MJTD

Thilawa Special Economic Zone (Zone B) Development

Environmental Monitoring Report Phase-3 (Construction Phase)

Myanmar Japan Thilawa Development Limited.

March 2020

CONTENTS

Appendix

1. Executive Summary

The environmental inspection and compliance monitoring program will be implemented under the direction of Ministry of Natural Resources and Environmental Conservation (MONREC) with oversight by Thilawa SEZ Management Committee.

The monitoring record from December 2019 to February 2020 according to the Environment Monitoring Plan is submitted in conformity with the provision of Chapter 10, 10.1 Table 10.1-2 and 10.2, Table 10.2-2 Content of the EIA Report of Thilawa SEZ Development Project (Zone B).

2. Summary of Monitoring Activities

a) Progress made to date on the implementation of the EMP against the submitted implementation schedule;

We submitted EMP for TSEZ Zone-B as following table.

Report No.	Description	Phase	Submission
1	Environmental Monitoring Report	Phase-1 Pre-construction Phase	March, 2017
2	Environmental Monitoring Report	Phase-1 Construction Phase	June, 2017
3	Environmental Monitoring Report	Phase-1 Construction Phase	September, 2017
4	Environmental Monitoring Report	Phase-1 Construction Phase	December, 2017
5	Environmental Monitoring Report	Phase-2 Pre-construction Phase	December, 2017
6	Environmental Monitoring Report	Phase-1&2 Construction Phase	March, 2018
7	Environmental Monitoring Report	Phase-1&2 Construction Phase	June, 2018
8	Environmental Monitoring Report	Phase-1&2 Construction Phase	September, 2018
9	Environmental Monitoring Report	Phase-3 Pre-construction Phase	December, 2018
10	Environmental Monitoring Report	Phase-2&3 Construction Phase	March, 2019
11	Environmental Monitoring Report	Phase-2&3 Construction Phase	June, 2019
12	Environmental Monitoring Report	Phase-2&3 Construction Phase	September, 2019
13	Environmental Monitoring Report	Phase- 3 Construction Phase	December, 2019
14	Environmental Monitoring Report	Phase- 3 Construction Phase	March, 2020

Report (No.14 is submitted this day attached with Construction Phase implementation schedule. Subsequent Construction Phase reports will be submitted on Quarterly.

b) Difficulties encountered in implementing of the EMP and recommendations for remedying those difficulties and steps proposed to prevent or avoid similar future difficulties;

None

c) Number and type of non-compliance with the EMP and proposed remedial measures and timelines for completion of remediation;

- Depend on the exceeding parameters and situation

d) Accidents or incidents relating to the occupational and community health and safety, and the environment:

Neither accidents nor incidents happen during this monitoring period.

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e) **Monitoring data on environmental parameters and conditions as committed in the EMP or otherwise required.**

Please refer to the attached Environmental Monitoring Form.

3. Construction Progress

Thilawa SEZ Zone B Development Project construction activities is submitted enclosed with monthly progress reports from contractor in Appendix E to G.

E. Monthly Progress Report for December, 2019

F. Monthly Progress Report for January, 2020

G. Monthly Progress Report for February, 2020

4. Monitoring Result

Environmental Monitoring Plan report for construction phase implemented according to the following table, reference on Table 10.2-2, Chapter 10, EIA for Industrial Area of Zone-B.

Monitoring Plan (Construction Phase)

Category	Item	Location	Frequency	Remark
Air Quality	NO_2, SO_2, CO, $PM_{2.5}$, PM_{10}	Construction site (1 point)	Once/ 3month	December 2019, Air Quality Monitoring Report
Water Quality	Water temperature, pH, SS, DO, BOD_5, COD, coliforms, oil and grease, chromium	· Over flow of construction site to the creek (at least 3 sampling points/ mixing point: i) discharge water, ii) upstream water and iii) downstream water · Well near the construction site (1 point)	Once/ 2 month	December 2019 Water and Wastewater Quality Monitoring Report
Waste	Amount and kind of solid waste	Construction site	Once/ 3 month	Monthly Progress Reports (December 2019, January, February 2020)
Noise and Vibration	· Noise and vibration level · Traffic Count	Preservation area such as residence around the proposed construction site (at least 1 point)	Once/ 3 month (peak period)	Noise and Vibration Monitoring Report December 2019 Traffic Count Monitoring Report December 2019
		Preservation site such as residence along the route for on-site vehicles (1 point for noise and vibration and 2 points for traffic count)		
Ground Subsidence	· Ground water level · Ground elevation level · Consumption of ground water amount	Representative (1 point)	Every week	Monthly Progress Reports (December 2019, January, February 2020)
Hydrology				
Risk for infectious disease such as AIDS/HIV	Status of measures of infectious disease	Construction site	Once/month	Monthly Progress Reports (December 2019, January, February 2020)

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Category	Item	Location	Frequency	Remark
Working conditions (including occupational safety)	Prehension of condition of occupational safety and health Prehension of infectious disease	Construction site	Once/ month	
Accident	Existence of accident	Construction site	As occasion arise	

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Thilawa Special Economic Zone (Zone B)

Development Project –Phase 3

Environment Monitoring Form

Environment Monitoring Form

The latest results of the below monitoring items shall be submitted to Authorities on once at Pre-Construction Phase and on quarterly basis at Construction Phase, and on bi-annually base at Operation Phase. The items, standards to be applied, measurement points, and frequency for each monitoring parameter are established based on the EIA Report for Thilawa Special Economic Zone Development Project (Industrial Area of Zone B). Should there be any changes to the original plan, such change shall be reviewed and evaluated by environmental expert.

(1) General

1) Phase of the Project

- Please mark the current phase.

☐ Pre-Construction Phase ☑ Construction Phase ☐ Operation Phase

2) Obtainment of Environmental Permits

Name of permits	Expected issuance date	Actual issuance date	Concerned authority	Remarks (Conditions, etc.)
Approved letter for Environmental Impact Assessment (EIA) Report of Industrial Area, Thilawa Special Economic Zone (Zone-B)		29th December 2016	Thilawa SEZ Management Committee	
Notification of the comments of Ministry of Natural Resources and Environmental Conservation regarding with the Standard Change of Wastewater Quality of Industrial Zone, Internal Regulations of Thilawa SEZ Zone-A and Zone-B	5th January 2018	10th January 2018	Thilawa SEZ Management Committee	

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3) Response/Actions to Comments and Guidance from Government Authorities and the Public

Monitoring Item	Monitoring Results during Report Period	Duration of Report Period	Frequency
Number and contents of formal comments made by the public			Upon receipt of comments/ complaints
Number and contents of responses from Government agencies			

(2) Monitoring Results

1) Ambient Air Quality (December 2019)

NO_2, SO_2, CO, $PM_{2.5}$, PM_{10}

Location	Item	Unit	Measured Value (Mean)	Measured Value (Max)	Country's Standard	Target value to be applied*1	Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
AQ-1	NO_2	mg/m³	0.072	0.175	0.2 mg/m³ (1 Hour)	0.1 mg/m³ (24 Hour)	-	One time / 3 months	Haz-Scanner EPAS	Refer to air quality report
	SO_2*2	mg/m³	0.088	0.0487	0.02 mg/m³ (24 Hours)	0.02 mg/m³ (24 Hours)	-			
	CO	mg/m³	0.336	1.130	-	10.26 mg/m³ (24 Hours)	-			
	PM2.5*3	mg/m³	0.091	0.256	0.025 mg/m³ (24 Hours)	0.025 mg/m³ (24 Hours)	-			
	PM10*3	mg/m³	0.123	0.385	0.05 mg/m³ (24 Hours)	0.05 mg/m³ (24 Hours)	-			

*1**Remarks:** Referred to the tentative target value of ambient air quality (EIA Report for industrial area, Table 2.4-1), Reference to the air quality monitoring report (December 2019)

[2]**Remarks:** The result of SO2 in AQ1 is excess than target value due to four expected reasons i) combustion of fuel from nearby roads ii) operation activities of Myanmar International Terminals Thilawa Port iii) operation activities of local industrial zone iv) construction activities of Zone-B.

[3]Remarks: The results of PM2.5 and PM10 are excess than target value due to three expected reasons i) natural origin such as dust from unpaved land area from outside of Zone-B ii) Transportation in and around the monitoring area iii) construction activities of Zone-B.

Complaints from Residents

- Are there any complaints from residents regarding air quality in this monitoring period? ☐ Yes ☑ No
If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Complaints from Residents	Countermeasures

2) (b) Water Quality – December 2019

Measurement Point: Effluent of Wastewater (SW-2 and SW-4 are attached as reference point only and they are natural creek water which are combine all the wastewater from the Local industrial water and domestic water from existing living environment. SW-7 is the main discharging point. GW-2 is also as reference point for monitoring of existing tube well located in the Monastery Compound near Zone-B area)

- Are there any effluents to water body in this monitoring period? ☐ Yes, ☑ No
If yes, please attach "Analysis Record" and fill in the items not to comply with Refereed International Standard

Location	Item	Unit	Measured Value (Max)	Country's Standard*2	Target value to be applied*1	Frequ-ency	Method	Note (Reason of excess of the standard)
SW-2 (reference point)	Temperature	°C	27	< 3 (increase)	≤ 35	Once per 2 months	Instrument Analysis Method	Refer to water quality report
	pH	-	7.7	6-9	6.0 - 9.0		Instrument Analysis Method	
	SS	mg/L	20	50	50		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	3.4	-	-		Instrument Analysis Method	
	BOD_5	mg/L	9.42	50	30		APHA 5210 B (5days BOD Test)	
	COD_{Cr}	mg/L	31.2	250	125		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform*4	MPN/100 ml	35,000	400	400		APHA 9221 B (Standard Total Coliform Fermentation Technique)	
	Oil and Grease		<3.1	10	10		APHA 5520 B (partition Gravimetric Method)	
	Chromium	mg/L	≤0.002	0.5	0.5		APHA (Inductively Coupled Plasma (ICP) Method)	
	Total Dissolved solids (TDS) *6	mg/L	202	-	2000		APHA 2540C (Total Dissolved Solids Dried at 180.C)	
	Iron*6	mg/L	1.688	3.5	3.5		APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	
	Mercury*6	mg/L	≤ 0.002	0.01	0.005		APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	
SW-4 (reference point)	Temperature	°C	27	< 3 (increase)	≤ 35	Once per 2 months	Instrument Analysis Method	
	pH	-	8.1	6-9	6.0 - 9.0		Instrument Analysis Method	
	SS*3	mg/L	382	50	50		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	5.85	-	-		Instrument Analysis Method	

Location	Item	Unit	Measured Value (Max)	Country's Standard*2	Target value to be applied*1	Frequ-ency	Method	Note (Reason of excess of the standard)
	BOD_5	mg/L	4.86	50	30		APHA 5210 B (5days BOD Test)	
	COD_{Cr}	mg/L	5.4	250	125		APHA 5220 D (Close Reflux Colorimetric Method)	Refer to water quality report
	Total Coliform*4	MPN/100 ml	24000	400	400		APHA 9221 B (Standard Total Coliform Fermentation Technique)	
	Oil and Grease	mg/L	<3.1	10	10		APHA 5520 B (partition Gravimetric Method)	
	Chromium	mg/L	0.044	0.5	0.5		APHA (Inductively Coupled Plasma (ICP) Method)	
	Total Dissolved solids (TDS)*6, *3	mg/L	2036	-	2000		APHA 2540C (Total Dissolved Solids Dried at 180.C)	
	Iron*5, *6	mg/L	25.840	3.5	3.5		APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	
	Mercury*6	mg/L	≤ 0.002	0.01	0.005		APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	
	Temperature	°C	31	< 3 (increase)	≤ 35		Instrument Analysis Method	
	pH	-	8.6	6-9	6.0 – 9.0		Instrument Analysis Method	
	SS	mg/L	28	50	50		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	6.33	-	-		Instrument Analysis Method	Refer to water quality report
	BOD_5	mg/L	2.66	50	30	Once per 2 months	APHA 5210 B (5days BOD Test)	
SW-7 (Discharged Point)	COD_{Cr}	mg/L	18.5	250	125		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform	MPN/100 ml	79	400	400		APHA 9221 B (Standard Total Coliform Fermentation Technique)	
	Oil and Grease	mg/L	< 3.1	10	10		APHA 5520 B (partition Gravimetric Method)	

Location	Item	Unit	Measured Value (Max)	Country's Standard*2	Target value to be applied*1	Frequ-ency	Method	Note (Reason of excess of the standard)
	Chromium	mg/L	≤0.002	0.5	0.5		APHA (Inductively Coupled Plasma (ICP) Method)	
	Total Dissolved solids (TDS) *6	mg/L	650	-	2000		APHA 2540C (Total Dissolved Solids Dried at 180.C)	
	Iron*6	mg/L	1.828	3.5	3.5		APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	
	Mercury*6	mg/L	≤ 0.002	0.01	0.005		APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	
GW-2 (reference point)	Temperature	°C	30	< 3 (increase)	≤ 35	Once per 2 months	Instrument Analysis Method	Refer to water quality report
	pH	-	7.4	6-9	6.0 – 9.0		Instrument Analysis Method	
	SS	mg/L	6.00	50	50		APHA 2540D (Dry at 103-105°C Method)	
	DO	mg/L	8.06	-	-		Instrument Analysis Method	
	BOD_5	mg/L	0.78	50	30		APHA 5210 B (5days BOD Test)	
	COD_{Cr}	mg/L	< 0.7	250	125		APHA 5220 D (Close Reflux Colorimetric Method)	
	Total Coliform	MPN/100 ml	13	400	400		APHA 9221 B (Standard Total Coliform Fermentation Technique)	
	Oil and Grease	mg/L	< 3.1	10	10		APHA 5520 B (partition Gravimetric Method)	
	Chromium	mg/L	≤0.002	0.5	0.5		APHA (Inductively Coupled Plasma (ICP) Method)	
	Total Dissolved solids (TDS) *6	mg/L	140	-	2000		APHA 2540C (Total Dissolved Solids Dried at 180.C)	
	Iron*7,*6	mg/L	5.340	3.5	3.5		APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	
	Mercury*6	mg/L	≤ 0.002	0.01	0.005		APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	

*[1]Remark: Reference to the Water and Wastewater Quality Monitoring Report (December 2019)

*[2]Remark: Referred to the National Emission Quality Guideline (NEQG) 29th December 2015

*[3]Remark: For the monitoring point of SW-4, the result of SS exceeded than the target value due to three expected reasons i) delivered from upstream area such as natural origin and wastewater from local industrial zone outside of Thilawa SEZ, and ii) influence by water from the downstream due to flow back by tidal fluctuation iii) surface water run-off from bare land in Zone B.

*[4]Remark: For the monitoring point of SW2 and SW-4, the result of total coliform exceeded than the target value due to three expected reasons i) natural bacteria existed in discharged creek because there are various kinds of vegetation of creature such as birds, and small animals in and along the discharged creek and retention pond ii) wastewater from the local industrial zone outside of Thilawa SEZ and iii) delivered from surrounding area by tidal effect. Total coliforms do not affect human health directly, self-monitoring was carried out to identify health impact by coliform bacteria. As for the result of E-Coli SW-7 was 5.5. It is considered that there is no significant impact to human health.

*[5] Remark: For the monitoring point of SW-4, the result of iron exceeded than the target value due to the influence of natural origin i) iron is used as a construction material and in the rainy season the water run-off from the construction sites may contain iron particles ii) influence of natural origin (iron can reach out from soil by run-off)

*[6] Remark: Recommendation from JICA Environmental expert (TSMC) , to be more emphasized on Environmental and analyzing only.

*[7] Remark: For the monitoring point of GW-2, the results of iron exceeded due to expected reason i) it may be due to corrosion of pipe because the water is pumped through the iron pipelines buried underneath the ground.

3) Soil Contamination (only operation phase)

Situations environmental report from tenants

- **Are there any serious issues regarding soil contamination in this monitoring period?** ☐ Yes, ☑ No

If yes please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Issues on Soil Contamination	Countermeasures

Remark: Soil contamination survey will be done after the whole Zone-B is operation stage.

4) Noise Level (December 2019)

Location	Item	Unit	Measured Value (Mean)	Measured Value (Max)	Country's Standard	Target value to be applied*	Referred International Standard	Frequency	Method	Note (Reason of excess of the standard)
Residential Area NV-2	Leq (day)	dB(A)	52	56	Refer to NEQG Article 1.3	75	Refer the section 2.4 in EIA main report	One time / 3 months		
	Leq (evening)	dB(A)	51	53		60				
	Leq(night)	dB(A)	55	57		55				
Along the road (NV-1)	Leq (day)	dB(A)	65	64		75				
	Leq(night)	dB(A)	54	64		70				

***Remarks:** Referred to the tentative target value of ambient air quality (EIA Report for industrial area, Table 2.4-8), Reference to the noise and vibration monitoring report (December 2019)

Complaints from Residents

- Are there any complaints from residents regarding noise in this monitoring period? ☐ Yes, ☑ No
  If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Complaints from Residents	Countermeasures

5) Solid Waste

Measurement Point: Construction Site (Construction Phase), Storage for Sludge (Operation Phase)

Are there any wastes if sludge in this monitoring period? ☑ Yes, ☐ No

If yes, please report the amount of sludge and fill in the results of solid waste management activities.

Item	Date	Generated from	Unit	Value	Solid Waste Management Activities
Amount of Sludge	12-Dec-2019	Construction Waste	Loads	3	Waste disposing to authorized waste collector (YCDC)
Amount of Sludge	7-Jan-2020	Construction Waste	Loads	3	Waste disposing to authorized waste collector (YCDC)
Amount of Sludge	30-Jan-2020	Construction Waste	Loads	3	Waste disposing to authorized waste collector (YCDC)
Amount of Sludge	3-Feb-2020	Construction Waste	Loads	2	Waste disposing to authorized waste collector (YCDC)

6) (a) Ground Subsidence Hydrology

Duration (Week)	Water Consumption		Ground Level		Note
	Quantity	Unit	Quantity	Unit	
5- December -2019	150	m^3/ week	+ 6.297	m	
12- December -2019	148	m^3/ week	+ 6.299	m	
19- December -2019	198	m^3/ week	+ 6.300	m	
26- December -2019	186	m^3/ week	+ 6.301	m	

Remarks: Reference to Monthly Progress Report (December-2019)

6) (b) Ground Subsidence Hydrology

Duration (Week)	Water Consumption		Ground Level		Note
	Quantity	Unit	Quantity	Unit	
2- January -2020	186	m^3/ week	+ 6.300	m	
9- January -2020	220	m^3/ week	+ 6.301	m	
16- January -2020	195	m^3/ week	+ 6.299	m	
23- January -2020	179	m^3/ week	+ 6.297	m	

30- January -2020	214	m^3/ week	+ 6.298	m	

Remarks: Reference to Monthly Progress Report January-2020)

6) (c) Ground Subsidence Hydrology

Duration (Week)	Water Consumption		Ground Level		Note
	Quantity	Unit	Quantity	Unit	
6- February -2020	198	m^3/ week	+ 6.298	m	
13- February -2020	182	m^3/ week	+ 6.300	m	
20- February -2020	225	m^3/ week	+ 6.301	m	
27- February -2020	172	m^3/ week	+ 6.299	m	

Remarks: Reference to Monthly Progress Report (February-2020)

7) Offensive Odor (only operation phase)

Complaints from Residents

- Are there any complaints from residents regarding offensive odor in this monitoring period? ☐ Yes, ☑ No
  If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Complaints from Residents	Countermeasures

Situations environmental report from tenants

- Are there any serious issues regarding offensive odor in this monitoring period? ☐ Yes, ☑ No
  If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Issues on Soil Contamination	Countermeasures

8) Infectious disease, Working Environment, Accident

Information from contractor (construction phase) or tenants (operation phase)

- Are there any incidents regarding infectious disease, Working Environment, Accident in this monitoring period? ☐ Yes, ☑ No

If yes, please describe the contents of complains and its countermeasures to fill in below the table.

Contents of Incidents	Countermeasures

Note: If emergency incidents are occurred, the information shall be reported to the relevant organizations and authorities immediately.

9) Resettlement Works for Project Affected Persons (PAPs) and Common Assets

Information from TSMC

- Please describe the progress and remarkable issues (if any) to fill in below the table.

Resentment Works		Progress in Narrative	Remarkable Issues
Projected Affected Persons	Land Acquisition and Relocation	1) The number of PAHs who received land compensation, crop compensation and relocated is one. 2) The number of PAHs who received land compensation is one. 3) The number of PAHs who received crop compensation and relocated is two. 4) The number of PAHs who received crop compensation is one. The number of PAHs who relocated is	

		eight.	
	Income Restoration Program	1) Supporting rice and cooking oil to PAPs for Valuable People Program in Zone B and Phase 3 for every month 2) Community Center Construction was started in Jan'20 for Zone B PAPs Providing electricity charges for streetlight and trash cleaning charges for Zone B PAPs every month	
Common Assets	Relocation		

- **Are there any grievances submitted, solved and pending regarding resettlement works?** ■ Yes, □ No
  If yes, please describe the contents of grievances to fill in below the table.

Contents of Grievance	Response/ Countermeasures
There was 7 grievance received during December 2019 to February 2020. These complains are about "Labor" and "Environment" issue.	Among them, 2 grievance is Under investigation ·On Track and 5 Grievance have been resolved.

10) CSR activities such as Community Support Program

- **Are there any CSR activities implemented in this monitoring period?** ■ Yes, □ No

If yes, please describe the outline of CSR activities implemented to fill in below the table.

Date	Activities	Description (Location, Participant etc)
December 2019	Monthly Scholarship Support	15 high school students in Kyaut Tan and Thanlyin Township
	Closing of Japanese Language Class	Fuji Work Myanmar Company Limited
	Educational Supportive Class for state school student	Aye Mya Thida School
	Awareness Seminar on Narcotics	Aye Mya Thida School
	Myanmar Meets Japan Young Musicians Collaborative Workshop and Concert	Fuji Work Myanmar Company Limited
January 2020	Monthly Scholarship Support	15 high school students in Kyaut Tan and Thanlyin Township
	1st Thilawa Community Coordination Meeting	MJTD multipurpose hall
	Excursion trip of scholarship support	Downtown
February 2020	Monthly Scholarship Support	15 high students in Kyauk Tan and Thanlyin Township
	Educational Supportive Class for state school student	Aye Mya Thida School
	Factory visit program for university students	MJTD-WPP,STP, Alidac Healthcare, Kubota, Suzuki Thilawa Myanmar, Yakult

End of Document

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED MJTD

Thilawa Special Economic Zone (Zone B)

Development Project –Phase 3

Appendix-A

Water and Waste Water Monitoring Report

December 2019

WATER QUALITY MONITORING REPORT

FOR DEVELOPMENT OF INDUSTRIAL AREA

IN THILAWA SEZ ZONE B

(PHASE 3 CONSTRUCTION STAGE)

(Bi-Monthly Monitoring)

December 2019

Myanmar Koei International Ltd.

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CHAPTER 1: INTRODUCTION

1.1 General

Thilawa Special Economic Zone (SEZ) is located in southern district of Yangon region and about 23 km southeast of Yangon city. As the developer of Thilawa SEZ, Myanmar Japan Thilawa Development Ltd. (MJTD) has a responsibility to carry out regular monitoring in the industrial area of Zone B in accordance with the approved Environmental Impact Assessment (EIA) report and Environmental Management Plan (EMP). MJTD has implemented monitoring various environmental items with the specified time frame to know the environmental conditions in and around the area. As for the monitoring of the water quality, total four sampling points are set for water quality survey, named SW-2, SW-4, SW-7, and GW-2 have been monitored in Thilawa SEZ and its surrounding area in timely manner. Among the four locations, SW-7 is main discharged point of Zone B during the construction stage. Moreover, GW-2 is monitored as a reference of existing tube well which located in the monastery compound of Phalan village. Location of sampling points for water quality monitoring is shown in Figure 1.1-1.

Figure 1.1-1 Location of Sampling Points of Water Quality Monitoring

CHAPTER 2: WATER QUALITY MONITORING

2.1 Monitoring Items

Sampling points and parameters for water quality monitoring are determined to cover the environmental monitoring plan of the EIA report.

Water quality sampling was carried out at four locations. Among the four locations, water flow measurement was carried out at two locations (SW-4 and SW-7) where can be measured by current meter. Monitoring items and sampling points are summarized in Table 2.1-1.

Table 2.1-1 Monitoring Items for Water Quality

No.	Parameters	SW-2	SW-4	SW-7	GW-2	Remarks
1	Water Temperature	○	○	○	○	On-site measurement
2	pH	○	○	○	○	On-site measurement
3	DO	○	○	○	○	On-site measurement
4	$BOD_{(5)}$	○	○	○	○	Laboratory analysis
5	$COD_{(Cr)}$	○	○	○	○	Laboratory analysis
6	Suspended Solids	○	○	○	○	Laboratory analysis
7	Total Coliform	○	○	○	○	Laboratory analysis
8	Oil and Grease	○	○	○	○	Laboratory analysis
9	Chromium	○	○	○	○	Laboratory analysis
10	Total Dissolved solids (TDS) (Self-monitoring)	○	○	○	○	Laboratory analysis
11	Iron (Self-monitoring)	○	○	○	○	Laboratory analysis
12	Mercury (Self-monitoring)	○	○	○	○	Laboratory analysis
13	Escherichia Coli (Self-monitoring)	○	○	○	○	Laboratory analysis
14	Flow Rate	-	○	○	-	On-site measurement

Source: Myanmar Koei International Ltd.

2.2 Description of Sampling Points

The outline of sampling points is mentioned in Table 2.2-1. The photos of conducting field survey at each sampling points are mentioned in Appendix-1.

Table 2.2-1 Outline of Sampling Points

No.	Station	Detailed Information
1	SW-2	**Coordinate**- N - 16° 40' 20.69", E - 96° 17' 18.04"
		Location - Upstream of Shwe Pyauk Creek
		Survey Item - Surface water sampling
2	SW-4	**Coordinate**- N - 16° 39' 42.84", E - 96° 16' 27.42"
		Location - Downstream of Shwe Pyauk Creek
		Survey Item - Surface water sampling and water flow rate measurement
3	SW-7	**Coordinate** - N - 16° 40' 13.25", E - 96° 17' 5.66"
		Location – Outlet of retention pond of Zone B construction site before connecting to Shwe Pyauk Creek
		Survey Item - Discharge water sampling and water flow rate measurement
4	GW-2	**Coordinate** - N - 16° 39' 25.30", E - 96° 17' 15.60"
		Location - In the monastery compound of Phalan village
		Survey Item - Ground water sampling

Source: Myanmar Koei International Ltd.

SW-2 (Reference Point)

SW-2 was collected at the upstream of Shwe Pyauk creek. This sampling point is located at the northeast of Zone B area and at the south of Dagon-Thilawa road. The surrounding areas are Zone A in the northwest and local industrial zone in the east respectively.

SW-4 (Reference Point)

SW-4 was collected at the downstream of Shwe Pyauk creek, after mixing of discharge water from local industrial zone, construction site of Zone B and Zone A, which is flowing from east to west and then entering into the Yangon River. The distance is about 2.15 km downstream of SW-2. This sampling point is located in the west of Zone B area and in the south of Dagon-Thilawa road. The surrounding areas are Zone A in the northeast, local industrial zone in the east and paddy fields in the south and west respectively.

SW-7 (Discharged Point)

SW-7 is main discharged point of Zone B during construction stage. The distance is about 434 m downstream of SW-2. This sampling point is located at outlet of retention pond of Zone B construction site, in the north of Zone B area and in the south of Dagon-Thilawa road. The surrounding areas are Zone A in the north and local industrial zone in the east respectively.

GW-2 (Reference of Existing Tube Well)

GW-2 was collected from tube well as ground water sample. It is located in the monastery compound of Phalan village. The surrounding areas are Thilawa SEZ Zone A in the north, Phalan village in the south and fields in the west and local industrial zone in the northeast and construction of Thilawa SEZ Zone B in the east and northeast respectively.

2.3 Monitoring Method

All water samples were collected with cleaned sampling bottles and analyzed by the following standard method as shown in Table 2.3-1. All samples were kept in iced boxes keeping at 2-4 °C and were transported to the laboratory. Among the parameters; water temperature, pH and DO were measured by the on-site instrument "Horiba, U-52" and water flow rate was also conducted by using the on-site instrument "Tamaya Digital Current Meter".

Table 2.3-1 Analytic Method for Water Quality

No.	Parameter	Method
1	Water Temperature	Instrument Analysis Method (Horiba, U-52, Multi Water Quality Checker)
2	pH	Instrument Analysis Method (Horiba, U-52, Multi Water Quality Checker)
3	Dissolved Oxygen (DO)	Instrument Analysis Method (Horiba, U-52, Multi Water Quality Checker)
4	$BOD_{(5)}$	APHA 5210 B (5 days BOD Test)
5	$COD_{(Cr)}$	APHA 5220D (Close Reflux Colorimetric Method)
6	Suspended Solids (SS)	APHA 2540D (Dry at 103-105°C Method)
7	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)
8	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)
9	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)
10	Total Dissolved solids (TDS)	APHA 2540C (Total Dissolved Solids Dried at 180°C Method)
11	Iron	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)
12	Mercury	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)
13	Escherichia Coli	APHA 9221 F (Escherichia Coli Procedure Using Fluorogenic Substrate)
14	Flow Rate	Detection of Electromagnetic Elements (Real-time measurement by UC-200V Digital Current Meters)

Source: Myanmar Koei International Ltd

2.4 Monitoring Period

Water quality and water flow rate monitoring were conducted on 18 December 2019 and sampling time is shown in Table 2.4-1 to avoid tidal effect. The tide record for Yangon River, Myanmar on 18 December 2019 is shown in Table 2.4-2.

Table 2.4-1 Sampling Time of Each Station

No.	Station	Sampling Time
1	SW-2	18/12/2019 11:28
2	SW-4	18/12/2019 09:27
3	SW-7	18/12/2019 13:26
4	GW-2	18/12/2019 12:26

Source: Myanmar Koei International Ltd

Table 2.4-2 Tide Record for Yangon River, Myanmar

Date	Time	Height	Tide Conditions
18/12/2019	03:31	1.07	Low Tide
	08:29	5.13	High Tide
	16:17	0.68	Low Tide
	21:25	4.99	High Tide

Source: Myanmar Port Authority, Tide Table for the Yangon River and Elephant Point, 2019

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED MJTD

2.5 Monitoring Results

Results of water quality monitoring at discharged point and discharged creek are summarized in Table 2.5-1. Analytical results of the laboratory are described in Appendix-2 and Appendix-3. The results were compared with the target value of effluent water quality discharged to water body stipulated in the EIA report.

2.5.1 Results of Discharged Point and Discharged Creek

As the comparison with the target value, the results of SS, TDS, total coliform and iron exceeded the target value. As for the result of SS and TDS, results at the surface water monitoring point (SW-4) exceeded the target value. The exceed result for SS and TDS may be due to two expected reasons; i) delivered from upstream area such as natural origin and wastewater from local industrial zone outside of Thilawa SEZ, and ii) influence by water from the downstream due to flow back by tidal fluctuation.

As for the result of total coliform of surface water, results at surface water monitoring points (SW-2 and SW-4) exceeded the target value due to three expected reasons; i) natural bacteria existed in discharged creek because there are various kinds of vegetation and creature such as birds and small animals in and along the discharged creek and ii) wastewater from the local industrial zone outside of Thilawa SEZ and iii) delivered from surrounding area by tidal effect.

As for the result of iron, the result at the monitoring point of surface water monitoring point (SW-4) exceeded the target value. The possible reasons may be due to the influence of natural origin (iron can reach out from soil by run-off). In Yangon, soil is naturally rich in iron. However, since it cannot reach to the conclusion of what is the reason for this result, the periodic monitoring will be necessary.

Table 2.5-1 Results of Water Quality Monitoring at Discharged point and Discharged Creek

No.	Parameters	Unit	SW-2	SW-4	SW-7	Target Value (Reference Value for Self-Monitoring)
1	Water Temperature	°C	27	27	31	≤ 35
2	pH	-	7.7	8.1	8.6	6~9
3	Suspended Solid (SS)	mg/L	20.00	382.00	28.00	50
4	Dissolved Oxygen (DO)	mg/L	3.40	5.85	6.33	-
5	$BOD_{(5)}$	mg/L	9.42	4.86	2.66	30
6	$COD_{(Cr)}$	mg/L	31.2	5.4	18.5	125
7	Total Coliform	MPN/100ml	35000	24000	79	400
8	Oil and Grease	mg/L	< 3.1	< 3.1	< 3.1	10
9	Chromium	mg/L	≤ 0.002	0.044	≤ 0.002	0.5
10	Total Dissolved solids (TDS)	mg/L	202	2036	650	2000
11	Iron	mg/L	1.688	25.840	1.828	3.5
12	Mercury	mg/L	≤ 0.002	≤ 0.002	≤ 0.002	0.005
13	Escherichia Coli	MPN/100ml	-	-	17.0	(1000)* (CFU/100ml)
14	Flow Rate	m^3/s	-	0.82	0.11	-

Note: Red color means exceeded value than target value

*Note: Based on the water utilization at discharged creek, the quality standard for water baths in Japan, (Ministry of Environment, 1997) is set as a reference value for self-monitoring of E. coli for surface water monitoring. However, due to limitation of capacity for analytical laboratory in Myanmar, the method to analyze the "Colony Forming Unit (CFU)" is not available in Myanmar. Therefore, the results of "Most Probable Number (MPN)" are assumed similar to CFU values and compared with reference values. Once the method to analyze the CFU will be available in Myanmar, the analytical method will be changed.

Source: Myanmar Koei International Ltd.

2.5.2 Result of Reference Tube Well

Result of water quality monitoring at reference tube well monitoring point is shown in Table 2.5-2. As the comparison with the target value, the result of iron exceeded the target value.
As for the result of the iron, the result at the monitoring point of reference tube well (GW-2) exceeded the target value. It may be due to the corrosion of pipes because the water is pumped through the iron pipelines buried underneath the ground. However, since it cannot reach to the conclusion of what is the reason for this result, the periodic monitoring will be necessary.

Table 2.5-2 Results of Water Quality Monitoring at Reference Tube Well

No.	Parameters	Unit	GW-2	Target Value (Reference Value for Self-Monitoring)
1	Water Temperature	°C	30	≤ 35
2	pH	-	7.4	6–9
3	Suspended Solid (SS)	mg/L	6.00	50
4	Dissolved Oxygen (DO)	mg/L	8.06	-
5	$BOD_{(5)}$	mg/L	0.78	30
6	$COD_{(Cr)}$	mg/L	< 0.7	125
7	Total Coliform	MPN/100ml	13	400
8	Oil and Grease	mg/L	< 3.1	10
9	Chromium	mg/L	≤ 0.002	0.5
10	Total Dissolved solids (TDS)	mg/L	140	2000
11	Iron	mg/L	5.340	3.5
12	Mercury	mg/L	≤ 0.002	0.005
13	Escherichia Coli	MPN/100ml	< 1.8	(1000)* (CFU/100ml)
14	Flow Rate	m^3/s	-	-

Note: Red color means exceeded value than target value

*Note: Based on the water utilization at monitoring point for ground water, B1(Irrigation water) of National Technical Regulation on Surface Water Quality in Vietnam (No. QCVN 08: 2008/BTNMT) is set as a reference value of self-monitoring for ground water monitoring.

Source: Myanmar Koei International Ltd.

CHAPTER 3: CONCLUSION AND RECOMMENDATIONS

As described in Chapter 2 (Section 2.5), the results of SS and TDS at (SW-4), total coliform at (SW-2 and SW-4) and iron at (SW-4) in surface water exceeded the target value in this monitoring period for construction stage of Thilawa SEZ Zone B.

There are some possible reasons for exceeding the target values of SS and TDS at (SW-4) and total coliform at (SW-2 and SW-4). They are by i) natural origin such as natural bacteria existed in discharged creek because there are various kinds of vegetation and creature such as birds and small animals in and along the discharged creek and ii) wastewater from the local industrial zone outside of Thilawa SEZ and iii) delivered from surrounding area by tidal effect.

As for the result of iron, the result at the monitoring point of surface water monitoring point (SW-4) exceeded the target value. The possible reasons may be due to the influence of natural origin (iron can reach out from soil by run-off). In Yangon, soil is naturally rich in iron.

As for the result of the iron, the result at the monitoring point of reference tube well (GW-2) exceeded the target value due to expected reason. It may be due to the corrosion of pipes because the water is pumped through the iron pipelines buried underneath the ground.

However, it cannot reach to the conclusion of what the reason to be exceeded the target values is, thus the periodic monitoring and yearly trend analysis will be necessary to carry out based on the rainy and dry season data.

End of the Document

APPENDIX-1 FIELD SURVEY PHOTOS

FOR DISCHARGED POINT OF THILAWA SEZ ZONE B

Surface water sampling and onsite measurement at SW-7

FOR REFERENCE MONITORING POINTS FOR COMPARISON WITH DISCHARGED POINTS AND BASELINE OF DISCHARGED CREEK

Surface water sampling and onsite measurement at SW-2

Surface water sampling and onsite measurement at SW-4

Ground water sampling and onsite measurement at GW-2

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED MJTD

APPENDIX-2 LABORATORY RESULTS

FOR DISCHARGED POINT

DOWA

[redacted]

Report No. : GEM-LAB-20200237
Revision No. : 1
Report Date : 8 January, 2020
Application No. : 0001 C001

Analysis Report

Client Name : Myanmar Allac International LTD (MAI)
Address : No. 38/A, 1st Floor, Grand Pho Sein Condominium, Pho Sein Road, Tamwe Township, Yangon, Myanmar
Project Name : Environment Monitoring report for Zone A & B
Sample Description :
Sample Name : MAI-SW 7 1218
Sample No : W-1912184
Waste Profile No :
Sampling Date : 18 December, 2019
Sampling By : Customer
Sample Received Date : 18 December, 2019

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105°C Method)	mg/l	28.00	-
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	2.66	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	18.5	0.7
4	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	79	1.8
5	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)	mg/l	< 3.1	3.1
6	Total Nitrogen	HACH Method 10072 (TNT Persulfate Digestion Method)	mg/l	< 0.5	0.5
7	Total Phosphorous	APHA 4500-P E (Ascorbic Acid Method)	mg/l	< 0.05	0.050
8	Color	APHA 2120C (Spectrophotometric Method)	TCU	2.80	0.00
9	Odor	APHA 2150 B (Threshold Odor Test)	TON	2	0
10	TDS	APHA 2540 C (Total Dissolved Solids Dried at 180°C Method)	mg/l	550	-
11	Mercury	APHA 3125 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.002	0.002
12	Zinc	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.002	0.002
13	Arsenic	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.01	0.01
14	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.002	0.002
15	Cadmium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.002	0.002
16	Selenium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.01	0.01
17	Lead	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.002	0.002
18	Copper	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.002	0.002
19	Barium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	0.044	0.002
20	Nickel	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	0.008	0.002
21	Silver	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.002	0.002
22	Iron	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	1.828	0.002
23	Cyanide	HACH 8027 (Pyridine - Pyrazolone Method)	mg/l	< 0.002	0.002
24	Total Cyanide	Distillation Process APHA 4500-Cn- C Total Cyanide after Distillation, Determine Cyanide Concentration Process: HACH 8027 (Pyridine -Pyrazolone Method)	mg/l	0.002	0.002
25	Ammonia	HACH Method 10205 (Salicylate TNT Plus Method)	mg/l	0.054	0.020
26	Hexavalent Chromium (Cr6+)	ISO 11083:1994 (Determination of chromium(VI) Spectrometric method using 1,5-diphenylcarbazide)	mg/l	< 0.05	0.05
27	Fluoride	APHA 4110 B (Ion Chromatography with Chemical Suppression of Eluent Conductivity)	mg/l	0.176	0.014
28	Free Chlorine	APHA 4500 Cl. G (DPD Colorimetric Method)	mg/l	< 0.1	0.1
29	Total Chlorine	APHA 4500 Cl. G (DPD Colorimetric Method)	mg/l	< 0.1	0.1
30	Sulphide	HACH 8131 (USEPA Methylene Blue Method)	mg/l	0.017	0.005
31	Formaldehyde	HACH 8110 (MBTH Method)	mg/l	0.068	0.003
32	Phenols	USEPA Method 420.1 (Phenolics (Spectrophotometric, Manual 4AAP With Distillation))	mg/l	0.007	0.002

Remark : LOQ - Limit of Quantitation
APHA - American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 22nd edition

Analysed By
Ni Ni Aye Lwin
Assistant Manager

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Jan 8 2020
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Approved By
Tomoki Suzuki
Director
Jan 8, 2020.

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED MJTD

FOR REFERENCE MONITORING POINTS FOR COMPARISON WITH DISCHARGED POINTS AND BASELINE OF DISCHARGED CREEK

DOWA

GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD.
Lot No. B1, Thilawa SEZ Zone A, Yangon Region, Myanmar
Phone No: [illegible]

Page 1 of 1

Report No: GEM-LAB-202001034
Revision No: 1
Report Date: 8 January 2020
Application No: 0021-C001

Analysis Report

Client Name: Myanmar Koei International LTD. (MKI)
Address: No. 38/A, 1st Floor, Grand Mya Sein Condominium, Mya Sein Road, Tamwe Township, Yangon, Myanmar
Project Name: Environment Monitoring report for Zone A & B
Sample Description:
Sample Name: MKI-SW-2-1218 — Sampling Date: 18 December 2019
Sample No: W-1912181 — Sampling By: Customer
Waste Profile No: — Sample Received Date: 18 December 2019

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105°C Method)	mg/l	20.00	
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	8.82	1.10
3	COD (Cr)	APHA 5220D (Closed Reflux Colorimetric Method)	mg/l	17.1	3.7
4	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	15000	1.8
5	Oil and Grease	APHA 5520B (Partition-Gravimetric Method)	mg/l	< 3.1	3.1
6	Total Nitrogen	HACH Method 10072 (TNT Persulfate Digestion Method)	mg/l	2.3	0.5
7	Total Phosphorous	APHA 4500-P E (Ascorbic Acid Method)	mg/l	0.177	0.010
8	Color	APHA 2120C (Spectrophotometric Method)	TCU	17.85	0.50
9	Odor	APHA 2150 B (Threshold Odor Test)	TON	1.4	1
10	TDS	APHA 2540 C (Total Dissolved Solids Dried at 180°C Method)	mg/l	202	
11	Mercury	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.002	0.002
12	Zinc	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.002	0.002
13	Arsenic	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.01	0.01
14	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.002	0.002
15	Cadmium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.002	0.002
16	Selenium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.01	0.01
17	Lead	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.002	0.002
18	Copper	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.002	0.002
19	Barium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	0.019	0.002
20	Nickel	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	0.006	0.002
21	Silver	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.002	0.002
22	Iron	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	1.688	0.002
23	Cyanide	HACH 8027 (Pyridine-Pyrazalone Method)	mg/l	< 0.002	0.002
24	Total Cyanide	Distillation Process: APHA 4500-CN- C Total Cyanide after Distillation, Determine Cyanide Concentration Process: HACH 8027 (Pyridine-Pyrazalone Method)	mg/l	< 0.002	0.002
25	Ammonia	HACH Method 10205 (Salicylate TNT Plus Method)	mg/l	0.110	0.015
26	Hexavalent Chromium (Cr6+)	ISO 11083:1994 (Determination of chromium(VI) Spectrometric method using 1,5-diphenylcarbazide)	mg/l	< 0.05	0.05
27	Fluoride	APHA 4110 B (Ion Chromatography with Chemical Suppression of Eluent Conductivity)	mg/l	0.257	0.024
28	Free Chlorine	APHA 4500-Cl G (DPD Colorimetric Method)	mg/l	< 0.1	0.1
29	Total Chlorine	APHA 4500-Cl G (DPD Colorimetric Method)	mg/l	< 0.1	0.1
30	Sulphide	HACH 8131 (USEPA Methylene Blue Method)	mg/l	0.039	0.005
31	Formaldehyde	HACH 8110 (MBTH Method)	mg/l	0.065	0.003
32	Phenols	USEPA Method 420.1 (Phenolics (Spectrophotometric, Manual 4AAP with Distillation))	mg/l	0.008	0.002

Remark: LOQ : Limit of Quantitation
APHA : American Public Health Association (APHA), American Water Works Association (AWWA), and the Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 23rd edition

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Assistant Manager

Approved By: Tomoya Suzuki
Jan 8, 2020
Director

MJTD
MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED

DOWA

Report No. GEM LAB 202001035
Revision No. 1
Report Date 8 January, 2020
Application No. 0001-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No. 38/A, 1st Floor, Diagid Pho Sein Condominium, Pho Sein Road, Tamwe Township, Yangon, Myanmar
Project Name : Environment Monitoring report for Zone A & B
Sample Description :
Sample Name : MKI SW-4-1218
Sample No : M-1912182
Waste Profile No :
Sampling Date : 18 December, 2019
Sampling By : Customer
Sample Received Date : 18 December, 2019

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dry at 103-105°C Method)	mg/l	362.00	-
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	4.86	0.00
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	5.4	0.7
4	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	24000	1.8
5	Oil and Grease	APHA 5520B (Partition Gravimetric Method)	mg/l	< 3.1	3.1
6	Total Nitrogen	HACH Method 10072 (TNT Persulfate Digestion Method)	mg/l	2.3	0.5
7	Total Phosphorous	APHA 4500-P E (Ascorbic Acid Method)	mg/l	< 0.05	0.050
8	Color	APHA 2120C (Spectrophotometric Method)	TCU	149	0.00
9	Odor	APHA 2150 B (Threshold Odor Test)	TON	1	0
10	TDS	APHA 2540 C (Total Dissolved Solids Dried at 180°C Method)	mg/l	2036	-
11	Mercury	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.002	0.002
12	Zinc	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	0.03	0.002
13	Arsenic	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.01	0.01
14	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	0.044	0.002
15	Cadmium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.002	0.002
16	Selenium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.01	0.01
17	Lead	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.002	0.002
18	Copper	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.002	0.002
19	Barium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	0.04	0.002
20	Nickel	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	0.078	0.002
21	Silver	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.002	0.002
22	Iron	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	25.845	0.002
23	Cyanide	HACH 8027 (Pyridine - Pyrazolone Method)	mg/l	< 0.002	0.002
24	Total Cyanide	Digestion Process APHA 4500-CN- C Total Cyanide after Distillation, Determine Cyanide Concentration Process: HACH 8027 (Pyridine - Pyrazolone Method)	mg/l	< 0.002	0.002
25	Ammonia	HACH Method 10205 (Salicylate TNT Plus Method)	mg/l	2.838	0.020
26	Hexavalent Chromium (Cr6+)	ISO 11083: 1994 (Determination of chromium(VI) Spectrometric method using 1,5-diphenylcarbazide)	mg/l	< 0.05	0.05
27	Fluoride	APHA 4110 B (Ion Chromatography with Chemical Suppression of Fluoride Conductivity)	mg/l	0.153	0.014
28	Free Chlorine	APHA 4500 Cl- G (DPD Colorimetric Method)	mg/l	< 0.1	0.1
29	Total Chlorine	APHA 4500 Cl- G (DPD Colorimetric Method)	mg/l	< 0.1	0.1
30	Sulfide	HACH 8131 (USEPA Methylene Blue Method)	mg/l	0.072	0.005
31	Formaldehyde	HACH 8110 (MBTH Method)	mg/l	0.051	0.003
32	Phenols	USEPA Method 420.1 (Phenolics (Spectrophotometric, Manual 4AAP With Distillation))	mg/l	0.007	0.002

Remark : LOQ : Limit of Quantitation
APHA : American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 22nd edition

Analysed By :
N. Ni Aye Lwin
Associate Manager

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Jan 8, 2020
GEM

Approved By :
Tomoya Suzuki Jan 9, 2020
Director

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED ★ MJTD

DOWA

GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD.
Lot No. [illegible], Thilawa SEZ Zone A, Yangon Region, Myanmar
Phone No. Tel No. [illegible]

Report No. : GEM-LAB-202001038
Revision No. : 1
Report Date : 8 January, 2020
Application No. : 1912-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No. 36/A, 1st Floor, Grand Mya Sein Condominium, Mya Sein Road, Tamwe Township, Yangon, Myanmar
Project Name : Environment Monitoring Report for Zone A & B
Sample Description
Sample Name : MKI-GW-3-1218
Sample No. : W-1912180
Waste Profile No. :
Sampling Date : 18 December, 2019
Sampling By : Customer
Sample Received Date : 18 December, 2019

No.	Parameter	Method	Unit	Result	LOQ
1	SS	APHA 2540D (Dried at 103-105°C Method)	mg/l	6.00	
2	BOD (5)	APHA 5210 B (5 Days BOD Test)	mg/l	0.78	0.60
3	COD (Cr)	APHA 5220D (Close Reflux Colorimetric Method)	mg/l	< 2.1	2.1
4	Total Coliform	APHA 9221B (Standard Total Coliform Fermentation Technique)	MPN/100ml	13	1.8
5	Oil and Grease	APHA 5520B (Partition Gravimetric Method)	mg/l	< 3.1	3.1
6	Total Nitrogen	HACH Method 10072 (TNT Persulfate Digestion Method)	mg/l	< 0.5	0.5
7	Total Phosphorous	APHA 4500-P E (Ascorbic Acid Method)	mg/l	0.730	0.050
8	Color	APHA 2120C (Spectrophotometric Method)	TCU	21.30	3.00
9	Odor	APHA 2150 B (Threshold Odor Test)	TON	1	0
10	TDS	APHA 2540 C (Total Dissolved Solids Dried at 180°C Method)	mg/l	140	-
11	Mercury	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002
12	Zinc	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.002	0.002
13	Arsenic	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.01	0.01
14	Chromium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002
15	Cadmium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.002	0.002
16	Selenium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.01	0.01
17	Lead	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	≤ 0.002	0.002
18	Copper	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.002	0.002
19	Barium	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	0.008	0.002
20	Nickel	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.002	0.002
21	Silver	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	< 0.002	0.002
22	Iron	APHA 3120 B (Inductively Coupled Plasma (ICP) Method)	mg/l	1.340	0.002
23	Cyanide	HACH 8027 (Pyridine - Pyrazalone Method)	mg/l	< 0.002	0.002
24	Total Cyanide	Distillation Process APHA 4500-CN C: Total Cyanide after Distillation, Determine Cyanide Concentration Process: HACH 8027 (Pyridine - Pyrazalone Method)	mg/l	< 0.002	0.002
25	Ammonia	HACH Method 10205 (Salicylate TNT Plus Method)	mg/l	0.200	0.025
26	Hexavalent Chromium (Cr6+)	ISO 11083: 1994 (Determination of chromium(VI) Spectrometric method using 1,5-diphenylcarbazide)	mg/l	< 0.05	0.05
27	Fluoride	APHA 4110 B (Ion Chromatography with Chemical Suppression of Eluent Conductivity)	mg/l	0.138	0.014
28	Free Chlorine	APHA 4500 CL G (DPD Colorimetric Method)	mg/l	< 0.1	0.1
29	Total Chlorine	APHA 4500 CL G (DPD Colorimetric Method)	mg/l	< 0.1	0.1
30	Sulphide	HACH 8131 (USEPA Methylene Blue Method)	mg/l	0.005	0.005
31	Formaldehyde	HACH 8110 (MBTH Method)	mg/l	0.025	0.003
32	Phenols	USEPA Method 420.1 (Phenolics (Spectrophotometric, Manual 4AAP with Distillation))	mg/l	< 0.002	0.002

Remark : LOQ : Limit of Quantitation
APHA : American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 22nd edition

LAB
Jan 8, 2020
GEM

Analyzed By
Ni Ni Aye Lwin
Assistant Manager

Approved By
鈴木 智也
Tomoya Suzuki Jan 8, 2020
Director

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED
MJTD

APPENDIX-3 LABORATORY RESULT OF ESCHERICHIA COLI (SELF-MONITORING)

FOR DISCHARGED POINT

DOWA

GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD.
Lot No E1, Thilawa SEZ Zone A, Yangon Region, Myanmar
Phone No. Fax No. (+95) 1 2309051

motivate our planet

Doc No: GEM-LB-R004E/00
Page1of1

Report No. : GEM-LAB-202001028
Revision No. : 1
Report Date : 8 January, 2020
Application No. : 0001-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)

Address : No. 36/A, 1st Floor, Grand Pho Sein Condominium, Pho Sein Road, Tarmwe Township, Yangon, Myanmar

Project Name : Environment Monitoring report for Zone A & B

Sample Description

Sample Name : MKI-SW-7-1218 — Sampling Date : 18 December, 2019

Sample No. : W-1912175 — Sampling By : Customer

Waste Profile No. : - — Sample Received Date : 18 December, 2019

No.	Parameter	Method	Unit	Result	LOQ
1	Escherichia Coli	APHA 9221 F Escherichia Coli Procedure Using Fluorogenic Substrate	MPN/100ml	17.0	1.8

Remark : LOQ - Limit of Quantitation

APHA - American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 22nd edition

Analysed By :

Ni Ni Aye Lwin
Assistant Manager

LAB
Jan 8, 2020
GEM

Approved By :

Tomoya Suzuki Jan 8, 2020
Director

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED ★ MJTD

FOR REFERENCE MONITORING POINTS FOR COMPARISON WITH DISCHARGED POINTS AND BASELINE OF TUBE WELL

DOWA

GOLDEN DOWA ECO-SYSTEM MYANMAR CO., LTD.
Lot No E1, Thilawa SEZ Zone A, Yangon Region, Myanmar
Phone No. Fax No: (+95) 1 2309051

motivate our planet

Report No. : GEM-LAB-202001030
Revision No. : 1
Report Date : 8 January, 2020
Application No. : 0001-C001

Analysis Report

Client Name : Myanmar Koei International LTD (MKI)
Address : No. 36/A, 1st Floor, Grand Pho Sein Condominium, Pho Sein Road, Tarmwe Township, Yangon, Myanmar.
Project Name : Environment Monitoring report for Zone A & B
Sample Description

Sample Name : MKI-GW-2-1218 — Sampling Date : 18 December, 2019
Sample No. : W-1912177 — Sampling By : Customer
Waste Profile No. : - — Sample Received Date : 18 December, 2019

No.	Parameter	Method	Unit	Result	LOQ
1	Escherichia Coli	APHA 9221 F Escherichia Coli Procedure Using Fluorogenic Substrate	MPN/100ml	< 1.8	1.8

Remark : LOQ - Limit of Quantitation
APHA - American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF), Standard Methods for the Examination of Water and Wastewater, 22nd edition

Analysed By :

Ni Ni Aye Lwin
Assistant Manager

LAB
Jan 8, 2020
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Approved By :

Tomoya Suzuki Jan 8 2020.
Director

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED ★ MJTD

Thilawa Special Economic Zone (Zone B)

Development Project –Phase 3

Appendix-C

Air Quality Monitoring Report

December 2019

AIR QUALITY MONITORING

REPORT

FOR DEVELOPMENT OF INDUSTRIAL AREA

THILAWA SEZ ZONE B

(PHASE 3 CONSTRUCTION STAGE)

(QUARTERLY MONITORING)

December 2019

Myanmar Koei International Ltd.

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CHAPTER 1: OUTLINES AND SUMMARY OF MONITORING PLAN

1.1 General

Thilawa Special Economic Zone (TSEZ) is located in southern district of Yangon region and about 23 km southeast of Yangon city. As the developer of Thilawa SEZ, Myanmar Japan Thilawa Development Ltd. (MJTD) has a responsibility to carry out regular environmental monitoring in the industrial area of Zone B in accordance with the approved Environmental Impact Assessment (EIA) report with Environmental Management Plan (EMP). MJTD has implemented monitoring various environmental items with the specified time frame to know the environmental conditions in and around the area.

1.2 Outlines of Monitoring Plan

To assess the environmental condition under the construction of industrial area in and around Thilawa SEZ Zone B, air quality had been monitored from 9 December 2019 - 16 December 2019 as follows;

Table 1.2-1 Outlines of Air Quality Monitoring Plan

Monitoring Date	Monitoring Item	Parameters	Number of Point	Duration	Monitoring Methodology
From 9 December – 16 December, 2019	Air Quality	CO, NO_2, $PM_{2.5}$, PM_{10} and SO_2	1	7 Days	On site measurement by Haz-Scanner Environmental Perimeter Air Station (EPAS)

Source: Myanmar Koei International Ltd.

CHAPTER 2: AIR QUALITY MONITORING

2.1 Monitoring Item

The parameters for air quality monitoring were CO, NO_2, $PM_{2.5}$, PM_{10} and SO_2.

2.2 Monitoring Location

The air quality measurement equipment, "Haz-Scanner Environmental Perimeter Air Station (EPAS) was set up at the south of the Thilawa SEZ Zone B, N: 16°39'24.20", E: 96°17'15.80", inside the monastery compound of Phalan village, surrounded by the residential houses of Phalan village in the south and fields in west, Thilawa SEZ Zone A in north, local Thilawa Industrial Zone in northeast and construction of Thilawa SEZ Zone B in east, north, north-northwest, northwest and northeast respectively. The air quality monitoring is carried out above location where is near to the residential houses of Phalan village. Possible emission sources are dust emissions from construction activities and exhaust gas emissions from construction fuel-burning equipment and daily human activities in Phalan village. The location of air quality monitoring is shown in the Figure 2.2-1.

Source: Google Earth Pro

Figure 2.2-1 Location of Air Quality Monitoring Point

2.3 Monitoring Period

Air quality monitoring was conducted seven consecutive days from 9 December, 2019 – 16 December, 2019.

2.4 Monitoring Method

Monitoring of CO, NO_2, $PM_{2.5}$, PM_{10} and SO_2 were conducted by referring to the recommendation of the United States Environmental Protection Agency (U.S. EPA). The Haz-Scanner EPAS was used to collect ambient air pollutants. The EPAS measures automatically every one minute and directly reads and records onsite for CO, NO_2, $PM_{2.5}$, PM_{10} and SO_2. The state of air quality monitoring is shown in Figure 2.4-1.

Source: Myanmar Koei International Ltd.

Figure 2.4-1 Status of Air Quality Monitoring Point

2.5 Monitoring Results

The daily average value of air quality monitoring results of CO, NO_2, $PM_{2.5}$, PM_{10} and SO_2 are described in Table 2.5-1. Comparing with the target value of CO, NO_2, $PM_{2.5}$, PM_{10} and SO_2 prescribed in EIA report for Thilawa SEZ development project Zone B, seven days average concentration of CO and NO_2 were lower than the target value and seven days average concentration of $PM_{2.5}$, PM_{10} and SO_2 were higher than the target value. Moreover, daily average concentration of $PM_{2.5}$, PM_{10} and SO_2 measured results for seven days exceeded the target value.

Table 2.5-1 Air Quality Monitoring Result (Daily Average) During Construction and Non-Construction Period

Date	CO	NO_2	$PM_{2.5}$	PM_{10}	SO_2
	mg/m³	mg/m³	mg/m³	mg/m³	mg/m³
09–10 Dec, 2019	0.368	0.074	0.087	0.108	0.113
10–11 Dec, 2019	0.394	0.045	0.083	0.117	0.097
11–12 Dec, 2019	0.346	0.071	0.102	0.139	0.088
12–13 Dec, 2019	0.373	0.082	0.113	0.149	0.080
13–14 Dec, 2019	0.286	0.077	0.120	0.164	0.078
14–15 Dec, 2019	0.310	0.082	0.082	0.114	0.077
15–16 Dec, 2019	0.275	0.069	0.052	0.070	0.080
7 Days Average Value	0.336	0.072	0.091	0.123	0.088
Target Value	10.26	0.1	0.025	0.05	0.02

Note: Red color mentions the exceeded value for $PM_{2.5}$, PM_{10} and SO_2

The target value of CO, NO_2 and SO_2 were converted from ppm units to mg/m³. The conversion equation are as follows;

1. (CO, mg/m³) = (CO, ppm) * (Molecular Weight of CO (28)) / 24.45 at 25°C and 1 atm condition
2. (NO_2, mg/m³) = (NO_2, ppm) * (Molecular Weight of NO_2 (46)) / 24.45 at 25°C and 1 atm condition
3. (SO_2, mg/m³) = (SO_2, ppm) * (Molecular Weight of SO_2 (64)) / 24.45 at 25°C and 1 atm condition

Source: Myanmar Koei International Ltd

Construction activities of Thilawa SEZ Zone B during the air quality monitoring period are described in Table 2.5-2. $PM_{2.5}$, PM_{10} and SO_2 results during construction period are described in Table 2.5-3, Table 2.5-4 and Table 2.5-5. During construction period, (Day 1 to Day 7) daily and seven days average results for $PM_{2.5}$, PM_{10} and SO_2 were higher than the target value.

Table 2.5-2 Construction Activities of Thilawa SEZ Zone B

Date	Time	Construction Activities
9 December 2019	7:00- 20:00	Land Grading works, Road Sub-grade, Pipe installation works, Retention Pond, General use
10 December 2019	7:00- 20:00	Land Grading works, Road Sub-grade, Pipe installation works, General use
11 December 2019	7:00- 20:00	Land Grading works, Road Sub-grade, Pipe installation works, Retention Pond, General use
12 December 2019	7:00- 20:00	Land Grading works, Road Sub-grade, Pipe installation works, Retention Pond, General use
13 December 2019	7:00- 20:00	Land Grading works, Road Sub-grade, Pipe installation works, Retention Pond, General use
14 December 2019	7:00- 20:00	Land Grading works, Road Sub-grade, Pipe installation works, Retention Pond, General use
15 December 2019	7:00- 20:00	Land Grading works, Road Sub-grade, Pipe installation works, Retention Pond, General use
16 December 2019	7:00- 20:00	Land Grading works, Road Sub-grade, Pipe installation works, Retention Pond, General use

Source: Myanmar Japan Thilawa Development Ltd.

Table 2.5-3 $PM_{2.5}$ Results (During Construction Period)

Day	Construction Time for each day	$PM_{2.5}$
		mg/m³
Day 1	7:00-20:00	0.042
Day 2	7:00-20:00	0.037
Day 3	7:00-20:00	0.043
Day 4	7:00-20:00	0.077
Day 5	7:00-20:00	0.071
Day 6	7:00-20:00	0.047
Day 7	7:00-20:00	0.032
7 days Average value		0.050
Target Value	-	0.025

Note: Red color mentions the exceeded value than target value
Source: Myanmar Koei International Ltd.

Table 2.5-4 PM_{10} Results (During Construction Period)

Day	Construction Time for each day	PM_{10}
		mg/m³
Day 1	7:00-20:00	0.057
Day 2	7:00-20:00	0.051
Day 3	7:00-20:00	0.058
Day 4	7:00-20:00	0.099
Day 5	7:00-20:00	0.097
Day 6	7:00-20:00	0.069
Day 7	7:00-20:00	0.052
7 days Average value		0.069
Target Value	-	0.05

Note: Red color mentions the exceeded value than target value
Source: Myanmar Koei International Ltd.

Table 2.5-5 SO_2 Results (During Construction Period)

Day	Construction Time for each day	SO2
		mg/m³
Day 1	7:00-20:00	0.197
Day 2	7:00-20:00	0.169
Day 3	7:00-20:00	0.152
Day 4	7:00-20:00	0.137
Day 5	7:00-20:00	0.130
Day 6	7:00-20:00	0.130
Day 7	7:00-20:00	0.135
7 days Average value		0.150
Target Value	-	0.02

Note: Red color mentions the exceeded value than target value
Source: Myanmar Koei International Ltd

Wind direction and wind speed were measured at AQ-1. Hourly average values of measured wind direction and wind speed data are described in Appendix-1. Status of air quality monitoring point and wind direction are described in Figure 2.5-1. Depending on the wind direction, West-Northwest (WNW), Northwest (NW), North-Northwest (NNW), North (N), North-Northeast (NNE), Northeast (NE), East-Northeast (ENE) and East (E) directions are assumed to come from the construction site of Zone B.

Source: Google Earth Pro

Figure 2.5-1 Status of Air Quality Monitoring Point and Wind Direction

Remark: N *North* NNE *North-Northeast* NE *Northeast* ENE *East-Northeast* E *East* ESE *East-Southeast* SE *Southeast* SSE *South-Southeast* S *South* SSW *South-Southwest* SW *Southwest* WSW *West-Southwest* W *West* WNW *West-Northwest* NW *Northwest* NNW *North-Northwest*

Overall summary of total exceeded hours for Day 1 to Day 7 during construction and non-construction time for $PM_{2.5}$, PM_{10} and SO_2 are shown in Table 2.5-6, Table 2.5-7 and Table 2.5-8. The summary of wind direction at AQ-1 is shown in Table 2.5-9.

Based on the summary table of total exceeded hours for $PM_{2.5}$, the total exceeded hours for seven days during construction and non-construction were 121 hours but exceeded hours for construction time was 45 hours. After detailed analyzed the $PM_{2.5}$ exceeded time according to the wind direction during construction period, 22 hours exceeded are come from other sides of Zone B and 23 hours exceeded are come from construction site of Zone B.

Based on the summary table of total exceeded hours for PM_{10}, the total exceeded hours for seven days during construction and non-construction were 119 hours but exceeded hours for construction time was 46 hours. After detailed analyzed the PM_{10} exceeded time according to the wind direction during construction period, 20 hours exceeded are come from other sides of Zone B and 26 hours exceeded are come from construction site of Zone B.

Based on the summary table of total exceeded hours for SO_2, the total exceeded hours for seven days during construction and non-construction were 64 hours but exceeded hours for construction time was 60 hours. After detailed analyzed the SO_2 exceeded time according to the wind direction during construction period, 30 hours exceeded are come from other sides of Zone B and 30 hours exceeded are come from construction site of Zone B.

According to the summary of wind direction at AQ-1, 19.05% come from outside of Zone B and 80.95 % come from inside of Zone B.
Possible emission sources for $PM_{2.5}$ and PM_{10} are affected from natural origin such as dust from unpaved land area from outside of Zone B, transportation in and around the monitoring area and construction activities of Zone B.
Possible emission sources for SO_2 are affected from the combustion of fuel for vehicles from nearby roads, operation activities of Myanmar International Terminals Thilawa Port, operation activities of local industrial zone and construction activities of Zone B.

Table 2.5-6 Summary of Total Exceeded Hours for Day 1 to Day 7 During construction and non-Construction Period for $PM_{2.5}$

$PM_{2.5}$								
	Construction Time for each day	Total Exceeded hours	Construction Period exceeded hours	Non-construction period exceeded hours	Non-construction period (wind from Zone B)	Non-construction period (wind from other sides)	Construction period (wind from Zone B)	Construction period (wind from other sides)
Day-1	(7:00- 20:00)	16	5	11	10	1	4	1
Day-2	(7:00- 20:00)	15	5	10	8	2	3	2
Day-3	(7:00- 20:00)	17	6	11	10	1	3	3
Day-4	(7:00- 20:00)	22	11	11	6	5	6	5
Day-5	(7:00- 20:00)	18	7	11	8	3	3	4
Day-6	(7:00- 20:00)	17	6	11	6	5	2	4
Day-7	(7:00- 20:00)	16	5	11	8	3	2	3
Total		121	45	76	56	20	23	22

Source: Myanmar Koei International Ltd

Table 2.5-7 Summary of Total Exceeded Hours for Day 1 to Day 7 During construction and non-Construction Period for PM_{10}

PM_{10}								
	Construction Time for each day	Total Exceeded hours	Construction Period exceeded hours	Non-construction period exceeded hours	Non-construction period (wind from Zone B)	Non-construction period (wind from other sides)	Construction period (wind from Zone B)	Construction period (wind from other sides)
Day-1	(7:00- 20:00)	14	3	11	10	1	2	1
Day-2	(7:00- 20:00)	14	4	10	8	2	3	1
Day-3	(7:00- 20:00)	17	6	11	10	1	3	3
Day-4	(7:00- 20:00)	22	11	11	6	5	7	4
Day-5	(7:00- 20:00)	20	9	11	8	3	5	4
Day-6	(7:00- 20:00)	17	6	11	6	5	2	4
Day-7	(7:00- 20:00)	15	7	8	5	3	4	3
Total		119	46	73	53	20	26	20

Source: Myanmar Koei International Ltd.

Table 2.5-8 Summary of Total Exceeded Hours for Day 1 to Day 7 During construction and non-Construction Period for SO_2

SO_2								
	Construction Time for each day	Total Exceeded hours	Construction Period exceeded hours	Non-construction period exceeded hours	Non-construction period (wind from Zone B)	Non-construction period (wind from other sides)	Construction period (wind from Zone B)	Construction period (wind from other sides)
Day-1	(7:00- 20:00)	9	9	0	0	0	8	1
Day-2	(7:00- 20:00)	8	8	0	0	0	5	3
Day-3	(7:00- 20:00)	9	9	0	0	0	2	7
Day-4	(7:00- 20:00)	10	9	1	0	1	4	5
Day-5	(7:00- 20:00)	10	9	1	1	0	4	5
Day-6	(7:00- 20:00)	9	8	1	1	0	2	6
Day-7	(7:00- 20:00)	9	8	1	0	1	5	3
Total		64	60	4	2	2	30	30

Source: Myanmar Koei International Ltd.

Table 2.5-9 Summary of Wind Direction at AQ-1

Wind Direction	All Day	Day Time	Night Time	Inside/Outside Zone B	
N	20.4%	10.9%	30.0%	71.53%	Inside Zone B
NNE	13.6%	11.3%	15.9%		
NE	9.9%	10.3%	9.5%		
ENE	21.3%	11.7%	31.0%		
E	6.3%	9.3%	3.2%		
ESE	7.1%	13.3%	1.0%	19.05%	Outside Zone B
SE	1.5%	2.4%	0.6%		
SSE	3.8%	6.3%	1.2%		
S	0.8%	1.6%	0.0%		
SSW	1.2%	2.4%	0.0%		
SW	3.3%	5.8%	0.8%		
WSW	0.9%	1.8%	0.0%		
W	0.5%	0.8%	0.2%		
WNW	1.0%	1.6%	0.4%	9.42%	Inside Zone B
NW	1.4%	2.0%	0.8%		
NNW	7.0%	8.5%	5.6%		

Source: Myanmar Koei International Ltd.

CHAPTER 3: CONCLUSION AND RECOMMENDATION

The result of seven days average air quality of CO and NO_2 during seven days monitoring did not exceed the target value, thus there are no impacts on the surrounding environments. The result of seven days average air quality of $PM_{2.5}$, PM_{10} and SO_2 were higher than the target value. In addition, daily average concentration of $PM_{2.5}$, PM_{10} and SO_2 measured results for seven days exceeded the target value. During construction period, (Day 1 to Day 7) daily average results for $PM_{2.5}$, PM_{10} and SO_2 were also higher than the target values.

During the seven days monitoring period, 121 hours results were exceeded for $PM_{2.5}$. According to wind direction of Zone B, total 45 exceeded hours are during construction period and 22 exceeded hours are come from outside of Zone B and 23 exceeded hours are come from construction site Zone B. During the seven days monitoring period, 119 hours results were exceeded for PM_{10}. According to wind direction of Zone B, total 46 exceeded hours are during construction period and 20 exceeded hours are come from outside of Zone B and 26 exceeded hours are come from construction site Zone B. Possible emission sources for $PM_{2.5}$ and PM_{10} is affected from natural origin such as dust from unpaved land area from outside of Zone B, transportation in and around the monitoring area and construction activities of Zone B.

According to US Environmental Protection Agency (EPA) and WHO' health effect of particulate matter, there is no evidence of safe level of exposure or a threshold below which no adverse health effects occur. Exposure to $PM_{2.5}$ and PM_{10} reduces the life expectancy of the population of the Region by about 8.6 months on average. Short term (hours, days) exposure to $PM_{2.5}$ and PM_{10} can aggravate lung disease, causing asthma attacks and acute bronchitis, and may also increase susceptibility to respiratory infections. In people with heart disease, short term exposures have been linked to heart attacks and arrhythmias. However, healthy children and adults have not been reported to suffer serious effects from short term exposures. Long term exposures (months, years) have been associated with problems such as reduced lung function and the development of chronic bronchitis and even premature death.

During the seven days monitoring period, 64 hours results were exceeded for SO_2. According to wind direction of Zone B, total 60 exceeded hours are during construction period and 30 exceeded hours are come from outside of Zone B and 30 exceeded hours are come from construction site Zone B. Possible emission sources for SO_2 are affected from the combustion of fuel for vehicles from nearby roads, operation activities of Myanmar International Terminals Thilawa Port, operation activities of local industrial zone and construction activities of Zone B. In the public health statement SO_2 reported by ATSDR (Agency for Toxic Substances and Disease Registry) in US, 100 ppm (261.8 mg/m^3) SO_2 is considered immediately dangerous to life and health (short term). Lung function changes observed when 0.4 to 3 ppm (1.05mg/m^3 to 7.85 mg/m^3) exposure for 20 years or more (long term). Therefore, although the target value of SO_2 was exceeded during monitoring period but it is considered that there is no significant impact on human health.

As for future subject for air quality monitoring in Zone B, the following action may be taken to achieve the target level:

1) To spray the water during construction period.
2) To control the speed limit of all machinery & vehicle (25km/hr) on site to avoid excessive dust creation and to minimize air pollution by the exhaust fumes.
3) To conduct the proper operation (stop idling while no operation).
4) To implement the regular maintenance of machine used for construction activities.
5) To give awareness training to workers on machinery.
6) To check and maintain the generator regularly.

The continuous monitoring will be necessary to grasp the environmental conditions in construction stage of Thilawa SEZ Zone B. The mitigation measures for environmental management will be considered in collected periodical environmental data and has to be reviewed in future.

APPENDIX-1 HOURLY AIR RESULTS

Date	Time	CO	NO_2	$PM_{2.5}$	PM_{10}	SO_2	Wind Speed	Wind Direction	
		mg/m³	mg/m³	mg/m³	mg/m³	mg/m³	kph	Deg.	Direction
		Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly
09 Dec, 2019	13:00 ~ 13:59	0.000	0.004	0.002	0.041	0.487	0.90	51.67	NE
09 Dec, 2019	14:00 ~ 14:59	0.000	0.004	0.001	0.034	0.360	0.65	33.50	NNE
09 Dec, 2019	15:00 ~ 15:59	0.000	0.004	0.028	0.036	0.474	0.83	67.00	ENE
09 Dec, 2019	16:00 ~ 16:59	0.000	0.004	0.002	0.003	0.443	0.57	78.67	ENE
09 Dec, 2019	17:00 ~ 17:59	0.331	0.004	0.004	0.004	0.282	0.48	87.33	E
09 Dec, 2019	18:00 ~ 18:59	0.818	0.006	0.123	0.135	0.170	0.00	131.17	SE
09 Dec, 2019	19:00 ~ 19:59	0.980	0.034	0.185	0.212	0.085	0.18	73.17	ENE
09 Dec, 2019	20:00 ~ 20:59	1.002	0.074	0.203	0.251	0.014	0.13	66.67	ENE
09 Dec, 2019	21:00 ~ 21:59	0.870	0.113	0.127	0.179	0.013	0.13	59.83	ENE
09 Dec, 2019	22:00 ~ 22:59	0.896	0.132	0.135	0.182	0.013	0.13	101.83	ESE
09 Dec, 2019	23:00 ~ 23:59	0.540	0.141	0.125	0.152	0.013	0.16	59.80	ENE
10 Dec, 2019	0:00 ~ 0:59	0.506	0.152	0.131	0.156	0.013	0.15	63.00	ENE
10 Dec, 2019	1:00 ~ 1:59	0.502	0.157	0.135	0.155	0.013	0.35	66.17	ENE
10 Dec, 2019	2:00 ~ 2:59	0.545	0.168	0.147	0.173	0.013	0.07	72.00	ENE
10 Dec, 2019	3:00 ~ 3:59	0.297	0.143	0.139	0.160	0.013	0.33	42.00	NE
10 Dec, 2019	4:00 ~ 4:59	0.262	0.126	0.128	0.129	0.013	0.15	23.00	NNE
10 Dec, 2019	5:00 ~ 5:59	0.318	0.128	0.170	0.191	0.013	0.13	28.50	NNE
10 Dec, 2019	6:00 ~ 6:59	0.324	0.137	0.115	0.123	0.013	0.15	18.67	NNE
10 Dec, 2019	7:00 ~ 7:59	0.304	0.138	0.115	0.127	0.013	0.17	20.00	NNE
10 Dec, 2019	8:00 ~ 8:59	0.164	0.091	0.036	0.039	0.013	0.27	9.00	N
10 Dec, 2019	9:00 ~ 9:59	0.130	0.012	0.006	0.008	0.013	0.63	30.67	NNE
10 Dec, 2019	10:00 ~ 10:59	0.032	0.004	0.019	0.028	0.013	1.12	47.50	NE
10 Dec, 2019	11:00 ~ 11:59	0.002	0.004	0.015	0.037	0.055	1.28	74.00	ENE
10 Dec, 2019	12:00 ~ 12:59	0.000	0.004	0.004	0.032	0.157	0.93	49.67	NE

Max	1.002	0.168	0.203	0.251	0.487
Avg	0.368	0.074	0.087	0.108	0.113
Min	0.000	0.004	0.001	0.003	0.013

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED MJTD

Date	Time	CO	NO_2	$PM_{2.5}$	PM_{10}	SO_2	Wind Speed	Wind Direction	
		mg/m³	mg/m³	mg/m³	mg/m³	mg/m³	kph	Deg.	Direction
		Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly
10 Dec, 2019	13:00 ~ 13:59	0.000	0.004	0.002	0.025	0.264	0.75	40.17	NE
10 Dec, 2019	14:00 ~ 14:59	0.000	0.004	0.002	0.043	0.401	0.62	57.33	ENE
10 Dec, 2019	15:00 ~ 15:59	0.030	0.004	0.036	0.065	0.447	0.73	96.75	E
10 Dec, 2019	16:00 ~ 16:59	0.042	0.004	0.001	0.001	0.394	0.82	103.83	ESE
10 Dec, 2019	17:00 ~ 17:59	0.587	0.004	0.004	0.004	0.267	0.57	143.83	SE
10 Dec, 2019	18:00 ~ 18:59	0.688	0.021	0.045	0.050	0.094	0.05	202.67	SSW
10 Dec, 2019	19:00 ~ 19:59	0.584	0.061	0.090	0.092	0.013	0.00	176.17	S
10 Dec, 2019	20:00 ~ 20:59	0.808	0.092	0.101	0.103	0.013	0.00	140.83	SE
10 Dec, 2019	21:00 ~ 21:59	0.657	0.129	0.126	0.143	0.013	0.03	142.17	SE
10 Dec, 2019	22:00 ~ 22:59	0.492	0.153	0.147	0.199	0.013	0.23	73.50	ENE
10 Dec, 2019	23:00 ~ 23:59	0.463	0.090	0.145	0.194	0.013	0.07	68.50	ENE
11 Dec, 2019	0:00 ~ 0:59	0.488	0.135	0.145	0.208	0.013	0.12	67.33	ENE
11 Dec, 2019	1:00 ~ 1:59	0.412	0.076	0.161	0.245	0.013	0.12	57.00	ENE
11 Dec, 2019	2:00 ~ 2:59	0.736	0.000	0.187	0.275	0.013	0.30	59.00	ENE
11 Dec, 2019	3:00 ~ 3:59	0.714	0.034	0.188	0.285	0.013	0.22	59.50	ENE
11 Dec, 2019	4:00 ~ 4:59	0.794	0.000	0.224	0.385	0.013	0.05	62.50	ENE
11 Dec, 2019	5:00 ~ 5:59	0.802	0.000	0.024	0.042	0.013	0.00	59.00	ENE
11 Dec, 2019	6:00 ~ 6:59	0.451	0.000	0.061	0.075	0.013	0.15	54.33	NE
11 Dec, 2019	7:00 ~ 7:59	0.198	0.081	0.168	0.191	0.013	0.16	28.80	NNE
11 Dec, 2019	8:00 ~ 8:59	0.211	0.135	0.093	0.099	0.013	0.30	15.00	NNE
11 Dec, 2019	9:00 ~ 9:59	0.220	0.049	0.013	0.014	0.013	0.43	17.83	NNE
11 Dec, 2019	10:00 ~ 10:59	0.076	0.004	0.016	0.024	0.013	0.55	24.00	NNE
11 Dec, 2019	11:00 ~ 11:59	0.000	0.004	0.003	0.022	0.055	0.60	25.00	NNE
11 Dec, 2019	12:00 ~ 12:59	0.000	0.004	0.005	0.027	0.205	0.65	22.33	NNE

Max	0.808	0.153	0.224	0.385	0.447
Avg	0.394	0.045	0.083	0.117	0.097
Min	0.000	0.000	0.001	0.001	0.013

Date	Time	CO	NO_2	$PM_{2.5}$	PM_{10}	SO_2	Wind Speed	Wind Direction	
		mg/m³	mg/m³	mg/m³	mg/m³	mg/m³	kph	Deg.	Direction
		Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly
11 Dec, 2019	13:00 ~ 13:59	0.000	0.004	0.050	0.057	0.369	0.63	144.83	SE
11 Dec, 2019	14:00 ~ 14:59	0.000	0.004	0.000	0.003	0.397	0.47	199.17	SSW
11 Dec, 2019	15:00 ~ 15:59	0.036	0.004	0.002	0.004	0.212	0.75	236.50	WSW
11 Dec, 2019	16:00 ~ 16:59	0.044	0.004	0.002	0.004	0.404	0.70	166.00	SSE
11 Dec, 2019	17:00 ~ 17:59	0.309	0.004	0.005	0.005	0.182	0.73	110.33	ESE
11 Dec, 2019	18:00 ~ 18:59	0.632	0.004	0.076	0.081	0.049	0.45	133.50	SE
11 Dec, 2019	19:00 ~ 19:59	0.606	0.038	0.118	0.120	0.021	0.23	199.17	SSW
11 Dec, 2019	20:00 ~ 20:59	0.570	0.150	0.108	0.129	0.013	0.13	197.67	SSW
11 Dec, 2019	21:00 ~ 21:59	0.764	0.162	0.124	0.159	0.013	0.20	73.00	ENE
11 Dec, 2019	22:00 ~ 22:59	0.803	0.129	0.123	0.164	0.013	0.08	68.17	ENE
11 Dec, 2019	23:00 ~ 23:59	0.611	0.140	0.146	0.215	0.013	0.05	89.50	E
12 Dec, 2019	0:00 ~ 0:59	0.387	0.123	0.165	0.244	0.013	0.13	57.17	ENE
12 Dec, 2019	1:00 ~ 1:59	0.435	0.108	0.195	0.304	0.013	0.15	62.50	ENE
12 Dec, 2019	2:00 ~ 2:59	0.577	0.113	0.211	0.298	0.013	0.10	79.33	E
12 Dec, 2019	3:00 ~ 3:59	0.708	0.028	0.256	0.359	0.013	0.13	57.67	ENE
12 Dec, 2019	4:00 ~ 4:59	0.133	0.112	0.199	0.256	0.013	0.38	47.83	NE
12 Dec, 2019	5:00 ~ 5:59	0.369	0.125	0.183	0.234	0.013	0.02	15.50	NNE
12 Dec, 2019	6:00 ~ 6:59	0.328	0.132	0.166	0.213	0.013	0.05	22.00	NNE
12 Dec, 2019	7:00 ~ 7:59	0.323	0.104	0.132	0.164	0.013	0.22	20.83	NNE
12 Dec, 2019	8:00 ~ 8:59	0.265	0.161	0.095	0.118	0.013	0.33	13.00	NNE
12 Dec, 2019	9:00 ~ 9:59	0.200	0.055	0.035	0.044	0.013	0.43	14.17	NNE
12 Dec, 2019	10:00 ~ 10:59	0.107	0.004	0.009	0.016	0.013	0.60	28.67	NNE
12 Dec, 2019	11:00 ~ 11:59	0.056	0.004	0.016	0.042	0.073	0.88	48.50	NE
12 Dec, 2019	12:00 ~ 12:59	0.029	0.004	0.024	0.093	0.214	1.32	88.17	E

Max	0.803	0.162	0.256	0.359	0.404
Avg	0.346	0.071	0.102	0.139	0.088
Min	0.000	0.004	0.000	0.003	0.013

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED MJTD

Date	Time	CO	NO_2	$PM_{2.5}$	PM_{10}	SO_2	Wind Speed	Wind Direction	
		mg/m³	mg/m³	mg/m³	mg/m³	mg/m³	kph	Deg.	Direction
		Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly
12 Dec, 2019	13:00 ~ 13:59	0.007	0.004	0.013	0.097	0.281	1.25	98.67	E
12 Dec, 2019	14:00 ~ 14:59	0.006	0.004	0.060	0.098	0.351	1.26	104.40	ESE
12 Dec, 2019	15:00 ~ 15:59	0.016	0.004	0.100	0.104	0.355	1.12	99.60	E
12 Dec, 2019	16:00 ~ 16:59	0.129	0.004	0.166	0.118	0.309	1.03	109.17	ESE
12 Dec, 2019	17:00 ~ 17:59	0.520	0.004	0.036	0.040	0.171	0.82	112.33	ESE
12 Dec, 2019	18:00 ~ 18:59	0.624	0.027	0.148	0.160	0.102	0.10	168.17	SSE
12 Dec, 2019	19:00 ~ 19:59	0.990	0.080	0.153	0.189	0.028	0.00	191.83	SSW
12 Dec, 2019	20:00 ~ 20:59	0.939	0.143	0.154	0.210	0.020	0.00	151.00	SSE
12 Dec, 2019	21:00 ~ 21:59	0.481	0.158	0.156	0.217	0.013	0.05	230.00	SW
12 Dec, 2019	22:00 ~ 22:59	0.781	0.175	0.160	0.216	0.013	0.10	85.67	E
12 Dec, 2019	23:00 ~ 23:59	0.605	0.143	0.159	0.209	0.013	0.17	65.00	ENE
13 Dec, 2019	0:00 ~ 0:59	0.565	0.143	0.162	0.222	0.013	0.13	62.83	ENE
13 Dec, 2019	1:00 ~ 1:59	0.557	0.162	0.172	0.236	0.013	0.20	107.00	ESE
13 Dec, 2019	2:00 ~ 2:59	0.605	0.060	0.186	0.248	0.013	0.28	56.17	NE
13 Dec, 2019	3:00 ~ 3:59	0.490	0.032	0.185	0.239	0.013	0.10	83.17	E
13 Dec, 2019	4:00 ~ 4:59	0.113	0.163	0.137	0.172	0.013	0.38	180.83	S
13 Dec, 2019	5:00 ~ 5:59	0.289	0.153	0.129	0.159	0.013	0.25	182.67	S
13 Dec, 2019	6:00 ~ 6:59	0.242	0.155	0.122	0.147	0.013	0.28	76.00	ENE
13 Dec, 2019	7:00 ~ 7:59	0.314	0.160	0.110	0.139	0.013	0.25	68.00	ENE
13 Dec, 2019	8:00 ~ 8:59	0.241	0.133	0.093	0.112	0.013	0.38	18.17	NNE
13 Dec, 2019	9:00 ~ 9:59	0.209	0.000	0.041	0.056	0.013	0.45	18.33	NNE
13 Dec, 2019	10:00 ~ 10:59	0.099	0.004	0.012	0.037	0.013	0.97	37.83	NE
13 Dec, 2019	11:00 ~ 11:59	0.069	0.004	0.040	0.076	0.036	1.80	64.83	ENE
13 Dec, 2019	12:00 ~ 12:59	0.055	0.004	0.025	0.065	0.091	1.85	77.50	ENE

Max	0.990	0.175	0.186	0.248	0.355
Avg	0.373	0.082	0.113	0.149	0.080
Min	0.006	0.000	0.012	0.037	0.013

Date	Time	CO	NO_2	$PM_{2.5}$	PM_{10}	SO_2	Wind Speed	Wind Direction	
		mg/m³	mg/m³	mg/m³	mg/m³	mg/m³	kph	Deg.	Direction
		Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly
13 Dec, 2019	13:00 ~ 13:59	0.028	0.004	0.014	0.066	0.152	1.77	92.50	E
13 Dec, 2019	14:00 ~ 14:59	0.012	0.004	0.024	0.083	0.219	1.65	91.67	E
13 Dec, 2019	15:00 ~ 15:59	0.070	0.004	0.082	0.101	0.254	1.40	100.50	E
13 Dec, 2019	16:00 ~ 16:59	0.209	0.004	0.149	0.117	0.216	0.95	107.50	ESE
13 Dec, 2019	17:00 ~ 17:59	0.542	0.004	0.023	0.024	0.270	0.18	150.50	SSE
13 Dec, 2019	18:00 ~ 18:59	0.411	0.026	0.158	0.184	0.124	0.00	170.67	S
13 Dec, 2019	19:00 ~ 19:59	0.084	0.090	0.196	0.250	0.138	0.03	145.83	SE
13 Dec, 2019	20:00 ~ 20:59	0.588	0.145	0.234	0.321	0.054	0.17	67.83	ENE
13 Dec, 2019	21:00 ~ 21:59	0.632	0.085	0.229	0.321	0.013	0.12	95.67	E
13 Dec, 2019	22:00 ~ 22:59	0.662	0.120	0.227	0.319	0.013	0.12	71.33	ENE
13 Dec, 2019	23:00 ~ 23:59	0.755	0.148	0.227	0.316	0.013	0.13	65.00	ENE
14 Dec, 2019	0:00 ~ 0:59	0.757	0.111	0.214	0.296	0.013	0.12	63.17	ENE
14 Dec, 2019	1:00 ~ 1:59	0.417	0.145	0.205	0.285	0.013	0.13	69.17	ENE
14 Dec, 2019	2:00 ~ 2:59	0.193	0.052	0.143	0.179	0.013	0.17	88.17	E
14 Dec, 2019	3:00 ~ 3:59	0.159	0.172	0.205	0.285	0.013	0.15	68.83	ENE
14 Dec, 2019	4:00 ~ 4:59	0.160	0.150	0.143	0.179	0.013	0.38	121.83	ESE
14 Dec, 2019	5:00 ~ 5:59	0.196	0.137	0.041	0.052	0.013	0.25	183.33	S
14 Dec, 2019	6:00 ~ 6:59	0.164	0.135	0.094	0.120	0.013	0.45	180.83	S
14 Dec, 2019	7:00 ~ 7:59	0.306	0.145	0.093	0.131	0.013	0.42	122.67	ESE
14 Dec, 2019	8:00 ~ 8:59	0.171	0.118	0.089	0.109	0.013	0.57	64.83	ENE
14 Dec, 2019	9:00 ~ 9:59	0.202	0.029	0.053	0.076	0.013	0.65	73.83	ENE
14 Dec, 2019	10:00 ~ 10:59	0.090	0.004	0.023	0.033	0.013	0.60	72.17	ENE
14 Dec, 2019	11:00 ~ 11:59	0.058	0.004	0.011	0.041	0.046	0.62	23.33	NNE
14 Dec, 2019	12:00 ~ 12:59	0.001	0.004	0.005	0.043	0.225	0.62	150.67	SSE

Max	0.757	0.172	0.234	0.321	0.270
Avg	0.286	0.077	0.120	0.164	0.078
Min	0.001	0.004	0.005	0.024	0.013

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED MJTD

Date	Time	CO	NO_2	$PM_{2.5}$	PM_{10}	SO_2	Wind Speed	Wind Direction	
		mg/m³	mg/m³	mg/m³	mg/m³	mg/m³	kph	Deg.	Direction
		Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly
14 Dec, 2019	13:00 ~ 13:59	0.022	0.004	0.004	0.047	0.431	0.60	90.17	E
14 Dec, 2019	14:00 ~ 14:59	0.002	0.004	0.008	0.055	0.090	0.53	180.33	S
14 Dec, 2019	15:00 ~ 15:59	0.000	0.004	0.064	0.091	0.000	0.38	269.17	W
14 Dec, 2019	16:00 ~ 16:59	0.022	0.004	0.015	0.017	0.027	0.35	188.83	S
14 Dec, 2019	17:00 ~ 17:59	0.313	0.004	0.023	0.027	0.438	0.12	196.33	SSW
14 Dec, 2019	18:00 ~ 18:59	0.566	0.007	0.147	0.164	0.224	0.05	188.17	S
14 Dec, 2019	19:00 ~ 19:59	0.772	0.079	0.118	0.147	0.085	0.13	104.67	ESE
14 Dec, 2019	20:00 ~ 20:59	1.130	0.122	0.140	0.188	0.025	0.05	96.67	E
14 Dec, 2019	21:00 ~ 21:59	0.881	0.149	0.138	0.199	0.014	0.12	110.83	ESE
14 Dec, 2019	22:00 ~ 22:59	0.892	0.148	0.141	0.216	0.013	0.02	78.83	E
14 Dec, 2019	23:00 ~ 23:59	0.355	0.160	0.158	0.244	0.013	0.08	61.33	ENE
15 Dec, 2019	0:00 ~ 0:59	0.389	0.129	0.170	0.235	0.013	0.02	35.00	NE
15 Dec, 2019	1:00 ~ 1:59	0.190	0.167	0.097	0.120	0.013	0.28	181.67	S
15 Dec, 2019	2:00 ~ 2:59	0.180	0.147	0.092	0.113	0.013	0.25	187.17	S
15 Dec, 2019	3:00 ~ 3:59	0.239	0.148	0.114	0.152	0.013	0.13	182.83	S
15 Dec, 2019	4:00 ~ 4:59	0.160	0.140	0.110	0.145	0.013	0.20	242.67	WSW
15 Dec, 2019	5:00 ~ 5:59	0.219	0.140	0.087	0.103	0.013	0.32	354.00	N
15 Dec, 2019	6:00 ~ 6:59	0.299	0.140	0.099	0.119	0.013	0.33	351.50	N
15 Dec, 2019	7:00 ~ 7:59	0.294	0.141	0.117	0.147	0.013	0.55	351.33	N
15 Dec, 2019	8:00 ~ 8:59	0.154	0.105	0.069	0.087	0.013	0.73	295.67	WNW
15 Dec, 2019	9:00 ~ 9:59	0.148	0.023	0.029	0.036	0.013	0.85	233.33	SW
15 Dec, 2019	10:00 ~ 10:59	0.111	0.004	0.009	0.012	0.013	0.80	288.17	WNW
15 Dec, 2019	11:00 ~ 11:59	0.055	0.004	0.007	0.027	0.081	0.80	122.00	ESE
15 Dec, 2019	12:00 ~ 12:59	0.045	0.004	0.004	0.039	0.266	0.80	289.50	WNW

Max	1.130	0.167	0.170	0.244	0.438
Avg	0.310	0.082	0.082	0.114	0.077
Min	0.000	0.004	0.004	0.012	0.000

Date	Time	CO	NO_2	$PM_{2.5}$	PM_{10}	SO_2	Wind Speed	Wind Direction	
		mg/m³	mg/m³	mg/m³	mg/m³	mg/m³	kph	Deg.	Direction
		Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly	Hourly
15 Dec, 2019	13:00 ~ 13:59	0.004	0.004	0.004	0.055	0.349	0.67	283.17	WNW
15 Dec, 2019	14:00 ~ 14:59	0.000	0.004	0.004	0.054	0.154	0.67	334.17	NNW
15 Dec, 2019	15:00 ~ 15:59	0.000	0.004	0.049	0.076	0.000	0.53	341.67	NNW
15 Dec, 2019	16:00 ~ 16:59	0.022	0.004	0.008	0.011	0.028	0.47	330.50	NNW
15 Dec, 2019	17:00 ~ 17:59	0.457	0.004	0.019	0.021	0.341	0.30	258.33	WSW
15 Dec, 2019	18:00 ~ 18:59	0.801	0.016	0.080	0.092	0.252	0.13	145.00	SE
15 Dec, 2019	19:00 ~ 19:59	0.657	0.071	0.117	0.149	0.079	0.07	170.83	S
15 Dec, 2019	20:00 ~ 20:59	0.617	0.109	0.105	0.135	0.020	0.00	163.33	SSE
15 Dec, 2019	21:00 ~ 21:59	0.871	0.130	0.114	0.145	0.013	0.00	47.17	NE
15 Dec, 2019	22:00 ~ 22:59	0.508	0.157	0.109	0.136	0.013	0.05	182.33	S
15 Dec, 2019	23:00 ~ 23:59	0.516	0.157	0.093	0.111	0.013	0.13	319.67	NW
16 Dec, 2019	0:00 ~ 0:59	0.155	0.126	0.078	0.096	0.013	0.38	295.50	WNW
16 Dec, 2019	1:00 ~ 1:59	0.153	0.105	0.051	0.058	0.013	0.62	352.50	N
16 Dec, 2019	2:00 ~ 2:59	0.158	0.101	0.044	0.048	0.013	0.57	295.33	WNW
16 Dec, 2019	3:00 ~ 3:59	0.138	0.101	0.039	0.042	0.013	0.53	296.33	WNW
16 Dec, 2019	4:00 ~ 4:59	0.164	0.100	0.037	0.043	0.013	0.57	351.50	N
16 Dec, 2019	5:00 ~ 5:59	0.205	0.109	0.053	0.067	0.013	0.23	295.83	WNW
16 Dec, 2019	6:00 ~ 6:59	0.223	0.114	0.112	0.131	0.017	0.28	235.67	SW
16 Dec, 2019	7:00 ~ 7:59	0.270	0.118	0.046	0.058	0.013	0.40	292.50	WNW
16 Dec, 2019	8:00 ~ 8:59	0.157	0.101	0.054	0.064	0.013	0.78	233.33	SW
16 Dec, 2019	9:00 ~ 9:59	0.193	0.019	0.018	0.029	0.013	0.70	237.17	WSW
16 Dec, 2019	10:00 ~ 10:59	0.163	0.004	0.011	0.023	0.016	0.67	347.33	NNW
16 Dec, 2019	11:00 ~ 11:59	0.116	0.004	0.004	0.019	0.148	0.75	344.67	NNW
16 Dec, 2019	12:00 ~ 12:59	0.064	0.004	0.003	0.028	0.355	0.73	285.67	WNW

Max	0.871	0.157	0.117	0.149	0.355
Avg	0.275	0.069	0.052	0.070	0.080
Min	0.000	0.004	0.003	0.011	0.000

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED MJTD

APPENDIX-2 CERTIFICATE OF CALIBRATION

MYANMAR JAPAN THILAWA DEVELOPMENT LIMITED
MJTD

Certificate of Calibration

Certificate Number: EDCQP200-4.11.5

Environmental Devices Corporation certifies the Haz-Scanner model EPAS is calibrated to published specifications and NIST traceable.

Calibration Dust Specifications are NIST traceable using Coulter Mutisizer II c. ISO12103 –1 A2 Fine Test Dust and is designed to agree with EPA Class I and Class III FRM and FEM particulate samplers and monitors and EN 12341 and EN 14907 standards.

Gas sensors are Calibrated against NIST/EPA traceable Calibration Gas using NIST primary Flow Standard: LFE774300 to ISO 17025 and EPA Instrumental Test Methods as defined by 40 CFR Part 60.

Quality system standard to meet the requirements of ANSI/ASQC standard Q9000-1994 (ISO 9001), MIL-STD 45662A, and customer's specification if required.

Temperature = 22°C
Relative Humidity = 30%
Atmospheric Pressure = 760 mmHg
Measurement Uncertainty Estimated @ 95% Confidence Level (k=2) using ISO 17025 guidelines.

Model	Serial Number	Calibration Date	Next Calibration Due
EPAS	918189	October 28, 2019	October 2020

Calibration Span Accessory if purchased	Sensor A	Sensor B	Model
	K= 12. F 50	K= 9.475	CS-105

Technician

Dan Okuniewicz

Supervisor

Mark Sullivan

Environmental Devices Corporation
4 Wilder Drive Building #15
Plaistow, NH 03865
ISO-9001 Certified

Thilawa Special Economic Zone (Zone B)

Development Project –Phase 3

Appendix-B

Noise and Vibration Monitoring Report

December 2019

NOISE AND VIBRATION

MONITORING REPORT

FOR DEVELOPMENT OF INDUSTRIAL AREA

THILAWA SEZ ZONE B

(PHASE 3 CONSTRUCTION STAGE)

(QUARTERLY MONITORING)

December 2019

Myanmar Koei International Ltd.

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CHAPTER 1: OUTLINES AND SUMMARY OF MONITORING PLAN

1.1 General

Thilawa Special Economic Zone (TSEZ) is located in southern district of Yangon region and about 23 km southeast of Yangon city. As the developer of Thilawa SEZ, Myanmar Japan Thilawa Development Ltd., (MJTD) has a responsibility to carry out regular environmental monitoring in the industrial area of Zone B in accordance with the approved Environmental Impact Assessment (EIA) report with Environmental Management Plan (EMP). MJTD has implemented monitoring various environmental items with the specified time frame to know the environmental conditions in and around the area.

1.2 Outlines of Monitoring Plan

To assess the environmental condition under the construction of industrial area in and around Thilawa SEZ Zone B, noise and vibration levels had been monitored from 9 December 2019 – 11 December 2019 as follows:

Table 1.2-1 Outlines of Noise and Vibration Level Monitoring

Monitoring Date	Monitoring Item	Parameters	Number of Points	Duration	Monitoring Methodology
From 10–11 Dec 2019	Noise Level	L_{Aeq} (dB)	1 (NV-1)	24 hours	On-site measurement by "Rion NL-42 sound level meter"
From 9–10 Dec 2019	Noise Level	L_{Aeq} (dB)	1 (NV-2)	24 hours	On-site measurement by "Rion NL-42 sound level meter"
From 10–11 Dec 2019	Vibration Level	L_{v10} (dB)	1 (NV-1)	24 hours	On-site measurement by "Vibration Level Meter- VM-53A"
From 9–10 Dec 2019	Vibration Level	L_{v10} (dB)	1 (NV-2)	24 hours	On-site measurement by "Vibration Level Meter- VM-53A"

Source: Myanmar Koei International Ltd

CHAPTER 2: NOISE AND VIBRATION LEVEL MONITORING

2.1 Monitoring Item

The noise and vibration level monitoring items are shown in Table 2.1-1.

Table 2.1-1 Monitoring Parameters for Noise and Vibration Level

No.	Item	Parameter
1	Noise	A-weighed loudness equivalent (L_{Aeq})
2	Vibration	Vibration level, vertical, percentile (L_{V10})

Source: Myanmar Koei International Ltd.

2.2 Monitoring Location

Noise and vibration levels were measured in the northeast corner of the Thilawa SEZ Zone B, monitoring point (NV-1); N: 16°40'18.22", E: 96°17'18.18" for traffic noise concerned and in the south of the Thilawa SEZ Zone B, monitoring point (NV-2); N: 16°39'24.90", E: 96°17'16.70", inside the monastery compound of Phalan village. The location of the noise and vibration monitoring points are shown in Figure 2.2-1.

Source: Google Earth

Figure 2.2-1 Location of Noise and Vibration Level Monitoring Points

NV-1

NV-1 is located in front of temporary gate of construction site of Thilawa SEZ Zone B and next to Thilawa Development road. The surrounding area are Zone A in the northwest, local industrial zone in the east respectively. Possible sources of noise and vibration is generated from construction activities and road traffic.

NV-2

NV-2 is located at the south of the Thilawa SEZ Zone B, inside the monastery compound of Phalan village, surrounded by the residential houses of Phalan village in the south and fields in west, Thilawa SEZ Zone A in north, local industrial zone in northeast respectively. Possible sources of noise and vibration is generated from construction activities from Zone B and daily human activities from nearby Phalan village.

2.3 Monitoring Method

Noise level was measured by "Rion NL-42 sound level meter" and automatically records every 10 minutes in a memory card. The vibration level meter, VM-53A (Rion Co., Ltd., Japan), was accompanied by a 3-axis accelerometer PV-83C (Rion Co., Ltd.) and it was placed on solid soil ground. Vertical vibration (Z axis), L_v, was measured every 10 minutes within the adaptable range of (10-70) dB at NV-1 and (10-70) dB at NV-2 and recorded to a memory card.
The measurement period of noise and vibration was 24 hours for each monitoring point. The status of the noise and vibration level monitoring on NV-1 and NV-2 are shown in Figure 2.3-1.

Source: Myanmar Koei International Ltd.

Figure 2.3-1 Status of Noise and Vibration Level Monitoring at NV-1 and NV-2

2.4 Monitoring Results

Noise Monitoring Results

Noise monitoring results are separated as daytime (6:00 AM to 10:00 PM) and evening time (10:00 PM to 6:00 AM) time frames for NV-1 and daytime (7:00 AM to 7:00 PM), evening time (7:00 PM to 10:00 PM) and night time (10:00 PM to 7:00 AM) time frames respectively for NV-2. Noise measurement was carried out for one location on a 24-hour basis. The monitoring results are summarized in Table 2.4-1 and Table 2.4-2. Hourly noise level (LA_{eq}) monitoring results at NV-1 and NV-2 are shown in Table 2.4-3 and Table 2.4-4. Figure 2.4-1 and Figure 2.4-2 showed the results of noise level (LA_{eq}) at NV-1 and NV-2. Comparing with the target value of noise level in construction stage prescribed in EIA report for Thilawa SEZ development project Zone B, all results were under the target values. However, hourly noise level monitoring results at NV-2 at dawn (5:00-6:00) was slightly higher than the target value for one hour. And there were no construction activities at that time. According to the field surveyor record, this is due to passing of motorcycles, horns and there was Dhama-sound broadcasting by loudspeaker at that time. Therefore, it is considered that there is no impact from construction activities of Zone B to the surrounding environment.

Table 2.4-1 Results of Noise Levels (LA_{eq}) Monitoring at NV-1

Date	(Traffic Noise Level) Equivalent Noise Level (LA_{eq}, dB)	
	Day Time (6:00 AM – 10:00 PM)	Night Time (10:00 PM – 6:00 AM)
10 – 11 Dec 2019	63	54
Target Value	75	70

Note: Target value is applied to the noise standard along main road stipulated in the Noise Regulation Law (Japan) (Law No. 98 of 1968, Latest Amendment by Law No 91 of 2000)
Source: Myanmar Koei International Ltd

Table 2.4-2 Results of Noise Levels (LA_{eq}) Monitoring at NV-2

Date	(Residential area & monastery located less than 150m from the construction site) Equivalent Noise Level (LA_{eq}, dB)		
	Day Time (7:00 AM – 7:00 PM)	Evening Time (7:00 PM – 10:00 PM)	Night Time (10:00 PM – 7:00 AM)
9 – 10 Dec 2019	52	48	51
Target Value	75	60	55

Note: Target value is applied to the noise level during the construction stage in the EIA Report for Thilawa SEZ Development Project (Industrial Area of Zone B)
Source: Myanmar Koei International Ltd

Table 2.4-3 Hourly Noise Level (LA_{eq}) Monitoring Results at NV-1

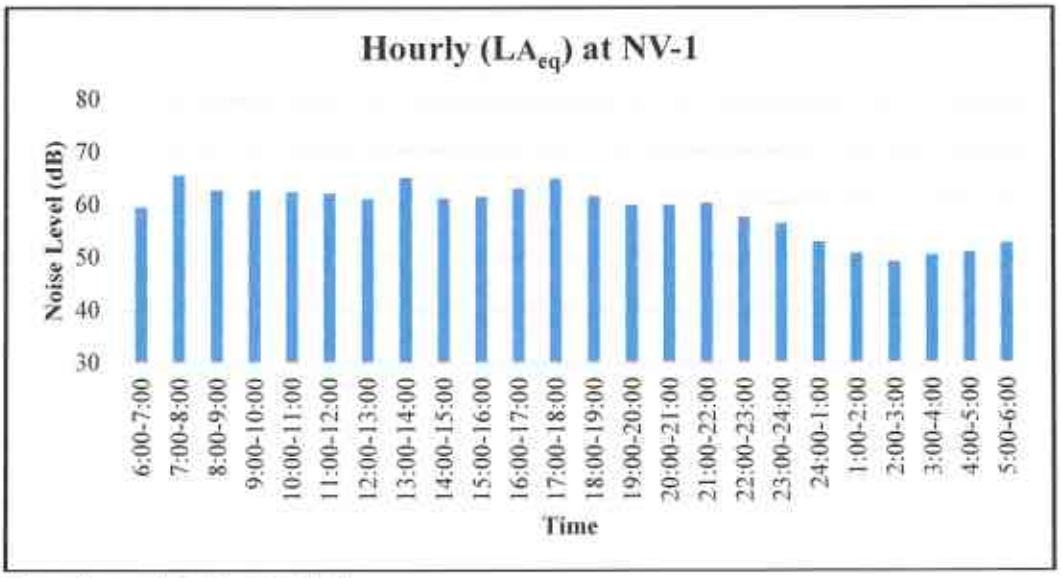
Date	Time	(LA_{eq}, dB)	(LA_{eq}, dB) Each Category	(LA_{eq}, dB) Target Value	Remark
10 - 11 Dec 2019	6:00-7:00	59	63	75	No construction Activities
	7:00-8:00	66			
	8:00-9:00	63			Construction activities of Zone B (Land Grading works, Road Sub-grade, Pipe installation works, Retention Pond and General use, etc.,)
	9:00-10:00	63			
	10:00-11:00	62			
	11:00-12:00	62			
	12:00-13:00	61			
	13:00-14:00	65			
	14:00-15:00	61			
	15:00-16:00	62			
	16:00-17:00	63			
	17:00-18:00	65			
	18:00-19:00	62			
	19:00-20:00	60			
	20:00-21:00	60			No construction Activities
	21:00-22:00	60			
	22:00-23:00	58	54	70	
	23:00-24:00	56			
	24:00-1:00	53			
	1:00-2:00	51			
	2:00-3:00	49			
	3:00-4:00	50			
	4:00-5:00	51			
	5:00-6:00	53			

Source: Myanmar Koei International Ltd.

Table 2.4-4 Hourly Noise Level (LA_{eq}) Monitoring Results at NV-2

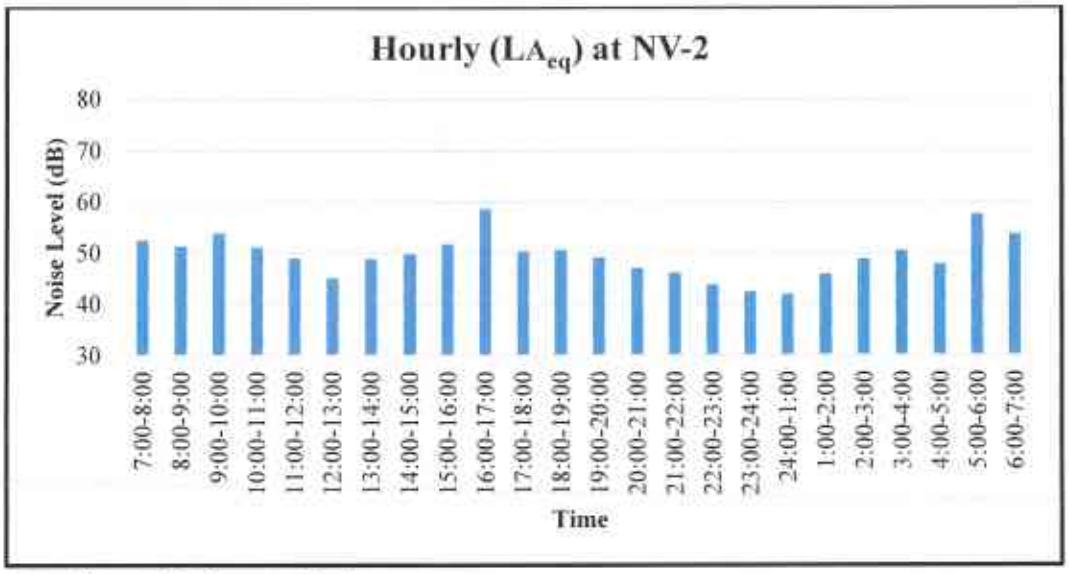
Date	Time	(LA_{eq}, dB)	(LA_{eq}, dB) Each Category	(LA_{eq}, dB) Target Value	Remark
9 - 10 Dec 2019	7:00-8:00	53	52	75	Construction activities of Zone B (Land Grading works, Road Sub-grade, Pipe installation works, Retention Pond and General use, etc.,)
	8:00-9:00	51			
	9:00-10:00	54			
	10:00-11:00	51			
	11:00-12:00	49			
	12:00-13:00	45			
	13:00-14:00	49			
	14:00-15:00	50			
	15:00-16:00	52			
	16:00-17:00	59			
	17:00-18:00	50			
	18:00-19:00	51			
	19:00-20:00	49	48	60	
	20:00-21:00	47			No construction Activities
	21:00-22:00	46			
	22:00-23:00	44	51	55	
	23:00-24:00	42			
	24:00-1:00	42			
	1:00-2:00	46			
	2:00-3:00	49			
	3:00-4:00	50			
	4:00-5:00	48			
	5:00-6:00	58			
	6:00-7:00	54			

Source: Myanmar Koei International Ltd.



Source: Myanmar Koei International Ltd.

Figure 2.4-1 Results of Noise Levels (LA_{eq}) Monitoring at NV-1



Source: Myanmar Koei International Ltd.

Figure 2.4-2 Results of Noise Levels (LA_{eq}) Monitoring at NV-2

Vibration Monitoring Results

Vibration monitoring results are separated as daytime (7:00 AM to 7:00 PM), evening time (7:00 PM to 10:00 PM) and night time (10:00 PM to 7:00 AM) time frames respectively for both NV-1 and NV-2. Vibration measurement was carried out for one location on a 24-hour basis. The results of vibration level (L_{v10}) monitoring at NV-1 and NV-2 are shown in Table 2.4-5 and Table 2.4-6. Hourly vibration level (L_{v10}) monitoring results at NV-1 and NV-2 are shown in Table 2.4-7 and Table 2.4-8. Figure 2.4-3 and Figure 2.4-4 showed the graph of vibration level monitoring results at NV-1 and NV-2. By comparing with the target vibration level in construction stage in EIA report for Thilawa SEZ development project Zone B, all of results were under the target values.

Table 2.4-5 Results of Vibration Levels (L_{v10}) Monitoring at NV-1

Date	(Residential and commercial and industrial areas) Equivalent Vibration Level (L_{v10}, dB)		
	Day Time (7:00 AM – 7:00 PM)	Evening Time (7:00 PM – 10:00 PM)	Night Time (10:00 PM – 7:00 AM)
10 – 11 Dec 2019	44	41	35
Target Value	70	70	65

Note: Target value is applied to the vibration level during the construction stage in the EIA Report for Thilawa SEZ Development Project (Industrial Area of Zone B).
Source: Myanmar Koei International Ltd.

Table 2.4-6 Results of Vibration Levels (L_{v10}) Monitoring at NV-2

Date	(Monastery and residential area) Equivalent Vibration Level (L_{v10}, dB)		
	Day Time (7:00 AM – 7:00 PM)	Evening Time (7:00 PM – 10:00 PM)	Night Time (10:00 PM – 7:00 AM)
9 – 10 Dec 2019	33	25	14
Target Value	65	65	60

Note: Target value is applied to the vibration level during the construction stage in the EIA Report for Thilawa SEZ Development Project (Industrial Area of Zone B).
Source: Myanmar Koei International Ltd.

Table 2.4-7 Results of Hourly Vibration Levels (L_{v10}) Monitoring at NV-1

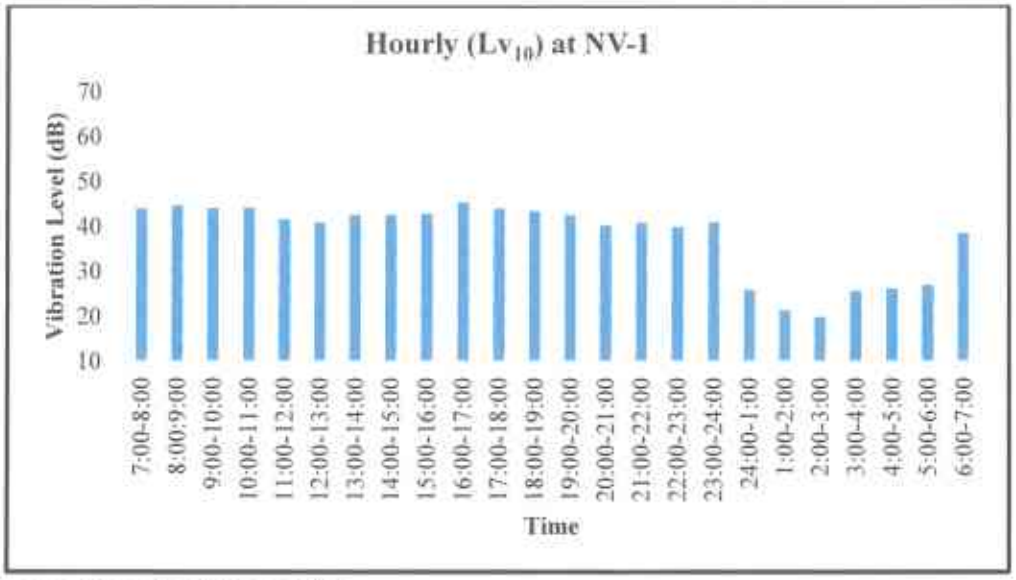
Date	Time	(L_{v10}, dB)	(L_{v10}, dB) Each Category	(L_{v10}, dB) Target Value	Remark
10 - 11 Dec 2019	7:00-8:00	44	44	70	Construction activities of Zone B (Land Grading works, Road Sub-grade, Pipe installation works, Retention Pond and General use, etc.,)
	8:00-9:00	45			
	9:00-10:00	44			
	10:00-11:00	44			
	11:00-12:00	42			
	12:00-13:00	41			
	13:00-14:00	43			
	14:00-15:00	43			
	15:00-16:00	43			
	16:00-17:00	45			
	17:00-18:00	44			
	18:00-19:00	43			
	19:00-20:00	43	41	70	No construction Activities
	20:00-21:00	40			
	21:00-22:00	41			
	22:00-23:00	40	35	65	
	23:00-24:00	41			
	24:00-1:00	26			
	1:00-2:00	21			
	2:00-3:00	20			
	3:00-4:00	26			
	4:00-5:00	26			
	5:00-6:00	27			
	6:00-7:00	39			

Source: Myanmar Koei International Ltd

Table 2.4-8 Results of Hourly Vibration Levels (L_{v10}) Monitoring at NV-2

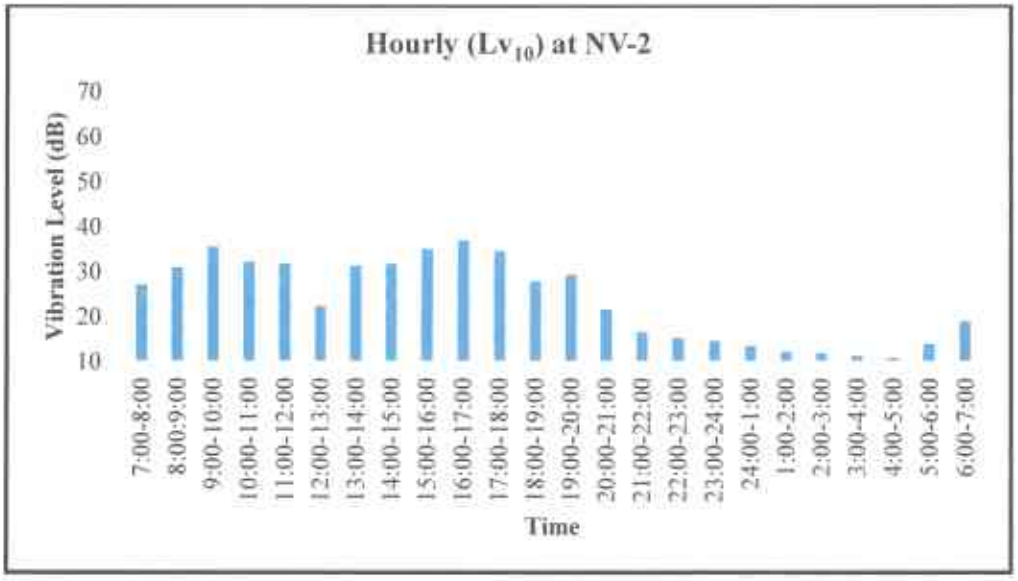
Date	Time	(L_{v10}, dB)	(L_{v10}, dB) Each Category	(L_{v10}, dB) Target Value	Remark
9 – 10 Dec 2019	7:00-8:00	27	33	65	Construction activities of Zone B (Land Grading works, Road Sub-grade, Pipe installation works, Retention Pond and General use, etc.,)
	8:00-9:00	31			
	9:00-10:00	36			
	10:00-11:00	32			
	11:00-12:00	32			
	12:00-13:00	22			
	13:00-14:00	31			
	14:00-15:00	32			
	15:00-16:00	35			
	16:00-17:00	37			
	17:00-18:00	35			
	18:00-19:00	28			
	19:00-20:00	29	25	65	No construction Activities
	20:00-21:00	22			
	21:00-22:00	17			
	22:00-23:00	15	14	60	
	23:00-24:00	15			
	24:00-1:00	14			
	1:00-2:00	12			
	2:00-3:00	12			
	3:00-4:00	11			
	4:00-5:00	11			
	5:00-6:00	14			
	6:00-7:00	19			

Source: Myanmar Koei International Ltd



Source: Myanmar Koei International Ltd

Figure 2.4-3 Results of Vibration Levels (L_{v10}) Monitoring at NV-1



Source: Myanmar Koei International Ltd

Figure 2.4-4 Results of Vibration Levels (L_{v10}) Monitoring at NV-2

CHAPTER 3: CONCLUSION AND RECOMMENDATION

By comparing with the target noise and vibration level in construction stage in EIA report for Thilawa SEZ development project Zone B, all results were under the target values at NV-1 and NV-2. As for the detailed analysis of noise level at NV-1 and NV-2 for 24 hours, all results were under the target value except for NV-2 at dawn (5:00 – 6:00). Hourly noise level monitoring results at NV-2 at dawn was slightly higher than the target value for one hour. And there were no construction activities at that time. According to the field surveyor record, this is due to passing of motorcycles, horns and there was Dhama-sound broadcasting by loudspeaker at that time. Therefore, it is considered that there is no impact from construction activities of Zone B to the surrounding environment. The results of vibration level for NV-1 and NV-2 were also lower than the target levels. Thus, there is no negative impact on noise and vibration from construction activities of Zone B to the surrounding environment.

In conclusion of this environmental monitoring, there are no specific noise and vibration impacts to the surrounding area of industrial area of Thilawa SEZ Zone B during the monitoring period.

Thilawa Special Economic Zone (Zone B)

Development Project –Phase 3

Appendix-D

Traffic Volume Monitoring Report

December 2019

TRAFFIC VOLUME MONITORING REPORT

FOR DEVELOPMENT OF INDUSTRIAL AREA

THILAWA SEZ ZONE B

(PHASE 3 CONSTRUCTION STAGE)

(QUARTERLY MONITORING)

December 2019

Myanmar Koei International Ltd.

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CHAPTER 1: OUTLINES AND SUMMARY OF MONITORING PLAN

1.1 General

Thilawa Special Economic Zone (TSEZ) is located in southern district of Yangon region and about 23 km southeast of Yangon city. As the developer of Thilawa SEZ, Myanmar Japan Thilawa Development Ltd., (MJTD) has a responsibility to carry out regular environmental monitoring in the industrial area of Zone B in accordance with the approved Environmental Impact Assessment (EIA) report with Environmental Management Plan (EMP). MJTD has implemented monitoring various environmental items with the specified time frame to know the environmental conditions in and around the area.

1.2 Outlines of Monitoring Plan

To assess the environmental condition under the construction of industrial area in and around Thilawa SEZ Zone B, Traffic volume had been monitored from 10 December 2019 to 11 December 2019 as follows;

Table 1.2-1 Outlines of Traffic Volume Monitoring

Monitoring Date	Monitoring Item	Parameters	Number of Points	Duration	Monitoring Methodology
10 Dec 2019 - 11 Dec 2019	Traffic Volume	-	1 (TV-1)	24 hours	Manual Count

Source: Myanmar Koei International Ltd.

CHAPTER 2: TRAFFIC VOLUME MONITORING

2.1 Monitoring Item

The traffic volume monitoring item are shown in Table 2.1-1. All vehicles were classified into four types as detailed in Table 2.1-2.

Table 2.1-1 Monitoring Parameters for Traffic Volume

No.	Item	Parameter
1	Traffic volume	Number of Vehicle (4 Types)

Source: Myanmar Koei International Ltd.

Table 2.1-2 Classification of Vehicles Types

No.	Classification		Description
1	Two-wheeled vehicle		Motorbike, Motorcycle taxi
2	Four-wheeled light vehicle	  	Pick-up car, Jeep, Taxi, Saloon car, Light truck (under 2 tons)
3	Four-wheeled heavy vehicle	  	Medium bus, Express, Big bus, Medium truck, Heavy truck
4	Others		Tractor

Source: Myanmar Koei International Ltd.

2.2 Monitoring Location

Traffic volume was measured at the northeast corner of the Thilawa SEZ Zone B, monitoring point (TV-1); N: 16°40'17.90", E: 96°17'18.20". The location of the traffic volume monitoring point is shown in Figure 2.2-1.

Figure 2.2-1 Location of Traffic Volume Monitoring Point

TV-1

TV-1 is located in front of main gate of construction site of Thilawa SEZ Zone B and next to Thilawa Development road. The surrounding area are Zone A in the northwest and local industrial zone in the east respectively.

2.3 Monitoring Method

The traffic volume monitoring was conducted for 24 hours at the same time as the traffic noise and vibration level monitoring. Traffic volume monitoring was conducted to count the number of vehicles moving in each direction. Manual count method was used and data was recorded using tally sheets. The status of the traffic volume monitoring on TV-1 is shown in Figure 2.3-1.

Source: Myanmar Koei International Ltd.

Figure 2.3-1 Status of Traffic Volume Monitoring at TV-1

2.4 Monitoring Results

The traffic volume monitoring results are summarized in Table 2.4-1. Hourly quantities of each type of vehicle were recorded. Table 2.4-1 shows that the number of 2-wheel vehicles are distinctly and highly utilized in weekdays. The number of 4-wheel heavy vehicles are four times lower than the number of 4-wheel light vehicles (Phalan village to Dagon-Thilawa road) and the number of 4-wheel heavy vehicles are three times lower than the number of 4-wheel light vehicles (Dagon-Thilawa road to Phalan village) for each direction.

Table 2.4-1 Summary of Traffic Volume Recorded at TV-1

Survey Point	Direction	Date	Weekday	2-wheel Vehicles	4-wheel Light Vehicles	4-wheel Heavy Vehicles	Others	Total
TV-1	Phalan village to Dagon-Thilawa road	10 Dec 2019 - 11 Dec 2019	Tuesday & Wednesday	3,082	1,511	449	75	5,117
	Dagon-Thilawa road to Phalan village			2,673	1,147	455	58	4,333

Source: Myanmar Koei International Ltd.

The summary monitoring results of hourly traffic volume at TV-1 is shown in Table 2.4-2 and Table 2.4-3 respectively. Compare the result of each direction in morning peak hours as 6:00 to 9:00 and in the evening peak hours as 16:00 to 18:00, traffic volume from Phalan village to Dagon Thilawa road is higher than another direction in the morning peak hours and in the evening peak hours. It may be possible that the commuting vehicles are passing from Phalan village to Dagon Thilawa road in the morning peak hours and in the evening peak hours in this monitoring period.

Table 2.4-2 Hourly Traffic Volume Results at TV-1 (From Phalan Village to Dagon-Thilawa Road)

From	To	Classification				Total
		Type of vehicles				
		Two-wheeled vehicle	Four-wheeled light vehicle	Four-wheeled heavy vehicle	Others	
11:00	12:00	150	99	22	5	276
12:00	13:00	187	125	26	8	346
13:00	14:00	126	98	29	8	261
14:00	15:00	111	99	38	4	252
15:00	16:00	129	92	37	7	265
16:00	17:00	111	103	34	6	254
17:00	18:00	500	201	35	5	741
18:00	19:00	195	103	35	1	334
19:00	20:00	90	33	11	0	134
20:00	21:00	160	27	15	1	203
21:00	22:00	34	15	20	2	71
22:00	23:00	54	23	16	0	93
23:00	0:00	12	9	12	0	33
0:00	1:00	7	7	1	0	15
1:00	2:00	12	3	1	1	17
2:00	3:00	6	2	4	0	12
3:00	4:00	4	4	1	1	10
4:00	5:00	3	7	1	0	11
5:00	6:00	17	7	1	1	26
6:00	7:00	120	24	2	1	147
7:00	8:00	636	166	21	9	832
8:00	9:00	235	134	30	4	403
9:00	10:00	83	60	27	4	174
10:00	11:00	100	70	30	7	207
Total		3082	1511	449	75	5117

Table 2.4-3 Hourly Traffic Volume Results at TV-1 (From Dagon-Thilawa Road to Phalan Village)

From	To	Classification				Total
		Type of vehicles				
		Two-wheeled vehicle	Four-wheeled light vehicle	Four-wheeled heavy vehicle	Others	
11:00	12:00	128	111	19	5	263
12:00	13:00	154	113	27	6	300
13:00	14:00	97	99	41	4	241
14:00	15:00	107	100	42	2	251
15:00	16:00	105	78	35	4	222
16:00	17:00	146	78	56	5	285
17:00	18:00	375	90	30	8	503
18:00	19:00	182	58	24	2	266
19:00	20:00	115	26	22	1	164
20:00	21:00	77	26	8	1	112
21:00	22:00	33	12	9	0	54
22:00	23:00	11	12	8	0	31
23:00	0:00	0	19	6	0	25
0:00	1:00	19	6	4	0	29
1:00	2:00	4	3	0	1	8
2:00	3:00	4	2	0	0	6
3:00	4:00	5	2	1	0	8
4:00	5:00	10	3	1	0	14
5:00	6:00	26	7	1	0	34
6:00	7:00	145	51	3	1	200
7:00	8:00	500	57	20	3	580
8:00	9:00	175	77	31	7	290
9:00	10:00	166	72	39	5	282
10:00	11:00	89	45	28	3	165
Total		2673	1147	455	58	4333

The summary of traffic volume results during quarterly monitoring at TV-1 is shown in Table 2.4-4 and Table 2.4-5 respectively. In the summary of traffic volume results during quarterly monitoring surveys at TV-1, comparison of traffic volume results for three years was described. Among the traffic monitoring surveys (quarterly), traffic volume results for September 2017 is the lowest compared with other quarterly monitoring surveys. Traffic volume results are increasing start from December 2017. Traffic volume results of December 2019 are the highest compared with other quarterly monitoring surveys from Phalan village to Dagon Thilawa Road and traffic volume results of September 2019 are the highest compared with other quarterly monitoring surveys from Dagon Thilawa Road to Phalan village.

Table 2.4-4 Summary of Traffic Volume Results During Quarterly Monitoring Surveys at TV-1 (From Phalan Village to Dagon Thilawa Road)

Survey Point	Direction	Date	Weekday	2-wheel Vehicles	4-wheel Light Vehicles	4-wheel Heavy Vehicles	Others	Total
TV-1	Phalan village to Dagon-Thilawa road	29 Mar – 30 Mar 2017	Wednesday & Thursday	1,712	545	216	29	2,502
		22 Jun – 23 Jun 2017	Thursday & Friday	1,402	528	352	47	2,329
		19 Sep – 20 Sep 2017	Tuesday & Wednesday	1,254	509	393	17	2,173
		7 Dec – 8 Dec 2017	Thursday & Friday	1,800	652	339	43	2,834
		15 Mar – 16 Mar 2018	Thursday and Friday	2,210	830	360	52	3,452
		5 Jun – 6 Jun 2018	Tuesday & Wednesday	2,253	847	323	54	3,477
		5 Sep – 6 Sep 2018	Wednesday & Thursday	2,146	826	242	41	3,255
		11 Dec – 12 Dec 2018	Tuesday & Wednesday	2,404	865	371	50	3,690
		12 Mar – 13 Mar 2019	Tuesday & Wednesday	2,484	916	377	68	3,845
		11 Jun – 12 Jun 2019	Tuesday & Wednesday	2,743	1,158	278	58	4,237
		17 Sep – 18 Sep 2019	Tuesday & Wednesday	2,908	1,364	438	63	4,773
		10 Dec – 11 Dec 2019	Tuesday & Wednesday	3,082	1,511	449	75	5,117

Source: Myanmar Koei International Ltd.

Table 2.4-5 Summary of Traffic Volume Results During Quarterly Monitoring Surveys at TV-1 (From Dagon-Thilawa Road to Phalan Village)

Survey Point	Direction	Date	Weekday	2-wheel Vehicles	4-wheel Light Vehicles	4-wheel Heavy Vehicles	Others	Total
TV-1	Dagon-Thilawa road to Phalan village	29 Mar – 30 Mar 2017	Wednesday & Thursday	1,534	500	236	28	2,298
		22 Jun – 23 Jun 2017	Thursday & Friday	1,291	542	357	43	2,233
		19 Sep – 20 Sep 2017	Tuesday & Wednesday	1,195	486	372	19	2,072
		7 Dec – 8 Dec 2017	Thursday & Friday	1,695	682	322	40	2,739
		15 Mar – 16 Mar 2018	Thursday and Friday	2,062	812	312	48	3,234
		5 Jun – 6 Jun 2018	Tuesday & Wednesday	2,048	799	322	52	3,221
		5 Sep – 6 Sep 2018	Wednesday & Thursday	2,117	865	250	41	3,273
		11 Dec – 12 Dec 2018	Tuesday & Wednesday	2,388	944	384	65	3,781
		12 Mar – 13 Mar 2019	Tuesday & Wednesday	2,618	970	362	57	4,007
		11 Jun – 12 Jun 2019	Tuesday & Wednesday	2,940	1,200	244	54	4,438
		17 Sep – 18 Sep 2019	Tuesday & Wednesday	2,911	1,280	422	48	4,661
		10 Dec – 11 Dec 2019	Tuesday & Wednesday	2,673	1,147	455	58	4,333

Source: Myanmar Koei International Ltd.

CHAPTER 3: CONCLUSION AND RECOMMENDATION

The results of the traffic volume show that the number of 2-wheel vehicles are distinctly and highly utilized in this monitoring period. The number of 4-wheel heavy vehicles are four times and three times significantly lower than the number of 4-wheel light vehicles for each direction. It seems that commuting vehicles are more utilized during this monitoring period as compared with construction related vehicles (4-wheel heavy vehicles). By comparing the previous quarterly traffic surveys, the traffic volume is increasing, starting from December 2017. Traffic volume results of December 2019 are the highest compared with other quarterly monitoring surveys from Phalan village to Dagon Thilawa Road and traffic volume results of September 2019 are the highest compared with other quarterly monitoring surveys from Dagon Thilawa Road to Phalan village.

The continuous monitoring will be necessary to grasp the traffic volume data in construction stage of Thilawa SEZ Zone B. Once enough traffic volume data is collected, the mitigation measures for traffic volume management will be considered in future.

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