCRS)</p> <ul style="list-style-type: none"> · Primary LCRS must be located above the top liner, while secondary LCRS must be located between the liners immediately above the bottom composite liner · Secondary LCRS, which also serves as the leak detection system, must be: <ul style="list-style-type: none"> ○ Designed with a bottom slope of at least one percent ○ Made of materials chemically resistant to the wastes placed in the unit ○ Able to remove the liquids · Must be designed to collect liquids in a sump and subsequently pump out those liquids
Leachate Treatment	Pond System	Pond System	Pond System	Combination physical, biological & chemical	No regulation
Liners	Clay liner should be at least 60cm thick and has a permeability of 10 ⁻⁵ cm/sec	Clay liner should be at least 75cm thick and has a permeability of 10 ⁻⁶ cm/sec	Clay liner should be at least 75cm thick, clay liner with a permeability of 10 ⁻⁷ cm/sec or better, or composite liner consisting of at least 1.5mm thick HDPE membrane over at least 60cm thickness of compacted fine material with permeability no more than 10 ⁻⁶ cm/sec	Synthetic liner should be at least 1.5mm thick HDPE membrane over at least 60cm thickness of compacted clay materials with permeability no more than 10 ⁻⁷ cm/sec	Double Liner Must consist of a top liner to prevent migration of hazardous constituents into the liner and a composite bottom liner consisting of a synthetic geo membrane and three feet of compacted soil material
Corss Section	Clay liner at least 60cm thick, a permeability of 10 ⁻⁵ cm/sec	Clay liner at least 75cm thick, a permeability of 10 ⁻⁶ cm/sec	<p>Clay liner at least 75cm thick, a permeability of 10⁻⁷cm/sec or better</p> <p>OR</p> <p>HDPE membrane liner at least 1.5mm thick</p> <p>Clay liner at least 60cm thick, a permeability no more than 10⁻⁶cm/sec</p>	<p>HDPE membrane liner at least 1.5mm thick</p> <p>Compacted clay material liner at least 60cm thick, a permeability no more than 10⁻⁷cm/sec</p>	<p>Primary LCRS</p> <p>Top liner</p> <p>Synthetic geo membrane</p> <p>Secondary LCRS</p> <p>Compacted clay material liner at 3feet (91.44cm) thick</p>

Source: JICA Expert Team

Table 2.39 Proposed Revisions on the Rules and Regulations for SLFs

Facilities	DAO 2006-10 Category 4	Proposed structural regulations	Referenced regulations, etc.
Liners	Double liner Top liner - HDPE geomembrane should be at least 1.5 mm thick Bottom liner - Clay liner should be at least 60 cm with permeability no more than 1.0×10^{-7} cm/sec	Double liners Top liner - HDPE geomembrane should be at least 1.5 mm thick with permeability no more than 1.0×10^{-14} cm/sec Bottom liner - Clay liner should be at least 60 cm with permeability no more than 1.0×10^{-7} cm/sec	- Adopted the structure in category 4 in DAO 2006-10 - Adopted the HDPE's permeability in DAO 2001-34
Leachate collection facility	No regulation	- Adoption of semi-aerobic landfill structure - Installation of perforated pipes, etc., capable of draining leachate generated by a 10-year chance of rainfall with a cross-section of 0.5	- Refer to JICA Technical Guidebook
Rainwater collection facility	No regulation	- Install a facility that can drain rainfall with a probability of 25 years	- Refer to TSD Facility Technical Guidelines
Landfill gas venting facility	No regulation	- Install perforated pipes or other means to collect and treat or effectively use the gas generated from the landfill.	- Refer to RA 9003
Leachate treatment facility	- Treatment Method - Combination of physical, biological, and chemical treatment	- Combination of physical, biological, and chemical treatment - Treatment Method - Capacity - Leachate pond and leachate treatment facility can treat the maximum rainfall over the past 20 years.	- Adopted the structure in category 4 in DAO 2006-10 - Refer to JICA Technical Guidebook

Source: JICA Expert Team

Table 2.40 Proposed revisions on the Rules and Regulations for TSD Landfills

Facilities	TSD Facility Technical Guidelines	Proposed structural regulations	Referenced regulations, etc.
Liners	Double liner Top liner - Prevent migration of hazardous constituents into the liner Bottom liner - Composite bottom liner consisting of a synthetic geo membrane and 3 ft of compacted soil material	Double liners Top liner - HDPE geomembrane should be at least 1.5 mm thick with permeability no more than 1.0×10^{-14} cm/sec Bottom liner - Clay liner should be at least 60 cm with permeability of no more than 1.0×10^{-7} cm/sec	- Adopted the structure in category 4 in DAO 2006-10 - Adopted the HDPE's permeability in DAO 2001-34
Leachate collection facility	Double Leachate Collection and Removal System (LCRS) • Primary LCRS must be located above the top liner, while secondary LCRS must be located between the liners immediately above the bottom composite liner • Secondary LCRS, which also serves as the leak detection system	- Adoption of semi-aerobic landfill structure - Installation of perforated pipes, etc., capable of draining leachate generated by a 10-year chance of rainfall with a cross-section of 0.5	- Refer to JICA Technical Guidebook
Rainwater collection facility	Facilities capable of collecting and draining rainfall with a 25-year probability	- No revision required	- Refer to TSD Facility Technical Guidelines
Landfill gas venting facility	No regulation	- Install perforated pipes or other means to collect and treat or effectively use the gas generated from the landfill.	- Refer to RA9003
Leachate treatment facility	No regulation	- Treatment Method - Combination of physical, biological, and chemical treatment - Capacity - Leachate pond and leachate treatment facility can treat the maximum rainfall over the past 20 years.	- Adopted the structure in category 4 in DAO 2006-10 - Refer to JICA Technical Guidebook

Source: JICA Expert Team

2.3 Activities for Output 2

Activities 2-1: Review of current situation for introducing WTE in each target LGUs

The situations of WTE project were confirmed by reviewing the relevant documents, and summarized in the 1st Progress Report in 2020. The status of each project varied according to the conditions of each LGU.

(1) LGU Quezon City (as of February 2020)

1) Overview of the WTE Development in Quezon City

- The private consortium, composed of Metro Pacific Investments Corporation, Covanta Energy LLC, and Macquarie Capital Limited, submitted the Project as an unsolicited proposal of Quezon City. The consortium was authorized as the “Original Proponent”;
- In October 2018, Quezon City has launched the Swiss/Competitive Challenge for the Project based on the Quezon City PPP Code¹³, following the end of negotiation with the Original Proponent and the approval of the project by the PPP Selection Committee (PPP-SC),
- Since no comparative proposal was submitted to the city upon the bid deadline on February 4, 2019, it was believed that the Original Proponent would be awarded shortly. However, due to the change of government administration after the national and local election in May 2019 wherein a new mayor in Quezon City was elected, it has not been awarded as of the end of February 2020 and has continued to be pending to date.

2) Proposed WTE Project by Original Proponent

Major contents of the proposed WTE project of the Original Proponent which was given in the Project Information Memorandum as one of the Swiss Challenge documents, are shown in the table below. Quezon City also explained that the indicative cost of the project is up to PHP22B based on the new tipping fee of PHP1,400/t.

Table 2.41 Overview of Proposed WTE Project to Quezon City

Feature	Terms
Project Scope	The Project involves the provision of the following infrastructure facilities: <ul style="list-style-type: none"> - Biodegradable source separated organics (SSO) treatment facility; - Residual combustible waste treatment facility; - Monofill for fly ash disposal - Other ancillary facilities, including continuous emission monitoring system, administration building, scale house, transmission lines, and utility systems and connections
Indicative Cost	Up to PHP22B
PPP Structure	Incorporated Joint Venture (JV) with Build-Own-Operate (BOO) mechanism, except in case of pre-termination whereby facility is transferred to the LGU upon paying a termination payment
Concession Period	35 years starting on MBT Component Operations Start Date (as defined under the Concession Agreement)
Revenue Source	- Tipping fees

13 Ordinance No. SP 2336, series of 2014, entitled “Quezon City Code Pursuing a Public-Private Partnership (PPP) Approach Towards Development, providing for the Procedure for Selecting the Private Sector Proponent, adopting a Contract Management Framework, and Providing Appropriations and For Other Purposes”, and its Implementing Rules and Regulations (the “IRR”)

Feature	Terms
	<ul style="list-style-type: none"> - Power generation fees - Sale of by-products (e.g., recyclables, digestate, etc.)
Bid Parameter	Lowest Tipping Fee (inclusive of VAT and other applicable taxes)
Equity Share in the Incorporated JV	<ul style="list-style-type: none"> - Private Concessionaire – 95% - LGU – 5%
Project Site	<p>Any site within Quezon City which shall not:</p> <ul style="list-style-type: none"> - adversely affect the current flow of traffic within Quezon City; - result in an increase in haulage costs to the LGU; and - disrupt the residents of nearby communities considering the necessary ingress and egress of trucks hauling municipal solid waste to and from the proposed Project site location
LGU’s Obligations	<ul style="list-style-type: none"> - Payment of Tipping Fees to Concessionaire - Delivery of 1,700 metric tons of MSW per day - LGU right-of-way acquisition (e.g., access roads, transmission line, etc.) - Project site acquisition in case of expropriation

Source: Project Information Memorandum of QCISWMF, Oct23, 2018 Quezon City

(2) LGU Davao City (as of February 2020)

1) Overview of the WTE Development in Davao City

- A Japanese company conducted a study on the WTE project in 2015 under the JICA scheme for collaboration with private sector¹⁴. After this study, they submitted a proposal to Davao City in 2017. Based on the proposal, Davao City applied for a Japan Grant Aid for WTE project to Government of Philippines.
- After the Exchange of Note (E/N) between the two Governments, the procedure of Grant Aid Project for the Construction of Waste-to-Energy Facilities in Davao City was officially commenced. The procurement agent, which has been appointed by the Government of the Philippines contracted with a consultant, conducts FS, tender assistance, and construction supervision. The Special Purpose Company (SPC) will enter into a contract with Davao City through the procurement agent for the operation and maintenance.
- Presently, the procured consultant team was implementing FS, which supposed to be completed at the end of February 2020.

2) The WTE Project of Davao City (recognized as “not final information”)

Highlights of Davao City’s WTE project in progress is shown in the table below. However, this information shall be further validated and updated by the consultants hired by Davao City under the Japan Grant-aid project.

¹⁴ <https://openjicareport.jica.go.jp/pdf/12302113.pdf>

Table 2.42 Overview of Davao City WTE Project (to be Validated in FS)

Feature	Terms
Project Scope	From reception of MSW until discharge of residues (Fly/Bottom ash)
PPP Structure	Build-Own-Operate (BOO) mechanism with Viability Gap Finance of JPY 5.013B agreed in the Exchange of Notes as a grant ¹⁵ *Detailed terms and conditions are not disclosed yet.
Concession Period	20 years starting from commencement of construction
Revenue Source	<ul style="list-style-type: none"> · Tipping fees · Power generation fees (FIT rate will not be applicable)
Bid Parameter	To be discussed in FS
Equity Share in the Incorporated JV	To be discussed in FS
LGU's Obligations	<ul style="list-style-type: none"> · Payment of Tipping Fees to Concessionaire · Delivery of 600 metric tons of MSW per day with guaranteed calorific value · Off-take and appropriate disposal of residues (60 t/day of bottom and fly ash), · LGU right-of-way acquisition (e.g., access roads, transmission line, etc.) · Secure project site and provide to Concessionaire

Source: Prepared by JICA Expert Team utilizing the Documents provided by Davao City

(3) LGU Cebu City (as of February 2020)

1) Overview of the WTE Development in Cebu City

- Cebu City had been supported by ADB's Technical Assistance (TA) for the evaluation of unsolicited proposals and had provided, in May 2019, the Original Proponent Status (OPS) to MPIC who proposes MBT technology, not incineration technology.
- However, after the transition to the new administration in June 2019, the decision of choosing incineration was made based on the suggestion of the previous ADB-TA on evaluation of WTE proposals from private companies. As a result, the OPS for MPIC was cancelled.
- The new administration of Cebu City terminated the ADB-TA as well.
- The city is currently evaluating and negotiating with, the proposal of an Incineration WTE from a private company, New Sky Energy Philippines Inc. (NSEPI).
- Since the city does not have enough knowledge and experience on WTE, they requested the support of JET in evaluating the proposal of NSEPI. JET agreed and had already conducted three meetings with members of the Cebu City's Joint-Venture Selection Committee (JVSC).

2) WTE Project Proposed by NSEPI

The JVSC of Cebu City and NSEPI were negotiating with the detailed conditions.

Some mismatches are found between the proposal and the expectations of Cebu City, such as (but not limited to), scope of work (in particular ash utilization/disposal), obligation of the city, capacity of the facility, etc. These shall be clarified and agreed in the negotiation.

¹⁵ https://www.mofa.go.jp/policy/oda/page22e_000803.html

(4) Updated Status of the WTE projects (as of December 2020)

The updates reported and shared by the LGUs with the member institution of ITWG are shown in Table 2.43. It is apparent that the preparation progress of LGU's projects were delayed by restrictions due to the COVID-19 pandemic.

Table 2.43 Updates of WTE Project of Three LGUs (December 2020)

LGUs	Terms
Quezon City	<ul style="list-style-type: none"> - The consortium declared as the original proponent has not been awarded for WTE project although the Swiss Challenge process was completed from October 2018 to February 2019. - Under administration headed by a new mayor elected in May 2019, the Quezon City WTE Project is still under review by the Investment Affairs Office.
Davao City	<ul style="list-style-type: none"> - The FS which was conducted by the procured consultant under the Japan Grant Aid scheme has already been finalized and submitted to SWMD-EMB for comments. - The SWMD comments on the FS have already been submitted to the Office of the Director, DENR- EMB. - Once the FS is approved, paperwork will be endorsed to the Department of Finance and NEDA.
Cebu City	<ul style="list-style-type: none"> - Joint Venture Selection Committee (JVSC) of LGU Cebu has resumed negotiations with the private proponent of WTE facility after a halt due to the pandemic. - The previously identified location for the site (Brgy. Inayawan) is being disputed and a new site is being located. - The Comprehensive Land Use Plan (CLUP) is still being finalized. - The JVSC has not yet forwarded the draft Joint Venture Agreement to CCENRO, which is supposed to be technically reviewed by JET according to initial agreement.

Source : LGUs' information reported at the 2nd ITWG meeting held on December 3, 2020.

Activities 2-2: Clarify the current waste flow/amount, and support to setup the reduction target in existing MSWM 10-year Plan

The 10-year solid waste management plans provided by the target LGUs were reviewed focusing on their waste material flow, where the waste reduction targets of the target LGUs were confirmed in 2019.

This activity was implemented in February 2020 and the following information was reported in the 1st Progress Report.

(1) LGU Quezon City

Based on the information in the 10-year SWM Plan of Quezon City shared in April 2019, the current and planned waste material balance of Quezon City was summarized as shown in Table 2.44.

Table 2.44 Waste Material Balance of Quezon City in the 10-Year SWM Plan

Waste material balance	2015 (current)	2017	2024 (target)
a) Waste Generation (t/day)	2,796	2,970	4,187
b) Waste Collection (t/day)	N.A.	2,873	N.A.
c) Waste Diversion (t/day)	1,576	1,776	3,140
c1) Composting (t)		3,071	N.A.
c2) Material recovery (t)		2,248	N.A.
c3) WTE (t/day)		0	(1,700)
Diversion rate	56%	60%	75%
d) Waste Disposal (t/day)	1,220	1,194	1,047

Source: Prepared by JICA Expert Team based on the LGU's 10-year SWM plan

Based on the above table, the results of the confirmation and analysis of waste reduction targets in the 10-year SWM plan are as follows:

- The waste flow for the start and target years of the plan is unclear.
- Only the amount of waste generation, disposal, and diversion (defined as the difference between the waste generation and disposal) are described. Consequently, targets for waste collection, composting and material recovery are not indicated.
- For this reason, it is difficult to understand the planned timeline and intervention. Additionally, the feasibility of the waste diversion rate (75% in 2024) cannot be assessed.
- It is difficult to understand the planned measures because quantitative data are scattered in the plan and their units are not consistent.
- Some information of the planned WTE (waste incineration with power generation) project is reflected in the approved 10-year plan in Chapter 6 - Plan Strategy under Section 6.3. Strategies, Chapter 7 - SWM Systems under Section 7.6.3. New Facilities, Chapter 8 – Implementation Strategy under Section 8.4. Alternative Technologies, and Chapter 11 - Cost Estimates/Financial Aspects under Section 11.1 Investments Costs.

(2) LGU Davao City

Based on the information in the 10-year SWM plan of Davao City shared in April 2019, the current and planned waste material balance of Davao City was summarized as shown in Table 2.45.

Table 2.45 Waste Material Balance of Davao City in the 10-Year SWM Plan

Waste material balance	2017 (current)	2022	2027 (target)
a) Waste Generation (kg/day)	990,703	1,099,623	1,208,544
b) Waste Collection (kg/day)	712,726	690,014	710,624
c) Waste Diversion (kg/day)	306,507	451,742	1,115,475
c1) Diversion at source	277,977	409,610	497,920
c2) Crew scavenging	15,442	10,446	9,185
c3) Composting	10,000	25,000	50,000
c4) Material recovery	3,088	6,686	18,370
c5) WTE	0	0	540,000
Diversion rate	31%	41%	92%
d) Waste Disposal (kg/day)	684,195	647,882	93,069

Source: Prepared by JICA Expert Team based on the LGU's 10-year SWM plan

Based on the above table, the results of confirmation and analysis of waste reduction targets in the 10-year SWM plan are as follows:

- The waste flow for the start and target year of the plan is clear.
- The amounts of waste generation, collection, diversion, and disposal are summarized in several tables in the plan.
- Hence, this plan is evaluated as a good example of the 10-year SWM plans in terms of waste material balance.
- However, the amount of waste diversion may include uncollected and illegally dumped waste, and most of the recycling relies on in-house treatment/disposal. Therefore, it is desirable to classify the 'waste diversion rate' into 'collection rate' and 'recycling rate by LGU'.

- The WTE (waste incineration with power generation) project is included in the 10-year SWM plan and its relevance and effectiveness in improving the waste diversion rate (from 5% to 87%) is clarified.
- The planned policy measures and its budget plan are consistent with the waste material balance and are easy to understand.

(3) LGU Cebu City

Based on the information in the 10-year SWM plan of Cebu City shared in April 2019, the current and planned waste material balance of Cebu City was summarized as shown in Table 2.46.

Table 2.46 Waste Material Balance of Cebu City in the 10-year SWM Plan

Waste material balance	2015 (current)	2019	2028 (target)
a) Waste Generation (kg/day)	861,719	906,335	1,015,351
b) Waste Collection (kg/day)	481,715	N.A.	N.A.
c) Waste Diversion (kg/day)	N.A.	589,118	866,196
c1) Diversion at source	N.A.	N.A.	N.A.
c2) Crew scavenging	N.A.	N.A.	N.A.
c3) Composting	N.A.	N.A.	N.A.
c4) Material recovery	N.A.	N.A.	N.A.
c5) WTE	0	0	500,000
Diversion rate	N.A.	65%	85%
d) Waste Disposal (kg/day)	N.A.	317,217	149,155

Source: Prepared by JICA Expert Team based on the LGU's 10-year SWM plan

Based on the above table, the results of confirmation and analysis of waste reduction targets in the 10-year SWM plan are as follows:

- The waste flow in the start and target year of the plan is unclear.
- Little quantitative data is included in the plan and even the current situation of waste management cannot be fully grasped.
- For this reason, it is difficult to understand the planned timeline and intervention and, the feasibility of the waste diversion rate (85% in 2028) cannot be assessed.
- It is difficult to understand the planned measures because quantitative data are scattered in the plan.

Activities 2-3: Evaluate LGUs' Land use plan for the WTE project

The WTE guidelines, NSWMC resolution (2016-669) stipulates that "a WTE facility shall be located at a site consistent with the land use plan of the LGU". This shall also harmonize with the LGU's Comprehensive Land Use Plans (CLUP).

Solid waste management is discussed in the CLUP of Quezon City and Davao City while the Cebu LGU is finalizing their CLUP as written in Table 2.43. The description of SWM in the CLUP of Quezon City and Davao City is shown in Table 2.47.

Table 2.47 Description related with SWM in the Comprehensive Land Use Plan (CLUP) of LGUs

CLUP	Description
CLUP (2011-2025), Quezon City	<ul style="list-style-type: none"> - Solid waste management system is identified in the land use policy framework as one of the plans for infrastructure development. - Sanitary landfill, MRF (including composting), storage, collection and transport are considered as infrastructure. WTE and other treatment facilities are not specified. - Potential of increasing capacity of the methane power plant using biogas generated from solid waste in Payatas special development area is mentioned.
CLUP (2013-2022), Davao City	<ul style="list-style-type: none"> - Necessity of extension of lifespan of sanitary landfill is recognized. - MRF and composting facility are considered in each barangay. - It is envisaged to adopt new technologies on SWM while WTE was not identified and specified. - New site of SWM infrastructure is not identified in the land use / zoning map (2013-2022).

Source : prepared based on the CLUP of Quezon City and Davao City

Since the WTE projects in LGUs are in different status as described in Table 2.43, due to restriction of information disclosure, it was not possible in March 2021, to verify if their project site would be located in the area designated for such use according to the CLUP. The project team shall remind the LGUs to comply with requirements set by the NSWMC resolution and to update their 10-year SWM plan and the CLUP to satisfy the said requirements. It was also expected that the information of the project site might be disclosed to the Project once the MOU between DENR and LGU are signed.

Activities 2-4 : Analyze and verify the candidate WTE project selected from the existing FS, unsolicited/solicited proposals

This activity was implemented on February 2020 and the following information was reported in the 1st Progress Report.

As of February 2020, for Quezon City, no updates was made to the existing FS and no new proposals was submitted to the LGUs. For Cebu City, the LGU received a proposal from NSESI in 2019. The FS has been conducted under Japan Grant Aid for WTE project of Davao City.

(1) Quezon City LGU

- As written in Activity 2-1, the previous administration of Quezon City has already finished the negotiation with the Original Proponent for each contract conditions, and JET does not have the status yet to review them in detail.
- With regard to the capacity of the facility, based on several feasibility studies for Quezon City and weigh bridge data accumulated in closed Payatas sanitary landfill (SLF) and private haulers, Quezon City understands its allowable quantity for WTE (deemed 1,700 t/day in total). However, further study and analysis will be conducted on how much biodegradable waste will be fed to the MBT and combustible residues to the incinerator, given recent ordinances that would reduce plastic wastes in the waste stream as well as other initiatives that will be undertaken to avoid, minimize, and reduce wastes disposed.
- With regard to the quality of feedstock (biodegradable for the MBT and combustible residual for the incinerator), there are certain rules for the quality of acceptable waste that the city needs to achieve and proper system intervention and stricter monitoring is necessary for the city to achieve this output for the long term.
- The project proponent, consist of MPIC, Macquarie Capital, and Covanta Energy, seems to be one of the most reliable joint-ventures in the Philippines because of its existing achievements in

other PPP projects in the Philippines, technical experiences in procuring WTEs in the world, and financial standings. For these reasons, is the city needed to be careful in implementing self-obligations such as provision of waste with quantity/quality standards, and monitoring required performance standards of the proponents in construction/operation phases.

(2) Davao City LGU

- As written in Activity 2-1, Davao City is currently in the stage of its technical, financial, and legal due diligence on the planned WTE project, and similar to Quezon City’s case, JET was not in the position to review the project conditions in detail.
- JET suggests consideration of the following items for reviewing the due diligence discussed in the FS report of the Davao City LGU:

Table 2.48 Suggestions in Evaluating due Diligence in FS

Items	Suggestions
Confirmation of MSW amount survey and validation of the plant capacity (600 t/d)	<p>According to the 10-year SWM plan (2018-2027), out of 990 t/day of generated MSW in 2018, the amount of landfill waste was 684 t/day. By 2022, one year before the start of operations of the WTE facility, it is planned for the generated MSW to be 1,099 t/day, of which 626 t/day will be landfilled. This figure is planned to be reduced from the present figure through improvement of the recycling rate.</p> <p>It has been confirmed that the actual amount of MSW disposed in landfill is increasing, rising from an average of 575 t/day in 2017 to 602 t/day in 2018. However, since the capacity of the plant directly affects the project cost (Capex) and considering that incombustible waste is calculated in the amount of present landfilling waste, it will be possible to reconsider the plant scale based on the result of waste composition analysis and studies which Davao City has been doing until now.</p>
Verification of planned quality of waste	<p>Same as the amount of MSW, the quality of incoming waste (three components and lower heating value) is an important factor in designing the WTE plant. In Japan, when orders are placed for WTE facilities, the client (LGU) presents the quality of waste over the range of low, standard, and high quality, and this is used as the basis for designing the size of the furnace, exhaust gas treatment system, and power generating equipment. In the project, since it is a BOT undertaking whereby the plant investment by the SPC will be covered by T/F and revenue from power sales, if the presumed quality of waste differs from the actual quality, the annual amount of generated power will fall, and this will have a direct impact on the SPC business feasibility. Therefore, the presumed quality of waste is an extremely important factor.</p> <p>Therefore, the results of waste quality survey by the Davao City, Kitakyushu City, and other parties shall be reviewed and set guarantee value carefully.</p>
EPC cost and annual O&M cost	<p>For the evaluation of financial feasibility, expected EPC cost, annual O&M cost, and their breakdowns shall be examined carefully. At the same time, market sounding shall be conducted with the technical providers to confirm the envisaged facility specifications and confirm if there is any technical possibility for cutting the EPC costs (for example, whether or not, to adopt a boiler shed, etc.).</p>
Fundraising of Davao City for T/F, etc.	<p>To increase the equity IRR for the purpose of attracting private investors, aside from the above-mentioned points, Davao City has several options such as additional VGF, increase of the T/F as the price for purchasing services, and application of an appropriate inflation rate, etc.</p> <p>To examine the possibility of public fundraising, Economic IRR demonstration shall be conducted. Generally, it is necessary to show that the Economic IRR shall exceed the benchmark of 10-12% (according to the NEDA ICC Procedure, it is 15% in the Philippines). When conducting Economic IRR analysis for environmental improvement projects including WTE, the investment efficiency is evaluated based on incremental analysis of the case without WTE facilities (Without Case) and the case with WTE facilities (With Case).</p> <p>Without Case: As is the case at present, almost all the generated MSW (600 t/day) are continued to be landfilled. In newly constructed landfill sites, it will be necessary to install and operate appropriate leachate treatment facility.</p> <p>With Case: Thanks to the WTE facilities, since the amount of MSW in volumetric terms will be reduced to approximately 1/25 (assuming bulk specific gravity of 0.2 t/m³ x ash content 20%), the scale of newly-construct landfills will be 1/25 of that in the Without Case (assuming the same service life). Compared to the Without case, it</p>

Items	Suggestions
	will be possible to greatly reduce the cost for land, construction of land, leachate treatment facility, and operation.
Net power sale capacity, operating days, MSW receiving days	It is necessary to confirm the power sales capacity following deduction of internal power consumption from the equipment capacity, as well as operating hours, etc.
Power sale unit price / Power tariff	The FIT rate for biomass renewable energy (PHP6.63/kwh) was abolished and replaced by RPS from 2020 onwards. Under the RPS, power distribution companies will be obliged to procure a certain percentage of power from RE power sources, and power sale prices will be determined according to bilateral contracts signed between RE operators and the power distribution companies.

Source: JICA Expert Team

(3) Cebu City LGU

Upon request by Cebu City, JET reviewed NSEPI's proposal and gave technical comments on it. Since Cebu City does not have enough information on quantity and quality of disposed waste until now, JET strongly recommended figuring out the facility plan on a "what-the-city-wants" basis based on the existing status of disposed waste.

Activities 2-5: Define the points and issues to be addressed for formulating WTE project in target LGUs

Data tabulated in Table 2.49 are identified and summarized based on the information obtained from each target LGUs. These points were reported in the 1st and 2nd Progress Report in March 2020 and March 2021 respectively.

These are JET's opinions and suggestions from the technical points of view. It must be critical for LGUs to pay attention to these points and issues because big projects using PPP scheme tend to be decided by political reasons without enough discussion and evaluation on the technical aspect.

Table 2.49 Points and Issues Associated in Formulating WTE Project in LGUs

Points and Issues	Explanation and how to address the Points/Issues
1. Tipping fees for waste	<ul style="list-style-type: none"> - Most of the LGUs have not shouldered the cost for SWM at a reasonable level even at this moment. Accordingly, LGUs do not accept increase of tipping fees (T/F) associated with WTE from present landfill cost, - The reason why the cost shouldered by the LGU could be lower than reasonable level is that some components of SWM still need improvements to meet environmental compliance. - The cost of SWM will be bigger since land price for SWM facility increase with economy development, strict environmental measures will be required according to more consciousness on environment.
2. Misunderstanding on SWM-PPP including WTE	<ul style="list-style-type: none"> - In many cases, it is a misunderstanding when "the waste can be converted to the money through PPP scheme" in the Philippines. There are two types of PPP projects, one is <i>revenue generated and revenue sharable PPP</i> project (such as toll road, power generation, and water distribution projects) and another one is <i>service fee payment-based PPP</i> (such as SWM project, where service fee shall be paid by the LGU to a private entity as T/F). These two types are written interchangeably in many documents and may lead to misunderstanding. - Thus, LGUs as well as National Government shall the clarify the following: <ul style="list-style-type: none"> · SWM-PPP projects are not <i>revenue sharable PPP projects</i>, and LGUs shall pay the T/F through the project period to private investor to recover their initial investment. · Private investor is eligible to recover its initial investment cost through project duration by T/F.

Points and Issues	Explanation and how to address the Points/Issues
	<p>*It means that total government expenditure (In Japan, it is called as “Public Sector Comparator”) through project period is mostly same in both cases that LGUs procure the project in BOT or DBO.</p>
<p>3. Responsibility of LGUs</p>	<ul style="list-style-type: none"> - It is necessary to clarify the real meaning of SWM being "primarily responsibility of LGU" in RA9003 <ul style="list-style-type: none"> · Waste Treatment and Cleanness Law (1970) in Japan states that "even if LG contract out the construction, O&M of SWM to private entities, LGU still have all responsibilities of it." This means that the LGU shall have an avoidance/recovery plan before the start of operations of the SWM facility so as to keep continuous operations of SWM in its jurisdiction if at any case, private company failed to comply with environmental standards or is bankrupt and cease to operate for any reasons. · The LGU shall realize the responsibility securing the environmental compliance of concessionaries in the SWM-PPP project while EMB regional office is one of the organizations for monitoring.
<p>4. Needs of technical expertise in LGUs</p>	<ul style="list-style-type: none"> - LGUs in the Philippines do not have experts on WTE technology. They need expertise to evaluate proposals that sometimes try to mislead through unrealistic projects. LGU/s shall have readiness before deliberation of proposed PPP project. - Some LGUs who do not have technical capability tends to contract out all of activities in MSWM stream to one company. Such too high reliance on one private firm has a lot of risks such as: <ul style="list-style-type: none"> · Anytime, private company can cease the operation by their sole discretion if the project doesn't generate profit, · LGUs shall find successors/alternative options immediately but it is quite difficult to find it in particular patented/complex facility, · Then, private company requests LGUs to increase processing cost (T/F) and LGUs have no other option but to shall agree to it considering the risks above.
<p>5. Applicability of Solicited Approach</p>	<ul style="list-style-type: none"> - LGUs always face difficulties in evaluating unsolicited proposals without idea of “proper” development approach of WTE. - Same like other public service infrastructure, solicited approach shall be considered for WTE. This is the way for the LGU to specify and require private investor to offer the WTE project in accordance to the needs of the LGU. - With regards to the capacity of the facility, the LGU must know its MSW stream and the amount of waste they can supply to the WTE. This is also same for the composition (quality) of waste, - As an example, on March 2020, JET stayed 3 days in Cebu City for the study on Setting up the Capacity of WTE in Cebu then reported to the city. As a result, combustible matter in 2019 was 500 t/d and 600 t/d in 2035. The private proponent requests the city to guarantee an 800 t/d of MSW which is too big for Cebu city. - With regard to the scope of the Project, LGUs shall decide what components shall fall under their responsibility to manage and what components shall be contracted out to the private sector.
<p>6. Definition of waste category (Residual, Recyclable, Biodegradable) 7. Segregation obligation in RA 9003 8. Waste category in WACS</p>	<ul style="list-style-type: none"> - In Section VIII and IX, IRR of RA9003, there are the basic requirement for the segregation; “Responsibility for sorting and segregation of <i>biodegradable</i> and <i>non-biodegradable</i> wastes shall be at the household level” and “Waste segregation and collection shall be conducted at the barangay level specifically for <i>biodegradable/compostable</i> and <i>reusable/recyclable</i> wastes. The collection and disposal of <i>non-recyclable/non-recoverable</i> materials and <i>special wastes</i> shall be the responsibility of the city or municipality.” - The following terms in this provision are not clear: <ul style="list-style-type: none"> · What is the difference between “<i>non-recyclable/non-recoverable</i>” and “<i>residual</i>”?

Points and Issues	Explanation and how to address the Points/Issues
	<ul style="list-style-type: none"> · It is common practice that “residual” waste includes not only “non-recyclable/non-recoverable” materials but also “<i>biodegradable, reusable/recyclable</i>” material if there are no appropriate segregation/recovery system nor sufficient demand in the local market for recyclables and compost. · JET recommends to define “<i>Residual waste</i>” as “wastes which can’t be reduced, reused, nor recycled, in economically nor technically, in the LGU’s waste treatment system including material recovery, utilization industries, and other circumstances”, which means that the LGU can define materials classified into the residual waste based on their SWM plan. “Residual waste” is defined in the WTE technical standards as draft MC discussed in Activity 1-4. · Then, the LGU can understand the meaning and necessity of WACS for “Residual waste” to consider how to control/manage/minimize “<i>Residual waste</i>”. - In this context, it should be discussed for the WACS procedure. Present NSWMC’s categorization for WACS is four items; <i>Biodegradable, Recyclable, Special Waste, and Residual Waste (Categorized in downstream usage basis)</i>. It is recommended that WACS categorization should be in material basis and not the usage basis. ¹⁶
<p>9. Accumulated data of solid waste quantity and quality</p>	<ul style="list-style-type: none"> - When LGUs consider putting up any facility such as WTE or MRF, it is recommended to have “<i>at least</i>” statistic quantity data of MSW disposal because SWM processing facility shall need the information of “target waste” quantity. Additionally, waste classification survey in WACS in continuous manner is also required to prepare appropriate WTE project capacity. - In addition, only WACS data is not usable. It should be study report basis which includes implemented period (season and time), detail sampling, analytical procedure, etc. - Under the limited business activity caused by COVID-19, these self-data accumulation activities are strongly recommended for LGUs to consider.
<p>10. Address to various stakeholders</p>	<ul style="list-style-type: none"> - It is suggested that a program must be developed to educate the LGUs how to consult with the various stakeholders such as civil society to eliminate stigma and participate in the dialogues in a more constructive manner.
<p>11. Change of administration/ Long-term WTE development plan</p>	<ul style="list-style-type: none"> - Political risk (e.g., Newly elected government official might cause a change of direction) is the biggest risk for the private investor. It shall be considered by the LGU side (and guaranteed by NG, etc.) to ensure cooperation for long-term contracts. - In the case of QC, the Consortium’s unsolicited proposal has gone through Swiss Challenge during the previous administration. Currently, the new administration is conscientiously studying the Project taking into consideration the recently passed Ordinances on Plastic Bag Ban and Single-Use Plastic/Disposable Materials Ban while exhausting all efforts on Waste Minimization/Reduction and Avoidance. - It is recommended for LGUs to have a consistent long-term MSWM Plan including WTE development supported by LGUs’ budgetary plan. This should be published and uploaded time to time to let the citizens, politicians, and investors can understand, its alignment to the long-term plans of the LGU, and to encourage a more transparent cooperation between all stakeholders.
<p>12. Handling of ETV Statement/Report</p>	<ul style="list-style-type: none"> - As written in Activity 1-4 above, ETV statement or report is the evaluation result on the claim that the applicant requested to validate. It is important to note however that the ETV does not endorse, approve or authorize for use any product

¹⁶ In Japan, WACS category is at least 5 kinds and can be divided into more, which are (1) Paper and textile, (2) Plastic, rubbers, (3) Wood, bamboos, (4) Kitchen waste, (5) Inert, because usage can be changed based on the recycling market. (Demand of plastic is drastically changed recent years. If it is categorized in “recyclables”, composition of plastic at the landfill can’t be monitored in the WACS statistics.)

Points and Issues	Explanation and how to address the Points/Issues
	that it evaluates. This shall guide the end user of WTE, which is normally the LGU, to understand such ETV policies and to validate how the proposed technology is reliable.

Source: JICA Expert Team

Activities 2-6: Define proper responsibility of target LGUs in promoting WTE under PPP scheme

(1) Proper risk allocation between implementation Agency (public) and Private Company

It is indispensable for the task/role demarcation between the LGU and private company shall be well considered and set forth clearly in the contract. The optimal risk sharing setup is to delegate the work and its corresponding risks based on the capacity and capability of the entity, such that risks are assigned to the entity that can best manage them.

For example, with regard to land security, LGUs are more proficient in land prices and knowledgeable in land convenience than international technology providers, so in WTE PPP projects, LGUs are more suitable to carry out the work to secure the land. On the other hand, in the WTE-ACC, considering that LGUs have no or limited exposure to handling such projects, rather than an amateur LGU performing the design, construction, and operation work of the facility, it is more appropriate to stipulate only the required output specifications, allow the private sector to execute the details, and supervise whether the work is being carried out as requested.

Since it is sometimes difficult for LGUs to find the suitable land for this kind of NIMBY project, they tend to rely on the private sector for such task. However, this contains two important risks.

- (1) By leaving the important task of land security to the private sector, bidders are often led by local investors who are good at securing land. However, the local strongman often lacks the ability to select the appropriate technology, and as a result of adopting an inexperienced technology, they can get frustrated during the construction and operation phases.
- (2) Even if the performance on the private operator is poor and the LGU wants to cancel the contract based on the terms of the contract, it is sometimes difficult to cancel the contract in a situation where the private sector holds ownership of the land. Even if the contract can be terminated, it will be necessary to continue to lease the land.

In view of these factors, considering the continuity of projects that provide public services and the ease of contract cancellation, it is preferable for LGU to secure the land unless there are special circumstances.

Table 2.50 and Table 2.51 shows the examples of task allocation between the LGU and private partner, in the case of DBO and BOT, respectively.

Under the DBO scheme, ownership of the facility throughout the project period is of the LGU, and all permits including EIA are usually obtained by the LGU. However, EIA must have a technology-specific information including layout, exhaust gas treatment system settings, etc. that the private partner is obliged to specify in cooperation with the LGU. Prior to the operation, even DBO or BOT where the private sector operates the facility, manuals for the facility operation, maintenance, emergency plan, and other related manuals must be prepared by the private entity for the LGU's approval. During the operation phase, since waste quantity and quality are not able to be handled by the private entity, security of waste feedstock must be the LGU's responsibility. Meanwhile, the selling right of the recovered outputs and materials such as power, heat, or any sellable products can be determined project-by-project. Since the LGU shall pay annual O&M cost based on the DBO bid for the operation period, such sales revenue ownership must be specified during the bid process.

An example of BOT, this Project was developed by the host national/local governments together with international donors. Since there are several failure cases of WTE-ACC in the country, it was required to

attract internationally reputed investors and technology providers by the fair task allocation. The LGU is better suited to manage and be responsible for all the task related to the waste, land, utilities, etc. whereas for the scope of the WTE-ACC which includes fund rising, design, construction, and operation for a certain period e.g., 15 years, shall be obliged to the private entity.

Table 2.50 Example of Task Allocation between LGU and Private Partner (in the case of DBO)

Phase	Responsibility of LG	Responsibility of Private Partner
Design and Construction Phase	<ul style="list-style-type: none"> ✓ Security of Land ✓ Topographic Survey ✓ Geological Survey ✓ Obtain project approval from government agencies, ✓ EIA*, ✓ Application of the permission*, ✓ Supervision of Design/Construction*, etc. 	<ul style="list-style-type: none"> ✓ Support LGU on Topo/Geo Survey, ✓ Support LGU on the documentation for applications to gov. agencies, ✓ Design and Construction of WTE, ✓ Process and disposal of construction waste, ✓ Preparation of manuals for operation*, ✓ Provision of spare parts, etc.
Operation and Maintenance Phase	<ul style="list-style-type: none"> ✓ Delivery of Waste Feedstock, ✓ Sales of Recovered Material, ✓ Monitoring of the operation, etc. 	<ul style="list-style-type: none"> ✓ Reception, weighing, collection of fees, ✓ Operation management (prepare plan, implement, etc.) ✓ Consumables management (prepare plan, procurement, etc.), ✓ Maintenance management (prepare plan, regular inspection, repair, back up, etc.)

Note: In DBO facility will be owned by LG so permissions including EIA usually be secured by LG.

Source: JICA Expert Team

Table 2.51 Example of Task Allocation between LGU and Private Partner (in the case of BOT)

Category	No	Role	Gov.	SPC
Land Acquisition	1	Project Site and water supply facility	✓	
Design and Construction (including commissioning and testing)	2	MSW Acceptance Facility (Weighbridge and Registration)		✓
	3	Sample sorting facility (Dumping box, etc.)		✓
	4	Processing system and visitor center		✓
	5	Water supply piping	✓	
	6	Adherent Landfill and Leachate Treatment Facility	✓	
	7	Supporting Infrastructure (Road, rainwater drainage, etc.) in MSWM complex but outside of Waste Treatment Facility Plot	✓	
	8	Supporting Infrastructure (Road, rainwater drainage, etc.) in Waste Treatment Facility Plot		✓
Operation and Maintenance	9	MSW supply to site and Unsuitable Waste removal prior to site delivery	✓	
	10	Processing system (from MSW weighbridge until residue loading station), visitor center		✓
	11	Water supply	✓	
	12	Landfill and Leachate Treatment Site operation including residue transfer to landfill	✓	

Category	No	Role	Gov.	SPC
	13	Supporting Infrastructure (Road, rainwater drainage, etc.) in MSWM complex but outside of Waste Treatment Facility Plot	✓	
	14	Supporting Infrastructure (Road, rainwater drainage, etc.) in Waste Treatment Facility Plot		✓
Financing	15	Land for Project Site	✓	
	16	Weighbridge, Registration Office, Sample Sorting, Processing System, visitor center		✓
	19	Water supply facility	✓	
	20	Supporting Infrastructure (Road, rainwater drainage, etc.) in MSWM complex but outside of Waste Treatment Facility Plot	✓	
	21	Supporting Infrastructure (Road, rainwater drainage, etc.) in Waste Treatment Facility Plot		✓

Remarks: The above risk allocation table only shows some of the risks of the Project. Further detail of the risk allocation shall be developed under the Bidding Document.

Source: An ASEAN WTE-PPP PQ document obtained by JICA Expert Team

(2) Cooperation with PPP Center

1) Background of Cooperation with PPPC

The TCP is composed of four outputs to streamline the capacity building activities. In particular, Output 2 was crafted to enhance the target LGUs' capacity for planning, evaluation, formulation, and supervision of WTE projects. This Project Output initially consists of activities aligned to supporting the target LGUs to review their current SWM practices, prepare them for the implementation of WTE projects, and to support the LGUs as they endeavor these projects through a Public-Private Partnership (PPP) scheme.

Through the course of the TCP, the WTE projects of the target three LGUs encountered challenges in its implementation and prompted the project team to reevaluate the activities, and formulate both new and reinforcement activities to adapt to the observed changes. Among these reinforcement activities is Activity 2-6: Support to SWM PPP Projects to Clarify Responsibility of LGUs under PPP Scheme.

Activity 2-6 has allowed the TCP to expand its scope beyond the targeted LGUs, and to assist them through technical review of their SWM PPP Projects through coordination with the PPP Center (PPPC) Project Development Service (PDS) and Policy Formulation and Project Evaluation and Monitoring Services (PFPEMS).

JET and PPPC commenced this extended cooperation through a series of kick-off and consultation meetings on March-April 2021 to level the expected activities and timelines. The Work Plan was then prepared to illustrate these agreements.

Table 2.52 Work Plan with PPPC

Items listed in the Work Plan	Activities carried out
A. Review and Provision of Recommendations to LGU Projects - General Santos City Sanitary Landfill (SLF) Project	JET reviewed and commented on the Unsolicited Proposal submitted to GSC, mainly for 5 major aspects as stated below: (1) Technical details of the proposed technologies, (2) Technical capability of project proponents, (3) Minimum Performance Standards and Specifications (MPSS) and Key Performance Indicators (KPIs), (4) Waste Characterization Report Validation (5) Cost and Revenue Estimates,
B. Participation in Knowledge Sharing Session (KSS)	The KSS was scheduled on November 22, 2021 over MS Teams, Mr. Takahiro Kamishita, Chief Advisor of JET presented the “Overview of the BAT/BEP Guidelines” which was developed under Activity 1-1 as the one of the requirements of the JICA TCP.
C. Assistance for the finalization of the SWM PPP Guide: Guide on Assessing Unsolicited Joint Venture Proposals of Waste to Energy projects	JET reviewed and commented on the following SWM PPP Guide and the Unsolicited Joint Venture Proposal of Waste to Energy Project: (1) LGU Readiness Check Enrichment (2) Screening at Project Idea Note Level Simplification (3) Difficulties for LGUs for integration of WTE Aspect into the LGUs MSWM Master Plan (4) Financial Feasibility Analysis
D. Review and Provision of Recommendations to the Conceptual Framework on Solid Waste Management PPPs	JET reviewed and commented on the following Conceptual Framework on Solid Waste Management PPPs: (1) Inclusion of developments in LGU long-term plans (2) Consideration for new technologies (3) Caution on dependency on private sector (4) Community consultation

Source: Work Plan of the Coordination between PPPC and JICA Expert Team (2021)

2) Activities under Work Plan

i) Review and Provision of Recommendations to LGU Projects

Under this activity, technical review was required for two unsolicited proposals namely, “Unsolicited Proposal for the General Santos City Sanitary Landfill (SLF) Project” and “Unsolicited Proposal - Zamboanga Waste to Value (WtV) Project”. However, Zamboanga WtV project was initially proposed but was shortly removed in the Work Plan upon the withdrawal of the proponent.

JET identified the following comments and recommendations for the GSC’s preliminary report:

- Technical details of the proposed technologies

The technologies that the proponents will enforce to implement the operations and maintenance of the SLF and MRF were not specified, along with the specifics of the technology that will be processing plastic waste and biodegradable wastes, respectively. Although it is understandable that the proponents cannot divulge the entirety of their technical proposal, a certain level of specificity must be required from the proponents to allow for a reliable technical review of their proposal.

- Technical capability of project proponents

The proposal indicated the general profile of the consortium of companies behind the Project. The involved entities range from companies that handle meteorological and water services, waste management, and waste to energy, and although this rich background is assuring of the quality of work, they can promise to the LGU, JET noted that it would be helpful for the LGU to solicit a technical profile that illustrates the

track record of the proponent in implementing the technologies it proposes. This will allow the LGUs to better assess the capability of the proponent in implementing the plan based on past projects. It was further advised for this requirement to be asked not just for this particular proponent but also for other engagements that the LGU will pursue.

- Minimum Performance Standards and Specifications (MPSS) and Key Performance Indicators (KPIs)

JET echoes the request from PPPC for the proponents to indicate a more detailed MPSS that will specify the operations and maintenance strategies to ensure its compliance with local and industry standards and best practices and meet the service level requirements of the city. Additionally, the inclusion of pertinent KPIs and explanations on how these rates will be achieved will be vital in the assessment of the soundness of the proposal.

- Waste Characterization Report Validation

The values cited in the proposal, including the WACS data, were derived from reports done by the past contractor, and may need validation from the city's own reports. This will be integral in the imposition of the necessary capacity and yield for the biomass processing and the plastic conversion technology.

- Cost and Revenue Estimates

A more detailed cash flow forecast and financial model covering capital and operational expenditures of the facility is needed from the proponents to more accurately justify the revenue forecasts being claimed. For example, the sale of the diesel additives derived from plastic wastes has to have a more concrete plan by identifying prospective off-takers that are willing to purchase the additives in the rates indicated in the proposal.

JET presented the above preliminary findings to PPPC for the consideration of the General Santos City LGU and the proponents. After the said meeting, PPPC reached out to the LGU and project proponents to seek the additional information requested by JET, but to no avail.

The proponents did not send additional materials since the presentation of the preliminary findings. With this, JET and PPPC agreed, during the meeting on September 14, 2022, to close this activity with the submission of the Accomplishment Report detailing the team's findings from the initial review. PPPC PDS will take charge in relaying the report to the GSC LGU.

ii) Participation in Knowledge Sharing Session (KSS)

The issuance of the DAO 2019-21 opened the doors for WTE technologies for the integrated management of municipal solid waste. The introduction of best practices and technologies exercised in other countries is a means for the country to benchmark from these activities and explore what practices and technologies would best fit in the Philippine context.

The TCP developed a Case Study Analysis for Guidelines of Best Available Technique/Best Environmental Practice ("Case Study") in fulfillment of Activity 1-1.

The Case Study was developed in close coordination with DOST and other Output 1 Subgroup members with the intention of the output being a reference document for the BAT/BEP Guideline to be later

developed by the NEC. At the time of the KSS, the Case Study had been approved by the ITWG and has been endorsed to the Joint Coordination Committee (JCC) for its approval and adoption.

PPPC asked JET to present an overview of the Case Study in the KSS to share the best practices from other countries and promote dialogue on Waste to Energy. With this objective in mind, the invitation to the KSS was disseminated to PPPC employees as well as other implementing agencies and LGUs.

Other resource speakers included DENR-EMB who was requested to present the highlights of the DAO 2019-21. Mr. Jon Alan Cuyno, National Consultant of the PPP Center, discussed how the BAT/BEP Guidelines can be integrated into the MPSS used in PPP Projects and Atty. Lerma Advincula tackled how the private sector can participate in SWM projects through PPP channels.

The KSS was scheduled on November 22, 2021 over MS Teams, and observed the following program:

Table 2.53 Program of KSS

Time	Program	Speaker
1:30PM	House Rules and Introduction	-
1:45PM	Welcome Remarks	Atty. Mia G. Sebastian Assistant Secretary and Deputy Executive Director PPPC Center
2:00PM	Highlights of the DAO 2019-21	Ms. Elvira S. Pausing Program Manager Solid Waste Management Division DENR-EMB
2:30PM	Overview of the BAT/BEP Guidelines	Mr. Takahiro Kamishita Chief Advisor JICA Expert Team
3:00PM	Incorporating the BAT/BEP Guidelines to the Minimum Performance Standards and Specifications (MPSS) in PPP Projects	Mr. Jon Alan M. Cuyno National Consultant PPPC Center
3:30PM	Private sector participation in SWM projects through PPP arrangement	Atty. Lerma L. Advincula Director IV Project Development Service PPPC Center
4:00PM	Open Forum and Wrap-up	

Source: PPPC, KSS(2021)

The event was well-attended by LGU representatives from Quezon City, Zamboanga City, General Santos City, among others, and regulatory agencies including DENR, DOST, DOE, to name a few. The program was concluded successfully with the support of DENR-EMB, JET, and PPPC, stepping towards the direction of a healthy dialogue on Waste to Energy.

iii) Assistance for the finalization of the SWM PPP Guide: Guide on Assessing Unsolicited Joint Venture Proposals of Waste to Energy projects

PPPC-PFPEMS through Ms. Yao shared to JET in September 2021 the draft Guide on Assessing Unsolicited Joint Venture Proposals of Waste-to-Energy Projects (“Guide”) to seek assistance for its finalization. This guidance document was prepared in lieu of the SWM PPP Guide after a surge of requests from LGUs seeking assistance in managing the unsolicited proposals received.

The Guide was then reviewed by JET and preliminary recommendations were presented to Ms. Yao during a coordination meeting on October 18, 2021. The comments were acknowledged and were considered in the updating of the Guide, but the updated document was no longer routed to JET for further review. The following are the highlights in JET’s report to Ms. Yao:

- LGU Readiness Check Enrichment

JET identified the prerequisite documents that LGUs must first prepare prior to its involvement in WTE projects, as part of the readiness check.

The conduct of a FS is recommended for LGUs to implement in a general scope and to understand the waste situation in their community. This will allow the LGUs to generate validated information instead of relying on private proponents providing waste data. In addition to the waste quantity analysis and profiling (FS and WACS data), the LGU should be able to figure out the capacity of waste that it can provide, the budget that the LGU currently utilizes in the tipping fee payment and other related expenses, and they can also arrive at a list of preferred technologies that they would like to implement to ease their waste problem.

- Screening at Project Idea Note Level Simplification

The current screening procedure for proposals entail a heavy analysis on the legal and financial aspects of the project, often overlooking the technical details. Although the legal and financial aspects matter, the overall feasibility of the project must first be assessed before proceeding to a more exhaustive review process. JET recommends at least a 2-stage evaluation process, where the first stage will assess the technical feasibility of the proposed technology and a brief review at the legal and financial evaluation of the proposal.

Firstly, to understand whether the proponent and LGU are capable in undertaking the proposal, an assessment will be enacted of the Project's feasibility through a simplified review. In this first clearing process, legal, financial, and WTE technical experts shall be invited to assess this. Once passed, a more detailed review of the Project must be conducted in the second screening stage. This 2-stage review is expected to easily screen out projects that are not technically feasible and simplify the process of assessment by checking for the overall feasibility of the project before the deep dive in the project specifics.

- Difficulties for LGUs for integration of WTE Aspect into the LGUs MSWM Master Plan

WTE is a new technology in the Philippines and LGUs have no prior experience in dealing with such proposals. Because of this, WTE experts must be hired by the LGUs very early on in the planning process to provide unbiased opinion and immersive guidance for the LGUs on how to deal with proposals involving such technologies.

Primarily, WTE plans must be incorporated into the 10-year SWM plans of the LGUs. This not only guides proponents in the type of proposals to pursue with the LGUs, it also gives the LGUs to better align the developments to their long-term goals.

- Financial Feasibility Analysis

Span and depth of the financial elements in the proposal must be identified, not only the capital outlay required of the proponent and LGU, but also the operational cash flows necessary to sustain the facility. For instance, a certain level of clarity must be incorporated in the report regarding the terms with the off-takers, not just for power but for the other byproducts that can be yielded by the facility. Frameworks for the national government guarantee system must also be considered given that LGUs may not have enough financial resources to undertake a WTE project. Lastly, a holistic review of the SWM cashflows considering the institution of WTE facilities must be considered. Changes in the waste collection process, 3R projects, and other parts of the SWM value chain will be made to make way for the WTE facility and the financial changes these will incur should also be considered by the proponents and assessed during the screening process for the proposals.

Investing in these steps will also tie the WTE project more closely to the LGUs and may promote better sustainability that can withstand the changes in administration. If incorporated in the 10-year SWM plan, FS, and other materials prepared by the LGUs themselves, it will be easier for LGUs to appreciate and launch these WTE projects despite the recency in its introduction here in the Philippines.

iv) Review and Provision of Recommendations to the Conceptual Framework on Solid Waste Management PPPs

The Conceptual Framework (CF) was crafted as an overview document that encompasses the PPPC guidance documents for LGUs in managing their SWM PPP projects. The use case of the CF is in the conduct of the preliminary assessment during the project development phase where initial studies in different SWM components are conducted to determine the scope of the PPP Project and the role of the private sector partner. The CF was shared with JET on May 25, 2022.

The following points summarize the main points noted during this review:

- Inclusion of developments in LGU long-term plans

The CF and its contents entail the analysis of the current situation in each of the SWM value chain components and identifying the opportunities for partnership with the private sector. In order to align these efforts to the long-term plans of the LGUs, the team recommends harmonizing the CF to their 10-year SWM plan.

Given that the 10-year SWM plan of the LGU also entails a component-based analysis of the SWM value chain, it is vital to use their insights on this on the issues that they would like to solve or programs they would like to undertake but will not have sufficient resources to address the gaps that the private sector can help with through these PPP projects.

- Consideration for new technologies

It is understandable that LGUs have not built enough confidence on WTE technologies, incineration in particular, given that it has been banned for the longest time in the Philippines. JET however advises for the CF to be more embracing of new technologies including WTE for as long as the proper measures will be taken to ensure their environmental compliance and observance of protocols and legislations.

This is also applicable for the other technologies and practices that may be proposed by the private sector. LGUs must take appropriate measures to ensure that careful research and analysis is done to understand the technology, its applicability in the context of the LGU, and other key considerations. These analyses must be given more weight as LGUs consider these options for improving their SWM situation.

- Caution on dependency on private sector

The private sector provides a huge opportunity for the LGU through the provision of resources that the LGU is unable to provide. However, in the implementation of these PPP projects, the LGU must be wary of being too dependent on the private sector.

Encouraging competition in the bidding process and project development will allow the LGUs to evaluate the best plans for their SWM projects, benchmarking with best technologies and best practices in other regions will widen the awareness of the LGU of other potential endeavors, and other initiatives are encouraged to guarantee the best service from the private proponents.

- Community consultation

At the early stages of development, engaging the community that may be potentially affected by the SWM project may be necessary to minimize or even eliminate conflicts later on. Community consultations are necessary to provide a sense of ownership to the community and instill their support to the project. Their terms and considerations may also be raised during this period of consultation that may be incorporated into the terms and conditions to be settled with potential proponents.

Overall, the team aligns with the goal and contents of the CF. Through this guidance document, LGUs are expected to be more capable of assessing their current situation and determining the best courses of action to address their needs. The team notes however that LGUs may be expected of too much and may

not be able to bear all these responsibilities. Firstly, the technical staff of the LGUs may lack the personnel to take on all these roles, so support from the national government and field experts are encouraged to provide guidance to the LGUs.

Activities 2-7: Formulate the Technical Specification of the WTE Facility for each LGU

(1) Discussion between LGUs and JET to identify needs of technical assistance for WTE

This activity, formulation of the technical specification of the WTE facility, was not able to be executed for the target LGUs because of following reasons:

- As per QC, since their WTE project procurement was processing and all the detailed information is protected by non-disclosure agreement with the proponent,
- For Davao City, a feasibility study under Japanese Grant Aid is on-going. All project information was protected by non-disclosure agreement. Since commencement of the FS by the consultant procured through the Grant Aid scheme in 2019, the communication to discuss WTE between JET and the Davao City was suspended until 2022.
- For the Cebu City, as reported in Activity 2-4, JET provided technical assistance to validate some parts of technical specification of WTE proposed by the private proponent, and is intended to continue such support to the city. However, since a period of difficulty in communication due to COVID-19, coordination with Cebu City was interrupted. In addition. The contact persons of Cebu City for the WTE project were replaced several times because of the administration change of the city. So, it was difficult to continue the support based on the previous communication between the LGU and JET.

Even under the circumstances mentioned above, JET continued discussion and visitation with the LGUs to identify technical assistant needs.

The history of JET visitations and discussions with LGUs are summarized in Table 2.54 - Table 2.56.

Table 2.54 Records of Discussion/Correspondence between Quezon City and JET

Date/ Location	Participants / Parties		Overview of the meeting
	Quezon City	JET	
2019/03 @ EPWMD Office	Ms. Po Mr. Vinarao Mr. Alzona Mr. Vergara	Mr Kamishita Mr. Kosaka Mrs. Ramos	<ul style="list-style-type: none"> - Mr. Tomihara of JICA Philippines joined the meeting - The winning bidder was identified following the Swiss Challenge. - Details of the WTE Proposal were shared by Quezon City LGU. - Mr. Vincent Vinarao was identified/named as the official contact person from Quezon City EPWMD for the Project. - Clarification on the extent /kind of assistance JET will be providing Quezon City LGU through the TCP.
2019/04 @ EPWMD Office	Ms. Rentoy Mr. Lu Mr. Barrera Ms. Guevarra Ms. Nieto Ms. Vinarao Mr. Alzona Mr. Vergara	Mr Kamishita Mr. Kosaka Mrs. Ramos	<ul style="list-style-type: none"> - Representatives from NSWMC (Mr. Lao), DENR (Mr. Dacug), EMB (Ms. Flores and Ms. Ferarez), and MMDA (Ms. Encarnacion) participated in the meeting. - Overview of the status of WTE Facility (development on bidding process; implications of the impending release of DENR DAO) - Quezon City EPWMD expressed their gratitude to JICA and DENR for the project and said that it is timely since there is a provision in the city's existing PPP code that requires the city to have an

Date/ Location	Participants / Parties		Overview of the meeting
	Quezon City	JET	
			independent consultant for crafting manual for operations and monitoring for WTE.
2019/10 @ EPWMD Office	Mr. Vinarao Mr. Vergara	Mr. Hosono Ms. Sato Mrs. Ramos	<ul style="list-style-type: none"> - Updates on the WTE Project were provided. - Sharing of Current Solid Waste Management in Quezon City (Generation, Collection, and Intermediate Treatment).
2020/02 @ Kick-Off Seminar, Joy Nostalg Hotel	Mr. Vergara	Mr Kamishita Mr. Higashi- nakagawa Ms. Kimura Mr. Cea	<ul style="list-style-type: none"> - Mr. Vergara explained his presentation sharing the status of a WTE project of Quezon City as one of program of the seminar.
2021/03 @Email	Mr. Vergara	Ms. Mallare	<ul style="list-style-type: none"> - Following Ms. Mallare's inquiry, Mr. Vergara shared updates regarding the current status of the WTE Project. He also endorsed JET to the Task Force on Solid Waste Management (TFSWM) for updates on the 10-yr. SWM Plan.
2021/04 @Conf. Call	Output 1 Sub-group		<ul style="list-style-type: none"> - Mr. Vergara confirmed his attendance at the 7th SG-OP1 meeting through an email to Ms. Mallare. - New Participants from the Quezon City LGU were acknowledged during the sub-group meeting (Engr. Sabater, Ms. Orante, and Mr. Ador).
2021/05 @Conf. Call	Output 2 Sub-group		<ul style="list-style-type: none"> - Mr. Sabater attended the 3rd SG-OP2 Meeting along with Ms. Orante.
2021/06 @Email	Mr. Vinarao	Ms. Mallare	<ul style="list-style-type: none"> - JET sent an official correspondence letter regarding a request for confirmation on activities under Output 2.
2021/09 @Conf. Call	Mr. Sabater Mr. Rios Mr. Robiso Ms. Orante Mr. Dajao	Mr. Kamishita Mr. Hosono Mr. Kosaka Ms. Kimura Ms. Sato Ms. Mallare Mr. Cea	<ul style="list-style-type: none"> - Mr. Farrales and Ms. Barcnas of EMB-SWMD-PMO attended. - Presentation of Quezon City TFSWM's evaluation of non-WTE technologies as part of OP 4. - Request for Quezon City TFSWM to present during the next SG meeting. - Discussion of Quezon City TFSWM's comment on BAT/BEP - Clarification of expectations and level of involvement of QC LGU.
2022/01 @Email/Letter	Mayor's Office TFSWM	Ms. Mallare Mr. Kamishita	<ul style="list-style-type: none"> - JET sent a letter of request for regular meetings to all LGU counterparts, including QC LGU. - The same letter also includes an inquiry on the next steps for Activity 2-7.
2022/03 @Email	Ms. Orante	Ms. Mallare	<ul style="list-style-type: none"> - TFSWM requested for the deferral of the conduct of regular meetings until updates are received from other concerned departments.

Source: JICA Expert Team

Table 2.55 Records of Discussion/Correspondence between Davao City and JET

Date/ Location	Participants		Overview of the meeting
	Davao City	JET	
2019/03/15	Atty. Domingo Engr. Madrazo	Mr. Kamishita Mr. Kosaka Ms. Rachel	<ul style="list-style-type: none"> - Davao City reported that their 10-year SWM plan is currently under review by the NSWMC.
2019/03/27	Atty. Domingo Engr. Reyes Ms. Resma Engr. Singco	Mr. Kamishita Mr. Hosono Ms. Sato Ms. Rachel	<ul style="list-style-type: none"> - JICA Philippines also attended the meeting. - Davao City raised that their main hindrance in implementing the WTE project is the fact that DENR has yet to pass the formal guidelines for WTE facilities.

Date/ Location	Participants		Overview of the meeting
	Davao City	JET	
	Mr. Yaplito Engr. Corda Engr. Orcullo Ms. Guibelondo Mr. Narciso Ms. Pesana Ms. Saemitsu Engr. Cellona Mr. Enriquez Ms. Sasay Ms. Lobaton		<ul style="list-style-type: none"> - The tipping fee rates was also discussed, noting the current fees collected, and their planned collection fees that the LGU need to prepare for. - Davao City noted that they would like to seek for JET's assistance in supplementing the assistance of Crown Agents (CA), the procurement agent for the construction of their WTE facility, for a smooth implementation of their WTE project.
2019/06/10-16	Engr. Madrazo Engr. Orcullo Engr. Corda Engr. Cabrera Mr. Narciso Ms. Albindo Ms. Lobaton Mr. Justo	Mr. Kamishita Mr. Higashinakagawa Mr. Kosaka Mr. Hidano Ms. Kimura Ms. Andrei	<ul style="list-style-type: none"> - Davao City reported that Brgy. Biao Escuela is the determined site for the WTE facility, and public consultations have already been facilitated. ECC application is currently ongoing. - Their plan for ash disposal was also shared, noting that they are targeting to dispose ash waste in an SLF, and they have identified candidate sites for this SLF facility at the moment. - Joined by Kitakyushu City representatives, a series of site visits were conducted aligned to the JICA Grassroots Project including a WACS training at New Carmen SLF - Additional site visits were conducted to 3 MRF sites (Brgy. Catalunan Grande, Brgy. Mahayag, and United Elenita 2 Homeowners Association)
2019/09/09	Atty. Domingo Engr. Madrazo Engr. Orcullo Engr. Cabrera	Mr. Kamishita Mr. Kosaka Ms. Kimura Ms. Rachel	<ul style="list-style-type: none"> - Clarified details on the 10-year SWM Plan and progress of WTE project implementation - Discussed the current SWM situation in Davao City in terms of collection rates, MRF facility placements, IEC campaigns, 3R projects, new SLF situation, etc. - Davao City reported that land acquisition for the WTE site is ongoing and shall be settled shortly, and preparation for the conduct of the FS is to be undertaken

Source: JICA Expert Team

Table 2.56 Records of Discussion/correspondence between Cebu City and JET

Date/ Location	Participants		Overview of the meetings
	Cebu City	JET	
2019/03/29 @CCENRO	Ms. Nida, Mr. Joelito, Ms. Glory, Mr. Bryle	Mr. Kamishita Mr. Hosono Ms. Sato Mrs. Ramos	<ul style="list-style-type: none"> - Briefing Inception Report and MOU (bet. EMB-Cebu). - Confirmation of the progress of WTE project in Cebu (At this moment, Metro Pacific and Ayala proposed WtE and are being evaluated by ADB Technical Assistance).
2019/07/15 @CCENRO	Atty. Dacua, Mr. Rhoderick, Mr. Irvin Ms. Lourdes, Ms. Glory	Mr. Hosono Mrs. Ramos	<ul style="list-style-type: none"> - Mr. John and Ms. Angelli from EMB R7 attended. - Briefing JICA project and clarification of difference with ADB TA. - Confirmation of the progress of WTE project in Cebu (CENRO, JVSC under new administration yet to review WTE proposals. JET shared all relative info including proposals from MPIC and New Sky provided by former CCENRO).
2019/09/10 @CCENRO/DPS	Engr. Biton,	Mr. Kamishita,	<ul style="list-style-type: none"> - Confirmation of the progress of WTE project in Cebu (Evaluation of WTEs are handled by City Admin Office).

Date/ Location	Participants		Overview of the meetings
	Cebu City	JET	
	Mr. Rhoderick, Ms. Lourdes, Ms. Glory	Mr. Kosaka, Ms. Kimura, Mrs. Ramos	- Interview with other SWM situation from collection to disposal, 10-year plan, budget, etc.
2019/09/11 @Inayawan	2 Persons (DPS) Mr. Rhoderick, Ms. Glory	Mr. Kamishita, Mr. Kosaka, Ms. Kimura, Mrs. Ramos	- Ms. Angelli from EMB Region VII attended. - JET visited Inayawan SLF on Sep 11, 2019 and observed monthly MSW collection data and actual situation of weighing and transfer station operated by Jomara.
2019/12/03 @City Admin Office	Atty. Casas Jr. , Atty. Daluz, Ms. Gail, Atty. Dacua, Engr. Rhodelick, Ms. Glory	Mr. Kamishita, Ms. Kimura, Ms. Rose	- Confirmation of the progress of WTE project in Cebu, (City admin clarified that OPS to MPIC was cancelled and evaluating a proposal of New Sky. ADB support has been terminated.) - City admin asked JET to assist the evaluating of WTE proposal and JET affirmed that it is already in the scope of TCP. - JET received New Sky proposal as of Sep 2019 for review.
2020/01/09 @City Admin Office	Mr. Ornopia, Atty. Maratas, Atty. Lubino, Ms. Gail Engr. Rhoderick, Engr. Glory	Mr. Kosaka Mr. Higashi, Ms. Rose	- JET explained the review result of New Sky proposal by clarification table, which contains; (1) scope of work, (2) track records, (3) WTE capacity (t/day), (4) 3R and MRFs, (5) JV ordinance, (6) Cebu city's obligation, (7) the Proponent, etc. - Due to time limitation, last half of the clarification were not able to be discussed, JVSC will answer them afterward. - JVSC extends their gratitude to JET and requested continuation of assistance. JVSC also confirmed to provide answers to their clarifications, ETV report on New Sky, Draft JV Agreement, hauling/disposal waste quantity data, etc.
2020/02/07 @City Admin Office	Atty. Lubino, Mr. Taneo Jr., Ms. Gail Ms. Gelig, Engr. Glory	Mr. Kamishita, Ms. Rose	- Ms. Angellie from EMB R7 attended. - JET explained another half (from No. 27) of clarification , then discussed on usage of ash, new waste collection scheme, waste quantity guaranteed by the city, financial analysis, etc. - JVSC is continuing the negotiation with New Sky, inputs from JET will be incorporated/conveyed to New Sky. - Draft JVA provision to JET will be checked in Cebu city.
2020/03/09-11 @City Admin Office	Atty. Garcia, Engr. Legazpi, Ms. Gelig, Ms. Glory,	Mr. Kosaka (TV), Mr. Higashi, Ms. Rose	- JET stayed 3 days for the study on "Setting up the Capacity of WTE in Cebu" from March 9 to 11, 2020 then reported to JVSC on March 11, 2020. - As the result, combustible matter in 2019 is 500 t/d (+ fine), and 600 t/d (+fine) in 2035. 800 t/d of WTE, New Sky requests the city to guarantee, is too big for Cebu city to guarantee. - JET expresses further support for Cebu city's WTE development in reviewing the JV contract draft. - Atty. Garcia assured to provide a copy to JET. Ms. Glory mentioned that Atty. Casas also agreed to share the JVA.
2020/07/28 @Conf. Call	Ms. Glory	Mr. Kamihsita,	- JET reported the 2 nd Sub-Group Meeting on Output 2 held on July 16, 2020 which Ms. Glory was not able to

Date/ Location	Participants		Overview of the meetings
	Cebu City	JET	
		Mr. Kosaka, Mr. Higashi, Ms. Nikka	<ul style="list-style-type: none"> attend. - JET requested Ms. Glory to follow up the JVSC with regard to the provision of draft JV agreement for review, and set the meeting with new head of CCENRO, Engr. Peros. - Discussed and shared the updates of WTE and other MSW management conditions in Cebu.
2020/09/16 @Conf. Call	Engr. Peros, Engr. Glory	Mr. Kamishita, Mr. Hosono, Mr. Higashi, Mr. Kosaka, Ms. Andrei	<ul style="list-style-type: none"> - Briefing of TCP and its activities until now. - Confirmation of the progress of WTE project in Cebu, (During COVID-19, JVSC didn't hold the meeting with New Sky so there is no update). - <u>JET to re-send the review result of the New Sky proposal to Engr. Peros and asked to follow up JVSC for their provision of draft JVA as the part of assistance.</u> - CCENRO has no more comment on MOU to be closed with EMB.

Source: JICA Expert Team

(2) Technical assistance to Quezon City

At the initial stage of the project, Quezon City was very positive on the WTE project that they were in the process of procurement. In April 2019, they expressed the expectation that JET would give input on the crafting manual for operations and monitoring for WTE, which is required by their PPP code. JET was expecting further discussions on this coordination.

However, after the change in administration during the election in May 2019, their project set up stepped back in neutral to discuss their SWM again including necessity of the WTE. While the LGU was invited and participated in the project meetings such as JCC, ITWG, and Sub-group meetings, the details of WTE were not discussed in those meetings.

(3) Technical assistance to Davao City

JET did not visit Davao LGU since September 2019 because the LGU was working for WTE project supported by Japan Grant Aid and they were working with the consultant hired by the Grant Aid scheme. JET resumed site work in March 2022 after suspension by the COVID-19 pandemic. JET realized that the WTE project did not make good progress since the FS under grant aid was finished in February 2020. In April 2022, JET asked online conference with Davao LGU to understand their difficulties to progress their WTE project. At the meeting, Davao LGU explained the following:

- The FS of WTE project had not been approved by DOF because the feasibility required additional financial support from the National Government which was being discussed in DOF.
- The Davao LGU was open to discuss and accept technical cooperation by JET to solve any issues related with WTE.
- Davao LGU was especially concerned with the development of new sanitary landfill for the ash from WTE operation. It would be appreciated if JET would be able to support in this regard.

Accordingly, in June, July, and September 2022, JET visited and discussed with the Davao LGU at their project office. Also, JET conducted the site reconnaissance for the new sanitary landfill.

JET planned to conduct the following technical support in this period because the new sanitary landfill is indispensable to complete sanitary waste flow of Davao City where WTE ash would be disposed of. During the discussion, the knowledge and recommendations from Activity 1-8 were also shared with Davao City to facilitate their understanding on the WTE and SWM. The third one was not implemented because the preparation of the initial layout of sanitary landfill was not completed by Davao City.

- Example of TOC of the technical specifications for the sanitary landfill procurement
- Recommendations on the improvement of the existing regulations for the sanitary landfill
- Review and comments on the initial layout plan of new sanitary landfill

(4) Technical assistance to Cebu City

From the end of 2019 to March 2020, JET provided technical assistance to Cebu City. JET started with the review of the private proposal, then supported setting the amount of solid waste to be fed to the WTE as a basic condition for setting the size of the WTE project.

In December 2019, JVSC requested assistance from JET for the evaluation of the private proposal. From January to February 2020, JET explained the results of the review and held discussions based on the comment of JET with the Cebu City Administrator Office and CCENRO. Since there were many inadequacies in the proposals, such as technical information, JET specifically indicated items that Cebu City needed to confirm with the proponent. However, no information was shared with JET regarding the responses from the private proponent.

In March 2020, since the JVSC expressed concerns about the WTE facility size setting during the last month's discussion, JET worked together to confirm the missing data from the July-December 2019 municipal solid waste volume data obtained by the city's weighing scale.

Based on the modified waste data and the results of waste composition analysis conducted from the ADB technical assistance, guidance was provided on how to forecast future waste volumes. In addition to experts, Mr. Kamishita and Mr. Higashinakagawa, who visited Cebu City, an expert, Mr. Kosaka, participated in the work and discussions virtually from Japan.

In the contract negotiation between Cebu City and the private proponent (NSEPI), it was expected that LGUs would agree to the contract terms that do not impose a waste amount guarantee to WTE. It was the intention of the Cebu City to proceed with the contract as soon as possible by eliminating the concerns about the waste amount guarantee. However, JET explained that the amount of waste delivered to the WTE was indispensable information for waste management and city budgeting, and provided guidance in analyzing the above-mentioned waste amount data.

The City Administrator of Cebu City requested JET's cooperation in confirming the contents of the draft JV agreement with the private proponent. However, the draft agreement was not shared with JET. Then communication became difficult due to COVID-19 and the change of the city administration.

In September 2022, a JV agreement was signed between the proponent and Cebu City. Although the details of the agreement are unclear, there are concerns about the future development of the project, as excessive reliance on private proposals may include factors that could delay the project implementation.

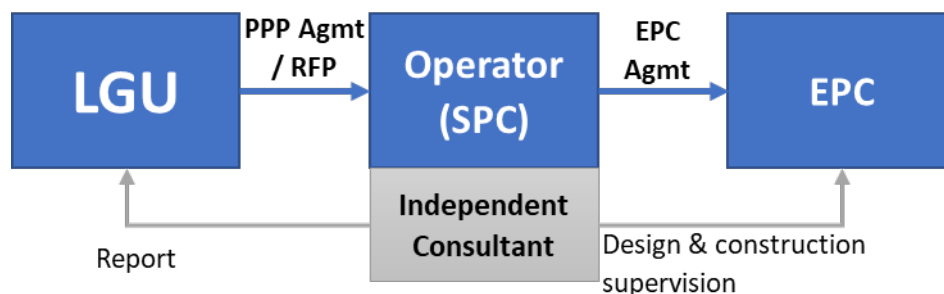
Activities 2-8: Define the points and issues to be addressed in supervising WTE project
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Contract management (monitoring) is conducted by the LGU to monitor and confirm whether the services provided by the private partner (private operator) are properly and reliably performed in accordance with the PPP agreement, RFP, and the project proposal submitted by the proponent for the project.

During the design and construction phase, the LGU which is the client of the project, directly or indirectly through the project operator, monitors the contractor's drawings on the design and construction (EPC), including the detailed design documents, equipment manufacturing drawings, and construction drawings, as well as the commissioning procedures and performance test procedures, etc. The purpose of monitoring is to confirm, through approval and confirmation of drawings and implementation of inspections and tests, whether the construction work is planned and executed in accordance with the contract agreement, RFP, and the project proposal.

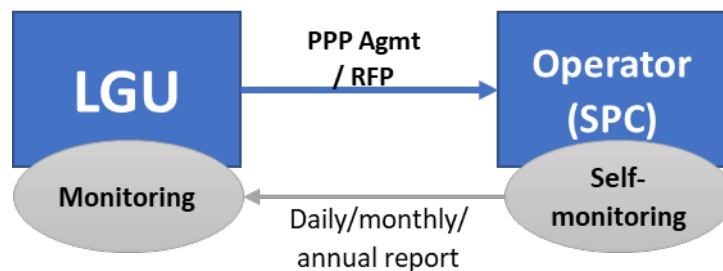
In the operation phase, the purpose of monitoring is to provide citizens with high-quality public services based on an appropriate division of roles between the LGU and the operator by monitoring and confirming the implementation status of tasks related to the operation of the operator and reflecting the results in the payment of fees.

The roles of the LGU, SPC, EPC and Independent Certifier (I/C) in the project are shown and described in Figure 2.17, Figure 2.18 and Table 2.57 to Table 2.59.



Source: JICA Expert Team

Figure 2.17 Relationship among LGU, Project Operator, and EPC in the Project (Design and Construction Stage)



Source: JICA Expert Team

Figure 2.18 Relationship between LGU and Project Operator (Operation Stage)

LGU, as the client for this facility construction and operation project, is responsible for supervising the installation and operation of the facility by SPC. SPC, as the installer of the facilities, places orders with the EPC contractor, supervise the design and construction, and conduct completion inspections, etc. The EPC contractor designs and constructs the facilities upon SPC's approval as a construction contractor using the lump-sum design and construction method. This depends on the project, in any case, SPC shall propose and jointly appoint with LGU a suitably qualified and experienced consultant as I/C. They are responsible for approving various plans and drawings prepared by the EPC contractor on behalf of SPC until the COD.

Supervising/Monitoring procedure and points to be observed carefully through the project are detailed in the manual prepared in Activity 1-6 which is using the example in DBO project in Japan and implication to Philippines BOT context.

Table 2.57 An example on Roles of the LGU, SPC, and EPC in BOT Project (Construction Phase)

Main Actor	Roles
LGU	LGU is the client for this facility construction and operation project. LGU shall confirm the status of SPC's review and approval of the design documents and construction drawings, as well as various inspections and witnessing (indirect supervision).
SPC	SPC shall carry out the project as the owner of the facility development and operation project on behalf of LGU. Since the design and construction work will be carried out under the performance order system, SPC will appoint a supervisor who will review the design documents and construction drawings submitted by the EPC contractor, implement the approval process, and conduct various inspections and witnesses.
EPC (Construction JV, etc)	Considering that the work is a performance order system and a public project, the EPC contractor shall prepare detailed design documents based on the requirements and proposals. In addition, shall implement equipment fabrication and construction after obtaining the approval of SPC (and LGU). In addition, various procedures, inspections, tests, and trial operations necessary before the start of operation shall be carried out with the approval of SPC (and LGU). EPC contractor shall prepare the necessary documents such as application documents for permits and approvals.
Independent Certifier (I/C)	The I/C shall assist SPC (and LGU) in its supervisory duties and will support SPC's (and LGU's) construction supervision activities in accordance with the Indicative Independent Certifier Activities and the TOR of Independent Certifier Contract. Specifically, I/C shall review from a professional standpoint various types of approval application documents such as detailed design documents and construction drawings and conduct various inspections and witnesses under the direction of SPC (and LGU). Among the procedures to be carried out with the various government agencies, I/C shall review those that are prepared by EPC contractor and shall assist SPC (and LGU) in preparing those that require them to take the initiative. In addition, I/C shall keep in close contact with SPC (and LGU) and report promptly so that their construction supervision work of can proceed smoothly. I/C is responsible for various services for EPC companies, such as contact office work, document management work, and meeting management work.

Source: JICA Expert Team

Table 2.58 Example of Indicative Independent Certifier Activities

Contract Phase	Independent Certification Service
Construction	Review PPP Agreements
	Works Inspection
	Status of snagging issues
Commissioning	Test & Commissioning Plan
	Mechanical Completion
	Readiness Test
	Cold Commissioning
	Hot Commissioning
Operations	Acceptance Test
	Annual Performance Tests
	Performance/data review
Handback	Modification
	Condition survey

Source: JICA Expert Team

Table 2.59 Example of Division of Roles between Local Government and Operator in DBO Projects in Japan

	Roles of Local Government	Roles of Operator
Operational work	<ul style="list-style-type: none"> • Carrying in the subject waste • Recycling of recyclable waste • Final disposal of incinerated ash and unsuitable materials, etc. • Monitoring • Dealing with residents • Others 	<ul style="list-style-type: none"> • Reception and weighing • Operation management • Environmental management • Operations related to byproducts and resources • Inspection, testing, repair, and renewal of plant facilities • Service management • Equipment management • Building maintenance and management • Administration • Information management • Community contribution projects

Source: JICA Expert Team

2.4 Activities for Output 3

Activities 3-1: Review of the current capacity and activities in central and regional EMB

(1) Roles and Responsibilities of EMB for the Environmental Monitoring

For reviewing the current capacity and activities in the central office and regional offices (focusing in Regions VII and XI) of EMB, roles and responsibilities regarding environmental monitoring (hereinafter refer to as simply “monitoring”) were grasped by the interview survey. Interview surveys were conducted as shown in Table 2.60.

Table 2.60 Interview with EMB Regarding Roles and Responsibilities for Monitoring

Organization	Interview Date	Interviewee
EMB-ERLSD (Environmental Research and Laboratory Services Division)	March 25, 2019, etc.	Ms. Ma. Fatima Anneglo R. Molina, OIC Chief
EMB-AQMS (Air Quality Management Section)	April 11, 2019, etc.	Mr. Jundy T. del Socorro, Senior Environmental Management Specialist
EMB Regional Office (Region VII)	March 29, 2019	Ms. Jacquelyn T. Odtojan, Laboratory Head
EMB Regional Office (Region XI)	March 27, 2019	Mr. Raymond Jan H. Borcelas, Laboratory Head

Source: JICA Expert Team

As a result of the survey, it turned out that sampling and analysis were conducted separately by different sections in charge regarding monitoring (ERLSD implements research surveys, and in the research surveys, ERLSD conducts both sampling and analysis). As for Dioxins and Furans (D&F) surveys, ERLSD is supposed to be in-charge for D&F analysis because of its capability to conduct analysis utilizing its existing facilities and the EMB equipment in their laboratory, while AQMS and EMB regional office are supposed to do the actual sampling works, and AQMS is supposed to be also in charge of supervision of sampling works conducted by Accredited Stack Sampler (ASS). Therefore, for reviewing the current capacity and activities, sections were separately targeted are as follows:

- Sampling: AQMS and regional offices (sampling section)
- Analysis: ERLSD

Results of the confirmation of roles and responsibilities of each organization regarding monitoring are shown in Table 2.61.

Table 2.61 Divisions/Sections of EMB Organizations and their Roles for Monitoring

Organization	Main Roles	Note
EMB-AQMS	Ambient air, emission gas: supervision of sampling works conducted by Accredited Stack Sampler (ASS) for monitoring regulated by RA8749.	Since sampling works are basically conducted by ASS, supervision is the main responsibility. AQMS conduct samplings only in special occasions such as exceeding regulated values and complaint raised. Ambient air sampling is conducted for research purpose survey (e.g., impact study on ambient air from Philippine International Pyromusical Competition).
EMB regional offices (sampling section)	Emission gas: supervision of sampling works conducted by ASS Ambient air: sampling regulated by RA 8749	For emission gas, same as AQMS
EMB-ERLSD	Sampling and analysis for research purpose survey Analysis for monitoring regulated by RA 8749	ERLSD is responsible for all the works on D&F monitoring from preparation of sampling materials (filter, adsorbent, impinger, etc.) to analysis of the samples.
EMB regional offices (laboratory)	Analysis for monitoring regulated by RA 8749	Performance is limited compared to ERLSD, in terms of matrices/ items which can be analyzed. As for items which cannot be analyzed by the regional laboratory, they can be analyzed by recognized laboratories (accredited by ERLSD) or ERLSD.

Source: Project Team

(2) Preparation Status for Monitoring of D&F

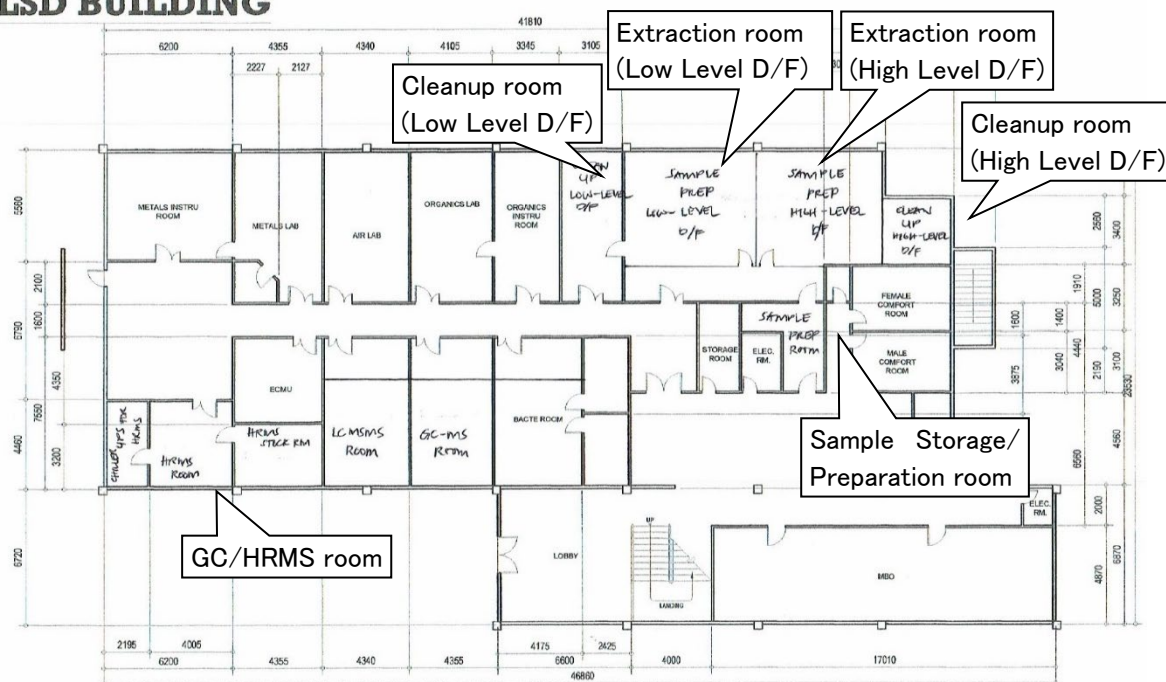
1) Sampling

AQMS (in charge of survey regulated by the law) and ERLSD (in charge of research purpose survey) have already procured (or budget was allocated) the sampling equipment.

2) Analysis

Preparation status of the facilities/equipment for implementation of D&F analysis was reviewed through inspection and interview. As of February 2020, ERLSD laboratory has almost been renovated for D&F analysis and necessary equipment have been procured. Layout of the laboratory rooms are shown in Figure 2.19. The renovation work was appropriately conducted since the pre-treatment rooms (extraction room and cleanup room) are completely separated for high-level, low-level, samples and so on.

ERLSD BUILDING



Source :JICA Expert Team added comments on the figure by ERLSD, EMB-DENR (2019)

Figure 2.19 Layout of the ERLSD Laboratory for D&F Analysis

All necessary glassware and consumables have already been procured based on experiences of training in Australia funded by WB. For the following years, budget allocation was proposed as well.

US EPA methods will be applied for D&F monitoring as shown in Table 2.62, as US EPA methods for both sampling and analysis are basically applied in EMB for other monitoring.

Table 2.62 Applied Methodologies for D&F Monitoring

Matrix	Applied Methodology
Ambient air	TO-09A
Emission gas	EPA method 23
Water, sediment, soil	EPA method 1613

Source :ERLSD, EMB-DENR (2019)

Moreover, ERLSD envisages conducting analysis of Dioxin-Like PCBs (DL-PCBs) for research purposes, necessary standard solutions for the analysis were already procured. Methodology for the analysis is expected to be US EPA standard (EPA method 1668), same as that of D&F analysis.

(3) Results of the Review of the Current Capacity and Activities of DENR-EMB

To review the current capacity and activities for D&F monitoring, DENR-EMB's monitoring of similar compounds with similar technique used in D&F monitoring, was also looked at (sampling: particulate matters in ambient air and emission gas, analysis: POPs such as Polychlorinated Biphenyl (PCBs) for any matrices).

Results of review of the current capacity and activities are shown in Table 2.63. Isokinetic sampling of emission gas, which specifically requires high-level skills, has already been conducted by AQMS and EMB regional offices. For analysis, rather complicated pre-treatment and operation of analysis equipment, etc. have been conducted by ERLSD. Appropriate QA/QC has already been performed as well.

Table 2.63 Results of Review of the Current Capacity and Activities for D&F Monitoring

Review Point	Results
Capacity (analysis)	<p>Toward realizing the routine monitoring for D&F, facilities and equipment have already been appropriately prepared.</p> <p>In terms of chemical reagent/gases/consumables, some difficulties in acquiring organic solvent were found (dichloromethane (with purity specific for D&F analysis): import permit is required for delivery of requested stocks for 2019; it is controlled under local regulations, nonane: no supplier in the Philippines)</p> <p>Expected number of D&F samples to be analyzed per year is 300.</p>
Experiences	<ul style="list-style-type: none"> - Sampling <p>Presently, D&F monitoring has been conducted for emission gas of cement kiln. Samplings are conducted by ASS.</p> <ul style="list-style-type: none"> - Analysis <p>ERLSD has an experience in D&F analysis at their laboratory in the proficiency test organized by UNEP, but the analysis was by Gas Chromatography - Tandem Mass Spectrometry (GC-MS/MS), not by gas chromatography/high-resolution mass spectrometry (GC/HRMS). Experiences in D&F analysis of the actual samples by GC/HRMS were only through training at the National Measurement Institute (NMI) in Australia, funded by WB in 2017.</p>
Monitoring activity of compounds similar to D&F	<p>POPs monitoring has been conducted regularly. Pretreatment with open columns and analysis using Gas chromatography–mass spectrometry (GC/MS) and Liquid Chromatography with tandem mass spectrometry (LC/MS/MS) are performed, which requires high-level skills.</p>
Sampling technique	<ul style="list-style-type: none"> - AQMS and EMB regional office <p>Isokinetic sampling for emission gas sampling and operation of high-volume air sampler for heavy metals in ambient air can be conducted without any problem.</p> <p>As for isokinetic sampling of emission gas which specifically requires high-level skill, Sampling Assessment Team (SAT) has been appointed in the EMB Special Order No. 296, Series of 2018. SAT has a high skill so that members of SAT can conduct training of isokinetic sampling.</p> <ul style="list-style-type: none"> - ERLSD <p>Sampling of emission gas has not been conducted as of the end of February 2020. ERLSD has access to high-volume air samplers which can be used for D&F sampling, but are not used frequently.</p>
Management system	<p>DENR is certified under ISO 14000 and the basis of the management system has been established. ERLSD developed a quality manual complying with ISO 17025: 2005. The manual is currently being revised to comply with ISO 17025: 2017.</p>
Organization, human resource	<ul style="list-style-type: none"> - AQMS and EMB regional office <p>Monitoring of gas emission and ambient air has already been conducted and trainings for EMB regional offices are being conducted regularly.</p> <ul style="list-style-type: none"> - AQMS accredits ASS. <p>During the year 2001 to 2008, EMB staffs joined emission gas sampling (isokinetic sampling) training organized by ADB for the Metro Manila Air Quality Improvement Sector Development Project. Moreover, EMB staffs joined D&F sampling training on emission gas (EPA Method 23) and ambient air (TO-09) organized by WB in 2017.</p> <ul style="list-style-type: none"> - ERLSD <p>Organics laboratory has been established and roles and responsibilities are clarified in the organization chart.</p> <p>Periodical monitoring has been conducted including POPs, and technical trainings have been conducted for EMB regional laboratories.</p> <p>ERSLD accredits the third-party laboratories under the DENR Environmental Laboratory Recognition process.</p> <p>ERLSD staff joined D&F analysis training on EPA Method 1613 (soil, sediment, biota and water) and Method 23 (emission gas) funded by WB in 2017.</p>

Source: Project Team

Activities 3-2 : Analyze gap between the present capacity of the central EMB laboratory and required capacity, and formulating training plans

(1) Gap Analysis

In 2019 and early 2020, gap analysis was conducted by comparing required and present capacity which were grasped in Activity 3-1. The gap analysis was conducted at each monitoring process as shown in Table 2.64 and to be reflected in the training plans. Since DENR-EMB laboratory has only one instrument (GC/HRMS), measures for monitoring continuation should be discussed, considering possible equipment malfunctions and necessary maintenance.

Table 2.64 Points in Gap Analysis at Monitoring Process

Components in Monitoring		Points to be confirmed
Planning of monitoring		Appropriateness of location, frequency, etc. of monitoring
Sampling (by each matrix)	Sampling	Presence of sampling device, proficiency level of operation of the device, etc.
	Transportation	Awareness of contamination prevention at the transportation stage
	Storage	Awareness for prevention of cross-contamination between samples (Separation of storage location of samples for high concentration and low concentration, etc.).
Pretreatment (by each matrix)	Extraction	Procurement of equipment, chemical reagents, expendables proficiency level of operation, etc.
	Pretreatment	Preparation of clean-up column and proficiency level of operation
Analysis	Operation	Proficiency level of daily inspection, operation of the analysis device, etc.
	Others	Proficiency level of management for calibration of the device, preparing relative calibration curve, verification of detection limit.
QA/QC	Internal activity	Proficiency level of judgement of abnormal result of measurement
	External activity	Experiences of participation in inter-laboratory comparison regularly, etc.
Common items	Analytical records	Preparation of format for analytical records, implementation/keeping of analytical records
	SOP	Concreteness of description of existing SOP, documentation management such as revision history of SOP, etc.
Continuation of monitoring		External quality control for outsourced monitoring results, etc.

Source: JICA Expert Team

Results of the gap analysis are shown below. Facts identified as gaps are underlined.

1) Environmental Monitoring Planning

- Ambient air: Manual has been prepared. Periodical monitoring is being conducted. Moreover, monitoring for special events such as the Philippine International Pyromusical Competition is conducted based on air quality simulation results.
- Emission gas: Manual has been prepared. Periodical monitoring is being conducted. Target facilities are identified clearly (Regulated under Republic Act No. 8439).
- Water: Manual has been prepared. Periodical monitoring is being conducted.
- Sediment, Soil: Manual has been drafted but not finalized.

2) Sampling

i) Sampling

- Ambient air: Similar type of samplers for D&F have been used by the regional offices, AQMS and ERLSD, for periodical monitoring of particulate matters such as PM and Lead. ERLSD uses the samplers, which can be applied to D&F monitoring, for POPs monitoring, however, no regular sampling/ monitoring activities are being conducted at the moment for D&F due to shift in priorities of the DENR (i.e., Manila Bay Rehabilitation).
- Emission gas: Isokinetic sampling can be conducted by the regional offices and AQMS. A Sampling Assessment Team is appointed by EMB Special Order No. 296/2018, which can conduct isokinetic sampling training. For ERLSD, sampling equipment for D&F has been procured and was delivered on December 2019, sampling training has not been done as of the beginning of February 2020. Training on the use of the new equipment is scheduled on February 2020. ERLSD has one trained personnel for isokinetic sampling of D&F. As of now, D&F samplings are conducted by accredited testers in the Philippines.
- Water: Equipment has already been procured and sampling technique is same as that for POPs.
- Sediment: Manual has been drafted and now under review. Sampling technique is same as that for other POPs.

ii) Transportation

- Contamination control measures are not sufficient (not described in the existing manuals).

iii) Storage

- Storage room for D&F samples is being prepared within the ERLSD laboratory. Contamination control measures need improvement.

3) Pre-Treatment

i) Conditioning of adsorbent material

- ERLSD has some experience on analysis of POPs and the methodology is similar to that for D&F. For preparation of adsorbent material for ambient air (PUF) and emission gas (XAD), ERLSD has acquired their experience through trainings only since there are no regular sampling activities yet.

ii) Extraction

- Ambient air, water, sediment and soil: ERLSD has knowledge on the techniques for POPs analysis (e.g., Organochlorine Pesticides, Polychlorinated Biphenyls, D&F). For extraction of samples for D&F, ERLSD has acquired their experience on trainings only since analysis of other POPs such as OCPs and PCBs are already routinely performed.
- Emission gas: ERLSD has gained experience on this through training with NMI Australia using actual samples.
- ERLSD has some equipment for D&F analysis (e.g., Automated Soxhlet Extractor) which has not been used in routine analysis.

iii) Cleanup

- ERLSD has capability to conduct various cleanup techniques for POPs analysis (e.g., Silica, Alumina, Sulfur, GPC, etc.).
- ERLSD has some equipment for D&F analysis (e.g., Automated clean up system) which has not been used in routine analysis.

iv) Others

- ERLSD has some difficulties in acquiring organic solvent (dichloromethane (with purity specific for D&F analysis): import permit and other compliance requirements per local laws of suppliers is required for delivery of requested stocks for 2019.; nonane: no supplier in Philippines).

4) Analysis

i) Operation of the GC/HRMS

- Operation verifications of GC/HRMS has started since June 2019 and was on-going (as of early 2020). Before starting the training for D&F analysis, some verifications (calibration curve, detection limit, etc.) need to be done.
- DIOK (specialized D&F analysis program procured with GC/HRMS) is a very unique software and ERLSD needs some time to get used to it. It seems that the operation of this software hinders the GC/HRMS operation.
- Experiences of operation/ regular/ routine maintenance of the GC/HRMS are not enough, particularly the local service provider lacks this capability.
- Now the GC can accommodate only one column, but the EPA method requires two types of columns, so the lead time will be longer than the GC which has a double column interface. (Column exchange will take almost one day)

ii) Others

- ERLSD envisages analyzing DL-PCBs for research purpose and standard solutions have already been procured. Samples of sediment or soil might contain high amounts of DL-PCBs and will behave as an interfering substance for D&F analysis, affecting the accuracy of results. Ideally, the capacity of analysis of DL-PCBs should also be enhanced.

5) QA/QC

i) Internal QA/QC

a. AQMS

- Ambient air, emission gas: AQMS manages the calibration of sampler and measuring instruments. For calibrator of the stack sampler, it is not possible to receive the inspection which is required under the EPA method, in the Philippines.

b. ERLSD

- Certified Reference Materials (CRM) of D&F have been procured for soil, clay loam, and water.

-
- QA/QC for POPs analysis can be conducted appropriately by ERLSD. Since the D&F sampling/monitoring is not frequently conducted yet, QA/QC method for D&F analysis still needs to be strengthened.

ii) External QA/QC

a. AQMS

- All the stack sampling plans and results (conducted by accredited organization) are reviewed by AQMS and regional offices. Some of the samplings are conducted in the presence of staffs from AQMS and regional offices.

b. ERLSD

- Recognized laboratories are being audited by ERLSD every year for other parameters. There are no recognized laboratories for D&F analysis to date. Only EMB-ERLSD has the capability to perform this kind testing in the Philippines.

6) Common Items from Sampling to QA/QC

i) Records format

- Emission gas sampling: Details are defined in the Stack Testing Manual.
- Ambient air sampling: Some of the records are defined in the Air Quality Monitoring Manual, but not so detailed as that for emission gas.
- Laboratory analysis: Records for analysis are well-managed by ERLSD, but since the D&F analysis sampling/monitoring is not frequently conducted, record formats for D&F analysis are not fully prepared yet.

ii) SOP

- Emission gas sampling: There is no specific SOP for stack gas sampling, but procedures and track records are described in detail in the Stack Testing Manual.
- Ambient air sampling: There is no specific SOP for air quality sampling.
- Laboratory Analysis: Documentation management (preparation, review, and approval) is appropriately conducted. The existing SOP needs further improvement. Since D&F monitoring is not frequent, SOPs for D&F analysis needs refinement. Current reference used is the SOP from NMI Australia.

7) Continuation of the Environmental Monitoring

i) AQMS

- Basically, emission gas samplings are conducted by the accredited organization. As of now, there are 3 to 4 accredited organizations which can conduct D&F sampling (EPA method 23).
- Key technique for D&F is isokinetic sampling. EMB has some staffs who can conduct isokinetic sampling. Sampling Assessment Team members can conduct training for isokinetic sampling.

ii) ERLSD

- ASS (third party) is sending their samples for D&F analysis abroad.
- ERLSD owns only one GC/HRMS. In case the GC/HRMS malfunctions, lead time will be very long even after ERLSD start regular analysis of D&F.
- Organics laboratory unit in ERLSD will be in-charge of D&F analysis. Ability of each staff is very high, but the number of staff will not be sufficient for more frequent D&F monitoring.

(2) Training Plan

Based on the results of the gap analysis, the training plans were formulated by JET in May 2020 as shown in Table 2.65. During the preparation of the training plan, priorities and simplifications were considered.

Table 2.65 Training Plans Related to D&F Measurement

Item	Training Plan
Prepare SOPs	JET reviewed the existing SOP (based on EPA Method 1613, provided by ERLSD) and sent some advices which included recommendations for developing SOPs. Based on the advices, ERLSD will prepare SOPs for stack gas and ambient air analysis, then JET will review them.
	As for sampling, manuals were already prepared by AQMS and sampling works are implemented without problems. Thus, existing manuals can be referred/ utilized for sampling SOPs. JET will recommend adding specific information for D&F sampling (i.e., preparation and preservation of capturing/adsorbent materials) and ERLSD will prepare the SOP.
Conduct training of sampling, analysis and QA/QC of Dioxins and Furans	Stack gas sampling training: ERLSD can join stack gas sampling training organized by AQMS and acquire skills for isokinetic sampling (the most important technique). For specific technique for D&F sampling, ERLSD is able to learn from the supplier of stack sampler. JET will provide some knowledge for contamination control based on Japanese experiences.
	Ambient air sampling training: ERLSD will ask AQMS to learn about on-site calibration and routine maintenance. JET will provide some knowledge for contamination control based on Japanese experiences.
	Operation verification of GC/HRMS: Some verification activities required in EPA Methods 1613, TO-9A, and Method 23 needs to be done, but skills for daily maintenance/ inspection of GC/HRMS and operation of software for Dioxin Analysis Program (DIOK) are necessary beforehand.
	Analysis training: Basically, the training will be conducted by spike and recovery test. Blank test will be included in the training. Moreover, samples taken by AQMS will be analyzed.
Prepare Sampling Plan (Design) for ambient air samples	JET will recommend ambient air sampling plan of baseline/follow-up survey for WTE facilities, considering laws and policies for EIA in Philippine and experiences of Japan.

Source :JICA Expert Team

Activities 3-3: Prepare Standard Operation Procedures (SOP)

(1) Review Results of Existing Draft SOP

Since ERLSD had prepared draft SOP based on EPA Method 1613, JET reviewed the SOP. JET identified and suggested some important points to be modified for SOPs finalization by ERLSD:

1) Confirmation of Consistency with Reference Standard Methods

Differences between the applied methods and the reference standard methods should be noted so that anyone in the laboratory are aware of them. The technical manager is mainly responsible for understanding all the identified differences. Moreover, the technical manager shall be able to clarify the reasons for all the differences and explain that there is no concern in terms of quality assurance.

In addition, among the differences, anything that are recognized as deviations from the reference standard methods should be validated, and the validation data should be retained.

The reasons of the differences and the validation data should be recorded in official documents in accordance with documentation management system in the laboratory.

In order to do the above work certainly, it is highly recommended to create a comparison table between the reference standard method and the SOP. Creating the comparison table can be good training to gain a deeper understanding of the reference standard method and it will be good materials and make it easier to explain to successors about the differences. In addition, if the format of the comparison table is decided, it can be recorded as an official document which explains the reasons of the differences.

2) Items to be Included in the SOPs

It is important that the same operation can be accurately reproduced by anyone at any time by using SOP. For that purpose, the following items need to be included in the SOP in addition to the reference standard. Note that the procedure performed at the time of initial verification and the procedure performed on the regular basis must be the same, and the SOP plays important roles to make that possible.

i) Reagents

It is necessary to list the manufacturer and grade. This is because changing the reagents may increase the blank value or change the uncertainty.

ii) Equipment

For general scientific equipment, it is not necessary to specify the manufacturer, but specify the specifications such as volume, etc. Moreover, if a grade such as ISO is specified in the reference standard method, or if it is necessary for metrological traceability reasons, include the required specifications to satisfy these standards.

iii) Instruments

Specify the manufacturer, model and options applied. For example, for automatic pretreatment device, the type of column used should be specified.

iv) In case the reference standard method has an option to be selected

It is necessary to specify which procedure is selected in the laboratory. If the selection depends on the matrix and/or the situation, specify the judgment criteria.

For example, the following samples, which are expected to contain many sulfur compounds that interfere with the analysis, will be treated with activated copper.

- Sediments
 - Biota
 - Samples with sulfur odor
 - Concentrated extraction solution with yellow precipitates
-

(2) Trainings for SOP Preparation

JET proposed to ERLSD the development of SOPs through the creation of a comparison table to identify consistency with reference standards. However, ERLSD did not agree with the recommendations given by JET. In May 2021, ERLSD shared the draft SOPs for stationary sources and ambient air with JET. JET reviewed them through the development of comparison tables as shown in Figure 2.20.

ERLSD conducts certification reviews of laboratories in the Philippines and also conducts periodic audits. It should be necessary to confirm in these reviews and audits whether analytical laboratories are using methods that differ from the reference standard, and if so, how to ensure the validity of these methods. To confirm the validity, the comparison table is one of the most efficient ways. JET expect that the comparison table will be used for those activities as well.

SOPs are finalized by ERLSD and endorsed at the JCC conducted in December 2022. Outline of those SOP are attached as Appendix 1.

Document No. OLU-TM-005: Determination of Polychlorinated Biphenyls (PCDDs), Polychlorinated Dibenzofurans (PCDFs) and Dioxin-Like Polychlorinated Biphenyls (DL-PCBs) in Soil/Sediment, Biota and Water Samples	Method 1631B Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS (1994)	Comments
<p>3. SAMPLE STORAGE AND PRESERVATION</p> <p>Sampling bottles should be made of amber glass with 1000-ml, or more capacity, with aluminum or polytetrafluoroethylene (PTFE) lined screw caps.</p> <p>The minimum sample volume required for the analysis of aqueous samples is 1000 ml. Maintain aqueous samples in the dark at 0-4°C from the time of collection until receipt at the laboratory. If sample pH is greater than 9, adjust to pH 7-9 with sulfuric acid.</p> <p>The minimum sample mass required for the analysis of solids, semi-solids, oily and mixed-phase samples is 100 g. Maintain solid and mixed-phase samples in the dark at -4°C from the time of collection until receipt at the laboratory.</p> <p>The minimum sample mass required for the analysis of biota samples is 500 g fresh weight. Biota samples like fish may be cleaned, filleted or processed in other ways in the field, and must be wrapped in aluminum foil and maintained at -4°C from the time of collection until receipt at the laboratory.</p> <p>Aqueous samples should be stored in the dark at 0-4°C until extraction. Semi-solid, semi-solid, oily, mixed-phase, and tissue samples in the dark at <math>-10^{\circ}\text{C}</math> until extraction. Sample extracts can be stored in the dark at <math>-10^{\circ}\text{C}</math> until analysis. Under these conditions, samples and extracts can be stored for up to one year.</p>	<p>3.0 Sample Collection, Preservation, Storage, and Holding Times</p> <p>3.1 Collect samples in amber glass containers following conventional sampling practices (Reference 16). Aqueous samples that flow freely are collected in refrigerated bottles using automatic sampling equipment. Solid samples are collected as grab samples using wide-mouth jars.</p> <p>3.2 Maintain aqueous samples in the dark at 0-4°C from the time of collection until receipt at the laboratory. If residual chlorine is present in aqueous samples, add 90 mg sodium thiosulfate per liter of water. EPA Methods 300.4 and 300.5 may be used to measure residual chlorine (Reference 17). If sample pH is greater than 9, adjust to pH 7-9 with sulfuric acid.</p> <p>Maintain solid, semi-solid, oily, and mixed-phase samples in the dark at -4°C from the time of collection until receipt at the laboratory.</p> <p>Store aqueous samples in the dark at 0-4°C. Store solid, semi-solid, oily, mixed-phase, and tissue samples in the dark at -10°C.</p> <p>3.3 Fish and Tissue Samples</p> <p>3.3.1 Fish may be cleaned, filleted, or processed in other ways in the field, such that the laboratory may expect to receive whole fish, fish fillets, or other tissues for analysis.</p> <p>3.3.2 Fish collected in the field should be wrapped in aluminum foil, and must be maintained at a temperature less than 4°C from the time of collection until receipt at the laboratory.</p> <p>3.3.3 Samples must be frozen upon receipt at the laboratory and maintained in the dark at -10°C until prepared. Maintain unfrozen sample in the dark at -10°C.</p> <p>3.4 Holding Times</p> <p>3.4.1 There are no demonstrated maximum holding times associated with CDDs/PCDFs in aqueous, solid, semi-solid, tissues, or other sample matrices. If stored in the dark at 0-4°C and preserved as given above (if required), aqueous samples may be stored for up to one year. Similarly, if stored in the dark at -10°C, solid, semi-solid, multi-phase, and tissue samples may be stored for up to one year.</p> <p>3.4.2 Store sample extracts in the dark at -10°C until analyzed. If stored in the dark at -10°C, sample extracts may be stored for up to one year.</p>	<p>There is no description of Holding Time. It is necessary to specify the time until the analysis is started and the storage period. Please refer to Section 4 SAMPLE HANDLING/STORAGE of Association Government National Measurement Institute SOP (hereinafter AGNMI SOP)</p> <p>ASE is not included in the standard, but if it is adopted based on the fact that it is adopted in the AGENN SOP, please declare it.</p>

Source :JICA Expert Team

Figure 2.20 Example of the Comparison Table

Activities 3-4: Conduct training of sampling, analysis and QA/QC of Dioxins and Furans

(1) Basic information

1) Limitation of the activities due to the unexpected malfunction of GC/HRMS, etc.

Activities 3-4 were initiated earlier than the PO attached to the R/D, as ERLSD had already started operating GC/HRMS at the beginning of this project. ERLSD and JET agreed that intensive training in the operation of DIOK, a software program dedicated to data analysis, was necessary.

However, the COVID-19 pandemic made it difficult to proceed with laboratory activities at times and ERLSD requested that JET use the remote access software, TeamViewer, to provide effective training under the influence of COVID-19. JET also obtained a dedicated PC for TeamViewer. However, due to information security problems that occurred when ERLSD communicated with its service providers via TeamViewer, training using TeamViewer was not realized for this Project. While JET was not able to visit, ERLSD was working on upgrading its laboratories to include the recommendations by JET and assigning a new staff member for D&F analysis.

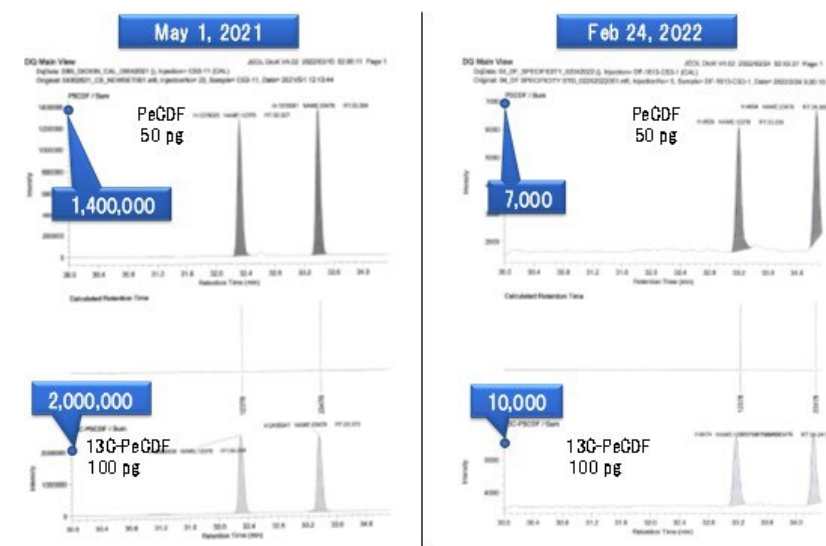
Unfortunately, the failure of the GC/HRMS Uninterruptible Power Supply (UPS) led to prolonged GC/HRMS downtime and a significant slowdown in activities. Furthermore, after JET travel resumed after the COVID-19 pandemic subsided, an unexpected GC/HRMS failure was discovered. With the understanding and cooperation of JICA Headquarters, JICA shouldered the repair costs excluding parts at the request of DENR-EMB, and further activity delays were kept to a minimum. Major events and trainings related to GC/HRMS are summarized in Table 2.66.

Table 2.66 Timeline of the Events related to the GC/HRMS

Year/Month	Event
Apr 2019	GC/HRMS had been shut down for the ERLSD laboratory renovation at the 1 st visit of JET.
Sept 2019	ERLSD succeeded the data acquisition of standard solution analysis result.
Feb 2020	JET visit was suspended due to COVID-19 pandemic. Due to ERLSD work attendance restrictions and other factors, activity was stagnant.
May 2021	ERLSD has successfully created a calibration curve. UPS malfunctioned and GC/HRMS had to be shut down until repairs were completed.
Oct 2021	Completion of the defective UPS (GC/HRMS had been shut down about five months)
Jan 2022	Communication error occurred between GC/HRMS and the control PC.
Feb 2022	Recovered from communication error (took over a month for the local service provider to resolve.) Resumption of GC/HRMS operation by ERLSD
Mar 2022	Resumption of JET visit Significant deterioration in the sensitivity of GC/HRMS was observed compared to the performance in May 2021, the last time a calibration curve was successfully created.
Apr 2022	It was found that the GC/HRMS transfer line needed to be replaced. (It took for a month since ERLSD had requested the local service provider to come to the lab.)
May 2022	JICA HQ decided to shoulder the cost for repairing work (direct cost of the new transfer line was not included), upon the official request from DENR-EMB.
June 2022	Repairs were performed by a technician from the manufacturer of GC/HRMS, JEOL.
July 2022	Resumption of the GC/HRMS operation verification has become possible

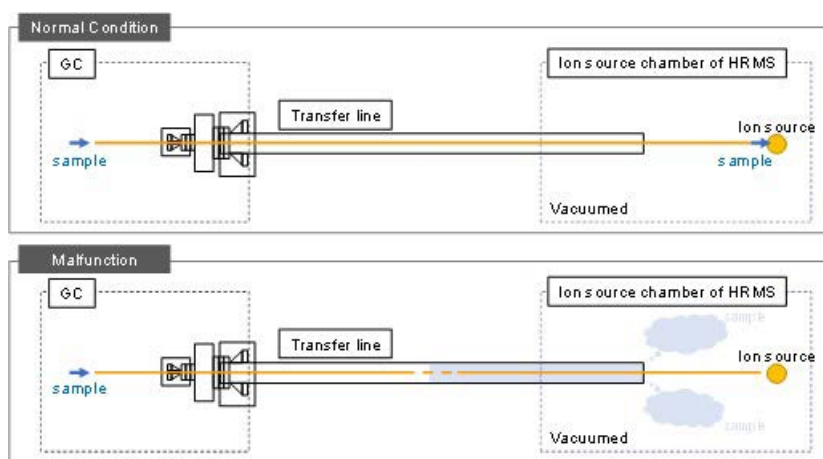
Source :JICA Expert Team

GC/HRMS malfunction in April 2022 was confirmed as the result of an investigation to identify the cause of significantly decreased sensitivity of the GC/HRMS. The status of the decreased sensitivity and the cause of the identified failure are described in Figure 2.21 and Figure 2.22. For the replacement work of the defective transfer line, and GC/HRMS manufacturer (JEOL) engineer visited ERLSD lab in June 2022 as shown in Figure 2.23.



Source :JICA Expert Team

Figure 2.21 Deterioration of the GC/HRMS Sensitivity



Source :JICA Expert Team

Figure 2.22 Identified Cause of the GC/HRMS Sensitivity Deterioration: Sample Leakage from the Broken Part of the GC Column



Source :JICA Expert Team

Figure 2.23 Repair of the Defective GC/HRMS Transfer Line by the GC/HRMS Manufacturer Engineer

2) Confirmation of the standard analysis procedures, etc.

ERLSD has extensive knowledge of technical matters pertaining to the analysis of D&F, based on technical documents from equipment suppliers, experience with WB-supported training, and recent experience exchange between a laboratory of Vietnam in recent years. However, due to the fact that they have extensive knowledge, ERLSD adopted multiple operation options in the draft SOPs, and JET considered that it would be difficult to realize the validation/verification of all options from the beginning, both in terms of time and cost. For this reason, JET suggested ERLSD to determine one procedure for the representative matrices for the initial stage of the analysis development, and JET recommended the training contents to implement these procedures. The methodology for the initial stage is shown in Table 2.67

Table 2.67 Standard Analysis Procedures planned to Apply by ERLSD

Process	Stack emission	Ambient air	Fly ash	Sediment
Sample Volume	1 m ³	325 to 400 m ³ (24h)	5 g	5-10 g
Spike Surrogate	EPA-23 ISS 80µL*	EPA-23 ISS 80µL*	EPA-1613 LCS 100uL	EPA-1613 LCS 100uL
Extraction	Pressurized Fluid Extraction	Soxhlet Extraction	Soxhlet Extraction/ Pressurized Fluid Extraction	Soxhlet Extraction/ Pressurized Fluid Extraction
Split after Extraction	1/2	1/2	1/2	1/2
Cleanup 1	Multilayer Sulfuric Acid Column by LC Tech	Multilayer Sulfuric Acid Column by LC Tech	Multilayer Sulfuric Acid Column by LC Tech	Multilayer Sulfuric Acid Column by LC Tech
Cleanup 2	Aluminum Oxide Column by LC Tech	Aluminum Oxide Column by LC Tech	Aluminum Oxide Column by LC Tech	Aluminum Oxide Column by LC Tech
Cleanup 3	Carbon Cleanup by LC Tech	Carbon Cleanup by LC Tech	Carbon Cleanup by LC Tech	Carbon Cleanup by LC Tech
Concentration	Rotary Evaporation then Nitrogen Blowdown	Rotary Evaporation then Nitrogen Blowdown	Rotary Evaporation then Nitrogen Blowdown	Rotary Evaporation then Nitrogen Blowdown
Final Volume	20 µL	20 µL	50 µL	20 µL
Recovery Standards	EPA-23 RS 20µL	EPA-23 RS 20µL	EPA-1613 ISS 50µL	EPA-1613 ISS 20µL
Estimated MDL (T4CDD)	Equivalent to CS 0.5	Equivalent to CS 0.5	Equivalent to CS 0.5	Equivalent to CS 0.5

Source :JICA Expert Team

3) Additional training of maintenance of GC/HRMS

Regarding the maintenance of the analytical instruments used by ERLSD, ERLSD personnel themselves are supposed to carry out the maintenance work after receiving guidance from the instrument suppliers after installation. Maintenance is one of the most important skills that must be acquired to enable routine analysis. However, there is still only one GC/HRMS in the Philippines, and the service provider in the Philippines does not have capacity to adequately maintain it. In this circumstance, ERLSD has been unable to do so as well. Furthermore, the service providers in the Philippines did not respond to the request by ERLSD promptly. As shown in Table 2.66, it took one month from the time a problem occurred until the service provider visited to the ERLSD laboratory in some cases. Based on the above situation, training was also provided by JET for maintenance tasks that are inevitable for routine analysis, such as GC column replacement, ion source cleaning, and filament replacement.

(2) Sampling Training

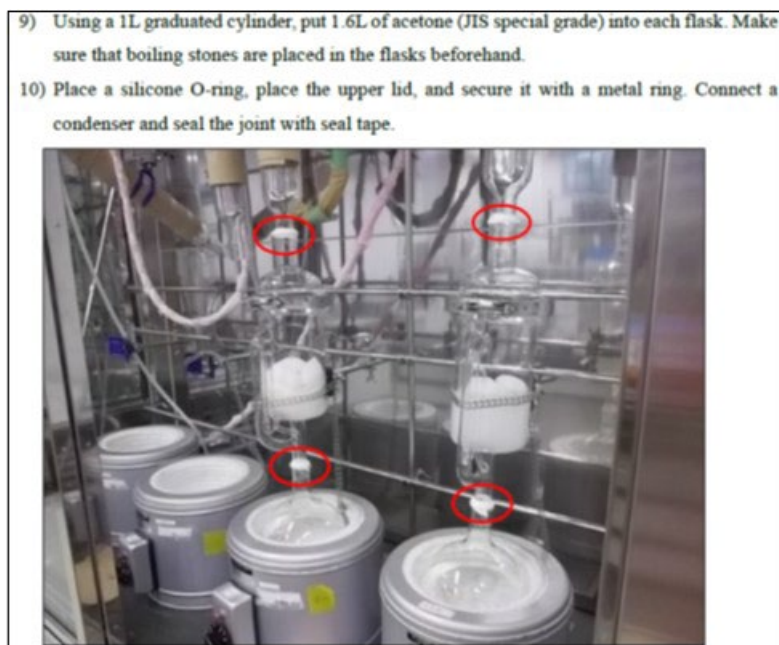
Sampling operations are under the jurisdiction of AQMS, and the same type of equipment used for D&F sampling is already in use for daily operations. Manuals for sampling operations of stack emission and ambient air were prepared and record forms were provided. QA/QC such as instrument calibration has been conducted in reference to the EPA method. Based on the above situation, JET decided to provide training on the preparation of adsorbent/capturing materials, which is the scope of work of ERLSD for sampling. This work is one of the most important aspects of contamination control for sampling of D&F.

Adsorbent/capturing material preparation was included in the topics of the online training conducted on November 2021, and technical materials were developed and provided as shown in Figure 2.24 and Figure 2.25. In addition, the training in the laboratory was conducted after May 2022 as shown in Figure 2.26, when the trip JET to the Philippines had been resumed.



Source :JICA Expert Team

Figure 2.24 Example of Prepared Technical Document: Pre-cleaning of the XAD Resin (For Stack Emission Sampling)



Source :JICA Expert Team

Figure 2.25 Example of Prepared Technical Document: Pre-cleaning of the PUF (For Ambient Air Sampling)



Source :JICA Expert Team

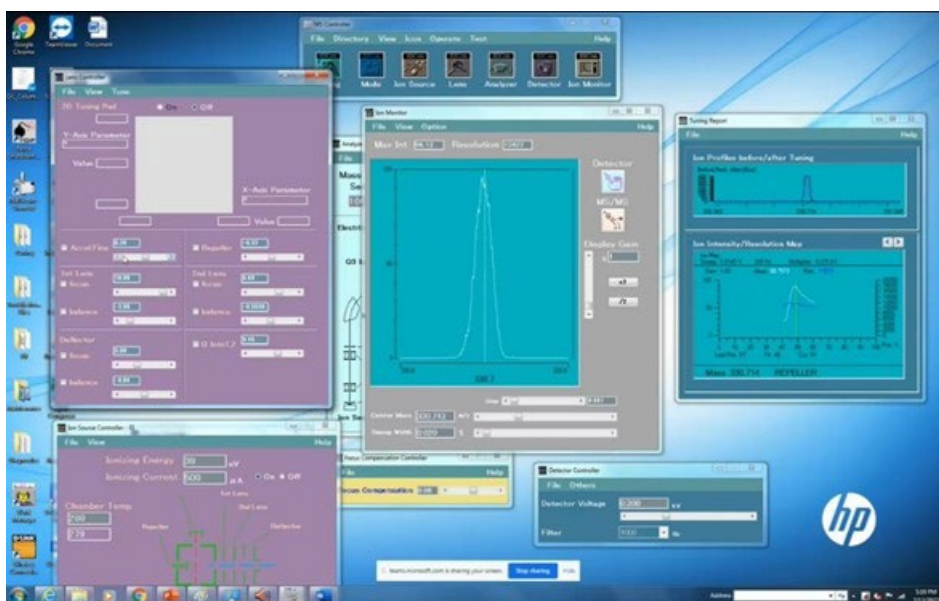
Figure 2.26 Training on Pre-cleaning of PUF for Ambient Air Sampling

(3) Operation Verification of GC/HRMS Training

1) Mass resolution

The EPA method referenced by ERLSD requires HRMS to ensure a mass resolution of 10,000 or higher; JET has been consulted by ERLSD on how to tune to ensure mass resolution since around September 2019, but due to the impact of the COVID-19 pandemic and the GC/HRMS unexpected malfunction, etc., the full-scale training was commenced in July 2022 as shown in Figure 2.27. GC/HRMS normally needs to be inspected and maintained by an instrument supplier once a year, but due to the COVID-19 pandemic, the Taiwanese instrument supplier was unable to visit the ERLSD laboratory for a period of more than two years. GC/HRMS was diagnosed as much as possible by GC/HRMS manufacturer technicians during the transfer line replacement work, and it was recommended that the slit width of the HRMS be slightly narrower than the default value. Although this improves the mass resolution to achieve 10,000, it is found that the sensitivity of the instrument has to be operated with a slightly reduced sensitivity as a compensation. It is expected that the HRMS alignment will be adjusted during future maintenance and inspection work to improve this issue.

Tuning to ensure mass resolution must be performed prior to the start of measurement. During the tuning operation, it is necessary to adjust various parameters, paying attention not only to the mass resolution but also to the reduction in sensitivity of HRMS. In September 2022, ERLSD was able to complete the tuning operation by themselves.

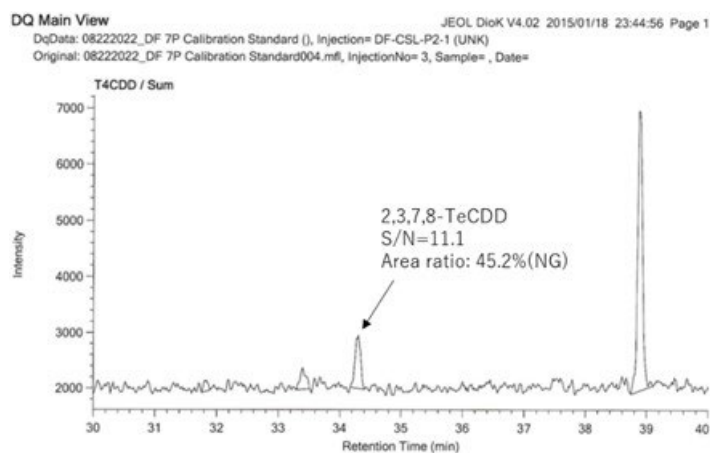


Source :JICA Expert Team

Figure 2.27 Training on the GC/HRMS Tuning

2) Confirmation of the sensitivity at the lowest standard solution for calibration curve

The EPA method requires that a signal-to-noise ratio of 10 be secured at the lowest concentration of standard solutions for calibration curves. ERLSD plans to adopt EPA Method 1613 standard solutions for calibration curves, but also plans to use two-level lower solutions (CSL: 0.1 ng/mL in TeCDD, CS0.5: 0.25 ng/mL in TeCDD) than the minimum standard solution concentrations indicated in the EPA (CS 1: 0.5 ng/mL in TeCDD). As a result of the measurement of the standard solutions, the signal-to-noise (S/N) ratio was satisfactory even at the lowest concentration of CSL as shown in Figure 2.28, but the ion abundance ratio criteria could not be satisfied for some compounds, so the ERLSD decided not to apply CSL in the calibration curve as of October 2022.



Source :JICA Expert Team

Figure 2.28 Example of the Lowest Standard Solution Analysis Result (Aug 22, 2022)

3) EF tuning and MF tuning

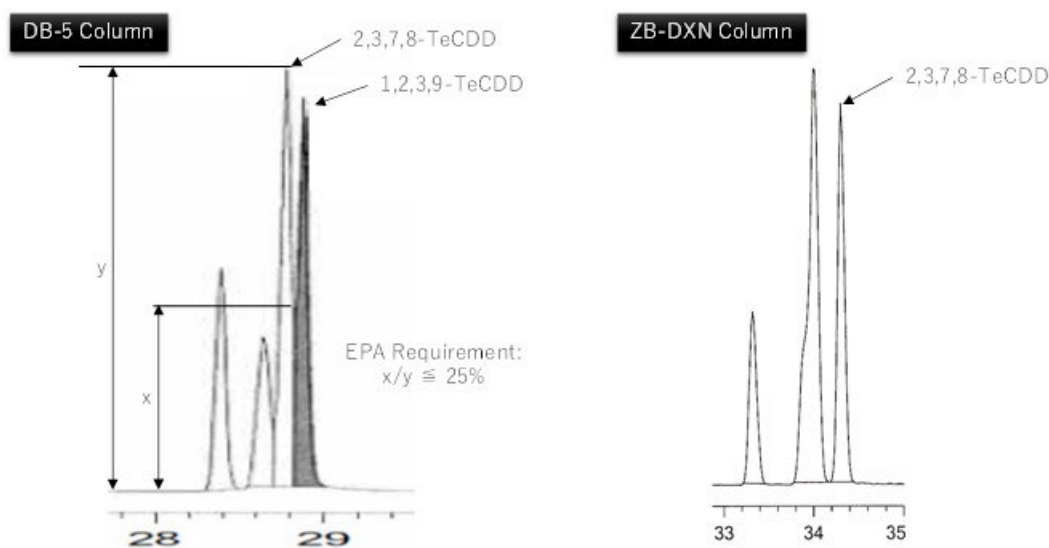
In order to perform mass resolution tuning, the electric and magnetic fields of the HRMS must be tuned (EF/MF tuning). Since the EF/MF tuning does not need to be performed frequently once it has been set up,

it was initially planned not to include it in the training program. However, the air conditioner installed in the GC/HRMS room malfunctioned in June 2022, resulting in a period of about one month of severe temperature fluctuations. During this period, the HRMS electric and magnetic field settings became incorrect due to the frequent temperature change. The analysis could not proceed because the mass resolution tuning was not executed. Since it was feared that the same incident may occur again in the future, training on EF/MF tuning was conducted on July 2022.

(4) Training through measurement of standard solutions

1) GC temperature settings and GC column selection

It was found that the GC/HRMS measurement setup conditions of ERLSD was not able to satisfy the peak separation of chromatograms required by the EPA method. Because it takes about an hour for an analysis, it is not realistic to find the optimum conditions by adjusting the temperature rise conditions through trial-and-error analysis. After considering the results of several trial experiments and the available GC columns owned by ERLSD, ERLSD decided to change the column (DB-5) that had been used since the introduction of GC/HRMS to another column (ZB-DXN) for the time being. JET supported the decision to change columns because the ERLSD's review process was reasonable. Prior to the COVID-19 pandemic, the column replacement had to be done by a service provider. After JET provided the training in July 2022, ERLSD successfully performed it as shown in Figure 2.29. With the column replacement, peak separation satisfied EPA's requirements.

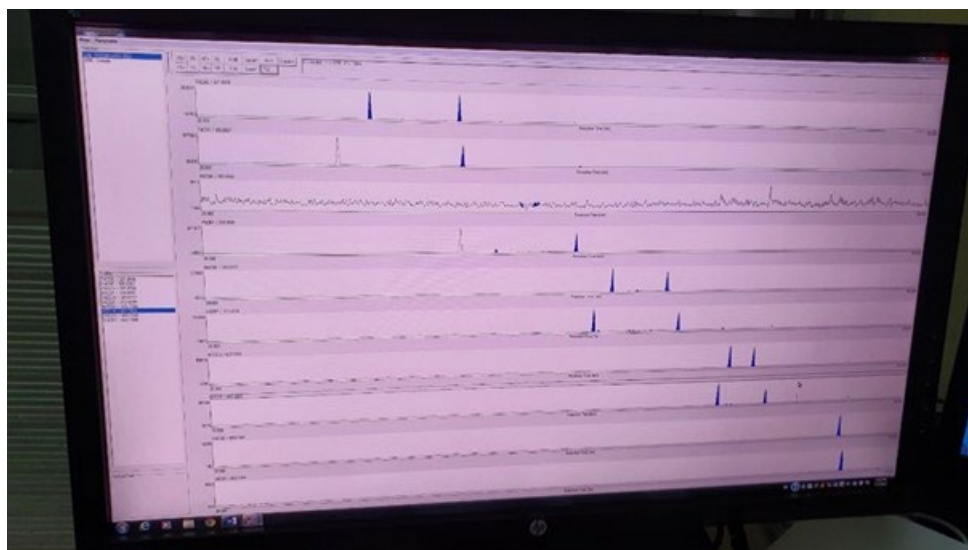


Source: JICA Expert Team

Figure 2.29 Peak Separation Test of ISS

2) Change settings for time segment

The measurement of D&F by GC/HRMS requires approximately an hour. It is necessary to divide the measurement time into several groups and set the measurement conditions for each time period. To make this possible, it is necessary to know at which time each compound appears. ERLSD had been inquiring with the local service provider since May 2021 about how to change the HRMS settings needed for this study, but they did not receive any answer. After the GC/HRMS repairs were completed, training was provided by JET in July 2022 on how to change the HRMS settings. This made it possible to confirm which compounds appeared at certain periods during the measurement time as shown in Figure 2.30. Based on the results, training was also conducted on setting up segments of the measurement time.

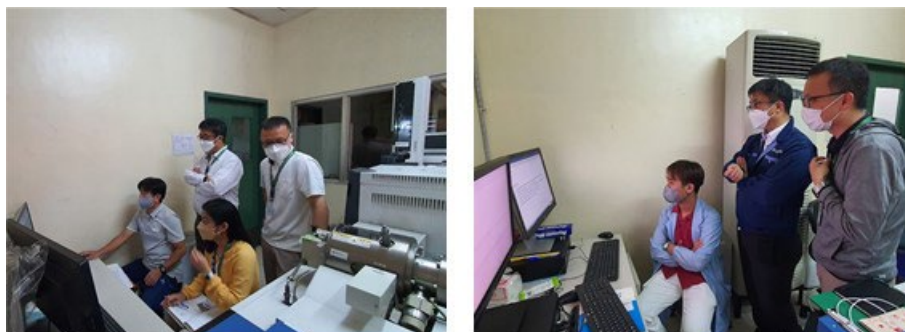


Source :JICA Expert Team

Figure 2.30 Confirmation Result of Peak Appearance Time for the Entire Analysis Time

3) Change settings for target compounds

As the GC/HRMS standard solutions were successfully measured, ERLSD determined on September 2022 the specifications for the internal standard compounds (labeled compounds) to be applied in future analyses. This required customization of the HRMS measurement conditions. Training on this issue was conducted during JET visit in October 2022 as shown in Figure 2.31.



Source :JICA Expert Team

Figure 2.31 Training on Customizing the GC/HRMS Settings

4) Calibration curve

The goal of the calibration was set to apply seven concentration levels of standard solutions. This is an extension of the five concentration levels in EPA Method 1613 with the addition of two lower concentration levels. After a number of trials and errors, ERLSD successfully prepared the calibration curve with seven levels of standard solutions in December 2022.

(5) Training for sample pretreatment

1) Extraction of samples

ERLSD uses an Accelerated Solvent Extractor (ASE) as shown in Figure 2.32 for the extraction of exhaust gas samples and a Soxhlet extractor for ambient air; both the ASE and Soxhlet extractors have been

used by ERLSD for POPs analysis, and JET provided some advice after checking the actual operation status. Typical examples of advice are as follows:

i) ASE

- Since sample extraction is performed under high temperature and pressure conditions, leaks and other problems are likely to occur. Frequent repair requests should be available.
- The structure of the equipment is prone to cross contamination. It may be better to limit the matrix to be applied for each device.
- Since the extraction efficiency is higher than that of Soxhlet extraction, there is a high possibility that there will be a difference between the two measurements. Also, due to its higher extraction efficiency, ASE may cause more foreign substances to be extracted, which may interfere with the analysis. Since it is not known whether or not interference will definitely occur, this should be kept in mind in future verifications.
- Exhaust gas collection materials such as filter paper and XAD resin may contain a large amount of moisture. If extraction is performed using only toluene, there is concern that the extraction efficiency may decrease, so it is desirable to conduct verification experiments with the addition of moisture. If the extraction efficiency becomes low, it is necessary to take measures such as extracting with a hydrophilic solvent like acetone first.



Source :JICA Expert Team

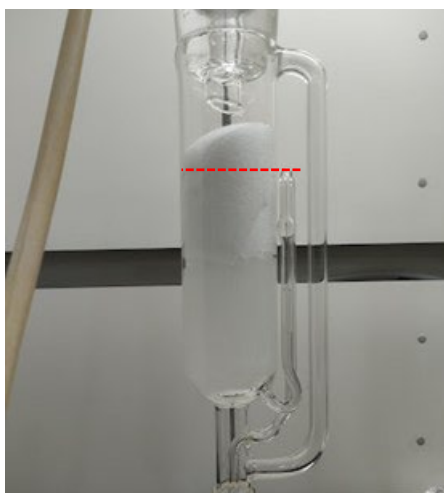
Figure 2.32 ASE owned by ERLSD

ii) Soxhlet extractor

- Control the extraction chamber so that it is at the height where the material to be extracted is immersed in the extraction chamber as shown in Figure 2.33 (In the pre-cleaning of PUF, the PUF swelled and exceeded the height of the top of the siphon tube. Use of weights or fixation with wire, etc. is necessary.)
- When extracting a thimble filter, adjust it to a height where its tip does not dip into the liquid surface. Otherwise, fine particles will scatter into the liquid phase and interfere with later analysis (Figure 2.34). For the same reason, filter paper used for ambient air sampling should be extracted

in a thimble filter. It is advisable to procure and use a thimble filter of the appropriate size for the extraction chamber.

- The temperature control capability of the Soxhlet heater is not sufficient, so it is necessary to increase the frequency of visual inspection to ensure that the extraction solvent is properly rotated (several events were observed in which the solvent was not properly rotated due to excessive heating). Due to some problems with the chiller's capacity, some cases were observed in which all of the solvent for extraction evaporated. The highest attention must be paid to ensuring that Soxhlet extraction is in proper operating condition, including in terms of safety control.
- The entrance to the siphon at the bottom of the extraction chamber should not be blocked. It is advisable to make a supporter with wire, etc. to secure the space.
- Insulate equipment with low heater capacity by wrapping aluminum foil around it as shown in Figure 2.35 to increase efficiency.
- The solution after Soxhlet extraction should be passed through anhydrous sodium sulfate to remove water and solids before proceeding to the clean-up process.



Source :JICA Expert Team

Figure 2.33 Example of Insufficient Cleaning of PUF due to Swelling (Above the Red Line)



Source :JICA Expert Team

Figure 2.34 Example of Possibility of Scattering the Sample Particles in the Extraction Chamber



Source :JICA Expert Team

Figure 2.35 Example of Insulation of the Heater

For fly ash CRM, which will be measured during the establishment of analytical methods, it is likely that hydrochloric acid treatment should be performed prior to extraction. Therefore, training on hydrochloric acid treatment of samples was also conducted in October 2022 as shown in Figure 2.36.



Source :JICA Expert Team

Figure 2.36 Training on HCl Treatment Sample

2) Clean-up of samples

ERLSD plans to clean-up the sample extracts with an automated pretreatment equipment as shown in Figure 2.37. Basically, it should be possible to purify the sample appropriately if it is operated according to the conditions indicated by the manufacturer, but the results of the spike and recovery test showed that the recovery rate was a little low, about 50%.

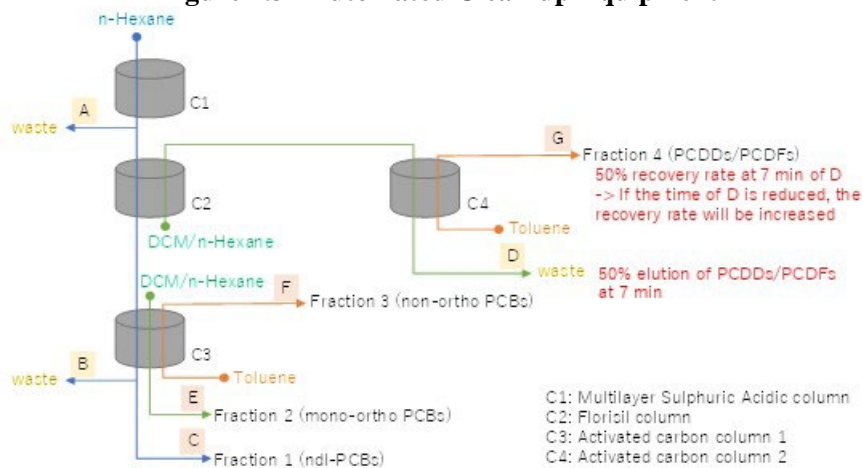
JET advised on the verification test method in October 2022 as shown in Figure 2.38. Based on the results of the verification test, the operation conditions were reviewed and decided by ERLSD.

There was a concern that the automated pretreatment equipment has many pipes and joints in the flow path and is prone to cross-contamination. It is expected that exhaust gas treatment from WTE facilities to be introduced in the Philippines in the future will be strictly controlled. Therefore, JET advised ERLSD that it may be desirable to operate the automated pretreatment equipment exclusively for WTE exhaust gas samples.



Source :JICA Expert Team

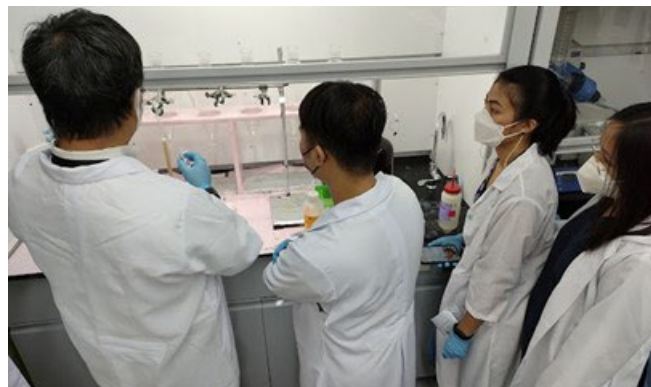
Figure 2.37 Automated Clean-up Equipment



Source :JICA Expert Team

Figure 2.38 Example of Study on the Operating Condition of the Automated Clean-up Equipment

For the time being, the analysis at ERLSD will focus on exhaust gas and ambient air samples and CRM of fly ash. Since these do not contain large amounts of interfering substances such as sulfur or fat, training was provided on purification using sulfuric acid silica gel columns and activated carbon columns as shown in Figure 2.39.



Source :JICA Expert Team

Figure 2.39 Training on the Manual Clean-up Operation

3) Method blank test, Method detection limit test

At the time of JET's stay in December 2022, extraction operations were being conducted to test the method blanks and the method detection limit for ambient air. These will undergo pretreatment and be measured by GC/HRMS and evaluated shortly.

(6) Training through analysis of the fly ash CRM

Measurement training was conducted using certified reference materials for fly ash owned by ERLSD. Both exhaust gases and ambient air are suitable for use in the verification of measurement methods for exhaust gases and ambient air, since most of D&F in them are considered to originate from combustion. Sample pretreatment was performed under several conditions during JET stay in October 2022, and GC/HRMS measurements were performed through November.

(7) Additional training

1) Maintenance work for the ion source of HRMS

In order to achieve routine analysis of D&F, cleaning of the ion source and filament replacement must be performed at a certain frequency. Laboratory staff must be able to determine maintenance necessity and perform it in a timely manner. Maintenance training around the ion source was conducted in May and July 2022 as shown in Figure 2.40.



Ion source removal/installation



Ion source disassembly



Ion source cleaning



Ion source assembly

Source :JICA Expert Team

Figure 2.40 Training on Maintenance Work for Ion Source

2) GC column installation

ERLSD bases its analysis of D&F on Method 1613, which requires an initial analysis on a DB-5 column and, if a 2,3,7,8-TeCDF peak is identified that cannot be separated, a DB-225 column is used to separate and quantify the 2,3,7,8-TeCDF. This means that future routine analysis will require timely column replacement. In addition, the DB-5 column owned by ERLSD was not expected to meet the separation

criteria for 2,3,7,8-TeCDD required by Method 1613 soon. For these reasons, training on how to replace the GC columns was conducted in July 2022 as shown in Figure 2.41.



Source :JICA Expert Team

Figure 2.41 Training on the GC Column Replacement

3) Maintenance of auxiliary equipment

The UPS of GC/HRMS defected in May 2021, resulting in a prolonged period of downtime. The cause was that periodic replacement and maintenance were not performed; the GC/HRMS itself was included in the equipment supplier's maintenance and inspection work, but auxiliary equipment was not covered. Therefore, JET advised ERLSD on equipment specifications, setting conditions, and maintenance for auxiliary equipment such as chillers and compressors.



Source :JICA Expert Team

Figure 2.42 Training on the auxiliary equipment

4) Proposal for the laboratory modification

ERLSD was renovating its laboratory to achieve analysis of D&F; several items for improvement were identified during JET's visit, and these were relayed to ERLSD as advice. Typical suggestions for improvement are listed below.

- The GC/HRMS room is not air tight and may become humid. In the past, the PC board has become corroded, making measurements impossible. In addition, HRMS is generally vulnerable to sudden fluctuation of the room temperature. It is not practical to control room temperature and humidity only with air conditioners and dehumidifiers. It is necessary to prevent the inflow of hot and humid air by installing an anteroom. (Figure 2.43)
- If the air conditioning capacity of the GC/HRMS room is not sufficient, the room temperature may rise due to exhaust heat from the GC. There were several events from June to July 2022 where measurement became impossible due to room temperature fluctuation. In the future, when samples are measured continuously, it is recommended to record the temperature change over time near the HRMS section which is susceptible to temperature fluctuations. One of the countermeasures is to install ducts to release the exhaust heat from the GC to the outside of the room, but there is concern that dust in the outside air may be introduced into the GC/HRMS room due to the ventilation effect. Basically, adequate air conditioning and dehumidifiers should be installed.
- Draft chambers are installed in the sample prep rooms, but since there are no outdoor air intake ports, the exhausted air by the chambers is supplemented by air coming in through door gaps and other openings. There are concerns about contamination due to dust scattering and lack of ventilation. During the operation phase, it will be important to check if there is ventilation problem, and if improvement is necessary, an air intake should be installed. Filters should be installed at the air intake.



Source :JICA Expert Team

Figure 2.43 Installed Anteroom for Maintaining the GC/HRMS Room Temperature/Humidity

5) Advice for preventive maintenance for GC/HRMS

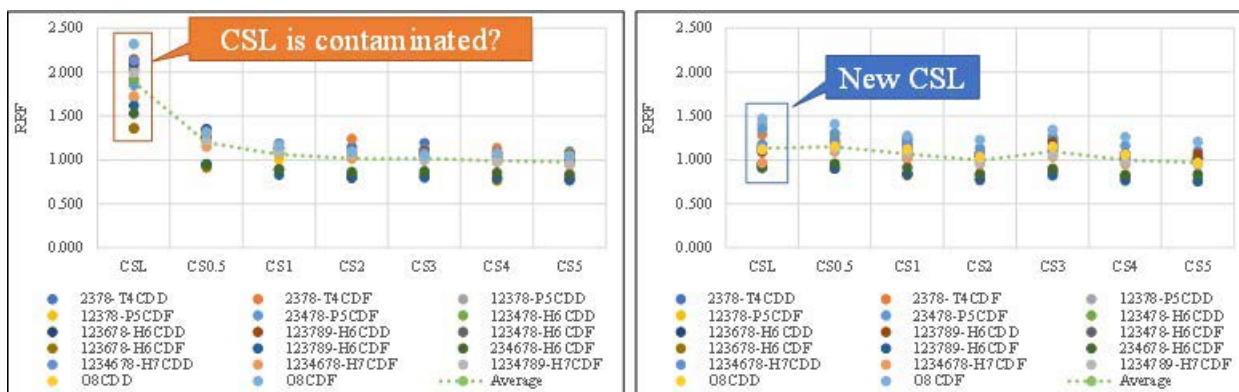
Due to the severe restrictions on entry into the Philippines since the COVID-19 pandemic, preventive maintenance services that are normally performed annually were not performed for two years. The service provider proposed a much higher quote than in previous years for the year 2022. JET was consulted because the cost exceeded the budget that ERLSD could realistically secure.

Basically, it is better to buy the parts recommended by the service provider. However, the quotation lacked transparency, as it did not indicate the unit price or the parts, or quantity, or the number of technicians dispatched or the number of days they would be dispatched.

JET advised ERLSD to obtain quotations that clearly stated unit prices and quantities, and to prepare an inventory of spare parts in ERLSD's possession. Based on this information and the status of the GC/HRMS, JET informed ERLSD of the priorities for parts to be procured.

6) Improvement of storing the standard solutions

A number of standard solution measurements were performed to develop the calibration curve. In these measurements, results were obtained that suggested that the standard solutions were contaminated. In the course of investigating the cause of contamination, JET found items that needed to be improved in the management of standard solutions and the method of solvent washing during measurements, and advised ERLSD. After replacing the standard solution with a new one, the measured values became normal (right side of the Figure 2.44).



Source: JICA Expert Team

Figure 2.44 Example of Possibility of Contamination of the Standard Solution

Activities 3-5: Prepare Sampling Plan (Design) for ambient air samples

(1) Status of preparing the sampling plan for ambient air in Philippines

Air quality monitoring has started since October 2022 by the EMB to establish ambient air quality guideline values for D&F. AQMS and ERLSD had already discussed and the sampling plan was formulated. Since the roles of AQMS and ERLSD in the series of work from sampling to analysis are clear, and in addition, points to consider when selecting sampling sites can be found in the guidelines developed by AQMS. Moreover, installation of sampling equipment, and preparation of materials for sampling are already in place, no issues were found regarding the development of the sampling plan.

Although there was virtually no need to support environmental air quality measurement plans, it was decided to collect and organize the guidelines for environmental considerations published by the MOEJ for the construction of waste incineration facilities and some examples of environmental assessments in Japan, and were provided to AQMS as reference information.

(2) Japanese technical guidelines

Japan's Waste Management and Public Cleansing Act sets forth the procedures required for the establishment of facilities for waste treatment and disposal. One of the procedures is a living environment survey. MOEJ, the supervising authority for waste treatment and disposal, has established guidelines to ensure that considerations on living environment are properly implemented.

1) Survey items

- Ambient air: SO₂, NO₂*, SPM, HCl, Dioxins (dioxins, furans, dioxin-like PCBs), others such as heavy metals.
- *: For the field survey, NO_x and NO should be measured
- Meteorological conditions (ground level): Wind direction, Wind speed, radiation, Solar radiation, Radiation balance, etc. which will be necessary for air quality prediction modeling.
 - Meteorological conditions (upper air meteorology): Wind direction, Wind speed, Temperature for the large scale capacity facility with high stack height such as over 50 m.

2) Survey area

- The area should be set considering the distance of maximum ground concentration appearance estimated from atmospheric diffusion equations such as the plume equation.

Table 2.68 Example of setting the survey area for stack emission impact

Facility capacity, etc.	Treatment rate (t/hour)	0.2	0.5	1	2	5	12	18
	Stack height (m)	10	20	30	40	59	80	100
Survey area* (radius: km)		1	2	3	4	6	8	10

The distance was set to be approximately twice the expected distance of the maximum ground concentration appearance.

Source :MOEJ

3) Survey sites

- Ambient air: Survey sites should be set up where the impact of stack emissions is expected to be significant.
- Meteorology: Survey sites should be set up in the proposed project site, basically.

4) Survey period

- Ambient air: Four times in one year (four seasons). Survey duration for each time is one to two weeks.
- Meteorology (ground level): Continuous monitoring for one year.
- Meteorology (upper air): Four times in one year. Survey duration for each time is five to seven days.

(3) Examples of EIA for WTE in Japan

Several EIA for WTE projects in Japan were reviewed, and the situation regarding the ambient air quality monitoring was summarized as follows.

- Ambient air quality surveys are usually conducted at a total of five sites, including the proposed project site and four other sites in the east, west, north, and south directions. (In addition to these, ambient air sampling is implemented for the purpose of studying the impact of vehicle emissions from waste collection trucks.)
- The survey points are set based on the distance where the maximum ground concentrations appear, based on a preliminary study by an atmospheric dispersion model.
- The survey points are located in public places such as government offices and schools so that the situation before and after the project implementation can be compared.

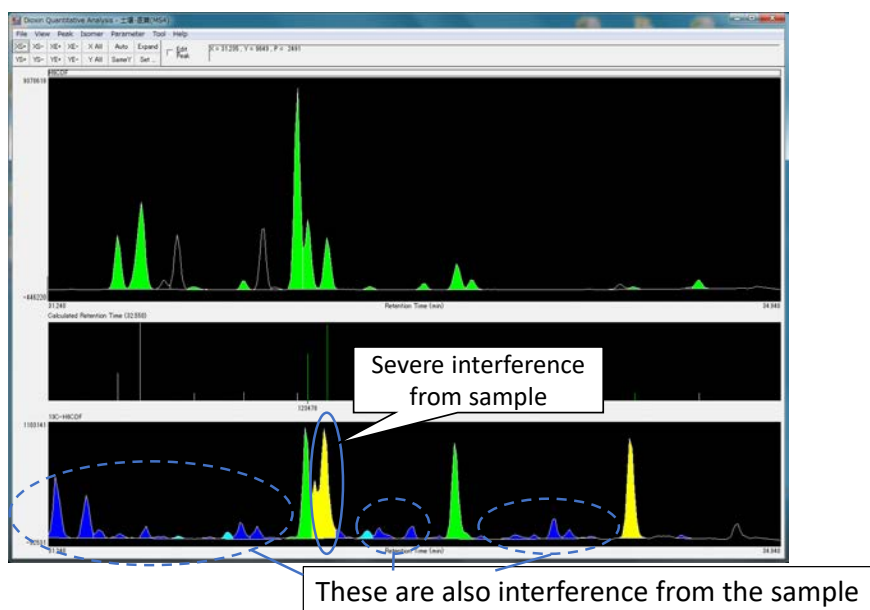
- For dioxins, continuous sampling is conducted at five sites at the same time for one week.

Activities 3-6: Implement sampling, analysis and QA/QC of Dioxins and Furans

(1) Measurement of actual samples

After completion of Activity 3-4, analysis of ambient air and stack emission samples by ERLSD's laboratory will be available. For ambient air quality, sampling has already started in October and samples are being extracted and will be analyzed by ERLSD. As for stack emission, there are currently eight establishments in the Philippines that are required to measure D&F in stack emission. These are measured once a year. Exhaust gas samples are sent to foreign countries for analysis, and will be analyzed by ERLSD accordingly.

In the future, as ERLSD conducts analyses of actual samples, it is anticipated that it will encounter situations where data will not be measured correctly due to the condition of the GC/HRMS or impurities in the sample. Since no analysis of actual samples could be conducted during this project, practice-based training on how to deal with these problems were not able to be provided. To fill the gap from the original plan, JET used chromatograms obtained from actual analyses conducted in Japan to compile and share with ERLSD examples of cases that required reanalysis or other decisions. The ability to determine which processes need to be re-examined when an ideal chromatogram is not obtained is something that can be enhanced through actual analytical experience and trial-and-error. For this reason, JET expects that ERLSD will continue to enhance its skills.



Refer to the table of section 3-2-2 in the online training material “GC/HRMS measurement and data processing by Diok”.

- Perform re-analysis (Including additional cleanup)

Source :JICA Expert Team

Figure 2.45 Example of Chromatogram that need to consider re-analysis

(2) Advice on calculation of TEQ

The results of D&F measurements are expressed in terms of toxic equivalent (TEQ): TEQ is calculated by multiplying the measured concentration of each compound by the Toxicity Equivalent Factor (TEF)

which expresses the relative toxicity of each compound, and then summing them up. In Japan, the latest WHO-TEF (2005) is applied. Although it is up to EMB to decide which TEF to adopt and how to calculate TEQ, JET provided the following information expecting that it will be used as reference information for EMB's consideration in the future.

- WHO-TEF (2005), which is the most up-to-date knowledge, should be adopted: I-TEF was developed in the 1980s and is considerably older than the WHO-TEF (2005) which was based on much more recent data. Although it is not certain, the reagents used in the older experiments might have contained more impurities. Since the toxicity of D&F has a more than 3,000-fold difference between the most and least toxic compounds, even small amounts of impurities can affect experimental results.
- Dioxin-like PCBs (DL-PCBs) should also be measured: I-TEF only covers D&F, whereas WHO-TEF (2005) also covers DL-PCBs. This means that DL-PCBs have toxicity based on the same mode of action. Current baseline information on DL-PCB in the environment in the Philippines is unknown, but if concentrations are high, they could affect the TEQ. The purpose of measuring dioxins is to assess the risk to humans; it is not logical to conclude that measurement of DL-PCB is unnecessary because the TEF for DL-PCB is not set in the I-TEF.
- It is necessary to consider how measurement results below the limit of quantification should be taken into account when calculating the TEQ: In Japan, the calculation methods are different for source emission matrices and ambient matrices. For source emission matrices, values below the lower limit of quantification are not included in the TEQ calculation. This is thought to avoid overestimation, since the measurement results for emission sources will also be used to determine the penalties. On the other hand, ambient matrices are considered in the TEQ calculation even if they are below the detection limit. Dioxins in nature are not generated by only one specific congener, but by hundreds of congeners simultaneously. In addition, dioxins are persistent compounds that are widely present in the environment. Therefore, even if the calculated concentration is below the detection limit, the concentration should not be said to be zero. A method for calculating TEQ that does not underestimate the risk has been established in Japan.

Table 2.69 Method for Calculation of TEQ in Japan

No.	< LOD	≥LOD and <LOQ	≥LOQ	Matrix
1	0	0	the value shall be used as it is	Source emission
2	LOD	the value shall be used as it is	the value shall be used as it is	
3	1/2 LOD	the value shall be used as it is	the value shall be used as it is	Ambient

Source :JICA Expert Team

2.5 Activities for Output 4

Activities 4-1: Grasp the current situation by National SWM strategy and 10-year SWM plan in the target LGUs

JET researched the situation by National Solid Waste Management Strategy 2012-2016 and 10-year SWM plan in the target LGUs. JET also visited the office of LGUs in charge of SWM and the related facilities in the target LGUs, such as composting facilities, MRFs and landfills.

The situations of SWM were confirmed by reviewing the relevant documents, and summarized in the 1st Progress Report in 2020.

(1) National Strategy of SWM

In accordance with Section 15 of RA9003, the NSWMC enacted the National Solid Waste Management Framework in 2004. This framework served as comprehensive and practical guidelines for LGUs and related sectors responsible for enforcing RA9003 and its implementing rules and regulations. Moreover, the government of the Philippines enacted the National Solid Waste Management Strategy 2012-2016. This strategy adopted the 3R concept while giving shape to the following sorts of strategies.

This national strategy was being updated in conjunction with the Philippine Development Plan 2017-2022.¹⁷

Strategies in the National Solid Waste Management Strategy 2012-2016 are shown below.

[National Solid Waste Management Strategy 2012-2016]

- Bridging policy gaps and harmonizing policies
- Capacity development, social marketing, and advocacy
- Sustainable solid waste management financing mechanisms
- Creating economic opportunities
- Support for technology and research and development
- Organizational development and inter-agency collaboration
- Compliance monitoring and enforcement
- Good solid waste management governance, caring for socially vulnerable groups, and reducing disaster and climate change risks

(2) SWM Situation in Quezon City

In Quezon City, residents shall segregate their waste to 1) biodegradable 2) recyclable 3) residual, and 4) special wastes. The segregated waste is collected twice a week. Collection of biodegradable waste according to area is set on Monday/Friday or Tuesday/Saturday, while non-biodegradable waste is collected once a week every Wednesday or Friday. Waste collection is carried out by private contractors in each of the six wards. Recyclable waste is either collected by barangays or sold directly to certified junk shops through a Material Recovery System (MRS). Waste is collected from barangays either by big trucks which are directly disposed at the landfill or by small trucks and transferred to large trucks at staging area for efficient transportation.

MRFs are operated by each barangay in Quezon City. Currently, 64 MRFs have been developed in Quezon City (as of November 2019).

¹⁷ National SWM strategy has not been updated as of December 2022.

Since closure of the Payatas SLF, Quezon City is utilizing the Rizal Sanitary Landfill. It is said that the remaining life and area of the Rizal Sanitary Landfill is 16 years and 50ha, respectively (as of February 2020). If the capacity of the Rizal Sanitary Landfill reaches its limit, Quezon City will follow the Metropolitan Manila Development Authority (MMDA) recommendations on the alternate landfill sites.

The city was inclined to establishing WTE facilities, and there are no plans to establish new sanitary landfills. The waste treatment in Metro Manila is privatized, and a tipping fee (PHP 600/t) is paid by MMDA.

(3) SWM Situation in Davao City

All the four types of waste, biodegradable, recyclable, residual, and special waste, are recommended for segregation at house. Each household puts their garbage in a bag and deposits it in a mobile waste bin with a lid along the road. Solid wastes are collected from 112 barangays out of 182. The LGU consider expanding areas in waste collection coverage in the future. The discharge time is set from 18:00 to 21:00, twice a week. Medical waste is disinfected and stored in landfills or warehouses.

A few barangays have composting facilities or MRFs. The reason that there are many barangays without MRF is that there is no land suitable for MRFs and there are no managers nor funding.

New Carmen Landfill has been in operation since 2004. Some dumping areas in the SLF are being operated in open dumping method. The amount of waste was projected to increase up to 500 t/day to 600 t/day by 2017. LGU is promoting waste segregation to reduce the amount of waste being dumped at the landfill as a way to extend its remaining life. The unloading area is small and can accommodate only one truck, which causes queue of trucks waiting for waste unloading. When it rains, the access road becomes muddy, making it harder to access the landfill and causing traffic among trucks unloading wastes.

(4) SWM Situation in Cebu City

Based on RA9003, waste must be separated into 1) biodegradable waste 2) recyclable waste 3) residual waste, and 4) special waste. However, residents dump their garbage in plastic bags without any separation. Waste collection points are defined by the LGUs but residents may discharge waste to other places which causes wastes piling up at the corner of the road. Medical wastes are treated by a private company Pollution Abatement System Specialist Inc. (PASSI) using autoclave technology. Monitoring on PASSI is carried out by EMB.

While LGU is promoting composting, it is mostly NGOs and informal sector that mainly act for recycling. The MRF managed and operated by LGU treats plastic bottles and broken glass. Glass is shredded and used as paving material while plastics are used as eco-fences on waste collection on rivers.

The Inayawan landfill in Cebu City started operation in September 1998, it was closed in 2016 upon DENR instruction due to improper operation and potential environmental impact. The residual waste after sorting is transported and disposed at a landfill owned by a private company located in Municipality of Aloguinsan or Consolacion. In a privately-operated waste transfer station near Inayawan landfill, waste is measured at the weighing scale at the former disposal site of Inayawan, and valuables materials are sorted. Remaining residual wastes are transported to landfill.

Activities 4-2: Identify the current issues for other SWM technologies in the target LGUs

Based on the results of Activity 4-1, which includes review and analysis of LGU's 10-Year SWM Plan and the current situation, the issues related to SWM in the 3 target LGUs are summarized as shown in the following tables. These were reported in the 1st Progress Report in 2020.

Table 2.70 Current Issues on SWM in Quezon City

Item	Issue
Budget of SWM	- The amount of waste will increase as population increases. Therefore, it is required to increase the city budget for SWM to implement appropriate SWM. In order to ensure the budget for SWM in the city, it is needed to consider the collection of garbage fees from households. In addition, since the amount of bulky waste will increase with economic development, it is also necessary to consider charging on bulky waste.
Waste Generation Quantity and Quality	- Waste generation is increasing by 3.33% per year. - Quezon City is considering the introduction of WTE. The city does not have data on chemical composition of waste. In carrying out the WTE project, it is recommended to investigate the chemical composition of feed stock, not only by the private proponent but also by the city.
Collection and Transportation of Waste	- In some barangays, waste collection is not managed well. From the aspect of public health, the monitoring system of waste collection should be improved so that the measures for improving performance of waste collection can be discussed.
Intermediate treatment facility /3R	- Quezon City instructs the residents to segregate the waste at source, but there is no effective way to use the segregated biodegradable waste. - The actual value of the diversion rate is not clear because it is calculated based on the estimated amount of waste generation. It is necessary to obtain data which can provide actual values of the diversion rate. - Lack of area to develop MRF is a fundamental issue. Residents are not positive to accept MRFs in their communities. - The expansion of MRF is planned in the 10-year plan, but the cost-effectiveness of MRF has not been confirmed. It shall be studied. - The compost produced in MRF is not sold and are used for gardening in the MRF. It is stated in the 10-year plan that only a few local farmers are willing to buy compost. So, the city uses compost in parks and other facilities just to consume it. However, in order to promote the demand for compost, it is recommended to provide some incentives. - The city envisages to have a centralized recycling facility through PPP, but this has not been realized. - The budget for construction and operation of WTE is not specified in the 10-year plan. The budget for WTE should be indicated in updating the 10-year plan.
Landfill	- Alternate site for final disposal should be identified.
Others (Education of SWM/ Social Impact on SWM)	- Quezon City conducts the IEC activities. Outcomes and impact of these activities should be evaluated.

Source: JICA Expert Team

Table 2.71 Current Issues on SWM in Davao City

Item	Issues
Planning of Waste Management	- The 10-year plan is prepared considering the requirements of RA9003. Some plans seem far from the actual situation of SWM in the city which makes actual implementation more difficult (ex. Waste collection to all barangays, development of MRFs for all barangays). It is recommended to formulate plan based on the actual situation of SWM in the city.
Budget of SWM	- The garbage fees collection method should be improved to increase revenue for SWM. - It is assumed that residents do not understand the required cost for SWM. Delivery of information about SWM cost should be included in the IEC.
Waste Generation Quantity and Quality	- WACS training has been conducted with the support of Kitakyushu City. The city is improving the methodology of WACS.

Item	Issues
Collection and Transportation of Waste	<ul style="list-style-type: none"> - In case barangays do not have MRF, unsegregated and mixed solid wastes are collected and transported to a disposal site. - The issue is how to collect and transport the waste after being separated and placed on waste station's waste bin. - Although provision of collection services for all barangays should be achieved in the long run, barangays with larger amount of waste generation should be prioritized.
Intermediate treatment facility /3R	<ul style="list-style-type: none"> - Despite having waste separation at source, all types of waste are still disposed to the landfill due to non-existence of any recycling facility. - Recycling projects are not easy making a profit, so the understanding of the government, LGUs, and residents is necessary.
Landfill	<ul style="list-style-type: none"> - Since there is no available space in the landfill for unloading waste, a long queue of trucks occupies the access road. During rainy days, the site is also difficult to access. All of these problems must be solved. - Existing piles of wastes are present in the landfill and are at high risks of collapsing. Dumping waste without careful planning is the identified root cause of this and must be addressed as well.
Other	<ul style="list-style-type: none"> - Although active IEC activities have been implemented, residents do not fully understand how to properly treat waste. For instance, waste segregation at source is not yet satisfactory. Appropriate medium that can effectively deliver IEC message to all residents should be discussed.

Source: JICA Expert Team

Table 2.72 Current Issues on SWM in Cebu City

Item	Issues
Ordinance of SWM	<ul style="list-style-type: none"> - Ordinances on waste reduction and minimization exist, but implementation methods have not been identified.
Organization of SWM	<ul style="list-style-type: none"> - Each barangay has a Barangay Environmental Officers (BEO), but its role is limited only to crackdown. It is desirable to promote BEO's involvement in IEC activities.
Budget of SWM	<ul style="list-style-type: none"> - While budget of SWM by 2022 are stated in the 10-year plan, expenditure records in the past are not available. Expenditures and corresponding activities should be recorded and utilized for next plan. - Annual budget requirements need to be reviewed so that funds can be allocated to activities.
Waste Generation Quantity and Quality	<ul style="list-style-type: none"> - The method of waste segregation including discharging method, collection method, facilities, etc. has not been established. This situation is same for special waste (electric and electronic waste, etc.).
Collection and Transportation of Waste	<ul style="list-style-type: none"> - The ordinance allows adoption of charged garbage bag, but waste is put into various bags and given to waste collection service. - On managing operations of waste collection and transportation, there is a need to consider which is better: direct management by the LGU or outsourcing. - The barangays far from the city should also be served at a suitable frequency (according to the population).
Intermediate treatment facility /3R	<ul style="list-style-type: none"> - Clustering of barangays is not applied for sharing MRF. Most barangays do not have MRF.
Landfill	<ul style="list-style-type: none"> - It is necessary to understand and evaluate the economics and environmental aspects of utilization of private disposal sites.
Other	<ul style="list-style-type: none"> - How to enable BEO to function for SWM should be discussed.

Source: JICA Expert Team

Activities 4-3 : Collect the information of “Good practice/Good technology” of other SWM technologies in Japan/third countries

In order to achieve appropriate waste management in consideration of various aspects such as social/economic conditions, technical, financial capacities and restriction and effectiveness technologies, it is important to utilize good technologies, such as fertilization, recycling, final disposal and environmental education to the community, etc.

In Activity 4-3, the project team collected the information of “Good practice/Good technology” of other SWM technologies in Japan/third countries to select and introduce technology other than WTE according to the issues and situations of each LGU.

The assigned organization introduced and explained “Good practice/Good technology” that they collected at the subgroup meeting, and opinions were exchanged among the subgroup members. In response to the comments from SG members, JET researched to obtain supplemental information on behalf of other subgroup members. Some practices extracted from the collected examples are shown below.

In addition, “Good practice/Good technology” was summarized as a booklet with figures and photographs. It helps the LGUs to identify the optimal technology in Activity 4-4.

Table 2.73 Example of Good practice/Good technology

#	Good Practice	Outline	Collected by
Budget			
1	Charge on a waste bag designated by local government (Japan and other countries)	- Charge on waste bags are auxiliary budget of waste management. A survey reported that waste reduction was found in 118 cities in Japan after introduction of charge on waste bags.	JET
2	SWM cost allocated from general taxpayer	- In Japan, as a residential tax, it is collected from residents as well as public service costs such as education and welfare. The amount of contribution can be determined according to the income of the residents.	JET
3	Garbage Fee Collection Attached to Electric Bill (Olongapo City, Philippines)	- Households are charged their garbage collection fees along with their electric utility billing to enforce payment.	JET
Waste Generation Quantity and Quality			
1	Regular study and disclosure of WACS data to the public (Japan and other countries)	- In Japan, the composition survey of household waste (ordinary waste, recyclable waste, plastic containers and packaging, used paper and clothing) is conducted regularly, and the secular change is disclosed. - A regular monitoring and analysis of waste generation serves as an objective and sound basis for policy development that will improve the SWM. The result is posted on the local government website so that residents' awareness on waste would be encouraged.	JET
2	WACS Study with a classification of the community and seasons (USA, Turkey)	- MSW samples were collected to represent 4 lifestyles (high, medium, low, downtown) in summer and winter periods.	DOST
Collection and Transportation			
1	Station collection (Japan)	- The point of collecting waste called as “waste station” is designated and waste is collected on a fixed day by waste type. By setting the collection point, garbage can be collected in a short time because the collection equipment/truck can avoid frequent stop and go. - Since unsorted garbage is not collected, the accuracy of separation of residents increases.	JET

#	Good Practice	Outline	Collected by
2	Transfer station (Japan, USA and others)	<ul style="list-style-type: none"> - When the waste disposal sites are located far from the collection area, a transfer station is employed. - Transfer station may contribute to reduce the traffic and air pollution impact associated with hauling wastes to landfill sites. 	Cebu City
Intermediate Treatment Facility /3R			
1	Food Waste Recycling (Taipei, Taiwan)	<ul style="list-style-type: none"> - Food and kitchen wastes from households and restaurants are collected separately to be used as animal feeding and composting. - This was also practiced in conjunction with food waste reduction initiatives, which make the program effective. 	JET
2	Selling of Recyclable Wastes for Tuition Fee and School Funding (Region 4A/Philippines)	<ul style="list-style-type: none"> - Provinces under Region 4A encourage students and residents to collect recyclable materials, particularly PET bottles, and earn monetary incentives, tuition fee discounts, or receive funds for school rehabilitation. 	JET
3	Smart Mobile Waste Transfer Centers (Istanbul, Turkey)	<ul style="list-style-type: none"> - The City of Istanbul installed reverse vending machines that allow passengers to deposit plastic bottles and aluminum cans in exchange for credit in their subway cards. - The implementation of a reward system instead of punishment system encouraged more people to recycle, dispensing over \$4,500 (over 200,000 PhP) worth of credits in exchange for waste deposits over the first 6 months of operation. 	JET
4	Refuse derived paper and plastics densified Fuel: RPF (Hanoi, Vietnam)	<ul style="list-style-type: none"> - Uses RPF to make pellets that are used in incineration facilities, mostly small scale, to treat domestic solid waste. 	DOST
Landfill			
1	Leachate Collection Pipes of Semi-Aerobic Landfill (Japan)	<ul style="list-style-type: none"> - A piping system is installed and provided to minimize the leachate in the landfill. The piping system allows for the drainage of leachate from the landfill while at the same time providing passage of air to ventilate the waste pile. 	Davao City
2	Gas Ventilation System (Japan and other countries)	<ul style="list-style-type: none"> - Vertical piping system placed in the landfill to collect gas for treatment or productive use as an energy source. The piping system allows for air to escape, avoiding buildup of methane and other harmful gases in the landfill. 	Davao City
3	Bottom Lining Facility (Japan and other countries)	<ul style="list-style-type: none"> - Water-proof bottom liner prevents contaminants from the landfill to flow into groundwater. 	Davao City
Information, Education and Communication (IEC)			
1	Leaflet explaining waste segregation (Kawasaki City/Japan)	<ul style="list-style-type: none"> - Kawasaki City lists separation and discharge methods for each item on the local government website and public relations brochure. 	JET
2	Waste Wise Festival (Taipei/Taiwan)	<ul style="list-style-type: none"> - Taipei City Government organized the Taipei Lantern Festival with the aim of showing citizens that they can enjoy themselves, while at the same time, without leaving a great deal of trash behind. Specially designed recycle bins were provided during the festival to collect recyclables, non-recyclables and food waste for composting. Roughly 36 tons of waste was collected on site, and 23 tons of which were either recyclables or food waste suitable for composting. 	JET
3	Live Green Conference (Muntinlupa City, Philippines)	<ul style="list-style-type: none"> - Live Green Conference is an annual competition among Muntinlupa City's youth which provides a venue for the expression of environmental perceptions through art. Total of 27 campus journalists and artists from both private and public schools in Muntinlupa joined the contest in 2014. 	JET
4	Requirement to attend SWM course (Santiago City, Philippines)	<ul style="list-style-type: none"> - Santiago City has integrated environmental concerns into the distribution of business licenses, with a requirement to attend an SWM course before receiving the licenses. 	JET

Source :Project Team

Activities 4-4: Summarize and provide suggestion/recommendation to improve utilization of other SWM technologies to target LGUs

Based on the good practices and good technologies compiled in Activity 4-3, the target LGUs evaluated the waste management technologies appropriate for their respective LGUs, taking into account the situation, structure and the characteristics of the LGUs. The evaluation criteria for each technology were technical feasibility, economic feasibility, cultural acceptability, and environmental soundness. The target LGUs identified their concerns with respect to each evaluation criteria and organized the conditions for the technology application based on these concerns. The target LGUs shared their evaluation results at the SG meeting. Examples of technology evaluations by the target LGUs are shown below.

Table 2.74 Example of Technology Evaluation by Quezon City

Project	Project Description	Recommendations/ Concerns	Other discussion items
Sale of Recyclables	"- Brgy. South Cembo in Makati City generates revenues through the sale of recyclables collected from households.	"Recommendation: 1. The City can include recyclables in the daily collection- find recycling companies that can be a partner. Concern: Decrease in income of junkshop owners."	-
Kitchen Waste Collection	- In Shibushi City, Kagoshima Prefecture, food waste is collected separately - Residents put kitchen waste in a draining bucket at each household and discharge them to dedicated container on the collection day - Collected food waste is sold or distributed to the residents as compost. - In this city, the draining buckets are purchased by the residents, but there is also an option to distribute them through the local government	Previous project: kitchen waste collection for animal feeds Recommendation: 1. Collection of yard waste and kitchen waste from residents and business establishments for composting. 2. A truck is on standby in PCDF to take non-compostable waste to the landfill/CSA 3. Dry kitchen waste will be fed to BSF and vermi- the rest will be buried underground	In 2019, the African swine fever affected QC and other nearby LGUs so the wastes had nowhere to go and had to be discontinued. This can be brought back again, this time not just for animal feeds but can also be used for the urban gardening projects in QC.

Source :Project Team

Table 2.75 Example of a Technology Evaluation by Davao City

Station collection for recyclable waste	Technical aspect	Economic aspect	Cultural aspect	Environmental aspect
Concerns about introducing practice/technology by LGU	Many communities regard collection points as NIMBY. Collection points have tendency to become nuisance.	Costs for installation of collection boxes. Need to establish market for recyclables.	Needs educating residents on the benefit of this system.	Uncollected Unsorted wastes may pose as nuisance and will accumulate if not collected. Collected unsorted wastes will set a bad precedence to those complying.
Applicable conditions for introducing practice/technology	Maintenance of collection pts.	Can be subsidized by the government.	Awareness campaigns	Consistency will mitigate the

		Define Materials that have market value.		problems. Enforcement of laws.
Waste bank (Bank Sampah)	Technical aspect	Economic aspect	Cultural aspect	Environmental aspect
Concerns about introducing practice/technology by LGU	Needs careful planning, and consultation from various stakeholders	Not all recyclables have market demand.	Needs cooperation of the residents.	Acceptable
Applicable conditions for introducing practice/technology	Learn from the experiences of those who adapted the system.	Define materials that have market value.	Awareness campaigns	Learn from the experiences of those who adapted the system.

Source :Project Team

Table 2.76 Example of a Technology Evaluation by Cebu City

Plastic for rice program	Technical aspect	Economic aspect	Cultural aspect	Environmental aspect
Applicable conditions for introducing practice/technology	The program enables residents to receive rice in exchange for recyclable wastes.	The collected recyclable wastes will provide additional income stream for the city, which may be used for solid waste management activities.	The residents will habitually practice segregation, so they can exchange their segregated wastes for rice.	The initiative will promote segregation and minimized landfill disposal.
Promotion of SWM for private companies; requiring them to attend SWM Course	Technical aspect	Economic aspect	Cultural aspect	Environmental aspect
Applicable conditions for introducing practice/technology	The City will organize seminars to spread awareness of good solid waste management practices in which the private companies are required to attend as a pre-condition of the issuance of licenses.	The City will establish effective incentive systems to encourage the communities of companies to abide with the solid waste management practices and regulations.	The companies and its employees will be made aware of proper solid waste management practices.	This will ensure that solid waste management and environmental regulations are observed by the companies.

Source :Project Team

Based on the characteristics of LGUs, JET also compiled recommendations on the suitability of each technology and shared them with SG members at the SG meeting. For each of the three target LGU characteristics, JET examined the points to consider when applying each technology.

The common characteristics of the three target LGUs are that they are;

- cities with a population of about one million or more, and
- cities that were interested in WTE operation

The characteristics of each LGU should include the following considerations;

- Quezon City: Consists mostly of urban areas with very few rural areas.
- Davao City: Large area, mostly occupied by rural and forest areas. There is also agriculture and industry in urban areas.
- Cebu City: There are urban areas and rural/forest areas.

Shown are the example of the good examples and common features to note for LGUs.

Table 2.77 Example of the Case Studies and Common Features to Note for LGUs

1. Cost recovery of SWM: Charge on Waste	
Applicable sections of the case studies	1-1. Charge on a waste bag designated by local government 1-2. No Segregation –No Sticker -No Collection Policy 1-3. Volume-based Fee System Using Designated Waste Bags 1-8. Collection Fee for Tagged Sack of Waste
Technology features	There are many municipalities that use this system, including Japan and the Philippines. The purpose of introducing the system is not to collect fees, but rather to reduce waste.
Common features to note for LGUs	Costs of the waste bags will be an additional burden for the families and even greater burden for low-income families. Consultation on proper charging is necessary. Needs convincing and educating residents of the benefits of the system. Different types of waste bags were prepared to separate the proper waste to be brought to the WTE facility from other waste. Since there is a concern that free-riding and illegal dumping will occur, the fee should be an amount that takes into account the acceptability of residents. Need to consideration, such as free collection of recyclable materials.
2. Collection and transportation: Organic Waste Collection	
Applicable sections of the case studies	2-6. kitchen waste collection 2-7. Food Waste Truck Program 2-8. High-tech food waste recycling machines
Technology features	As this initiative is based on composting and reuse, methods to prevent other waste from entering the system should be considered. Business waste is easy to deal with because food waste is generated in large quantities.
Common features to note for LGUs	Since food waste is low in calories and prevents combustion in the WTE, should be considered ways to reuse it as much as possible.
3. Intermediate treatment/3R: Plastic as fuel (RPF)	
Applicable sections of the case studies	3-11. Refuse derived paper and plastics densified fuel
Technology features	Solidification of combustible wastes as fuel. In some cases, private companies have entered the recycling industry.
Common features to note for LGUs	It is a condition that combustible waste (plastic and paper waste) is brought in a segregated manner. It is necessary to secure a stable place to receive the products.
4. landfill: Proper Management Landfill	
Applicable sections of the case studies	4-1. Fences, retaining walls 4-2. Daily Soil Cover 4-3. Leachate Collection Pipes of Semi-aerobic landfill 4-4. Gas Ventilation System of Semi-aerobic landfill 4-5. Surface lining system 4-6. Holding basin and Regulating Pond for leachate 4-7. Leachate Treatment Facility
Technology features	All of these are basic technologies necessary for the proper management of landfill. Each municipality should set its own priorities and try to implement safe landfill management.
Common features to note for LGUs	Installation of fences and covering of soil is relatively easy to start. Separate the waste by characteristics, such as hazardous waste (medical waste).

5. Information, education and communication (IEC): Promotion of Segregation	
Applicable sections of the case studies	5-2. Leaflet explaining waste segregation 5-3. Application for waste segregation
Technology features	It is essential to create a collection calendar and inform residents of the items to be sorted and the collection date.
Common features to note for LGUs	Such as bottles and cans, which cannot receive at the WTE facility, municipality should hold explanatory meetings for residents and thoroughly inform them of the situation.
Points to note for each LGU	In Davao, at the grassroots cooperative project, a calendar of waste collection was prepared. Municipality will try to aware to residents until they understand the necessity of the activities.

Source :JICA Expert Team

Activities 4-5: Seminar for disseminating suggestion/recommendation is held

Details of this activity are described in Activity 1-3 of Output 1. This section describes the details regarding Output 4. The first seminar of this activity was held in June 2022, and the second seminar was held in September 2022.

In the first seminar, JET presented the recommendations on the use of waste management technology compiled in Activity 4-3 and 4-4, including actual photographs. Examples of the presentations are shown below.

Source :JICA Expert Team

Figure 2.46 Presentation on the Utilization of Technologies other than WTE at the 1st Dissemination Seminar

In the second dissemination seminar, Davao City and Cebu City made presentations on the adaptation of each technology studied in Activity 4-4. Participants from LGUs other than the targeted LGUs asked questions about the Davao and Cebu presentations. The presentations by both LGUs are shown below.

Source :Project Team

Figure 2.47 Presentation by the Target LGUs (left: Davao City, right: Cebu City)

As a result of the activities under Output 4, it was announced that a collection of case studies was compiled as a booklet with the cooperation of SG members. This is a result of the technical cooperation project and will continue to be used by people involved in SWM after the project is completed.

3. Measures, Issues, and Lesson Learned in the Project

The findings from the project implementation are summarized below according to the following definitions:

- Measures: actions taken during project implementation
- Issues: Difficulties in implementation. Things that could not be devised.
- Lessons learnt: to be applied to the future project implementation

(1) Waste to Energy (WTE)

1) Measures: Cooperation with the institution that supports LGUs (PPPC) for the introduction of WTE projects through PPP

While LGUs are responsible for waste management administration, the national government is responsible for ensuring a safe and comfortable life for its citizens, and the NSWMC, an autonomous government agency, is in a position to make policy decisions. Since the NSWMC is a committee and has no technical staff, the SWMD of the EMB serves as the Secretariat (Secretariat) and provides technical input. On the other hand, the EMB, as the policy-making body, has the function of regulating and is not allowed to promote any technologies. Therefore, it is difficult for the EMB to strongly promote the introduction of WTE-ACC projects in the Philippines.

The primary function of a WTE facility is the sanitary disposal of municipal solid waste, and it is reasonable that the NEC of the NSWMC and its Secretariat, the, provide the necessary technical assistance should the LGU choose to implement a WTE-ACC facility. WTE-ACC is defined as a form of renewable energy in the Philippines, and the government policy is to adopt PPP methods such as BOT to promote public infrastructure development by reducing the initial cost. With regard to PPP projects, PPPC provides support to municipalities with insufficient knowledge of the technical aspects of SWM. Therefore, in order to complement and create synergy between JET needs for knowledge on the policies of SWM-PPP projects of LGUs and more appropriate recognition of the system, and the PPPC's needs to complement its knowledge in the SWM sector, the collaboration between JET and PPPC in this TCP was highlighted and strengthened since February 2021.

2) Measures: Recommendations to the Sanitary Landfill Regulations to complete WTE project operations without environmental impact

WTE-ACC is an intermediate treatment technology that enables the sanitary treatment of several hundred tons/day or more of municipal solid waste in a short time without retention. At the same time, the generation of incineration fly ash and bottom ash as residues is inevitable. To complete sanitary waste management including WTE in the Philippines, it is necessary to look over the material flow of waste from generation to final disposal and make necessary improvements.

Final disposal facilities, in particular, remain a challenge for management practices in LGUs even in their current state. Since the characteristics of the waste to be finally disposed of may change significantly with the introduction of WTE, it was deemed necessary to review the existing relevant laws and regulations on final disposal and make necessary recommendations that will contribute to future revisions. Accordingly, this technical component was proposed in February 2021 as an activity of Output 2 and approved by the JCC.

3) Measures: Addition of relevant institution to ITWG subgroup (ex. EMB/HWMS)

In the absence of WTE facilities in the Philippines, the treatment and disposal of incinerator ash from these facilities is an unprecedented experience. In other countries where WTE has been implemented earlier, bottom ash is disposed of in sanitary landfills for municipal solid waste or reused as other materials. Under the current regulations in the Philippines, residues from WTE are not identified in a waste classification, and the disposal method must be confirmed after hazard determination on a case-by-case basis. This would require complicated procedures and cost burdens on the part of WTE facility operators and LGUs responsible for waste treatment.

For developing technical standards and treatment guidance in cooperation with HWMS of EMB, which is in charge of hazardous waste treatment was included as an additional sub-group member of Output 1. After exchanging information and opinions, in order to properly treat and dispose of WTE incineration ash without affecting the environment during the WTE operation phase, the HWMS participated in the activities of Output 1.

4) Issue : Impact of change of LGU Mayor on policy and 10-year plan of SWM

The duration of the TCP spanned three years and nine months. During that time, all three target LGUs experienced changes of mayors. The change of mayors in the Philippines will have a major impact on municipal administration, including waste management administration. The WTE project was no exception. In Quezon City no award of a bidder continued for more than two years. Cebu City canceled negotiations with a WTE proponent appointed by the former mayor. Such incidents could have a significant impact not only on the activities and decisions related to this TCP, but also on the continuity of the project and the waste management of LGU over the 20-year or longer project period if the WTE is formed as a PPP project.

Private companies investing in the WTE project evaluate the fact that political changes regarding the introduction of WTE are easily made the waste management administration in the Philippines is considered as a major risk. It is urgently needed to resolve the issues to achieve waste sanitation treatment through WTE projects in the Philippines.

5) Issue : Need for the National Government supports for LGUs (technical and financial aspects)

A properly operated WTE facility can typically expect to operate for 20 years or more. It may not be efficient for LGUs to retain experts and expertise in facilities procurement. On the other hand, in order for WTE projects to increase and for the national government to respond to requests for support from the LGUs to the national government and to serve in a position of guidance by the regulatory authorities, the national government needs to have sufficient knowledge of the facility development and operation and to provide technical guidance to LGUs and private companies.

On the other hand, the cost of waste disposal by WTE is certain to exceed the current cost. The cost of disposal will increase even in LGUs that have completed the sanitary waste flow, as well as in cases of improper disposal in the current situation.

This is true even in the case of leveling the cash flow of initial costs related to facility design and construction, which are concentrated over a period of about five years through PPP commercialization. Not only initial costs but also operating costs are certain to exceed current levels. Therefore, an appropriate financial support mechanism for LGUs by the national government is needed, as has been practiced in other countries such as Japan and Indonesia.

6) Issue : Supervision and guidance for proper disposal and recycling by DENR

It is understood that DENR/EMB is not in a position to promote specific technologies such as WTE. By the way, open dumping at disposal site is still operated in many LGUs¹⁸ and the situation is tacitly accepted.

From this operation, an unreasonably low cost of direct disposal is recognized as the baseline, so improper understanding of the appropriate burden of treatment costs associated with the introduction of WTE spreads in the country. The low treatment cost burden leads to lower business revenues and is a major factor in the difficulty of ensuring business profitability.

In addition, the Diversion Rate is an evaluation indicator of LGU's SWM 10-year plan. The difference between the estimated waste generation and the amount of waste collection and recycling is considered as self-disposal and private resource recovery (recycling). However, these are likely to include illegal dumping and uncollected waste. This may result in the overestimate of the Diversion rate in the plan.

DENR should encourage LGUs to practice proper disposal by sanitary landfill, which is a requirement of the current legal system, and to evaluate recovery/recycling (Diversion) rates appropriately based on correct definitions so that the benefits of introducing WTE technology will be properly evaluated, leading to a better business environment for WTE project.

7) Lesson learned: Projects stagnation through unsolicited approach (QC, CC)

Unsolicited PPP project formation may not proceed smoothly, as observed by the examples collected in the case studies for BAT/BEP guidelines.

WTE projects were discussed with the unsolicited proposals by the private proponents for Quezon City and Cebu City, two of three target LGUs. In both cases, the change of mayors affected the evaluation progress of the project proposals. In the case of Quezon City, the review of 3R policies, plastic sorting in the waste management policy after the change of mayor has resulted in the suspension of the evaluation of private proposals, which were underway just before the award by the city.

It is wondered what would have been the progress of the project if the position of WTE in the LGU's 10-year SWM plan and the amount of waste to be processed by WTE had been carefully examined in conjunction with the 3R policy before the proposal by the private proponent. Although difficult to evaluate it, a different outcome could have been achieved had a facility that matched the LGU's needs been identified and procured.

8) Lesson learned: Need for careful evaluation of business profitability and support system and mechanism for LGUs (DC)

Private companies will not participate in a project if they cannot earn a reasonable profit. When PPP is envisioned, project profitability should be carefully analyzed and evaluated. Given the financial capacity of LGUs, it is anticipated that financial support from donors and other foreign sources would be required to implement WTE projects. Note that in this case, the approval of the national government for the utilization of donor funds is also required.

The WTE project in Davao City, which is being carried out through a Japanese Grant Aid project, is a project based on the FS conducted by a Japanese company in 2015. At the time of the FS, a financial evaluation was conducted, assuming the application of the biomass FIT and taking into account the project income at the electricity sales price determined by FIT. However, the amount of electricity planned under the biomass FIT program had already been achieved and the FIT price was not applied in time, so the assumption of the financial evaluation was broken.

¹⁸ The number of illegal dumpsites is 353 in 2018. (National Solid Waste Management Status Report 2008-2018, DENR)

In another FS under the Grant Aid scheme that started in 2020, a business model that does not assume a biomass FIT was analyzed. A subsidy by the national government was proposed as a countermeasure by the FS. An application for financial assistance from Davao City to DENR was submitted, of which approximately 25% was approved by the Department of Finance in 2022. The timing of the start of the project is still unknown, as Davao City plans to start the project upon approval of the full amount that the city applied to the national government.

As confirmed in case of Davao City, it is not easy to ensure business profitability with acceptable waste disposal costs (T/F) by LGUs. While LGUs should first consider the appropriate burden of T/F, it is necessary to identify a central government agency that will take the initiative in considering measures to utilize WTE in the Philippines and to take measures to ensure the profitability of the project, such as financial mechanism by the national government.

(2) Solid Waste Management (SWM)

1) Issue : Strengthening mechanisms to support insufficient capacity (technical and financial capacity) of LGUs and barangays

According to RA 9003, the waste segregation by residents and the collection and transportation of separated biodegradable and recyclables are the responsibility of the barangays. Barangays are partially supported by LGUs due to insufficient technical and financial capacity. However, the capacity of LGUs is also limited. More than 20 years after RA 9003 was enacted, the challenges of segregation and separated waste collection and final disposal have not been achieved.

While the EMB and its regional offices operate and guide LGUs with the limited resources, technical and financial support is to be increased for further improvement in LGUs and this country.

2) Issue : Clarification of the role of the NSWMC and the function of the SWMD, which serves as the NSWMC Secretariat

The NSWMC, with SWM in its name, is an organization that is strongly expected by the public to play a role in the improvement of the sector. In this TCP, the NSWMC is positioned as the Cooperating Agency.

In reality, however, the committee is composed of a number of concerned national governments and private organizations, and the DENR-EMB/SWMD as the secretariat plays an important role in providing guidance and coordination to LGUs and other waste management-related organizations.

The NSWMC resolution stipulates that the BAT/BEP guidelines for WTE are to be developed by the NEC. However, the NEC only exists ad-hoc within the SWMD and does not function. There is no clear organization and responsibility to accumulate SWM technical know-how and provide guidance to LGUs for SWM improvement, including technical evaluation and guidance of WTE. For stable improvement of waste management step by step, it is necessary to clarify responsibilities to improve the current LGU status quo, which is struggling daily with SWM.

It was unfortunate that the NSWMC's involvement was very limited in this TCP, which envisaged the circumstances including related standards and manuals to develop WTE technology applications. Although some member agencies of the NSWMC participated in meetings of the sub-group, ITWG and JCC, they did not represent NSWMC. Because JET was invited by NSWMC to their meeting/event when they required JET's input to NSWMC.

3) Lesson learned: Promote sharing of SWM good practices in the Philippines

Output 4 activities collected good practices not only in foreign countries but also in the Philippines. There are examples of barangays and LGUs that are being creative with limited resources, which can be helpful

to other LGUs and barangays. The good practices compiled as a booklet will be shared on the EMB website, so that even remote LGUs will be able to refer to and access the examples in the Philippines. Actually, in addition to the targeted LGUs, other municipalities participated in the technology dissemination seminars conducted by the TCP. They have been aware of and know some good practices. It is expected that the regular LGU guidance provided by the EMB regional office will strengthen the network by exchanging information among LGUs and introducing case studies.

(3) Dioxins analysis

1) Issue : Continued capacity building on incomplete activities

The dioxin analysis activities in this TCP were affected by three main factors: 1) the busyness of ERLSD technical counterparts, 2) the Pandemic of COVID-19, and 3) the unexpected failure of the GC/HRMS owned by the DENR. As a result, the project was terminated with some activities being inadequately accomplished.

After the completion of the project period, it will be necessary for DENR/EMB to continue its dioxin analysis work and achieve its targets through Bureau-initiative. JET raised the issue of necessity to continue the activity in the third JCC meeting as well, which was described in chapter 6 of this PCR.

2) Measures: Identification of appropriate training needs based on gap analysis results (software operation capability enhancement)

The equipment of dioxins and furans analysis (GC/HRMS manufactured by JEOL) owned by DENR/EMB remains the only one in the Philippines as of the end of 2022. Although foreign and donor (Australian Government and WB) assistance was provided before the TCP implementation, no training specific to this equipment had been provided. A gap analysis conducted in the early stages of the TCP identified a low proficiency level in the equipment's software operation. JET stressed the need for training content on software operation. For this, an additional expert skilled in software operation was assigned to ensure adequate training.

3) Measures: Training to compensate for the lack of capacity of the local service provider

Through observation of the actual maintenance of GC/HRMS by ERLSD, the poor response and lack of capacity of the local service provider were confirmed. The late response to maintenance and repair requests from ERLSD, guidance on instrument maintenance that seems inappropriate judging from the analytical experience in Japan, and other factors that hinder the routine dioxin analysis work that ERLSD aims for.

For this reason, JET's training also included some of the content that ERLSD had requested to the local service provider so that analytical work could continue without relying on outsourcing services.

In the case of the GC/HRMS transfer line failure that happened in April 2022, it was determined that it would take at least three months for JOEL to repair the line through the local agent, resulting in a six-month delay in activities. After reporting to and consulting with JICA headquarter, JET arranged for the dispatch of a JEOL technician from Japan, thereby limiting the period of inactivity to approximately three months.

(4) Other (General)

1) Measures: Continuation of activities under the COVID-19 pandemic through web communication

The spread of COVID-19 (Pandemic), which started in Wuhan, China at the end of 2019 and continued to affect all over the world until the end of 2022, had a significant impact on the activities of the TCP, which is based on the principle of implementing activities through collaborative work between technical Philippine Counterparts and JET.

The March 2020 lockdown suspended JET's Japanese experts from working in the Philippines for two years (March 20, 2020 - March 2, 2022). After the lockdown, Philippine CPs were forced to conduct their work remotely from their homes and other locations, and discussions on the WTE project in the LGU were stalled for a long time. Nevertheless, to avoid a long period of stagnation in TCP activities, a web meeting was held with DENR-EMB on May 8, 2020 to discuss the continuation of future activities, and ITWG subgroup meetings (online) resumed the following month (June 2020). Thereafter, communication remained difficult, but by holding subgroup meetings, IWWG meetings, JCC meetings, etc., as appropriate, the project team made efforts to achieve outputs and project purpose in line with the project design.

4. Achievement of Project Purpose

(1) Outputs and indicators

1) Output 1: National government's capacity for supporting and coordinating of LGUs' WTE project is enhanced.

➤ Indicators

1-1. BAT/BEP guideline and Technical Standard for WTE facility (including Standard for O&M of WTE facility) is endorsed by the Project to DENR-EMB for adoption.	Achieved
1-2. Manual for planning, evaluation, formulation and Supervision of WTE project is endorsed by the Project to DENR-EMB for adoption	Achieved

➤ Observations

- ✧ The delayed appointment of the counterpart personnel and COVID-19 pandemic had caused the changes in the scheduled implementation of some activities which resulted in the revision of the plan of operation.
- ✧ The meeting agenda including technical presentations for subgroup meetings were initiated by JET during remote communication between the project team Members due to the COVID-19 Pandemic.
- ✧ The case study analysis for BAT/BEP guidelines were also drafted by JET with substantial inputs from DENR and sub-group members.
- ✧ The deliverables of the project such as the technical standards and the case study analysis for BAT/BEP guidelines, which have been approved by the ITWG and JCC and endorsed to DENR, would be beneficial as improvement of instructional capacity of the national government.
- ✧ It is also believed that the subgroup members obtained information and knowledge of WTE project and its facilities through discussion in the meeting.

2) Output 2: Target LGUs' capacity for Planning, Evaluation, Formulation and Supervision of WTE project is enhanced.

➤ Indicators

2-1. Updated 10-year SWM plan which reflected the waste volume reduction target and plan is approved by NSWMC in each Target LGU.	Partially achieved
2-2. Compiled experiences of target LGUs' WTE project in PPP scheme are reported to NSMWC.	Partially achieved

➤ Observations

- ✧ The restriction in providing information on WTE projects by the target LGUs was a barrier for achievement of the output.
- ✧ It is believed that the inputs by the project regarding the WTE project such as suggestions and recommendations must be helpful for LGUs' WTE project. However, the real WTE projects of LGUs were not discussed due to said restriction. So, the extent of capacity development of LGUs was limited.
- ✧ The WTE projects of LGUs were not progressed as assumed before the project. Accordingly,

the status of WTE projects of target LGUs were not appropriate to conduct some activities of the project such as “Activity 2-7. Preparation of technical specification of the WTE project”.

3) Output 3: National government’s capacity of environmental monitoring for WTE project is enhanced

➤ Indicators

3-1. Standard Operation Procedure (SOP) for monitoring, analyzing and QA/QC of Dioxins and Furans in ambient air and source emission gas is endorsed by the Project to DENR-EMB for adoption.	Partially achieved
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➤ Observations

- ✧ Since the COVID-19 pandemic, there was a period of sparse communication with JET, partly due to the urgent tasks assigned to ERLSD, and partly due to force majeure such as GC/HRMS malfunctions. During two years that JET was unable to enter the Philippines, ERLSD proceeded to renovate the EMB central office the laboratory based from the recommendations from JET. Since the resumption of JET visits to the ERLSD lab in March 2022, active communication resumed.
- ✧ JICA provided immediate support for the repair of GC/HRMS, which made possible to continue the remaining activities. Even so, the delay due to suspension of the analysis work affected the extent of activities completion such as activity3-5 and 3-6.
- ✧ The operational verification of the GC/HRMS was completed, which enabled to start activities to establish analytical methods through GC/HRMS measurements. The verification through the measurement of standard solutions preparation of the calibration curve and setting of the measurement conditions of the apparatus were completed too. Then, an analytical method through a series of validation experiments, including a sample pretreatment process, shall be established.
- ✧ ERLSD and AQMS have started discussions for actual sample measurement and have drawn up a sampling plan. Preparations for sampling have started as well. Once the analytical method is established, the measurement of actual samples shall be started accordingly.

4) Output 4: National Government’s and target LGUs’ capacity to identify issues and provide suggestion/recommendation for other SWM technologies than WTE is enhanced

➤ Indicators

4-1. Report of identified issues and recommendation/suggestion is prepared.	Achieved
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➤ Observations

- ✧ Activities 4-1, 4-2, 4-3 and 4-4 were implemented as scheduled.
- ✧ At activity 4-3, a lot of information of good practice and good technology was collected and compiled into a booklet. This booklet will be used as a reference by Philippines CP and LGUs for improving their SWM plan. At activity 4-4, for each technology, Davao City and Quezon City examined the impact and adaptability of implementing the technology in their own

LGUs. The personnel of LGUs were somehow capacitated on how to evaluate and try the SWM technologies for their solid waste management.

(2) Project Purpose and indicators

- Project purpose: National government and target LGUs' capacity for improving solid waste management utilizing WTE and other SWM technologies is enhanced.

➤ Indicators

1. Recommendations are made for the National SWM strategy (2023-28) based on the Project's output.	Achieved
2. Formulation of WTE project is promoted in target LGUs.	Partially Achieved
3. The dioxins analysis is periodically implemented.	Partially achieved

➤ Observations

- ✧ It is believed that the personnel of National government and target LGUs had opportunities to gain the knowledge of WTE and other SWM technologies to improve their SWM situation.
- ✧ Delays due to the pandemic of COVID-19 and change of the situation of LGU's WTE project caused incomplete achievement of the project output and activities such as Activity2-7, Activity3-6.

(3) History of PDM Modification

The Project Design Matrix (PDM) and Plan of Operation (PO) were updated in line with the various discussions on the draft ICR with the DENR, and the revised version of PDM was attached to the ICR. The order of the activities of Output 1 under the PDM (Version 1) was changed in chronological order without changing the overall goal, project purpose, as well as the project outputs, specific activities, and deliverables.

The updated PDM and PO (Version2), reflecting the reindorsements and addition of activities, and extension of the project period, was approved in the 1st JCC held in February 9, 2021.

(4) Environmental and Social Considerations

DENR-EMB issued the Memorandum Circular (MC) 2020 entitled "Clarifications on the requirements of Waste to Energy (WTE) Projects relative to ECC application pursuant to DAO2019-21" to instruct project proponents category of WTE projects that are subjected to EIS/IEE procedures.

5. Project Evaluation

The project evaluation by the six DAC criteria, namely relevance, consistency, effectiveness, efficiency, impact and sustainability, is described below. An evaluation of the project's risk management was conducted based on an analysis of the major factors that affected project implementation and the achievement of its results.

(1) Evaluation by Six DAC Criteria

1) Six DAC criteria

JICA consistently conducts its evaluations by applying the “Six DAC Evaluation Criteria”¹⁹ as an international perspective for ODA evaluation established by the Development Assistance Committee (DAC) of the Organization for Economic Co-operation and Development (OECD) and JICA’s own rating system.

Based on the revision of the DAC evaluation criteria in December 2019, JICA has revised its project evaluation criteria. (Source: Evaluation Department, JICA)

The result of evaluation for 6 criteria is classified in four ranks (and its score); Very high (Score 4), High (Score 3), Mostly achieved as planned (Score 2), and Low (Score 1). This is applied for this project.

Table 5.1 DAC Six Criteria in JICA cooperation

Criteria	Definition
Relevance	Validity with project implementation (development needs) Focus on “beneficiary”, Consideration for inclusiveness and equity Appropriateness of the project plan and logic of approach
Coherence	Consistency with development assistance policies of the Japanese Government and JICA Synergistic effect/mutual relations with JICA’s other projects (technical cooperation, loans, grant aid, etc.)
Effectiveness	The degree of achievement of target level in target year of expected project outcome (differential results across the group)
Impact	Positive and negative indirect and long-term effects (systems and norms, people’s well-being, human rights, gender equality, and the environment)
Efficiency	Comparisons of planned and actual projects inputs, project period, and project cost
Sustainability	Outlook on sustainability of effects that are realized by the project for aspects of policy/political, institutional/organizational, technical, financial, social & environment, risk, and operation & maintenance

Source: Evaluation Department, JICA

2) Relevance

The Philippines' development policy, development needs, and the Japanese government's assistance policy toward the Philippines have not changed since before the start of the project. Therefore, the relevance is "High". However, it was actually difficult for some institutions of the target groups to participate in the project activities.

¹⁹ The OECD DAC Network on Development Evaluation (EvalNet) has defined six evaluation criteria – relevance, coherence, effectiveness, efficiency, impact and sustainability – and two principles for their use. These criteria provide a normative framework used to determine the merit or worth of an intervention (policy, strategy, programme, project or activity). They serve as the basis upon which evaluative judgements are made.
<https://www.oecd.org/dac/evaluation/daccriteriaforevaluatingdevelopmentassistance.htm#:~:text=The%20OECD%20DAC%20Network%20on,two%20principles%20for%20their%20use.>

a. Development Policy of the Philippine

In the National Development Plan 2017-2022, approved in February 2017, waste management was identified as one of the priority goals, and the goal explicitly states that the challenges will be solved through the clustering of waste management and the introduction of technologies, including WTE. The National Waste Management Strategy (2017-2023) will also be revised in line with the policies of the National Development Plan. This project contributed to the application of WTE, which the Philippine government has identified as a new waste management issue in the National Development Plan and the National Waste Management Strategy.

b. Needs of CP institutions

The WTE guidelines were issued in June 2016 as NSWMC Resolution 669, and the DENR's Ministerial DAO was issued in November 2021 after the project started. The results of this TCP will be used to strengthen specific management and supervision methods for the execution of the DAO. On the other hand, the progress of WTE projects in the three target LGUs that were envisioned for collaboration in Output 2 activities has not progressed as expected. Although Quezon City has undergone a policy change that does not clarify its policy on WTE implementation, the other two cities have technical needs, and it is assumed that the results of the technical professional will be used.

On the other hand, the MOU between the three target LGUs and DENR, which was a basic condition for the start of the project, was not concluded even after the project started, which prevented JET from accessing the information on the WTE projects of LGUs and conducting collaborative work with LGUs personnel. In addition, there was a change of mayors in the target LGUs during the project period, resulting in a change of policy regarding WTE project. This change was recognized as a change in the important assumption of the project purpose given in the PDM, which affected the achievements of project activities and outputs.

Unfortunately, communication with the NSWMC, which was identified as a cooperating agency, was not many. Then, their participation in the project activities was very limited. It was necessary to confirm the role of the DENR/EMB in utilizing WTE and supporting LGUs to improve waste management because it is in charge of regulating SMW.

c. Japanese cooperation policy to the Philippines

The Joint Declaration and the "Action Plan for Strengthening the Strategic Partnership" adopted at the Japan-Philippines Meeting in June 2015 clearly stated that the two governments would promote the sharing of knowledge and experience in environmental fields, including waste management. Since then, the "Japan-Philippines Environmental Policy Dialogue" has been held every year, although interrupted by COVID-19, to exchange opinions on waste issues and raise issues related to waste power generation and other issues. The Ministry of Foreign Affairs, Japan continues its Japan Grant Aid in Davao City.

3) Coherence

There is a strong linkage with the ongoing projects of JICA and the Japanese government. Coherence is "Very high" as it also relates to donor projects underway in the Philippines.

a. JICA Grassroots Project to Davao City

Before the start of this TCP, Kitakyushu City, KITA, and IGES had been supporting Davao City through JICA grassroots project. The grassroots project provided guidance to Davao City on waste segregation and public awareness activities, etc. These support activities may be also useful in the operation of WTE.

b. Environmental policy dialogue between the Ministry of the Environment of Japan and DENR

In the environmental policy dialogue between the two governments, Quezon City, Davao City, and Cebu City were selected as priority LGUs, as was the case with this project. In conjunction with the environmental policy dialogue, workshops have been held in the three cities to discuss and exchange views with stakeholders on waste management, including WTE.

c. DENR and LGUs initiatives and support

Provision of Philippine counterpart funding in relation to the construction of the WTE facility.

4) Effectiveness

The effectiveness of the project is "Mostly achieved as planned" because some of the objectively verifiable indicators of the project purpose were not achieved within the project period.

The PDM logic is evaluated as having no big problems. However, the project purpose was partially achieved because the planned activities were not completed due to the following reasons;

a. Factors affecting the activity schedule

(i) More than 8 months from the start of the project to establish the JCC and appoint CP members

(ii) The global spread of COVID-19 caused site work to be halted for two years

(iii) Suspension of dioxins analysis activity due to malfunction of the GC/HRMS owned by DENR

b. the situation of the LGU's WTE projects was not an appropriate to implement some of the activities

c. The WTE project under the Japan Grant Aid for Davao City aimed at the same goal of improving waste management through the utilization of WTE as planned by the TCP. However, due to confidentiality obligations and the difficulty of sharing roles in both cooperation, synergies were limited.

5) Efficiency

Inputs to the project were properly utilized and project purpose are mostly achieved. Therefore the efficiency is "High" even there were the following circumstances:

a. The pandemic of COVID-19 forced remote work and communication. A decision was made to extend the project period by 9 months in February 2021. Then, the resumption of JET experts' work in the Philippines was delayed until March 2022, which affected the project operation.

b. National government officials, such as the EMB, were very busy and sometimes took a long time to respond to JET, or JETs took the initiative in making technical documents. Joint work with ownership of the Philippines CP personnel was difficult.

The knowledge and experience to be obtained from the LGUs' WTE projects as case studies could not be reflected in the National Government's regulations, etc. It was not possible for the target LGUs to actively participate in the project and to respond to the project timely due to unclear decisions on the WTE application to the cities.

6) Impact

The prospect of the Project' impact is "Mostly achieved as planned" because it highly depends on the continuation and strengthening of project activities after the project period.

To achieve the overall goals, it is necessary to utilize project outputs in LGUs, share knowledge and update project deliverables with relevant national and local government institutions, and maintain and strengthen the functions of the ITWG. (see "Ch.7 4. Recommendations for Achieving Overall Goal)

With regard to dioxin analysis, the continuation of uncompleted activities is a condition for achieving the overall goal. In addition, continued regular dioxin analysis and capacity development will enable the implementation of dioxin monitoring of emission sources other than WTE and the general environment, and the development of dioxin inventories and environmental standards are expected to be impact from the project.

7) Sustainability

Factors and scores by various aspects to evaluate the sustainability of DENR/EMB's knowledge and experience in WTE and dioxin analysis is shown in Table 5.2 and Table 5.3. The overall evaluation of sustainability is "Mostly achieved as planned" because more improvements were expected based on the anticipated capacity level.

- a. Since it was not able to sufficiently support the WTE project of 3LGUs as envisioned in the Outout2 activities, the knowledge and experience based on LGUs case studies obtained by DENR/EMB are insufficient. Further capacity development is needed to guide LGUs in utilizing the project deliverable. With regard to the promotion of WTE projects, the role of the EMB in WTE projects, which provides administrative guidance for waste management, needs to be clarified again in the event of future government decisions for which other government agencies (DOE, PPPC or others) will be responsible.
- b. Due to delays in the work process caused by COVID-19 and other factors, some of Output3 activities were not completed. For sustainable implementation of sampling from fixed emission sources and periodic monitoring at WTE facilities, the implementation plan should be developed and included in ERLSD's work plan.

Table 5.2 Aspects to Confirm the Sustainability (WTE/SWM)

Aspect	Factors of Sustainability	Score
Policy/Political	<ul style="list-style-type: none"> - Improvement of SWM is critical issue, WTE is an option to be introduced. - Renewable energy is promoted - WTE bills are being discussed 	3
Organization of the implementing agency	<ul style="list-style-type: none"> - Institution leading WTE should be clarified - Organization which can support technical aspects of SWM/WTE such as NEC is needed. 	2
Technical capacity of the implementing agency	<ul style="list-style-type: none"> - Technical capacity to support LGUs are insufficient because such activities were limited in the TCP - Experiences and lessons from LGU WTE projects shall be needed to improve the capacity 	2
Financial capacity of the implementing agency	<ul style="list-style-type: none"> - LGUs' financial capacity are weak so that the cost sharing/support by the NG is required as seen in the preceding countries 	2

Environmental and social consideration	<ul style="list-style-type: none"> - WTE-ACC facility has not been developed in the Philippines. - The project shall be carefully evaluated and managed to avoid social conflicts. 	2
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Source: JICA Expert Team

Table 5.3 Aspects to Confirm the Sustainability (Dioxin Analysis)

Aspect	Factors of Sustainability	Score
Policy/Political	<ul style="list-style-type: none"> - Monitoring of dioxin/furans is required and promoted 	3
Organization of the implementing agency	<ul style="list-style-type: none"> - ERLSD and AQMS are in charge. - Necessary human resources can be allocated. 	3
Technical capacity of the implementing agency	<ul style="list-style-type: none"> - Capacity of analysis methodology can be maintained. - Further improvements is required for the regular analysis and monitoring 	3
Financial capacity of the implementing agency	<ul style="list-style-type: none"> - Procurement of new equipment is being prepared. - Fund for consumables for analysis should be maintained. 	2
Environmental and social consideration	<ul style="list-style-type: none"> - Capacity of local service provider would be the key for sustainability 	2

Source: JICA Expert Team

(2) Key Factors Affecting Implementation and Outcomes

The main factors contributed to the effective and efficient implementation of the project are as follows;

1) Promote inter-agency collaboration and coordination

In conjunction with the establishment of the JCC in November 2019, an ITWG was formed with the participation of JCC member institutions. While the primary objective of the WTE facility and project is the sanitary treatment of waste, it also has the nature of energy policy and PPP promotion, etc. Therefore, a platform was created and utilized for information sharing and discussions by a number of related organizations to come together, which contributed to the promotion of understanding among the institutions concerned.

2) Utilize long-term experience of WTE operation in Japan

Japan's experience in using waste incineration methods for waste treatment since the 1950s -1960s was utilized in the preparation of technical standards, manual and other technical deliverables related to the WTE facility, and in providing technical guidance on dioxin analysis. Japan, as a preceding country in applying WTE, has overcome many difficulties in the preparation and operation of incineration and WTE-ACC, and has achieved a stable operational track record. Based on the extensive experience, it is expected that the technical cooperation deliverables prepared based on the Japanese regulations, and taking into account the requirements of the regulations of the Philippines, will be useful for the new application of WTE in the Philippines.

3) Active participation of ERLSD personnel and increase in human resource

EMB/ERLSD, responsible for environmental analysis, was the CP agency for dioxin analysis. ERLSD was extremely busy because it was responsible for routine analytical work for environmental monitoring other than dioxin analysis, as well as analytical work for plural projects, including the Manila Bay Remediation Project, which had been conducted concurrently since the project's inception. Nevertheless,

during JET expert stay in the Philippines, they took their time as much as possible to join the project activities with an eagerness to absorb new knowledge. However, after COVID-19 made it impossible to work face-to-face, it took sometimes a very long time to respond to e-mails and other correspondence, or there were no longer any replies, making it difficult to continue activities.

From early 2022, when the prospect of JET's resumption of site work in the Philippines became more promising, communication through monthly meetings resumed. After JET returned to the Philippines in March 2022, active participation and implementation in the activities were observed. In addition, training was effectively implemented because the laboratory improvements and arrangement of more personnel in charge were systematically implemented to implement dioxin analysis. Although some activities will not be completed due to delays in the schedule, ERLSD's efforts are greatly appreciated.

(3) Evaluation on the results of the Project Risk Management

The COVID-19 Pandemic since the end of 2019 posed a major risk to project implementation. The project team unavoidably tolerated the risk and continued to work online. The impact of the pandemic was protracted, and a decision was made to extend the project period in February 2021, approximately one year after the lockdown in the Philippines. The transition to on-site activities after the resumption of JET travel in March 2022 was relatively smooth because of the continuation of activities despite the low efficiency of implementing activities in online remote project implementation.

6. Recommendations for Achieving Overall Goal

(1) Prospects to achieve Overall Goal

By utilizing the technical documents by the project and continuing the activities of DENR and other related institutions, the overall goals can be achieved. However, since the formation and implementation of WTE projects in LGUs depend on the policy decisions of the LGUs, proper project formation is necessary to develop and operate WTE facilities in the Philippines. In addition, since it takes about 10 years to plan, design, construct and operate a WTE project, the post-evaluation phase does not anticipate the operation of new projects for which planning has not been completed at the end of the project.

Overall Goal	Objectively Verifiable Indicators
Improvement of Philippine SWM system through the adoption of WTE and other SWM technologies	<ol style="list-style-type: none"> 1) The outputs of the Project are utilized by more than one LGU. 2) Recommendation by the Project is reflected in the National SWM strategy (2023-28). 3) Result of dioxins analysis is reported in the annual report of EMB.

(2) Recommendations to achieve overall goal

The overall goal is achieved by satisfying the three evaluation indicators. The following are recommendations to meet each verifiable indicator.

1) Utilization of the technical deliverables for the WTE in LGUs

The feedback of findings through the formation of WTE projects in the target LGUs, which was envisioned in this TCP, could not be implemented due to various circumstances. In order to utilize the above-mentioned technical cooperation deliverables as better suited to the society of the Philippines, LGU support by national government agencies to obtain feedback and collaboration with LGUs are essential.

For this purpose, it is recommended that the ITWG formed for the implementation of this TCP maintain its function and use it as a platform for discussions among relevant national institutions and target LGUs on WTE project formation and its management. Although the NSWMC includes many of the member institutions of the ITWG, it does not include DOE and PPPC, which have an important role in the implementation of WTE projects in LGUs. It is necessary for the continuation of the project that the function of evaluation and advice on WTE project formation and proposals (referring and utilizing technical cooperation deliverables) be added and maintained in the ITWG, where discussed the progress of project activities and deliverables.

2) Reflect recommendations of the project in the National Waste Management Strategy (2023-28)

Input is needed from the implementing agency, DENR, into the NSWMC on the update of a national strategy with respect to the following recommendations from the project;

- i) Reflection in the national strategy of the following and other benefits of waste treatment by WTE
 - Sanitary waste treatment
 - Waste volume reduction in particular in metropolitan areas to extend the life of final disposal facilities and reduce final disposal capacity requirements

- Possible application of PPP scheme
- Effectiveness in combating plastic waste runoff
- ii) Reflection of conditions of WTE applicability
 - Conditions under which WTE can be applied, such as waste disposal scale, dominant technology, etc. (formulate BAT/BEP guidelines by utilizing information from case studies)
 - Appropriate amount of waste tipping fees
 - Waste management options in the cities where the above benefits (a) outweigh the cost burden

3) Publish the result of dioxins analysis in the annual report of EMB

- i) Continuation and accomplishment of incomplete project activities

Sampling and analysis of dioxins from the fixed emission sources, as well as the regular implementation of these tasks, was not accomplished in the project period. While the concept of the environmental monitoring plan was presented by JET, it is essential to put it into practice in monitoring for WTE or similar fixed sources for actual planning and monitoring operations.

- ii) Establishment and publication of annual plan for dioxin analysis project

On the assumption that dioxin analysis will be possible to be carried out stably, dioxins and furans shall be identified as regular parameters for the annual monitoring plan. Furthermore, it is necessary to establish a system to publicize the results.

- iii) Monitoring and publication of the monitoring results based on the above annual plan (Annual report)

Periodic dioxin analysis results shall be published in an annual report to enable the EMB as well as the public to understand how the data has changed over time.

(3) Recommendation on the Plan of the Philippines side to achieve overall goal

At the final JCC meeting, JET gave recommendations on the monitoring plan after the project period and the plan of operation to achieve the overall goal. It is expected that these recommendations would be helpful for DENR to prepare their sustainability plan for coming years.

1) Monitoring Plan from the end of the Project to Ex-post Evaluation

The recommended monitoring plan for continuation of the project outputs and its effect is shown in Table 6.1. In addition to formalization status of the deliverables by the project, follow up and discussion on the WTE projects which would be developed in the target LGUs as well as others are required. LGUs must need technical supports by the national governmental institutions and feedback from LGU's WTE projects would be useful for the national government to promote appropriate management of WTE in the Philippines. Follow-up activities are necessary for dioxin analysis capacity development as activity 3-4 and 3-6 were not achieved as expected within the project period.

Table 6.1 Monitoring Plan from the End of the Project to Ex-post Evaluation

Item	Frequency	In charge	Reporting	Target date
Output1				
Formalization of the BAT/BEP case study by DENR, PFEC manual	Monthly	EMB/ SWMD	ITWG meeting	March 2023
Formalization of the technical standards as JAO	Monthly	EMB/ SWMD	ITWG meeting	June 2023
Amend the annotated outline for 10-year SWM plan	Quarterly	EMB/ SWMD	NSWMC Exe-com	June 2023
Activation of NEC to technically support LGUs	Quarterly	SWMD	ITWG meeting	September 2023
Update DAO2013-22 for hazardous waste management	Quarterly	HWMS	EMB-EPTWG	December 2023
Update the regulation of sanitary landfill for MSW	Quarterly	SWMD/HWMS	EMB-EPTWG	December 2023
Output2				
Update 10-yr plan to include WTE project	N/A	Cebu City	NSWMC meeting	March 2023
Issue of PPP-SWMD guide	Quarterly	PPPC	ITWG meeting	June 2023
Confirm/discuss the WTE projects in LGUs	Quarterly	ITWG (lead by DOE, PPPC)	ITWG meeting	December 2025 (3yrs after the project)
Output3				
Follow up of Activity3-4 - Satisfying all the requirements for the initial performance test prescribed in the EPA method	Quarterly	ERLSD	Report from ERLSD	Mar. 2023
Follow up of Activity3-6 - Ambient air: Regular monitoring of dioxins and furans for 10 samples/month	Quarterly	AQMS and ERLSD	Analysis results	Sept. 2023 (can be started only after activity 3-4)
Follow up of Activity3-6 - Stack emission: Regular monitoring of dioxins and furans analysis at ERLSD at least 8 samples/year (factories with measurement obligation)	Quarterly	ERLSD	Analysis results	Sept. 2023 (can be started only after activity 3-4)
Output4				
Formalize and publish and upload the booklet of good practices of SWM technologies	Quarterly	EMB-EEIE	Upload and publish	Mar. 2023

Source: JICA Expert Team

2) Plan of Operation and Implementation Structure to achieve Overall Goal

As previously mentioned, it is expected that the ITWG would be maintained for sharing the information of the sustained activities of the project with the concerned institutions. It is better to clarify which institution would facilitate the application of WTE-ACC technologies for improvement of situation of SWM in this country. The recommended plan of operation is shown in Table 6.2.

Table 6.2 Plan of Operation to Achieve the Overall Goal

Item	In charge	Method	Target date
Before operation			
Preparation and finalization of the sustainability plan	EMB/ SWMD	Drafting and confirming the plan by ITWG	Feb. 2023
WTE/SMW			
1) Decision of the leading institution responsible for promotion of the WTE-ACC	ITWG	Discussion, or votes	Mar. 2023
2) Policy on the cost sharing, subsidy to WTE/WTF of LGUs	Institution decided in 1)	TBD	Dec. 2023
3) Technical support to evaluate the WTE-ACC projects of LGUs (Solicited approach)	PPPC, DOE	Technical support	Mar. 2023 - Dec. 2025
4) Organize/activate the NEC (National Ecology Center) or alternate organization to technically support LGUs	NSWMC or ITWG	DENR Special Order	Dec. 2023
5) Technical support to evaluate the WTE-ACC projects of LGUs (Solicited approach)	Organization decided in 4)	Technical support	Dec. 2025
6) Compile lessons from technical supports to LGUs conducted by 3) and 5)	EMB/SWMD, DOE, PPPC, DOST	Monitor and evaluate result of Item3) and 5)	June 2025
7) Update the technical deliverables of the TCPs based on the experiences of WTE in the target LGUs	EMB/SWMD		Dec. 2025
Dioxin analysis			
1) Formulate the annual plan of dioxins and furans monitoring for ambient air	AQMS, ERLSD	Planning and authorizing in EMB	Jan. 2025
2) Prepare and publish the annual report of dioxins and furans monitoring for ambient air	AQMS, ERLSD	Publish	2026 (as part of EMB annual report)
3) Receiving the self-monitoring reports including dioxins and furans analyzed at ERLSD from the factories	AQMS	Receiving the self-monitoring reports	Mar. 2024 (as a part of self-monitoring report)

Source: JICA Expert Team