CONTENTS

List of Figures

List of Tables

List of Photographs

List of Appendies

1. Excuetive Summary

1. Introduction

This environmental impact assessment (EIA) report for the Thigyit Coal Fired Power Plant has been prepared in accordance with the requirement set forth by the Environmental Impact Assessment Procedure (2015) in Myanmar. In line with the Environmental Conservation Law (2012) and Environmental Rules (2014) issued by the Ministry of Natural Resources and Environmental Conservation (MONREC), an EIA needs to be conducted.This assessment aims at identifying and evaluating the environmental and social impacts that would be occured from the operation of Thi gyit Coal fired power plant and at putting forward measures to to avoid, minimize and mitigate the negative impacts, and to further enhance the positive ones.

The proponent for the proposed project is Wuxi Hua Guang (Myanmar) Limited, established in April 29th 1993, a sole subsidiary of the former famous boiler manufacturer – Wuxi Boiler Works (now Wuxi Hua Guang Boiler Co., Ltd., a public company in Shanghai Stock Exchange with a Share Code of 600475) but it is an EPC Company taking boiler design, manufacturing as the business platform integrated with power plant design (coal-fired, gas & fuel oil-fired and variable regenerative fuels), manufacturing of boiler and its auxiliaries, matching of complete set of power plant, building, Installation and commissioning.

The EIA study has been carried out by E Guard Environmental Services Company Limited on approval of MONREC. Members of the EIA team along with their roles and responsibilities and academic qualifications are listed in Table 1.1. Contact address of the EIA consultant is shown below:

Name of Company: E Guard Environmental Services Company Limited

Address: No.11, Airport Avenue Road, Yangon Airport Road,
Saw Bwar Gyi Gone, Insein Township, Yangon 11011, Myanmar

Tel/Fax: +951-667953

Table 1.1 Positions, Responsibility and Academic Qualification of EIA Consultants

Name	Role	Academic Qualification
U Aye Thiha	Project Leader	M. Sc., (Natural Resources Management)
Daw Yu Wai Yan Thein Tan	Team Leader	M.Eng. (Environmental Engineering & Management)
U Win Myint	Biodiversity	Phd (Environmental Science)
Daw May Thu Htet	Social Specialist	Master of Economic
Daw Khine Mar Kyaw	Water and Air Pollution Control	M.S.C (Environmental Engineering & Management)
U Kyaw Soe Moe	GIS Expert	BE (civil)
U Sithu Min Naing	Mining Expert	BE (Mining)

U Aung Moe Oo	Survey and Enumerator	BE (Chemical)
Daw Thet Shwe Yee Aung	Survey and Enumerator	B.Sc (Geology)
Daw Ru Par Kyaw	Electrician	BE (Electrical Power)
U Thant Zin Aung	Project Assistant	BE (Mining)

2. Policy, Legal and Institutional Framework

Policies, legislations and guidelines in Myanmar that are of relevance to the project have been identified in the assessment and are shown in Table 1.2. Important parts of them are documented in Chapter 3 of this report. Among them, Environmental Impact Assessment Procedure (2015) and National Environmental Quality (Emission) Guidelines (2015), are considered to be the most important and hence a more detailed, yet brief, explanation is given for them in Chapter 3.

Table 1.2 Legislation related to Environmental and Social Considerations

No.	Name of Laws and Regulations	Year
1.	The Environmental Conservation Law	2012
2.	The Environmental Conservation Rules	2014
3.	Environmental Impact Assessment Procedure	2015
4.	Emission Quality Standards Guideline	2015
5.	The Myanmar Investment Law	2016
6.	Myanmar Investment Rule	2017
7.	The Rights of National Races Law	2015
8.	The Electricity Law	2014
9.	Boiler law	2015
10.	The Public Health Law	1972
11.	Prevention and Control of Communicable Disease Law	1995
12.	The Control of Smoking and Consumption of Tobacco Product Law	2006
13.	Myanmar Fire Force Law	2015
14.	The Motor Vehicle Law (2015) and Rules (1987)	2015

15.	The Myanmar Insurance Law	1993
16.	Factories Act	1951
17.	Labor Organization Law	2011
18.	Settlement of Labor Disputes law	2012
19.	The Development of Employment and Skill Law	2013
20.	Minimum Wages Law	2013
21.	Payment of Wages Law	2016
22.	Workmen"s Compensation Act	1923
23.	The Leaves and Holiday Act	1951
24.	Social Security Law	2012
25	Petroleum and Petroleum and Product of petroleum law	2016
26.	The Petroleum Rules	1937
27.	Conservation of Water Resources and Rivers Law	2006
28.	Freshwater Fisheries Law	1991
29.	The Protection and Preservation of Cultural Heritage Regions Law	1998
30.	The Protection and Preservation of Antique Objects Law	2015
31.	The Protection and Preservation of Ancient Monument Law	2015
32.	The Engineering Council Law	2013
33.	Import and Export law (if boiler is imported)	2012

3. Project Description and Alternative Selection

Project description includes project background, project location, overview map and site layout maps and power plant design concept, production process, project facilities, utilities and human resource requirement for operation of the power plant. The former Myanmar Electric Power Generation Enterprise under Ministry of Electricity and Energy had made an agreement with China Heavy Machinery Corporation (CHMC) of People"s Republic of China on 27 August 2001 for this power plant. The coal fired power plant will efficiently produce 120 MW of electricity by using coal produced from Thigyit coal mine. The total investment amounts to USD 45.150 million. Thigyit Coal Fired Power Plant is located at Thigyit village tract, Pinlaung Township, Pa Oh Self-Administration Region in the Southern Shan State at a coordinate of

Latitude 20°25'51.02"N and 96°42'9.24"E Longitude. Major similar activities near the project area comprises of Nagar Cement Plant, Nagar Quarry Site and Eden Coal Mine.

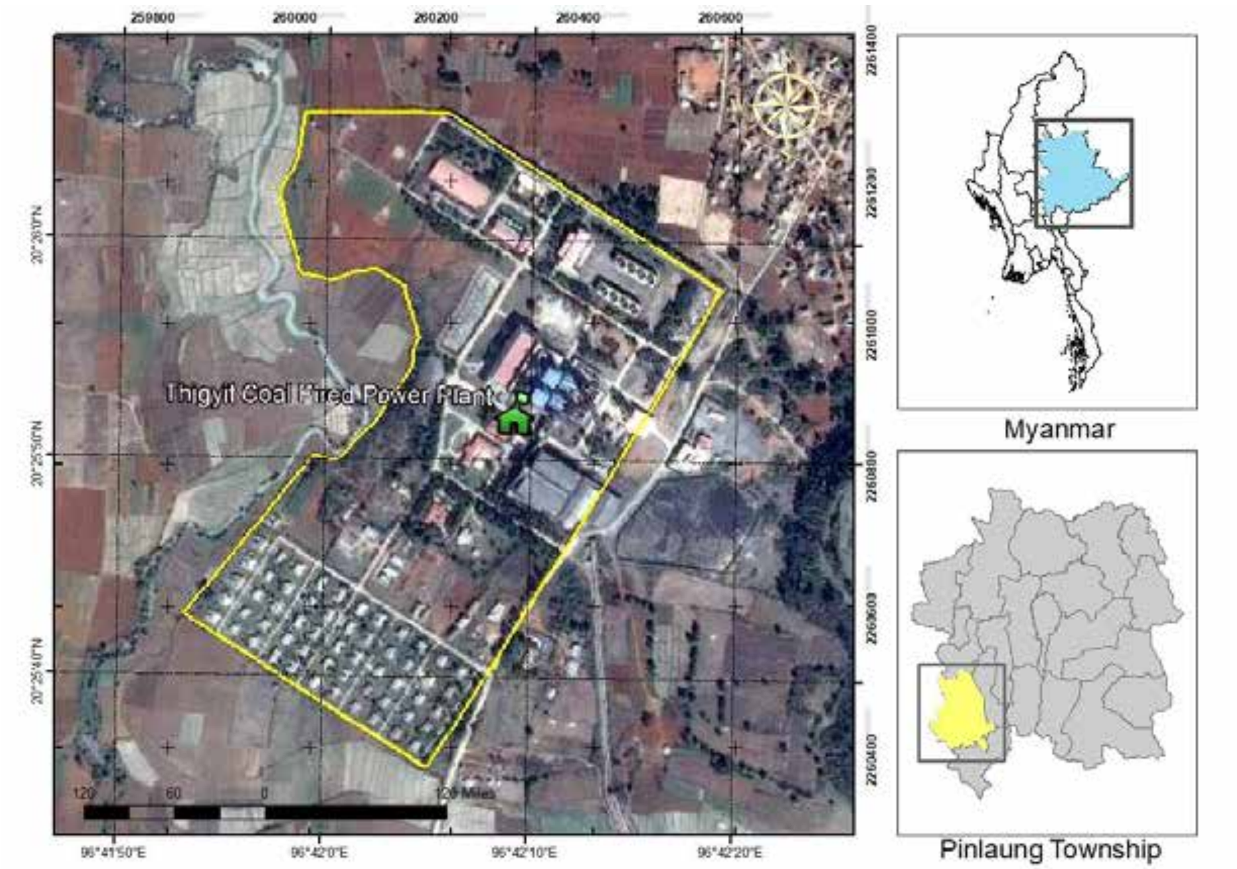


Figure 1.1 Project Location Map

Source: E Guard Study Team

The total land area of proposed project for power plant is 45.05 hectares (111.34 Acres). The power station use a conventional coal-fired technology at the initial stage which produces electricity by the burning of coal and air in a steam generator, where water is heated to produce high pressure and high temperature steam. The steam flows through a series of steam turbines which spin an electrical generator to produce electricity. The exhaust steam from the turbines is cooled, condensed back into water, and returned to the steam generator to repeat the process again. The detail production process, utilities alternatives are also explained in Chapter 4.

4. Description of Surrounding Environment

The baseline conditions of environmental and social status are determined based on the site visit, literature review, data from GAD and social survey questionnaire results. Field measurements were carried out near the project area ate eighteen locations for air quality, noise, and at ten locations for water quality. In addition, an inventory survey was carried out within the area of 5 km radius in order to assess biodiversity. A social survey was also carried out the 23 villages, staff housings of Thigyit power plant and Eden coal mine.

It was observed that all air quality measurements except that of PM2.5 value of A-5 located in Bank Mart Village exceeded the National Environmental Quality (NEQ) (emission) guideline values of 50 µg/m3and 25 µg/m3 in dry season. At wet season, the level of PMs at all points were within the guideline values. . The average concentration for 1 hour was, for instance, 44.17 µg/m3 at A-1, 43.32 µg/m3 at A-2, and 26.63 µg/m3 at A-3. All measurements were found to be lower than 200µg/m3, the guideline value specified in the NEQ (emission) Guidelines. Measured SO2 level was, for instance, 2.5µg/m3 and 1.29µg/m3 at A-1. All values at both seasons did not exceed 20µg/m3, the prescribed limit of the NEQ (emission) Guidelines.

Table 1.3 Results of Air Quality Measurement for Dry Season and Set Season

Point	**Location**	**Longitude and Latitude**	**Description of survey point**	**Season**	**Date**	**NEQ Guideline Values (µg/m3)**			
						PM10 (24 hrs average)	**PM2.5 (24 hrs average)**	**NO2 (1 hr average)**	**SO2 (24 hrs average)**
						50	25	200	20
						Result			
A-1	Junction of PyinThar and Thar Yar Gone	Lat: 20° 26‟ 0.813"N, Lon 096° 42‟ 19.709"E	0.53 km away from the Thigyit Coal Fired Power Plant	Dry Season	(30-31) March 2018	114.63	91.25	83.11	5.24
				Wet Season	(13-14) August 2018	9.41	5.08	27.27	3.37
A-2	Monastery of Taung Po Gyi	Lat: 20° 26‟ 28.760"N, Lon 096° 42‟ 20.519"E	1.11 km away from the Thigyit Coal Fired Power Plant	Dry Season	(31-1) March & April 2018	89.32	76.48	81.52	9.85
				Wet Season	(11-12) August 2018	7.2	3.12	28.83	2.72
A-3	Phayar Ngar Su Village	Lat: 20° 26‟ 47.705"N, Lon 096° 41‟ 53.205"E	1.73 km away from the Thigyit Coal Fired Power Plant	Dry Season	(1-2) April 2018	125	111.21	50.10	6.55
				Wet Season	(10-11) August 2018	15.19	8.74	33.19	2.71
A-4	Myin Twin Village	Lat: 20° 27‟ 52.778"N, Lon 096° 41‟ 36.149"E	3.79 km away from the Thigyit Coal Fired Power Plant	Dry Season	(3-4) April 2018	86.25	71.96	54.02	8.84
				Wet Season	(9-10) August 2018	13.09	6.03	32.35	2.81
A-5	Bank Mart Village	Lat: 20° 26‟ 53.390"N, Lon 096° 42‟ 45.445"E	2.08 km away from the Thigyit Coal Fired Power Plant	Dry Season	(4-5) April 2018	50	40	60.07	3.88
				Wet Season	(12-13) August	8.54	4.48	31.82	3.02

					2018				
A-6	Mya Sein Taung Village	Lat: 20° 25‟ 34.591"N, Lon 096° 43‟02.364"E	1.61 km away from the Thigyit Coal Fired Power Plant	Dry Season	(5-6) April 2018	56	43	56.46	3.87
				Wet Season	(15-16) August 2018	9.23	4.74	32.47	3.12
A-7	Pin Mi Gone Village	Lat: 20° 25‟ 00.073"N, Lon 096° 43‟45.101"E	3.18 km away from the Thigyit Coal Fired Power Plant	Dry Season	(7-8) April 2018	76	63	60.88	8.04
				Wet Season	(16-17) August 2018	8.48	3.87	39.52	2.76
A-8	Monastery of Thigyit Myo Ma	Lat: 20° 25‟ 05.099"N, Lon 096° 42‟14.903"E	1.52 km away from the Thigyit Coal Fired Power Plant	Dry Season	(8-9) April 2018	75	59	52.70	6.09
				Wet Season	(7-8) August 2018	14.97	8.26	29.90	2.75
A-9	Junction of Gant Kaw Pin and Pin Sein Su Village	Lat: 20° 25‟ 57.868"N, Lon 096° 39‟50.103"E	4.08 km away from the Thigyit Coal Fired Power Plant	Dry Season	(20-21) April 2018	55.38	45.81	77.65	7.72
				Wet Season	(22-23) August 2018	7.48	1.84	28.38	2.71
A-10	Naung Mu Village	(Lat: 20° 25‟ 14.20"N, Lon 096° 39‟49.77"E)	4.27 km away from the Thigyit Coal Fired Power Plant	Dry Season	(21-22) April 2018	53.88	42.65	65.69	4.87
				Wet Season	(21-22) August 2018	15.03	6.81	38.56	2.98
A-11	Moon Pin Village	Lat: 20° 25‟31.87"N, Lon 096° 41‟2.78"E	2.09 km away from the Thigyit Coal Fired Power Plant	Dry Season	(22-23) April 2018	83.75	62.14	61.26	2.80
				Wet Season	(24-25) August 2018	16.97	11.26	59.18	3.84
A-12	Sae Khaung Village	Lat: 20° 25‟ 30"N, Lon 096° 41‟39"E	1.14 km away from the Thigyit Coal	Dry Season	(23-24) April 2018	86.16	66.78	66.57	3.49

			Fired Power Plant	Wet Season	(17-18) August 2018	11.62	3.67	28.97	3.14
A-13	Pat Ta Lae Village	Lat: 20° 27" 9"N, Lon 096° 40" 3"E	4.35 km away from the Thigyit Coal Fired Power Plant	Dry Season	(24-25) April 2018	99.71	86.23	64.22	3.09
				Wet Season	(19-20) August 2018	8.69	4.07	36.42	2.84
A-14	Lwin Village	Lat: 20° 26" 19.50"N, Lon 096° 40" 35.49"E	2.76 km away from the Thigyit Coal Fired Power Plant	Dry Season	(25-26) April 2018	53.33	42.97	63.50	3.34
				Wet Season	(20-21) August 2018	6.2	1.82	27.81	2.70
A-15	Naung Moon Village	Lat: 20° 24" 52.17"N, Lon 096° 41" 51.50"E	2.46 km away from the Thigyit Coal Fired Power Plant	Dry Season	(26-27) April 2018	79.33	67.05	46.85	3.95
				Wet Season	(18-19) August 2018	10.13	2.57	29.80	2.81
A-16	Mee Thway Chaung Village	Lat: 20° 23" 37.91"N, Lon 096° 43" 5.19"E	4.50 km away from the Thigyit Coal Fired Power Plant	Dry Season	(28-29) April 2018	60.95	47.11	54.70	3.37
				Wet Season	(23-24) August 2018	9.41	5.54	41.85	2.84
A-17	Mya Kan Thar Village	Lat: 20° 25" 18.59"N, Lon 096° 42" 13.59"E	1.1 km away from the Thigyit Coal Fired Power Plant	Dry Season	(7-8) May 2018	94.78	77.13	98.42	43.70
				Wet Season	(14-15) August 2018	12.13	8.33	29.94	2.81
A-18	Taung Chay Village	Lat: 20° 26" 0.813"N, Lon 096° 42" 19.709"E	4.9 km away from the Thigyit Coal Fired Power Plant	Dry Season	(8-9) May 2018	95.09	77.62	93.11	3.66
				Wet Season	(8-9) August 2018	26.29	15.22	40.18	2.90

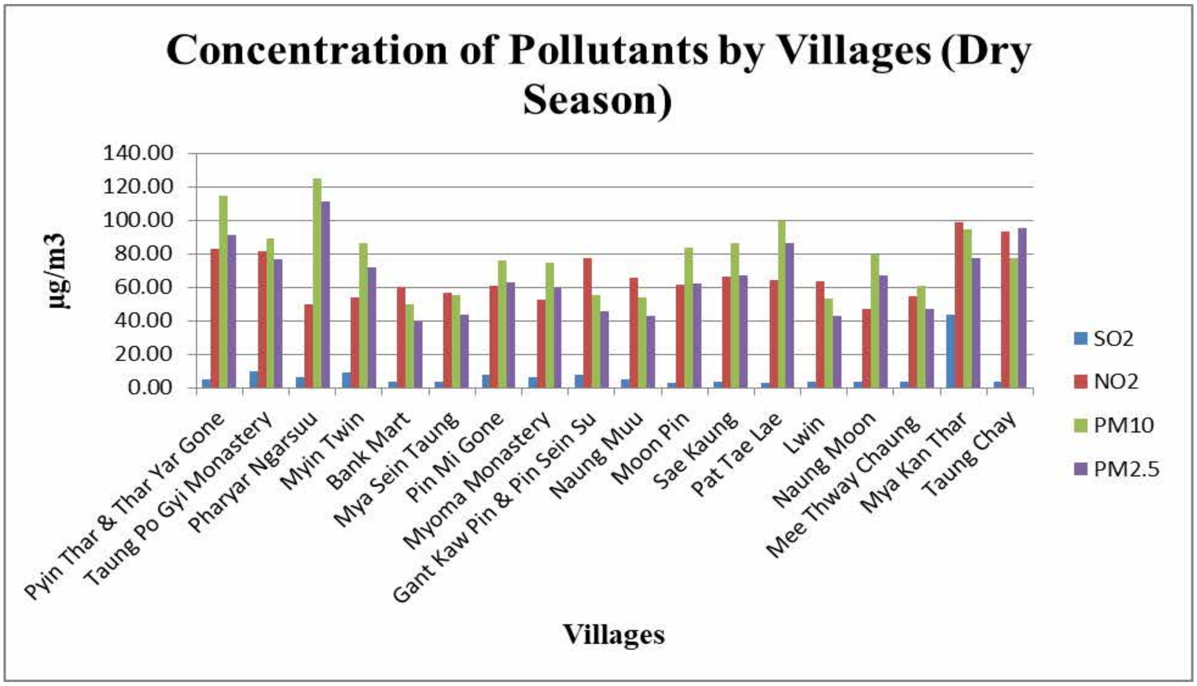


Figure 1.2 Concentration of Pollutants by Villages in Dry Season

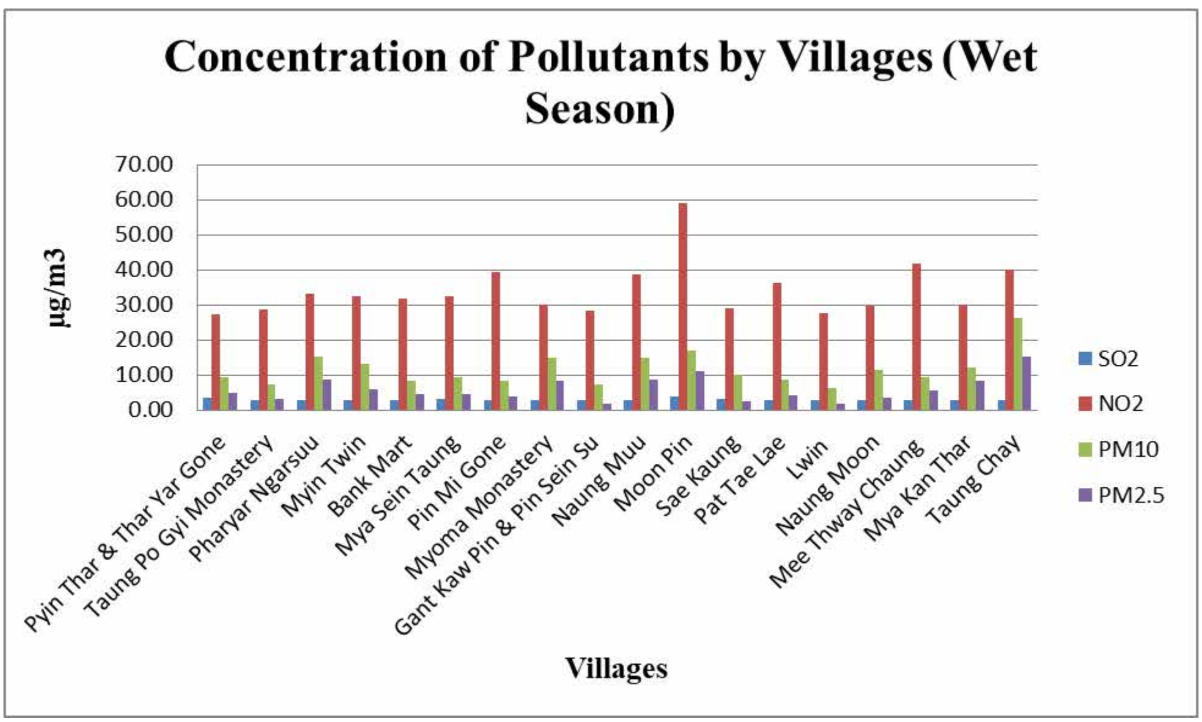


Figure 1.3 Concentration of Pollutants by Villages in Dry Season

Noise level measurement was carried out at two source points namely Near Boiler and Near Cooling Water Tower and at two receptor-1 points, namely, Staff Housing-1 and Staff Housing-2 of Thigyit Coal-fired Power Plant. Results of Noise level measurement are shown in Table 4. Noise level measurement was also carried out at proposed eighteen villages (i.e. N-1, N-2 etc.) which are located within 5km from Thigyit Coal Fired Power Plant in the yard of Thigyit Coal Fired Power Plant. Residential noise level measurements were conducted from March 30 to April 30, 2018 for dry season and from August 7 to August 25, 2018 for wet season at the proposed eighteen villages whereas industrial noise level measurement was conducted at Thigyit Coal Fired Power Plant from April 20 to April 30, 2018 for dry season.

Using a digital sound level meter, Noise levels were measured for 24 hours interval at the same eighteen points as the air quality measurement. Measured values for eighteen locations are compared with the NEQ Guidelines in Table 1.5.

Table 1.4 Results of Noise Level Measurement at Source and Receptor-1

Point	Date	Period	Observed value LAeq (dB)	NEQ Guideline Value (dB) (Residential)
Near Boiler	(23-24) January 2019	Daytime (7:00-22:00)	64.75	55
		Night-time (22:00-7:00)	67.78	45
Near Cooling water tower	(24-25) January 2019	Daytime (7:00-22:00)	69.20	55
		Night-time (22:00-7:00)	68.08	45
Staff Housing-1	(23-24) January 2019	Daytime (7:00-22:00)	51.22	55
		Night-time (22:00-7:00)	52.44	45
Staff Housing-2	(24-25) January 2019	Daytime (7:00-22:00)	51.59	55
		Night-time (22:00-7:00)	46.89	45

*Measurement values that exceed the NEQ Guideline values are shown in a red word.

Source: E Guard Study Team

Table 1.5 Results of Noise Level Measurement in Eighteen Villages

Point	Date	Name of Villages	Period	Dry Season LAeq (dB)	Wet Season LAeq (dB)	NEQ Guideline Value (dB) (Residential)
N-1	(30-31)March 2018	Junction of Pyin Thar, Thar Yar Gone villages and Monastery of Taung Po Gyi	Daytime (7:00-22:00)	56.77	53.45	55
			Night-time (22:00-7:00)	55.77	52.17	45
N-2	(31-1) March 2018	Monastery of Taung Po Gyi	Daytime (7:00-22:00)	53.74	49.70	55
			Night-time (22:00-7:00)	52.40	54.44	45
N-3	(1-2) April 2018	Phayar Ngar Su Village	Daytime (7:00-22:00)	48.75	51.18	55
			Night-time (22:00-7:00)	43.57	51.43	45
N-4	(3-4) April 2018	Myin Twin Village	Daytime (7:00-22:00)	54.06	52.63	55
			Night-time (22:00-7:00)	45.03	46.13	45
N-5	(4-5) April 2018	Bank Mart Village	Daytime (7:00-22:00)	50.27	54.52	55
			Night-time (22:00-7:00)	47.35	56.56	45
N-6	(5-6) April 2018	Mya Sein Taung Village	Daytime (7:00-22:00)	63.37	50.54	55
			Night-time (22:00-7:00)	61.52	50.49	45
N-7	(7-8) April 2018	Pin Mi Gone Village	Daytime (7:00-22:00)	57.63	52.68	55
			Night-time (22:00-7:00)	48.54	52.16	45
N-8	(8-9) April 2018	Thigyit Myo Ma Monastery	Daytime (7:00-22:00)	54.83	53.23	55
			Night-time (22:00-7:00)	49.29	57.90	45

Point	Date	Name of Villages	Period	Dry Season LAeq (dB)	Wet Season LAeq (dB)	NEQ Guideline Value (dB) (Residential)
N-9	(20-21)April 2018	Junction of Gant Kaw Pin and Pin Sein Su Villages	Daytime (7:00-22:00)	47.64	56.05	55
			Night-time (22:00-7:00)	47.9	55.42	45
N-10	(21-22)April 2018	Naung Mu Village	Daytime (7:00-22:00)	45.42	60.86	55
			Night-time (22:00-7:00)	41.84	49.68	45
N-11	(22-23)April 2018	Moon Pin Village	Daytime (7:00-22:00)	45.81	56.31	55
			Night-time (22:00-7:00)	40.73	53.65	45
N-12	(23-24)April 2018	Sae Kaung Village	Daytime (7:00-22:00)	62.77	52.20	55
			Night-time (22:00-7:00)	59.56	47.98	45
N-13	(24-25)April 2018	Pat Ta Lae Village	Daytime (7:00-22:00)	49.64	56.14	55
			Night-time (22:00-7:00)	45.11	55.08	45
N-14	(25-26)April 2018	Lwin Village	Daytime (7:00-22:00)	63.69	52.46	55
			Night-time (22:00-7:00)	63.17	51.93	45
N-15	(26-27)April 2018	Naung Moon Village	Daytime (7:00-22:00)	67.23	52.00	55
			Night-time (22:00-7:00)	62.59	50.80	45
N-16	(28-29)April 2018	Mee Thway Chaung Village	Daytime (7:00-22:00)	47.69	52.55	55
			Night-time (22:00-7:00)	48.79	51.35	45
N-17	(7-8)May 2018	Mya Kan Thar Village	Daytime (7:00-22:00)	47.15	57.41	55

Point	Date	Name of Villages	Period	Dry Season LAeq (dB)	Wet Season LAeq (dB)	NEQ Guideline Value (dB) (Residential)
			Night-time (22:00-7:00)	46.13	56.58	45
N-18	(8-9)May 2018	Taung Chay Village	Daytime (7:00-22:00)	47.61	52.27	55
			Night-time (22:00-7:00)	45	52.73	45

Water samples from Than Tae Creek and Balu Creek located near the Thigyit Coal Fired Power Plant to measure existing water quality. Ten sample points denoted as W1, W2, etc. were selected for water quality sampling along these two creeks. Sample points W7 and W8 were included presuming water contamination may take place at these locations as a result of waste water generated by the coal mine. Water samples from points W1, W2, W3, and W4 along Than Tae Creek were collected twice before and after mixing with discharged wastewater of Thigyit Coal Fired Power Plant in order to compare the quality of water under these two different circumstances. Over flow water from the process of water cooling system of Coal Fired Power Plant are discharged into Than Tae Creek. Those residual water flows along the Than Tae Creek after entering the reduction pond which reduces the water temperature. Sample points W9 and W10 were located before and after reaching to the sedimentation pond. Additional, sample point W5 located in Balu Creek before adding and flowing discharged water from Nagar Cement Plant was also included. A sample point at the confluence of Than Tae Creek and Balu Creek (i.e. point W6) was also taken. Water quality samples were collected in both dry and wet season at the same points. Water samples the first dry season were collected on April 1 and 2, 2018 and the second wet season sampling was carried out in July, 2018.

The results indicated that iron concentration in water was higher than WHO Guideline value at sample points W7 and W8. Suspended solid concentration in water of points W4, W7 and W8 exceeded than NEQ Guideline value whiles the values of the other point value were within the NEQ Guideline value. Suspended particles in water can cause turbidity and obstruct light transmission through the water which is an indicator for the presence of water contamination. At points W9 and W10, i.e. before and after passing the sedimentation pond (i.e. W9 and W10), mercury concentration was slightly higher than NEQ Guideline value. Measured values at points W2, W3, W5, W7, W8 and W10 were higher in concentration of Oil and Grease than NEQ Guideline value. At wet season, chromium concentration at two stream points and discharge water from coal mine points was higher than NEQ Guideline value.

Table 1.6 Results of Water Quality Measurement

No.	Parameter	Season	Than Tae Creek (Than Tae Bridge)	Than Tae Creek (Near Sae Kaung Village)	Junction of Than Tae Creek and Coal Fired Power Plant"s discharged water	Agricultural water which is channeled from Than Tae Creek	Balu Creek before Nagar Cement Plant"s discharged water point	Junction of Than Tae Creek and Balu Creek	Discharged water from Coal mine-1	Discharged water from Coal mine-2	Before Sedimentation Pond	After Sedimentation Pond	NEQ Guideline value	Unit	Name of Lab
			W1	W2	W3	W4	W5	W6	W7	W8	W9	W10			
1	pH	Dry Season	7.4	7.5	7.9	7.8	7.8	7.7	7.9	8	8.2	8.3	6-9	mg/L	ISO
		Wet Season	7.4	7.8	7.9	8	7.8	7.9	7.8	7.8	8.6	8.2			
2	Iron (Fe)	Dry Season	0.38	0.57	0.83	0.88	0.37	0.48	3.4	6.2	0.27	0.22	1	mg/L	ISO
		Wet Season	0.36	4.28	3.7	5.5	0.86	0.88	7.8	6.88	0.4	0.42			
3	Suspended solids	Dry Season	12	38	50	64	18	26	110	250	20	15	50	mg/L	ISO
		Wet Season	25	110	130	172	63	74	377	286	36	52			
4	Dissolved solids	Dry Season	283	253	236	239	213	207	237	230	205	204	–	mg/L	ISO
		Wet Season	247	176	188	189	147	148	244	236	149	155			
5	Temperature	Dry Season	28.89	27.73	28.18	30.18	29.31	28.21	27.73	28.88	31.08	27.27		°C	ISO

		Wet Season	21.88	22.92	23.89	23.88	22.31	23.31	23.18	24.86	30.60	26.41	<3		
6	Lead (Pb)	Dry Season	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	0.5	mg/L	ISO
		Wet Season	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil			
7	Arsenic (As)	Dry Season	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	0.5	mg/L	ISO
		Wet Season	0.006	0.006	0.007	0.006	0.006	0.007	0.007	0.006	0.006	0.006			
8	Ammonia (NH3)	Dry Season	Nil	Nil	Nil	Nil	Nil	Nil	1.8	2.5	1.1	1.1	–	mg/L	ISO
		Wet Season	2.22	3.30	3	4	2.44	3	5.5	4.4	1.2	2.4			
9	COD	Dry Season	32	32	32	32	32	32	64	64	32	32	–	mg/L	ISO
		Wet Season	32	64	64	64	32	32	64	64	32	32			
10	BOD	Dry Season	6	8	8	8	4	6	18	22	4	4	–	mg/L	ISO
		Wet Season	10	16	14	16	8	6	18	16	8	14			
11	Zinc (Zn)	Dry Season	NIl	Nil	NIl	NIl	NIl	NIl	NIl	NIl	NIl	NIl	1	mg/L	ISO
		Wet Season	NIl	Nil	NIl	NIl	NIl	NIl	NIl	NIl	NIl	NIl			

12	Copper (Si)	Dry Season	NIl	Nil	NIl	NIl	NIl	NIl	NIl	NIl	NIl	NIl	0.5	mg/L	ISO
		Wet Season	0.12	0.07	0.08	0.17	0.22	0.18	0.42	0.41	0.02	0.04			
13	Mercury (Hg)	Dry Season	NIl	Nil	NIl	NIl	NIl	NIl	0.001	0.001	0.006	0.006	0.005	ppm	OH
		Wet Season	NIl	Nil	NIl	NIl	NIl	NIl	NIl	NIl	NIl	NIl			
14	Selenium	Dry Season	0.032	0.03	0.024	0.028	0.025	0.025	0	0	0.01	0.009	–	ppm	OH
		Wet Season	0.001	0.000	0.000	0.008	0.000	0.000	0.000	0.000	0.004	0.000			
15	Oil and Grease	Dry Season	6.2	16.63	17.4	8.01	14.9	4.56	16.38	11.41	4.92	16.48	10	ppm	OH
		Wet Season	6.1	3.7	1.6	3.9	5.8	7.7	6.3	3.1	14.5	5.1			
16	Cadmium (Cd)	Dry Season	0.048	0.009	0.011	0.041	0.018	0.003	0.018	0.061	0.021	0.032	0.1	mg/L	Suprem e
		Wet Season	0.046	0.044	0.056	0.048	0.05	0.022	0.068	0.036	0.048	0.047			
17	Chromium (Cr)	Dry Season	0.09	0.07	0.1	0.08	0.05	0.08	0.23	0.2	0.14	0.13	0.5	mg/L Cr	Suprem e
		Wet Season	0.53	0.5	0.53	0.5	0.51	0.53	0.54	0.51	0.47	0.04			
18	Aluminium (Al)	Dry Season	0.04	0.06	0.32	0.07	0.07	0.06	0.004	0.06	0.004	0.07		mg/L	Suprem e

		Wet Season	0.09	0.09	0.08	0.06	0.06	0.24	0.009	0.07	0.09	0.34	–		
19	Nickel (Ni)	Dry Season	0.38	1.39	0.6	0.39	0.36	0.2	0.39	0.43	0.2	0.19	–	mg/L	Supreme
		Wet Season	0.22	0.23	0.26	0.27	0.24	0.49	0.25	0.44	0.2	0.18			
20	Total Chlorine	Dry Season	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	0.2	mg/L	OH
		Wet Season	0.02	0.04	0.04	0.03	0.07	0.02	0.04	0.02	0.02	0.02			

*Measurement values that exceed the NEQ Guideline values are shown in a red word.

According to the result of soil sample from agricultural land which is near the damp site of bottom ash, the amount of silicon content is the highest among other parameters. The optimal level of silicon in agricultural soil is 28% of concentration by weight. Generally, silicon, which is as a trace element, is beneficial to many crops by strengthening the plant to protect form insect attacks and stimulation of growth and yield of plants, especially, which are high-value horticultural crops. The micronutrients such as iron (Fe), Calcium (Ca) and manganese (Mn) are good for plants and the amount of nutrients which is found in that soil are at an acceptable level but, on the other hand, the concentration weight of silicon exceeds the optimal level because of the induced impact of damp site of bottom ash.

Table 1.7 Soil Results

Sample Mark	Resulted Parameters	Concentration Weight (%)
Tikyit Soil	Silicon (Si)	41.980
	Iron (Fe)	37.487
	Calcium (Ca)	13.131
	Titanium (Ti)	3.501
	Potassium (K)	2.838
	Zirconium (Zr)	0.521
	Manganese (Mn)	0.348
	Nickel (Ni)	0.079
	Strontium (Sr)	0.057
	Yttrium (Y)	0.057
	Arsenic (As)	Non-detectable

Odor Level Measuring was detected at six locations to identify which sources are the most irritating for the communities. Four selected points are located at the project boundary as sources and the other two selected points are located at nearby villages and a monastery as receptors. The detected value of source points were within and the value of receptors were under the NEQ Guideline value.

Table 1.8 Results of Odor Level Measuring

Point	Location	Value (ppm)	National Environmental Quality (Emission) Guideline Value (ppm)
Odor-P1	At Indoor Coal Yard	0	5-10
Odor-P2	Near DeSOx System	15	
Odor-P3	At Bottom Ash Sedimentation Tanks	4	
Odor-P4	At Sedimentation Pond	0	
Odor-P5	At junction of Pyin Thar and Thar Yar Gone Villages	6	
Odor-P6	At Taung Po Gyi Monastery	0	

The assessment of biodiversity richness was carried out in both dry and wet seasons within the three representative areas, namely, 1km radius, 3km radius and 5km zones radius around the Tigyit coal-fired electric power plant. There are (3) villages in the 1km radius direct impact zone. The 14 villages that are located in the 3km radius indirect impact zone, are Tigyit, Le-gya, Le-na (Zingon), Lai-ti-taung (Tharyarkone), Loi-ti-myauk (Tharyarkone), Pyin-tha, Sea-kaung, Ban-met, Phayar-Ngar-Su, Lwin-ywa, Mun-loin, Naung-moon, Ta-da-u and Pin-hmi-gone whereas there are (35) villages in the 5 km radius of the indirect impact zone. The changes in species population and density are shown in the tables below. There is no natural vegetation in the 1 km radius of the direct impact zone although it includes some cultivated land areas. The majority of the area (about 40 %) is occupied by Thigyit Coal-fired Power Plant compound with 20 buildings, including turbine and power generating rooms. The other 30 % of the area is occupied by the workers quarters. Cultivated lands and villages also occupied the remaining 30% of the area.

Two circular areas with 3 km radius and 5 km radius from the Power Plant are considered as the indirect impact zone. In the 3 km radius zone, there is no forested area, but cultivated lands and orchards of fruit trees such as pears and avocados are found. In the 5km radius zone, there are some evergreen forest, pine forest and bamboo forest. There also exist some fruit tree cultivations in this zone.

Among many streams in the area two have names which are Balu Creek and Than-de´ Creek. There are also small creeks without a particular name. Balu Creek is flowing from southwest to northeastern side of the project area, at a distance of (5) km from the plant. Than-de stream is flowing from Southwest on the Western side of the project area. These two streams converage together and then flow into the Inle Lake, one of the famous natural heritages of the Shan State. Balu creek is the main creek supplying water to Inle Lake.

There are three ponds and three springs in the indirect impact zone; two natural ponds are located close to Naunglin Village and Tayoketaung Village and one waste rock dump and earthen pond on the way to Tayoketaung Village. Three natural springs are located one close to Patlale Village, the second one close to Bummet Village and the last one is located near Tayoketaung Village.

A total number of 182 flora species and 358 flora species are recorded in the direct impact zone (1 km radius centered from power plant) in the indirect impact zone (3 km and 5m radius centered from power plant) in both dry and wet season. The following inhabitant flora species are identified 17 climbers, 1 fern, 53 herbs, 9 grass species, 46 shrubs species, 22 small tree species and 20 tree species. Altogether 434 plant species are identified and recorded. Among of them, 61 species were classified as Lease concerned species under the IUCN Red List Species 2016 Version 3.1.

In both dry and wet season, 114 bird species, 12 mammal species, six amphibians, and eleven reptiles and 48 insect and other invertebrates which amounted to a total of 201 fauna species of 160 genera belonging to 86 families under 29 orders were recorded. According to the IUCN conservation status, one vulnerable (VU) species was recorded in the dry season during the two-survey period (Dry and Wet Season). Moreover, 13 species were recorded as Completely Protected Animals (CPA), 20 species were carried out as Protected Wild Animals (PWA) and 24 species were observed as Seasonal Protected Animals (SPA).

The threats to the biodiversity had been discussed. The potential impacts on biodiversity are identified and impacts significance is analysed. The table 1.9 below show the potential impacts and mitigation measure.

Table 1.9 Potentail Impacts and Mitigation Measure

No	**Partial Impact Biodiversity**	**Extent**			**Duration**			**Probability**			**Magnitude**			**Significance**			**Recommended measure**
		L	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**	**L**	**M**	**H**	
FLORA																	
1.	Expension of farm land into the forested areas		√			√				√		√			√		To reduce dependency of the community on forest and springs in the area. To introduce community forestry
1.	Fire wood extraction		√			√				√		√			√		To plant fast growing tree species in the community forest for fire wood. To supply electricity for the community.
3.	Extraction of turpentine from pine		√			√			√			√			√		To plant pine tree in community forest.

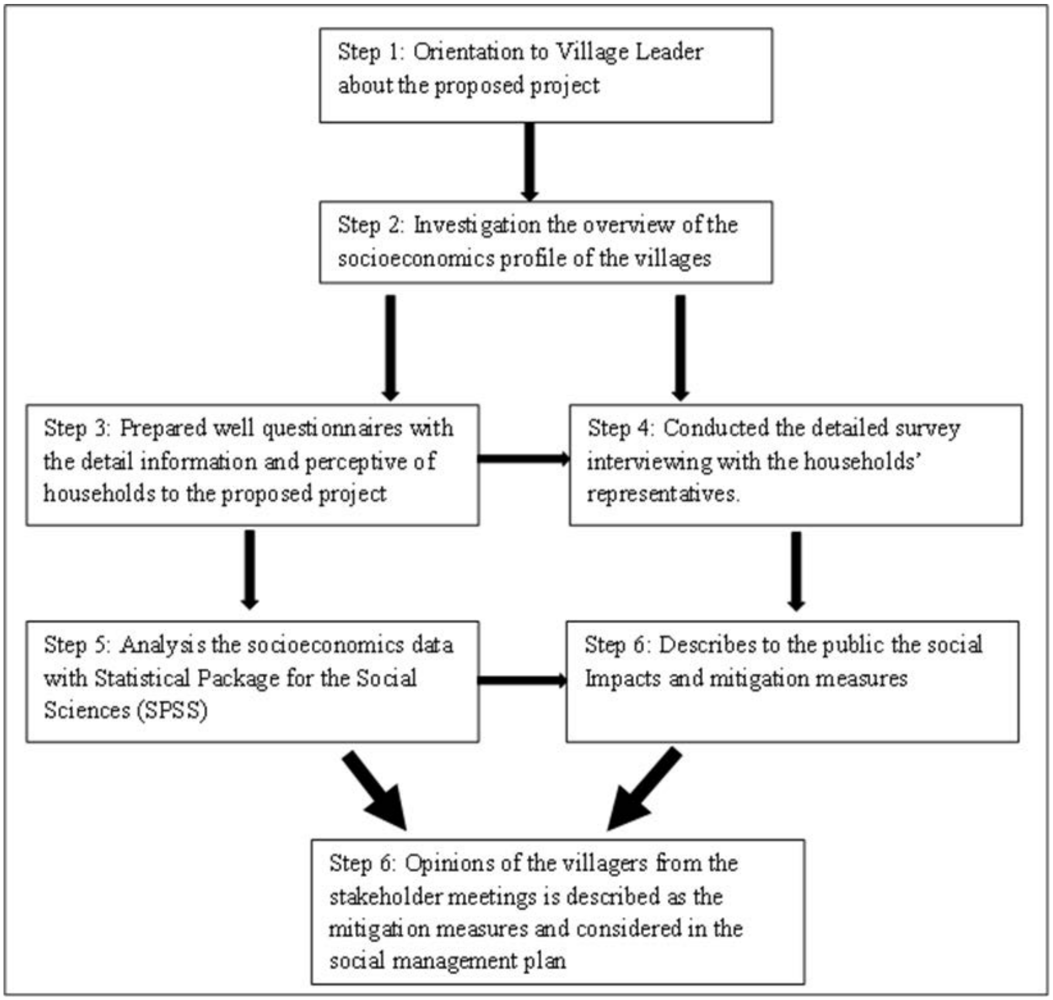
	forest																
4.	Cumulative impacts		√			√				√			√			√	To assess the cumulative impact and implement the management plan.
FAUNA																	
1.	Decrese of fish population		√				√			√			√			√	To raise awareness of people about the hazard of disposal of empty bottles and plastic bags into the stream. To prohibit disposing hazardous wastes by low enforcement.
2.	Hunting for bushmeat		√			√			√				√		√		Help the community promote of animal husbandry and aquaculture practices.

L: Low, M: Medium, H: High

The socioeconomics profile of the coal-fired power plant area with the objective to understand gain insights into the demographic trends and economic performance of the area is also described in this part (Chapater 5). Socioeconomics impact analysis examines how an act of development could potentially impact a community, the social and economic aspects of the potential impact, and the community‟s attitude towards resulting changes. Potential impact outcomes include: demographic changes in the community, changes in the demand for public services, employment and income levels. The project goal is to assess the potential impacts of the operation of the proposed coal-fired power plant on the net welfare of the local communities and economic development in the project area. In the context, the objectives of the study are to

- Develop an understanding of the strategic national importance the coal fired power plant.
- Develop an economic profile of the local areas and regions.
- Understand a basic social profile of the communities located in the local areas and regions.
- Identify the potential impact, including direct, indirect and cumulative.
- Interpret the results in relation to impact in the net social welfare and economic development.
- Make recommendations pertaining to possible mitigation measures.

Methodological Approach



The socioeconomics sampling is conducted in 10 villages and staff housing of Eden and Thigyit Coal-fired Power Plant as the primary impact zone where 3km far from the proposed coal fired power plant, and 13 villages as the secondary impact zone where 5 km far from the proposed coal fired power plant. An appropriate sample size is estimated to be 1,000 households out of the total population of about 13,500 households in both impact zones. About 40 percent of the total households in primary impact zone will be surveyed and about 20 percent of the total households in secondary impact zone will be surveyed. The following Table 11 shows the total households and sample to be surveyed in each village. (See details in Chapter 5).

Table 1.10 Description of total households and sample size of villages

Type of Impact Zone	Village Name	Land areas	Total Households	Sample Size
Primary Impact Zone (3km from the proposed project)	Aedin		108	25
	Kone Thein		47	19
	Mya Kan Thar		80	54
	Mya Sein Taung		32	19

Type of Impact Zone	Village Name	Land areas	Total Households	Sample Size
	Phayar Ngar Su		105	30
	Pyin Thar		42	26
	Sae Kaung		250	108
	Tharyar Gone		94	61
	Tigyit A Lae		199	72
	Tigyit North		167	61
	Tigyit South		246	86
	Staff Housing		101	32
Secondary Impact Zone (5km from the proposed project)	Bank Mat		29	5
	Gant Kaw Pin		60	10
	Kyat Thon Khone		94	21
	Lwin		132	16
	Mee Thway Chaung		116	21
	Moon Pin		87	10
	Myinn Twin		160	30
	Naung Moon		120	79
	Naung Muu		210	20
	Pat Ta Lae		140	13
	Pin Mi Khone		86	9
	Pin Sane Su		44	10
	Taung Chay		132	13

5. Impact and Risk Assessment and Mitigation Measures

The project is required a full EIA under the EIA procedure (2015) in Myanmar. This section describes the methodology and the potential environmental and social impacts which are expected to take place during planning, construction, operation, decommission and closure and post-closure stages of the project.

Impact evaluation is conducted to predict what could happen to the social and natural environment as a result of the proposed project considering all sensitive receptors. An assessment process includes a range of prediction methods which provide inputs to formulation of environmental mitigation measures to be adopted in the project with an aim to properly contain negative impacts.

A number of possible impacts have been evaluated against the project, which was divided into three stages of the project; construction/renovation; operation; and decommissioning in accordance with the EIA procedure (2015). Impacts were classified to be either positive or negative, with the degree that ranges from A+/- (significant positive/negative impact is expected, B+/- (positive /negative impact is expected to some extent), C (extent of the impact is unknown) and D (no impact is expected). The following sections explain briefly the three stages of the project and environmental impacts that commonly arise at those phases.

Table 1.11 Environmental and Social Impact Assessment

No.	Item	Assessment			Sources of Impact
		CO	O	DE	
1	Air Pollution	B-	B-	B-	[Co] Earthwork, loading and unloading materials as well as construction machines, vehicles, movement of heavy machinery, buildings renovation and construction and other related activities will generate dust and emission gases that will deteriorate the ambient air quality. [O] During operation phase, potential impacts from the stack emissions caused by coal combustion are expected. The main pollutants such as NOx, and SOx, which are particulate matters, will be emitted from the plant stack. However, electrostatic precipitator (ESP) will help to reduce the emission of air pollutants. The emissions will be further reduced by employing desulphurization and denitrification processes. Coal will be the main fuel for the project but diesel oil will be the secondary fuel used on-site during start-up and periods of low load operation. The operation of the boiler will also emit particulate matter, NOx and SOx. The diesel oil will be used as a start-up fuel and for low operation hence the impacts shall not be deemed significant for these purposes. Operation of coal grinding and coal burning machines as well as transportation of vehicles such as loader, forklift, etc. will lead to air pollution. Dust emission will occur in indoor and outdoor coal yards. Bottom ash mound from brick manufacturing factory under Wuxi Hua Guang Electric Power Engineering Co., Ltd. Will also lead to air pollution. [De] Temporary air pollution is expected during the operation of decommissioning work.
2	Water Pollution	B-	B-	B-	[Co] Temporary Water pollution is expected due to the following construction and renovation work: (i) run off of muddy water from small scale cutting, filling and excavation work (ii) spilling over of toxic materials such as oil and lubricants. [O] Water may be polluted due to the waste water from cleaning machines, oil and grease used in the machines, domestic wastewater and thermal effluent from cooling system. Reduction pond will reduce sediment, oil and grease, and especially water temperature. [De] Water may be polluted from the construction office and other facilities. However, the impact will be temporary and limited.
3	Soil Contamination	B-	B-	B-	[Co] Soil may be contaminated from leakage of lubricating oil from construction, vehicles and machines. However, the amount of oil used is limited and the impact is considered to be insignificant. [O] Soil contamination may take place by spilling and infiltration of oil and greases, from leakage of lubricating oil for machines and transportation vehicles, leaching of metals from the ash disposal site and contamination from the coal storage area. The impact is also considered to be insignificant. [De] Soil may be contaminated from leakage of lubricating oil from construction, vehicles and machines. However, the amount of oil used is limited and the impact is considered to be insignificant.
4	Waste Disposal	B-	B-	B-	[Co] Waste disposal is expected due to the renovation materials, recyclable and non-recycle packaging materials and construction materials (concrete waste, used bags and other construction waste).

					[O] Bottom ash and Fly ash from operation process and domestic waste from staff are expected. [De] Waste of existing devices will be generated from decommissioning of construction facilities.
5	Noise	B-	B-	B-	[Co] Noise will be generated by construction works including operation of vehicles and diesel generators but they will be temporary and geographically confined. [O] Coal delivery systems, grinding coal, starting engines, generator and vehicles will lead to noise generation in the vicinity of villages. [De] Machines and vehicles used for decommissioning works are expected to generate noise and vibration but they will be site specific and temporary.
6	Ground Subsidence	D	D	D	Ground water will not be used during construction and operation stage.
7	Offensive Odours	D	D	D	No notable impact is expected.
8	Sediment Quality	B-	B-	B-	[Co][De] Run off water from renovation/ decommissioning area and leakages of oil and chemical materials from renovation/ decommissioning activity will lead to degradation of sediment quality [O] Run off water from ash disposal site coal yard and leakages of oil and chemical materials are expected to low quality of sediment.
9	Protected Areas	D	D	D	There is no protected area in the proposed project area. As the project area is located 17 kilometers away from the west of the Inle lake.
10	Ecosystem	D	D	D	[Co] [De] The principal discharges during construction and demolition activities will comprise drainage, sewage (i.e. black water, composed of human body wastes from toilets and urinals) and domestic wastewater (i.e. grey water, composed of discharges from kitchen, showers and wash areas) generated by the workers on-site during the construction and demolition phase. These wastewater discharges are generally characterized as having a high concentration of solids (suspended and dissolved), oil and grease, BOD and COD, ammonia and other organic material and micronutrient elements. They have the potential to result in adverse effect on aquatic life if released untreated. Indirect impacts on both terrestrial and aquatic habitats and associated fauna adjacent to work areas may potentially result from increased human activities/disturbance effects may include the avoidance of areas adjacent to the works areas and the reductions in wildlife density (e.g. birds and fish) close to the source of disturbance. [O] The daily activities of the permanent workforce hired during operation phase may cause the impacts on the terrestrial habitats including wildlife living in the vicinity of the project area. Upon discharge, chlorine concentration in the effluent will be quickly diluted with surrounding waters. Concentrations of residual chlorine thus typically diminish rapidly with time and distance from the discharge point as well as the high temperature effluent. Impacts on surface water as a result of potential concentrations of residual chlorine and high temperature are expected to be of low

					severity and therefore minor significance.
11	Cross Boundary Impacts and Climate Change	B-	B+/-	B-	[Co] Operation of construction-related vehicles and machinery will lead to an increase in greenhouse gas (GHG) emissions although it will occur in a small scale during construction only. [O] An increase in generator operations will in turn increase the GHG emissions. [De] Operation of construction-related vehicles will lead to an increase in GHG emissions but will be generated in a small scale during construction only.
12	Poverty	B+	B+	B+	[Co] [De] The project is expected to create a significant level of employment opportunities for local community and people from other localities. [O] The project will provide people including local community more access to electricity, which will lead to improved income and livelihood.
13	Local Economy such as Employment and Livelihood	B+	B+	B+	[Co] [O] [De] The project is expected to create a significant level of employment opportunities for community and people from other localities. It will employ local residents as much as possible and offer "livelihood restoration program" including job trainings to persons if desired. Agricultural awareness training serviced from Thigyit Coal Fired Power Plant will enhance local economy such as employment and livelihood.
14	Water Usage	D	B-	D	[P] No notable impact is expected. [Co] Balu Creek (Surface water) may be used for construction depending on the availability of water. [O] Surface water will likely be used for boiler process and other maintenance work. However, the amount of water to be used and its impact on the surface water level is not expected to be significant enough to limit other water uses. [De] [Cl/PCl] No notable impact is expected.
15	Cultural Heritage	D	D	D	No cultural heritage has been identified near the project area.
16	Landscape	D	D	D	No major earthwork is expected and its impact on the landscape is considered to be negligible.
17	Gender	D	B+	D	No notable impact is expected.
18	Rights of children	D	B+	D	[Co][O] [De] The project will not cause any adverse impact on children"s rights.
19	Infectious Diseases such	B-	D	B-	[Co] Due to an inflow of construction workers, infectious diseases such as STD (Sexually Transmitted Disease) may spread although at a limited scale.

	as HIV/AIDS				[O] No notable impact is expected. [De] Due to an inflow of construction workers, infectious diseases such as STD may spread although at a limited scale. [Cl/PCl] No notable impact is expected.
20	Work Environment (including work safety)	D	B-	D	[Co] [De] No notable impact is expected. [O] Diseases caused by air pollutants and noise by coal unloading activity if not properly controlled and managed.

A+/-: Significant positive/negative impact is expected; B+/-: Positive/Negative impact is expected to some extent; C: Extent of positive/negative impact is unknown; D: No impact is expected

[Co]: Construction Stage; [O]: Operation Stage; [De]: Decommissioning Stage

Source: E Guard Study Team

Table 1.12 Mitigation Measures against Project Impacts

No.	Item	Mitigation Measures	Implementing Organization
1	Air Pollution	[Co] [De] - Load of vehicle transporting fine materials such as sand, soil and waste to and from the project site shall be covered to reduce the release of dust. - Water should be frequently sprayed on the ground at construction site and near residential areas, as required. - Generators and other equipment that generate gases must be turned off when they are not in use. - Construction vehicles"speed should be controlled to minimize air pollution - Air quality should be regularly measured/monitored. [O] (1) Power Plant operational activities - To reduce PM emissions, Electrostatic Precipitator (ESP, around 99% efficiency)will be installed. - To reduce NO2 emissions, Selected non-catalytic reduction system (SNCR) will be installed. - To reduce SO2 emissions, FGD equipment (FGD; around 70 % efficiency) will be installed. - Emission of Dust and gases will be continuously with the support of infrastructure/facilities as prescribed by the NEQ guidelines. (2) Coal Handing - A cover will be installed for the conveyer for coal transportation to coal yard - Spraying water in coal yard to keep the surface wet and prevent wind for blowing coal and dust. - Re-greening especially along boundary of plant site, surrounding coal yard with domestic plants (3) Gas Emission from Vehicles - Periodic maintenance and management of vehicles.	Wu Xi Hua Guang

No.	Item	Mitigation Measures	Implementing Organization
2	Water Pollution	[Co] [De] - Turbid waste water from construction sites shall be disposed at designated sites after treated at sedimentation ponds and waste water treatment tanks. - Waste water shall be treated properly in accordance with regional governments‟regulation system. - Water quality shall be monitored to ensure that surface water (Balu Creek and Thadae Cleek) is not polluted by the project. [O] (1) Thermal effluents - Thermal effluents are discharged to reduce the impact on surrounding area. (2) Run off water - Run off water is colliected in the pond and discharged after employing appropriate treatment - Thermal effluents are discharged to reduce the impact on surrounding area. (3) Oil and Chemical materials leakage - Storage of oil and chemical materials in an appropriate tank with retaining wall to prevent leakages and applying method to prevent permeation into ground. (4) Wastewater - Installation of wastewater treatment system by neutralization, settling and oil separation so as to comply with NEQ Guildline. Water quality shall be monitored to ensure that surface water is not polluted by the project.	Wu Xi Hua Guang
3	Soil Contaminatio n	[Co] [De] - All waste including oil and grease shall be stored and disposed in designated sites in a way that minimizes the risk of soil contamination. [O] - The bottom of ash disposal site should have an impermeable layer (less than 10-6 cm/sec) such as impermeable geo membrane, sheet and clay. Storage of oil and chemical materials in an appropriate tank with retaining wall and method to prevent permeation into ground. Machines and vehicles should be regularly checked. -	Wu Xi Hua Guang
4	Waste Disposal	[Co] [De] - Waste generated from construction should be reduced and disposed if they cannot be reused and recycled. Disposal must be in accordance with instructions of city development committees and regional governments. [O] - Waste management program consisting of reduction, reuse, and recycling of materials - Systematic collection and protected storage	Wu Xi Hua Guang

No.	Item	Mitigation Measures	Implementing Organization
		- Waste disposal at appropriate location - Hazardous waste shall be treated inaccordance with the related regulations - Prohibition of dumping any contaminating materials.	
5	Noise	[Co] [De] - Installation of a noise barrier and use of low-noise equipment shall be considered. - Construction work during night and early time should be avoided as much as possible - Activities and schedule of the construction shall be made public to the surrounding communities in advance so that measures can be taken as found necessary. - Noise levels should be monitored. [O] - Installation of noise barriers - Maintenance of equipment - Adequate enclosure of equipment to reduce noise - Activities and schedule of the starting engines shall be made public to the surrounding communities in advance so that measures can be taken as found necessary.	Wu Xi Hua Guang
6	Offensive Odours	[Co] - The level of offensive odours should be monitored. - Mitigation measures will be considered depending on the source of odour. [O] - Taking appropriate measure for handling general waste - Prohibit illegal waste disposal	Wu Xi Hua Guang
7	Sediment Quality	(1) Run off water - Run off water is colliected in the pond and discharged after appropriate treatment - Thermal effluents are discharged to reduce the impact on surrounding area. (2) Oil and Chemical materials leakage - Storage of oil and chemical materials in an appropriate tank with retaining wall to prevent leakages and applying method to prevent permeation into ground. (3) Wastewater Installation of wastewater treatment system by neutralization, settling and oil separation so as to comply with NEQ Guildline	Wu Xi Hua Guang
8	Ecosystem	[Co] - Tree cutting and natural vegetation clearance shall be minimized. - Sedimentation ponds shall be used to avoid waste water from flowing directly into the aquatic ecosystem. - Hazardous waste material shall be stored properly until final disposal.	Wu Xi Hua Guang

No.	Item	Mitigation Measures	Implementing Organization
9	Cross Boundary Impacts and Climate Change	[Co] [De] - Generators and other equipment that generate gases must be turned off when thet are not in use. [O] - Machines and vehicles should be maintained well and regularly checked in order to reduce GHG emissions. - Use of USC of high efficiency for power generation.	
10	Water Usage	[O] - Water should be used as efficiently as possible and excessive use of water should be avoided. Water from the power plant should be re-used to control the high consumption of water resources.	Wu Xi Hua Guang
11	Infectious Diseases such as HIV/AIDS	[Co] [De] - In order to prevent spreading of infectious diseases such as HIV/AIDS, awareness training shall be provided to construction workers.	Wu Xi Hua Guang
12	Work Environment (including work safety)	[Co] [De] - Training shall be provided and adequate notice shall be put up for constructioin workers and local residents to prevent accidents. - Cases and causes of accidents shall be recorded and analysed. - Construction sites should be properly and sufficiently lightened. [O] - Education shall be provided to workers on operation and safety. - Provide workers with appropriate protective equipment. - Cases and causes of accidents shall be recorded and analysed.	Wu Xi Hua Guang
13	Communities and occupational health and safety	By controlling the pollutants emission. By providing safety training and awareness By giving warning in time to the social community in emergency case By checking environmental management plan, environmental monitoring plan and mitigation measures regularly.	Wu Xi Hua Guang

P: Pre-construction Stage, Co: Construction Stage, O: Operation stage, De: Decommissioning Stage

Source: E Guard Study Team

6. Cumulative Impact Assessments

The assessment of cumulative impacts was a key focus of the EIA study for the Thigyit coal fired power plant project. Cumulative impacts in relation to an activity are defined as the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities undertaking in the area.

In order to understand the manner in which the project will contribute to cumulative impacts, an understanding of the existing coal fired power plant operations by the past and present activities over space and time is essential. This will need the identification of existing and proposed projects within the region.

Table 1.13 Major infrastructures near the project area

No	Factories and Mine	Distance From Thigyit Coal Fired Plant
1	Nagar Cement Factory	4.88km
2	Nagar Limestone Quarry Site	3.85km
4	Eden Coal Mine	2km
5	Residential Sector	

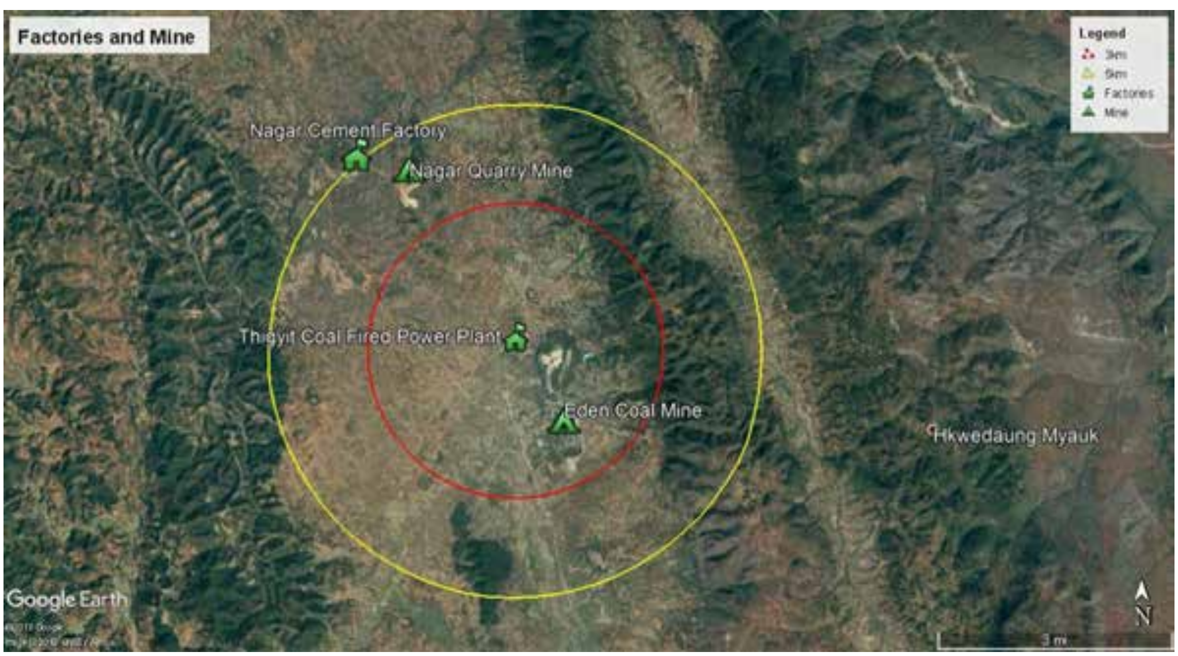


Figure 1.4 Major Infrastructures near the project area

When assessing cumulative assessment activities, it will focus on key significant issues that have been included in the findings of the impact assessment. (See details in Chapter 7)

7. Environmental Monitoring Plan

Table 1.14 Environmental Monitoring Plan

No.	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
Operation Phase								
1	Air Pollution	NO2, SO2, PM (PM10 and PM2.5), and micro climate (temperature, humidity, wind speed and direction etc. for reference)	One weekday for 24 consecutive hours per location	18 locations within 5km project area (*same places as baseline survey in principle)	Biannually in operation period	Third party consultant firm hired by Wu Xi Hua Guan	Wu Xi Hua Guan	**USD 36,000** (USD 1,000 * 18 points * 2 times)
2	Water Pollution	BOD, COD, oil & grease, pH, total coliform, total nitrogen, total phosphorus and TSS	Sampling and measurement using field equipment and laboratory analyses	18 locations within 5 km project area (*same places as baseline survey in principle)	Biannually in operation period (*once during dry season and once during rainy season)	Third party consultant firm hired by Wu Xi Hua Guan	Wu Xi Hua Guan	**USD 20,000** (USD 1,000 * 10 points * 2 times)
3	Soil Contamination	Soil condition Voices and complaints from the local community	Confirmation of voices and complaints Visual observation of surface soil	Project site and surrounding area	Quarterly in operation period and when complaints are heard in this regard	Wu Xi Hua Guan	Wu Xi Hua Guan	-
4	Waste Disposal	Volume of waste including soil, vegetation and garbage Voices and complaints from the local community	Confirmation of voices and complaints Visual observation	Project site	Quarterly in operation period and when complaints are heard in this regard	Wu Xi Hua Guan	Wu Xi Hua Guan	-

No.	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
5	Noise	LAeq (noise) LV10 (vibration)	One weekday for 24 consecutive hours per location	18 locations within 5 km project area (*same places as baseline survey in principle)	Biannually in operation period	Third party consultant firm hired by Wu Xi Hua Guan	Wu Xi Hua Guan	**USD 18,000** (USD 500 * 18 points * 2 times)
6	Cross Boundary Impacts and Climate Change	Air quality	Refer to „1. Air Pollution"above.					
Decommissioning Phase								
1	Air Pollution	NO2, SO2, PM (PM10 and PM2.5), and micro climate (temperature, humidity, wind speed and direction etc. for reference)	One weekday for 24 consecutive hours per location	18 locations within 5 km project area (*same places as baseline survey in principle)	Biannually in decommissioning phase	Contractor	MOEE	**USD 36,000** (USD 1,000 * 18 points * 2 times)
2	Water Pollution	BOD, COD, oil & grease, pH, total coliform, total nitrogen, Total phosphorus and TSS	Sampling and measurement using field equipment and laboratory analyses	10 locations within 5km (*same places as baseline survey in principle)	Biannually in decommissioning phase (*once during dry season and once during rainy season)	Contractor	MOEE	**USD 20,000** (USD 1,000 * 10 points * 2 times)
3	Soil Contamination	Soil condition Voices and complaints from the local community	Confirmation of voices and complaints Visual observation of surface soil	Ash disposal area and surrounding area	Quarterly and when complaints are heard in this regard	Contractor under supervision of consultant	MoEE	-
4	Waste Disposal	Volume of waste including	Confirmation of records of	Waste	Quarterly and when	Contractor	MoEE	-

No.	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
		soil, vegetation and garbage Voices and complaints from the local community	waste generated Confirmation of voices and complaints Visual observation	disposal site	complaints are heard in this regard			
5	Noise	LAeq (noise) LV10 (vibration)	One weekday for 24 consecutive hours per location	18 locations within 5km (*same places as baseline survey in principle)	Biannually in decommission ing period	Contractor	MoEE	**USD 18,000** (USD 500 * 18 points * 2 times)
6	Cross Boundary Impacts and Climate Change	Air quality	Refer to „1. Air Pollution‟above.					
7	Infectious Diseases such as HIV/AIDS	Number of infected patients Voices and complaints from the local community	Confirmation of health check list of workers (and preferably of local community) Confirmation of voices and complaints	Project site and surrounding area	Monthly and when complaints are heard in this regard	Contractor in collaboration with regional government	MoEE	-

Source: E Guard Study Team

8. Public Consultation

Public Consultations were held at the scoping stage in April, 2016 and at the draft EIA report preparation stage in May 2019. The meetings attracted a wide range of stakeholders including the local people, relevant government organizations including ECD/MONREC, regional governments, private companies and the media. An outline of the stakeholder meetings held on seven times from scoping stage and draft EIA report preparation stage is presented below and detailed information about the public consultation is provided in Chapter 9.

Table 1.15 Information of Public Consultation

No.	Date	Particular	Attendees
1.	24.4.2016	Environmental Impact Assessment (Scoping Stage) Stake Holder Meeting	Members from House of Nationalities, House of Representatives, Government Departments. NGOs/INGOs. Local Companies. Medias. Local People.
2.	8.11.2017	Explaining about the Environmental Impact Assessment Study concern with Thigyit Coal-fired Power plant to Dr. Nyi Nyi Aung, Minister of Natural Resources and Environmental Conservation	Minister of Natural Resources and Environmental. Members of Shan State Government. Members of Thigyit Coal Fired Thermal Power Plant and E Guard Environmental Services.
3.	23.10.2018	Site Visiting at Thigyit Coal-fired Power Plant and Explaining about EIA	Myanmar Centre for Responsible Business (MCRB) Managing Director Ms. Vicky Bowman and members
4.	22.2.2019	Obtaining attitude and comments from Dr. Nyi Nyi Aung, Minister of Natural Resources and Environmental Conservation about the holding of Thigyit Public Consultation for EIA study (Village Level)	Minister of Natural Resources and Environmental. Members of Shan State Government. Minister of Roads and Transport.
5.	22.2.2019	Obtaining attitude and comments from U Khun San Lwin, Chairman of Pa'O Self-Administrative Zone about the holding of Thigyit Public Consultation for EIA study (Village level)	Chairman of Pa Oh Self Administration Zone. Members of Related Departments.
6.	From 23.2.2019 to 25.2.2019	Event for EIA prodcedure and Public Consultation (Village Level) of Thigyit Coal-fired Power Plant	Head of Village Tract, Head of Villages. Local People. Members of Thigyit Coal Fired Thermal Power Plant and E Guard Environmental Services.
7.	7.5.2019	Environmental Impact Assessment Public Consultation	Members from House of Nationalities, House of Representatives, Government Departments.

			NGOs/INGOs. Local Companies. Medias. Local People.

9. Conclusion and Recommendations

In order to prepare evidence-based and sound EIA report, E Guard Environmental Services co., ltd had collected and analyzed physical, biological and social data such as people's perceptions, concern, opinion, and expectation on the project for the environment and guiltless society during and after the development of the project. Any type of development activity has both beneficial and adverse impacts on the socioeconomic situation and environment in which it operates. The impacts are identified and evaluated by the project proponent to reduce their negative impacts and maximize the positive effects on the surrounding environment.

Findings and suggestion of EIA study in project operation should be considered and implemented with strong monitoring. The power plant should be operated ensuring all pollution abatement measures e.g. desulphurization system (FGD) for reduction of SOx, Selective non-catalytic reduction (SNCR) and selective catalytic reduction (SCR) system for reduction of nitrogen dioxide (NOX) and electrostatic precipitator (ESP) for reduction of ash emission. Continuous emission monitoring system (CEMS) has to be employed to control the pollution. Continuous air monitoring stations should also be installed at the downwind areas to monitor the pollution level simultaneously.

As described above, the adverse impact expected from the project is considered to be minor in general. Practical mitigation measures and monitoring plan have been proposed by E Guard has agreed to put them in place to effectively reduce such impacts. Information on the project and the EIA has been made available to the public widely. In view of these circumstances, coupled with the profound contribution the project is expected to make to the economic and to meet electricity requirement in Myanmar, it is recommended that the project be implemented without delay. In doing so, Wu Xi Hua Guang should continue working closely with organizations such as MOEE, Shan State Government, Pa Oh Self Administration and steadily move forward together with the public.

As described above, the adverse impact expected from the project is considered to be minor in general. The project proponent has agreed to put practical mitigation measures and monitoring plan proposed by E Guard in place to effectively reduce such adverse impacts. Information on the project and the EIA has been made available to the public widely. In view of these circumstances, coupled with the profound contribution the project is expected to make to the national economy and to meet electricity requirement in Myanmar, it is recommended that the project be implemented without delay. In doing so, Wu Xi Hua Guang should continue working closely with organizations such as MOEE, Shan State Government, Pa Oh Self Administration and steadily move forward together with the public.

အကျဉ်းချုပ်အစီရင်ခံစာ

၁။ နိဒါန်း

တီကျစ်ကျောက်မီးသွေးသုံး ရေနွေးငွေ့ဓာတ်အားပေးစက်ရုံအတွက် ပတ်ဝန်းကျင်ဆန်းစစ်မှု အစီရင်ခံစာကို မြန်မာနိုင်ငံမှထုတ်ပြန်သော ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာလုပ်ထုံးလုပ် နည်း(၂၀၁၅) နှင့်အညီရေးဆွဲပြုစုထားပါသည်။ သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနမှ ထုတ်ပြန်သောပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဥပဒေ (၂၀၁၂) နှင့် ပတ်ဝန်းကျင်ထိန်းသိမ်း ရေးနည်းဥပဒေ (၂၀၁၄) အရအဆိုပြုစီမံကိန်းသည်ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း လုပ်ဆောင်ရန်လိုအပ်ပါသည်။ ဤဆန်းစစ်မှုကို တီကျစ်ကျောက်မီးသွေးသုံးရေနွေးငွေ့ဓာတ်အားပေးစက်ရုံ လည်ပတ်စဉ်ကာလအတွင်း ဖြစ်နိုင်ချေရှိသော လူထုနှင့်ပတ်ဝန်းကျင်အပေါ်သက်ရောက်နိုင်မှုများကို ဖော်ထုတ်ဆန်းစစ်ပြီး ဆိုးကျိုးများကိုလျှော့ချရန် နှင့်ကောင်းကျိုးများကိုတိုးမြင့်စေရန်ရည်ရွယ်ပါသည်။

အဆိုပြုစီမံကိန်းလုပ်ဆောင်သူမှာ Wuxi Hua Guang (Myanmar) Limited ဖြစ်ပြီး ယင်းသည် ယခင်နာမည်ကြီးဘွိုင်လာထုတ်လုပ်ရေးဖြစ်သော Wuxi Boiler Works (ယခု Wuxi Hua Guang Boiler ကုမ္ပဏီလီမိတက်) ၏အဓိကကုမ္ပဏီခွဲတစ်ခုဖြစ်ပါသည်။ ပင်မ Wuxi Hua Guang ကုမ္ပဏီသည် ဓာတ်အားပေးကုမ္ပဏီတစ်ခုဖြစ်ကာဘွိုင်လာဒီဇိုင်း၊ ဓာတ်အားပေး စက်ရုံဒီဇိုင်း၊ဘွိုင်လာထုတ်လုပ်ခြင်းနှင့် ဆက်စပ်လုပ်ငန်းများဖြစ်သော ဓာတ်အားပေးစက်ရုံအတွက် စက်ပစ္စည်းများတွဲဖက်ပေးခြင်း၊ တပ်ဆင်ခြင်း နှင့် လည်ပတ်ခြင်းတို့လုပ်ဆောင်ပေးလျက်ရှိပါသည်။

ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းကို အီးဂတ်ပတ်ဝန်းကျင်ဝန်ဆောင်မှုမှ သယံဇာတနှင့်သဘာဝ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန၏ ခွင့်ပြုချက် နှင့်အညီ လုပ်ဆောင်ပေးခဲ့ပါသည်။ ကုမ္ပဏီလိပ်စာနှင့် လေ့လာရေးအဖွဲ့ဝင်များ၏ တာဝန်နှင့်ဝတ္တရားများကိုအောက်တွင် ဖော်ပြပေးထားပါသည်။

ကုမ္ပဏီအမည်	အီးဂတ်ပတ်ဝန်းကျင်ဝန်ဆောင်မှုကုမ္ပဏီလီမိတက်
လိပ်စာ	အမှတ်(၁၁)၊ လေဆိပ်ရိပ်သာလမ်းသွယ်၊ ရန်ကုန်လေဆိပ်လမ်း၊ စော်ဘွားကြီးကုန်း၊ အင်းစိန်မြို့နယ်၊ ရန်ကုန်မြို့။ (၁၁၀၁၁)
ဆက်သွယ်ရန်ဖုန်း	+၉၅ ၁-၆၆၇၉၅၃

ဇယား ၁.၁ - EIA လေ့လာရေးအဖွဲ့ဝင်များ၏တာဝန်နှင့်ဝတ္တရားများ

အမည်	တာဝန်	ပညာအရည်အချင်း
ဦးအေးသီဟ	အဖွဲ့ခေါင်းဆောင်	M.Sc., (Natural Resources Management)
ဒေါ်ယုဝေယံသိန်းတန်	အထွေထွေကြီးကြပ်ခြင်း	M.Eng. (Environmental Engineering & Management)
ဦးဝင်းမြင့်	ဇီဝမျိုးစုံမျိုးကွဲများဆိုင်ရာပညာရှင်	Phd (Environmental Science)

ဒေါ်မေသူထက်	လူမှု- စီးပွားဆိုင်ရာကျွမ်းကျင်	Master of Economic
ဒေါ်ခိုင်မာကျော်	ရေနှင့်လေညစ်ညမ်းမှုထိန်းသိမ်းရေး	M.S.C (Environmental Engineering & Management)
ဦးကျော်စိုးမိုး	GIS ကျွမ်းကျင်	BE (civil)
ဦးစည်သူမင်းနိုင်	သတ္တုတူးဖော်ကျွမ်းကျင်	BE (Mining)
ဦးအောင်မိုးဦး	စစ်တမ်းနှင့်မှတ်တမ်းကောက်ယူသူ	BE (Chemical)
ဒေါ်သက်ရွှေရည်အောင်	စစ်တမ်းနှင့်မှတ်တမ်းကောက်ယူသူ	B.Sc (Geology)
ဒေါ်ရူပါကျော်	လျှပ်စစ်ကျွမ်းကျင်	BE (Electrical Power)
ဦးသန့်ဇင်အောင်	စီမံကိန်းအကူ	BE (Mining)

၂။ မူဝါဒ၊ ဥပဒေနှင့် မူဘောင်များ

အဆိုပြုစီမံကိန်းနှင့်ဆက်စပ်သော မြန်မာနိုင်ငံ၏မူဝါဒ၊ဥပဒေနှင့်လုပ်ထုံးများကို ယခုဆန်းစစ်မှုတွင် ဖော်ထုတ်ကာ အောက်ပါဇယားတွင်ဖော်ပြပေးထားပါသည်။ ယင်းတို့၏အရေးကြီးအချက်အလက် များကို အစီရင်ခံစာ၏ အခန်း(၃)တွင်ထည့်သွင်းဖော်ပြထားသည်။ ယင်းတို့အနက် ပတ်ဝန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ထုံးလုပ်နည်း (၂၀၁၅) နှင့် အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်များ (၂၀၁၅) တို့သည်အရေးကြီးဆုံးဖြစ်ကာ ယင်းတို့ကို အခန်း(၃) တွင် အသေးစိတ်ဖော်ပြပေးထားပါသည်။

ဇယား ၁.၂ - မူဝါဒ၊ ဥပဒေနှင့် မူဘောင်များ

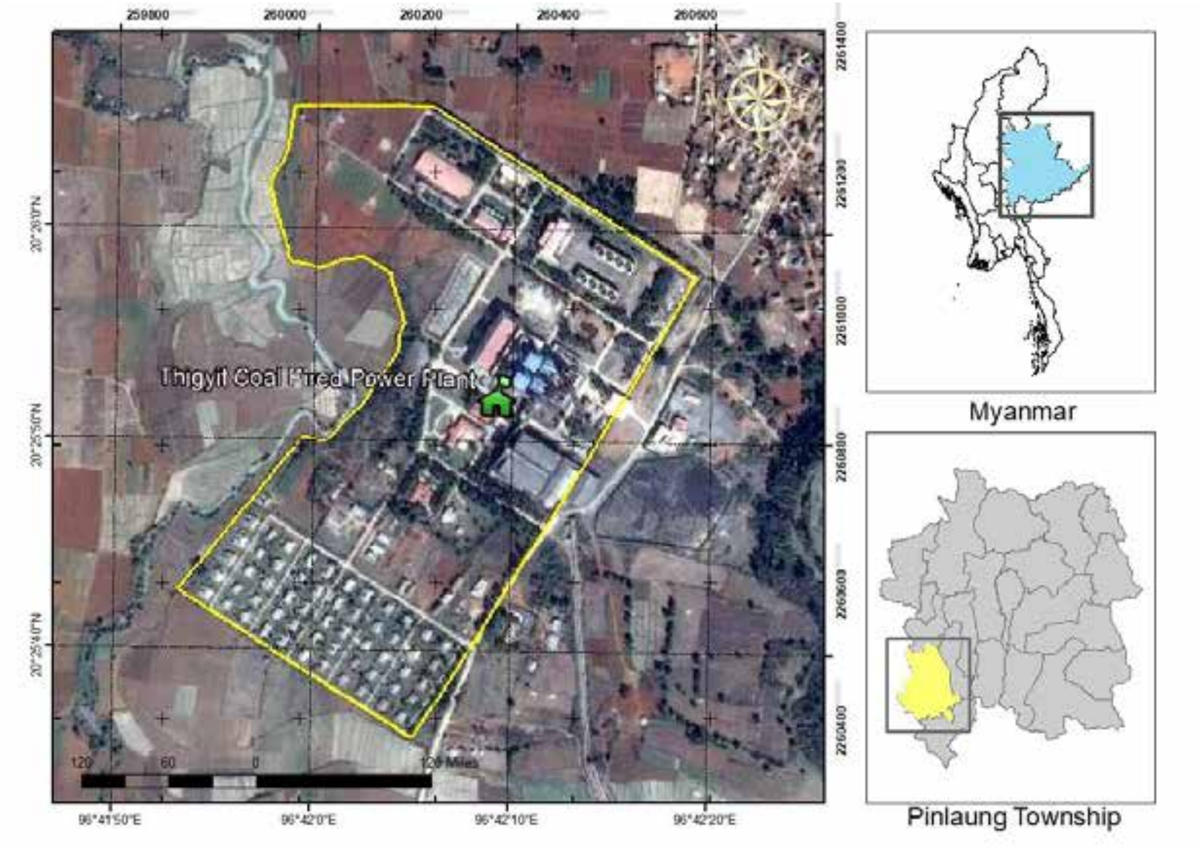
စဉ်	ဥပဒေနှင့်စည်းမျဉ်းများ	ထုတ်ပြန်သည့်နှစ်
၁။	အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာမူဝါဒ	၂၀၁၉
၂။	ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဥပဒေ	၂၀၁၂
၃။	ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနည်းဥပဒေ	၂၀၁၄
၄။	ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာလုပ်ထုံးလုပ်နည်း	၂၀၁၅
၅။	အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာအရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်များ	၂၀၁၅
၆။	မြန်မာနိုင်ငံရင်းနှီးမြှုပ်နှံမှုဥပဒေ	၂၀၁၆
၇။	မြန်မာနိုင်ငံရင်းနှီးမြှုပ်နှံမှုနည်းဥပဒေ	၂၀၁၇
၈။	တိုင်းရင်းသားလူမျိုးများ၏အခွင့်အရေးကာကွယ်စောင့်ရှောက်သည့်ဥပဒေ	၂၀၁၅
၉။	လျှပ်စစ်ဥပဒေ	၂၀၁၄
၁၀။	ဘွိုင်လာဥပဒေ	၂၀၁၅
၁၁။	ပြည်သူ့ကျန်းမာရေးဥပဒေ	၁၉၇၂

၁၂။	ကူးစက်ရောဂါများကာကွယ်နှိမ်နင်းရေးဥပဒေ	၁၉၉၅
၁၃။	ဆေးလိပ်နှင့်ဆေးရွက်ကြီးထွက်ပစ္စည်းသောက်သုံးမှုထိန်းချုပ်ရေးဥပဒေ	၂၀၀၆
၁၄။	မြန်မာနိုင်ငံမီးသတ်တပ်ဖွဲ့ဥပဒေ	၂၀၁၅
၁၅။	မော်တော်ယာဉ်ဥပဒေနှင့်မော်တော်ယာဉ်နည်းဥပဒေ	၂၀၁၅
၁၆။	မြန်မာ့အာမခံလုပ်ငန်းဥပဒေ	၁၉၉၃
၁၇။	အလုပ်ရုံအက်ဥပဒေ	၁၉၅၁
၁၈။	အလုပ်သမားအဖွဲ့အစည်းဥပဒေ	၂၀၁၁
၁၉။	အလုပ်သမားရေးရာအငြင်းပွားမှုဖြေရှင်းရေးဥပဒေ	၂၀၁၂
၂၀။	အလုပ်အကိုင်နှင့်ကျွမ်းကျင်မှုဖွံ့ဖြိုးတိုးတက်ရေးဥပဒေ	၂၀၁၃
၂၁။	အနည်းဆုံးအခကြေးငွေဥပဒေ	၂၀၁၃
၂၂။	အခကြေးငွေပေးချေရေးဥပဒေ	၂၀၁၆
၂၃။	အလုပ်သမားလျော်ကြေးဥပဒေ	၁၉၂၃
၂၄။	ခွင့်နှင့်အလုပ်ပိတ်ရက်အက်ဥပဒေ	၁၉၅၁
၂၅။	လူမှုဖူလုံရေးဥပဒေ	၂၀၁၂
၂၆။	ရေနံနှင့်ရေနံထွက်ပစ္စည်းဆိုင်ရာဥပဒေ	၂၀၁၆
၂၇။	ရေနံနည်းဥပဒေ	၁၉၃၇
၂၈။	ရေအရင်းအမြစ်နှင့်မြစ်ချောင်းများထိန်းသိမ်းရေးဥပဒေ	၂၀၀၆
၂၉။	ရေချိုငါးလုပ်ငန်းဥပဒေ	၁၉၉၁
၃၀။	ယဉ်ကျေးမှုအမွေအနှစ်ဒေသများကာကွယ်ထိန်းသိမ်းရေးဥပဒေ	၁၉၉၈
၃၁။	ရှေးဟောင်းဝတ္ထုပစ္စည်းကာကွယ်ထိန်းသိမ်းရေးဥပဒေ	၂၀၁၅
၃၂။	ရှေးဟောင်းအဆောက်အအုံကာကွယ်ထိန်းသိမ်းရေးဥပဒေ	၂၀၁၅
၃၃။	အင်ဂျင်နီယာကောင်စီဥပဒေ	၂၀၁၃
၃၄။	ပို့ကုန်၊ သွင်းကုန်ဥပဒေ	၂၀၁၂

၃။ စီမံကိန်းအကြောင်းအရာဖော်ပြချက်နှင့်အခြားနည်းလမ်းများရွေးချယ်ခြင်း

စီမံကိန်းအကြောင်းအရာများတွင် စီမံကိန်းနောက်ခံသမိုင်း၊ တည်နေရာ၊ တည်နေရာပြမြေပုံနှင့် လုပ်ကွက်နေရာချထားမှုပြပုံ၊ ဓာတ်အားပေးစက်ရုံ၏ဒီဇိုင်း၊ ထုတ်လုပ်မှုနည်းစဉ်၊ စီမံကိန်းဝန်ဆောင်မှုများနှင့် လုပ်သားအရင်းအမြစ်လိုအပ်ချက် စသည်တို့ပါဝင်သည်။ ၂၀၀၁ ခုနှစ်၊ ဩဂုတ် လ (၂၇) ရက်နေ့တွင် လျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီးဌာနလက်အောက်ရှိ မြန်မာ့လျှပ်စစ်ထုတ်လုပ်ရေးလုပ်ငန်း(ယခင်)သည် တရုတ်ပြည်သူ့သမ္မတနိုင်ငံ၏ တရုတ်အကြီးစားစက်မှုလုပ်ငန်း (CHMC) နှင့် ဓာတ်အားပေးစက်ရုံအတွက် သဘောတူညီချက်ရယူခဲ့သည်။ စက်ရုံကိုတီကျစ်ကျောက်မီးသွေးမိုင်း မှ ကျောက်မီးသွေးကိုအသုံးပြု၍ လျှပ်စစ် ၁၂၀ မီဂါဝပ်ထုတ်လုပ်နိုင်ရန်ဒီဇိုင်းရေးဆွဲခဲ့ပါသည်။ စုစုပေါင်းရင်းနှီးမြှုပ်နှံမှုပမာဏမှာ အမေရိကန်ဒေါ်လာ (၄၁.၁၅) မီလီယံ ဖြစ်သည်။ တီကျစ်ဓာတ်အားပေးစက်ရုံသည် ရှမ်းပြည်နယ်တောင်ပိုင်း၊ပအိုဝ့်ကိုယ်ပိုင်အုပ်ချုပ်ခွင့်ရဒေသ၊ ပင်လောင်း မြို့နယ်၊ တီကျစ်ကျေးရွာအုပ်စုတွင်တည်ရှိကာ တည်နေရာညွှန်းကိန်းမှာ မြောက်လတ္တီတွဒ် ၂၀°၂၅'၅၁.၀၂" နှင့်

အရှေ့လောင်တီတွဒ် ၉၆°၄၂'၁၂.၃၆" ဖြစ်သည်။ စီမံကိန်းအနီးပတ်ဝန်းကျင် တွင် နဂါးဘိလပ်မြေစက်ရုံ၊ နဂါးထုံးကျောက်မိုင်းနှင့် ဒေင်ကျောက်မီးသွေးမိုင်း တို့ဖြစ်သည်။



ပုံ ၁.၁ စီမံကိန်းတည်နေရာပြပုံ

(ရင်းမြစ်။ ။အီးဂတ်လေ့လာရေးအဖွဲ့)

အဆိုပြုဓာတ်အားပေးစက်ရုံ၏စုစုပေါင်းမြေဧရိယာမှာ ၄၅.ဂ၅ ဟက်တာ (၁၁၁.၃၄ဧက) ဖြစ်သည်။ စက်ရုံသည် ကနဦးအဆင့်တွင် သမားရိုးကျ ကျောက်မီးသွေးနည်းပညာကို အသုံးပြု ထားပြီး ယင်းသည် ကျောက်မီးသွေးနှင့်လေကို လောင်ကျွမ်းစေခြင်းဖြင့် ရေနွေးငွေ့ထုတ်လွှတ်စက်အတွင်းတွင် အပူချိန်မြင့်သော ဖိအားမြင့်ရေနွေးငွေ့ကိုရယူ ထုတ်လုပ်သည်။ အဆိုပါရေနွေးငွေ့များကို ရေနွေးငွေ့တာဘိုင်များမှ အဆင့် ဆင့်ဖြတ်သန်းလည်ပတ်စေကာ ထိုမှတဆင့် လျှပ်စစ်ကိုထုတ်လုပ်သည်။ တာဘိုင်များမှထွက်ရှိ ရေနွေးငွေ့များကိုအအေးခံကာ ရေအဖြစ်သို့ပြန်လည်ပြောင်းလဲ၍ လုပ်ငန်းစဉ်တွင်ပြန်လည်အသုံးပြု လည်ပတ်စေသည်။ ထုတ်လုပ်မှုနည်းစဉ်အသေးစိတ်ကိုအခန်း(၄)တွင်ဖော်ပြပေးထားပါသည်။

၄။ လက်ရှိပတ်ဝန်းကျင်အခြေအနေ

ပတ်ဝန်းကျင်နှင့်လူမှုအခြေအနေများကို လက်တွေ့ကွင်းဆင်းလေ့လာမှုများ၊ အထွေထွေ အုပ်ချုပ်ရေးဦးစီး ဌာနမှရရှိသော အချက်အလက်များနှင့် လူမှုစစ်တမ်းရလာဒ်များကို အခြေခံ၍ဖော်ပြထားပါသည်။ လက်တွေ့တိုင်းတာမှုများ ဖြစ်သည့် လေအရည်အသွေး နှင့်ဆူညံမှုအဆင့်တိုင်းတာမှုတို့ကို စီမံကိန်းအနီး အနားပတ်ဂန်းကျင် (၅) ကီလိုမီတာအတွင်းတွင် (၁၈) နေရာတွင်လည်းကောင်း၊ ရေအရည် အသွေးတိုင်းတာမှုကို (၁၀) နေရာတွင်လည်းကောင်း ဆောင်ရွက်ပြုလုပ်ခဲ့ပါသည်။ ထို့အပြင်ဇီဝမျိုးစုံမျိုးကွဲ များလေ့လာရန်အတွက် စီမံကိန်းမှ (၅) ကီလိုမီတာ အချင်းဝက်ရှိသော အဝိုင်းအတာအတွင်း သတ်မှတ်လေ့လာမှုများပြုလုပ်ခဲ့ပါသည်။ လူမှုစီပွားစစ်တမ်း ကောက်ယူခြင်းကို ကျေးရွာ၂၃ရွာ၊ ဓာတ်အားပေးစက်ရုံ၏ဝန်ထမ်းအိမ်ရာနှင့် ဒေင်ကျောက်မီးသွေးမိုင်း၏ ဝန်ထမ်းအိမ်ရာများတွင် လုပ်ဆောင်ခဲ့ပါသည်။

ခြောက်သွေ့ရာသီတွင် တိုင်းတာခဲ့သော လေအရည်အသွေးတိုင်းတာမှုရလဒ်များအနေဖြင့် ဘန်းမက်ရွာ အနီး (အမှတ်- A5) တွင် တိုင်းတာခဲ့သော လေထုအတွင်းအမှုန်အမွှားပါဝင်မှု ရလာဒ်မှလွဲ၍ ကျန်ရလဒ်များမှာ အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) သတ်မှတ်ချက် တန်ဖိုးထက် ကျော်လွန်နေသည်ကို လေ့လာတွေ့ရှိခဲ့ရသည်။ စိုစွတ်ရာသီတွင်တိုင်းတာခဲ့သော လေထုအတွင်း အမှုန်အမွှားပါဝင်မှု တိုင်းတာမှုရလာဒ်အားလုံးသည် သတ်မှတ်ချက် တန်ဖိုးအတွင်း တည်ရှိပါသည်။ နိုက်ထရိုဂျင်ဒိုင်အောက်ဆိုဒ်ပါဝင်မှု ရလာဒ်များအားလုံးသည် သတ်မှတ် တန်ဖိုးဖြစ်သည့် 200μg/m3 အောက်တွင်တည်ရှိပြီး ဆာလဖာဒိုင်အောက်ဆိုဒ်ပါဝင်မှု ပမာဏမှာလည်း စံနှုန်းသတ်မှတ်ချက်အတွင်း ကျရောက်နေ ပါသည်။

ဇယား ၁.၃ - ခြောက်သွေ့နှင့်စိုစွတ်ရာသီလေအရည်အသွေးတိုင်းတာမှုရလာဒ်များ

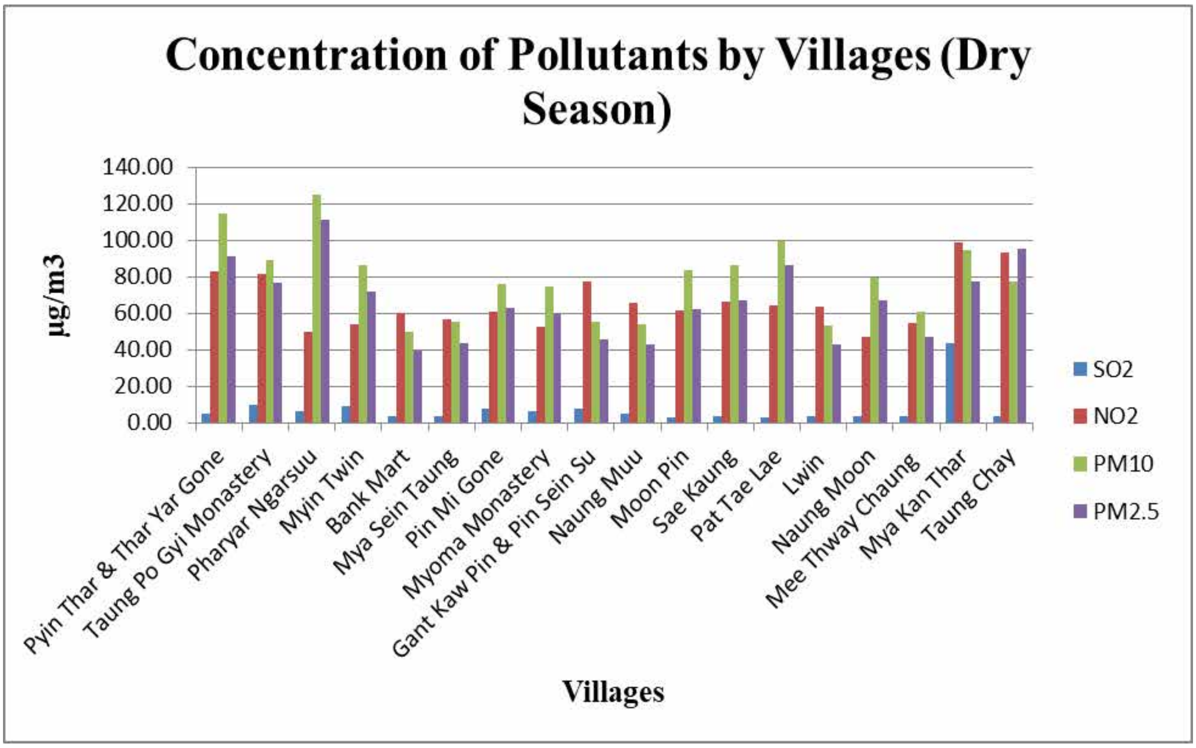
အမှတ်	တည်နေရာ	တည်နေရာညွှန်းကိန်း	ဖော်ပြချက်	ရာသီ	နေ့စွဲ	အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာအရည်အသွေး (ထုတ်လွှတ်မှု) သတ်မှတ်ချက် (µg/m3)			
						PM10 (24 hrs average)	PM2.5 (24 hrs average)	NO2 (1 hr average)	SO2 (24 hrs average)
						50	25	200	20
						Result			
A-1	ပြင်သာနှင့်သာယာကုန်း လမ်းဆုံ	Lat: 20° 26′ 0.813″N, Lon 096° 42′ 19.709″E	တီကျစ်စက်ရုံမှ ၀.၅၃ ကီလိုမီတာအကွာ	ခြောက်သွေ့ရာသီ	(၃၀-၃၁) မတ်၊ ၂၀၁၈	114.63	91.25	83.11	5.24
				စိုစွတ်ရာသီ	(၁၃-၁၄) ဩဂုတ်၊ ၂၀၁၈	9.41	5.08	27.27	3.37
A-2	တောင်ပို့ကြီး ဘုန်းကြီးကျောင်း	Lat: 20° 26′ 28.760″N, Lon 096° 42′ 20.519″E	တီကျစ်စက်ရုံမှ ၁.၁၁ ကီလိုမီတာအကွာ	ခြောက်သွေ့ရာသီ	(၃၁-၁) မတ်ဧပြီ၊ ၂၀၁၈	89.32	76.48	81.52	9.85
				စိုစွတ်ရာသီ	(၁၁-၁၂) ဩဂုတ်၊ ၂၀၁၈	7.2	3.12	28.83	2.72

A-3	ဘုရားငါးဆူရွာ	Lat: 20° 26′ 47.705″N, Lon 096° 41′ 53.205″E	တီကျစ်စက်ရုံမှ ၁.၇၃ ကီလိုမီတာအကွာ	ခြောက်သွေ့ ရာသီ	(၁-၂) ဧပြီ၊ ၂၀၁၈	125	111.21	50.10	6.55
				စိုစွတ်ရာသီ	(၁၀-၁၁) ဩဂုတ်၊ ၂၀၁၈	15.19	8.74	33.19	2.71
A-4	မြင်တွင်းရွာ	Lat: 20° 27′ 52.778″N, Lon 096° 41′ 36.149″E	တီကျစ်စက်ရုံမှ ၃.၇၉ ကီလိုမီတာအကွာ	ခြောက်သွေ့ ရာသီ	(၃-၄) ဧပြီ၊ ၂၀၁၈	86.25	71.96	54.02	8.84
				စိုစွတ်ရာသီ	(၉-၁၀) ဩဂုတ်၊ ၂၀၁၈	13.09	6.03	32.35	2.81
A-5	ဘန်းမက်ရွာ	Lat: 20° 26′ 53.390″N, Lon 096° 42′ 45.445″E	တီကျစ်စက်ရုံမှ ၂.၀၈ ကီလိုမီတာအကွာ	ခြောက်သွေ့ ရာသီ	(၄-၅) ဧပြီ၊ ၂၀၁၈	50	40	60.07	3.88
				စိုစွတ်ရာသီ	(၁၂-၁၃) ဩဂုတ်၊ ၂၀၁၈	8.54	4.48	31.82	3.02
A-6	မြစိမ်းတောင်ရွာ	Lat: 20° 25′ 34.591″N, Lon 096° 43′ 02.364″E	တီကျစ်စက်ရုံမှ ၁.၆၁ ကီလိုမီတာအကွာ	ခြောက်သွေ့ ရာသီ	(၅-၆) ဧပြီ၊ ၂၀၁၈	56	43	56.46	3.87
				စိုစွတ်ရာသီ	(၁၅-၁၆) ဩဂုတ်၊ ၂၀၁၈	9.23	4.74	32.47	3.12

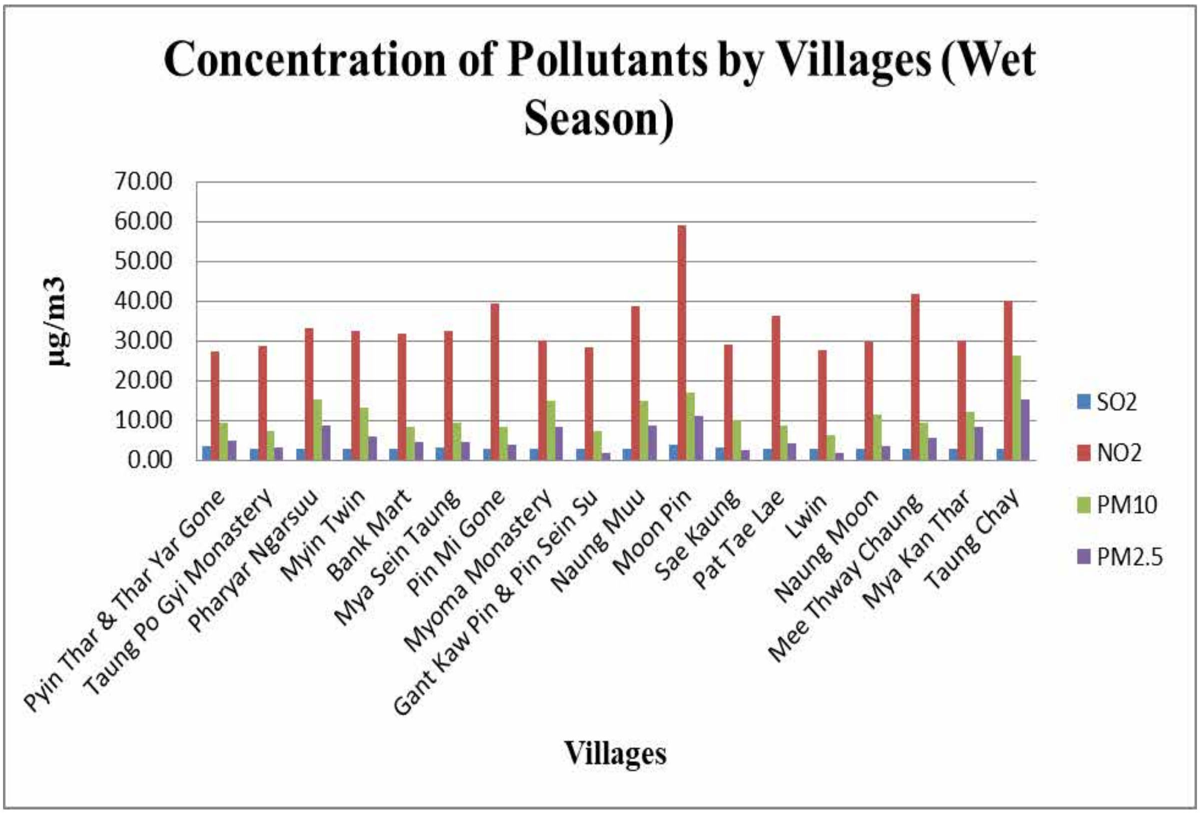
A-7	ပြင်မိုကုန်းရွာ	Lat: 20° 25′ 00.073″N, Lon 096° 43′ 45.101″E	တီကျစ်စက်ရုံမှ ၃.၁၈ ကီလိုမီတာအကွာ	ခြောက်သွေ့ရာသီ	(၇-၈) ဧပြီ၊ ၂၀၁၈	76	63	60.88	8.04
				စိုစွတ်ရာသီ	(၁၆-၁၇) ဩဂုတ်၊ ၂၀၁၈	8.48	3.87	39.52	2.76
A-8	တီကျစ်မြို့မ ဘုန်းကြီးကျောင်း	Lat: 20° 25′ 05.099″N, Lon 096° 42′ 14.903″E	တီကျစ်စက်ရုံမှ ၁.၅၂ ကီလိုမီတာအကွာ	ခြောက်သွေ့ရာသီ	(၈-၉) ဧပြီ၊ ၂၀၁၈	75	59	52.70	6.09
				စိုစွတ်ရာသီ	(၇-၈) ဩဂုတ်၊ ၂၀၁၈	14.97	8.26	29.90	2.75
A-9	ကံကော်ပင်နှင့်ပင်စိမ်းစု လမ်းဆုံ	Lat: 20° 25′ 57.868″N, Lon 096° 39′ 50.103″E	တီကျစ်စက်ရုံမှ ၄.၀၈ ကီလိုမီတာအကွာ	ခြောက်သွေ့ရာသီ	(၂၀-၂၁) ဧပြီ၊ ၂၀၁၈	55.38	45.81	77.65	7.72
				စိုစွတ်ရာသီ	(၂၂-၂၃) ဩဂုတ်၊ ၂၀၁၈	7.48	1.84	28.38	2.71
A-10	နောင်မူရွာ	Lat: 20° 25′ 14.20″N, Lon 096° 39′ 49.77″E	တီကျစ်စက်ရုံမှ ၄.၂၇ ကီလိုမီတာအကွာ	ခြောက်သွေ့ရာသီ	(၂၁-၂၂) ဧပြီ၊ ၂၀၁၈	53.88	42.65	65.69	4.87
				စိုစွတ်ရာသီ	(၂၁-၂၂) ဩဂုတ်၊ ၂၀၁၈	15.03	6.81	38.56	2.98

A-11	မွန်းပင်ရွာ	Lat: 20° 25′ 31.87″N, Lon 096° 41′ 2.78″E	တီကျစ်စက်ရုံမှ ၂.၀၉ ကီလိုမီတာအကွာ	ခြောက်သွေ့ရာသီ	(၂၂-၂၃) ဧပြီ၊ ၂၀၁၈	83.75	62.14	61.26	2.80
				စိုစွတ်ရာသီ	(၂၄-၂၅) ဩဂုတ်၊ ၂၀၁၈	16.97	11.26	59.18	3.84
A-12	ဆည်ခေါင်းရွာ	Lat: 20° 25′ 30″N, Lon 096° 41′ 39″E	တီကျစ်စက်ရုံမှ ၁.၁၄ ကီလိုမီတာအကွာ	ခြောက်သွေ့ရာသီ	(၂၃-၂၄) ဧပြီ၊ ၂၀၁၈	86.16	66.78	66.57	3.49
				စိုစွတ်ရာသီ	(၁၇-၁၈) ဩဂုတ်၊ ၂၀၁၈	11.62	3.67	28.97	3.14
A-13	ပက်တလဲ့ရွာ	Lat: 20° 27′ 9″N, Lon 096° 40′ 3″E	တီကျစ်စက်ရုံမှ ၄.၃၅ ကီလိုမီတာအကွာ	ခြောက်သွေ့ရာသီ	(၂၄-၂၅) ဧပြီ၊ ၂၀၁၈	99.71	86.23	64.22	3.09
				စိုစွတ်ရာသီ	(၁၉-၂၀) ဩဂုတ်၊ ၂၀၁၈	8.69	4.07	36.42	2.84
A-14	လွင်ရွာ	Lat: 20° 26′ 19.50″N, Lon 096° 40′ 35.49″E	တီကျစ်စက်ရုံမှ ၂.၇၆ ကီလိုမီတာအကွာ	ခြောက်သွေ့ရာသီ	(၂၅-၂၆) ဧပြီ၊ ၂၀၁၈	53.33	42.97	63.50	3.34
				စိုစွတ်ရာသီ	(၂၀-၂၁) ဩဂုတ်၊ ၂၀၁၈	6.2	1.82	27.81	2.70

A-15	နောင်မွန်းရွာ	Lat: 20° 24′ 52.17″N, Lon 096° 41′ 51.50″E	တီကျစ်စက်ရုံမှ ၂.၄၆ ကီလိုမီတာအကွာ	ခြောက်သွေ့ရာသီ	(၂၆-၂၇) ဧပြီ၊ ၂၀၁၈	79.33	67.05	46.85	3.95
				စိုစွတ်ရာသီ	(၁၈-၁၉) ဩဂုတ်၊ ၂၀၁၈	10.13	2.57	29.80	2.81
A-16	မီးသွေးချောင်းရွာ	Lat: 20° 23′ 37.91″N, Lon 096° 43′ 5.19″E	တီကျစ်စက်ရုံမှ ၄.၅ ကီလိုမီတာအကွာ	ခြောက်သွေ့ရာသီ	(၂၈-၂၉) ဧပြီ၊ ၂၀၁၈	60.95	47.11	54.70	3.37
				စိုစွတ်ရာသီ	(၂၃-၂၄) ဩဂုတ်၊ ၂၀၁၈	9.41	5.54	41.85	2.84
A-17	မြကန်သာရွာ	Lat: 20° 25′ 18.59″N, Lon 096° 42′ 13.59″E	တီကျစ်စက်ရုံမှ ၁.၁ ကီလိုမီတာအကွာ	ခြောက်သွေ့ရာသီ	(၇-၈) မေ၊ ၂၀၁၈	94.78	77.13	98.42	43.70
				စိုစွတ်ရာသီ	(၁၄-၁၅) ဩဂုတ်၊ ၂၀၁၈	12.13	8.33	29.94	2.81
A-18	တောင်ခြေရွာ	Lat: 20° 26′ 0.813″N, Lon 096° 42′ 19.709″E	တီကျစ်စက်ရုံမှ ၄.၉ ကီလိုမီတာအကွာ	ခြောက်သွေ့ရာသီ	(၈-၉) မေ၊ ၂၀၁၈	95.09	77.62	93.11	3.66
				စိုစွတ်ရာသီ	(၈-၉) ဩဂုတ်၊ ၂၀၁၈	26.29	15.22	40.18	2.90



ပုံ ၁.၂ -ခြောက်သွေ့ရာသီကျေးရွာအလိုက်လေထုညစ်ညမ်းမှုပမာဏ



ပုံ ၁.၃ -စိုစွတ်ရာသီကျေးရွာအလိုက်လေထုညစ်ညမ်းမှုပမာဏ

ဆူညံသံအဆင့်တိုင်းတာမှုကို သက်ရောက်မှုဖြစ်စေသောအရင်းမြစ်(source) တွင် (၂) နေရာ (ဘွိုင်လာအနီးနှင့်အအေးခံစက်အနီး) နှင့် သက်ရောက်မှုခံစားရနိုင်သောနေရာ (receptor) တွင် (၂) နေရာ (စက်ရုံတွင်းရှိဝန်ထမ်းအိမ်ရာ၁နှင့်၂) တို့တွင်တိုင်းတာခဲ့ပါသည်။ ထို့အပြင် စက်ရုံအနီး (၅) ကီလိုမီတာအချင်းဝက် ပတ်လည်အတွင်းရှိ ကျေးရွာပေါင်း၁၈ရွာတွင်လည်း တိုင်းတာခဲ့ ပါသည်။ ဆူညံသံတိုင်းတာမှုရလာဒ် များကိုအောက်ပါဇယားတွင်ဖော်ပြပေးထားပါသည်။ လူနေအိမ်ခြေဆိုင်ရာ ဆူညံသံအဆင့်တိုင်းတာမှုကို ခြောက်သွေ့ရာသီအတွက် ၂၀၁၈ခုနှစ်၊ မတ်လ(၃၀) မှ ဧပြီလ(၃၀) အထိလည်းကောင်း၊ စိုစွတ်ရာသီအတွက် ၂၀၁၈ခုနှစ်၊ဩဂုတ်လ(၇) မှ (၂၅) အထိလည်းကောင်း တိုင်းတာခဲ့ပြီး၊ စက်ရုံဧရိယာတွင်းတိုင်းတာမှုကို စက်ရုံတွင် ၂၀၁၈ခုနှစ်၊ ဧပြီလ (၂၀) မှ (၃၀) အထိ ခြောက်သွေ့ရာသီအတွက် တိုင်းတာခဲ့သည်။

ဆူညံသံအဆင့်တိုင်းတာရာတွင် (Digital sound level meter) ကိုအသုံးပြု၍ ၂၄နာရီကြားပိုင်း (24 time interval) ဖြင့်တိုင်းတာခဲ့ပြီးရလာဒ်များကို အမျိုးသားထုတ်လွှတ်မှုစံချိန်စံညွှန်းနှင့်နှိုင်းယှဉ်၍ ဖော်ပြထား ပါသည်။

ဇယား ၁.၄ - စက်ရုံတွင်းဆူညံသံတိုင်းတာမှုရလာဒ်

အမှတ်	နေ့စွဲ	ကာလ	ရလာဒ် LAeq (dB)	အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာအရည်အသွေး (ထုတ်လွှတ်မှု) သတ်မှတ်ချက် (µg/m3)
ဘွိုင်လာအနီး	(၂၃-၂၄) ဇန်နဝါရီလ ၂၀၁၉	နေ့ဘက် (၇း၀၀ မှ ၂၂း၀၀)	64.75	55
		ညဘက် (၂၂း၀၀ မှ ၇း၀၀)	67.78	45
အအေးခံတာဝါ အနီး	(၂၄-၂၅) ဇန်နဝါရီလ ၂၀၁၉	နေ့ဘက် (၇း၀၀ မှ ၂၂း၀၀)	69.20	55
		ညဘက် (၂၂း၀၀ မှ ၇း၀၀)	68.08	45
ဝန်ထမ်းအိမ်ရာ-၁	(၂၃-၂၄) ဇန်နဝါရီလ ၂၀၁၉	နေ့ဘက် (၇း၀၀ မှ ၂၂း၀၀)	51.22	55

		ညဘက် (၂၂:၀၀ မှ ၇:၀၀)	52.44	45
ဝန်ထမ်းအိမ်ရာ - ၂	(၂၄-၂၅) ဇန်နဝါရီလ ၂၀၁၉	နေ့ဘက် (၇:၀၀ မှ ၂၂:၀၀)	51.59	55
		ညဘက် (၂၂:၀၀ မှ ၇:၀၀)	46.89	45

ဇယား ၁.၄ - ကျေးရွာ(၁၈) တွင် တိုင်းတာရရှိခဲ့သော ဆူညံသံအဆင့်တိုင်းတာမှုရလာဒ်

အမှတ်	နေ့စွဲ	ကျေးရွာအမည်	ကာလ	ခြောက်သွေ့ရာသီ LAeq (dB)	စိုစွတ်ရာသီ LAeq (dB)	အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) သတ်မှတ်ချက် (µg/m3)
N-1	(၃၀-၃၁) မတ်လ၊ ၂၀၁၈	ပြင်သာ၊သာယာကုန်း လမ်းဆုံ	နေ့ဘက် (၇:၀၀ မှ ၂၂:၀၀)	56.77	53.45	55
			ညဘက် (၂၂:၀၀ မှ ၇:၀၀)	55.77	52.17	45
N-2	(၃၁-၁) မတ်လ၊ ၂၀၁၈	တောင်ပို့ကြီး ဘုန်းကြီးကျောင်း	နေ့ဘက် (၇:၀၀ မှ ၂၂:၀၀)	53.74	49.70	55
			ညဘက် (၂၂:၀၀ မှ ၇:၀၀)	52.40	54.44	45
N-3	(၁-၂) ဧပြီလ၊ ၂၀၁၈	ဘုရားငါးဆူရွာ	နေ့ဘက် (၇:၀၀ မှ ၂၂:၀၀)	48.75	51.18	55
			ညဘက် (၂၂:၀၀	43.57	51.43	45

အမှတ်	နေ့စွဲ	ကျေးရွာအမည်	ကာလ	ခြောက်သွေ့ရာသီ LAeq (dB)	စိုစွတ်ရာသီ LAeq (dB)	အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) သတ်မှတ်ချက် (µg/m3)
			မှ ၇း၀၀)			
N-4	(၃-၄) ဧပြီလ၊ ၂၀၁၈	မြင်တွင်းရွာ	နေ့ဘက် (၇း၀၀ မှ ၂၂း၀၀)	54.06	52.63	55
			ညဘက် (၂၂း၀၀ မှ ၇း၀၀)	45.03	46.13	45
N-5	(၄-၅) ဧပြီလ၊ ၂၀၁၈	ဘန်းမက်ရွာ	နေ့ဘက် (၇း၀၀ မှ ၂၂း၀၀)	50.27	54.52	55
			ညဘက် (၂၂း၀၀ မှ ၇း၀၀)	47.35	56.56	45
N-6	(၅-၆) ဧပြီလ၊ ၂၀၁၈	မြစိမ်းတောင်ရွာ	နေ့ဘက် (၇း၀၀ မှ ၂၂း၀၀)	63.37	50.54	55
			ညဘက် (၂၂း၀၀ မှ ၇း၀၀)	61.52	50.49	45
N-7	(၇-၈) ဧပြီလ၊ ၂၀၁၈	ပြင်မိုကုန်းရွာ	နေ့ဘက် (၇း၀၀ မှ ၂၂း၀၀)	57.63	52.68	55
			ညဘက် (၂၂း၀၀ မှ ၇း၀၀)	48.54	52.16	45
N-8	(၈-၉)	တီကျစ်မြို့မ	နေ့ဘက်	54.83	53.23	55

အမှတ်	နေ့စွဲ	ကျေးရွာအမည်	ကာလ	ခြောက်သွေ့ရာသီ LAeq (dB)	စိုစွတ်ရာသီ LAeq (dB)	အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) သတ်မှတ်ချက် (µg/m3)
	ဧပြီလ၊ ၂၀၁၈	ဘုန်းကြီးကျောင်း	(၇း၀၀ မှ ၂၂း၀၀)			
			ညဘက် (၂၂း၀၀ မှ ၇း၀၀)	49.29	57.90	45
N-9	(၂၀-၂၁) ဧပြီလ၊ ၂၀၁၈	ကံကော်ပင်နှင့် ပင်စိမ်းစု လမ်းဆုံ	နေ့ဘက် (၇း၀၀ မှ ၂၂း၀၀)	47.64	56.05	55
			ညဘက် (၂၂း၀၀ မှ ၇း၀၀)	47.9	55.42	45
N-10	(၂၁-၂၂) ဧပြီလ၊ ၂၀၁၈	နောင်မူရွာ	နေ့ဘက် (၇း၀၀ မှ ၂၂း၀၀)	45.42	60.86	55
			ညဘက် (၂၂း၀၀ မှ ၇း၀၀)	41.84	49.68	45
N-11	(၂၂-၂၃) ဧပြီလ၊ ၂၀၁၈	မွန်းပင်ရွာ	နေ့ဘက် (၇း၀၀ မှ ၂၂း၀၀)	45.81	56.31	55
			ညဘက် (၂၂း၀၀ မှ ၇း၀၀)	40.73	53.65	45
N-12	(၂၃-၂၄) ဧပြီလ၊ ၂၀၁၈	ဆည်ခေါင်းရွာ	နေ့ဘက် (၇း၀၀ မှ ၂၂း၀၀)	62.77	52.20	55

အမှတ်	နေ့စွဲ	ကျေးရွာအမည်	ကာလ	ခြောက်သွေ့ရာသီ LAeq (dB)	စိုစွတ်ရာသီ LAeq (dB)	အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) သတ်မှတ်ချက် (µg/m3)
			ညဘက် (၂၂:၀၀ မှ ၇:၀၀)	59.56	47.98	45
N-13	(၂၄-၂၅) ဧပြီလ၊ ၂၀၁၈	ပက်တလဲ့ရွာ	နေ့ဘက် (၇:၀၀ မှ ၂၂:၀၀)	49.64	56.14	55
			ညဘက် (၂၂:၀၀ မှ ၇:၀၀)	45.11	55.08	45
N-14	(၂၅-၂၆) ဧပြီလ၊ ၂၀၁၈	လွင်ရွာ	နေ့ဘက် (၇:၀၀ မှ ၂၂:၀၀)	63.69	52.46	55
			ညဘက် (၂၂:၀၀ မှ ၇:၀၀)	63.17	51.93	45
N-15	(၂၆-၂၇) ဧပြီလ၊ ၂၀၁၈	နောင်မွန်းရွာ	နေ့ဘက် (၇:၀၀ မှ ၂၂:၀၀)	67.23	52.00	55
			ညဘက် (၂၂:၀၀ မှ ၇:၀၀)	62.59	50.80	45
N-16	(၂၈-၂၉) ဧပြီလ၊ ၂၀၁၈	မီးသွေးချောင်းရွာ	နေ့ဘက် (၇:၀၀ မှ ၂၂:၀၀)	47.69	52.55	55
			ညဘက် (၂၂:၀၀	48.79	51.35	45

အမှတ်	နေ့စွဲ	ကျေးရွာအမည်	ကာလ	ခြောက်သွေ့ရာသီ LAeq (dB)	စိုစွတ်ရာသီ LAeq (dB)	အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) သတ်မှတ်ချက် (µg/m3)
			မှ ၇း၀၀)			
N-17	(၇-၈) မေလ၊ ၂၀၁၈	မြကန်သာရွာ	နေ့ဘက် (၇း၀၀ မှ ၂၂း၀၀)	47.15	57.41	55
			ညဘက် (၂၂း၀၀ မှ ၇း၀၀)	46.13	56.58	45
N-18	(၈-၉) မေလ၊ ၂၀၁၈	တောင်ခြေရွာ	နေ့ဘက် (၇း၀၀ မှ ၂၂း၀၀)	47.61	52.27	55
			ညဘက် (၂၂း၀၀ မှ ၇း၀၀)	45	52.73	45

လက်ရှိရေအရည်အသွေးကို သိရှိနိုင်ရန်အတွက် စီမံကိန်းအနီးရှိ သံတဲချောင်းနှင့်ဘီလူးချောင်း တစ်လျှောက်စုစုပေါင်းရေနမူနာ (၁၀) ခုကိုကောက်ယူခဲ့ပါသည်။ ယင်းတို့အနက် နမူနာအမှတ် W_7 နှင့် W_8 တို့တွင် အနီးရှိကျောက်မီးသွေးမိုင်းမှ စွန့်ထုတ်သောရေဆိုးများကြောင့် ရေအရည်အသွေး နိမ့်ကျနေသည်ကိုတွေ့ရှိရသည်။ သံတဲချောင်းတလျှောက်ရှိ နမူနာအမှတ် W_1, W_2, W_3 နှင့် W_4 အမှတ်များတွင် ဓာတ်အားပေးစက်ရုံ၏ စွန့်ပစ်ရေ နှင့် မရောနှောမီ နှင့် ရောနှောပြီး အချိန် ရေအရည်အသွေး ပြောင်းလဲမှုကို နှိုင်းယှဉ်သိရှိနိုင်ရန်အတွက် ရေနမူနာနှစ်ကြိမ်ကောက်ယူ ခဲ့ပါသည်။ စက်ရုံရှိရေအအေးခံ စနစ်မှလျှံထွက်သောရေများကို ရေစုကန်တွင်အအေးခံပြီးနောက် သံတဲချောင်းတစ်လျှောက် စီးဆင်းစေပါသည်။ နမူနာအမှတ် W_9 နှင့် W_{10} တို့သည် စက်ရုံ၏ စွန့်ပစ်ရေစုကန်သို့မရောက်ရှိမီ နှင့်အကျော်တွင် တည်ရှိပါသည်။ နဂါးဘီလပ်မြေစက်ရုံမှ စွန့်ပစ်ရေများဘီလူးချောင်းအတွင်းသို့ စွန့်ပစ်သည့်နေရာ မရောက်မီတွင် ရေနမူနာအမှတ် W_5 ကိုလည်းကောင်း၊ သံတဲချောင်းနှင့်ဘီလူးချောင်းဆုံရာတွင် W_6 ကိုလည်းကောင်း ထည့်သွင်းကောက်ယူခဲ့ပါသည်။ ရေနမူနာများကို ယင်းနေရာများတွင်စိုစွတ်ရာသီနှင့် ခြောက်သွေ့ ရာသီနှစ်ရာသီအတွက် ၂၀၁၈ခုနှစ်၊ ဧပြီလ နှင့် ၂၀၁၈ခုနှစ်၊ ဇူလိုင်လ တွင်လည်းကောင်း အသီးသီးကောက်ယူခဲ့ပါသည်။

ရေအရည်အသွေးတိုင်းတာမှုရလာဒ်များအရ နမူနာမှတ် (W_7 နှင့် W_8)တို့တွင် သံဓာတ်ပါဝင်မှုမှာ WHO စံနှုန်းထက် ပါဝင်မှုများနေသည်ကိုတွေ့ရှိရပြီး အနည်ပါဝင်မှုမှာ နမူနာအမှတ် (W_4, W_7နှင့်W_8) တို့တွင် အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) သတ်မှတ်ချက်ထက် ကျော်လွန်နေသည်ကို လေ့လာတွေ့ရှိရသည်။ ရေတွင်းအနည်ပါဝင်မှုသည် ရေ နောက်ကျိမှု၊ ရေအလင်းပေါက်ရောက်မှုကို လျော့ကျစေပြီး ရေညစ်ညမ်းမှုကိုဖြစ်ပေါ်စေနိုင် ပါသည်။ စက်ရုံ၏အနည်စစ်ကန်မတိုင်မီ နှင့် အနည်စစ်ကန်အထွက်များဖြစ်သော (W_9 နှင့် W_{10}) တို့တွင်ပြဒါးပါဝင်မှုနှုန်းသည် စံနှုန်းထက် မြင့်မားနေသည်ကိုတွေ့ရသည်။ W_2, W_3, W_5, W_7, W_8 နှင့် W_{10} တို့တွင် ဆီနှင့်အနည်အနှစ်ပါဝင်မှု အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) သတ်မှတ်ချက်ထက်ကျော်လွန်နေသည် ကိုတွေ့ရှိရပါသည်။ စိုစွတ်ရာသီတွင် ချောင်းတွင်းနစ်မှတ်နှင့် ကျောက်မီးသွေးမိုင်းစွန့်ထုတ်ရေ စသည့်အမှတ်တို့တွင် ခရိုမီယမ်ပါဝင်မှုများနေသည်ကိုတွေ့ရှိရပါသည်။

ဇယား ၁.၅ - ရေအရည်အသွေးတိုင်းတာမှုရလာဒ်များ

စဉ်	တိုင်းတာမှု	ရာသီ	သံတဲချောင်း (သံတဲချောင်းတံတား)	သံတဲချောင်း (ဆည်ခေါင်းရွာအနီး)	သံတဲချောင်းနှင့်တီကျစ်စက်ရုံစွန့်ထုတ်ရေဆုံမှတ်	သံတဲချောင်းမှစိုက်ပျိုးရေးအတွက်ဖြန့်ဝေရာ	ဘီလူးချောင်း (နဂါးဘီလပ်မြေစက်ရုံစွန့်ပစ်ရေမတိုင်မီ)	သံတဲချောင်းနှင့်ဘီလူးချောင်းဆုံရာ	ကျောက်မီးသွေးမိုင်းမှစွန့်ထုတ်ရေ - ၁	ကျောက်မီးသွေးမိုင်းမှစွန့်ထုတ်ရေ - ၂	အနည်ချကန်မတိုင်မီ	အနည်ချကန်အကျော်	အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာအရည်အသွေး (ထုတ်လွှတ်မှု) သတ်မှတ်ချက်	ယူနစ်	ဓာတ်ခွဲခန်းအမည်
			W1	W2	W3	W4	W5	W6	W7	W8	W9	W10			
1	pH	ခြောက်သွေ့ရာသီ	7.4	7.5	7.9	7.8	7.8	7.7	7.9	8	8.2	8.3	6-9		
		စိုစွတ်ရာသီ	7.4	7.8	7.9	8	7.8	7.9	7.8	7.8	8.6	8.2		mg/L	ISO
2	Iron (Fe)	ခြောက်သွေ့ရာသီ	0.38	0.57	0.83	0.88	0.37	0.48	3.4	6.2	0.27	0.22	1	mg/L	ISO
		စိုစွတ်ရာသီ	0.36	4.28	3.7	5.5	0.86	0.88	7.8	6.88	0.4	0.42			
3	Suspended solids	ခြောက်သွေ့ရာသီ	12	38	50	64	18	26	110	250	20	15	50	mg/L	ISO
		စိုစွတ်ရာသီ	25	110	130	172	63	74	377	286	36	52			
4	Dissolved solids	ခြောက်သွေ့ရာသီ	283	253	236	239	213	207	237	230	205	204		mg/L	ISO

		စိုစွတ်ရာသီ	247	176	188	189	147	148	244	236	149	155	–		
5	Temperature	ခြောက်သွေ့ရာသီ	28.89	27.73	28.18	30.18	29.31	28.21	27.73	28.88	31.08	27.27	<3	°C	ISO
		စိုစွတ်ရာသီ	21.88	22.92	23.89	23.88	22.31	23.31	23.18	24.86	30.60	26.41			
6	Lead (Pb)	ခြောက်သွေ့ရာသီ	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	0.5	mg/L	ISO
		စိုစွတ်ရာသီ	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil			
7	Arsenic (As)	ခြောက်သွေ့ရာသီ	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	0.5	mg/L	ISO
		စိုစွတ်ရာသီ	0.006	0.006	0.007	0.006	0.006	0.007	0.007	0.006	0.006	0.006			
8	Ammonia (NH3)	ခြောက်သွေ့ရာသီ	Nil	Nil	Nil	Nil	Nil	Nil	1.8	2.5	1.1	1.1	_	mg/L	ISO
		စိုစွတ်ရာသီ	2.22	3.30	3	4	2.44	3	5.5	4.4	1.2	2.4			
9	COD	ခြောက်သွေ့ရာသီ	32	32	32	32	32	32	64	64	32	32	_	mg/L	ISO
		စိုစွတ်ရာသီ	32	64	64	64	32	32	64	64	32	32			
10	BOD	ခြောက်သွေ့ရာသီ	6	8	8	8	4	6	18	22	4	4		mg/L	ISO

		စိုစွတ်ရာသီ	10	16	14	16	8	6	18	16	8	14	–		
11	Zinc (Zn)	ခြောက်သွေ့ ရာသီ	NIl	Nil	NIl	NIl	NIl	NIl	NIl	NIl	NIl	NIl		mg/L	ISO
		စိုစွတ်ရာသီ	NIl	Nil	NIl	NIl	NIl	NIl	NIl	NIl	NIl	NIl	1		
12	Copper (Si)	ခြောက်သွေ့ ရာသီ	NIl	Nil	NIl	NIl	NIl	NIl	NIl	NIl	NIl	NIl	0.5	mg/L	ISO
		စိုစွတ်ရာသီ	0.12	0.07	0.08	0.17	0.22	0.18	0.42	0.41	0.02	0.04			
13	Mercury (Hg)	ခြောက်သွေ့ ရာသီ	NIl	Nil	NIl	NIl	NIl	NIl	0.001	0.001	0.006	0.006	0.005	ppm	OH
		စိုစွတ်ရာသီ	NIl	Nil	NIl	NIl	NIl	NIl	NIl	NIl	NIl	NIl			
14	Selenium	ခြောက်သွေ့ ရာသီ	0.032	0.03	0.024	0.028	0.025	0.025	0	0	0.01	0.009	–	ppm	OH
		စိုစွတ်ရာသီ	0.001	0.000	0.000	0.008	0.000	0.000	0.000	0.000	0.004	0.000			
15	Oil and Grease	ခြောက်သွေ့ ရာသီ	6.2	16.63	17.4	8.01	14.9	4.56	16.38	11.41	4.92	16.48	10	ppm	OH
		စိုစွတ်ရာသီ	6.1	3.7	1.6	3.9	5.8	7.7	6.3	3.1	14.5	5.1			
16	Cadmium (Cd)	ခြောက်သွေ့ ရာသီ	0.048	0.009	0.011	0.041	0.018	0.003	0.018	0.061	0.021	0.032		mg/L	Supreme

		စိုစွတ်ရာသီ	0.046	0.044	0.056	0.048	0.05	0.022	0.068	0.036	0.048	0.047	0.1		
17	Chromium (Cr)	ခြောက်သွေ့ရာသီ	0.09	0.07	0.1	0.08	0.05	0.08	0.23	0.2	0.14	0.13	0.5	mg/L Cr	Supreme
		စိုစွတ်ရာသီ	0.53	0.5	0.53	0.5	0.51	0.53	0.54	0.51	0.47	0.04			
18	Aluminium (Al)	ခြောက်သွေ့ရာသီ	0.04	0.06	0.32	0.07	0.07	0.06	0.004	0.06	0.004	0.07	_	mg/L	Supreme
		စိုစွတ်ရာသီ	0.09	0.09	0.08	0.06	0.06	0.24	0.009	0.07	0.09	0.34			
19	Nickel (Ni)	ခြောက်သွေ့ရာသီ	0.38	1.39	0.6	0.39	0.36	0.2	0.39	0.43	0.2	0.19	_	mg/L	Supreme
		စိုစွတ်ရာသီ	0.22	0.23	0.26	0.27	0.24	0.49	0.25	0.44	0.2	0.18			
20	Total Chlorine	ခြောက်သွေ့ရာသီ	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	0.2	mg/L	
		စိုစွတ်ရာသီ	0.02	0.04	0.04	0.03	0.07	0.02	0.04	0.02	0.02	0.02			OH

ချော်ပုံ (Bottom Ash) နှင့်နီးသော စိုက်ပျိုးမြေများမှရရှိသည့် မြေအရည်အသွေး စမ်းသပ်ချက်အရ ဆီလီကွန်ပါဝင်မှုပမာဏသည် မြင့်မားနေသည်ကို တွေ့ရှိရသည်။ စိုက်ပျိုးမြေ အတွက် ဆီလီကွန်ပါဝင်မှုအကောင်းဆုံးပမာဏမှာ ၂၈% ဖြစ်သည်။ ပုံမှန်အားဖြင့် မြေကြီးအတွင်းရှိ ဆီလီကွန် အနည်းငယ်ပါဝင်မှုသည် အပင်များ (အထူးသဖြင့်တန်ဖိုးမြင့် သစ်သီးဝလံများ) စိုက်ပျိုးရာတွင် အင်းဆက်ရန်မှကာကွယ်ရန် ကြီးထွားမှုမြင့်တင်ရန်နှင့် ထွက်နှုန်း တိုးစေရန်အတွက်အထောက်အပံ့ ဖြစ်စေပါသည်။ အခြားပါဝင်ပစ္စည်းများဖြစ်သောသံဓာတ်၊ ကယ်ဆီယမ်နှင့် မဂ္ဂနီဆီယမ်တို့သည် လည်း အပင်များအတွက် အထောက်အပံ့ဖြစ်စေကာ ယင်းတို့ပါဝင်နှုန်းသည် စမ်းသပ်ချက်များအရ သတ်မှတ်ပမာဏအတွင်းရှိသည်ကိုတွေ့ရှိရသည်။ ဆီလီကွန်ပါဝင်မှုမြင့်မားခြင်းသည် ချော် (Bottom Ash) များစုပုံခြင်းနှင့် ဆက်စပ်သက်ရောက်စေခြင်း ဖြစ်သည်။

ဇယား ၁.၆ - မြေအရည်အသွေးတိုင်းတာမှုရလာဒ်များ

နမူနာအမည်	တိုင်းတာသည့်အချက်အလက်များ	ပါဝင်မှုနှုန်း (%)
တီကျစ်မြေ	Silicon (Si)	41.980
	Iron (Fe)	37.487
	Calcium (Ca)	13.131
	Titanium (Ti)	3.501
	Potassium (K)	2.838
	Zirconium (Zr)	0.521
	Manganese (Mn)	0.348
	Nickel (Ni)	0.079
	Strontium (Sr)	0.057
	Yttrium (Y)	0.057
	Arsenic (As)	မတွေ့ရှိပါ

ပတ်ဝန်းကျင်အတွက်အနှောက်အယှက်ဖြစ်စေနိုင်သည့်အနံ့အသက်ရင်းမြစ်ကိုသိရှိနိုင်ရန်အတွက်အနံ့အသက်အဆင့် တိုင်းတာမှုကိုစုစုပေါင်း ၆နေရာတွင်ပြုလုပ်ခဲ့ပါသည်။ သက်ရောက်မှုဖြစ်စေ သည့်အရင်းမြစ် (Source) အဖြစ် စက်ရုံအတွင်း (၄) နေရာနှင့် သက်ရောက်မှုခံစားရနိုင် သည့်နေရာ (Receptor) အဖြစ် စက်ရုံအနီးရှိကျေးရွာနှင့် ဘုန်းကြီးကျောင်းတို့ကို ရွေးချယ်သတ်မှတ်ခဲ့ပြီး အနံ့အသက်အဆင့်တိုင်းတာခြင်း

များပြုလုပ်ခဲ့ပါသည်။ တိုင်းတာရရှိသော ရလဒ်များမှာအမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) လမ်းညွှန်ချက်အတွင်း တွင်ရှိသည်ကိုတွေ့ရှိရပါသည်။

ဇယား ၁.၈ - အနံ့အသက်တိုင်းတာမှုရလာဒ်များ

အမှတ်	တည်နေရာ	တန်ဖိုး (ppm)	အမျိုးသားစံနှုန်း (ppm)
Odor-P1	ကျောက်မီးသွေးသိုလှောင်ဝင်းအတွင်း	0	5-10
Odor-P2	ဆာလဖာဖယ်ရှားမှုစနစ်အနီး	15	
Odor-P3	ချော် (Bottom Ash) အနည်စစ်ကန်	4	
Odor-P4	အနည်စစ်ကန်	0	
Odor-P5	ပြင်သာနှင့်သာယာကုန်းဆုံရာ	6	
Odor-P6	တောင်ပို့ကြီးဘုန်းကြီးကျောင်း	0	

ဇီဝမျိုးစုံမျိုးကတည်ရှိမှုဆန်းစစ်ခြင်းကို တီကျစ်စက်ရုံမှဗဟိုပြု၍ (၁) ကီလိုမီတာ၊ (၃) ကီလိုမီတာနှင့် (၅) ကီလိုမီတာ အချင်းဝက်အတိုင်းအတာသတ်မှတ်၍ ကိုယ်စားပြုဧရိယာသုံးခု အဖြစ် ခြောက်သွေ့ရာသီနှင့် စိုစွတ်ရာသီတို့တွင် ဆောင်ရွက်ခဲ့ပါသည်။ တိုက်ရိုက်သက်ရောက်မှု ဖြစ်နိုင်သောဧရိယာ (စက်ရုံမှ (၁) ကီလိုမီတာ) တွင် စုစုပေါင်း ၃ရွာ တည်ရှိပါသည်။ သွယ်ဝိုက်သက်ရောက်မှုဖြစ်နိုင်သောဧရိယာ (စက်ရုံမှ (၃) ကီလိုမီတာ) တွင် စုစုပေါင်း ၁၄ရွာ (တီကျစ်၊ လယ်ကြား၊ လယ်နား(ဇင်းကုန်း)၊ လွယ်ထွီတောင်(သာယာကုန်း)၊ လွယ်ထွီမြောက် (သာယာကုန်း)၊ ပြင်သာ၊ ဆည်ခေါင်း၊ ဘန်းမက်၊ ဘုရားငါးဆူ၊ လွင်၊ မန်လွိုင်၊ နောင်မွန်း၊ တံတားဦးနှင့်ပြင်မီကုန်း) နှင့် (၅) ကီလိုမီတာတွင် စုစုပေါင်း (၃၅) ရွာတည်ရှိပါသည်။ တွေ့ရှိရသောမျိုးစိတ်များ၏အကောင်အရေပေါ်များခြင်းများကို အောက်ပါဇယားတွင် ဖော်ပြထားသည်။ တိုက်ရိုက် သက်ရောက်မှု ဖြစ်နိုင်သောဧရိယာ (စက်ရုံမှ (၁) ကီလိုမီတာ) တွင် စိုက်ပျိုးမြေများ တည်ရှိသော်လည်း သဘာဝပေါက်ပင်များမတွေ့ရှိရပါ။ ယင်းဧရိယာ၏ အဓိက (၄၀%) မှာ တီကျစ်စက်ရုံဧရိယာဖြစ်ပြီး လုပ်သားတန်းလျားများမှာ (၃၀%) ရှိပါသည်။ ကျန် (၃၀%) မှာ စိုက်ပျိုးမြေနှင့်ကျေးရွာများဖြစ်သည်။

စက်ရုံမှဗဟိုပြု၍ (၃) ကီလိုမီတာပတ်လည်တွင် သစ်တောဧရိယာမပါဝင်ဘဲ စိုက်ပျိုးမြေနှင့် သစ်သီးစိုက်ခင်းများသာတွေ့ရှိပြီး (၅) ကီလိုမီတာပတ်လည်တွင်အမြဲစိမ်းတော၊ ထင်းရှူးတော၊ ဝါးတောများ နှင့် သစ်သီး စိုက်ခင်းအနည်းငယ်ကိုတွေ့ရသည်။

စီမံကိန်းအနီးဝန်းကျင်တွင်ချောင်းအများအပြားတွေ့ရှိရပြီးအဓိကမှာသံတဲချောင်းနှင့် ဘီလူးချောင်း တို့ဖြစ်ကြသည်။ ထို့အပြင်ချောင်းလက်တက်များလည်းတွေ့ရှိရသည်။ ဘီလူးချောင်းသည်စီမံကိန်း မှ ၅ကီလိုမီတာအကွာတွင်တည်ရှိကာ အနောက်တောင်မှ အရှေ့မြောက်သို့စီးဆင်းနေပါသည်။ သံတဲချောင်း

သည်စီမံကိန်း၏ အနောက်တောင်မှ အနောက်ဘက်သို့စီးဆင်းပါသည်။ ယင်းချောင်းနှစ်ခုသည် ပေါင်းစုံကာ ရှမ်းပြည်နယ်၏ အထင်ကရအမွေအနှစ်ဖြစ်သော အင်းလေးကန်အတွင်းသို့စီးဝင်ပါသည်။ ဘီလူးချောင်းသည်အင်းလေးကန်အတွင်းသို့ ဝင်ရောက် သော အဓိကရေအရင်းအမြစ်တစ်ခုလည်းဖြစ်သည်။

သွယ်ဝိုက်သက်ရောက်မှုဧရိယာတွင် သဘာဝကန် (၃) ကန်နှင့် စမ်းပေါက် (ရေထွက်ဦး)(၃) ခုတွေ့ရှိရပြီး သဘာဝကန်နှစ်ခုမှာ နောင်လင်း နှင့် တရုတ်တောင်ရွာအနီးတွင်တည်ရှိကာ စွန့်ပစ်မြေစာပုံနှင့် အရှေ့ဘက်ကန်ကို တရုတ်တောင်ရွာသွားရာလမ်းတွင်တွေ့နိုင်ပါသည်။ သဘာဝစမ်းသုံးခုမှာ ပတ်တလဲ့၊ ဘန်းမက်နှင့် တရုတ်တောင်ရွာတို့တွင်တည်ရှိပါသည်။

တိုက်ရိုက်သက်ရောက်မှုရှိနိုင်သောဇုံ (စက်ရုံမှ (၁) ကီလိုမီတာ)တွင် စုစုပေါင်းအပင်မျိုးစိတ် (၁၈၂) မျိုး နှင့် သွယ်ဝိုက်သက်ရောက်မှုရှိနိုင်သောဇုံ (စက်ရုံမှ (၃-၅) ကီလိုမီတာ) တွင်စုစုပေါင်းအပင်မျိုးစိတ် (၃၅၈) မျိုးအသီးသီးတွေ့ရှိရသည်။ ဒေသခံအပင်မျိုးရင်းတွင် 17 မြေလျှောက်ပင်(climbers) (၁၇) မျိုး , ဖန်းအပင် (Fern) (၁) မျိုး, ပင်ပျော့ပင် (Herbs) (၅၃) မျိုး, မြက်မျိုးစိတ် (Grass Species0 (၉) မျိုး, ခြုံပင် (Shrubs species) (၄၆) မျိုး, အပင်ငယ် (Small tree species) (၂၂) မျိုး နှင့် အပင်ကြီးမျိုးစိတ် (Tree species) (၂၀) မျိုး တို့ကိုလေ့လာတွေ့ရှိခဲ့ရပြီးစုစုပေါင်း အပင်မျိုးစိတ် ၄၃၄ စိတ်ကိုတွေ့ရှိ မှတ်တမ်းတင်နိုင်ခဲ့ပါသည်။ ယင်းတို့အနက် မျိုးစိတ် ၆၀ စိတ်သည် IUCN Red List Species 2016 Version 3.1 အရ မျိုးသုဉ်းရန် မစိုးရိမ်ရသေးသော မျိုးစိတ် (Lease concerned species) စာရင်းဝင်နေသည်ကို တွေ့ရှိရသည်။

ခြောက်သွေ့ရာသီနှင့် စိုစွတ်ရာသီ နှစ်ရာသီ ဆန်းစစ်လေ့လာချက်အရ နို့တိုက်သတ္တဝါ (၁၂) စိတ်၊ ငှက်မျိုးစိတ် (၁၁၄) စိတ်၊ ကုန်းနေရေနေမျိုးစိတ် (၆) မျိုး၊ တွားသွား (၁၁) စိတ်၊ အင်းဆက် (၄၈) စိတ်နှင့်အခြားကျောရိုးမဲ့မျိုးစိတ်များအပါအဝင် စုစုပေါင်း သတ္တဝါမျိုးစဉ် (၂၉) မျိုးအောက်တွင် အကျုံးဝင်သော မျိုးစု (၈၆) ခုတွင်ပါဝင်သည့် မျိုးရင်း (၁၆၀)၏ မျိုးစိတ်ပေါင်း (၂၀၁) မျိုး ကိုလေ့လာတွေ့ရှိခဲ့သည်။ ခြောက်သွေ့ရာသီတွင် IUCNသတ်မှတ်ချက်အရ မျိုးသုဉ်းရန် အန္တရာယ်ကျရောကိုင်သောမျိုးစိတ် (Vulnerable species) (၁) မျိုးကိုတွေ့ရှိ ရသည်။ ထို့အပြင် အပြည့်အဝကာကွယ်ပေးရမည့်သတ္တဝါမျိုးစိတ် (Completely Protected Animals (CPA)) (၁၃) မျိုး၊ အကာအကွယ်ပေးခံထားရသည့်မျိုးစိတ် (Protected Wild Animals (PWA)) (၂၀) မျိုး နှင့် ရာသီအလိုက်ကာကွယ်မှုပေးရသည့်မျိုးစိတ် (Seasonal Protected Animals (SPA)) (၂၄) မျိုး တို့ကိုတွေ့ရှိရပါသည်။

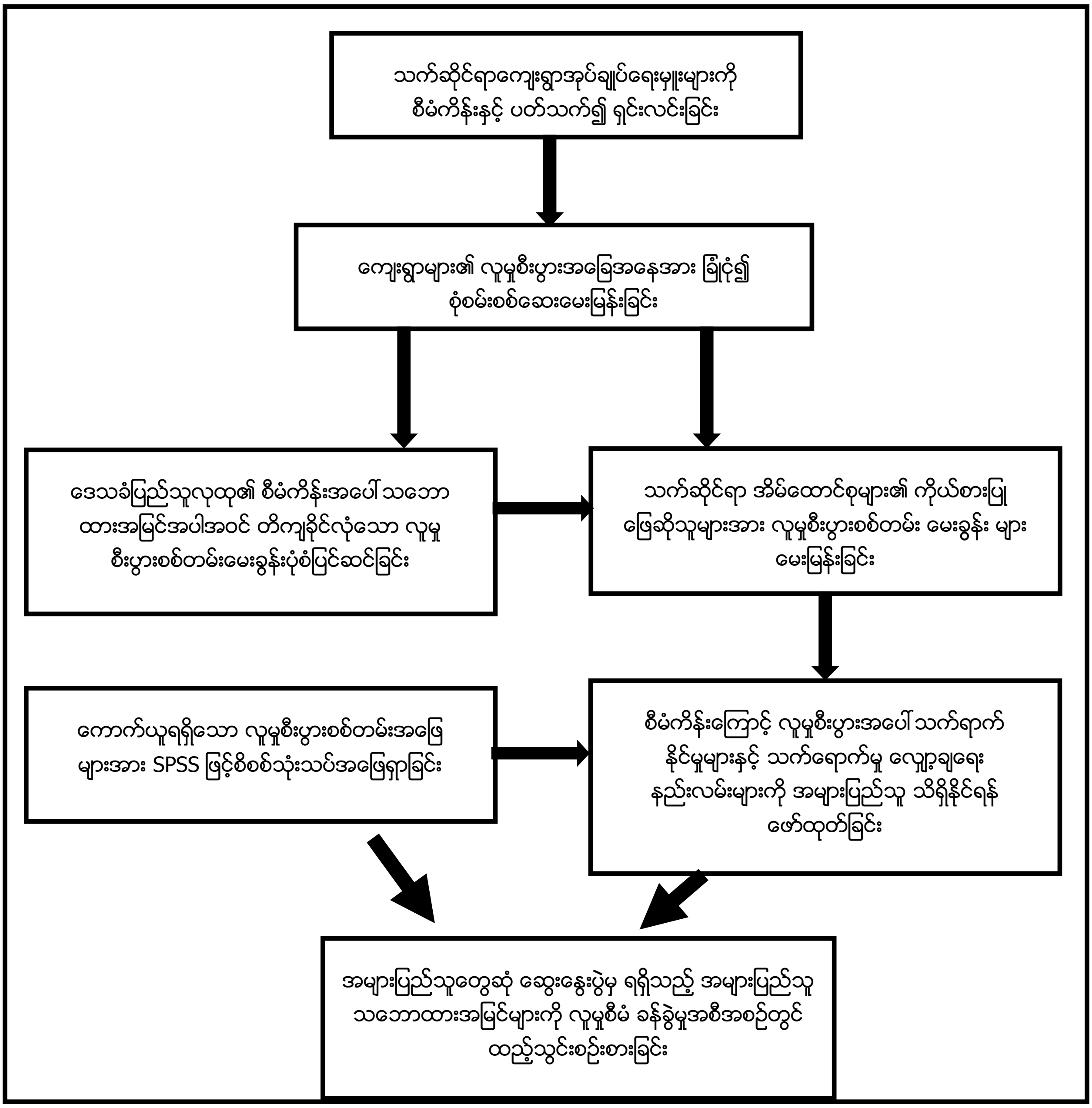
ဇီဝမျိုးစုံမျိုးကွဲများအပေါ် သက်ရောက်နိုင်သောထိခိုက်နိုင်မှုများနှင့်၎င်းတို့၏ထိခိုက်နိုင်မှုနှုန်းများကိုဆန်းစစ်ထားပါသည်။ အောက်ဖော်ပြပါဇယားတွင် ဖြစ်နိုင်ချေရှိသောသက်ရောက်မှုနှင့် ၎င်းတို့ကို လျော့ချရေး အစီအစဉ်များကို ဖော်ပြထားပါသည်။

စဉ်	ဇီဝမျိုးစုံမျိုးကွဲအပေါ်သက်ရောက်နိုင်မှု	အတိုင်းအတာ			ကာလ			ဖြစ်နိုင်ချေ			ပမာဏ			သိသာမှု			အကြံပြုထားသည့်နည်းလမ်းများ
		L	M	H	L	M	H	L	M	H	L	M	H	L	M	H	
အပင်များ																	
၁။	သစ်တောများအတွင်းသို့ လယ်ယာမြေများချဲ့ထွင်မှု		√			√				√		√			√		ပတ်ဝန်းကျင်ရှိသစ်တောနှင့်စမ်းပေါက်(ရေထွက်ဦး)များအပေါ် မှီခိုအသက်မွေးမှုကိုလျှော့ချ ခြင်း ဒေသအစုအဖွဲ့ပိုင်သစ်တောတည်ထောင်ခြင်း
၂။	ထင်းထုတ်ယူမှု		√			√				√		√			√		ဒေသအစုအဖွဲ့ပိုင်သစ်တောတွင်အကြီးမြန်သောထင်းသစ်အမျိုးအစားများစိုက်ပျိုးခြင်း ဒေသအတွက်လျှပ်စစ်မီးထောက်ပံ့ပေးခြင်း
၃။	ထင်းရှူးတောများမှထင်းရှူးဆီထုတ်ယူမှု		√			√			√			√			√		ဒေသအစုအဖွဲ့ပိုင်သစ်တောတွင် ထင်းရှူးပင်များစိုက်ပျိုးခြင်း
၄။	စုပေါင်းသက်ရောက်မှု		√			√				√			√			√	စုပေါင်းသက်ရောက်မှုကိုဆန်းစစ်ခြင်းနှင့်ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်ရေးဆွဲခြင်း
သတ္တဝါများ																	
၁။	ငါးမျိုးစိတ်များလျော့ကျလာမှု		√				√			√			√			√	မြစ်၊ချောင်းများအတွင်းစည်းကမ်းမဲ့အမှိုက်များမပစ်စေရန်အသိပညာပေးခြင်း အန္တရာယ်ရှိစွန့်ပစ်ပစ္စည်းများစွန့်ပစ်ခြင်းကို ဥပဒေဖြင့်တားမြစ်ခြင်း
၂။	တောကောင်သားရရန်အမဲလိုက်မှု		√			√			√				√		√		ကျေးရွာလူထုအားမွေးမြူရေးဆိုင်ရာနည်းလမ်းများသင်ကြားပို့ချတိုးမြင့်စေခြင်း

စီမံကိန်းအနီးဧရိယာရှိ လူဦးရေနှင့် စီးပွားရေးဆိုင်ရာအပြောင်းအလဲများ ကိုသိရှိနိုင်ရန် ရည်ရွယ် ချက်ဖြင့် အစီရင်ခံစာတွင်တီကျစ်ဓာတ်အားပေးစက်ရုံစီမံကိန်းဧရိယာ လူမှုစီးပွားဆိုင်ရာ အချက်အလက်များကိုဖော်ပြပေးထားသည်။ လူမှုစီးပွားဆိုင်ရာ သက်ရောက်မှုဆန်းစစ်ခြင်းတွင် အဆိုပြုဖွံ့ဖြိုးရေး လုပ်ငန်းကြောင့် ဒေသခံလူထုအပေါ် သက်ရောက်နိုင်မှုများ၊ ဖြစ်နိုင်ချေရှိသော လူမှုစီးပွား သက်ရောက်မှုများနှင့် အဆိုပါအပြောင်းအလဲများအပေါ် လူထု၏သဘောထားအမြင်များ တို့ပါဝင်သည်။ ဖြစ်နိုင်ချေရှိသောသက်ရောက်မှုများတွင် လူမှုပတ်ဝန်းကျင်လူဦးရေအပြောင်းအလဲ ဖြစ်ခြင်း၊ လူထုဝန်ဆောင်မှုလိုအပ်ချက်များပြောင်းလဲခြင်း၊ အလုပ်အကိုင် နှင့် ဝင်ငွေရရှိမှု ပြောင်းလဲခြင်းတို့ပါဝင်ပါသည်။ လူမှုစီးပွားဆိုင်ရာဆန်းစစ်မှု၏ပန်းတိုင်မှာ အဆိုပြုဓာတ်အားပေးစက်ရုံကြောင့် ကျေးရွာလူထု၏ လူမှုဘဝအဆင်ပြေသာယာမှုနှင့် စီမံကိန်းဧရိယာ၏ စီးပွားရေးဖွံ့ဖြိုးမှုအပေါ်ဖြစ်နိုင်ချေရှိသောသက်ကောက်မှုများကို ဆန်းစစ်ရန်ဖြစ်သည်။ ထိုပန်းတိုင် ကိုရရှိရန်အောက်ပါရည်ရွယ်ချက် တို့တို့ ချမှတ်အကောင်အထည်ဖော်ခဲ့ပါသည်။

- ကျောက်မီးသွေးသုံးဓာတ်အားပေးစက်ရုံများ၏မဟာဗျူဟာမြောက်နိုင်ငံ့အဆင့်အရေးပါမှု အပေါ် သိရှိနားလည်မှုဖြစ်ထွန်းလာစေရန်
- စီမံကိန်းပတ်ဝန်းကျင်ဧရိယာနှင့်ဒေသ၏စီးပွားရေးဆိုင်ရာအချက်အလက်များကိုဖော်ထုတ်ရန်
- စီမံကိန်းပတ်ဝန်းကျင်ဧရိယာ နှင့် ဒေသ၏လူမှုရေးဆိုင်ရာအချက်အလက်များကိုနားလည် ရန်
- ဖြစ်နိုင်ချေရှိသောသက်ရောက်မှုများ (တိုက်ရိုက်၊ သွယ်ဝိုက်နှင့် စုပေါင်း) တို့ကိုဖော်ထုတ် ရန်
- လူမှုဘဝဖွံ့ဖြိုးသာယာရေးနှင့်စီးပွားရေးဖွံ့ဖြိုးမှုအပေါ် သက်ရောက်မှုများနှင့်ဆက်နွယ်သော ရလာဒ်များကိုဖော်ထုတ်တင်ပြရန်
- ဖြစ်နိုင်ချေရှိသောလျော့ချရေးနည်းလမ်းများနှင့်ပတ်သက်၍အကြံပြုချက်များပေးရန်

ချဉ်းကပ်မှုနည်းလမ်း



သက်ဆိုင်ရာကျေးရွာအုပ်ချုပ်ရေးမှူးများကို စီမံကိန်းနှင့် ပတ်သက်၍ ရှင်းလင်းခြင်း
ကျေးရွာများ၏ လူမှုစီးပွားအခြေအနေအား ခြုံငုံ၍ စုံစမ်းစစ်ဆေးမေးမြန်းခြင်း
ဒေသခံပြည်သူလုထု၏ စီမံကိန်းအပေါ် သဘောထားအမြင်အပါအဝင် တိကျခိုင်လုံသော လူမှုစီးပွားစစ်တမ်းမေးခွန်းပုံစံပြင်ဆင်ခြင်း
သက်ဆိုင်ရာ အိမ်ထောင်စုများ၏ ကိုယ်စားပြုဖြေဆိုသူများအား လူမှုစီးပွားစစ်တမ်း မေးခွန်း များ မေးမြန်းခြင်း
ကောက်ယူရရှိသော လူမှုစီးပွားစစ်တမ်းအဖြေများအား SPSS ဖြင့်စိစစ်သုံးသပ်အဖြေရှာခြင်း
စီမံကိန်းကြောင့် လူမှုစီးပွားအပေါ် သက်ရောက်နိုင်မှုများနှင့် သက်ရောက်မှု လျှော့ချရေး နည်းလမ်းများကို အများပြည်သူ သိရှိနိုင်ရန် ဖော်ထုတ်ခြင်း
အများပြည်သူတွေဆုံ ဆွေးနွေးပွဲမှ ရရှိသည့် အများပြည်သူ သဘောထားအမြင်များကို လူမှုစီမံ ခန့်ခွဲမှုအစီအစဉ်တွင် ထည့်သွင်းစဉ်းစားခြင်း

လူမှုစစ်တမ်းကောက်ယူခြင်းကို ပထမသက်ရောက်မှုဇရိယာ (စီမံကိန်းမှ (၃) ကီလိုမီတာ) တွင် စက်ရုံနှင့်ဒေင်မိုင်းဝန်ထမ်းအိမ်ရာ နှင့် ကျေးရွာ (၁၀) ရွာကိုလည်းကောင်း၊ ဒုတိယသက်ရောက်မှု ဇရိယာ (စီမံကိန်းမှ (၅) ကီလိုမီတာ) တွင် ကျေးရွာ၁၃ရွာကိုလည်းကောင်း အသီးသီး ကောက်ယူခဲ့ပါသည်။ သက်ရောက်မှုဇရိယာနှစ်ခုပေါင်းအတွက်စစ်တမ်းကောက်ယူမှုပျမ်းမျှပမာဏ မှာ စုစုပေါင်းအိမ်ခြေ (၁၃၅၀၀) တွင်အိမ်ခြေ (၁၀၀၀) အားကောက်ယူရန်ဖြစ်ပါသည်။ ယင်းပမာဏမှာ ပထမ နှင့် ဒုတိယ သက်ရောက်မှုဇရိယာစုစုပေါင်းအိမ်ခြေ၏ (၄၀%) နှင့် (၂၀%) တို့ဖြစ်သည်။ အောက်ပါဇယားတွင်ကျေးရွာအလိုက် စုစုပေါင်းအိမ်ခြေနှင့်စစ်တမ်းကောက်ယူ ခဲ့သောအိမ်ခြေတို့ကိုဖော်ပြထားသည်။

ဇယား ၁.၉ - ကျေးရွာအလိုက်စုစုပေါင်းအိမ်ခြေနှင့်စစ်တမ်းကောက်ယူမှုပမာဏ

သက်ရောက်မှုဇရိယာ အမျိုးအစား	ကျေးရွာအမည်	စုစုပေါင်းအိမ်ခြေ	စစ်တမ်းပမာဏ
ပထမသက်ရောက်မှုဇရိယာ (စီမံကိန်းမှ၃ကီလိုမီတာ ပတ်လည်)	ဒေင်	108	25
	ကုန်းသိမ်	47	19
	မြကန်သာ	80	54
	မြစိမ်းတောင်	32	19
	ဘုရားငါးဆူ	105	30
	ပြင်သာ	42	26
	ဆည်ခေါင်း	250	108
	သာယာကုန်း	94	61
	တီကျစ်အလယ်	199	72
	တီကျစ်မြောက်	167	61
	တီကျစ်တောင်	246	86
	ဝန်ထမ်းအိမ်ရာ	101	32
ဒုတိယသက်ရောက်မှုဇရိယာ (စီမံကိန်းမှ ၅ကီလိုမီတာ ပတ်လည်)	ဘန်းမက်	29	5
	ကံကော်ပင်	60	10
	ကြက်သွန်ကုန်း	94	21
	လွှင်	132	16
	မီးသွေးချောင်း	116	21
	မွန်းပင်	87	10
	မြင်းတွင်း	160	30
	နှောင်မွန်း	120	79
	နှောင်မှု	210	20
	ပတ်တလဲ့	140	13
	ပြင်မိုကုန်း	86	9
	ပင်စိမ်းစု	44	10
	တောင်ခြေ	132	13

၅။ သက်ရောက်မှုနှင့်အန္တရာယ်ဖြစ်နိုင်ချေဆန်းစစ်ခြင်းနှင့်လျော့ချရေးနည်းလမ်းများ

စီမံကိန်းသည် မြန်မာနိုင်ငံ၏ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာလုပ်ထုံးလုပ်နည်း (၂၀၁၅) အရ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းကို အပြည့်အဝဆောင်ရွက်ရန်လိုအပ်ပါသည်။ ယခုအပိုင်းတွင် ဆန်းစစ်မှုနည်းလမ်းနှင့်စီမံကိန်းရေးဆွဲချိန်၊အကောင်အထည်ဖော်တည်ဆောက်ချိန်၊လည်ပတ် ချိန် နှင့် ပိတ်သိမ်းချိန်တို့တွင်ဖြစ်နိုင်သော ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်အပေါ်သက်ရောက်မှုများ ကိုဖော်ပြထားသည်။

သက်ရောက်မှုဆန်းစစ်ခြင်းကို ထိခိုက်လွယ်သော သက်ရောက်မှုခံရနိုင်သူများကိုထည့်သွင်း စဉ်းစား၍ စီမံကိန်းကြောင့် ဖြစ်နိုင်သောပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်အပေါ်သက်ရောက်မှုများကို ခန့်မှန်း၍ ဆောင်ရွက်သည်။ ဆန်းစစ်မှုဖြစ်စဉ်တွင် စီမံကိန်းကြောင့်ဖြစ်ပေါ်နိုင်သောဆိုးကျိုးများကို စနစ်တကျ ထိန်းချုပ်လျော့ချနိုင်ရန် သက်ရောက်မှုခန့်မှန်းခြင်းနည်းလမ်းများကိုအသုံးပြု၍ လျော့ချရေးနည်းစဉ်များ ဖော်ထုတ်ခြင်း တို့ပါဝင်သည်။

စီမံကိန်းနှင့်သက်ဆိုင်သောသက်ရောက်မှုများကို ၂၀၁၅လုပ်ထုံးလုပ်နည်းအရ စီမံကိန်း၏ သက်တမ်းကာလ (ပြုပြင်တည်ဆောက်မှုကာလ၊ လည်ပတ်မှုကာလနှင့် ပိတ်သိမ်းကာလ)ဟူ၍ခွဲခြား ဖော်ထုတ်ထားသည်။ သက်ရောက်မှုများကို ကောင်းကျိုးသက်ရောက်မှု သို့မဟုတ် ဆိုးကျိုးသက်ရောက်မှု ဟူ၍ အဆင့်လေးဆင့်(သိသာထင်ရှားသောအဆင့်၊ ပုံမှန်အဆင့်၊ သိသာမှုမရှိသောအဆင့် နှင့် သက်ရောက်မှုမရှိ) ပိုင်းခြားသတ်မှတ်ထားသည်။ အောက်တွင် စီမံကိန်းသက်တမ်းအလိုက် သက်ရောက်နိုင်မှုတို့ကို အကျဉ်းချုပ်ဖော်ပြပေးထားပါသည်။

ဇယား ၁.၁၀ - ပတ်ဝန်းကျင်နှင့်လူမှုဝန်းကျင်အပေါ် သက်ရောက်မှုဆန်းစစ်ချက်

စဉ်	သက်ရောက်မှု	ဆန်းစစ်ချက်			သက်ရောက်မှုရင်းမြစ်
		ပြုပြင်တည်ဆောက် [တ]	လည်ပတ် [လ]	ဖျက်သိမ်း [ဖ]	
၁။	လေထုညစ်ညမ်းမှု	B-	B-	B-	[တ] တည်ဆောက်ရေးလုပ်ငန်းများနှင့်ဆောက်လုပ်ရေးလုပ်ငန်းခွင်သုံးယာဉ်များကြောင့်လေထုညစ်ညမ်းစေနိုင်ပါသည်။ [လ]လည်ပတ်မှုကာလအတွင်းကျောက်မီးသွေးလောင်ကျွမ်းမှုကြောင့်ခေါင်းတိုင်မှအမှုန်အမွှားနှင့်ဓာတ်ငွေ့များထွက်ရှိမှုဖြစ်စေပါသည်။အဓိကညစ်ညမ်းပစ္စည်းများမှာ နိုက်ထရိုဂျင်အောက်ဆိုဒ်၊ ဆာလဖာအောက်ဆိုဒ် နှင့် အမှုန်အမွှားတို့ဖြစ်ပါသည်။ သို့သော် လျှပ်စစ်သုံးအမှုန်အမွှားဖမ်းစက် (ESP) အသုံးပြုထားခြင်းကြောင့် လေထုညစ်ညမ်းမှုကိုလျော့ကျစေပါသည်။ ဆာလဖာနှင့် နိုက်ထရိုဂျင်ဖယ်ရှားစက်များတပ်ဆင်ပေးခြင်းဖြင့်ဓာတ်ငွေ့ထွက်ရှိမှုကိုပို၍ လျော့ကျ စေနိုင်ပါသည်။ ကျောက်မီးသွေးကို အဓိကလောင်စာအဖြစ်အသုံးပြုထားသော်လည်း စက်စတင်လည်ပတ်ခြင်းနှင့် ဝန်အားလျော့လည်ပတ်ခြင်းတို့တွင် ဒီဇယ်ကိုအသုံးပြုပါသည်။ ဘွိုင်လာလည်ပတ်မှုမှလည်းနိုက်ထရိုဂျင်အောက်ဆိုဒ်နှင့်ဆာလဖာအောက်ဆိုဒ်တို့ထွက်ရှိပါသည်။ ဒီဇယ်ကို စက်စတင်လည်ပတ်ခြင်းနှင့် ဝန်လျော့လည်ပတ်ခြင်းတွင်သာအသုံးပြုသောကြောင့် သိသာထင်ရှားသောသက်ရောက်မှုမရှိနိုင်ပါ။ ကျောက်မီးသွေးကြိတ်ခွဲခြင်း၊ မီးရှို့ခြင်းနှင့် လုပ်ငန်းသုံးမော်တော်ယာဉ်များကြောင့်လည်း လေထုညစ်ညမ်းမှုဖြစ်စေနိုင်ပါသည်။ ကျောက်မီးသွေးသိုလှောင်ဝင်းအတွင်း၊အပြင် နှင့် အုတ်ထုတ်လုပ်ရာတွင်အသုံးပြုသော ချော်ပုံ (Bottom Ash) တို့မှလည်းလေထုညစ်ညမ်းမှု ဖြစ်ပေါ်စေနိုင်ပါသည်။ [ဖ] ဖျက်သိမ်းမှုလုပ်ငန်းများဆောင်ရွက်နေချိန်တွင်ယာယီလေထုညစ်ညမ်းမှုဖြစ်စေနိုင်ပါသည်။

၂။	ရေထုညစ်ညမ်းမှု	B-	B-	B-	[တ] တည်ဆောက်ရေးနှင့်မွမ်းမံရေးလုပ်ငန်းများ ကြောင့် ယာယီရေထုညစ်ညမ်းမှုဖြစ်စေနိုင်ပါသည်။ [လ] စက်ပစ္စည်းများသန့်စင်ခြင်း၊ စက်များမှဆီနှင့်အနည်အနှစ်များ၊ တကိုယ်ရည်သုံးစွန့်ပစ်အရည်များနှင့် အအေးခံစနစ်မှ အရည်များကြောင့် ရေထုညစ်ညမ်းမှု ဖြစ်စေနိုင်ပါသည်။ အနည်စစ်ကန်ဖြင့် အနည်အနှစ်၊ ဆီတို့ကိုလျှော့ချစေနိုင်ပြီး အထူးသဖြင့် ရေ၏အပူချိန်ကိုလျှော့ကျစေပါသည်။ [ဖ] ဖျက်သိမ်းမှုလုပ်ငန်းများဆောင်ရွက်နေချိန်တွင်ယာယီရေထုညစ်ညမ်းမှုအကန့်အသတ်ဖြင့်ဖြစ်စေနိုင်ပါသည်။
၃။	မြေထုညစ်ညမ်းမှု	B-	B-	B-	[တ] တည်ဆောက်ရေးလုပ်ငန်းနှင့် ယာဉ်ယန္တယားများတွင်အသုံးပြုသော ချောဆီများယိုဖိတ်မှုကြောင့် မြေညစ်ညမ်းမှုဖြစ်စေနိုင်သည်။ သို့သော်အသုံးပြုမှု ပမာဏအကန့်အသတ်ကြောင့်သိသာထင်ရှားမှု မရှိနိုင်ပါ။ [လ] စက်ပစ္စည်းများနှင့်ယာဉ်များမှဆီ၊ အနည်အနှစ်နှင့်ချောဆီများယိုဖိတ်ခြင်း၊ စွန့်ပစ်ပြာပုံမှ သတ္တုဓာတ်များစိမ့်ဝင်ခြင်း၊ ကျောက်မီးသွေးသိုလှောင်သည့်နေရာတို့မှ မြေညစ်ညမ်းမှုကိုဖြစ်စေပါသည်။ သက်ရောက်မှုများမှာ သိသာထင်ရှားမှု မရှိနိုင်ပါ။ [ဖ] ဖျက်သိမ်းရေးလုပ်ငန်းနှင့် ယာဉ်ယန္တယားများတွင်အသုံးပြုသော ချောဆီများယိုဖိတ်မှု ကြောင့်မြေညစ်ညမ်းမှုဖြစ်စေနိုင်သည်။ သို့သော်အသုံးပြုမှု ပမာဏအကန့်အသတ်ကြောင့်သိသာထင်ရှားမှု မရှိနိုင်ပါ။
၄။	စွန့်ပစ်ပစ္စည်းများ	B-	B-	B-	[တ]တည်ဆောက်ရေးနှင့်မွမ်းမံပြင်ဆင်ရေးလုပ်ငန်းများမှစွန့်ပစ်အမှိုက်များထွက်ရှိနိုင်ပါသည်။ (အသုံးပြုပြီးအိတ်များ၊ တည်ဆောက်ရေး စွန့်ပစ်ပစ္စည်းများ နှင့် ကွန်ကရစ်အမှိုက်များ). [လ] လည်ပတ်မှုကာလတွင် ချော် (Bottom Ash) နှင့် ခေါင်းတိုင်ပြာများ၊ ဝန်ထမ်းအိမ်ရာများမှ အမှိုက်များထွက်ရှိနိုင်ပါသည်။ [ဖ] ဖျက်သိမ်းမှုကာလတွင်ကျန်ရှိစက်ပစ္စည်းများမှစွန့်ပစ်ပစ္စည်းများထွက်ရှိနိုင်ပါသည်။

၅။	ဆူညံသံ	B-	B-	B-	[တ] တည်ဆောက်ရေးလုပ်ငန်းနှင့်ယာဉ်များမှဆူညံသံများဖြစ်ပေါ်စေနိုင်ပါသည်။ သို့သော်ပမာဏနှင့် သက်ရောက်မှုဧရိယာ ကန့်သတ်မှု ရှိပါသည်။ [လ] ကျောက်မီးသွေးသယ်ပို့ခြင်း၊ ကြိတ်ချေခြင်း၊ စက်မောင်းနှင်ခြင်းနှင့်ယာဉ်များမှ ဆူညံသံများ ဖြစ်နိုင်ပါသည်။ [ဖ] ဖျက်သိမ်းရေးလုပ်ငန်းနှင့်ယာဉ်များမှဆူညံသံများဖြစ်ပေါ်စေနိုင်ပါသည်။ သို့သော်ပမာဏနှင့် သက်ရောက်မှုဧရိယာကန့်သတ်မှုရှိပါ သည်။
၆။	မြေပြိုမှု	D	D	D	ပြုပြင်တည်ဆောက်ဆဲနှင့်လည်ပတ်ဆဲကာလတွင်မြေအောက်ရေအသုံးပြုခြင်းမရှိပါ။
၇။	အနံ့အသက်ဆိုး	D	D	D	ထင်ရှားသောသက်ရောက်မှုမရှိပါ။
၈။	နုန်းနှစ် အရည်အသွေး	B-	B-	B-	[တ][ဖ] မွမ်းမံပြင်ဆင်ရေးနှင့်ဖျက်သိမ်းရေးကာလများတွင်လျှံထွက်ရေများ၊ ဆီနှင့်ဓာတုပစ္စည်းများမှ နုန်းနှစ်အရည်အသွေးလျော့ကျမှု ဖြစ်စေပါသည်။ [လ] ကျောက်မီးသွေးဝင်းမှလျှံထွက်ရေများနှင့် ဆီနှင့်ဓာတုပစ္စည်းများဖိတ်စင်ခြင်းမှ နုန်းနှစ်အရည်အသွေး လျော့ကျမှုဖြစ်စေပါသည်။
၉။	အကာအကွယ်ပေးထားသော ဧရိယာများ	D	D	D	စီမံကိန်းအနီးပတ်ဝန်းကျင်တွင်အကာအကွယ်ပေးထားသောဧရိယာများမရှိပါ။ စီမံကိန်းသည်အင်းလေးကန်မှ ၁၇ကီလိုမီတာကွာဝေးပါသည်။
၁ ၀။	ဂေဟစနစ်များ	D	D	D	[တ][ဖ]မွမ်းမံပြင်ဆင်ရေးနှင့် ဖျက်သိမ်းမှုကာလအတွင်း အဓိကထွက်ရှိမည့်စွန့်ပစ်ပစ္စည်းမှာမီးဖိုချောင်သုံး စွန့်ပစ်ရေနှင့် မိလ္လာရေ တို့ဖြစ်သည်။ ယင်းတို့တွင် အနည်အနစ်များ၊ အဆီ၊ အမိုးနီးယားနှင့်အခြားသော ဓာတ်ပစ္စည်းများမြင့်မားစွာပါဝင်၍ သန့်စင်မှုမရှိပဲစွန့်ပစ်မိပါက ရေနေဂေဟစနစ်အပေါ် ထင်ရှားသော သက်ရောက်မှုများ ဖြစ်စေနိုင်ပါသည်။ စီမံကိန်းဆိုင်ရာ ဆောင်ရွက်မှုများတိုးများလာခြင်းကြောင့် ကုန်းနေ၊ရေနေဂေဟစနစ်များနှင့် ယင်းတို့နှင့်

					ဆက်စပ်နေသော အပင်များအပေါ် သွယ်ဝိုက်သက်ရောက်နိုင်မှုများဖြစ်သည့် တောရိုင်းတိရစ္ဆာန်များ လျော့နည်းလာခြင်းတို့ဖြစ်ပေါ်နိုင်ပါသည်။ [လ] လည်ပတ်ဆဲကာလအတွင်းစက်ရုံမှဝန်ထမ်းများ၏ နေ့စဉ်ဆောင်ရွက်မှုကြောင့် ကုန်နေဂေဟစနစ် အပေါ် သက်ရောက်မှုရှိစေနိုင်ပါသည်။ စက်ရုံမှစွန့်ထုတ်ရေများတွင်ကလိုရင်းပါဝင်မှုသည်ပတ်ဝန်းကျင်ရှိရေများနှင့်ပေါင်း၍လျော့ကျလာမည်ဖြစ်က ာကျန်ရှိ ကလိုရင်းပါဝင်မှု ပမာဏနှင့် ရေအပူချိန်သည် စွန့်ထုတ်မှတ်မှဝေးကွာလာသည်နှင့်အမျှ အချိန်နှင့်တပြေးညီလျော့ကျလာမည်ဖြစ်ပါသည်။ ထို့ကြောင့် ရေထဲရှိကလိုရင်းပါဝင်မှုနှင့် ရေအပူချိန် မြင့်မားမှုကြောင့် သက်ရောက်မှုသည်ထင်ရှားမှုမရှိပဲအနည်းငယ်သာဖြစ်စေမည်ဖြစ်သည်။
၁ ၁။	နယ်မြေဖြတ်ကျော်သက်ရော က်မှု နှင့်ရာသီဥတု ပြောင်းလဲခြင်း	B-	B+/-	B-	[တ] တည်ဆောက်မှုလုပ်ငန်းများနှင့် လုပ်ငန်းသုံးယာဉ်များမှဖန်လုံအိမ်ဓာတ်ငွေ့ထွက်ရှိစေမည်ဖြစ် သော်လည်း ပမာဏအနည်းငယ်သာ ဖြစ်စေနိုင်ပါသည်။ [လ] မီးစက်မောင်းနှင်လည်ပတ်မှုများလာခြင်းသည်ဖန်လုံအိမ်ဓာတ်ငွေ့ကိုတိုးပွားစေပါသည်။ [ဖ] ဖျက်သိမ်းမှုလုပ်ငန်းများနှင့် လုပ်ငန်းသုံးယာဉ်များမှဖန်လုံအိမ်ဓာတ်ငွေ့ ထွက်ရှိစေမည်ဖြစ်သော်လည်း ပမာဏအနည်းငယ်သာ ဖြစ်စေနိုင်ပါသည်။
၁ ၂။	ဆင်းရဲမွဲတေမှု	B+	B+	B+	[တ][ဖ] စီမံကိန်း၏ပတ်ဝန်းကျင်ရှိ ဒေသခံပြည်သူများအတွက် အလုပ်အကိုင်အခွင့်အလန်းများစွာ ဖြစ်ထွန်းစေမည်ဖြစ်သည်။ [လ]စီမံကိန်းကြောင့်အနီးဝန်းကျင်ကျေးရွာများ လျှပ်စစ်ရရှိနိုင်မှုပိုမိုမြင့်မားလာစေပြီး ယင်းသည်ဝင်ငွေနှင့် လူနေမှုဘဝကိုပို၍တိုးတက်လာ စေနိုင်ပါသည်။
၁ ၃။	ဒေသတွင်းစီးပွားရေး	B+	B+	B+	[တ][လ][ဖ] စီမံကိန်းသည်တည်ရှိရာဒေသနှင့်အနီးပတ်ဝန်းကျင်ရှိဒေသများမှလူများ အတွက်အလုပ်အကိုင်အခွင့်အ လန်းများစွာဖြစ်ထွန်းစေမည်ဖြစ်သည်။ ထို့အပြင်ဒေသခံများကိုပို၍အလုပ်အကိုင်များပေးခြင်းနှင့် လူနေမှု ဘဝပြန်လည်ထူထောင်ပေးခြင်းအစီအစဉ်(သင်တန်းများပေးခြင်းစသည်)တို့လည်းရရှိ စေမည်ဖြစ်သည်။ တီကျစ်စက်ရုံမှပြုလုပ်ပေးသောစိုက်ပျိုးရေးအသိပညာပေးခြင်းသင်တန်းသည်လည်းဒေသတွင်းစီးပွားရေး

					ကိုဖွံ့ဖြိုးတိုးတက်စေမည်ဖြစ် သည်။
၁၄။	ရေအသုံးပြုမှု	D	B-	D	[တ] ရေရရှိမှုပေါ် မူတည်၍ဆောက်လုပ်ရေးအတွက်ရေကိုဘီလူးချောင်းမှရယူသုံးစွဲမည်ဖြစ်သည်။ [လ] ဘွိုင်လာနှင့်အခြားလုပ်ငန်းများအတွက်မြေပေါ် ရေကိုအဓိကအသုံးပြုမည်ဖြစ်သည်။ သို့သော်ရယူအသုံးပြုမည့်ပမာဏမှာသိသာ သောသက်ရောက်မှုကို မဖြစ်စေနိုင်ပါ။ [ဖ] ထင်ရှားသောသက်ရောက်မှုမတွေ့ရှိရပါ။
၁၅။	ယဉ်ကျေးမှု အမွေအနှစ်	D	D	D	စီမံကိန်းအနီးယဉ်ကျေးမှုအမွေအနှစ်များမတည်ရှိပါ။
၁၆။	ရှုခင်းပဒေသ	D	D	D	သိသာသောမြေပြင်ပြောင်းလဲမှုလုပ်ငန်းများမရှိသောကြောင့်ထင်ရှားသောရှုခင်းပဓာသပြောင်းလဲမှုမရှိနိုင်ပါ။
၁၇။	ကျား/မရေးရာ	D	B+	D	ထင်ရှားသောသက်ရောက်မှုမတွေ့ရှိရပါ။
၁၈။	ကလေးသူငယ်အခွင့်အရေး	D	B+	D	[တ][လ] [ဖ] စီမံကိန်းသည်ကလေးသူငယ်အခွင့်အရေးနှင့်ပတ်သက်၍သက်ရောက်မှုမရှိနိုင်ပါ။
၁၉။	ကိုယ်ခံအားကျဆင်းမှုစသည့် ကူးစက်ရောဂါများ	B-	D	B-	[တ] ဆောက်လုပ်ရေးလုပ်ငန်းလုပ်သားများဝင်ရောက်လာမှုကြောင့် လိင်ပိုင်းဆိုင်ရာကူးစက်ရောဂါများ ဖြစ်နိုင်ချေအကန့်အသတ် နှင့်ရှိနိုင်ပါသည်။ [လ] ထင်ရှားသောသက်ရောက်မှုမတွေ့ရှိရပါ။ [ဖ]ဆောက်လုပ်ရေးလုပ်ငန်းများဝင်ရောက်လာမှုကြောင့် လိင်ပိုင်းဆိုင်ရာကူးစက်ရောဂါများဖြစ်နိုင်ချေအကန့်အသတ်နှင့်ရှိနိုင်ပါသည်။
၂	လုပ်ငန်းခွင်ပတ်ဝန်းကျင် (ဥပမာ -	D	B-	D	[တ] [ဖ] ထင်ရှားသောသက်ရောက်မှုမတွေ့ရှိရပါ။

၇။	လုပ်ငန်းခွင်လုံခြုံရေး)				[လ] စနစ်တကျထိန်းချုပ်မှုမပြုလုပ်ပါကလေထုညစ်ညမ်းမှုကြောင့်ရောဂါများဖြစ်ပေါ်ခြင်းနှင့်ကျောက်မီးသွေးပို့ဆောင်မှုမှဆူညံသံများ ထွက်ရှိခြင်းတို့ဖြစ်နိုင် ပါသည်။

A+/-: သိသာထင်ရှားသောကောင်းကျိုး/ဆိုးကျိုး; B+/-: ပုံမှန်ကောင်းကျိုး/ဆိုးကျိုး; C+/-: မသိသာသောကောင်းကျိုး/ဆိုးကျိုး; D: သက်ရောက်မှုမရှိပါ

[တ]: တည်ဆောက်မှုကာလ; [လ]: လည်ပတ်မှုကာလ; [ဖ]: ဖျက်သိမ်းမှုကာလ

ဇယား ၁.၁၁ - သက်ရောက်မှုများအပေါ် လျှော့ချရေးနည်းလမ်းများ

စဉ်	သက်ရောက်မှု	လျှော့ချရေးနည်းလမ်းများ	အကောင်အထည်ဖော်မည့်အဖွဲ့
၁။	လေထုညစ်ညမ်းမှု	[တ] [ဖ] - သယ်ယူပို့ဆောင်ရေးယာဉ်များတွင်ဖုန်မှုန့်များပျံ့လွင့်မှုမရှိစေရန်အဖုံးအကာအုပ်၍သယ်ယူခြင်း - စီမံကိန်းဧရိယာနှင့်အနီးအနားပတ်ဝန်းကျင်များတွင်လမ်းများကိုရေမကြာခဏဖျန်းပေးခြင်း - မီးစက်နှင့်အခြားဓာတ်ငွေ့ထွက်ရှိစေနိုင်သောပစ္စည်းများကိုမလိုအပ်ပါကအသုံးမပြုပဲပိတ်ထားခြင်း - လေထုညစ်ညမ်းမှုထိန်းချုပ်လျှော့ချနိုင်ရန်ယာဉ်များမောင်းနှင်သည့်အရှိန်ကိုကန့်သတ်ထားရှိခြင်း - လေထုအရည်အသွေးတိုင်းတာမှုကိုပုံမှန်တိုင်းတာစစ်ဆေးခြင်း [လ] (၁) ဓာတ်အားပေးစက်ရုံဆိုင်ရာလုပ်ငန်းများ - အမှုန်အမွှားထွက်ရှိမှုကိုကာကွယ်ရန် လျှပ်စစ်သုံးအမှုန်ဖမ်းစက် (ESP) တပ်ဆင်ခြင်း - နိုက်ထရိုဂျင်ဒိုင်အောက်ဆိုဒ်ထွက်ရှိမှုလျှော့ချနိုင်ရန် Selected non-catalytic reduction system (SNCR) တပ်ဆင်ခြင်း - ဆာလဖာဒိုင်အောက်ဆိုဒ်ထွက်ရှိမှုလျှော့ချနိုင်ရန် FGD equipment (FGD; around 70 % efficiency) တပ်ဆင်ခြင်း - ဖုန်နှင့်ဓာတ်ငွေ့ထွက်ရှိမှုကို အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ (ထုတ်လွှတ်မှု) စံချိန်စံနှုန်းများအတိုင်းရှိနေစေရန်လျှော့ချရေးနည်းစဉ်၊ပစ္စည်းများဖြင့် ထိန်းသိမ်းထုတ်လွှတ်ခြင်း - (၂) ကျောက်မီးသွေးကိုင်တွယ်အသုံးပြုဆောင်ရွက်ခြင်းလုပ်ငန်းများ - ကျောက်မီးသွေးပို့ဆောင်ရာရွှေ့လျားစက်တလျှောက်တွင်အမိုးတပ်ဆင်ခြင်း - ကျောက်မီးသွေးနှင့်ဖုန်မှုန်ထွက်ရှိမှုမရှိစေရန်ကျောက်မီးသွေးဝင်းအတွင်းရေပုံမှန်ဖြန်းပေးခြင်း - စီမံကိန်းဧရိယာတစ်လျှောက်နှင့်ကျောက်မီးသွေးဝင်းတွင်ဒေသခံအပင်များဖြင့်စိုက်ပျိုးထားရှိပေးခြင်း	Wuxi Hua Guang (Myanmar) Limited

စဉ်	သက်ရောက်မှု	လျော့ချရေးနည်းလမ်းများ	အကောင်အထည်ဖော်မည့်အဖွဲ့
		(၃) ယာဉ်များမှဓာတ်ငွေ့ထွက်ရှိမှု - ယာဉ်များကိုအချိန်မှန်စစ်ဆေးစမ်းသပ်ပေးခြင်း	
၂။	ရေထုညစ်ညမ်းမှု	[တ] [ဖ] - ဆောက်လုပ်ရေးလုပ်ငန်းမှထွက်ရှိသောရေများကိုအနည်ချကန်နှင့်ရေသန့်စင်ကန်များတွင်ဖြတ်သန်းစေပြီးမှသတ်မှတ်ထားသောနေရာသို့စွန့်ပစ်ခြင်း - ရေဆိုးများကိုသက်ဆိုင်ရာအစိုးရသတ်မှတ်ချက်များနှင့်အညီသန့်စင်ပေးခြင်း - မြေပေါ်ရေ (ဘီလူးချောင်းနှင့်သံတဲချောင်း)များမှရေအရည်အသွေးကိုစီမံကိန်းကြောင့်မထိခိုက်စေရန်မပြတ်စောင့်ကြည့်လေ့လာခြင်း [လ] (၁) အပူစွန့်ထုတ်အရည်များ - အပူစွန့်ထုတ်အရည်များကိုပတ်ဝန်းကျင်အပေါ်ထိခိုက်မှုမရှိစေရန်လျော့ချပြီးမှစွန့်ထုတ်ခြင်း (၂) လျှံထွက်ရေများ - လျှံထွက်ရေများကိုကန်တွင်စုပြီးသန့်စင်မှုပြုလုပ်ပြီးမှသာစွန့်ထုတ်စေခြင်း (၃) ဆီနှင့်ဓာတုပစ္စည်းများဖိတ်စင်မှု - ဖိတ်စင်မှုနှင့်မြေကြီးထဲယိုစိမ့်မှုမှကာကွယ်ရန်ဆီနှင့်ဓာတုပစ္စည်းများကိုသင့်လျော်သောအကာအကွယ်များနှင့်ထားရှိခြင်း (၄) စွန့်ပစ်ရေ - အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး (ထုတ်လွှတ်မှု) စံနှုန်းသတ်မှတ်ချက်နှင့်ကိုက်ညီစေရန် ဓာတ်ပြယ်စေခြင်း၊ အနည်ကျစေခြင်းနှင့် ဆီဖယ်ရှားခြင်းစသည့်ရေဆိုးသန့်စင်စနစ်တပ်ဆင်ခြင်း စီမံကိန်းကြောင့်ရေညစ်ညမ်းမှုမဖြစ်စေရန်စောင့်ကြပ်ကြည့်ရှုမှုများဆောင်ရွက်ခြင်း	Wuxi Hua Guang (Myanmar) Limited

စဉ်	သက်ရောက်မှု	လျှော့ချရေးနည်းလမ်းများ	အကောင်အထည်ဖော်မည့်အဖွဲ့
၃။	မြေညစ်ညမ်းမှု	[တ] [ဖ] - မြေထုညစ်ညမ်းမှုဖြစ်နိုင်ချေလျှော့ချနိုင်ရန် ဆီနှင့်အမဲဆီများအပါအဝင်စွန့်ပစ်ပစ္စည်းများကိုစနစ်တကျသိမ်းဆည်းစွန့်ပစ်ခြင်း [လ] - စွန့်ပစ်ပြာပုံဧရိယာ၏အောက်ခြေမှ ရေဆိုးများမစိမ့်ထွက် နိုင်စေရန် ရေစိမ့်မထွက်နိုင်သောအလွှာထားရှိခြင်း။ မြေကြီးထဲယိုစိမ့်မှုမှကာကွယ်ရန်ဆီနှင့် ဓာတုပစ္စည်းများကိုသင့်လျော်သော အကာအကွယ်များနှင့်ထားရှိခြင်း။ စက်ပစ္စည်းနှင့်ယာဉ်များ ကို အချိန်မှန်စစ်ဆေးခြင်း -	Wuxi Hua Guang (Myanmar) Limited
၄။	စွန့်ပစ်ပစ္စည်းများ	[တ] [ဖ] - ဆောက်လုပ်ရေးလုပ်ငန်းမှ ပြန်လည်အသုံးပြု၍မရသောစွန့်ပစ်ပစ္စည်းများ ထွက်ရှိမှုကိုလျှော့ချခြင်းနှင့်စနစ်တကျစွန့်ပစ်ခြင်း။ စွန့်ပစ်ပစ္စည်းများကိုဒေသအစိုးရနှင့်မြို့ရွာဖွံ့ဖြိုးရေးကော်မရှင် မှလမ်းညွှန်ချက်ဖြင့်စွန့်ပစ်ခြင်း။ [လ] - လျှော့ချခြင်း၊ ပြန်လည်အသုံးပြုခြင်း၊ ပြန်လည်သုံးစွဲခြင်းစသည်တို့ပါဝင်သောစွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲအစီအစဉ်တည်ထောင်ခြင်း။ - စနစ်တကျသိမ်းဆည်းခြင်းနှင့်လုံခြုံစွာသိမ်းဆည်းခြင်း။ - သင့်လျော်သောနေရာတွင်စွန့်ပစ်ခြင်း။ - အန္တရာယ်ရှိစွန့်ပစ်ပစ္စည်းများကိုပြဌာန်းဥပဒေနှင့်အညီပြုပြင်ခြင်း။ - အန္တရာယ်ရှိပစ္စည်းများစုပုံခြင်းကိုတားမြစ်ခြင်း။	Wuxi Hua Guang (Myanmar) Limited
၅။	ဆူညံသံ	[တ] [ဖ] - ဆူညံသံလျှော့ချကိရိယာနှင့် ဆူညံသံတားကိရိယာများတပ်ဆင်ခြင်း။	Wuxi Hua Guang

စဉ်	သက်ရောက်မှု	လျော့ချရေးနည်းလမ်းများ	အကောင်အထည်ဖော်မည့်အဖွဲ့
		- မနက်အစောပိုင်းအချိန်များနှင့် ညပိုင်းအချိန်များတွင်ဆောက်လုပ်ရေးလုပ်ငန်းများလုပ်ဆောင်မှုဆောင်ရွက်ခြင်းမပြုရန်။ - လိုအပ်သည့်ကြိုတင်ဆောင်ရွက်မှုများပြုလုပ်နိုင်စေရန်တည်ဆောက်ရေးလုပ်ငန်းဆိုင်ရာအချိန်စာရင်းကိုလူထုသို့ကြိုတင်ချပြခြင်း။ - ဆူညံသံကိုပုံမှန်တိုင်းတာခြင်း။ [လ] - ဆူညံသံအတားအစီးများတပ်ဆင်ခြင်း။ - စက်ကိရိယာများကိုပုံမှန်ထိန်းသိမ်းပေးခြင်း။ - စက်ပစ္စည်းများဆူညံထွက်ရှိမှုလျော့နည်းစေရန်လုံခြုံစွာထားရှိခြင်း။ - လိုအပ်သည့်ကြိုတင်ဆောင်ရွက်မှုများပြုလုပ်နိုင်စေရန်စက်လည်ပတ်သည့်အချိန်စာရင်းကိုလူထုသို့ကြိုတင်ချပြခြင်း၊	(Myanmar) Limited
၆။	အနံ့ဆိုးထွက်ရှိမှု	[တ] - အနံ့ဆိုးထွက်ရှိမှုကိုပုံမှန်တိုင်းတာပေးခြင်း။ - အနံ့ထွက်ရှိမှုရင်းမြစ်ပေါ်မူတည်၍လျော့ချမှုနည်းလမ်းများကိုဖော်ထုတ်ပေးခြင်း။ [လ] - အထွေထွေစွန့်ပစ်ပစ္စည်းများကိုင်တွယ်မှုနှင့်ပတ်သက်၍သင့်လျော်သောနည်းလမ်းများအသုံးပြုခြင်း။ - တရားမဝင်အမှိုက်စွန့်ပစ်ခြင်းကိုတားမြစ်ခြင်း။	Wuxi Hua Guang (Myanmar) Limited
၇။	နန်းနစ်အရည်အသွေး	(၁) လျှံထွက်ရေ - လျှံထွက်ရေများကိုကန်တွင်စု၍သင့်လျော်သောနည်းစဉ်များဖြင့်သန့်စင်ပြုပြင်ပြီးမှစွန့်ပစ်ခြင်း။ - အပူစွန့်ထုတ်အရည်များကိုပတ်ဝန်းကျင်အပေါ်ထိခိုက်မှုမရှိစေရန်လျော့ချပြီးမှစွန့်ထုတ်ခြင်း။ (၂) ဆီနှင့်ဓာတုပစ္စည်းများဖိတ်စင်မှု	Wuxi Hua Guang (Myanmar) Limited

စဉ်	သက်ရောက်မှု	လျှော့ချရေးနည်းလမ်းများ	အကောင်အထည်ဖော်မည့်အဖွဲ့
		- ဖိတ်စင်မှုနှင့်မြေကြီးထဲယိုစိမ့်မှုမှကာကွယ်ရန်ဆီနှင့်ဓာတုပစ္စည်းများကိုသင့်လျော်သောအကာအကွယ်များနှင့်ထားရှိခြင်း။ (၃) စွန့်ပစ်ရေ - အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာအရည်အသွေး (ထုတ်လွှတ်မှု) စံနှုန်းသတ်မှတ်ချက်နှင့်ကိုက်ညီစေရန် ဓာတ်ပြယ်စေခြင်း၊ အနည်ကျစေခြင်းနှင့် ဆီဖယ်ရှားခြင်းစသည့်ရေဆိုးသန့်စင်စနစ်တပ်ဆင်ခြင်း။	
၈။	ဂေဟစနစ်	[တ] - သစ်ပင်ခုတ်ခြင်းနှင့်လုပ်ကွက်ရှင်းလင်းခြင်းများကိုတတ်နိုင်သမျှလျှော့ချဆောင်ရွက်ခြင်း။ - စွန့်ပစ်ရေများရေနေဂေဟစနစ်အတွင်းဝင်ရောက်မှုမရှိစေရန်အနည်စစ်ကန်များထားရှိခြင်း။ - အန္တရာယ်ရှိစွန့်ပစ်ပစ္စည်းများအားနောက်ဆုံးမစွန့်ပစ်မီစနစ်တကျသိုလှောင်သိမ်းဆည်းခြင်း။	Wuxi Hua Guang (Myanmar) Limited
၉။	နယ်ခြားဖြတ်ကျော်သက်ရောက်မှုနှင့်ရာသီဥတုပြောင်းလဲမှု	[တ] [ဖ] - မီးစက်နှင့်အခြားဓာတ်ငွေ့ထွက်ရှိစေနိုင်သောပစ္စည်းများကိုမလိုအပ်ပါကအသုံးမပြုပဲပိတ်ထားခြင်း။ [လ] - ဖန်လုံအိမ်ဓာတ်ငွေ့ထွက်ရှိမှုကိုလျှော့ချရန်စက်ပစ္စည်းနှင့်ယာဉ်များကိုအချိန်မှန်စစ်ဆေးပြုပြင်ပေးခြင်း။ - လျှပ်စစ်ထုတ်လုပ်ရာတွင်စွမ်းရည်မြင့်မားသောUSCနည်းပညာကိုအသုံးပြုခြင်း။	
၁၀။	ရေအသုံးပြုချမှု	[လ] - ရေသုံးစွဲမှုကိုတတ်နိုင်သမျှချွေတာသုံးစွဲခြင်းနှင့်မလိုအပ်ဘဲရေပိုသုံးစွဲမှုကိုရှောင်ကြဉ်ခြင်း။ - စက်ရုံတွင်းအသုံးပြုသောရေကိုပြန်လည်အသုံးပြုခြင်းဖြင့်ရေသုံးစွဲမှုမြင့်မားခြင်းကိုထိန်းချုပ်ခြင်း။	Wuxi Hua Guang (Myanmar) Limited
၁၁။	ကိုယ်ခံအားကျဆင်းမှုစသည့်	[တ] [ဖ] - ကိုယ်ခံအားကျကူးစက်ရောဂါမကူးစက်စေရန်ဆောက်လုပ်ရေးလုပ်သားများအားအသိပညာပေးခြင်း။	Wuxi Hua Guang

စဉ်	သက်ရောက်မှု	လျှော့ချရေးနည်းလမ်းများ	အကောင်အထည်ဖော်မည့်အဖွဲ့
	ကူးစက်ရောဂါများ		(Myanmar) Limited
၁၂။	လုပ်ငန်းခွင် ပတ်ဝန်းကျင် (ဉပမာ - လုပ်ငန်းခွင် လုံခြုံရေး)	[တ] [ဖ] - မတော်တဆဖြစ်မှုများအားရှောင်ကြဉ်နိုင်ရန်လုပ်သားများနှင့်ဒေသခံများကိုသင်တန်းများပေးခြင်းနှင့်အန္တရာယ်သတိပေးစာများကပ်ထားခြင်း။ - မတော်တဆဖြစ်ရပ်များကိုအကြောင်းအရာနှင့်တကွမှတ်တမ်းတင်၍ဆန်းစစ်ခြင်း။ - စီမံကိန်းလုပ်ကွက်ကိုအလင်းရောင်ကောင်းစွာထောက်ပံပေးထားခြင်း။ [လ] - လုပ်ငန်းခွင်နှင့်ဘေးအန္တရာယ်ကင်းရှင်းရေးဆိုင်ရာသင်တန်းများပို့ချပေးခြင်း။ - ဝန်ထမ်းများအားသင့်လျော်သောအကာအကွယ်ပစ္စည်းများအားထောက်ပံပေးထားခြင်း - မတော်တဆဖြစ်ရပ်များကိုအကြောင်းအရာနှင့်တကွမှတ်တမ်းတင်၍ဆန်းစစ်ခြင်း။	Wuxi Hua Guang (Myanmar) Limited
၁၃။	လူထုနှင့် လုပ်ငန်းခွင် ကျန်းမာရေးနှင့် ဘေးအန္တရာယ် ကင်းရှင်းရေး	- ညစ်ညမ်းပစ္စည်းထွက်ရှိမှုကိုထိန်းချုပ်ခြင်း။ - ဘေးအန္တရာယ်ကင်းရှင်းရေးဆိုင်ရာသင်တန်းများပို့ချပေးခြင်း။ - မတော်တဆမှုများဖြစ်ပေါ်ပါက ဒေသခံလူထုအား အချိန်မီ အသိပေးကြေငြာခြင်း။ - ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်၊ ပတ်ဝန်းကျင်စောင့်ကြပ်ကြည့်ရှုရေးအစီအစဉ်၊ ထိခိုက်မှုလျှော့ချရေးလုပ်ငန်းများကို ပုံမှန်စစ်ဆေးခြင်း။	Wuxi Hua Guang (Myanmar) Limited

[တ]: တည်ဆောက်မှုကာလ; [လ]: လည်ပတ်မှုကာလ; [ဖ]: ဖျက်သိမ်းမှုကာလ (ရင်းမြစ်။ ။အီးဂတ်လေ့လာရေးအဖွဲ့)

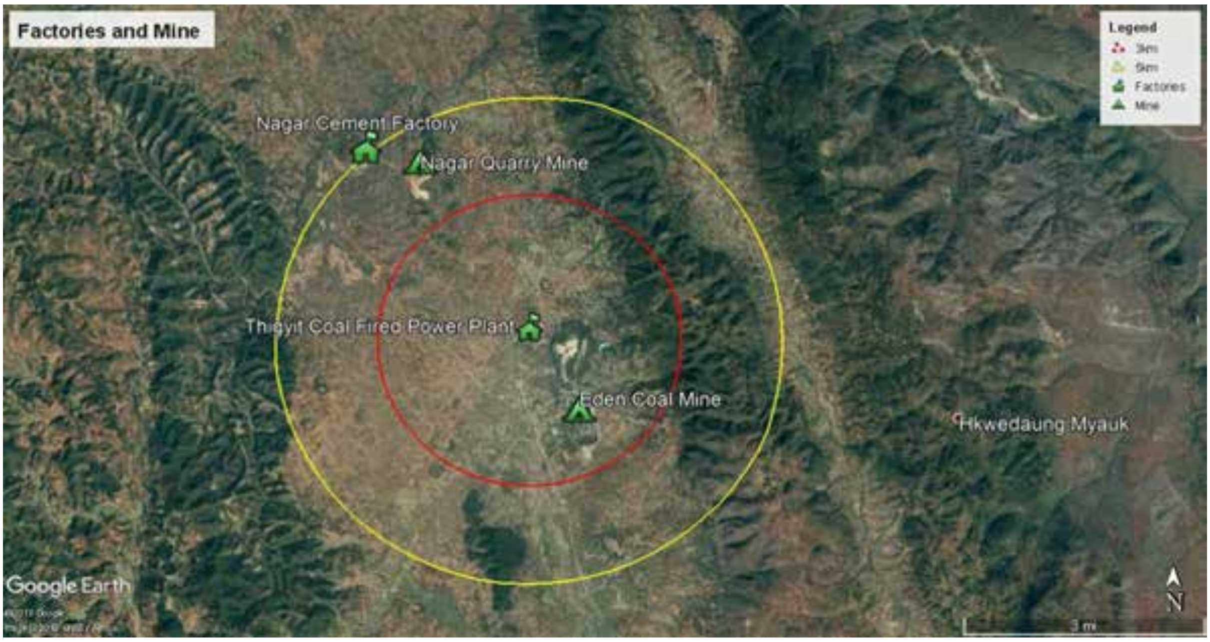
၆။ စုပေါင်းသက်ရောက်မှုဆန်းစစ်ခြင်း

စုပေါင်းသက်ရောက်မှုဆန်းစစ်ခြင်းသည်တီကျစ်ဓာတ်အားပေးစက်ရုံအတွက်ပတ်ဝန်းကျင်ဆန်းစစ်မှုလေ့လာခြင်း၏ အရေးပါသော အစိတ်အပိုင်းဖြစ်သည်။ လုပ်ငန်းတစ်ခု၏ စုပေါင်းသက်ရောက်မှု ဆိုသည်မှာ အဆိုပြုလုပ်ငန်းတစ်ခုသည် မိမိတခုတည်းဖြင့် ထင်ရှားသောသက်ရောက်မှု တို့ကို မဖြစ်ပေါ်စေသော်လည်း ထိုလုပ်ငန်းလုပ်ကိုင်ရာဧရိယာရှိ အလားတူလုပ်ငန်းများ၏ စုပေါင်းသက်ရောက်မှုများကြောင့် သိသာ ထင်ရှားသောသက်ရောက်မှုဖြစ်ပေါ်ခြင်းကိုခေါ်သည်။

စီမံကိန်း၏စုပေါင်းသက်ရောက်မှုကိုနားလည်နိုင်ရန်တီကျစ်ဓာတ်အားပေးစက်ရုံ တည်ရှိရာဒေသ၏ အချိန်နှင့်နေရာ အလိုက် ယခင်နှင့်ယခုဆောင်ရွက်နေမှုများကို သိမြင်နားလည်နိုင်ရန်လိုအပ်သည်။ ထိုသို့သိရှိနိုင်ရန် စီမံကိန်းတည်ရှိရာ ဒေသတွင်းရှိလက်ရှိနှင့် လျှောက်ထားဆဲ စီမံကိန်းများကို ဖော်ထုတ်ရန်လိုအပ်သည်။

ဇယား ၁.၁၂ - စီမံကိန်းဧရိယာအနီးရှိအဓိကစီမံကိန်းများ

စဉ်	စီမံကိန်း	တီကျစ်စက်ရုံမှအကွာအဝေး
၁။	နဂါးဘိလပ်မြေစက်ရုံ	၄.၈၈ ကီလိုမီတာ
၂။	နဂါးထုံးကျောက်မိုင်း	၃.၈၅ ကီလိုမီတာ
၃။	ဒေဝ်ကျောက်မီးသွေးမိုင်း	၂ ကီလိုမီတာ
၄။	လူနေဧရိယာ	



စုပေါင်းသက်ရောက်မှုလုပ်ငန်းစဉ်များအားဆန်းစစ်ရာတွင် သက်ရောက်မှုဆန်းစစ်မှု၏တွေ့ရှိချက် များမှ အဓိကကိစ္စရပ်များကိုဦးစားပေးဆောင်ရွက်ထားပါသည်။ (အသေးစိတ်ကိုအခန်း ၇ တွင် ကြည့်ရန်)

၇။ ပတ်ဝန်းကျင်စောင့်ကြည့်မှုအစီအစဉ်

ဇယား ၁.၁၃ - ပတ်ဝန်းကျင်စောင့်ကြည့်မှုအစီအစဉ်

စဉ်	အမျိုးအစား	အချက်အလက်	နည်းလမ်း	တည်နေရာ	အကြိမ်ရေ	ဆောင်ရွက်မည့် အဖွဲ့အစည်း	တာဝန်ရှိ အဖွဲ့အစည်း	နှစ်စဉ်ကုန် ကျငွေ
လည်ပတ်မှုကာလ								
၁။	လေထုညစ်ညမ်းမှု	NO2, SO2, PM (PM10 and PM2.5), and micro climate (temperature, humidity, wind speed and direction etc. for reference)	တစ်နေရာတွင်၂၄နာရီစဉ်ဆက်မပြတ် တိုင်းတာခြင်း	စီမံကိန်းမှ၅ကီလိုမီတာ အချင်းဝက်ပတ်လည်တွင်ရှိသော ကျေးရွာ (၁၈) နေရာ (အခြေခံတိုင်းတာမှုပြုခဲ့သည့်နေရာများ)	လည်ပတ်စဉ်ကာလတွင် တစ်နှစ်နှစ်ကြိမ် (ခြောက်သွေ့ရာသီနှင့် စိုစွတ်ရာသီ)	Third party consultant firm hired by Wuxi Hua Guang (Myanmar) Limitedg (Myanmar) Limited	Wuxi Hua Guang (Myanmar) Limitedg (Myanmar) Limited	**USD 36,000** (USD 1,000 * 18 points * 2 times)
၂။	ရေညစ်ညမ်းမှု	BOD, COD, oil & grease, pH, total coliform, total nitrogen, total phosphorus and TSS	လုပ်ကွက်ဧရိယာတွင်း ရေအရည်အသွေး တိုင်းတာသည့်ကိရိယာဖြင့် တိုင်းတာခြင်း နှင့် နမူနာကောက်ယူပြီး ဓာတ်ခွဲခန်းပို့ဆောင်ခြင်း	စီမံကိန်းမှ၅ကီလိုမီတာ အချင်းဝက်ပတ်လည်တွင်ရှိသော ကျေးရွာ (၁၀) နေရာ (အခြေခံတိုင်းတာမှုပြုခဲ့သည့်နေရာများ)	လည်ပတ်စဉ်ကာလတွင် တစ်နှစ်နှစ်ကြိမ် (ခြောက်သွေ့ရာသီနှင့် စိုစွတ်ရာသီ)	Third party consultant firm hired by Wuxi Hua Guang (Myanmar) Limited	Wuxi Hua Guang (Myanmar) Limited	**USD 20,000** (USD 1,000 * 10 points * 2 times)
၃။	မြေညစ်ညမ်းမှု	မြေကြီးအခြေအနေ ဒေသခံတို့၏ပြောကြားချက်	ဒေသခံများ၏အသံနှင့်ပြောကြားချက်	စီမံကိန်းနှင့် အနီးပတ်ဝန်းကျင်	လည်ပတ်စဉ်ကာလတွင် လေးလတစ်ကြိမ်	Wuxi Hua Guang (Myanmar)	Wuxi Hua Guang (Myanmar	-

စဉ်	အမျိုးအစား	အချက်အလက်	နည်းလမ်း	တည်နေရာ	အကြိမ်ရေ	ဆောင်ရွက်မည့် အဖွဲ့အစည်း	တာဝန်ရှိ အဖွဲ့အစည်း	နှစ်စဉ်ကုန် ကျငွေ
			များကိုနားထောင်ခြင်း လက်တွေ့ကွင်းဆင်းစစ်ဆေးခြင်း		နှင့် တိုင်ကြားချက်ရရှိချိန်	Limited	) Limited	
၄။	စွန့်ပစ်ပစ္စည်း	စွန့်ပစ်ပစ္စည်းပမာဏ (မြေစာ၊ အသီးအရွက်နှင့် အမှိုက်အပါအဝင်) ဒေသခံတို့၏ပြောကြားချက်	ဒေသခံများ၏အသံနှင့်ပြောကြားချက် များကိုနားထောင်ခြင်း လက်တွေ့ကွင်းဆင်းစစ်ဆေးခြင်း	စီမံကိန်းဧရိယာ	လည်ပတ်စဉ်ကာလတွင် လေးလတစ်ကြိမ် နှင့် တိုင်ကြားချက်ရရှိချိန်	Wuxi Hua Guang (Myanmar) Limited	Wuxi Hua Guang (Myanmar) Limited	-
၅။	ဆူညံသံ	LAeq (noise) LV10 (vibration)	တစ်နေရာတွင်၂၄နာရီစဉ်ဆက်မပြတ် တိုင်းတာခြင်း	စီမံကိန်းမှ၅ကီလိုမီတာ အချင်းဝက်ပတ်လည်တွင်ရှိသော ကျေးရွာ (၁၈) နေရာ (အခြေခံတိုင်းတာမှု ပြုခဲ့သည့်နေရာများ)	လည်ပတ်စဉ်ကာလတွင် တစ်နှစ်နှစ်ကြိမ် (ခြောက်သွေ့ရာသီနှင့် စိုစွတ်ရာသီ)	Third party consultant firm hired by Wuxi Hua Guang (Myanmar) Limited	Wuxi Hua Guang (Myanmar) Limited	**USD 18,000** (USD 500 * 18 points * 2 times)
၆။	နယ်ခြားဖြတ်ကျော် သက်ရောက်မှု နှင့် ရာသီဥတု ပြောင်းလဲမှု	လေအရည်အသွေး	၁။ လေညစ်ညမ်းမှု ကိုကြည့်ရန်					
ဖျက်သိမ်းမှုကာလ								

စဉ်	အမျိုးအစား	အချက်အလက်	နည်းလမ်း	တည်နေရာ	အကြိမ်ရေ	ဆောင်ရွက်မည့် အဖွဲ့အစည်း	တာဝန်ရှိ အဖွဲ့အစည်း	နှစ်စဉ်ကုန် ကျငွေ
၁။	လေထုညစ်ညမ်းမှု	NO2, SO2, PM (PM10 and PM2.5), and micro climate (temperature, humidity, wind speed and direction etc. for reference)	တစ်နေရာတွင် ၂၄နာရီစဉ်ဆက်မပြတ် တိုင်းတာခြင်း	စီမံကိန်းမှ၅ကီလိုမီတာ အချင်းဝက်ပတ်လည်တွင်ရှိသော ကျေးရွာ (၁၈) နေရာ (အခြေခံတိုင်းတာမှု ပြုခဲ့သည့်နေရာများ)	ဖျက်သိမ်းကာလတွင် တစ်နှစ်နှစ်ကြိမ်	Contractor	MOEE	**USD 36,000** (USD 1,000 * 18 points * 2 times)
၂။	ရေညစ်ညမ်းမှု	BOD, COD, oil & grease, pH, total coliform, total nitrogen, Total phosphorus and TSS	လုပ်ကွက်ဧရိယာတွင်း ရေအရည်အသွေး တိုင်းတာသည့် ကိရိယာဖြင့် တိုင်းတာခြင်း နှင့် နမူနာကောက်ယူပြီး ဓာတ်ခွဲခန်း ပို့ဆောင်ခြင်း	စီမံကိန်းမှ၅ကီလိုမီတာ အချင်းဝက်ပတ်လည်တွင်ရှိသော ကျေးရွာ (၁၀) နေရာ (အခြေခံတိုင်းတာမှု ပြုခဲ့သည့်နေရာများ)	လည်ပတ်စဉ်ကာလတွင် တစ်နှစ်နှစ်ကြိမ် (ခြောက်သွေ့ရာသီနှင့် စိုစွတ်ရာသီ)	Contractor	MOEE	**USD 20,000** (USD 1,000 * 10 points * 2 times)
၃။	မြေညစ်ညမ်းမှု	မြေကြီးအခြေအနေနှင့် ဒေသခံတို့၏ပြောကြားချက်	ဒေသခံများ၏အသံနှင့်ပြောကြားချက် များကိုနားထောင်ခြင်း နှင့် လက်တွေ့စစ်ဆေးခြင်း	စီမံကိန်းနှင့် အနီးပတ်ဝန်းကျင်	လည်ပတ်စဉ်ကာလတွင် လေးလတစ်ကြိမ် နှင့် တိုင်ကြားချက် ရရှိ ချိန်	Contractor under supervision of consultant	MoEE	-
၄။	စွန့်ပစ်ပစ္စည်း	စွန့်ပစ်ပစ္စည်းပမာဏ (မြေ၊ အသီးအရွက်နှင့် အမှိုက်အပါအဝင်)	ဒေသခံများ၏အသံနှင့်ပြောကြားချက် များကိုနားထောင်ခြင်း လက်တွေ့ကွင်းဆင်းစစ်ဆေးခြင်း	စီမံကိန်းဧရိယာ	လည်ပတ်စဉ်ကာလတွင် လေးလတစ်ကြိမ် နှင့်	Contractor	MoEE	-

စဉ်	အမျိုးအစား	အချက်အလက်	နည်းလမ်း	တည်နေရာ	အကြိမ်ရေ	ဆောင်ရွက်မည့် အဖွဲ့အစည်း	တာဝန်ရှိ အဖွဲ့အစည်း	နှစ်စဉ်ကုန် ကျငွေ
		ဒေသခံတို့၏ပြောကြားချက်			တိုင်ကြားချက် ရရှိချိန်			
၅။	ဆူညံသံ	LAeq (noise) LV10 (vibration)	တစ်နေရာတွင်၂၄နာရီစဉ်ဆက်မပြတ် တိုင်းတာခြင်း	စီမံကိန်းမှ၅ကီလိုမီတာ ပတ်လည်ရှိ၁၈နေရာ (အခြေခံတိုင်းတာမှုပြုခဲ့သည့်နေရာများ)	လည်ပတ်စဉ်ကာလတွင် တစ်နှစ်နှစ်ကြိမ် (ခြောက်သွေ့ရာသီနှင့် စိုစွတ်ရာသီ)	Contractor	MoEE	**USD 18,000** (USD 500 * 18 points * 2 times)
၆။	နယ်ခြား ဖြတ်ကျော် သက်ရောက်မှု နှင့် ရာသီဥတု ပြောင်းလဲမှု	လေအရည်အသွေး	၁။ လေညစ်ညမ်းမှု ကိုကြည့်ရန်					
၇။	ကိုယ်ခံအား ကျစသည့် ကူးစက်ရောဂါ	ကူးစက်ခံရလူနာအရေအတွက် ဒေသခံတို့၏ပြောကြားချက်	လုပ်သားများ၏ကျန်းမာရေးစစ်ဆေးချက် (ဖြစ်နိုင်ပါကဒေသခံများပါဝင်နိုင်ရန်) ဒေသခံများ၏အသံနှင့်ပြောကြားချက် များကိုနားထောင်ခြင်း	စီမံကိန်းနှင့် အနီးပတ်ဝန်းကျင်	လစဉ်နှင့် တိုင်ကြားချက် ရရှိချိန်	Contractor in collaboration with regional government	MoEE	-

(ရင်းမြစ်။ ။အီးဂတ်လေ့လာရေးအဖွဲ့)

၈။ လူထုတွေ့ဆုံခြင်း

လူထုတွေ့ဆုံပွဲများကိုနယ်မြေတိုင်းတာသတ်မှတ်ခြင်း (Scoping Stage) အတွက် ၂၀၁၆ခုနှစ်၊ ဧပြီလနှင့် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းမူကြမ်းပြင်ဆင်သည့်အဆင့် (EIA Stage) အတွက် ၂၀၁၉ခုနှစ်၊ မေလ တွင်ကျင်းပပြုလုပ်ခဲ့သည်။ တွေ့ဆုံပွဲများသို့ စီမံကိန်းနှင့်သက်ဆိုင်သူများ ဖြစ်သည့်ဒေသခံများ၊ အစိုးရဌာနဆိုင်ရာများ၊ ပြည်နယ်အစိုးရအဖွဲ့၊ ပုဂ္ဂလိကကုမ္ပဏီများနှင့် သတင်းမီဒီယာအဖွဲ့များ တက်ရောက်ခဲ့ကြသည်။ နယ်ပယ်တိုင်းတာသတ်မှတ်ခြင်းမှ မူကြမ်းရေးဆွဲပြုစုမှုကာလကြား ပြုလုပ်ခဲ့သောစီမံကိန်း နှင့်သက်ဆိုင်သူများနှင့် တွေ့ဆုံပွဲ (၇) ကြိမ်ကောက်နုတ်ချက်ကို အောက်တွင်ဖော်ပြပေးထားပြီး အသေးစိတ်ကို အခန်း (၉) တွင်လေ့လာကြည့်ရှုနိုင်ပါသည်။

စဉ်	ရက်စွဲ	အကြောင်းအရာ	တက်ရောက်သူများ
၁။	၂၄-၄-၂၀၁၆	တီကျစ်ကျောက်မီးသွေးဓာတ်အားပေးစက်ရုံ၏ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း (နယ်ပယ်တိုင်းတာ သတ်မှတ်ခြင်းအဆင့်) လူထုတွေ့ဆုံပွဲ	• လွှတ်တော်ကိုယ်စားလှယ်များ • အစိုးရဌာနဆိုင်ရာများ • အစိုးရမဟုတ်သောအဖွဲ့အစည်း၊ ပြည်ပအစိုးရမဟုတ်သောအဖွဲ့အစည်းများ • ပုဂ္ဂလိကကုမ္ပဏီများ • သတင်းမီဒီယာများ • ဒေသခံများ
၂။	၈-၁၁-၂၀၁၇	ဒေါက်တာညီညီအောင် (ရှမ်းပြည်နယ်သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီး)အားတီကျစ်ကျောက်မီးသွေးဓာတ်အားပေးစက်ရုံနှင့်ပတ်သက်သော ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းလေ့လာမှုနှင့်ပတ်သက်၍ရှင်းလင်းတင်ပြခြင်း	• ရှမ်းပြည်နယ်သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီး • ရှမ်းပြည်နယ်အစိုးရအဖွဲ့ဝင်များ • တီကျစ်ကျောက်မီးသွေးဓာတ်အားပေးစက်ရုံအဖွဲ့ဝင်များနှင့် • အီးဂတ်ပတ်ဝန်းကျင်ဝန်ဆောင်မှုမှအဖွဲ့ဝင်များ
၃။	၂၃-၁၀-၂၀၁၈	တီကျစ်ဓာတ်အားပေးစက်ရုံသို့ကွင်းဆင်းလေ့လာခြင်းနှင့် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းနှင့်ပတ်သက်၍ရှင်းလင်းခြင်း	Myanmar Centre for Responsible Business (MCRB) Managing Director Ms. Vicky Bowman and members
၄။	၂၂-၂-၂၀၁၉	ဒေါက်တာညီညီအောင် (ရှမ်းပြည်နယ်သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီး)ထံတီကျစ်ကျောက်မီးသွေးဓာတ်အားပေးစက်ရုံနှင့်ပတ်သက်သော ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း လူထုတွေ့ဆုံပွဲ (ကျေးရွာအဆင့်) ကျင်းပရန် သဘောထားမှတ်ချက် တောင်းခံခြင်း	• ရှမ်းပြည်နယ်သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီး • ရှမ်းပြည်နယ်အစိုးရအဖွဲ့ဝင်များ • ရှမ်းပြည်နယ်လမ်းပန်းဆက်သွယ်ရေးဝန်ကြီး
၅။	၂၂-၂-၂၀၁၉	ဦးခွန်စံလွင် (ပအိုဝ်းကိုယ်ပိုင်အုပ်ချုပ်ခွင့်ရဉက္ကဋ္ဌ) ထံ တီကျစ်ကျောက်မီးသွေးဓာတ်အားပေးစက်ရုံနှင့်ပ	• ပအိုဝ်းကိုယ်ပိုင်အုပ်ချုပ်ခွင့်ရဉက္ကဋ္ဌ • သက်ဆိုင်ရာဌာနဆိုင်ရာများ

		တ်သက်သောပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လူထုတွေ့ဆုံပွဲ(ကျေးရွာအဆင့်)ကျင်းပရန်သဘော ာထား မှတ်ချက် တောင်းခံခြင်း	
၆။	၂၃-၂-၂၀၁၉ မှ ၂၅-၂-၂၀၁၉	တီကျစ်ကျောက်မီးသွေးဓာတ်အားပေးစက်ရုံနှင့်ပ တ် သက်သော ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လူထုတွေ့ဆုံပွဲ(ကျေးရွာအဆင့်)	• ကျေးရွာအုပ်စုအကြီးအကဲများ • ကျေးရွာအုပ်ချုပ်ရေးမှူးများ • ဒေသခံများ • တီကျစ်ကျောက်မီးသွေးဓာတ်အားပေးစက်ရုံအဖွဲ့ဝင်များနှင့် • အီးဂတ်ပတ်ဝန်းကျင်ဝန်ဆောင်မှုမှအဖွဲ့ဝင်များ
၇။	၇-၅-၂၀၁၉	တီကျစ်ကျောက်မီးသွေးဓာတ်အားပေးစက်ရုံ၏ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအဆင့် လူထုတွေ့ဆုံပွဲ	• လွှတ်တော်ကိုယ်စားလှယ်များ • အစိုးရဌာနဆိုင်ရာများ • အစိုးရမဟုတ်သောအဖွဲ့အစည်း၊ ပြည်ပအစိုးရမဟုတ်သောအဖွဲ့အစည်းများ • ပုဂ္ဂလိကကုမ္ပဏီများ • သတင်းမီဒီယာများ • ဒေသခံများ

၉။ နိဂုံးနှင့်အကြံပြုချက်များ

အချက်အလက်ခိုင်လုံသော ကောင်းမွန်ပြည့်စုံသည့် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ အစီရင်ခံစာတစ်ခုပြုစုနိုင်ခြင်းအလို့ငှာ အီးဂတ်ပတ်ဝန်းကျင်ဝန်ဆောင်မှုကုမ္ပဏီသည် စီမံကိန်းနှင့်သက်ဆိုင်သော ရုပ်ပိုင်းဆိုင်ရာ၊ ဇီဝဝန်းကျင်ဆိုင်ရာများ နှင့် ဒေသခံလူထု၏အမြင်၊ သဘောထား နှင့် မျှော်လင့်ချက်များစသည်တို့ကိုကောက်ယူလေ့လာဆန်းစစ်ခဲ့ပါသည်။ ဖွံ့ဖြိုးမှုစီမံကိန်းတိုင်း သည် ယင်းလည်ပတ်ရာဒေသ၏ ပတ်ဝန်းကျင်နှင့်လူမှုစီးပွားအပေါ် ကောင်းကျိုးနှင့်ဆိုးကျိုးသက် ရောက်စေပါသည်။ ထို့ကြောင့်စီမံကိန်း၏ဆိုးကျိုးများကိုလျှော့ချရန်နှင့် ကောင်းကျိုးများကိုတိုးမြင့် ရန် စီမံကိန်းကြောင့်ဖြစ်နိုင်ချေရှိသော သက်ရောက်မှုများကိုဆန်းစစ်ခဲ့ပါသည်။

ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းလေ့လာမှု၏ တွေ့ရှိချက် နှင့်အကြံပြုချက်များကို စီမံကိန်းလည်ပတ်စဉ်ကာလအတွင်း ထည့်သွင်းစဉ်းစားကာ စဉ်ဆက်မပြတ်စောင့်ကြပ်ကြည့်ရှုခြင်း နှင့်တကွ အကောင်အထည်ဖော်ဆောင်ရွက်ရန်လိုအပ်ပါသည်။ စီမံကိန်းသည် ဖော်ပြထားသော ညစ်ညမ်းမှုလျှော့ချရေးနည်းလမ်းများအတိုင်း လည်ပတ်မည်ဖြစ်ကြောင်း သေချာစေရမည် ဖြစ်သည်။ ညစ်ညမ်းမှုထိန်းချုပ်နိုင်ရေး အတွက် ထုတ်လွှတ်မှုစဉ်ဆက်မပြတ်စောင့်ကြပ်ကြည့်ရှု ရေးစနစ်ကို တပ်ဆင်ရမည်ဖြစ်ပြီး စီမံကိန်းမှလေအောက်အရပ်ရှိ ကျေးရွာဝန်းကျင်တွင်လည်း တစ်ပြိုင်နက်စောင့်ကြပ်ကြည့်ရှုနိုင်ရေးအတွက် တပ်ဆင်သင့်ပါသည်။

အထက်တွင်ဖော်ပြခဲ့သည့်အတိုင်း စီမံကိန်းမှဖြစ်နိုင်ချေရှိသော အဓိကသက်ရောက်မှုများသည် အနည်းငယ်သက်ရောက်မှု ရှိသည်ကိုသာတွေ့ရသည်။ ထို့အပြင် ယင်းသက်ရောက်မှုတို့ကို ထိရောက်စွာ ထိန်းချုပ်နိုင်ရန်အီးဂတ်မှအဆိုပြုသော ထိခိုက်မှုလျှော့ချရေးနှင့်စောင့်ကြည့်ရေး နည်းလမ်းများအတိုင်း လိုက်ပါဆောင်ရွက်မည်ဖြစ်ကြောင်း သဘောတူညီမှုရရှိခဲ့ပြီးဖြစ်သည်။ တီကျစ်ကျောက်မီးသွေးသုံး ဓာတ်အားပေးစက်ရုံ၏ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာ နှင့်ဆက်နွယ်သော အချက်အလက် များကို ဒေသခံလူထုမှအလွယ်တကူရရှိနိုင်မည်ဖြစ်သည်။ ဖော်ပြပါအခြေအနေများအပြင် စီမံကိန်းမှ အခြားကောင်းကျိုးများအနေဖြင့်စီးပွားရေး နှင့် လျှပ်စစ်လိုအပ်ချက်တို့ကိုလည်း ဖြည့်တင်းပေးနိုင် မည်ဖြစ်သောကြောင့် စီမံကိန်းကို မနှောင့်နှေးဘဲ အကောင်အထည်ဖော် ဆောင်ရွက်ရန်အကြံပြုပါသည်။ ထိုသို့အကောင်အထည်ဖော်ရာတွင် Wuxi Hua Guang (Myanmar) Limited သည် လျှပ်စစ်နှင့်စွမ်းအင်ဝန်ကြီးဌာန၊ ရှမ်းပြည်နယ်အစိုးရအဖွဲ့နှင့် ပအိုဝ်းကိုယ်ပိုင် အုပ်ချုပ်ခွင့်ရအဖွဲ့တို့နှင့် နီးကပ်စွာဆက်လက်ပူးပေါင်း ဆောင်ရွက်သင့်ပြီး ဒေသခံပြည်သူလူထုနှင့်လည်း ဆက်လက်ချိတ်ဆက် အကောင်အထည်ဖော် ဆောင်ရွက်သင့်ပါသည်။

2. INTRODUCTION

2.1 Presentation of Project Proponent

2.1.1 Project Proponent

The proponent for the proposed project is Wuxi Hua Guang (Myanmar) Company Limited, established in April 29th 1993, a sole subsidiary of the former famous boiler manufacturer – Wuxi Boiler Works (now Wuxi Hua Guang Boiler Co., Ltd., a public company in Shanghai Stock Exchange with a Share Code of 600475) but it is an EPC Company taking boiler design, manufacturing as the business platform integrated with power plant design (coal-fired, gas & fuel oil-fired and variable regenerative fuels), manufacturing of boiler and its auxiliaries, matching of complete set of power plant, building, Installation and commissioning.

The company is a member of International Contractor‟s Association of The People‟s Republic of China. The business scopes of the company are sales of (a) boilers (b) completer sets of equipment for power generation project, metal, metallic materials and pressure vessels. Moreover, Wuxi Hua Guang Electric Power Engineering Co., Ltd has not only contracted projects in China but also established the agent network overseas including many power plants through EPC in Southeast Asia, Eastern Europe and South American. Wuxi Hua Guang Electric Power Engineering Co., Ltd has gained several years of experiences for EPC contracting power plant project of various kinds of fuels, industrial boiler houses by burning different fuel materials, boiler design and delivery for various fuels; construction and installation for power plant of various fuels, project of commissioning and operation of power plant.

Table 2.1 Board of Director's List

No.	Name	Nationality	National Registration Card No.	Residential Address
1.	Mr.Yingmin Dong	Chinese	P.P.No.G 47257330	Room 502, No.48 Huangnigang Street, Nan Chang Zone, Wuxi, Jiangsu, China
2.	Mr.Zhao Zheng	Chinese	P.P.No. ED6223359	14 floor,A3 Building, No.777 Jianzhu Road,Binhu Zone, Wuxi, Jiangsu Province, China

2.1.2 Investment Plan

The proponent had submitted the investment proposal for construction and operation of Thi gyit Coal-fired Power Plant to the Myanmar Investment Commission (MIC) in 2015. The company proposed its 47 million USD worth plan for 22 years contract period on field no.13 Holding U Paing, No 112, Thi gyit village, locating in Pin Laung Towship, Taung Gyi District in Southern Shan State.

The detail investment plan for the proposed project will be described in following table 2.2. According to the agreement between MEPE and the proponent, the project will start generation and distribution of electric power under BOT system by two phases

(1) Making refurbishment and modification of the existing infrastructures as the first phase and

(2) Constructing and installing the lignite dehydration plant as the second phase. The selling price per 1 unit would be 0.035 USD. It is expected that total electric power to be generated would be 380 million units in the first year and 760 million units from the second year onwards.

Table 2.2 Investment Plan

No.	Particular	Equity	Loan	Total
1.	Foreign Currency	500,000	-	500,00
2.	Value of machineries	13,600,000	17,631,600	31,231,600
3.	Value of factory accessories	-	10,522,221	10,522,221
4.	Value of office accessories	-	156,179	156,179
5.	Building value	-	3,150,000	3,150,000
6.	Imported building material	-	1,440,000	1,440,000
Total		14,100,000	32,900,000	47,000,000

2.2 Environmental and Social Consultant Teams (Roles and Responsibilities)

The EIA has been carried out by E Guard Environmental Services Company Limited with the approval of MONREC. The scoping study was successfully completed by E Guard on 02 Aungust 2017. A list of members of the EIA consultant is shown in Table 2.3 along with their roles and academic qualifications.

Table 2.3 Positions, Responsibility and Academic Qualification of EIA Consultants

Name	Role	Academic Qualification
U Aye Thiha	Project Leader	M. Sc., (Natural Resources Management)
Daw Yu Wai Yan Thein Tan	Team Leader	M.Eng. (Environmental Engineering & Management)
U Win Myint	Biodiversity Specialist	Phd (Environmental Science)
Daw May Thu Htet	Social Specialist	Master of Economic
Daw Khine Mar Kyaw	Water and Air Pollution Control Specialist	M.S.C (Environmental Engineering & Management)
U Kyaw Soe Moe	GIS Expert	BE (civil)
U Sithu Min Naing	Mining Expert	BE (Mining)
U Aung Moe Oo	Surveyor	BE (Chemical)
Daw Thet Shwe Yee Aung	Surveyor	B.Sc (Geology)

Daw Ru Par Kyaw	Electrician	BE (Electrical Power)
U Thant Zin Aung	Project Assistant	BE (Mining)

Table 2.4 Work Experiences of EIA Consultant Members

1. U Aye Thiha
Since E Guard was formed, U Aye Thiha is working for the company as Managing Director. He obtained his Bachelor Degree from University of Yezin in 1995. Furthermore, he got his Natural Resources Management Master Degree from Asia Institute of Technology in 2001. He was also awarded Master of Business of Administration from Yangon University of Economic in 2018. He also got Diploma in Computer Science from University of Yangon. He has a broad range of experiences in managing and implementing umerous projects (including local and foreign funded development as well as investment projects). At E Guard, he is responsible for cost estimation, contracting, staff recruitment, etc. Contact: 09-782042233; ayethiha@eguardservices.com
2.Daw Yu Wai Yan Thein Tan
Daw Yu Wai Yan Thein Tan is a senior consultant, who holds Transitional Consultant Certificate No 0071; described expertise are Master of Engineering with specializing in Environmental Engineering and Management from Asian Institute of Technology in Thailand and Master of engineering with specializing in Chemical Engineering from Mandalay Technology University. She has seven years consulting experience in the environmental field including her master‟s degree research. She also served as an engineer at Mandalay City Development Committee for three years. She oversees all aspects of E Guard‟s Environmental projects including peer review, quality assurance, budget and schedule. Her professional experience includes air and water quality analyses, environmental consulting, environment management and sustainable development, EIA , industry and environmental protection , and life cycle assessment: Contact: 09798788196: yu.yuwaiyan@gmail.com
3.U Win Myint
U Win Myint got his PhD degree of Environmental Science from Yangon University, BotanyDepartment, with the specific title of Ethnobotany in the Kachin and Yakhine ethnic people inMyanmar at 2004. Until 2008, he had been working as an associate professor in PanglongUniversity Shan State. After that, he quitted from the teaching career and joined the conservation NGO, BANCA, for participating the biodiversity survey in the fields of EIA assessments especially the hydropower sectors since 2007. Since them he has been doing research for data collection identifying of the terrestrial plants species and their ecological data also. After data collection data analysis, impact assessment and data compiling for the report development for doing projects.
4.Daw May Thu Htet
Daw May Thu Htet is an associate consultant in E Guard Environmental Services. She complent Master of Economics from Chaing Mai University,Thailand and Bachelor of Economics (Hons) from Yangon University of Economics. She has experience in prepare Social Survey, RAP survey form and fishery survey form, analysis and data interpretation and report writing of Social part in EIA. Her contributions on preparation of EIA for this project are literature and socio economics data analysis (Social and Economics Survey and interpretation). Contact: 09-778476209; maythuhtet094@gmail.com

<table>
<tr><th>5.Daw Khine Mar Kyaw</th></tr>
<tr><td>Daw Khine Mar Kyaw is an associate consultant in E Guard Environmental Services. She completed Master Degree with specializing in Environmental Engineering and Management from Asian Institute of Technology in Thailand and Bachelor of Pharmacy from University of Pharmacy, Mandalay. She participated in Myanmar Norway Hazardous Waste Management Plan. She has led in writing initial environmental examination (IEE) report for automobile technician school and service center, environmental impact assessment (EIA-scoping) report for production and sale of porcelain tableware project, and environmental conservation and prevention plan (ECPP) report for asphalt emulsion plant project. Before associate consultant, she had one year experience in Environmental Management Representative in one factory, which include format and procedure implementation, record keeping, leadership and knowledge sharing about ISO 9001, 14001 and 18001 to staffs, collaborate with other departments, clients & stakeholders (local & foreign), dealing with external auditor for ISO and Organic (local & foreign), energy conservation and sustainability, air pollution management, chemical control, solid waste control, wastewater treatment, preparing report and participating CSR activities in this factory. Contact: 09-797005212; khinemarkyaw@eguardservices.com</td></tr>
<tr><th>6.U Kyaw Soe Moe</th></tr>
<tr><td>U Kyaw Soe Moe is a Project Assistant who received Bachelor of Civil Engineering from Taunggyi Technological University in 2016. He has more than one year of experiences in conduction stakeholder engagement, public consultation, social survey and site visit. His contributions on preparation of EIA for this project are secondary data and laws and regulations collection and writing environmental quality report. Contant: 09-797005211; kyawsoemoe@eguardservices.com</td></tr>
<tr><th>7.U Sithu Min Naing</th></tr>
<tr><td>U Si Thu Min Naing is a project assistant, who received his Bachelor Engineer in Mining from the Technology University Mandalay. He has one year experience in communication with clients, regulators such as analytical laboratories.He is also familiar with conducting social survey.Contant: 09-09797005217; sithuminnaing@eguardservices.com</td></tr>
<tr><th>8.U Aung Moe Oo</th></tr>
<tr><td>Aung Moe Oo is a Project Assistant, who received his Bachelor Degree in Chemical Engineering from Technological University in 2016. He has experiences on environmental site survey and socio-economic surveys and Data Collection for (air, noise and vibration, water, soil), Data Computing and Analyzing. Another experience is to cooperate with clients and to conduct stakeholder‟s engagement and public consultations. In this project he assisted data collection for (air, noise and vibration, water, soil), data computing and analyzing. Contant: 09-09797005171; aungmoeoo@eguardservices.com</td></tr>
<tr><th>9.Daw Thet Shwe Yee Aung</th></tr>
<tr><td>Daw Thet Shwe Yee Aung is working as Project Assistant in E Guard Environmental Services. She completed her Bachelor Degree in Geology from University of Yangon in 2018. She has more than one experience in conduction stakeholder engagement and public consultation, site visit. She is currently assisting in preparing environmental reports, public consultation and information gathering processes.Contant: 09-797005173; thetshweyeeaugn@eguardservices.com</td></tr>
<tr><th>10. Daw Ru Par Kyaw</th></tr>
<tr><td>Daw Ru Par Kyaw is a Project Assistant, who received her Bachelor Degree in Electrical Power</td></tr>
</table>

Engineering from West Yangon Technological University in 2018. She has experiences on environmental site survey and socio-economic surveys. Another experience is to cooperate with clients and to conduct stakeholder‟s engagement and public consultations. She also participates in the activities of social survey and data entry. Contact: 09-797005185
11.U Thant Zin Aung
U Thant Zin Aung serves as a project assistant in E Guard Environmental Services Co., Ltd. He obtained his Bachelor Degree in Mining Engineering from Yangon Technological University in 2018. He currently contributes in preparing environmental related reports, conducting social survey and public consultation and gathering information for report preparation. Contant: 09-797005182; thantzinaung@eguardservices.com

3. POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

Polices, Legislations and guidelines in Myanmar that are of relevance to the project are summarized in Table 3.1 and are described in the following sections.

Table3.1 The Applicable Laws and Legal Commitments for Thigyit Coal Fired power plant Project in Southern Shan State

No.	Name of Laws and Regulations	Year
1.	Myanmar National Environmental Policy	2019
2.	The Environmental Conservation Law	2012
3.	The Environmental Conservation Rules	2014
4.	Environmental Impact Assessment Procedure	2015
5.	Emission Quality Standards Guideline	2015
6.	The Myanmar Investment Law	2016
7.	Myanmar Investment Rule	2017
8.	The Rights of National Races Law	2015
9.	The Electricity Law	2014
10.	Boiler law	2015
11.	The Public Health Law	1972
12.	Prevention and Control of Communicable Disease Law	1995
13.	The Control of Smoking and Consumption of Tobacco Product Law	2006
14.	Myanmar Fire Force Law	2015
15.	The Motor Vehicle Law (2015) and Rules (1987)	2015
16.	The Myanmar Insurance Law	1993
17.	Factories Act	1951
18.	Labor Organization Law	2011
19.	Settlement of Labor Disputes law	2012
20.	The Development of Employment and Skill Law	2013
21.	Minimum Wages Law	2013
22.	Payment of Wages Law	2016

23.	Workmen"s Compensation Act	1923
24.	The Leaves and Holiday Act	1951
25	Social Security Law	2012
26.	Petroleum and Petroleum and Product of petroleum law	2016
27.	The Petroleum Rules	1937
28.	Conservation of Water Resources and Rivers Law	2006
29.	Freshwater Fisheries Law	1991
30.	The Protection and Preservation of Cultural Heritage Regions Law	1998
31.	The Protection and Preservation of Antique Objects Law	2015
32.	The Protection and Preservation of Ancient Monument Law	2015
33.	The Engineering Council Law	2013
34.	Import and Export law (if boiler is imported)	2012

Source: E Guard Study Team

(1) Myanmar National Environmental Policy (2019)

Mission; to achieve a clean environment, with healthy and functioning ecosystems, that ensures inclusive development and wellbeing for all people in Myanmar.

Vision; to establish national environmental policy principles for guiding environmental protection and sustainable development and for mainstreaming environmental considerations into all policies, laws, regulations, plans, strategies, programmes and projects in Myanmar.

(2) The Environmental Conservation Law (2012)

This law stipulates the basic principles of environmental conservation. Its objectives are to construct a healthy and clean environment and to conserve natural and cultural heritage for the benefit of present and future generations; to maintain the sustainable development through effective management of natural resources and to enable to promote international, regional and bilateral cooperation in the matters of environmental conservation. To fulfill the requirements of this law the project proponent shall:

- Pay the compensation for damages if the project will causes injuries to environment;
- Purify, emit, dispose and keep the polluted materials in line with the stipulated standards, under section 14;
- Install or use the apparatus which can control or help to reduce, manage, control or monitor the impacts on the environment, under section 15;
- Allow relevant governmental organization or department to inspect whether performing is conformity with the terms and condition included in prior permission, stipulated by the ministry, or not, under section 24;

- Comply with the terms and conditions included in prior permission, under section 25;
- Abide by the stipulations included in the rules, regulation, by-law, order, notification and procedure, which are issued by said law, under section 29.

(3) The Environmental Conservation Rules (2014)

The rules provide guidance to incorporate environmental conservation into the sustainable development of the country. To comply with the rules the project proponent has to:

- Avoid emit, discharge or dispose the materials which can pollute to environment, or hazardous waste or hazardous material prescribed by notification in the place where directly or indirectly injure to public, under sub- rule (a) of rule 68.
- Avoid performing to damage to ecosystem and the environment generated by said ecosystem, under sub-rule (b) of rule 68.

(4) Environment Impact Assessment Procedure (2015)

Under the provisions of this Procedure, the project proponent has to:

- Be liable for all adverse impacts caused by doing or omitting of project owner or contractor, sub-contractor, officer, employee, representative or consultant who is appointed or hired to perform on behalf of project owner, under sub-paragraph (a) of paragraph 102;
- Support, after consultation with effected persons by project, relevant government organization, government department and other related persons, to resettlement and rehabilitation for livelihood until the effected persons by the project receiving the stable socio-economy which is not lower than the status in pre-project, under sub-paragraph (b) of paragraph 102;
- Fully implement all commitments of project and conditions included in EMP. Moreover the project proponent has to be liable for contractor and sub-contractor who perform on behalf of him/her have to fully abide by the relevant laws, rules, this procedure, EMP and all conditions, under paragraph 103;
- Be liable and fully & effectively implement all requirements included in ECC, relevant laws and rules, this procedure and standards under rule 104;
- Inform the completed information, after specifying the adverse impacts caused by the project, from time to time, under paragraph 105;
- Continuously monitor all adverse impacts in the pre-construction phrase, construction phrase, operation phrase, suspension phrase, closure phrase and post-closure phrase, moreover has to implement the EMP with abiding the all conditions included in ECC, relevant laws & rules and this procedure, under paragraph 106;
- Submit, as soon as possible, the failures of his or her responsibility, other implementation, ECC or EMP. If dangerous impact caused by this failure or failure should be known by the Ministry the project proponent has to submit within 24 hours and other than this situation has to submit within 7 days from knowing it, under paragraph 107;
- Submit the monitoring report dually or prescribed time by Ministry in line with the schedule of EMP, under paragraph 108;
- Prepare the monitoring report in accord with the rule 109;

- Show this monitoring report in public place such as library, hall and website and office of project for the purpose to know this report by public within 10 days from the date which the report is submitted to the Ministry. Moreover has to give the copy of this report, by email or other way which way agreed with the asked person, to any asked person or organization, under paragraph 110;
- Allow inspector to enter and inspect in working time and if it is needed by Ministry has to allow inspector to enter and inspect in the office and work-place of project and other work-place related to this project in any time, under paragraph 113;
- Allow inspector to immediately enter and inspect in any time if it is emergency or failure to implement the requirements related to social or environment or caused to it, under paragraph 115; and
- Allow inspector to inspect the contractor and sub-contractor who implement on behalf of project, under paragraph 117.

(5) Emission Quality Standards Guideline (2015)

The guidelines prescribe the performance level for effluent and emission control including pollution, dust, water, and wastewater effluent and discharge from development projects. The project proponent is required to maintain the emission, discharges or disposals within the level stipulated in this guideline

(6) The Myanmar Investment Law (2016)

The purpose; of this law is to ensure the appointing of employees, fulfilling the rights of employees, avoiding any injury to environment, social and cultural heritage, insure the prescribed insurance in line with the above law. It stipulates the following obligations of the project proponent:

- To appoint the nationalities in the various levels of administrative, technical and expert work by the arrangement to develop their expertise, in line with the sub-section (b) of section51of said law;
- To appoint the nationalities only in normal work without expertise, in line with the sub-section (c) of section51of said law;
- To appoint either foreigner or nationality with the appointment agreement in accord with the law, in line with the sub-section (d) of section51;
- To comply with the international best practices, existing laws, rules and procedures to not damage, pollute, and injure to environment, cultural heritage and social, in line with the sub-section (g) of section 65;
- To close the project after paying the compensation to the employees in accord with the existing laws if violates the appointment agreement or terminate, transfer or suspend the investment or reduce the number of employees , in line with the sub-section (i) of section 65;
- To pay the wages or salary to the employees in accord with the laws, rules, order and procedures in the suspension period, in line with the sub-section (j) of section65;
- To pay the compensation or injured fees to the respected employees or their inheritors if injury in or loss of part of body or death caused by work, in line with the sub-section (k) of section65;
- To stipulate the foreign employees to respect the culture and custom and abide by the existing laws, rules, orders, directives, in line with the sub-section (l) of section 65;

- To abide by labour laws, in line with the sub-section (m) of section65;
- To pay the compensation, to the injured person for damages if damage to environment or socio-economy is occurred by misuse of project, in line with the sub-section (o) of section 65;
- To allow to inspect in anywhere of project if Myanmar Investment Commission inform to inspect the project, in line with the sub-section (p) of section 65;
- To obtain the permission of MIC before EIA process and report back this process to Myanmar Investment Commission, in line with the sub-section (q) of section 65; and
- To insure the prescribed insurance by rules, under section 73.

(7) Myanmar Investment Rules (2016)

The Rules set out the following obligations of the project proponent

- To comply with the conditions of the permit issued by MIC and applicable laws when making the investment, under rule 202;
- To fully assist while negotiating with the authority for settling the grievance of the local community which has been affected due to investment, under rule 203; and
- To submit the passport, expertise evidence or document of degree and profile to the MIC office for approval if decide to appoint a foreigner as a senior management, technician expert or consultant according to sub-section (a) of section 51 of Myanmar Investment Law, under rule 206.

(8) Protection the Rights of National Races Law (2015)

- The purpose~~;~~ of this law is to ensure ~~to~~ full disclosure about the project to national races residents and to ensure cooperation with them. To comply with this law the project proponent has to disclose all the details about the project to the local residences and implement the project in cooperation with them.

(9) The Electricity Law (2014)

The purpose; of this law is to ensure the compliance with the conditions of permission for productions of electricity, abiding by any stipulation, implementing with the best practices and paying compensation in line with above law. It stipulated the following obligations of the project proponent:

- To implement the project with the best practices to reduce the damages on the environment, health and socio-economy, also will pay compensation for the damages and will pay the fund for environmental conservation, under sub-section (b) of section 10;
- To take the certificate of electric safety, issued by the chief-inspector, before the commencement of power generation, under section 18;
- To be liable for damages to any person or enterprise by failure to abide by the quality standards or rules, regulation, by-law, order and directive issued under said law according to sub-section (a) of section 21;
- To be liable for damages to any person or enterprise by negligence of project owner according to sub-section (a) of section 22;
- To comply with the permission for electric searching and generation, under sub-section (a) and (b) of section 26;

- To inform promptly to chief-inspector and head officer of related office while occurring of accident in electricity generation, under section 27;
- To comply with the standards, rules and procedure. Moreover will allow the inspection by respected governmental department and organization if it is necessary, under section 40; and
- To pay the compensation to anyone who is injured or caused to death in electric shock or fire caused by the negligence or omitting of the project owner or representative of project owner, under section 68..

(10) Boiler Law (2015)

The purpose~~;~~ of this law is to ensure the legal registration and safety in utilization of of boilers. It sets out the following obligations of the project proponent:

- To register the boiler, under section 5, 6, 7 and12;
- To apply to obtain the certificate to the relevant inspector in accord with the specified manner, under sub-section (a) of section 12;
- Submit application for using of the boiler at more than allowable pressure to the relevant inspector, under sub-section (a) of section 14 of said law (even though the certificate has been already issued);
- To submit the application for altering, repairing or renewing any steam-pipe, feed-pipe or any mounting or other fitting attached to such steam-pipe, feed-pipe or any mouthing or other fitting attached to the boiler to the relevant inspector under sub-section (a) of section 14 of said law.(even though the certificate has been already issued).
- To submit the certificate when requested by the relevant government department or organization as may be necessary, under section 15;
- To promptly inform to relevant inspector if any accident is occurred, under section 18;
- Not to use the boiler higher than allowable pressure under sub-section (a) of section 19;
- Not to repair and alter or force to repair and alter the safety value to exceed allowable pressure, under sub-section (b) of section 19 of said law and has to not do any act contained in sub-section (b) without permission, under sub-section (c) of section19;
- To engrave the register - number on the boiler in accord with the specified manner, under section 21;
- To carry out with the person who has the boiler repairer certificate on the receipt of notice to repair, alter, add or renew any boiler, steam-pipe, feed-pipe or any mounting or other fitting attached to such boiler, steam-pipe and feed-pipe, under sub-section (a) of section 24;
- Not to assign any person to charge the boiler used in the work except the person who operates and maintains the boiler, under sub-section (b) of section 24;.
- To import the boiler which is consistent with Myanmar standards or international standards, under section 26;
- To ensure that boiler attendant has to comply with the terms and conditions contained in boiler attendant certificate, under sub-section (b) of section 29 of said law and boiler attendant has not to use the boiler at more than allowable pressure, under section 31; and
- To allow the inspector to inspect the boiler, under section 40.

(11) The Public Health Law (1972)

The purpose; of this law is to ensure the public health include not only for employees but also resident people and cooperation with the authorized person or organization of health department. Following obligations of the project proponent are stipulate in this law:

- To cooperate with the authorized person or organization in line with the section 3 and 5;
- ***In Section 3*** - to abide by any instruction or stipulation for public health; and
- ***In Section 5*** - to allow any inspection, anytime, anywhere if it is needed.

(12) Prevention and Control of Communicable Diseases Law (1995)

The purpose; of this law is to ensure the healthy work environment and prevention the communicable diseases by the cooperation with the relevant health department. It stipulates following obligations of the project proponent:

- To build the housing in line with the health standards, distribute the healthful drinking water & using water and arrange to systematically discharge the garbage & sewage, under clause (9) of sub-section (a) of section 3;
- To abide by any instruction or stipulation by Department of health and Ministry of Health, under section 4;
- To inform promptly to the nearest health department or hospital if the following are occurred: (section 9).
    1. Mass death of animals including in birds or chicken;
    2. Mass death of mouse
    3. Suspense of occurring of communicable disease or occurring of communicable disease;
    4. Occurring of communicable disease which must be informed.
- To allow any inspection, anytime, anywhere if it is need to inspect by health officer, under section 11.

(13) The Control of Smoking and Consumption of Tobacco Product Law (2006)

The purpose: of this law is to ensure the creation of smoking area and non-smoking area in the power plant area for health and control of smoking. Following obligations of the project proponent are stipulated in this law:

- To keep the caption and mark referring that is non- smoking area in the project area, under sub-section (a) of section 9;
- To arrange the specific place for smoking in the project area and keep the caption and mark in accordance with the stipulations, under sub-section (b) of section 9;
- To supervise and carry out the measures so that no one shall smoke at the non-smoking area, under sub-section (c) of section 9; and
- To allow the inspection of supervisory body in the power plant area, under sub-section (d) of section 9.

(14) The Myanmar Fire Force Law (2015)

The purpose: of this law is to ensure prevention of the fire, provision of the precautionary material and apparatuses, if electricity and any inflammable materials such as petroleum are used in the project. The project owner, therefore, has to institute specific fire service in line with this law. This law stipulates that the project proponent has to:

- To institute the specific fire services, under sub-section (a)of section 25; and
- To provide materials and apparatuses for fire precaution and prevention, under sub-section (b) of section 25.

(15) The Motor Vehicles law (2015) and Rules (1987)

Purpose: This law is applicable to all vehicles used in construction period as well as in operation and production period. The project proponent has to abide by all necessary provisions of this law and corresponding rules, especially those related to air pollution, noise pollution and life safety.

(16) The Myanmar Insurance Law (1993)

The purpose of this law is to ensure necessary insurances against damages to the environment and injuries to public caused by the project at Myanmar Insurance Enterprise. This law stipulates that the project proponent has to:

- Insure all project vehicles against personal injuries (Section 15); and
- Against damages to the environment and injuries to public that may be caused by the project (Section 16).

(17) Factories Act (1951)

The purpose: of this law is to ensure the safety and cleaning of working place, drinking water, creation of nursing rooms and other required safty measures. The project proponent has to abide by all provisions for social warfare and occupational safety in this law.

(18) Labor Organization Law (2011)

The purpose: of this law is to ensure protection the rights of the employees, having the good relationships between the employees and employer and creation of an enabling environment to form and run labor organizations systematically and independently. To comply with this law the project proponent has to:

- To allow the labor organization to negotiate and settle with the employer if the workers are unable to obtain and enjoy the rights of the workers contained in the labor laws and to summit demands to the employer and claim in accord with the relevant law if the agreement cannot be reached (Section 17);
- To allow the demand for the re-appointment of worker who is dismissed by the employer without the conformity with the labour laws (Section 18);
- To send the representatives to the Conciliation Body in settling a dispute between the employer and the worker (Section 19);
- To allow the labour organization to participate and discuss in discussing with the government, the employer and the complaining employees in respect of employee"s rights or interest contained in the labour law (Section 20);
- To allow the labour organization to participate in solving the collective bargains of the employees in accord with the labour laws (Section21); and

- To allow the labour organization to carry out the holding the meetings, going on strike and other collective activities in line with the procedure, regulation ,by-law and directive of relevant Chief Labour Organization (Section 22).

(19) The Settlement of Labor Dispute Law (2012)

The purpose: of this law is to ensure negotiation and discussion between employees and project proponent, abiding the decision of Tribunal. Following obligations of the project are stipulated in this law:

- Not to be absent to negotiation within the stipulated time for complaint, under section 38;
- To not change the existing stipulations for employees within conducting period before Tribunal, under section 39;
- Not to close the work without negotiation, discussion on dispute in accord with this law and decision by Tribunal, under section 40 of said law; and
- To pay the compensation decided by Tribunal if violates any act or any omission to damage the interest of labor by reducing of product without efficient cause, under section 51.

(20) Employment and Skill Development Law (2013)

The Purpose: of this law is to ensure the job security and development of the employee‟s skill at the project owner‟s expense. To comply with this law the project proponent has to:

- To appoint employees with the contract in line with the provision of section 5;
- To carry out the training programs with the policy of Skill Development Body to develop the employment skill of employees who is appointed or will be appointed, under section 14;
- To pay monthly fees to the fund, which is fund for development of skill of employees, not less than 0.5 percentage of the total payment to the level of worker supervisor and the workers below such level under sub-section (a) of section 30; and
- To promise not to deduct from the payment of employees for above mentioned fund under sub-section (b) of section 30.

(21) The Minimum Wages Law (2013)

The purpose: of this law is to ensure that the project owner shall pay the prescribed minimum wages and clearly notify the workers of this wages and allow the inspection. This law stipulates that the project proponent has to:

- Pay the wages in line with section 12;
- Clearly notify the workers of the prescribed wages, under sub-section (a) of section 13;
- Correctly record the lists, schedules, documents and wages, report them to the relevant department and present them if requested while inspecting, in accord with the stipulations under sub-section (b)(c)(d) of section13;
- Allow the inspector to do necessary inspection, under sub-section (d) and (e) of section 13 and section 18;
- Allow medical leave of absence if the employee‟s health is not fit to work, under sub-section (f) of section 13; and

- Allow leave of absence without deducting from the wages if one of family dies, under sub-section (g) of section 13.

(22) Payment of Wages Law (2016)

The purpose~~:~~ of this law is to ensure the proper way of payment and undelayed payment to the employees. The obligations of the project proponent under provisions stipulated by this law are:

- To pay the wages in accord with the section 3 and 4;
- To submit the agreement~~s~~ of employees and justifiable reasons to department if it is unable to pay because of force majeure caused by natural disasters, under section 5;
- To abide by the provisions of section 7 to 13 in chapter (3) in respect of deduction from wages; and
- To pay the overtime fees prescribed by law to the employees under section 14.

(23) Workmen's Compensation Act (1923)

The purpose~~:~~ of this law is to ensure payment of compensations for injuries at work and other kinds of injuries. This law stipulates that the project proponent has to pay the compensation in line with the provisions under Section 13 of this law on case by case basis..

(24) The Leaves and Holiday Act (1951)

The purpose~~:~~ of this law is to ensure the right of employees to take paid leaves and holidays legally. The project proponent has to allow paid leaves and holidays in line with the law.

(25) Social Security Law

The purpose~~:~~ of this law is to ensure the social security for employees of the project. The project owner has to register to the social security offices and to pay the prescribed fund. Under the provisions of this law the project proponent has to:

- Register to the respected social security office, under sub-section (a) of section 11;
- Pay the social security fund for at least four types of social security included in sub-section (a) of section 15, under section 15;
- Pay the fund which has to be paid myself and together with the fund which has to be paid from their salary by the employees. Moreover, the project owner will pay the cost for paying the above mentioned fund only myself under sub-section (b) of section 18;
- Pay the fund for accidence, under sub-section (b) of section 48. (but this fund is not related to workmen compensation); and
- Make list and record prescribed in section 75 correctly and submit them to respected social security office, under section 75.

(26) Petroleum and Product of Petroleum Law (2017)

The purpose~~:~~ of this law is holding license for import and storage of petroleum and petroleum products, and the holder‟s compliance with the license terms. This law is applicable to the project because of the transportation and storage of fuel in all project phases. The obligations of the project proponent are:

- To transport the fuel by the vehicle or vessel which is licensed by the Ministry of Transportation and Communication under sub-section (a) of section 9;

- ➢ To abide by the procedures and conditions specified by the Ministry of Transportation and Communication under sub-section (e) of section 9;
- ➢ To transport after obtaining the transportation license issued by the Ministry of Natural Resource and Environmental Conservation under sub-section (b) of section 10;
- ➢ To allow inspection by the Ministry of Natural Resource and Environmental Conservation under sub-section (d) of section 10;
- ➢ To store the fuel in the tank which is licensed by the Ministry of Natural Resource and Environmental Conservation under sub-section (a) of section 10; and
- ➢ To show the sign of danger on the tank or container of fuel under section 11.

(27) The Petroleum Rules (1937)

The purpose÷ of the Rules is to ensure the project owner‟s compliance with the stipulations for transportation of oil. The project proponent has to abide by the provisions of chapter (3) for transportation as wellas the provisions of chapter (4) for storage.

(28) Conservation of Water Resources and Rivers Law (2006)

The purpose÷ of this law is to ensure the avoidance the disposal of stipulated materials into rivers and creeks. The project proponent has to:

- ➢ Avoid any activity to damage to the river, creek and water resource, under sub-section (a) of section 8.
- ➢ Avoid the violation of conditions stipulated by the directorate for prevention of water pollution, under sub-section (b) of section 24.

(29) Freshwater Fisheries Law (1991)

According to the sub-section (e) of section 2 of said law, the freshwater area includes any river, creek, pond and water area. If the project is located near a river or creek the safety of freshwater and aquatic lives must be ensured. The project proponent has to avoid any water pollution and disturbing to fish and other aquatic lives in any fresh-water area such as river or creek, under section 40 of this law.

(30) The Protection and Preservation of Cultural Heritage Regions Law (1998)

The purpose÷ of this law is to ensure the protection of cultural heritages and the cultural heritage area from the man-made damages and damages caused by natural disasters or. The obligations of the project proponent under provisions stipulated by this law are:

- ➢ To apply for the prior permission of Directorate of Ancient-Research to build the road, bridge or dam in the cultural heritage area (Section 13);
- ➢ Not to construct the building which are not in line with the stipulations prescribed by the Ministry of Culture in the cultural heritage area (Section 22).

(31) The Protection and Preservation of Antique Objective Law (2015)

The purpose÷ of this law is to ensure the protection of ancient monument, to inform about it if it was in the project area. The project proponent has to inform the village-tract or ward administrator if any antique objective is found in project area as stated in section 12.

(32) The Protection and Preservation of Ancient Monument Law (2015)

The purpose~~:~~ of this law is to ensure the protection of ancient monument.The obligations of the project proponent under provisions stipulated by this law are:

- To report the village-tract or ward administrators if any ancient monument under the ground or on the ground or under the water is found (Section 12);
- To apply for the prior permission of Department of Ancient Research Museum if the project area is located in the prescribed Ancient monument area (Section 15); and

To submit a written application to Department of Ancient Research and National Museum for the prior permission of chemical and solid waste disposals in the Ancient Monument area (Sub-section (f) of Section 20).

(33) The Engineering Council Law (2013)

The purpose~~:~~ of this law is to ensure the safety in technical and engineering work in the project. The project proponent has to:

- Appoint the employees~~,~~ who obtained the registration certificate issued by the Myanmar Engineering Council for technical and engineering works, under section 37; and
- Ensure that the employees who are engineers abide by the provisions of Myanmar Engineering Council law, prohibitions included in the rules, orders and directives issued under the said law, conditions included in the registration certificate issued by the Myanmar Engineering Council, under section 34.

(34) Import and Export Law (2012)

The purpose of this law is to ensure the legal import and export. The project proponent has to abide by the conditions contained in the permission for import if boilers or other machinaries are imported, under the provisions mentioned in Section 7.

4. Project Description and Alternative Selection

4.1 Project Background

Thigyit Coal Fired power plant is located at Thigyit village tract, Naung Ta Yar Township, Pa Oh Self-Administration Region in the Southern Shan State. The former Myanmar Electric Power Generation Enterprise under Ministry of Electricity and Energy had made an agreement with China Heavy Machinery Corporation (CHMC) of People‟s Republic of China on 27 August 2001 for this power plant. The coal fired power plant will efficiently produce 120 MW of electricity by using coal produced from Thigyit coal mine. The total investment amount is USD 45.150 million.

According to the project design, Thigyit coal mine can produce 20.7 million tons of coal. The type of coal from Thigyit coal mine is Lignite and the heating value is from (8100 Btu/lb) (or 4500 Kcal/Kg) to (10320 Btu/lb) (or 5700 Kcal/Kg). Thigyit coal mine owned by Eden group has been the main supplier of raw coals for the power plant since former Myanmar Electric Power Generation Enterprise under Ministry of Electricity and Energy took responsibility of the plant‟s operation. The type of boiler used is Subcritical Boiler (NG-240/9.8M). The water used for two boilers is fetched from the (Weir) Pump House which is 3.55 miles from the power plant and transport water into the settling pond via pipes.

Coal-fired power plant project was started on September 4, 2002 and operated the No.1 turbogenerator on 24 January 2004 and N0.2 turbogenerator on 3 May 2005. When operation phase was started, it was found that the heating value of raw coal is different from the value of 10320 Btu/lb in project design. The actual heating value of Lignite from Thigyit coal mine is from (7686 Btu/lb) (4270 Kcal/Kg) to (or 8208 Btu/lb) (or 4560 Kcal/Kg) according to the JCOAL (Japan Coal Energy Center) study conducted in September 2012.

According to the operation records, the heating value didn‟t match with calculated value in the project design so 1000 tons of coals per machine have been utilized more than 860 tons of coal that is identified in the project design. Moreover, the actual heating value is insufficient to reach the required steam pressure of about 240 ton per hour and the boiler furnace temperature is about 650-800 ˚C instead of the designated temperature of 1080˚C due to the low heating value of coal. The power plant, therefore, can actually produce only 45-55 MW of electricity although intended production rate of the project design is 60 MW.

After the two generators were operated, unstable electric energy and machine error generated machine trips which in trun resulted in lower rate of electricity production. Since low heating value of coal also caused damage to the machines used for coal transportation, cruching, and controlling and storage of fly ash, there are problems in installing spare parts in time

Consequently, the turbines broke down and finally stopped to work. Because of the long storage time of raw coal, bad smell was produced by the reaction of coal dusts with surrounding air. At that time, the operators didn‟t know the fact that fly ash produced from ESP can be reused in cement factory as ingredient and the fly ash was disposed near the project area and caused impacts on the surrounding environment and villages. The former Myanmar Electric Power Generation Enterprise under Ministry of Electricity and Energy had made an agreement with Ma Naw Ayer Co., Ltd. from 2008 to 2018 which had been cooperated with the operators to sell out the fly ash can be reused in cement factory as ingredient.

For the national electricity requirements, the above two turbines have been operated for 10 years and then, the No.1 turbine and No.2 turbine broke down on 19 March 2014 and on 5 November 2014 respectively.

With the approval of MIC, the former Myanmar Electric Power Enterprise under Ministry and Energy had made a lease agreement with Wuxi Hua Guang (Myanmar) Limited on November, 2015. The objectives of the agreement were to renovate the inefficient and profitless old design of Thigyit Coal Fired Power plant, to make new investment for fulfilling the national electricity requirements and to reduce the environmental impacts in accordance with the international standards. The duration of the contract is 22 years. Wuxi Hua Guang Electric Power Engineering Co., Ltd. maintains rotor shafts of the No.1 and No.2 turbines at the Shang Hai industry, the original source of turbines. The impaired parts of the turbines were also maintained and systematically substituted with the new ones. And impaired parts of ESP have been substituted with new ones as adviced by the Japanese Technicians who were employed as environmental conservation consultants for emission control. An Ash packing machine has also been installed for Fly ash controlling system.

Moreover, Flue Gas Desulfurization System (FGD System) has been installed to reduce the emission of Sulphur dioxide for DeSox Control System and Selective Non-Catalytic Reduction System (SNCR) and Selective Catalytic Reduciton System (SCR) have also been installed to reduce the emission of Nitrogen oxides for DeNox Control System. LED Board was installed as Continuous Emission Monitoring System (CEMS) at the main gate of the power plant to show the (Ash, Sox, Nox) emission data of the control room. At LED board, the data are shown together with the international standard values to compare the emission conditions of the power plant with those standards.

With the permissions of Shan State Government and Ministry of Electricity and Energy, the No.1 turbine operated from 20.12.2016 to 27.12.2016 and No.2 turbine also operated from 23.1.2017 to 30.1.2017 to find out whether the factory can be operated within the National Emission Guideline values. During this period, the emission values are found within the standard values.

During the testing period, the ministers from Shan State Government and representatives from relevant local organizations were invited to the power plant. Based upon the results of testing period, the maximum load of each turbine was calculated as 50 MW.

At this time, the total cost for first stage maintenance activities is about USD 25 million dollars. Wuxi Hua Guang Electric Power Engineering Co., Ltd. is negotiating with Shan State Government, Pa-Oh Self-administrative Region and Electricity Production Enterprise under the Ministry of Electricity and Energy to get obtain the permissions for Commercial Operation Date (COD).

At Stake Holder Meeting held in briefing hall of Thigyit Coal Fired Power Plant on April 29, 2017, Ministry of Shan State Government decided (i) to form the test run implementation committee for 1 year, and (ii) to form the inspection committee to inspect the test run activities under the Guideline values for 1 year. According to the section 5(d), 5(e) of regular cabinet (4-5/2017) of Shan State Government, these two committees were approved on May 23, 2017.

With the approval of Shan State Government and cabinet 24(15/961)/7/Myanmar President Office of Commercial Department, Myanmar President Office, test run of No.(1) and No.(2) turbines of Thigyit Coal Fired Power Plant started for 1 year started from May 26, 2017.

4.2 Project Location, Overview Map and Site Layout Maps

Thigyit Coal Fired Power Plant is located at Thigyit village tract, Naung Ta Yar Township, Pa Oh Self-Administration Region in the Southern Shan State at a coordination of Latitude 20°25'53.09" N and 96°12.36" E Longitude. Almost all of the land uses in the vicinity of the project sote are agricultural lands and residential areas. Major similar economic activities near the project area are comprises of Nagar Cement Plant, Nagar Quarry Site, Eden Coal Mine.

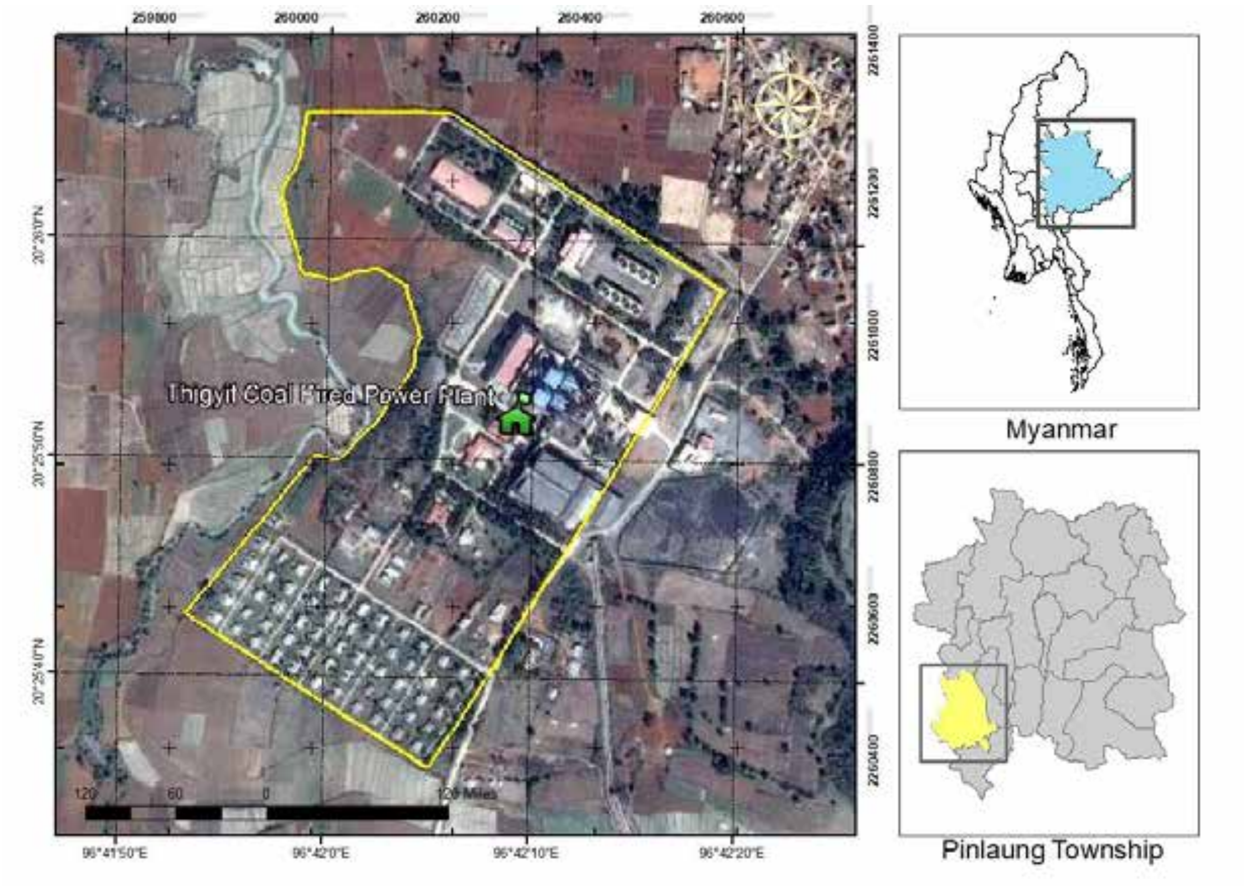


Figure 4.1 Project Location Map

Source: E Guard Study Team

4.3 Description of the Project

4.3.1 Project size

The total land area of proposed project for power plant is 45.05 hectares (111.34 Acres).

4.3.2 Power Plant Design Concept

Equipped with two 60MW two steam turbines (N60-6 83), 75000kVA type two steam generators (QF-60-2) and two pulverized coal-fired boilers (NG24079 8M) and the existing power plant is designed to produce the 120 MW export power (net of auxiliary loads), throughout the seasonal ambient conditions. The duration of production is 22 years, allowing for the performance degradation. The project proponent is planning to install coal-dried plant at the second phase.

4.3.3 Production of Process

The power plant is designed to provide the 120 MW export power (net of auxiliary loads), throughout the seasonal ambient conditions and for the duration of a 22 years, allowing for the performance degradation.

The existing power plant is designed to generate the power with 60MW two steam turbines (N60-6 83), 75000kVA type two steam generators (QF-60-2) and two pulverized coal-fired boilers (NG24079 8M).At the second phase, the proponent is planning to install coal-dried plant.

Coal-fired plants produce **electricity** by **burning coal** in a boiler to produce steam. The steam produced, under tremendous pressure, flows into a turbine, which spins a generator to create **electricity**. The steam is then cooled condensed back into water and returned to the boiler to start the process over.

The power station uses a conventional coal-fired technology at the initial stage which produces electricity by the burning of coal and air in a steam generator, where water is heated to produce high pressure and high temperature steam. The steam flows through a series of steam turbines which spin an electrical generator to produce electricity. The exhaust steam from the turbines is cooled, condensed back into water, and returned to the steam generator to repeat the process again.

4.3.4 Main component of Thigyit Coal-fired Power Plant

(1) Heat generation in the boiler

(a) Pulverized Coal-fired Boiler

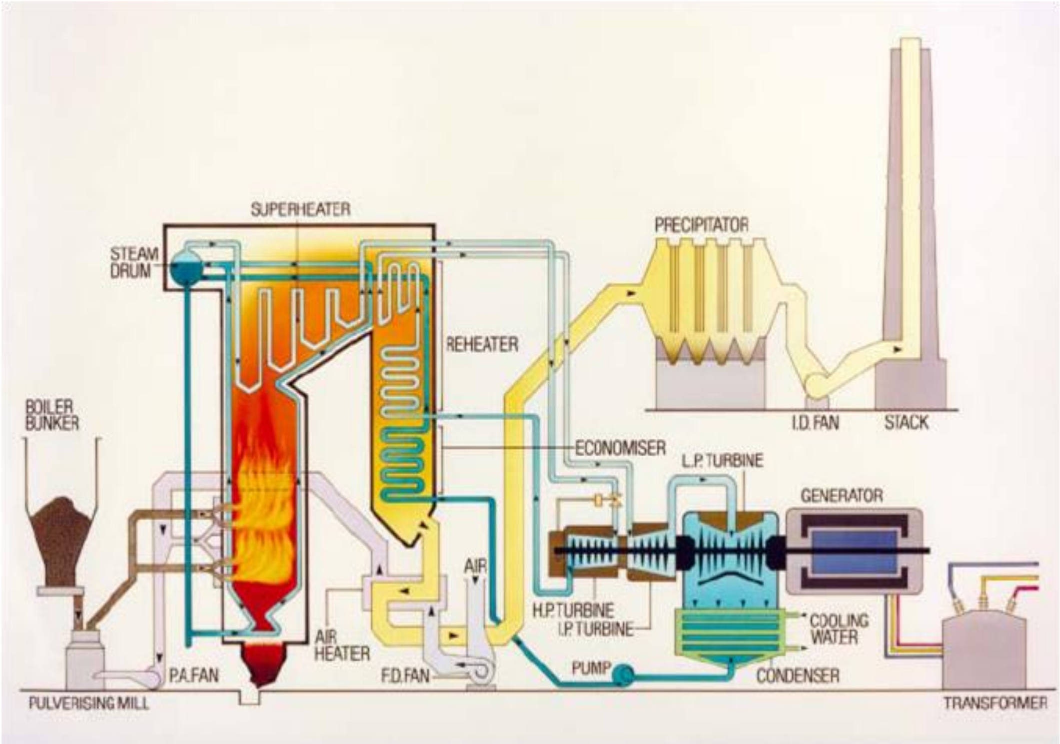


Figure 4.2 Pulverized Coal-fired Power Diagram

Coal is burnt in the boiler furnace to produce heat. Carbon in the coal and Oxygen in the air combine to produce Carbon Dioxide and heat. The crushed coal feed is either stored temporarily in bins or transported directly to the cyclone furnace. The furnace is a large cylinder jacketed with water pipes that absorb some of the heat to produce steam as well as to protect the burner itself from melting down. A high powered fan blows the heated air and chunks of coal into one end of the cylinder. The hot combustion gases leave the other end of the cylinder and enter the boiler to heat the water filled pipes and produce steam.

Thermal NOx is the result of high-temperature coal combustion. Each of the existing two boilers contains three branched low NOx burner which are designed to control air and fuel mixing at each burner. By reducing the peak flame temperature at the first two burners formation of NOx in the process is significantly decreased.

(b) Raw Material Collection and Preparation

Coals transported from Thigyit coal mine by conveyor belt will be used to fuel the power plant. That mine is an open cast dug on benches which is located 1.43km south-east direction from the power plant.

Pieces of raw coal from the mine with a size of 8 inches in diameter are directly sent to the indoor storage yard where are stored temporarily and then transported into the coal crusher. In the first stage, coal is crushed into pieces smaller than 1 inch in diameter by hammer crusher and ball mill. While the coal is being crushed by the rolling action in the pulverizer, the hot air dries it and blows the usable fine coal powder out to be used as fuel. The powdered coal from the pulverizer is directly blown to a burner in the boiler. The burner mixes the powdered coal in the air suspension with additional pre-heated combustion air which transports the pulverized coal to the steam generator furnace.

Figure 4.3 Conveyor and Indoor Coal Yard

(2) Electricity Generation

(a) Turbine and Generator

The electricity generated at the Power Station comes from a generator driven by a steam turbine. Highly purified water, pumped through pipes inside the boiler, is turned into steam by the heat (650-900 Degrees Celsius) within the walls and heats the water in the tubes. The water rises through the tubes into the boiler drum, turning into steam first and then into superheated steam at 215 degrees Celsius. Steam with high pressure and high temperature is fed into the multi-stage steam turbine. As the steam passes through each successive stage of the turbine both the temperature and pressure fall as the steam drives the turbine shaft round at 3,000 rpm. The turbine shaft is connected to the shaft of the generator, where magnets spin wire coils to produce electricity.

After passing through the turbine, the steam is drawn into a large chamber in the basement of the power plant. In these steps, millions of gallons of cooling water are pumped through the condenser. The cooling water within the condenser is returned to cooling tower where it‟s cooled to be reused. The cooling water in the tubes converts the steam back into water that is returned to the boiler to repeat the process again. The cooling water is transported to its source without any contamination.

Figure 4.4 Turbine and Generator

(b) Water Treatment System

The incoming raw water from Upper Balu Creek Pump Station passes through the clarifying and valve less filtration pool at a rate of 320m^3/hr and then stored in the settling pond with 100800 ton containing capacity for factory and domestic uses. In fact, some of those water is stored in 100 m^3 storage tank for boiler feed water treatment system. In the steam boiler, high purified feed water is required to ensure proper operation of steam generation system. Multi-Media filtering is the first stage of treatment system which reduces the level of suspended solids in incoming feed water. Incoming feed water is high in suspended solids that can cause a high-pressure drop and reduce the effectiveness of downstream filtration equipment such as reverse osmosis membranes. The second stage is Active Carbon Filtering at which the feed water passes through the activated carbon bed to be dechlorinated by dosing with Sodium Hydrogen Sulfite ($NaHSO_3$). As water softening system is also important stage in water treatment system, sodium Chloride (NaCl) is used as a water softener salt to remove calcium and magnesium ions which can cause scaling and damage in the boiler tube. And then, Reverse Osmosis System is used to remove the ions and larger particles from the incoming feed water. Electrodeionization (EDI) system is usually a polishing treatment to reverse osmosis system and is used to deionize water and separate dissolved impurities from feed water. Finally, the incoming water passes through the Demineralized Water System to remove the minerals and salts from the water.

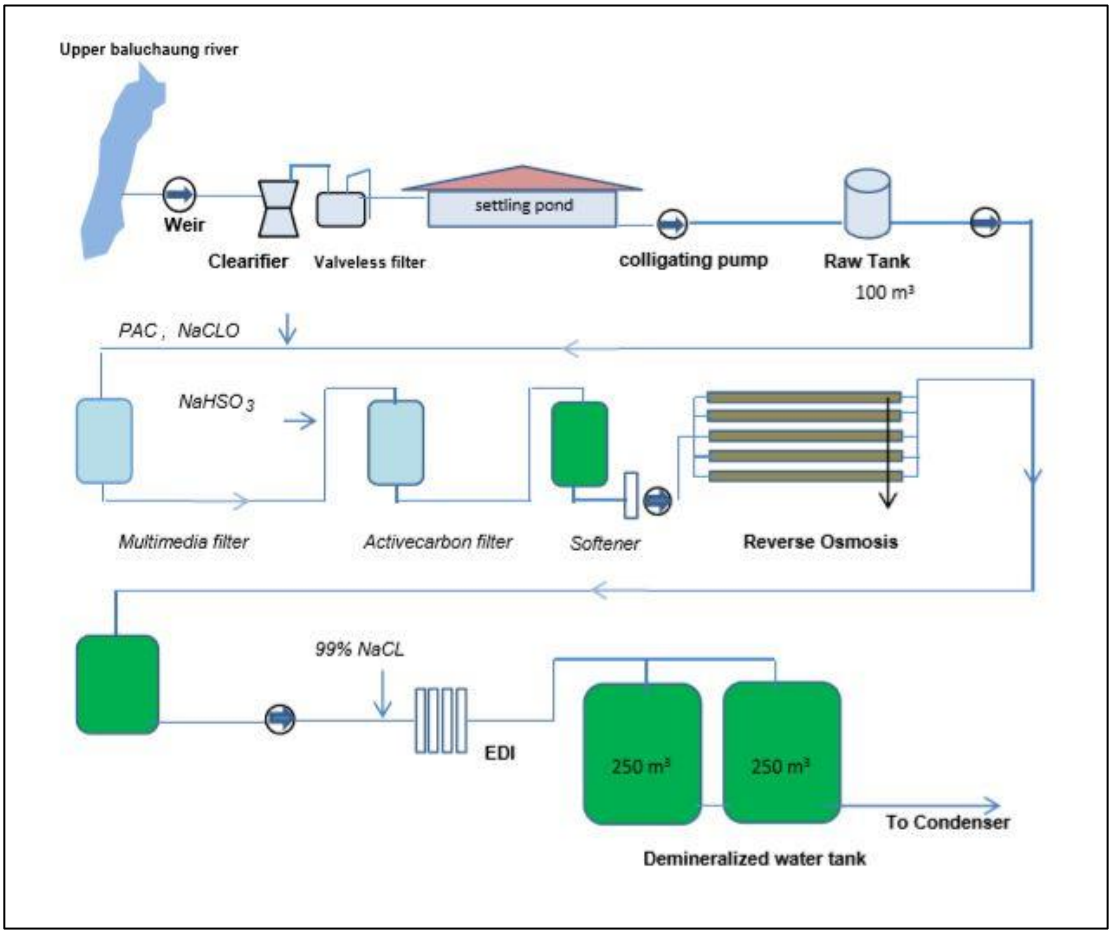


Figure 4.5 Boiler Feed water Treatment Process of Thigyit Coal-fired Power Plant

Figure 4.6 Upper Balu Creek Pump Station and Water Treatment Plant

Purified exhaust steam from the turbine enters the condenser chamber and condenses upon contact with the outside water containing cold tube connected with cooling water tower. Condensate water is returned back to the boiler by condensate pump and recycled as a boiler feed water. Boiler feed water actually as the combination of condensate water and treated water from water treatment plant.

As water is naturally mixed with residual oxygen, it is required to apply chemical dosing berfore using the boiler feed water in the process. Deoxygenation system, therefore, is applied for removal of residual oxygen to avoid corrosion in the system by using Hydrazine. Moreover, pH level can be changed by carbonate compound as the result of dissolving Carbon dioxide in the feed water. Ammonium Hydroxide Solution Dosing is also important to balance the pH value of feed water as well as to avoid the carbon dioxide corrosion. pH level changes and boiler sludge concentrations created by calcium coagulation may be avoided by Trisodium Phosphate (Na3PO4) Dosing treatment.

Water from the cooling tower circulates through the condenser, absorbs heat from the steam and returns to the cooling tower. Cooling effect can be declined as a result of calcium bicarbonate clogging in copper brass tube due to the heat absorption in the condenser. Sodium Tripolyphosphate Dosing is thus used to avoid the calcium bicarbonate clogging process and sodium hypochlorite dosing is used to eliminate the bacteria.

Figure 4.7 Cooling Tower of Thigyit Coal-fired Power Plant

(3) Air Pollution Control System

Coal is not a pure carbon and it contains non-flammable mineral residues. The heavier part of the residues called bottom ash winds up in a pan at the bottom of furnace whereas lighter part called fly ash is carried along by the flue gases as a fine gray dust. Electrostatic precipitators are required to capture all the fly ash. Additionally, another pollution-abatement technology called Selective Non-Catalytic Reduction System (SNCR) and Selective Catalytic System (SCR) are used to neutralize the nitrogen compounds within the flue gases. Moreover, two Low NOx burners also help to reduce nitrogen compounds while flue gas is passing through the furnace. Coal also contains a small amount of sulfur which burns to produce sulfur dioxide. Desulfurization System (FGD System) is also to reduce the emission of Sulphur dioxide for DeSox Control System. Thi gyit Coal-fired Power Plant conducted to mitigate the air pollution by installing air pollution control facilities above mentioned.

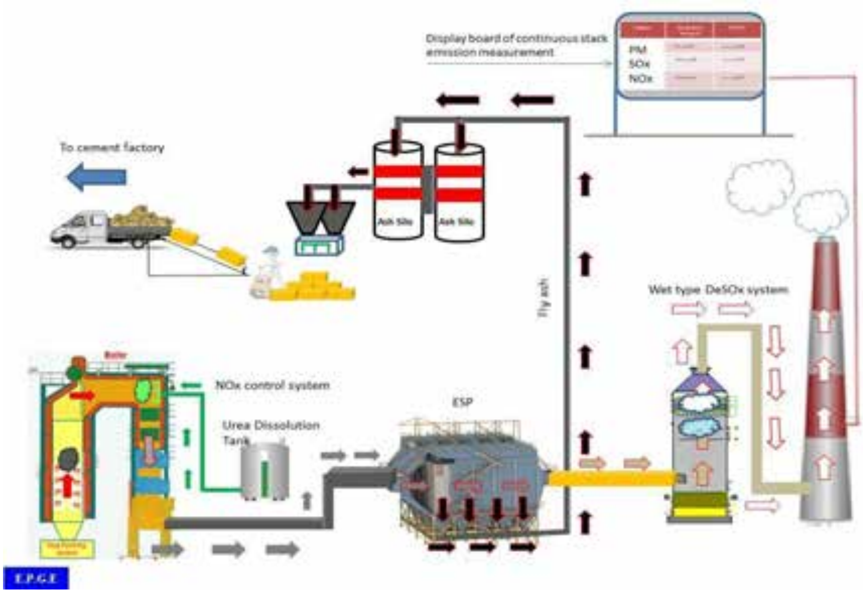


Figure 4.8 Air Pollution Control System Diagram of Thigyit Coal-fired Power Plant

(a) Selective Non-catalytic Reduction (SNCR) System

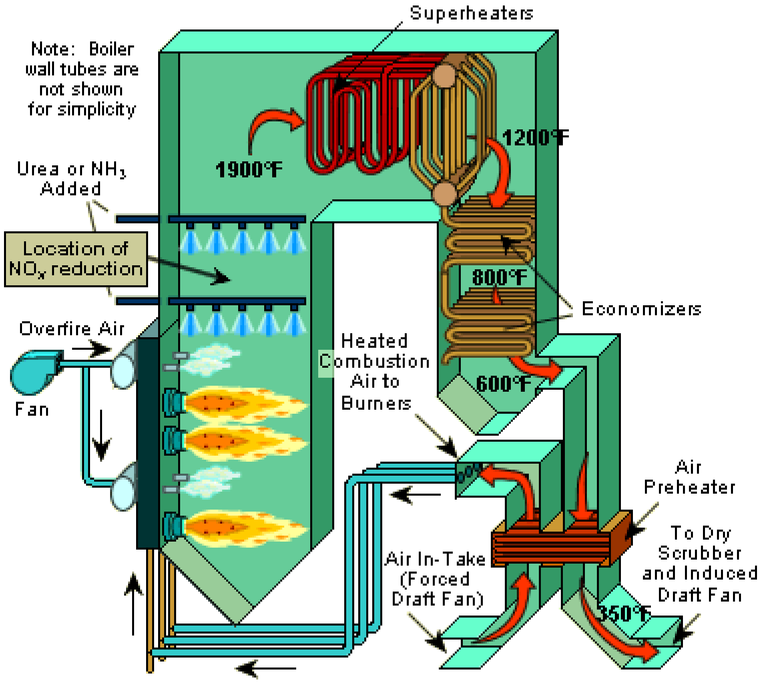


Figure 4.9 SNCR system

In Thigyit Coal-fired Power Plant, Selective Non-catalytic NOx reduction (SNCR) involves injection of a reducing agent – urea- into the flue gas with the optimum temperature of 800-900°C placed upper the Low NOx burner. At a high temperature of 870-1150°C, urea reacts with NOx from the combustion gases to yield nitrogen gas (N2) and water vapour (H2O), and consequently, 70% of NOx can be removed.

Figure 4.10 SNCR system Installation

(b) Selective Catalytic Reduction (SCR) System

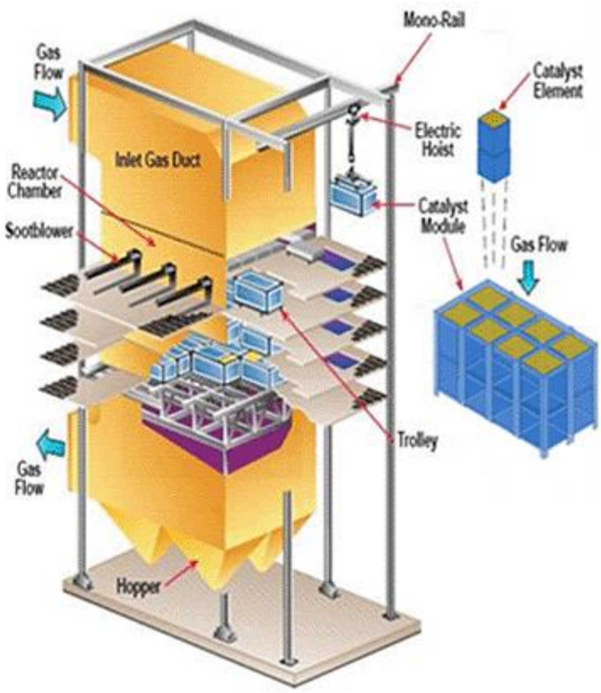


Figure 4.11 SCR system

Thigyit Coal-fired Power Plant uses the combination of SNCR and SCR system for the reducing NOx compound. After the flue gases pass through the SNCR system, Selective catalytic NOx reduction (SCR) system is applied as post- formation of NOx control technology that uses a Titanium dioxide (TiO_2) and Vanadium pentoxide (V_2O_5) catalyst to optimize the reaction between NOx and urea to produce nitrogen and water.

Figure 4.12 SCR system Installation

(c) Electrostatic Precipitator (ESP)

Figure 4.13 Electrostatic Precipitator (ESP)

Electrostatic precipitators (ESP) are widely used in pulverized coal-fired power plant. After passing through the SNCR and SCR system, the flue gas passes through the ESP device to remove suspended dust particles by applying electrostatic charge and collecting the particles on charged plates and then fly ashes are collected in the ESP hoppers which are connected with ash silo.

Figure 4.14 ESP Hoppers and Ash Silo

Fly ashes, a byproduct of the palnt, can be used as a raw material for production of cement. Therefore, Thigyit Coal-fired Power Plant is carrying out marketing of fly ashes as a byproduct jointly with Manaw Ayeyar Co., Ltd. After storage in ash silo temporarily, fly ashes are packaged, sold and shippe to the customers at fly ash packaging factory.

Figure 4.15 Fly ashes packaging factory and fly ashes packaging

Since discharged bottom ashes can be reused in manufacturing of block bricks, disposal of ashes in the project site is avoided. A brick manufacturing factory was built near water cooling tower of power plant in April 2017. By mixing 20 tons of bottom ashes, grounded stones (aggregates) and cement proportionally, 5000 bricks can be produced everyday.

Figure 4.16 Brick Factory

(d) Flue Gas Desulfurization system (FGD) Systems

Figure 4.17 Desulphurization system (FGD) with two layer of reagent MgO scrubbing

Magnesium Oxide (MgO) reagent is used to neutralize the sulfur compounds from the flue gas. The MgO slurry is injected into the FGD system using spray scrubbing process. The flue gas after passing the electrostatic precipitator (ESP) is absorbed to the FGD system where the gas flows upward through the spray MgO slurry in countercurrent downward flow direction (gas up, spray down) and then the flue gas passes through the mist eliminator which is located above the MgO spray scrubbing system. Mist eliminator prevents liquid droplets from escaping into the atmosphere and it also protects downstream equipment by preventing caustic problems.

The sprayed slurry in contact with SO_2 from the flue gas produces Magnesium sulfate ($MgSO_4$). This reaction can be expressed as follow;

$MgO + H2O = Mg(OH)_2$

$Mg(OH)_2 + SO_2 = MgSO_3 + H_2O$

$MgSO_3 + H_2O + SO_2 = Mg(HSO_3)_2$

$Mg(HSO_3)_2 + ½ O_2 = MgSO_4$

$MgSO_4$ sludge and water drain out from FGD system to the oxidizing pond which can neutralize acidic compound within the sludge with reagent Sodium Hydroxide (NaOH) named sodium acoustic. When the oxidizing pond is full of sludge, frame filter press is used for separation of solids from liquid of the sludge. After dewatering in the filter press, the solids are discharged as a filter cake in factory disposal site. Finally, the sludge of Sodium sulfate (Na_2SO_4) and Magnesium Hydroxide ($Mg(OH)_2$) is discharged as follows:

$MgSO_4 + 2NaOH + H_2O = Mg(OH)_2 + Na_2SO_4$

Figure 4.18 MgO3 Sludge Oxidizing Pond and Frame Filter Press

(4) Continuous Emission Monitoring System

Continuous Emission Monitoring System (CEMS) is the process to measure emission of pollutants emitted into the atmosphere. Particulate matter and gas concentration or emission rate can be determined by installing Gas Analyzer at the stack of the Power Plant. LED Board is connected with Continuous Emission Monitoring System (CEMS) and installed at the main gate of the power plant to show the ash, Sox and NOx emission data of control room. At LED board, the data are shown together with the international standard values to check the emission conditions of the power plant.

Figure 4.19 Control Room and Monitoring Analysis Room

Figure 4.20 LED Board Installation at the main gate of Power Plant

4.3.5 Project Facilities

Existing Project facilities comprise coal yard, conveyor belt, coal crushing unit (i.e. hammer crusher, ball mill), coal banker, heat generation unit (i.e. oil burner, coal exhaust fan, steam drum, air preheater), turbine generators, steam turbine, air cooled condenser, stack, bottom ash tank, pollution control (i.e. electric precipitator, desulfurizer), power dispatching facilities (i.e. Substation), water supply system (including pump station, pretreatment facilities (clarification and sedimentation), demineralization (filtration, Reverse Osmosis EC), and wastewater treatment facilities (sedimentation pond).

Project buildings include main power plant building to house in-door power production equipment and technical support facilities such as:

- Administration buildings,
- Workshop and warehouse, and
- Staff quarter.

4.3.6 Utilities

(1) Type of Coal

The type of coal is from lignite in outer zone of to sub-bituminous in inner zone. The calorific value provided by MEPE is about 10312 Btu/lb (~5700 kcal/kg). Coal analysis is shown in table 4.1.

Table 4.1 Coal Analysis

Composition	Percentage
Fixed carbon	35.95%
Volatile matter content	39.00%
Ash	9.63%

Sulphur	0.93%
Water	15.32%
Calorific value	10312 Btu/lb (~23984 kJ/kg, ~5700 kcal/kg)
Specific Gravity	1.29

Source: Basic Design Concept of Thigyit Coal-fired Power Plant

The main raw material, coal will be acquired from Thi gyit coal mine which is located about 1.5 miles South-east of the project site. The annual coal requirement for the two existing boilers is about 650,000 tons. A total of 20.7 Million tonnage of Lignite type coal is expected to be able to exploit from the Thigyit coal mine run by Eden Group of Company locating at the distance about 0.5 miles North East of the Thi gyit Coal-fired Power Plant.

(2) Fuel

The power plant will be supplied by diesels oil from local market. The estimated fuel consumption by oil burner per hour is approximately 225 gallons for starting process. Diesels oil will be stored within the project premises by the tanks.

Figure 4.21 Fuel Storage Tank

(3) Water

Water pumped out from the Upper Balu Creek supplied to the power plant. The pump station is located at the upstream of the project site. The annual maximum water requirement is shown in table 4.3.The pumped water is transported to the plant by pipeline and treated at the site using conventional chemical coagulation, sedimentation, and filtration process followed by advanced treating technology such as reverse osmosis and electrochemical process to remove all impurities that could deteriorate the steam pipelines and boiler walls.

Table 4.2 Maximum Requirement of Inputs

Inputs	Unit	MAXIMUM REQUIREMENT (Year)
Coal	Ton	650,000

Diesel	Cubic meter	150
Water	Cubic meter	83000
Electricity	Gwh	90

(4) Human Resource Requirement

The proponent employs 332 staffs for Thigyit coal fired power plant process. Organization and numbers of staff for operation processes are described in Figure 4.22 and details of staff requirements are described in Appendix.

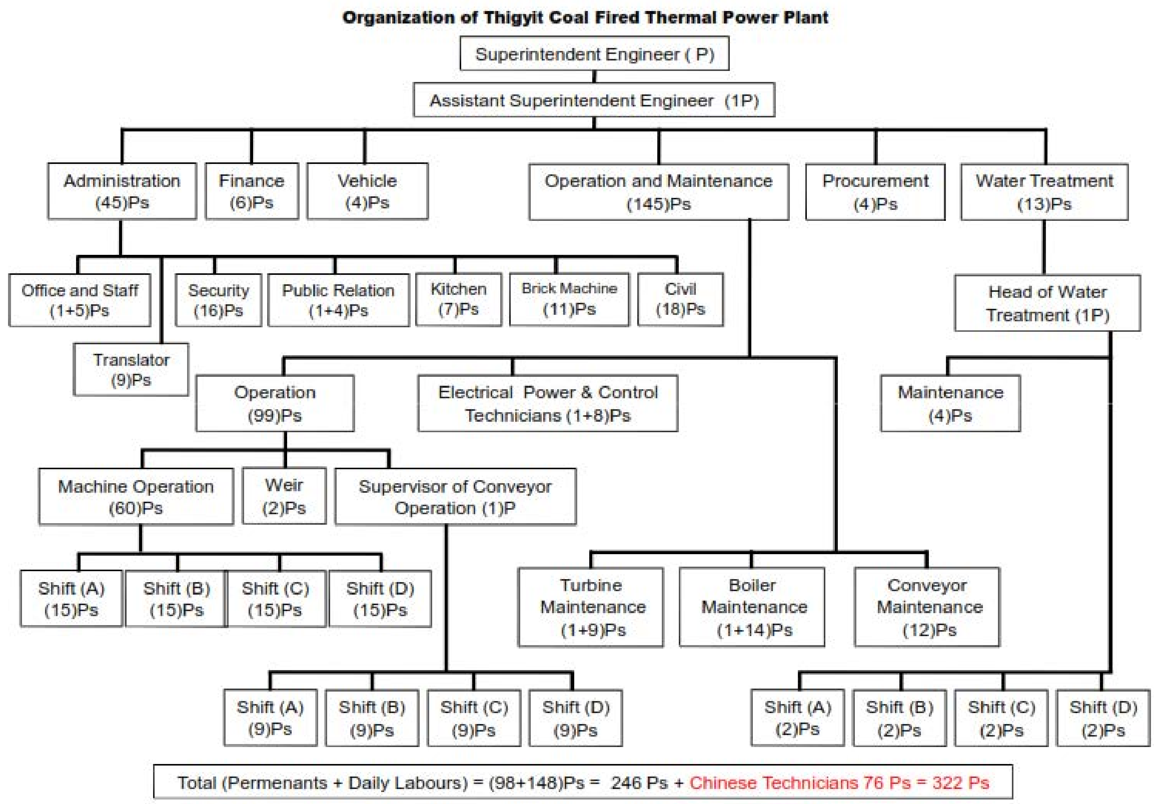


Figure 4.22 Organization Chart of Thigyit Coal Fired Thermal Plant

4.4 Project Alternatives

Process alternatives relate to alternative technologies that could be implemented at a new coal fired power station, and include combustion, cooling and atmospheric emission control technology alternatives and ash disposal alternatives. Each of these is discussed below. Primarily, three types of alternatives are available for coal-fired power generation based on their operation temperature and pressure in the market as described below:

(1)Conventional or subcritical coal-fired power plants, which make water boils to generate steam that activates a turbine. Large Subcritical thermal power plants with 170 bar and 540 / 540 ° C (SH / RH) operate at an efficiency of 38 %.

(2) Supercritical (SC) and ultra-supercritical (USC) power plants operate at temperatures and pressures above the critical point of water, i.e. above the temperature and pressure at which the liquid and gas phases of water coexist in equilibrium, at which point there is no difference between water gas and liquid water. This result in higher efficiencies – operating at 250 bar and 600/615 ° C can have efficiencies in the range of 42 %.

(3) Supercritical (SC) and ultra -supercritical (USC) power plants require less coal per megawatt-hour, leading to lower emissions (including carbon dioxide and mercury), higher efficiency and lower fuel costs per megawatt. Ultra supercritical units at 300 bar and 615 / 630 °C will still increase the efficiency up to 44 %.

In subcritical units the drum acts as a fixed evaporation end point. The furnace water walls act as the evaporator. The percentage of Superheat in supercritical units is higher than subcritical units. Because of this the furnace tubes act more as superheaters than waterwalls. This necessitates the use of higher grade of materials like alloy steels in the furnace.

In supercritical units the water entering the boiler has to be of extremely high levels of purity. Supercritical boilers do not have a steam drum that separates the steam and the water. If the entering water quality is not good, carryover of impurities can result in turbine blade deposits.

Supercritical power plants use special high grade materials for the boiler tubes. The turbine blades are also of improved design and materials. In fact, the very increase in higher pressure and temperature designs are dependent on the development of newer and newer alloys and tube materials.

4.4.1 Combustion Technology Alternatives

There are a suite of combustion technology options potentially available for new coalfired power stations. Wu Xi Hua Guang (Myanmar) is proposing to refurbish the existing pulverized fuel combustion boilers. The proposed technologies and other potential combustion technologies are described below.

(1) Pulverized fuel combustion boiler

With pulverized fuel combustion technology, the coal is first pulverized into a very fine dust, and then blown into the boiler where it is burned much in the manner of a combustible gas. It should be noted that existing coal-fired generation employs pulverized fuel technology as like in the other countries.

(2) Fluidized bed combustion boiler

A fluidized bed is a layer of solid particles kept in turbulent motion by bubbles of air being forced into the bed from below. The CFB mode of fluidization is characterized by a high slip velocity between the gas and solids and by intensive solids mixing. High slip velocity between the gas and solid, encourages high mass transfer rates that enhance the rates of the oxidation (combustion) and desulfurization reactions, critical to the application of CFB"s to power generation. The coal burnt in a fluidized bed combustion boiler is generally low grade coal, which is theoretically, less costly. Heat transfer to the water and steam in the tubes takes place from the hot solids and gases. Using a limestone bed can capture the sulphur in the coal to produce calcium sulphate as a waste product. As the bed operates at less than 900˚C, thermal nitrogen oxide emissions are reduced.

This technology is internationally unproven in unit sizes greater than 300 MW. To obtain the economies of scale required for this project, the individual station unit sizes need to be between 600 MW and 1000 MW. In the case of proposed power plant, it can be said that as a most efficient technology since the plant is designed for 120MW using low grade coal from Tygit coal mine

(3) Coal gasification technologies

Coal gasification involves the creation of a combustible synthesis gas (syngas) through the partial oxidization of coal. The syngas can then be used as fuel for power generation or other applications. Integrated coal gasification combined cycle (IGCC) power plants and underground coal gasification (UCG) are two such technologies. IGCC power plants convert the coal to gas and then burn the gas to create electricity.UCG technology partially oxidizes the coal in situ before the syngas is extracted and cofired with coal to generate electricity. Wu Xi Hua Guang is investigating the up scaling of the demonstration plant and the development of a commercial plant. However, neither of these technologies is commercially proven for plant of the desired magnitude.

4.4.2 Boiler Selection

The pulverized coal firing based on the advantages of two boiler were proposed as follow:

Advantages of Pulverized Coal Firing:

- The main advantage of pulverized firing system lies in the fact that by breaking a given mass of coal into smaller pieces exposes more surface area for combustion.
- Greater surface area of coal per unit mass of the coal allows faster combustion as more coal surface is exposed to heat and oxygen. This reduces the excess air required to ensure complete combustion and the required fan power also
- Wide variety and low grade coal can be burnt more easily when the coal is pulverized
- Pulverized coal gives faster response to load changes as the rate of combustion can be controlled easily and immediately. Automatic control applied to pulverized coal fired boilers is effective in maintaining an almost constant steam pressure under wide load variations
- This system is free from clinker and slagging troubles
- This system works successfully with or in combination with the gas and oil
- It is possible to use highly pre-heated secondary air (350oC) which helps in rapid flame propagation
- The pulverized system can be repaired easily without cooling the system as the pulverizing equipment is located outside the furnace. Large amount of heat release is possible in this system compared to stoke firing system
- The banking losses are low compared to stoke firing system
- The boiler can be started from cold very rapidly and efficiently. This is highly important when grid stability is of the important concern
- The external heating surface is free from corrosion and fouling as smokeless combustion is possible.
- There are no moving parts in the furnace or boiler subjected to high temperature. Therefore the life of the pulverized fuel firing system is longer and operation is trouble-less

- Practically no ash handling problem in this type of firing system
- The furnace volume required is considerably less as the use of the burners which produce turbulence in the furnace makes it possible to complete combustion with minimum travel

4.4.3 Coal Transport and Delivery Alternatives

Normally, Coal is delivered by highway truck, rail, and barge or collier ship from the mine to the plant. Since the plant is built near Thi gyit coal mine, the coal will be delivered from the mines by conveyor.

4.4.4 Fuel Transport and Storage Alternatives

For startup or auxiliary purposes, a coal-fired power plant has to use fuel oil as well. Fuel oil can be delivered to plants by pipeline, tanker, tank car or truck and stored in the underground or ground tank. For the proposed plant, the fuel will be delivered by fuel tanks and store in the ground tank within the site.

4.4.5 Pollution Control Alternatives

(1) Control of particulate matter emissions: Typically, particulate matter (referred to as fly ash) from the combustion flue gas is removed with electrostatic precipitators (ESP) or fabric filters. They are routinely achieving 99% or more fly ash removal.

(2) Control of sulfur dioxide emissions: To remove sulfur dioxide (SO2) from exhaust flue gases of coal power plants can be removed by a variety of methods. Below are common methods used:

- Wet scrubbing using a slurry of alkaline sorbent, usually limestone or lime, or seawater to scrub gases;
- Spray-dry scrubbing using similar sorbent slurries;
- Wet sulfuric acid process recovering sulfur in the form of commercial quality sulfuric acid;
- SNOX Flue gas desulfurization removes sulfur dioxide, nitrogen oxides and particulates from flue gases;
- Dry sorbent injection systems

Among these technologies, wet scrubbing system will be installed at the proposed plant. Wet flue gas desulfurization (FGD) that contacts the flue gases with lime which can achieve 95% sulfur dioxide removal without additives and 99+% removal with additives.

(2) Control of nitrogen oxides emissions: There are three technologies available for reducing the emissions of NOx from combustion sources.

- The lowest cost combustion control technology (Lo-NOx) can achieve up to a 50% reduction in NOx emissions compared to uncontrolled combustion.
- The most effective and expensive, NOx emission reduction technology is Selective Catalytic Reduction (SCR). It can achieve 90% NOx reduction.
- Selective non-catalytic reduction (SNCR) falls between Low-NOx and SCR in both cost and effectiveness.

Hence, SNCRs and SCR are selected to install at the new boiler to control the generation NOx from the furnace.

(3) Control of mercury emissions: Typically, mercury is removed partially during the SOx and fly ash removing process. The removal of the fly ash will be carried out in an ESP and a fabric filter which could also remove mercury by reacting with the fly ash since the efficiency is depending on the coal fuel types varying the results from 10 to 30% removal for bituminous coals to less than 10% for sub-bituminous coals and lignite. The oxidized mercury vapor left in the flue gas is effectively removed by wet FGD scrubbing, resulting in nearly 30–40% total mercury removal for sub-bituminous coals and lignite.

5. Description of Surrounding Environment

5.1 Setting the Study Limits

In the EIA study, it is necessary to establish baseline information on the environmental and socio-economic setting of the project area which could be affected by direct and indirect impacts during the project construction and operation.

The baseline information serves two purposes;

- Firstly, it is used in conjunction with the information on the project, for identification of potential impacts of the project and assessment of their significance, and
- Secondly, it serves as the indicator that can be compared against a benchmark such as NEQ values for evaluating environmental and social management performance of the project construction and operation.

This chapter describes environmental and socio-economic settings of the study area based on latest available secondary information and primary information collected from field surveys.

Study area limits of environmental and socio-economic settings were designated 5 km radius centered from Thi gyit Coal-fired Power Plant to be large enough to cope with the most potential environmental and social impact issues of the project construction and operation.

5.2 Methodology for Data Collection and Analysis

The aim of the ESIA baseline data collection is to provide the overview of the environmental and social surveys carried out as primary data collection as well as use of some secondary data for in-depth analysis.

5.3 Existing Environmental Condition

5.3.1 Topographic and Geological Conditions

The topography of Myanmar can be divided roughly into three portions: Western Hills Region; the Central Valley Region; and the Eastern Hill Region where the project area is located.

Shan State borders China to the north, Laos to the east, and Thailand to the south, and five administrative divisions of Myanmar to the west. Being the largest among 14 administrative divisions by land area, Shan State covers 155,800 km², almost a quarter of the total area of Myanmar. It is named „Shan people" because of the Shan people, one of several ethnic groups that inhabit the Region. Shan State is largely rural, with only three cities of significant size: Lashio, Kengtung, and the capital, Taunggyi.[3] Taunggyi is situated 150.7 km north east of the nation's capital Naypyitaw. **Thigyit Village Tract** and seat of Pinlaung Township, Taunggyi District, Southern Shan State, in the Pa-O Self-Administered Zone of Shan State of eastern-central Myanmar at the geopraphic coordinate of latitude 20°5′42″N and Longitude of 96°47′23″E . Pinlaung is located over 4800 feet above sea level. The highest mountain in Pinlaung Township is 6,124 feet high Lwel-Maung Mountain. The highest region is Lwel-Maung village and the lowest region is 1Lel-Pyin –Kyi village with an altitude of 1045 feet above sea level. Pin Loung Township lies along National Road 54, north-west by road from Loikaw.

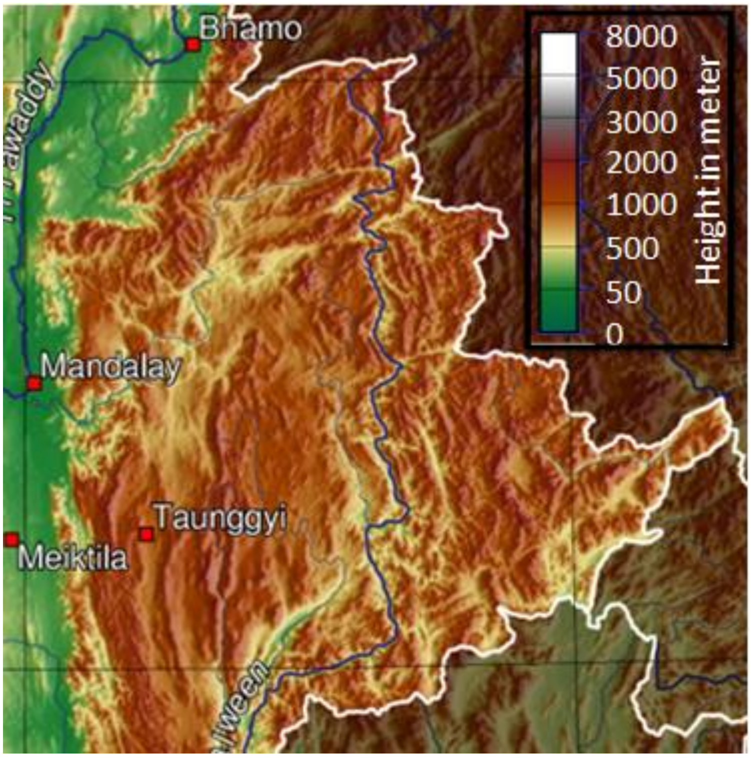


Figure 5.1 Topographic Map of Shan State

5.3.2 Soil Type

Soil types mostly found in Shan State are mountainous brown forest soil, mountainous red forest soil, and red brown forest soil. Meadow and meadow alluvial soil, yellow brown dry forest soil and Gray and gray swampy soil are found in some area. Soil map in Shan State is shown in Figure 5.2.

(1) Alluvial Soil (Fluvisol)

In the texture of classification, soil comprises sand, silt and clay. The soil that contains large amount of silt is classified as alluvial soils. They can be found in any region of the country regardless of relief, in the river plains, deltas, former lakes and coastal areas. The soil reaction is usually neutral and being young soils, developed from recent alluvial deposits of the river. Those soils are pervious, easily tilled and thus, they are very important soils for agriculture, suitable for culvation of rice, plantation crops, vegetables, pulses and beans, chili, sugarcane and maize.

(2) Meadow Soil (Gleysol)

There are different subtypes of Meadow soils. The Meadow soils or paddy soils are widely observed in different parts of Myanmar in river plains, delta and low coastal plains and valleys. All types of Meadow Soils have thick solum and are mostly having clayey texture. They are most suitable for paddy cultivation. The Meadow soils of the dry zone in upper Myanmar have the characteristic of being light colours. There are Meadow soils with neural reactions, whereas, some have the alkaline reaction. Although plant nutrients are not abundant, they can be used for pulses and vegetables.

The Meadow soils in the mountain region with large amount of rainfall and Meadow soils in the lower Myanmar have yellow brown colour with acid to neutral soil reaction. Meadow soil near the river plains with occasional tidal floods are non-carbonate.They usually contain large amount of salt. More plant nutrients are contained more plant nutrients than the Meadow soils of upper Myanmar. Despite high content of iron these soils can nevertheless be utilized for rice and vegetables.

(3) Meadow Alluvial Soil

Meadow Alluvial soil (Fluvic Gleyol) can be found in the flood plains. They have the texture of silty clay loam and can be utilized for groundnut, sesame, sunflower, jute, sugarcane and other vegetable cultivation in addition to rice cultivation. They have neutral soil reaction and are rich in available plant nutrients. Meadow Gley soil (Gleysol) and Meadow swampy soil (Histic Gleysol) can be found in the regions of lower depressions where the land is inundated for more than six months a year. The texture of these soils is clayey to clay. They usually have very strong acid reaction and contain large amount of iron. Moreover, soils with long periods of moisture content may contain large amount of aluminum and soluble iron, sulphur and manganese by chemical process and can be toxic to plants. The humus content is high and usually deficient in phosphorus and potassium. Rice and jute can be grown on these soils after flood recedes.

***(4) Yellow Brown Dry Forest and Indaing Soil (Orithic Cambisol*)**

These soils occur on low upland plains in the dry zone area. The land is dry and sandy so can be utilized for forests and dry cropping on uplands.

(5) Red Brown Forest Soils (Rhodic Ferralsol)

The Red Brown Forest soils are the typical soils of tropical ever green forest of Myanmar. They occur on the well-drained hill slopes at the elevation from 1000 to 4000 feet above sea level. These soils also occur in the northern hill region and on the hill slopes of Rakhine mountain range, Tenassaarim and Donna range. These soils are formed under the influence of tropical evergreen forests with the annual rainfall of about 80 to 200 inches. Some are also found at the low uplands. The soils are well structured and have a good drainage. The soil is slightly acid with the pH value ranging from 5.5 to 6.5. Usually these soils have medium to heavy loamy texture. The soils contain moderate amount of plant available nutrients. These soils can be regarded as forest land of good productivity; however, the soils on the lower elevation are suitable for gardens and plantation.

(6) Yellow Brown Forest Soils (Xanthic Ferralsol)

The Yellow Brown Forest soils widely occur in Myanmar covering the low hills of Pegu Yoma, foot hills of Taninthayee Yoma, Rakhine Yoma and sloping areas at the bottom of northern hilly region up to the approximate latitude of 25 feet. They are closely connected with the Red Brown Forest soils in their distribution and usually replacing them down the slope. They mainly occur in the region of gentle slopes of low hills and foot hills at the elevation of

300 to 1500 feet above sea level. These soils are typical for the monsoon or tropical mixed deciduous forests. These soils contain more percentage of clay and humus than the Red Brown Forest soils. However, in some places of the slopes, the soils are shallow due to the presence of pisolithic lateritic layer. According to the land use classification, the great moajority of these soils are classified as good garden lands. They are suitable for rubber, oil palm and orchards.

(7) Mountainous Red Forest Soil

The color, red indicates that the soil has high content of iron (Hematite) and aluminum. Lime, phosphate and nitrogen cannot be found in this kind of soil. They are commonly found at moist climate condition.

(8) Grey and Grey Swampy Soil

Grey and grey swampy soil can be found along the rivers where they are critically dependent upon natural water level fluctuations. According to the color, it can be said that they have high content in organic matter. The upper part of this soil layers is composed of undecomposed organic matter and the lower part is composed of humus.

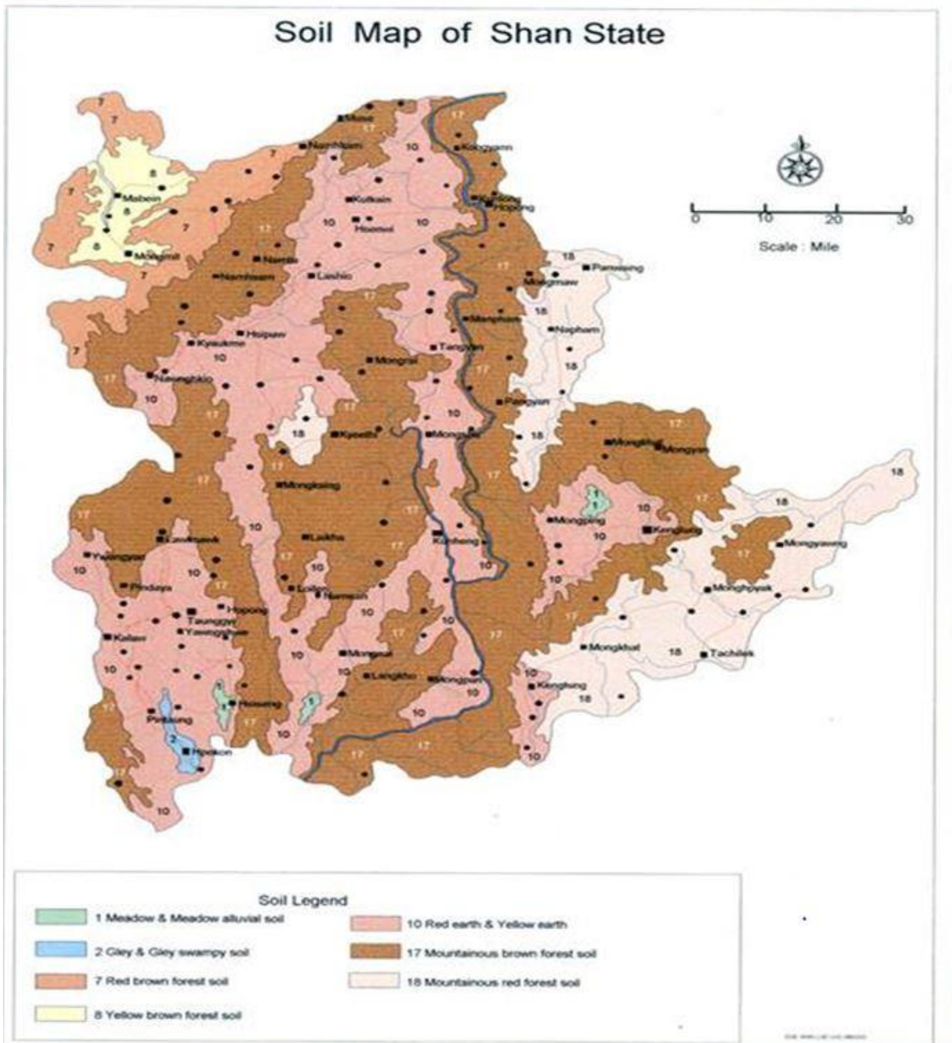


Figure 5.2 Soil Map of Shan State

5.3.3 Climate/Meteorological Characteristics

Although Chiang Mai station is very far away from the study area, the meteorological parameter such as temperature, precipitation, wind speed and wind direction are found to be comparable to the Taunggyi station. The summary of means annual meteorological conditions of both stations were presented in figure 5.3 to 5.8.

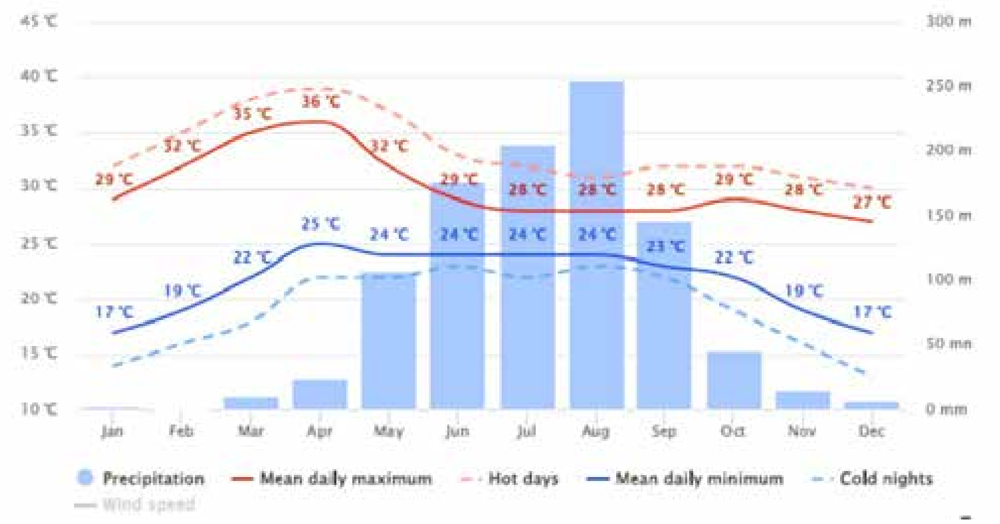


Figure 5.3 Average temperatures and precipitation at Chaing Mai Station

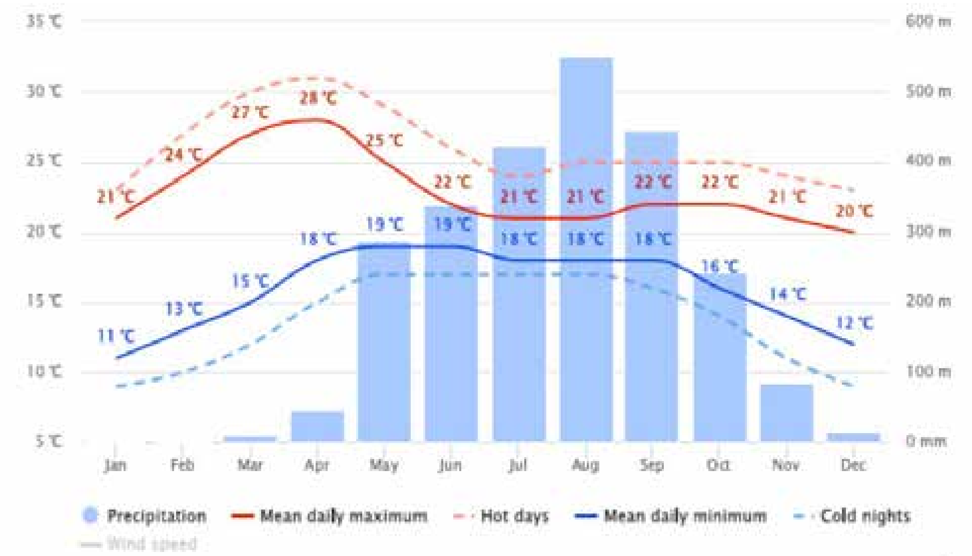


Figure 5.4 Average temperatures and precipitation at Taunggyi station

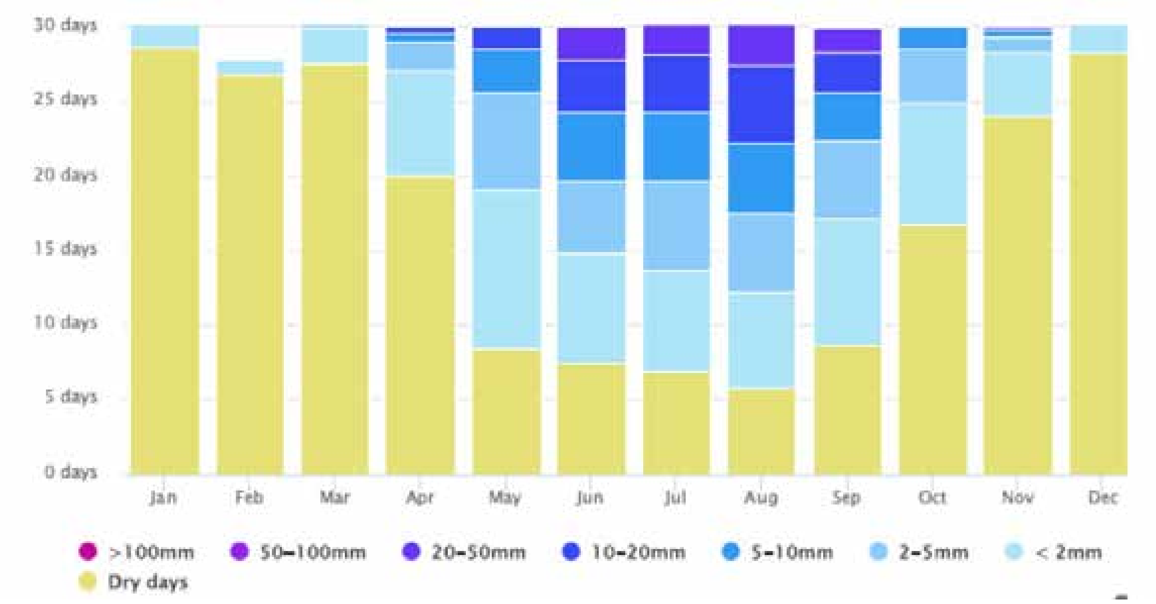


Figure 5.5 Precipitation amounts at Chiang Mai station

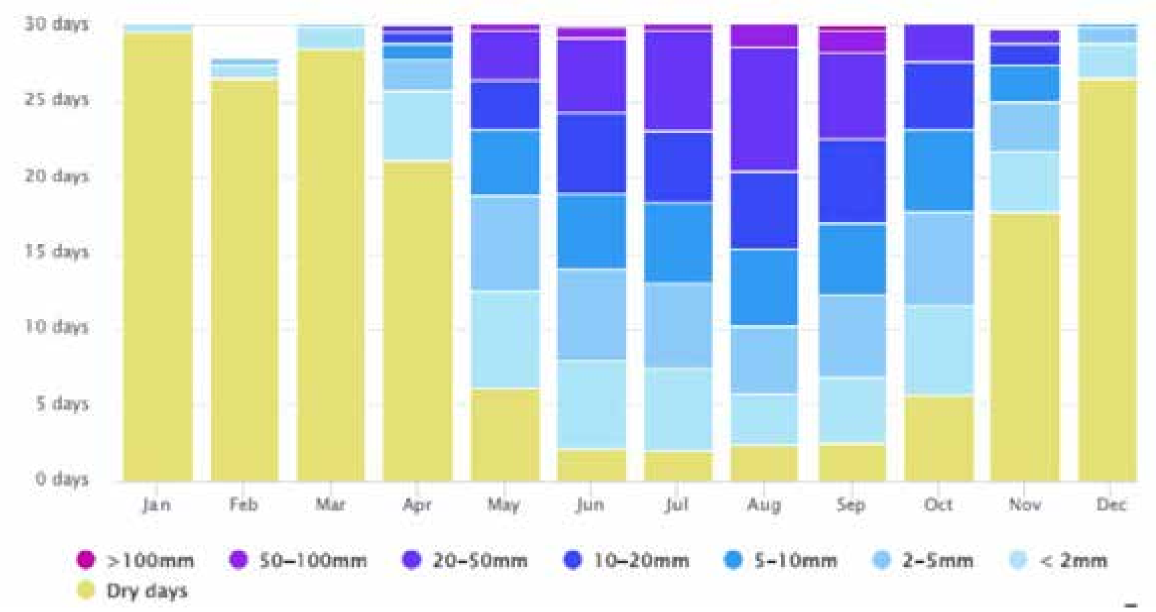


Figure 5.6 Precipitation amounts at Taunggyi station

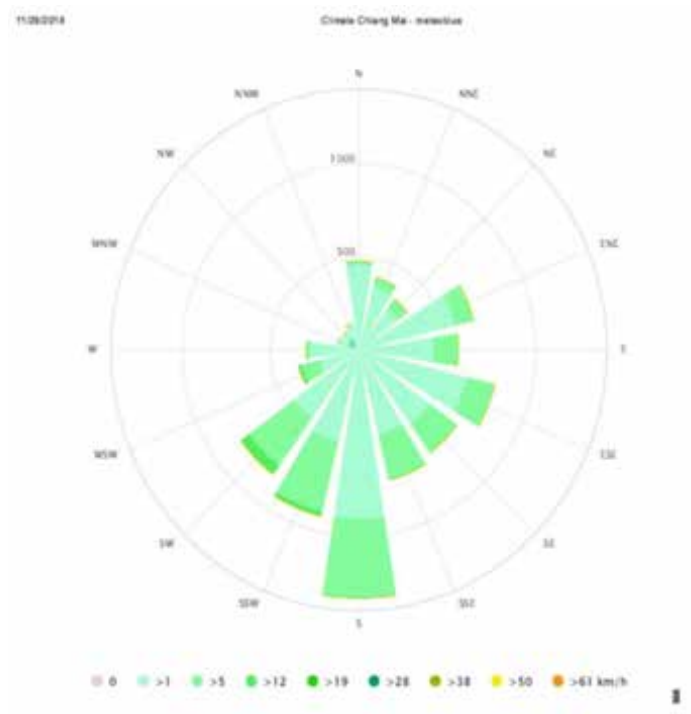


Figure 5.7 Annual windrose of Chinag Mai station, 2018

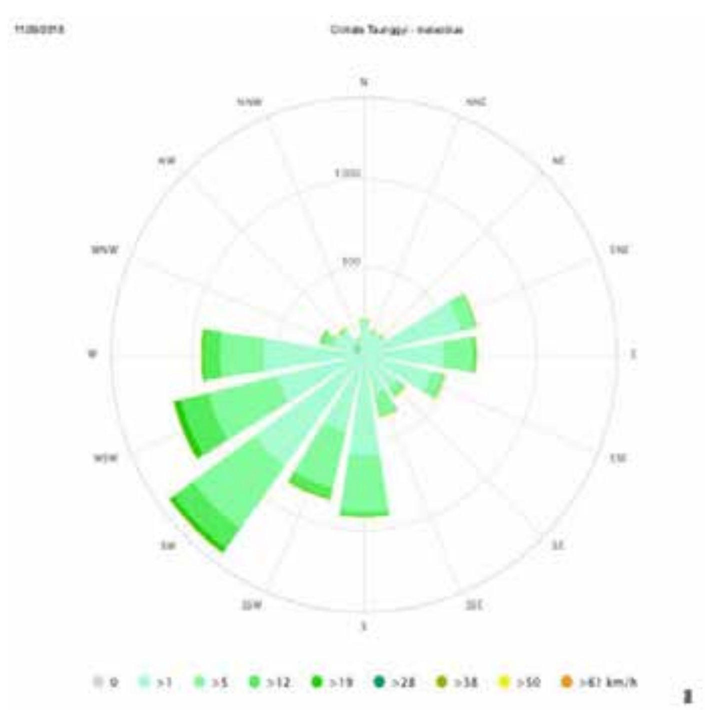


Figure 5.8 Annual windrose plot of Taunggyi station, 2018

5.3.4 Geography

Pin Laung Township falls into the Southern Shan plateau, one of the main natural features like a boundary dividing western central plain and eastern part of the country. Shan plateau with higher mountains in the north and south which is called the Shan Hills system is located 4800ft above sea level.

River cut across the state. Inle Lake, a significant geographical feature of the region, is the second largest natural expanse of water in the country. It is, though shallow, 14 miles (23 km) long and 7 miles (11 km) wide. The lake is famous for its leg-rowing Intha people living in floating villages, in the great Nyaung Shwe 'plain' which is only 21.9 km (13 miles) away east of the proposed project. The study area is regarded as one of the catchment area for Inle Lake by the name of upper Balu creek with a total area 808 square meter. Pindaya Caves, 57.61 km (35.79 miles) north of the proposed project, the vast limestone caves which contain 6226 Buddha images. Flanked by two mountain ranges to the east and to the west, terrain of the study area is flat.

5.3.5 Erosions and Sedimentation

As the project area, is located in flat plain, erosion and sedimentation is not expected.

5.3.6 Surface Water and Ground Water Sources for water supply

Balu Creek is the major water course in the study area and one of the four main channels drain possessing 21.29 % of total Inle catchment area by name of Indeing (Upper Blue). It originates northwest of Pinlaung town. It flows for 40 miles before reaching the west bank of Inle Lake which is also one of the stream inlet of Upper Balu Creek. There is also a water pond at about 1.49 km to the east of the project site. It extends approximately 0.4 km from East to West and 0.2 km from North to South.

The Than Dae stream flows from south to north direction into the Upper Balu creek near the Dragon Cement Plant. This stream is adjacent to the premise of the project site to the east and is assumed to be receiving surface runoff and effluent from the project site. The stream is being used for domestic and cultivation purposes by the local residents. Groundwater supply via bored wells (tube-wells) is also found in nearby villages.

Figure 5.9 ThanDae Stream flow through Farmlands

5.3.7 Natural Disasters

Myanmar is a country exposed to a number of natural disasters such as floods, cylones, storm surge, earthquakes, landslides, fires, and tsunamis. Over the decades, Myanmar has experienced a number of cyclones, floods, earthquakes, and landslides. Most parts of the country, especially the coastal regions, are periodically affected by the hazards.

5.3.8 Hydrology

There are a small number of creeks in Pinlaung Township and the streams are flowing from north to south. The famous creek is Balu creek and flows through from north to south near Pin Laung.

5.3.9 Land Use

The main land use is agriculture. Some of the crops are seasonally grown are rice, bean, sesame, sunflower, cabbage, chili, tomato and other seasonal crops. Reserved forests, industrial land, vacant land and other forms of land use are also found.

Table 5. 1 Land Use

No	Township	Size of Agricultural land (acre)	Shifting Cultivated Land	Garden Land	Reserved/Protected Public Forest	Wild Land	Vacant Land	Urban and Others
1	Pin Loung	98,969	120	16,263	387,388	21,493	50,535	263,314
2	Naung Ta Yar	1,952		109				767
3	Poung Loung	263			2,365			756

Table 5.1 shows land use status of Pin Loung Townsip. Types of land use are classified into nine categories, namely net area of agriculture land, vacant land, grazing land, industrial land, sub-urban area, reserved forest, wild forest, wild land, and fallow land.

5.3.10 Cultural Heritage

Five ancient pagodas around Thigyit Village tract were identified as significant cultural heritage of the area. Shwe Lin Sin Pagoda is located near Thigyit Coal Fired Power Plant. Myo Oo Pagoda, being located in the boundary of Eden Coal Mine, was damaged by blast of mining operation in December 2007. When it was collapsed, relics enshrined in this pagoda are still storing and collecting at that place. Eden has promised to rebuild this pagoda after reaching an agreement with local people. Yadana Mwetaw Pagoda is located near Sae Kaung Village besides national road 54 (Loikaw-Aungban). Rha Hta Par La Pagoda and the last unknown Pagoda are located between North Thigyit and Naung Moon Village. All of these pagodas are ancient and more than 100 years old having cultural and religious importance to local communities.

Table 5.2 Detailed Locations of Ancient Pagodas

Name of Pagoda	Location (Lat. & Long.)	Distance from Power Plant
Shwe Lin Sin Pagoda	20°25'16.23"N, 96°42'5.99"E	0.67 Mile (1.07 km)
Myo Oo Pagoda	20°25'0.62"N, 96°42'28.83"E	1.03 Miles (1.65 km)
Yadana Mwetaw Pagoda	20°25'13.69"N, 96°41'50.56"E	0.79 Mile (1.27 km)
Rha Hta Par La Pagoda	20°24'54.09"N, 96°41'49.86"E	1.14 Miles (1.84 km)
Old Pagoda (unknown)	20°25'5.35"N, 96°41'55.84"E	0.91 Mile (1.47 km)


Shwe Lin Sin Pagoda


Myo Oo Pagoda


Yadana Mwetaw Pagoda

Rha Hta Par La Pagoda

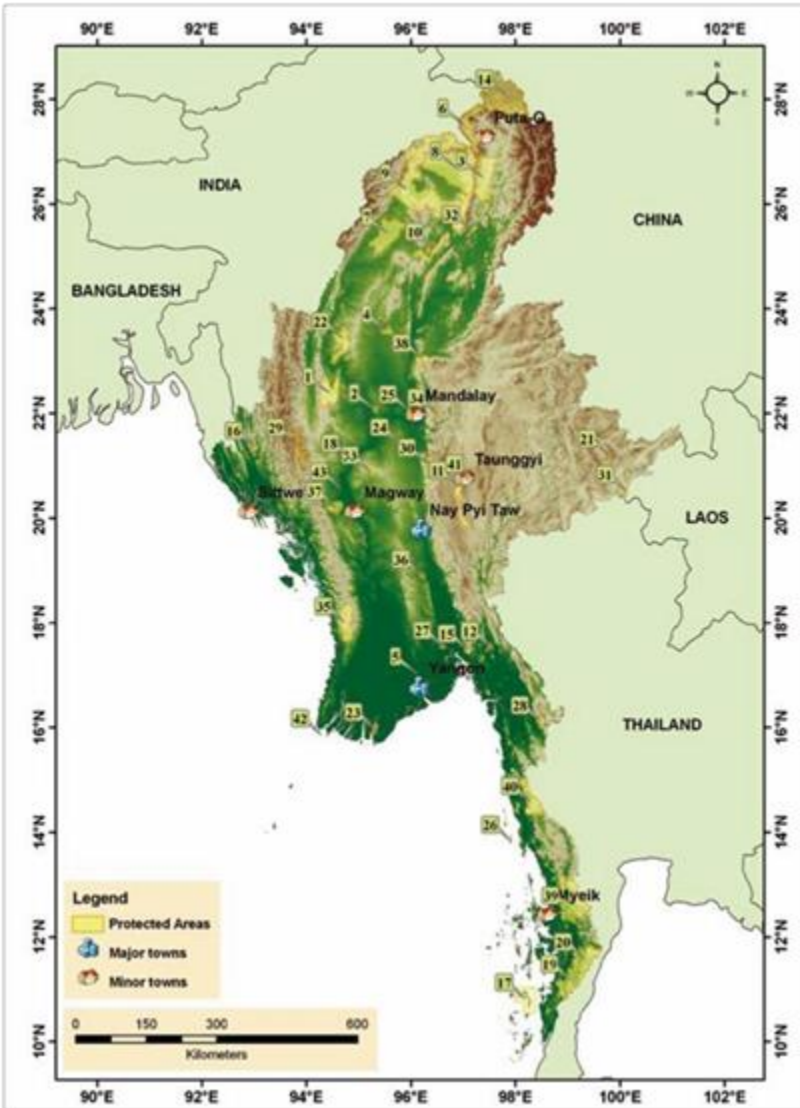
 

Old Pagoda

Photograph: 1 Ancient Pagodas around Thigyit Village Tract

5.3.11 Protected Areas

Protected areas (PAs) are distributed through the Regions and States of Myanmar. PAs located in Shan State are Inle Lake Bird Sanctuary (Wetland), Taunggyi Bird Sanctuary Loimwe Protected Area, Parsar Protected Area and Panlaung-Phadalin Cave. Although they are located in Shan State, no single PA is found within the project area. The nearest one is Inle Lake Bird Sanctuary which is located about 11 miles away from the project area.



Source: Myanmar Protect Areas (2011)

Figure 5.10 Protected Areas in Myanmar

Table 5.3 Protected Areas in Myanmar

No.	Name	National Designation	Year Established	Location and Coordinates	Area (km2)	Key Species Protected
1	Alaungdaw Kathapa N.P	National Park	1989	Sagaing Region, 23 36ʻN, 95 32ʻE	1,606	Elephant, Tiger, Leopard, Gaur, Sambar, Serow, Bear
2	Bawditataung	Nature Reserve	2008 (Proposed)		73	
3	Bumhpabum W.S *	Wildlife Sanctuary	2004	Kachin State, 26 29ʻN, 97 31ʻE	1,854	Elephant, Gaur, Serow, Deep Spp, Clouded Leopard, Golden Cat, Jackal, Goral, Mancaques, Civets, Bear, Leopard, Pheasant, Hornbills
4	Chatthin	Wildlife Sanctuary	1941	Sagaing Region, 23 36ʻʻ N, 95 32ʻE	269	Eldʻʻs Deer, Sambar, Barking Deer
5	Hlawga Wildlife Park	Wildlife Park	1982	Yangon Region, 17 00ʻN, 96 10ʻE	6	Enclosed Wildlife Park, Sambar, Barking Deer, Hog Deer, Eldʻʻs Deer, Mythun, Migratory Birds
6	Hponkanrazi W.S *	Wildlife Sanctuary	2003	Kachin State, 27 30ʻN, 97 43ʻE	2,704	Barking Deer, Avifauna, Red Goral, Gibbon, Wild Dogs, Mongooses
7	Htamanthi	Wildlife Sanctuary	1974	Sagaing Region, 25 26ʻN, 95 37ʻE	2,151	Rhinoceros, Elephant, Gaur, Tiger
8	Hukaung Valley W.S	Wildlife Sanctuary	2004	Kachin State, 26 11ʻN, 96 10ʻE	6,371	Elephant, Leopard, Tiger, Gaur, Sambar, Bear, Wild Boar, Serow
9	Hukaung Valley W.S (Extension)	Wildlife Sanctuary	2004	Kachin State	15,431	Elephant, Leopard, Tiger, Gaur, Sambar, Bear, Wild Boar, Serow
10	Indawgyi W.S	Wildlife Sanctuary	2004	Kachin State, 25 10ʻN, 96 15ʻE	815	Elephant, Tiger, Sambar, Leopard, Bear, Serow, Gaur
11	Inlay Lake Bird Sanctuary (Wetland)	Wildlife Sanctuary	1985	Shan State, 20 10ʻN, 97 02ʻE	642	Wetland and Migratory Birds
12	Kahilu W.S	Wildlife	1928	Karen State, 17	161	Rhinoceros, Serow,

No.	Name	National Designation	Year Established	Location and Coordinates	Area (km2)	Key Species Protected
		Sanctuary		13ʽN, 97 06ʽE		Mouse Deer, Hog Deer
13	Kelatha W.S	Wildlife Sanctuary	1942	Mon State, 17 13ʽN, 97 06ʽE	24	Serow, Avifauna
14	Khakaborazi Protected Area	National Park	1996	Kachin State, 28 12ʽN, 97 45ʽE	3,812	Takin, Musked Deer, Red Goral, Black Barking Deer
15	Kyaikhtiyoe W.S	Wildlife Sanctuary	2001	Mon State, 17 25ʽN, 97 06ʽE	156	Tiger, Goral, Gaur, Sambar, Monkey
16	Kyauk Pan Taung W.S	Wildlife Sanctuary	2001 (Proposed)	Chin State, 21 20ʽN, 92 55ʽE	133	Serow, Goral, Leopard, Clouded Leopard, Wild Cats, Barking Deer, Wild Boar
17	Lampi Islands Marine N.P	Marine National Park	1996	Tanintharyi Region, 10 45ʽN, 98 15ʽE	205	Coral Reefs, Mouse Deer and Salon Ethnic Culture
18	Lawkananda W.S	Wildlife Sanctuary	1997	Mandalay Region, 21 10ʽN, 94 48ʽE	0.47	Avifauna, Cultural Diversity
19	Lenya N.P *	National Park	2002 (Proposed)	Tanintharyi Region between 10 48ʽN & 99 20ʽN, between 98 49ʽE & 99 20ʽE	1,761	Tapir, Elephant, Monkeys, Barking Deer, Sambar, Wild Boar, Bear, Mouse Deer, Wild Cats, Pangolin, Lizards, Birds, Tiger
20	Lenya National Park * (Exension)	National Park	2004 (Proposed)	Tanintharyi Region	1,399	Tiger, Elephant, Tapir, Gaur, Banteng, Sambar, Gurneyʽʽs Pitta
21	LoimweProtected Area	Protected Area	1996	Shan State, 21 00ʽN, 99 55ʽE	43	Tiger, Bear, Pangolin, Pheasant
22	Mahamyaing W.S *	Wildlife Sanctuary	2002 (Proposed)	Sagaing Region between 22 50ʽN & 23 45ʽN, between 94 15ʽE &95 00ʽE	1,180	Sambar, Wild Boar, Banteng, Feline, Gibbon, Wild Dogs, Mongooses
23	Meinmahla Kyun W.S	Wildlife Sanctuary	1994	Ayeyarwady Region, 15 55ʽN, 95 20ʽE	137	Mangrove Crocodiles, Birds
24	Minsontaung W.S	Wildlife	1999	Mandalay Region, 21 30ʽN,	23	Barking Deer, Rabbit, Dhole, Reptiles, Land

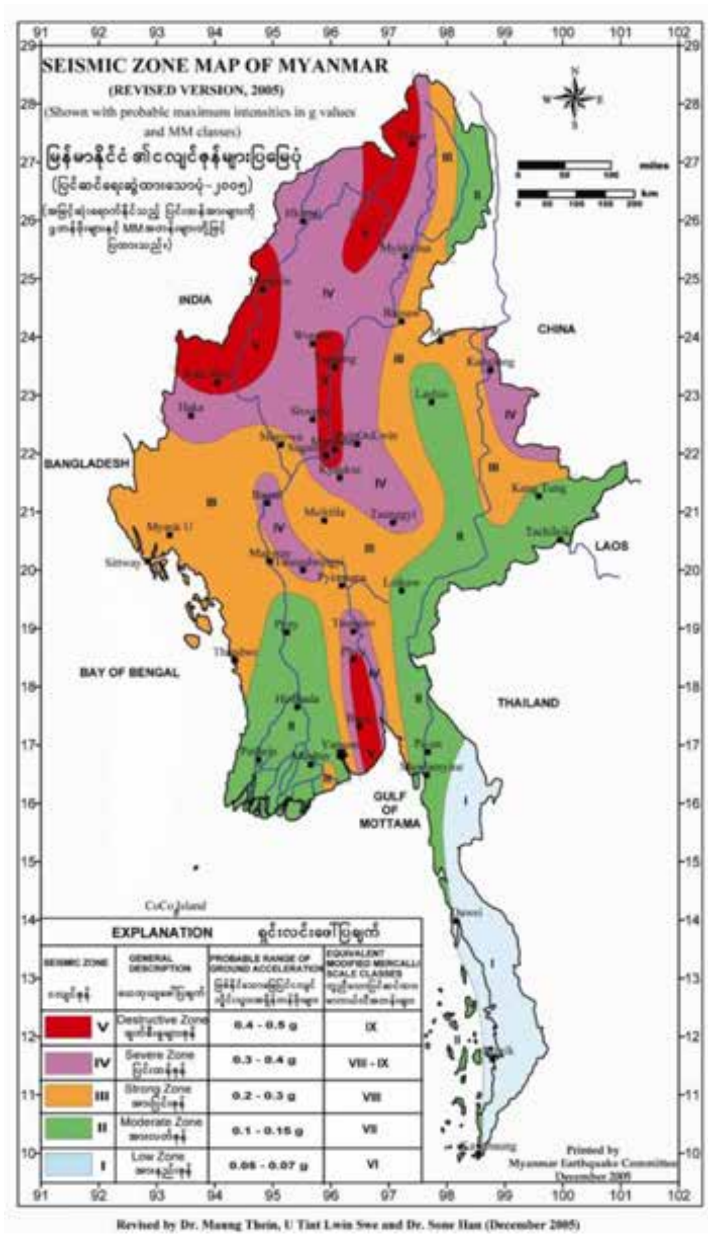
No.	Name	National Designation	Year Established	Location and Coordinates	Area (km2)	Key Species Protected
		Sanctuary		95 45ʹE		Tortoise, Wild Cat, Snakes
25	Minwun-Taung W.S	Wildlife Sanctuary	1972	Sagaing Region, 22 02ʹN, 95 58ʹE	206	Barking Deer, Avifauna
26	Moscos Island W.S	Wildlife Sanctuary	1927	Tanintharyi Region, 14 05ʹN, 97 05ʹE	49	Barking Deer, Sambar, Swiftlet
27	Moyungyi Bird Sanctuary (Wetland)	Bird Sanctuary	1988	Bago Region, 17 30ʹN, 96 30ʹE	104	Migratory Birds
28	Mulayit	Wildlife Sanctuary	1936	Kayin State, 16 07ʹN, 98 30ʹE	139	Barking Deer, Tiger, Leopard
29	Natma Taung N.P	National Park	1994 (Proposed)	Chin State, 21 10ʹN, 93 55ʹE	723	Gaur, Serow, Goral and Avifauna
30	Panlaung-Pyadalin Cave W.S	Wildlife Sanctuary	1999	Shan State, 21 10ʹN, 96 30ʹE	334	Elephant, Tiger, Leopard, Gaur, Banteng, Golden Cat, Clouded Leopard, Serow, Gibbon
31	Parsar Protected Area	Protected Area	1996	Shan State, 20 25ʹN, 99 45ʹE	77	Jungle Fowl, Chinese Pangolin
32	Pidaung W.S	Wildlife Sanctuary	1918	Kachin State, 25 25ʹN, 97 12ʹE	122	Elephant, Gaur, Banteng, Sambar, Tiger, Leopard, Bear
33	Popa Mountain Park	Mountain Park	1989	Mandalay Region, 20 53ʹN, 95 15ʹE	129	Barking Deer, Leopard, Geomorphologic features
34	Pyin Oo Lwin Bird Sanctuary	Bird Sanctuary	1918	Mandalay Region, 22 00ʹN, 96 30ʹE	127	Not available from source
35	Rakhine Yoma Elephant Range	Wildlife Reserve	1997	Rakhine State, 18 00ʹN, 94 40ʹE	1,756	Elephant, Gaur, Leopard, Jackal, Bear
36	Shinpin Kyatthaut W.S *	Wildlife Sanctuary	2006 (Proposed)	Bago Region between 15 50ʹN & 15 58ʹN, between 96 09ʹE & 96 16ʹE	72	Barking Deer, Hog Deer, Wild Boar, Pangolin, Wild Dog, Civet, Reptiles
37	Shwesettaw W.S	Wildlife	1940	Magwe Region,	553	Eldʹs Deer, Sambar,

No.	Name	National Designation	Year Established	Location and Coordinates	Area (km2)	Key Species Protected
		Sanctuary		20 12‵N, 94 35‵E		Barking Deer, Gaur
38	Shwe-U-Daung W.S	Wildlife Sanctuary	1918	Mandalay Region, 23 00‵N, 96 30‵E	326	Rhinoceros, Elephant, Gaur, Banteng, Sambar, Serow, Tiger, Bear
39	Tanintharyi N.P *	National Park	2002 (Proposed)	Tanintharyi Region, 12 02‵N, 97 00‵E	2,072	Sambar, Barking Deer, Serow, Goral, Leopard, Wild Elephant, Birds, Tiger
40	Tanintharyi Nature Reserve *	Nature Reserve	2005	Tanintharyi Region	1,700	Gurney‶s Pitta, Tiger, Elephant, Tapir
41	Taunggyi Bird Sanctuary	Bird Sanctuary	1930	Shan State, 20 45‵N, 97 04‵E	16	Avifauna
42	Thamihla Kyun W.S	Wildlife Sanctuary	1970	Ayeyarwady Region, 15 05‵N, 94 17‵E	0.88	Marine Turtle
43	Wethtikan Bird Sanctuary	Bird Sanctuary	1939	Magwe Region, 20 00‵N, 95 30‵E	4	Wetland Birds

Source: E Guard Study Team

5.3.12 Earthquake Intensity

The Taunggyi City is in the vicinity of the eastern section of the Sagaing Fault which has not been active in the past 50 to 75 years indicating that the faults may be under accumulating stress increasing the potential for an earthquake. The origin and occurrence of earthquakes occurred in Myanmar including Taunggyi city and other parts of the country. Earthquake intensity of the area can be seen in the following figure 5.11.



Source: Dr. Maung Thein, U Thin Lwin and Dr. Sone Han_2015

Figure 5.11 Seismic Zone Map of Myanmar

As shown in the map, five seismic zones are demarcated and named (from low to high) **Zone I (Low Zone), Zone II (Moderate Zone), Zone III (Strong Zone), Zone IV (Severe Zone), and Zone V (Destructive Zone),** mainly following the nomenclature of the European Macro Seismic Scale 1992.

As per the map, the proposed project is located within the **Zone II (Moderate Zone). As** the project involves construction of high buildings, the project has to consider possible risks and to fulfill all engineering requirements of the buildings to stand earthquakes as well as to prevent damages affected by earthquakes.

5.4 Environmental Baseline Study

5.4.1 Ambient Air Quality

In order to assess the ambient air quality of Thigyit coal fired power plant and to monitor the changes that may take place as a result of the project, dust (PM10 and PM2.5) and gases (SO2 and NO2) were measured using HAZSCANNER air monitoring station. The parameters to be monitored were selected with reference to the NEQ (Emission) Guidelines in Myanmar. Measured data was analyzed and compared with the permissible maximum values prescribed in the NEQ Guidelines for ambient air quality. The results serve as a useful input into ientifying effective measures to mitigate the potential impacts on the air quality and formulating a practical and robust environmental monitoring.

The air quality survey and noise level measurement were conducted in eighteen villages which are located around 5km from the Coal Fired Power Plant. The sample points were numbered form Air Quality Point 1 to 18 (denoted as A-1 to A18). Measurements were conducted twic in dry season and wet season to evaluate the status of flora and fauna in two prevailing seasons of the project area. Location of the air quality survey points is presented in Table 5.10 and Figure 5.12, and the equipment used is shown in Table 5.9 respectively.

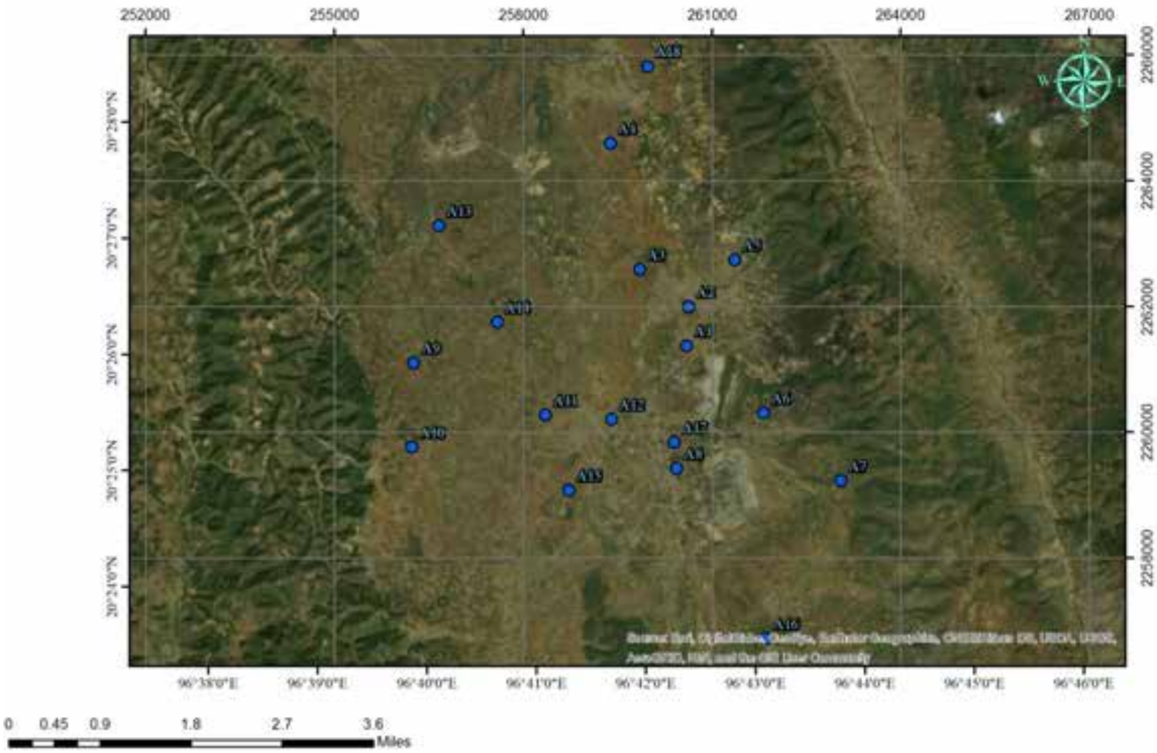


Figure 5.12 Location of Air Quality Measurement

Table 5.4 Instrument Used for Air Quality Monitoring

No.	Name and Model of Instrument Used	Measurement Items	Image
1	EPAS HAZS-Canner	PM 10, PM 2.5, NO_2, SO_2, temperature, wind speed, wind direction, and relative humidity.	

A-1 at Dry Season

A-1 at Wet Season

A-2 at Dry Season

A-2 at Wet Season

A-3 at Dry Season

A-3 at Wet Season

A-4 at Dry Season

A-4 at Wet Season

A-5 at Dry Season

A-5 at Wet Season

A-6 at Dry Season

A-6 at Wet Season

A-7 at Dry Season

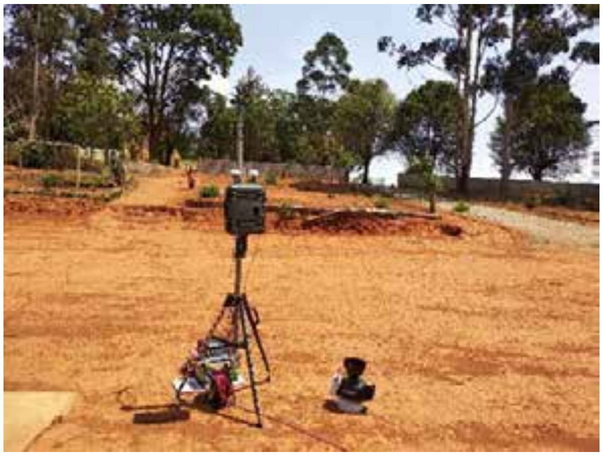
A-7 at Wet Season

A-8 at Dry Season

A-8 at Wet Season

A-9 at Dry Season

A-9 at Wet Season



A-10 at Dry Season

A-10 at Wet Season

A-11 at Dry Season

A-11 at Wet Season

A-12 at Dry Season

A-12 at Wet Season

A-13 at Dry Season

A-13 at Wet Season

A-14 at Dry Season

A-14 at Wet Season

A-15 at Dry Season

A-15 at Wet Season

A-16 at Dry Season

A-16 at Wet Season

A-17 at Dry Season

A-17 at Wet Season

A-18 at Dry Season

A-18 at Wet Season

Photograph: 2 Air Quality Survey at Dry and Wet Season

A summary of the results is shown in Table 5.10. It can be seen that the level of concentration for PM10 and PM2.5 exceeded the NEQ Guideline values at almost all sample points in dry season.

Table 5.5 Results of Air Quality Measurement for dry season and wet season

Point	Location	Longitude and Latitude	Description of survey point	Season	Date	NEQ Guideline Values (µg/m3)			
						PM10 (24 hrs average)	PM2.5 (24 hrs average)	NO2 (1 hr average)	SO2 (24 hrs average)
						50	25	200	20
						Result			
A-1	Junction of PyinThar and Thar Yar Gone	Lat: 20° 26" 0.813"N, Lon 096° 42" 19.709"E	0.53 km away from the Thigyit Coal Fired Power Plant	Dry Season	(30-31) March 2018	114.63	91.25	83.11	5.24
				Wet Season	(13-14) August 2018	9.41	5.08	27.27	3.37
A-2	Monastery of Taung Po Gyi	Lat: 20° 26" 28.760"N, Lon 096° 42" 20.519"E	1.11 km away from the Thigyit Coal Fired Power Plant	Dry Season	(31-1) March & April 2018	89.32	76.48	81.52	9.85
				Wet Season	(11-12) August 2018	7.2	3.12	28.83	2.72
A-3	Phayar Ngar Su Village	Lat: 20° 26" 47.705"N, Lon 096° 41" 53.205"E	1.73 km away from the Thigyit Coal Fired Power Plant	Dry Season	(1-2) April 2018	125	111.21	50.10	6.55
				Wet Season	(10-11) August 2018	15.19	8.74	33.19	2.71
A-4	Myin Twin Village	Lat: 20° 27" 52.778"N, Lon 096° 41" 36.149"E	3.79 km away from the Thigyit Coal Fired Power Plant	Dry Season	(3-4) April 2018	86.25	71.96	54.02	8.84
				Wet Season	(9-10) August 2018	13.09	6.03	32.35	2.81
A-5	Bank Mart Village	Lat: 20° 26" 53.390"N, Lon 096° 42" 45.445"E	2.08 km away from the Thigyit	Dry Season	(4-5) April 2018	50	40	60.07	3.88

			Coal Fired Power Plant	Wet Season	(12-13) August 2018	8.54	4.48	31.82	3.02
A-6	Mya Sein Taung Village	Lat: 20° 25‟ 34.591”N, Lon 096° 43‟ 02.364”E	1.61 km away from the Thigyit Coal Fired Power Plant	Dry Season	(5-6) April 2018	56	43	56.46	3.87
				Wet Season	(15-16) August 2018	9.23	4.74	32.47	3.12
A-7	Pin Mi Gone Village	Lat: 20° 25‟ 00.073”N, Lon 096° 43‟ 45.101”E	3.18 km away from the Thigyit Coal Fired Power Plant	Dry Season	(7-8) April 2018	76	63	60.88	8.04
				Wet Season	(16-17) August 2018	8.48	3.87	39.52	2.76
A-8	Monastery of Thigyit Myo Ma	Lat: 20° 25‟ 05.099”N, Lon 096° 42‟ 14.903”E	1.52 km away from the Thigyit Coal Fired Power Plant	Dry Season	(8-9) April 2018	75	59	52.70	6.09
				Wet Season	(7-8) August 2018	14.97	8.26	29.90	2.75
A-9	Junction of Gant Kaw Pin and Pin Sein Su Village	Lat: 20° 25‟ 57.868”N, Lon 096° 39‟ 50.103”E	4.08 km away from the Thigyit Coal Fired Power Plant	Dry Season	(20-21) April 2018	55.38	45.81	77.65	7.72
				Wet Season	(22-23) August 2018	7.48	1.84	28.38	2.71
A-10	Naung Mu Village	(Lat: 20° 25‟ 14.20”N, Lon 096° 39‟ 49.77”E)	4.27 km away from the Thigyit Coal Fired Power Plant	Dry Season	(21-22) April 2018	53.88	42.65	65.69	4.87
				Wet Season	(21-22) August 2018	15.03	6.81	38.56	2.98
A-11	Moon Pin Village	Lat: 20° 25‟ 31.87”N, Lon 096° 41‟ 2.78”E	2.09 km away from the Thigyit Coal Fired Power Plant	Dry Season	(22-23) April 2018	83.75	62.14	61.26	2.80
				Wet	(24-25)	16.97	11.26	59.18	3.84

				Season	August 2018				
A-12	Sae Khaung Village	Lat: 20° 25‟ 30”N, Lon 096° 41‟ 39”E	1.14 km away from the Thigyit Coal Fired Power Plant	Dry Season	(23-24) April 2018	86.16	66.78	66.57	3.49
				Wet Season	(17-18) August 2018	11.62	3.67	28.97	3.14
A-13	Pat Ta Lae Village	Lat: 20° 27‟ 9”N, Lon 096° 40‟ 3”E	4.35 km away from the Thigyit Coal Fired Power Plant	Dry Season	(24-25) April 2018	99.71	86.23	64.22	3.09
				Wet Season	(19-20) August 2018	8.69	4.07	36.42	2.84
A-14	Lwin Village	Lat: 20° 26‟ 19.50”N, Lon 096° 40‟ 35.49”E	2.76 km away from the Thigyit Coal Fired Power Plant	Dry Season	(25-26) April 2018	53.33	42.97	63.50	3.34
				Wet Season	(20-21) August 2018	6.2	1.82	27.81	2.70
A-15	Naung Moon Village	Lat: 20° 24‟ 52.17”N, Lon 096° 41‟ 51.50”E	2.46 km away from the Thigyit Coal Fired Power Plant	Dry Season	(26-27) April 2018	79.33	67.05	46.85	3.95
				Wet Season	(18-19) August 2018	10.13	2.57	29.80	2.81
A-16	Mee Thway Chaung Village	Lat: 20° 23‟ 37.91”N, Lon 096° 43‟ 5.19”E	4.50 km away from the Thigyit Coal Fired Power Plant	Dry Season	(28-29) April 2018	60.95	47.11	54.70	3.37
				Wet Season	(23-24) August 2018	9.41	5.54	41.85	2.84
A-17	Mya Kan Thar Village	Lat: 20° 25‟ 18.59”N, Lon 096° 42‟ 13.59”E	1.1 km away from the Thigyit Coal Fired Power Plant	Dry Season	(7-8) May 2018	94.78	77.13	98.42	43.70
				Wet Season	(14-15) August 2018	12.13	8.33	29.94	2.81

A-18	Taung Chay Village	Lat: 20° 26�too 0.813"N, Lon 096° 42" 19.709"E	4.9 km away from the Thigyit Coal Fired Power Plant	Dry Season	(8-9) May 2018	95.09	77.62	93.11	3.66
				Wet Season	(8-9) August 2018	26.29	15.22	40.18	2.90

*Measurement values that exceed the NEQ Guideline values are shown in a red word.

Source: E Guard Study Team

(1) Particulate Matters (PM 10 and PM 2.5)

PM10 and PM2.5 refer to particulate matter 10 micrometers or less in diameter and particulate matter 2.5 micrometers or less in diameter, respectively. PM2.5 is generally described as fine particles. The major components of PMs are sulfate, nitrates, ammonia, sodium chloride, black carbon, mineral dust and water. It consists of a complex mixture of solid and liquid particles of organic and inorganic substances suspended in the air.

Dust emission level was checked by measuring the concentration level of PM10 and PM2.5 for 24 hours at eighteen sample points. All values expect that of PM2.5 value of point A-5 located in Bank Mart Village exceeded the NEQ (emission) guideline values of 50 µg/m3 and 25µg/m3 in dry season. In wet season, the level of PMs at all points were within the guideline values.

(2) Nitrogen Dioxide (NO2)

Nitric oxide (NO) and nitrogen dioxide (NO2) are the two principle nitrogen oxides. It can be generated from operation and maintenance of vehicles and on-site power generation facilities. The quantity of nitrogen oxides depends on the available nitrogen and oxygen concentration, reaction time, and temperature. It can cause bronchitis and edema in lungs.

Concentration of ambient NO2 level was measured for 24 hours in the survey. The average concentration for 1 hour was, for instance, 44.17 µg/m3 at A-1, 43.32 µg/m3 at A-2, and 26.63 µg/m3 at A-3. All measurements were found to be lower than 200µg/m3, the guideline value specified in the NEQ (emission) Guidelines.

(3) Sulfur Dioxide (SO2)

Sulfur dioxide is generated from combustion of fuel such as oil, and as a by-product of some chemical products. On-road and off-road vehicles can also be emission sources of SO2. SO2 may cause respiratory diseases and irritation of throat and eyes. Measured SO2 level was, for instance, 2.5µg/m3 and 1.29µg/m3 at A-1. All values in both seasons were found to be lower than 20µg/m3, the guideline value stipulated in the NEQ (emission) Guidelines.

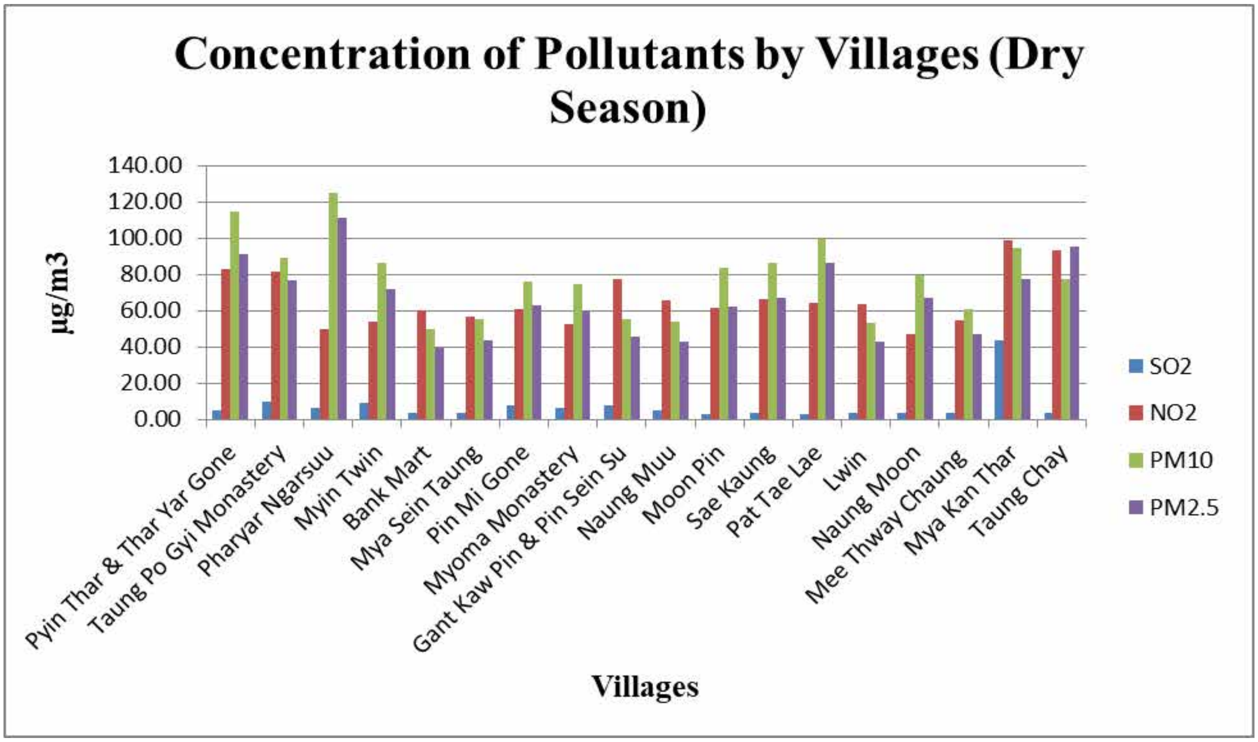


Figure 5.13 Concentration of Pollutants by Villages in Dry Season

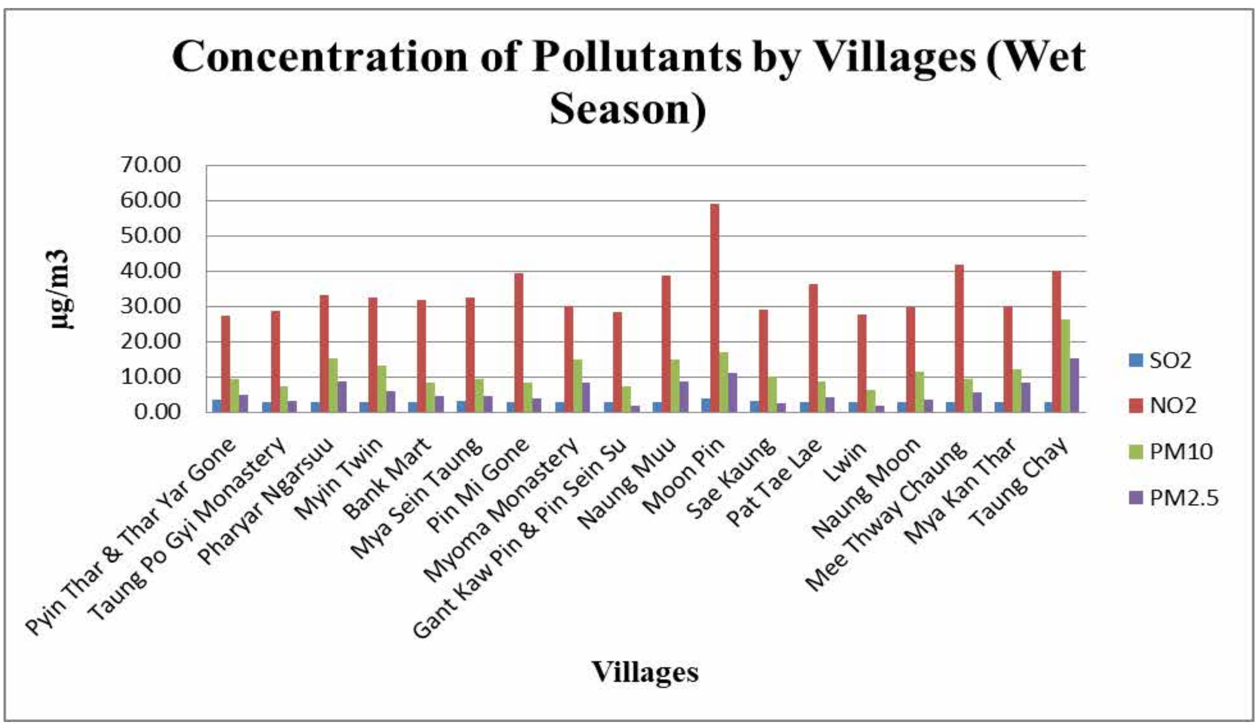


Figure 5.14 Concentration of Pollutants by Villages in Dry Season

5.4.2 Noise Level Measurement

(1) Noise Level Measurement at Noise Sources and Receptor-1

Noise level measurement was carried out at two sources namely Near Boiler and Near Cooling Water Tower and at two receptor-1 points, namely, Staff Housing-1 and Staff Housing-2 of Thigyit Coal-fired Power Plant. Locations of noise level measurement at noise sources and receptor-1 are shown in Figure 5.15 and Table 5.6 represents the results of these noise level measurements.

Figure 5.15 Locations of Noise Level Measurement at Source and Receptor-1

Table 5.6 Results of Noise Level Measurement at Source and Receptor-1

Point	Date	Period	Observed value LAeq (dB)	NEQ Guideline Value (dB) (Residential)
Near Boiler	(23-24) January 2019	Daytime (7:00-22:00)	64.75	55
		Night-time (22:00-7:00)	67.78	45
Near Cooling	(24-25) January	Daytime	69.20	55

water tower	2019	(7:00-22:00)		
		Night-time (22:00-7:00)	68.08	45
Staff Housing-1	(23-24) January 2019	Daytime (7:00-22:00)	51.22	55
		Night-time (22:00-7:00)	52.44	45
Staff Housing-2	(24-25) January 2019	Daytime (7:00-22:00)	51.59	55
		Night-time (22:00-7:00)	46.89	45

*Measurement values that exceed the NEQ Guideline values are shown in a red word.

Source: E Guard Study Team

Near Boiler and Near Cooling Water Tower as noise sources

Staff Housing-1 and Staff Housing-2 as noise receptors

Photograph 3: Noise Level Measurement

(2) Noise Level Measurement at 18 Villages as Noise Receptor-2

Noise is emerged from operating process of Coal Fired Power Plant. In fact, emerged noise is very loud when the plant re-generates after shutting down the process. Noise produced by starting and shutting down processes can affect sleep deprivation of villagers the inhabitants of nearby villages. Therefore, to determine the impact of noise caused by generating process, hourly sound exposure levels were measured as noise assessment.

Noise level measurements were carried out at eighteen villages (location denoted as N-1 to N-18) which are located within 3km from Thigyit Coal Fired Power Plant and also in the yard of Thigyit Coal Fired Power Plant. Residential noise level measurements were conducted from March 30 to April 30, 2018 for dry season and from August 7 to August 25, 2018 for wet season at the villages and industrial noise level measurement was conducted at Thigyit Coal Fired Power Plant from April 20 to April 30, 2018 for dry season.

Using a digital sound level meter, Noise levels were measured for 24 hours at the same eighteen points as the air quality measurement and were compared with the NEQ Guidelines of Myanmar. The eighteen locations for noise measurement are shown in Figure 5.16 and the equipment used for noise measurements is shown in Table 5.12.

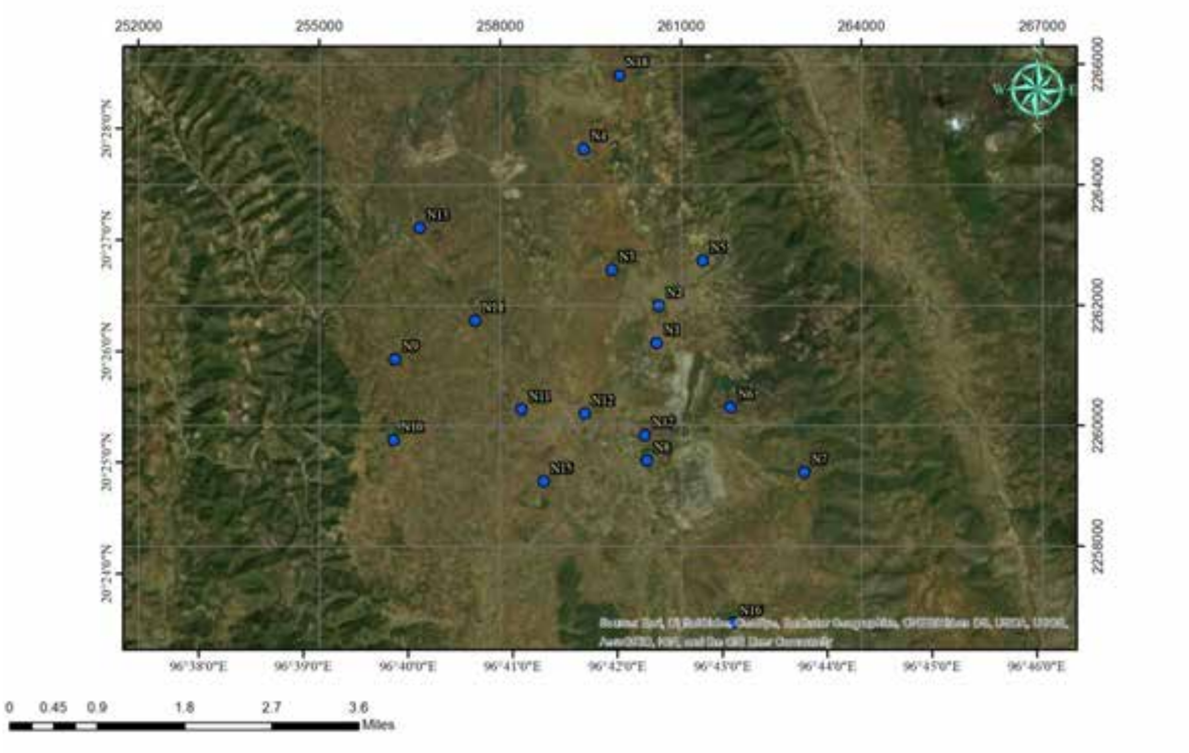


Figure 5.16 Location of Noise Level Measuring

Source: E Guard Study Team

Table 5.7 Instruments Used for Noise Level Measurement

No.	Name and Model of Instrument Used	Measurement Items	Image
1	Digital Sound Level Meter	Noise	

The following Table 5.8 represents the results of noise level measurement of eighteen villages as receptors.

Table 5.8 Results of Noise Level Measurement at each village

Point	Date	Name of Villages	Period	Dry Season LAeq (dB)	Wet Season LAeq (dB)	NEQ Guideline Value (dB) (Residential)
N-1	(30-31)March 2018	Junction of Pyin Thar, Thar Yar Gone villages and Monastery of Taung Po Gyi	Daytime (7:00-22:00)	56.77	53.45	55
			Night-time (22:00-7:00)	55.77	52.17	45
N-2	(31-1) March 2018	Monastery of Taung Po Gyi	Daytime (7:00-22:00)	53.74	49.70	55
			Night-time (22:00-7:00)	52.40	54.44	45
N-3	(1-2) April 2018	Phayar Ngar Su Village	Daytime (7:00-22:00)	48.75	51.18	55
			Night-time (22:00-7:00)	43.57	51.43	45
N-4	(3-4) April 2018	Myin Twin Village	Daytime (7:00-22:00)	54.06	52.63	55
			Night-time (22:00-7:00)	45.03	46.13	45

Point	Date	Name of Villages	Period	Dry Season LAeq (dB)	Wet Season LAeq (dB)	NEQ Guideline Value (dB) (Residential)
N-5	(4-5) April 2018	Bank Mart Village	Daytime (7:00-22:00)	50.27	54.52	55
			Night-time (22:00-7:00)	47.35	56.56	45
N-6	(5-6) April 2018	Mya Sein Taung Village	Daytime (7:00-22:00)	63.37	50.54	55
			Night-time (22:00-7:00)	61.52	50.49	45
N-7	(7-8) April 2018	Pin Mi Gone Village	Daytime (7:00-22:00)	57.63	52.68	55
			Night-time (22:00-7:00)	48.54	52.16	45
N-8	(8-9) April 2018	Thigyit Myo Ma Monastery	Daytime (7:00-22:00)	54.83	53.23	55
			Night-time (22:00-7:00)	49.29	57.90	45
N-9	(20-21)April 2018	Junction of Gant Kaw Pin and Pin Sein Su Villages	Daytime (7:00-22:00)	47.64	56.05	55
			Night-time (22:00-7:00)	47.9	55.42	45
N-10	(21-22)April 2018	Naung Mu Village	Daytime (7:00-22:00)	45.42	60.86	55
			Night-time (22:00-7:00)	41.84	49.68	45
N-11	(22-23)April 2018	Moon Pin Village	Daytime (7:00-22:00)	45.81	56.31	55
			Night-time (22:00-7:00)	40.73	53.65	45
N-12	(23-24)April	Sae Kaung	Daytime	62.77	52.20	55

Point	Date	Name of Villages	Period	Dry Season LAeq (dB)	Wet Season LAeq (dB)	NEQ Guideline Value (dB) (Residential)
	2018	Village	(7:00-22:00)			
			Night-time (22:00-7:00)	59.56	47.98	45
N-13	(24-25)April 2018	Pat Ta Lae Village	Daytime (7:00-22:00)	49.64	56.14	55
			Night-time (22:00-7:00)	45.11	55.08	45
N-14	(25-26)April 2018	Lwin Village	Daytime (7:00-22:00)	63.69	52.46	55
			Night-time (22:00-7:00)	63.17	51.93	45
N-15	(26-27)April 2018	Naung Moon Village	Daytime (7:00-22:00)	67.23	52.00	55
			Night-time (22:00-7:00)	62.59	50.80	45
N-16	(28-29)April 2018	Mee Thway Chaung Village	Daytime (7:00-22:00)	47.69	52.55	55
			Night-time (22:00-7:00)	48.79	51.35	45
N-17	(7-8)May 2018	Mya Kan Thar Village	Daytime (7:00-22:00)	47.15	57.41	55
			Night-time (22:00-7:00)	46.13	56.58	45
N-18	(8-9)May 2018	Taung Chay Village	Daytime (7:00-22:00)	47.61	52.27	55
			Night-time (22:00-7:00)	45	52.73	45

*Measurement values that exceed the NEQ Guideline values are shown in a red word.

Source: E Guard Study Team

Hourly equivalent continuous sound level ranged from 50.34 dB (A) to 68.71 dB (A) at location N-1. As can be seen from the table (5.8), an hourly equivalent noise level at some daytime period and night-time period were slightly higher than NEQ Guideline value due to a large number of vehicles passing in early morning and evening. Other possible reason was that the point was located at the junction of three village roads.

At N-2, at Monastery of Taung Po Gyi village, the hourly equivalent continuous sound level ranged from 44.26 dB (A) to 62.71 dB (A). The average equivalent sound level was 53.74 dB (A) at daytime and 52.40 dB (A) at night-time showing the fact that the hourly equivalent continuous sound level at nigh-time was slightly higher than NEQ Guideline value of 45 dB (A).

The maximum recorded hourly sound level at N-3 was 64.82 dB (A) and the minimum 38.76 dB (A). Hourly equivalent continuous sound level at the daytime period was higher compared to the night-time period because the noise monitoring point is at near the main road of Phayar Ngar Su village.

At Myin Twin Village (i.e. N-4), hourly equivalent sound level ranged from 34.01 to 67.26 dB (A). The average value of this point was 54.06 dB (A) in daytime and 45.03 dB (A) in night-time. These values were nearly equal to the NEQ Guideline value.

At N-5 (Bank Mart Village), the hourly equivalent continuous sound level ranged from 42.29 dB (A) to 59.46 dB (A). The average equivalent sound level was 50.27 dB (A) at daytime and 47.35 dB (A) at night-time indicating that the hourly equivalent continuous sound level at nigh-time was slightly higher than NEQ Guideline value of 45 dB (A) at night-time.

The noise level arranged from 58.34 dB (A) to 65.85 dB (A) at Mya Sein Taung Village (i.e. N-6). The average noise monitoring value of this point was 63.37 dB (A) at daytime period and 61.52 dB (A) at night-time period that were exceeded the NEQ Guideline value.

The maximum recorded sound level of this point was 63.70 dB (A) and the minimum sound level was 33.64 dB (A) at Pin Mi Gone Village (i.e. N-7). In average noise monitoring, daytime period of hourly equivalent sound level (i.e. 57.63 dB (A)) was slightly higher than NEQ Guideline value while the equivalent value at night-time period was below the NEQ Guideline value.

Maximum noise level was 62.23 dB (A) and the minimum noise level was 38.30 dB (A) at Monastery of Thigyit Myo Ma (N-8). The average equivalent sound level was 54.83 dB (A) at daytime period and 49.29 dB (A) at night-time period. The hourly equivalent continuous sound level at night-time period was slightly higher than NEQ guideline value.

At the junction of Gant Kaw Pin and Pin Sein Su villages (i.e. N-9), the average equivalent sound level was 47.64 dB (A) at daytime period and 47.90 dB (A) at night-time period. It was found that the hourly equivalent continuous sound level at night-time period was slightly higher than NEQ guideline value.

At Naung Mu village (i.e. N-10), the average equivalent sound level was 45.42 dB (A) at daytime period and 41.84 dB (A) at night-time period. These equivalent sound level at daytime and night-time were below the NEQ Guideline value.

At Moon Pin village (i.e. N-11), the average equivalent sound level was 45.81 dB (A) at daytime period and 40.73 dB (A) at night-time period. These equivalent sound level at daytime and night-time were below the NEQ Guideline value.

At Sae Kaung Village (i.e.N-12), the hourly equivalent continuous sound level ranged from 56.67 dB (A) to 65.42 dB (A). The average equivalent sound levels were 62.77 dB (A) at daytime and 59.56 dB (A) at night-time period. These equivalent sound levels were exceeded the NEQ Guideline value.

At Pat Ta Lae Village (i.e.N-13), the average equivalent sound level was 49.64 dB (A) at daytiem period and 45.11 dB (A) at night-time period. The average equivalent sound level was within the NEQ Guideline value.

At Lwin village (i.e. N-14), the average equivalent sound level was 63.69 dB (A) at daytime period and 63.17 dB (A) at night-time period. This equivalent sound level at daytime and night-time exceeded the NEQ Guideline value. Possible reason was that the village is located near Thigyit-Aungban main road.

At Naung Moon village (i.e. N-15), the average equivalent sound level was 67.23 dB (A) at daytime period and 62.59 dB (A) at night-time period. This equivalent sound level at daytime and night-time was above the NEQ Guideline value.

At Mee Thway Chaung village (i.e. N-16), the average equivalent sound level was 47.69 dB (A) at daytime period and 48.79 dB (A) at night-time period. The hourly equivalent continuous sound level at night-time period was slightly higher than the NEQ guideline value.

At Mya Kan Thar (i.e. N-17), the average equivalent sound level was 47.15 dB (A) at daytime period and 46.13 dB (A) at night-time period. In fact, the hourly equivalent continuous sound level at night-time period was slightly larger than NEQ guideline value.

At Taung Chay Village (i.e. N-18), the hourly equivalent sound level was within the NEQ Guideline value at both daytime period and night-time period.

It should be noted that the noise level mentioned above includes background noise level. Therefore, they are compared with the noise levels specified in the NEQ Guidelines. The result of all points exceed the NEQ Guideline values of 55 dB (daytime) and 45 dB (nighttime). Other sources such as traffic passing, wind and loud speaker from novitiation ceremony may be considered as additional causes of noise.

5.4.3 Wind Speed and Direction

The following figures show the wind speed and direction of villages around 5km from the Tigyit Coal Fired Power Plant. Wind speed and direction at each measured point in dry and wet can be seen in Table (5.9).

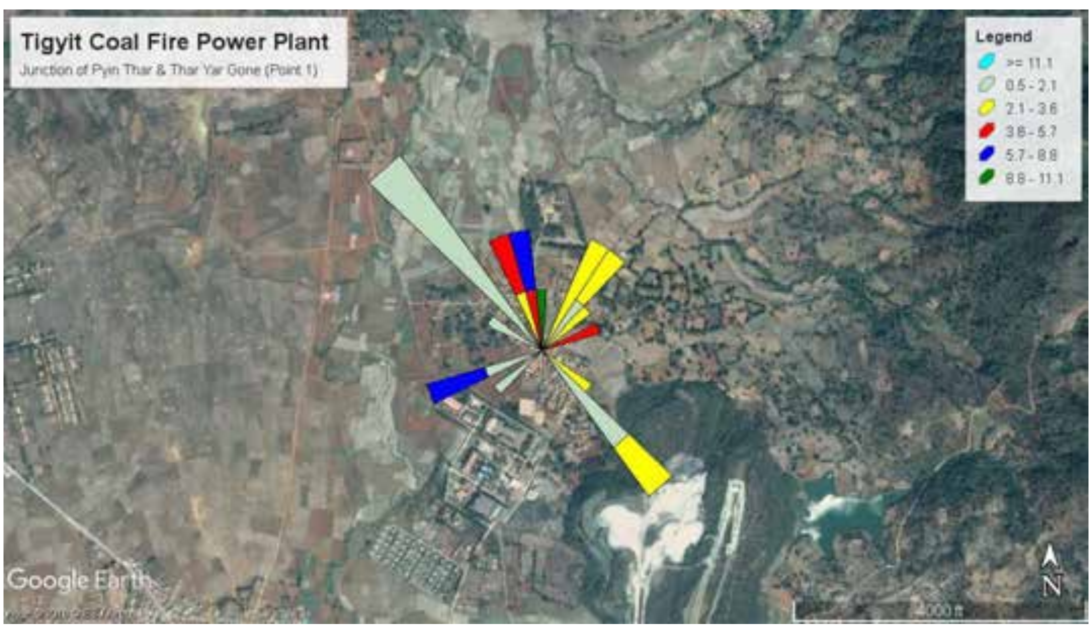
Table 5.9 Wind Speed and Direction

Point	Dry Season	Wet Season
A-1	Northwest to Southeast (3.6-5.7 m/s), West to East (0.5-2.1 m/s) and Northeast to Southwest (0.5-2.1 m/s)	Northeast to Southwest (5.7-8.8 m/s), Northwest to Southeast (2.1-3.6 m/s), Southwest to Northeast (2.1-3.6 m/s) and Southeast to Northwest (0.5-2.1)
A-2	Northwest to Southeast (2.1-5.7 m/s) and East-northeast to West-southwest (0.5-2.1 m/s)	Southwest to Northeast (0.5-5.7 m/s)
A-3	West-northwest to East-southeast (0.5-2.1 m/s)	Southwest to Northeast (0.5-5.7 m/s)
A-4	Southwest to Northeast (0.5-8.8 m/s)	West-southwest to East-northeast (0.5-3.6 m/s)
A-5	Northeast to Southwest (0.5-3.6 m/s), Southwest to Northeast (5.7-8.8 m/s) and West-northwest to East-southeast (0.5-5.7 m/s)	South-southeast to North-northwest (0.5-8.8 m/s)
A-6	Southeast to Northwest (0.5-8.8 m/s) and Southwest to Northeast (3.6-8.8 m/s) and East-northeast to West-southwest (0.5-2.1 m/s)	West-southwest to East-northeast (0.5-3.6 m/s)
A-7	Southeast to Northwest (0.5-8.8 m/s) and East-northeast to West-southwest (0.5-2.1)	Southwest to Northeast (0.5-2.1 m/s) and West to East (0.5-3.6 m/s)
A-8	Northeast to Southwest (0.5-3.6 m/s)	South to North (>=11.1)
A-9	Northwest to Southeast (0.5-5.7 m/s) and North-northwest to South-southeast (3.6-8.8 m/s)	Southeast to Northwest (2.1-5.7 m/s) and Northwest to Southeast (0.5-2.1 m/s)
A-10	East-northeast to West-southwest (2.1-5.7 m/s)	South-southeast to North-northwest (0.5-5.7 m/s)

A-11	Southwest to Northeast (0.5-5.7 m/s)	North-northeast to South-southwest (0.5-3.6 m/s) and North-northwest to South-southeast (0.5-2.1 m/s)
A-12	West to East (0.5-11.1 m/s) and Northwest to Southeast (0.5-11.1 m/s)	South-southeast to North-northwest (3.6-5.7 m/s) and East-northeast to West-southwest (0.5-3.6 m/s) and Southwest to Northeast (0.5-3.6 m/s)
A-13	Southwest to Northeast (0.5-5.7 m/s) and Northwest to Southeast (3.6-5.7 m/s)	East to West (0.5-5.7 m/s) and South to North (5.7-11.1 m/s) and Northwest to Southeast (0.5-5.7 m/s)
A-14	North-northeast to South-southwest (3.6-8.8 m/s) and North to South (0.5-5.7 m/s) and Northeast to Southwest (2.1-5.7 m/s)	Southeast to Northwest (0.5-3.6 m/s) and South to North (5.7-11.1 m/s)
A-15	North to South (2.1-11.1 m/s) and East to West (5.7-8.8 m/s) and Northwest to Southeast (2.1-11.1 m/s)	East to West (2.1-5.7 m/s) and Northeast to Southwest (0.5-2.1 m/s)
A-16	West to East (0.5-3.6 m/s)	Northwest to Southeast (0.5-2.1 m/s)
A-17	Northwest to Southeast (0.5-5.7 m/s) and West to East (0.5-3.6 m/s)	East to West and East-northeast to West-southwest (0.5-3.6 m/s) and West-southwest to East-northeast (0.5-2.1 m/s)
A-18	North to South (0.5-2.1 m/s) and Northwest to Southeast (0.5-2.1m/s) and North-northeast to South-southwest (3.6-5.7 m/s)	East-northeast to West-southwest (0.5-3.6 m/s) and East to West (2.1-3.6 m/s)

The following figures are the wind direction figures of each point.

Dry Season

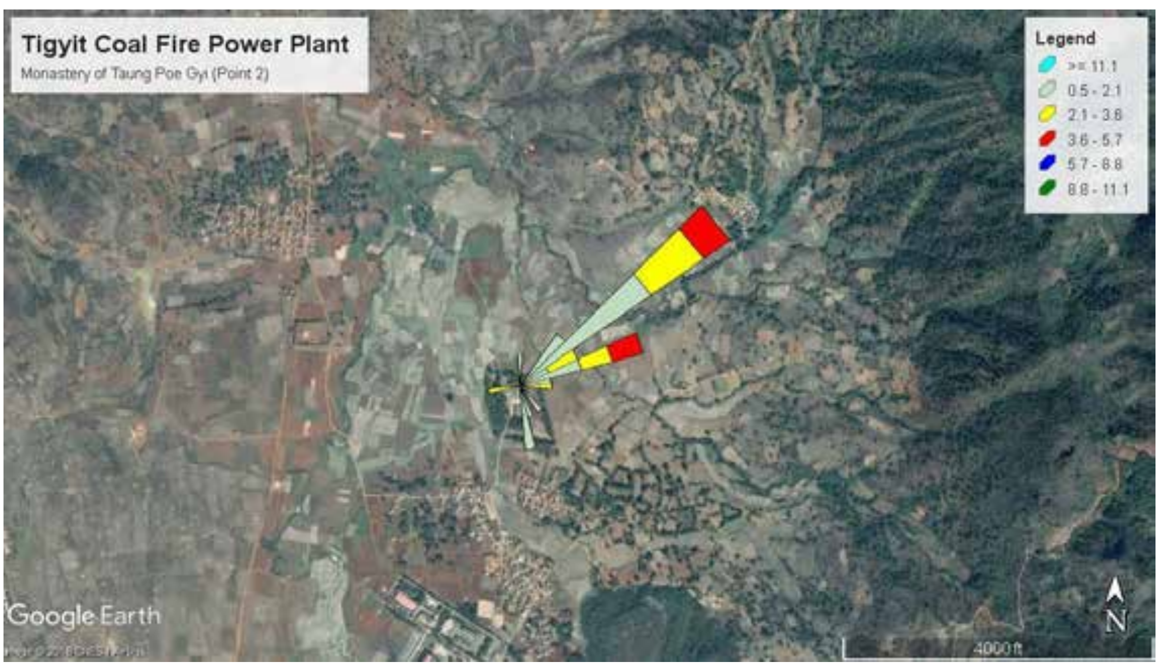


Wet Season

Figure 5.17 Wind Speed and Direction at A-1 (Junction of Pyin Thar, Taung Po Gyi and Thar Yar Gone villages)

Source: E Guard Study Team

Dry Season

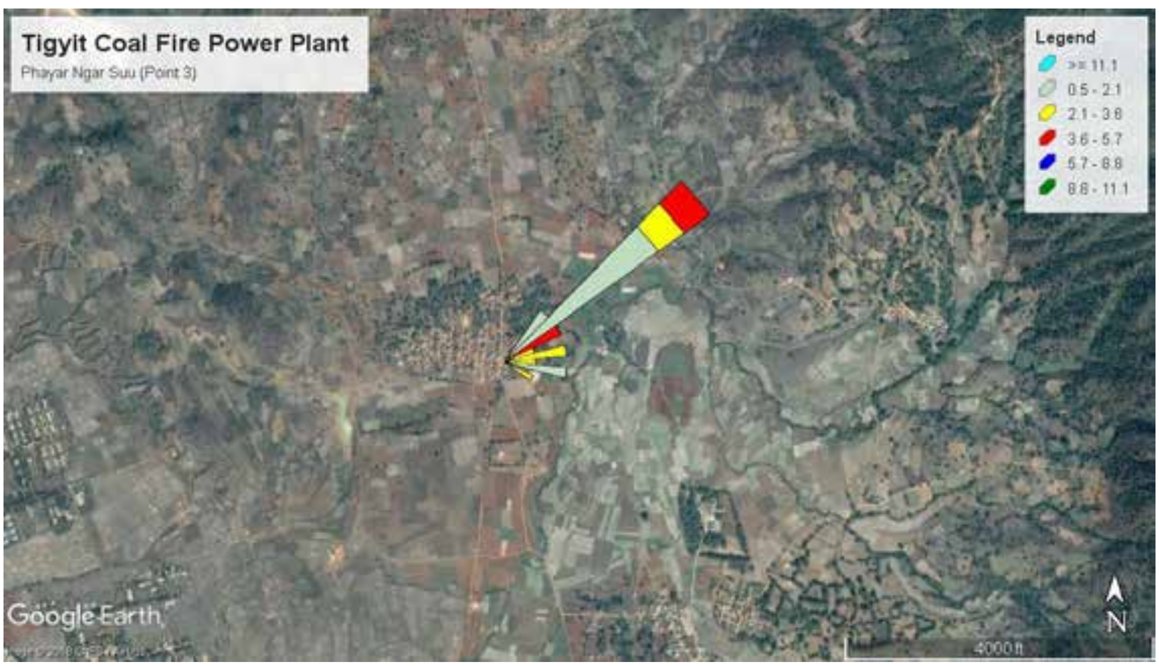


Wet Season

Figure 5.18 Wind Speed and Direction at A-2 (Taung Po Gyi Village)

Source: E Guard Study Team

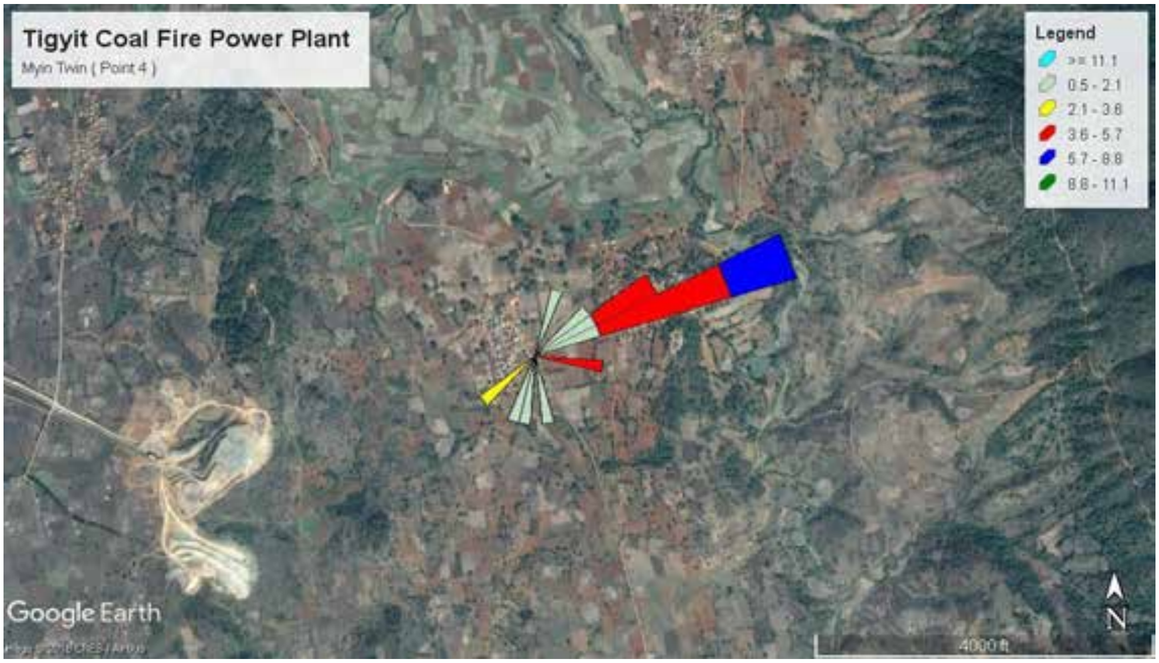
Dry Season



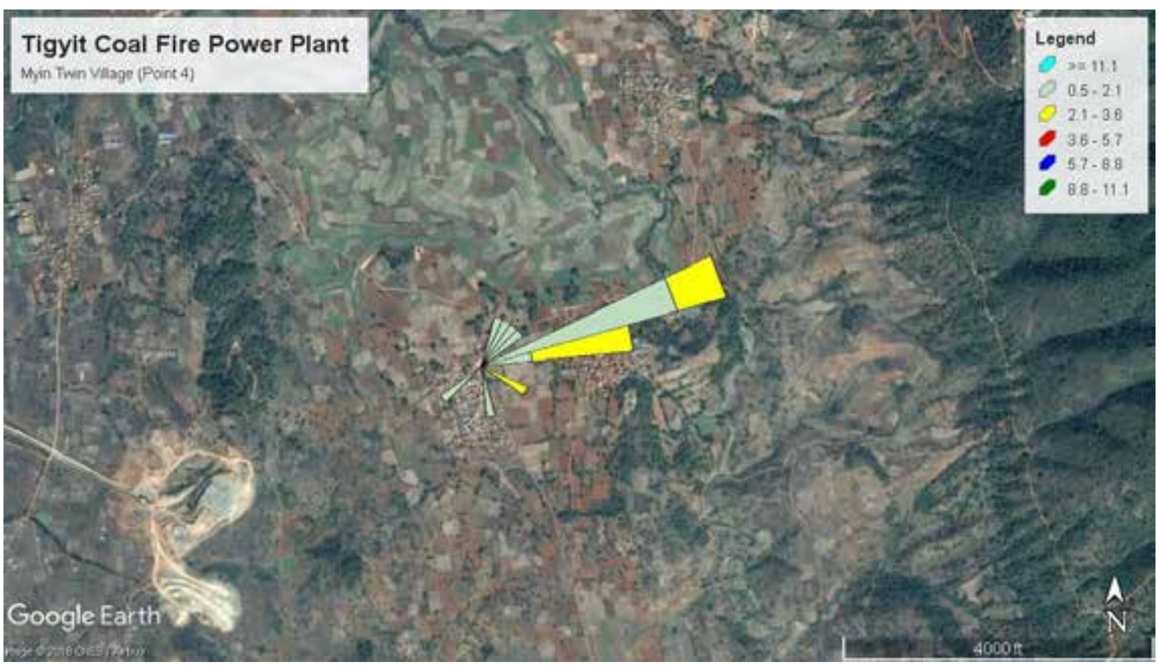
Wet Season

Figure 5.19 Wind Speed and Direction at A-3 (Phayar Ngar Su Village)

Source: E Guard Study Team



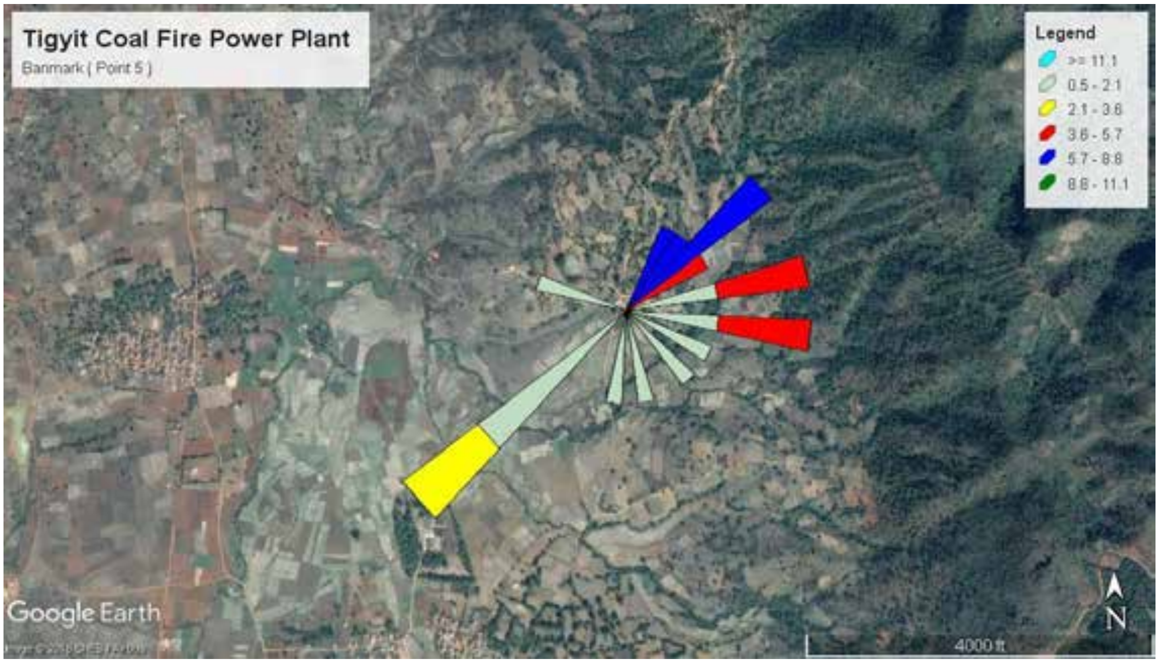
Dry Season



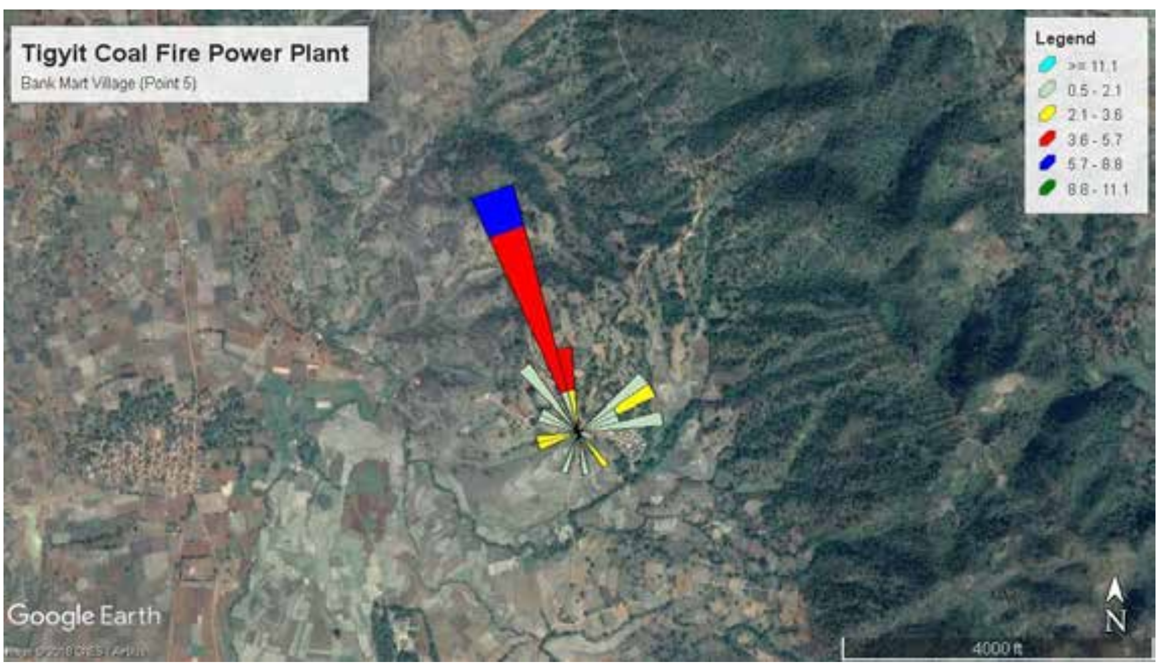
Wet Season

Figure 5.20 Wind Speed and Direction at A-4 (Myin Twin Village)

Source: E Guard Study Team



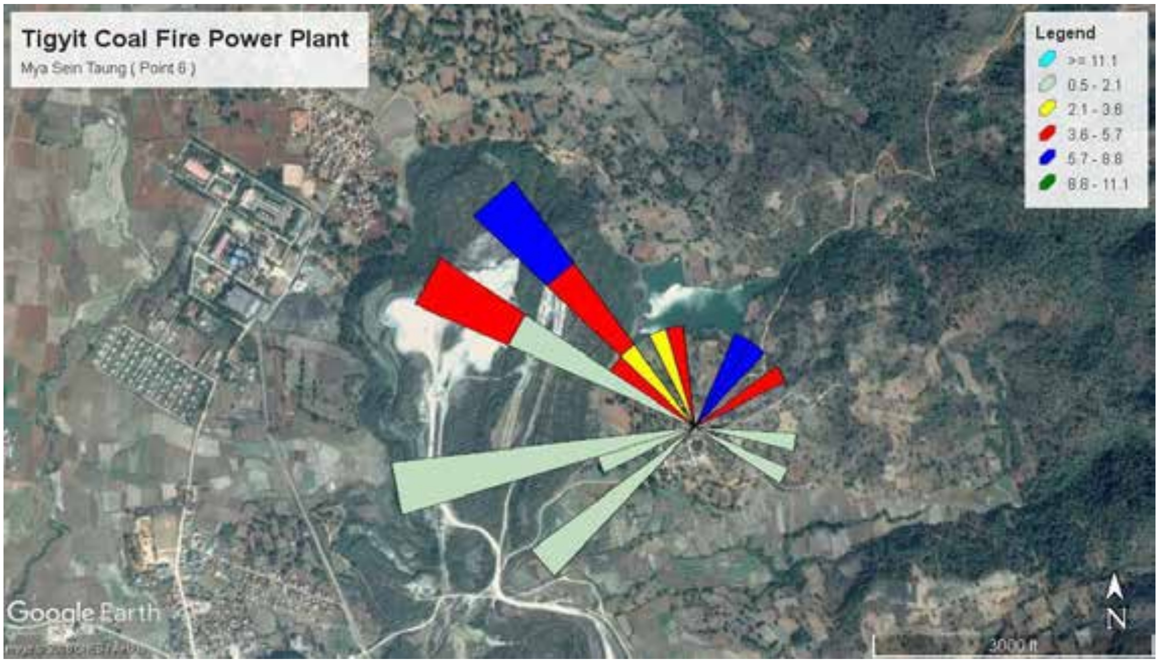
Dry Season



Wet Season

Figure 5.21 Wind Speed and Direction at A-5 (Bank Mart Village)

Source: E Guard Study Team

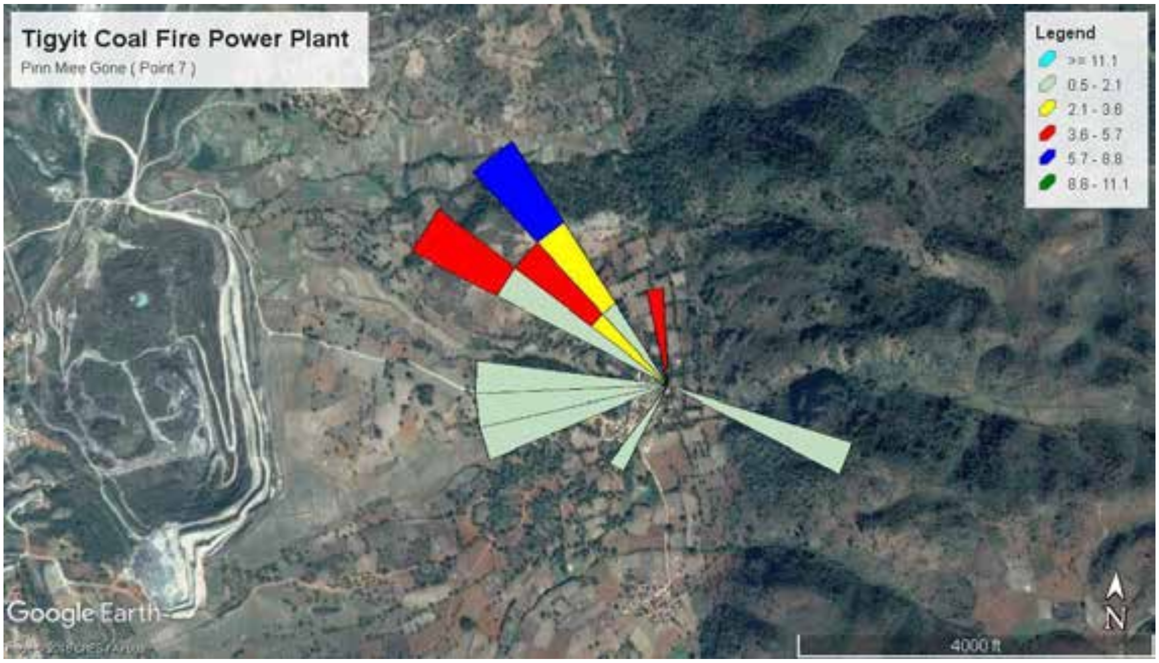


Dry Season

Wet Season

Figure 5.22 Wind Speed and Direction at A-6 (Mya Sein Taung Village)

Source: E Guard Study Team

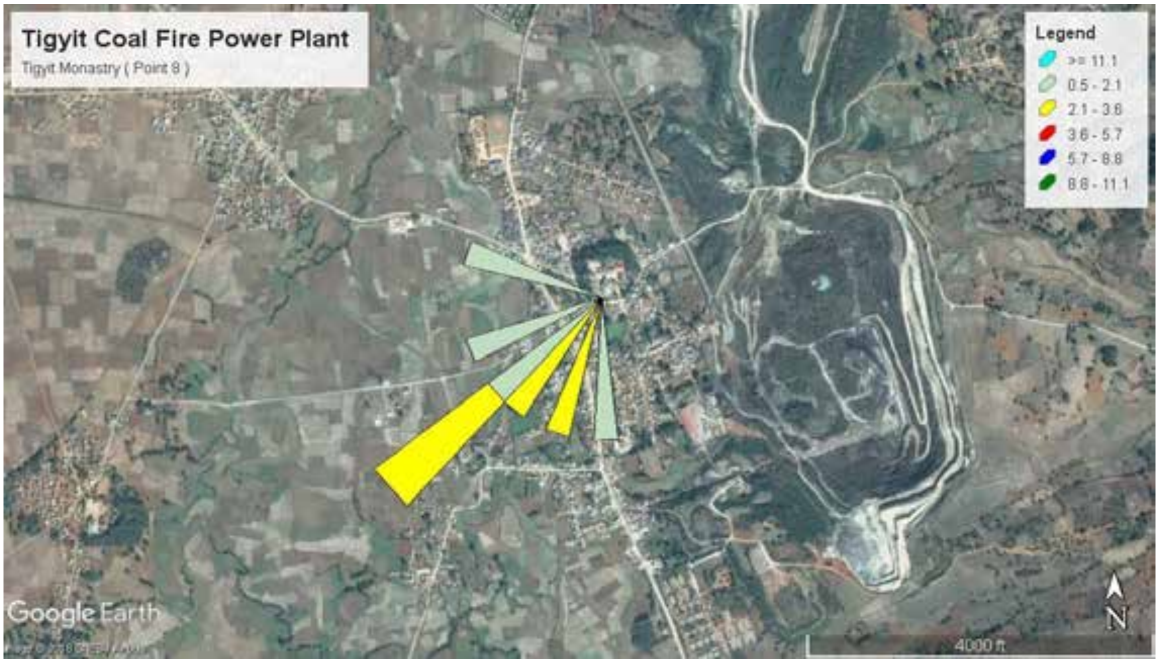


Dry Season

Wet Season

Figure 5.23 Wind Speed and Direction at A-7 (Pin Mi Gone Village)

Source: E Guard Study Team

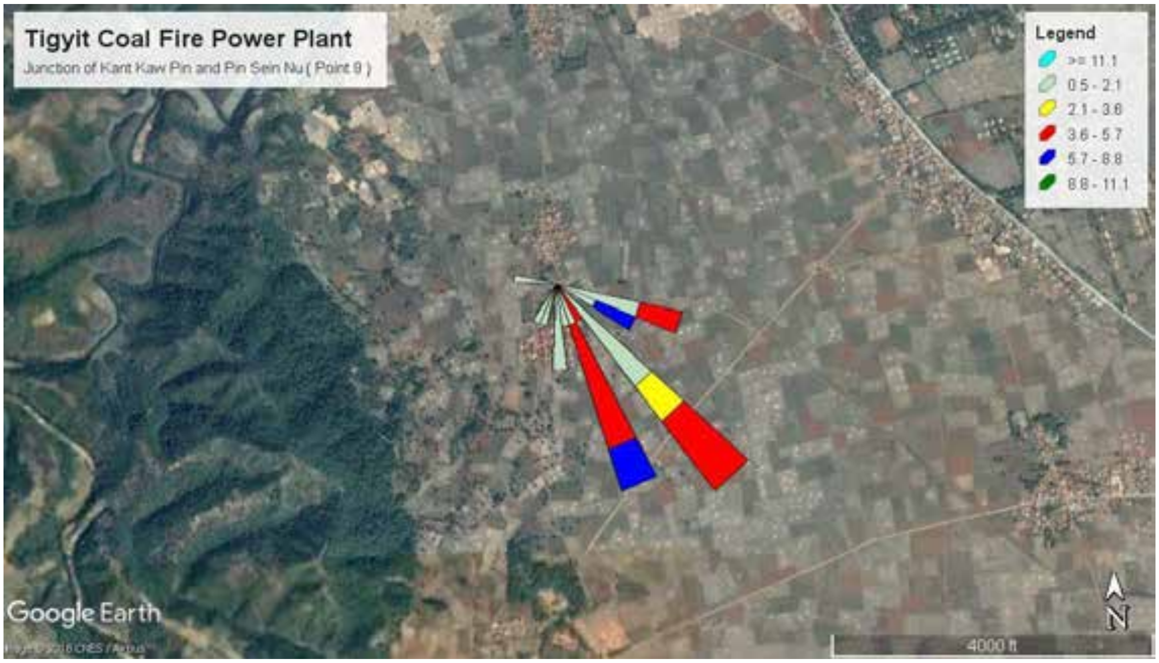


Dry Season

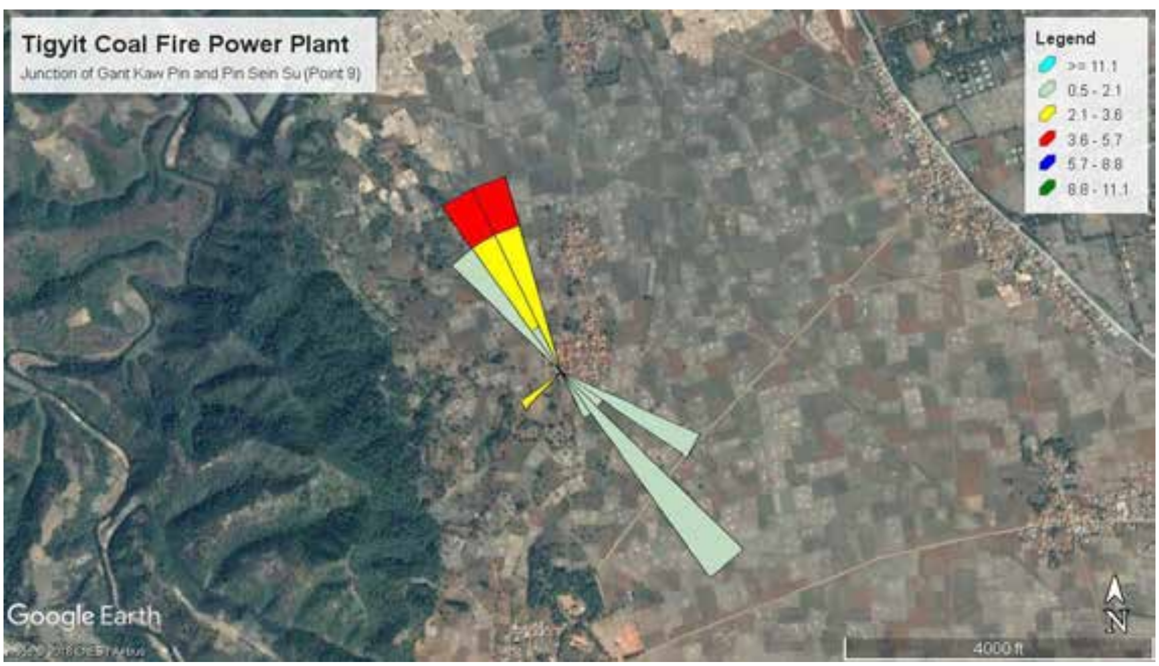
Wet Season

Figure 5.24 Wind Speed and Direction at A-8 (Thigyit Myo Ma Monastery)

Source: E Guard Study Team



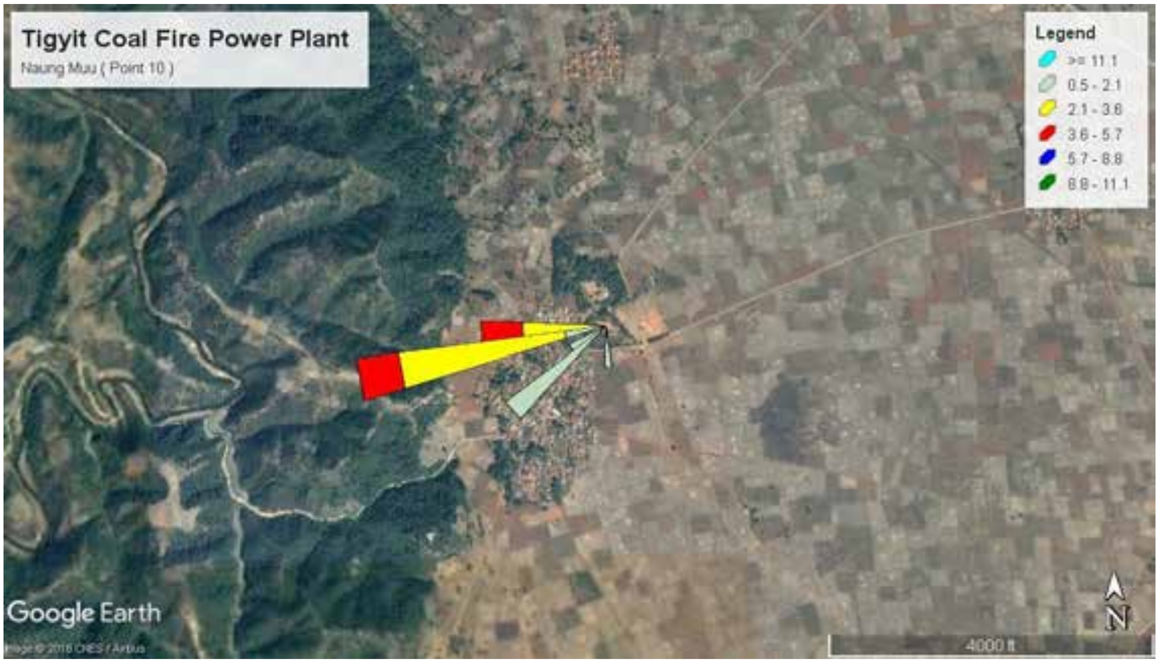
Dry Season



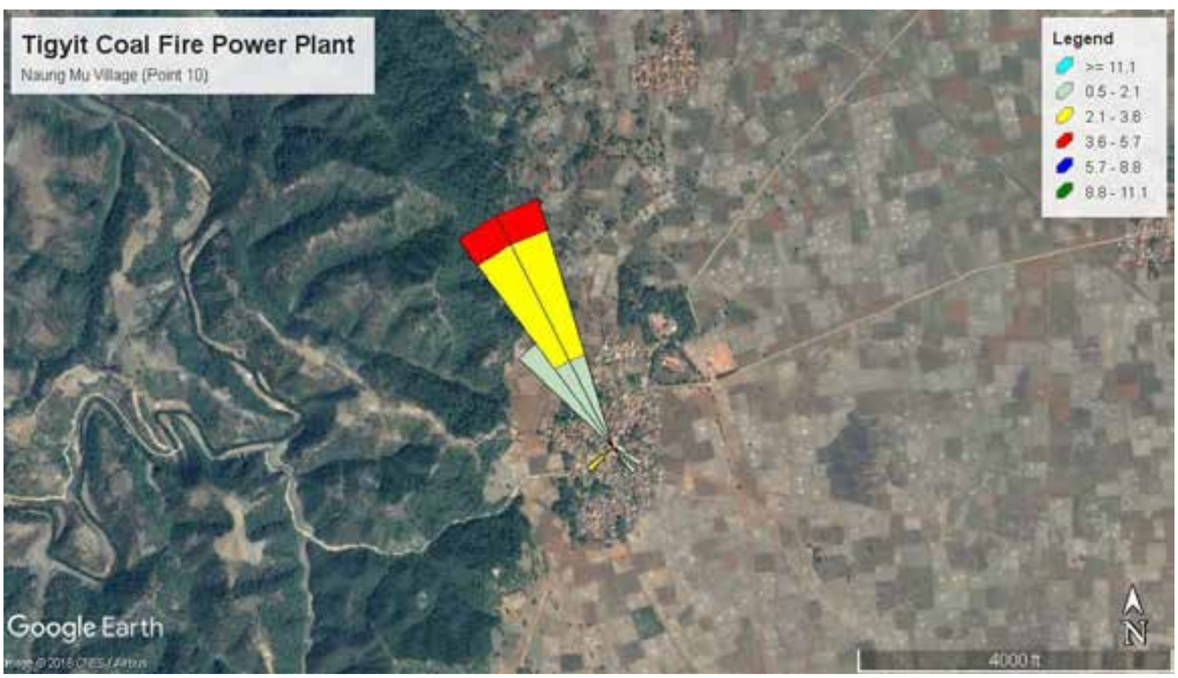
Wet Season

Figure 5.25 Wind Speed and Direction at A-9 (Junction of Gant Kaw Pin and Pin Sein Su Villages)

Source: E Guard Study Team



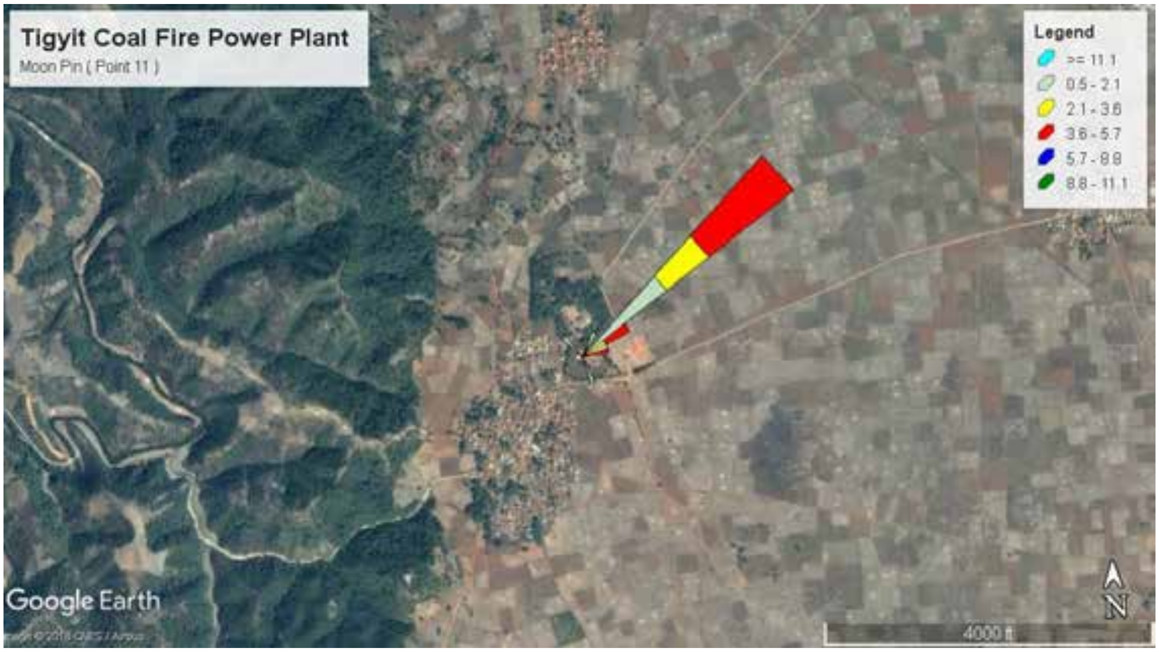
Dry Season



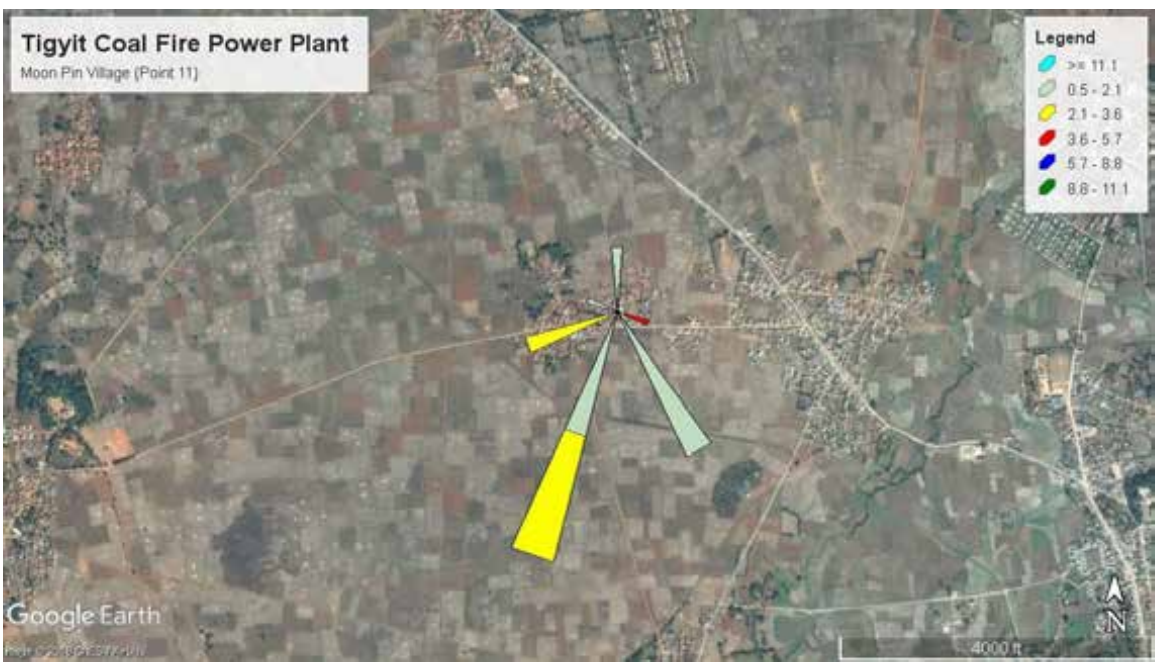
Wet Season

Figure 5.26 Wind Speed and Direction at A-10 (Naung Mu Village)

Source: E Guard Study Team



Dry Season

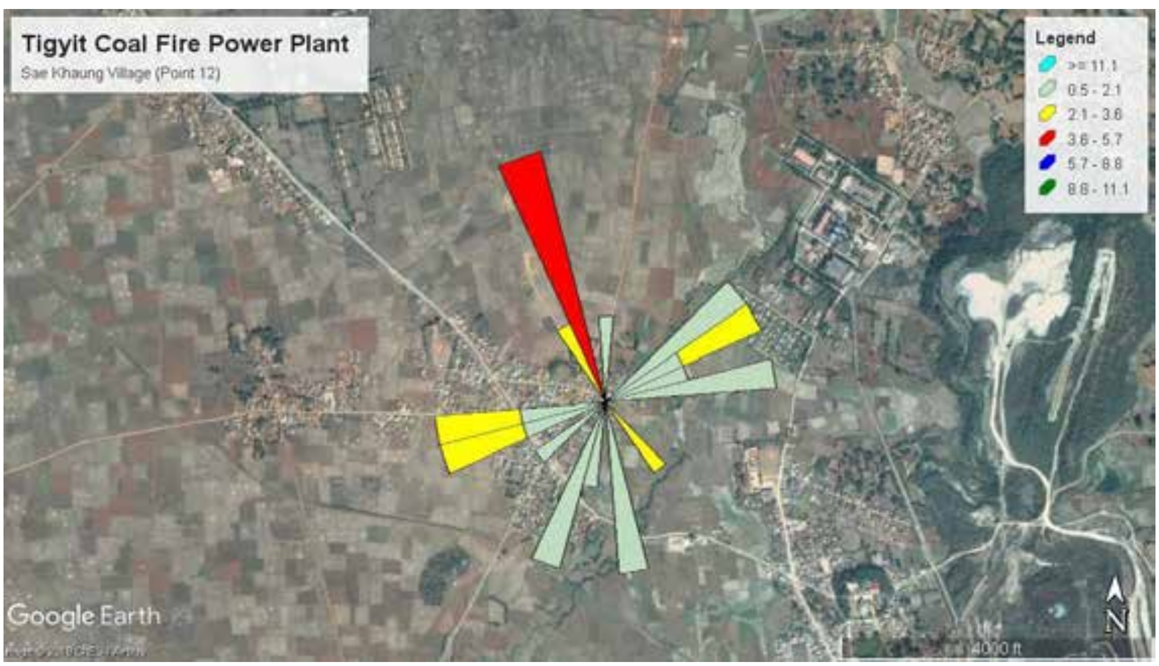


Wet Season

Figure 5.27 Wind Speed and Direction at A-11 (Moon Pin Village)

Source: E Guard Study Team

Dry Season

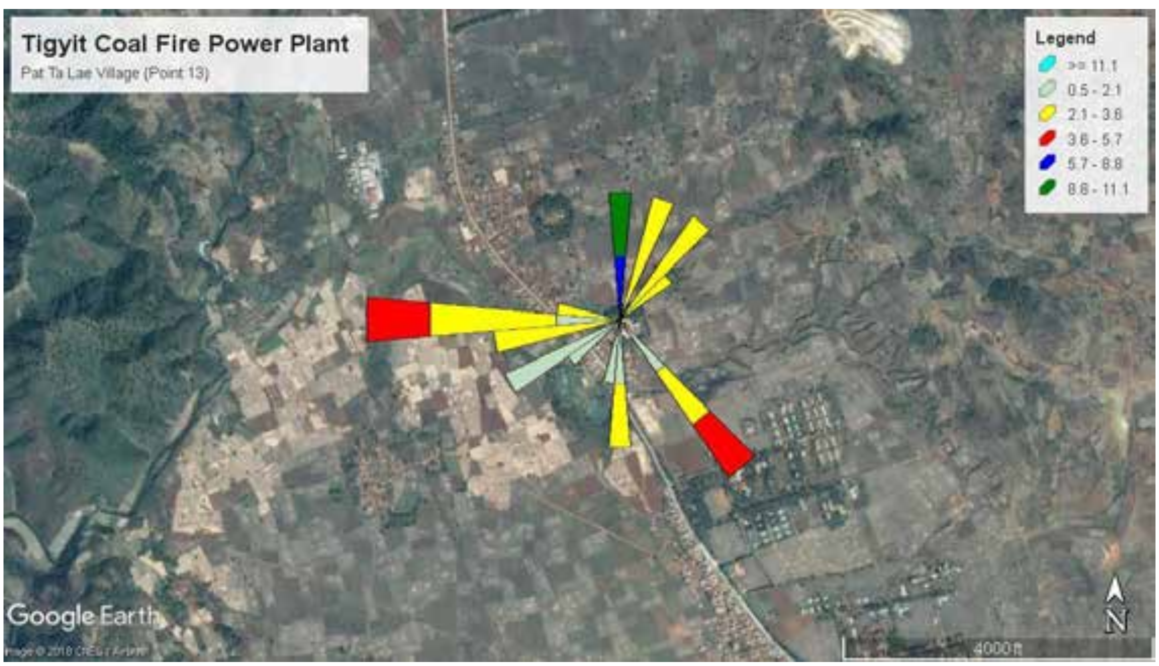


Wet Season

Figure 5.28 Wind Speed and Direction at A-12 (Sae Kaung Village)

Source: E Guard Study Team

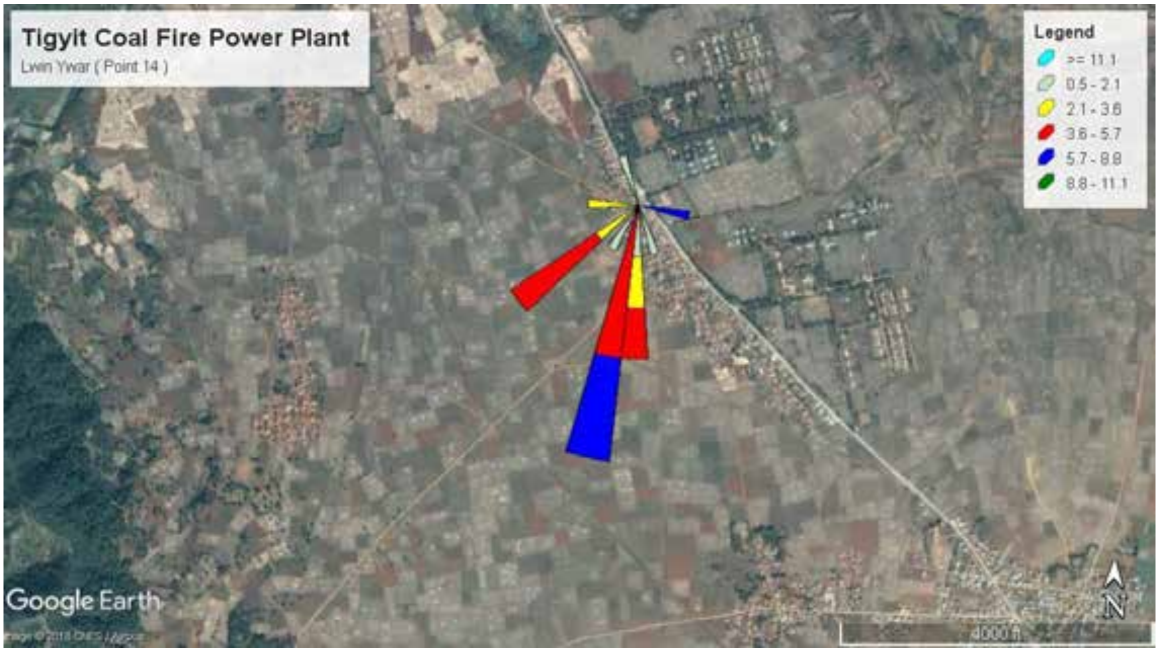
Dry Season



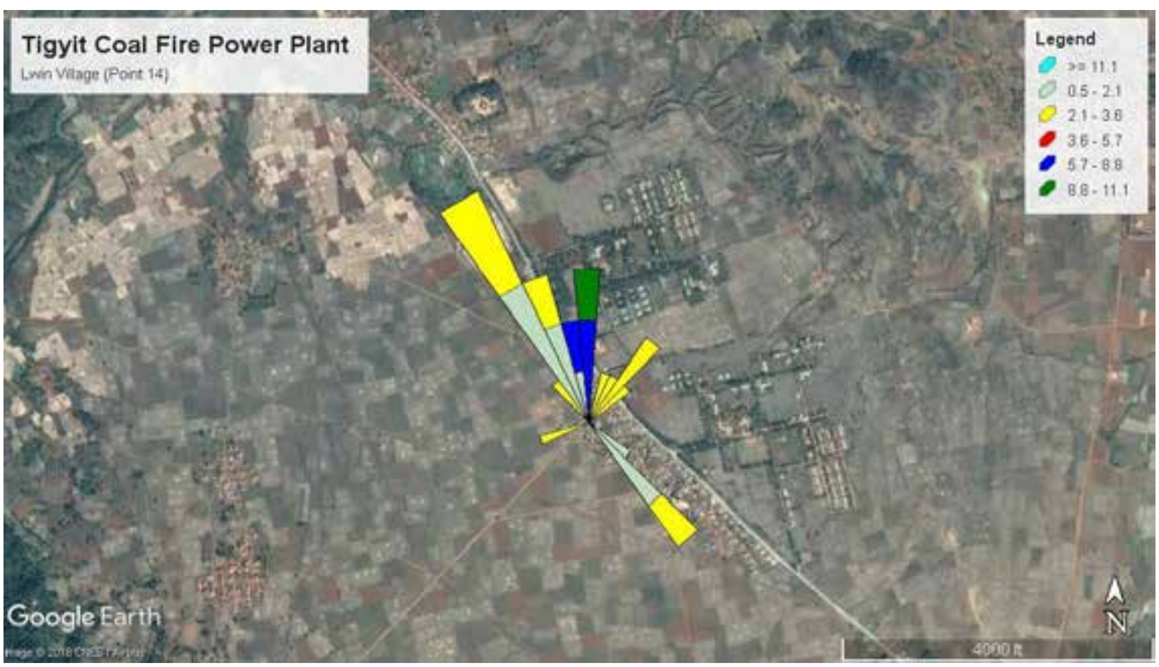
Wet Season

Figure 5.29 Wind Speed and Direction at A-13 (Pat Ta Lae Village)

Source: E Guard Study Team



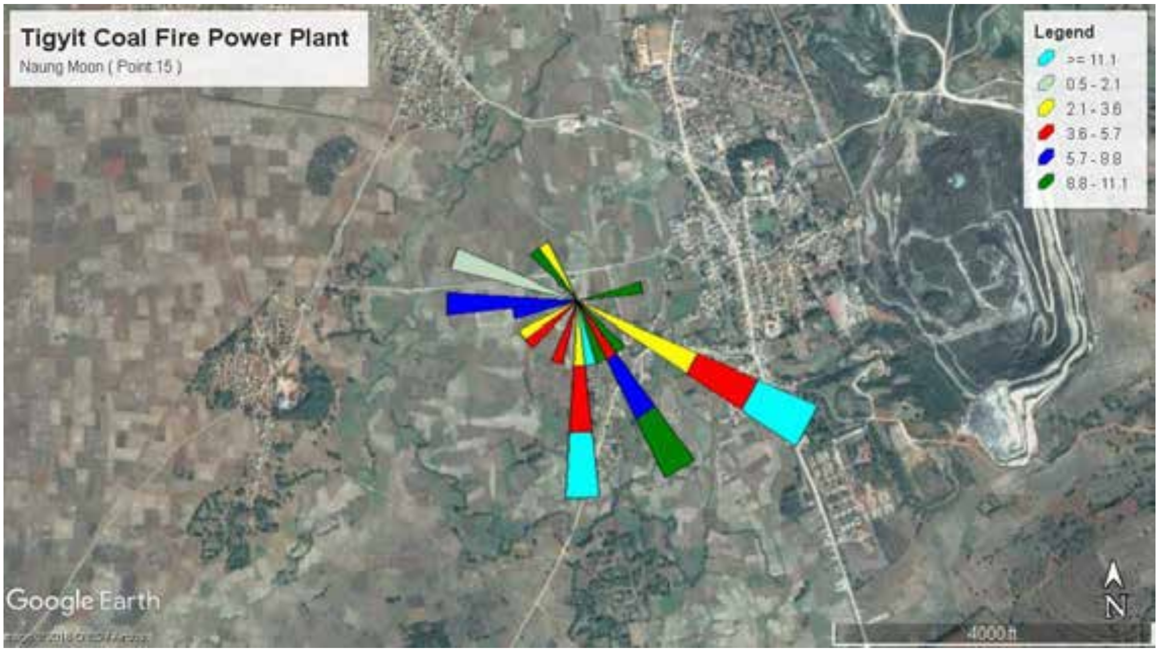
Dry Season



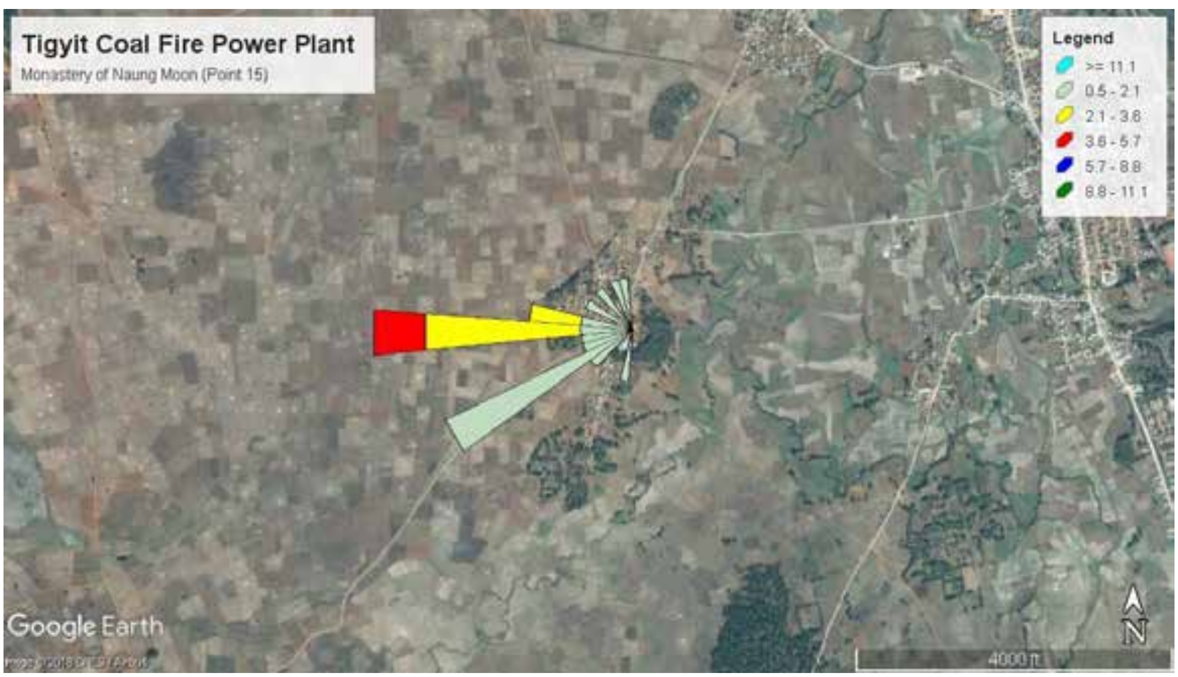
Wet Season

Figure 5.30 Wind Speed and Direction at A-14 (Lwin Village)

Source: E Guard Study Team



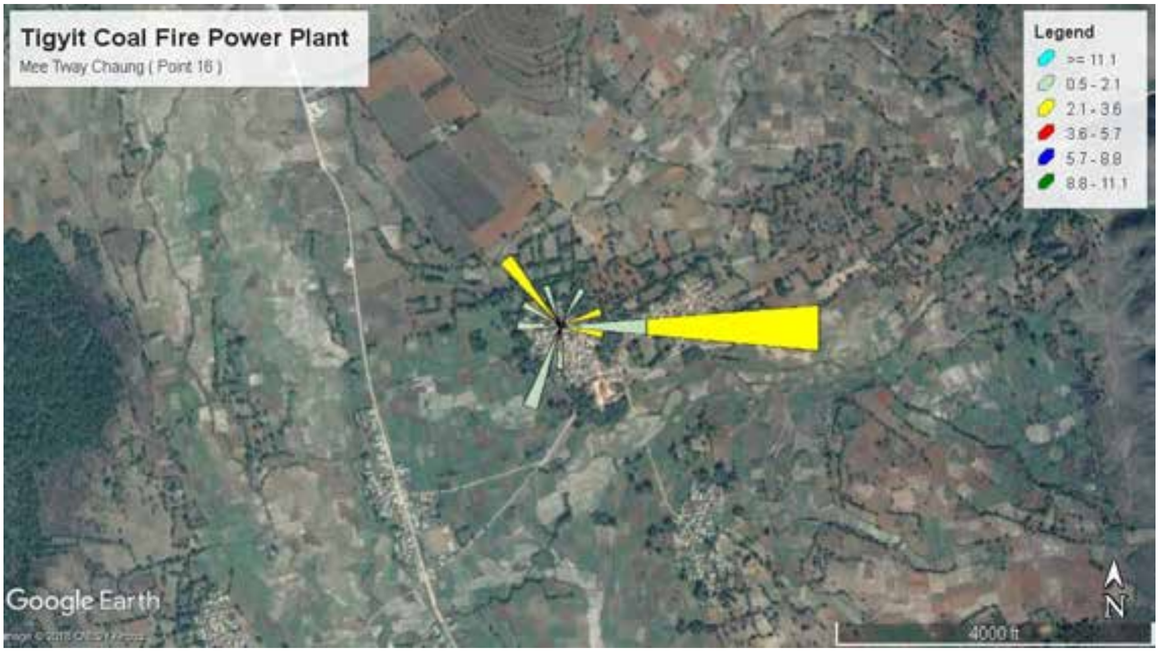
Dry Season



Wet Season

Figure 5.31 Wind Speed and Direction at A-15 (Naung Moon Village)

Source: E Guard Study Team



Dry Season

Wet Season

Figure 5.32 Wind Speed and Direction at A-16 (Mee Thway Chaung Village)

Source: E Guard Study Team

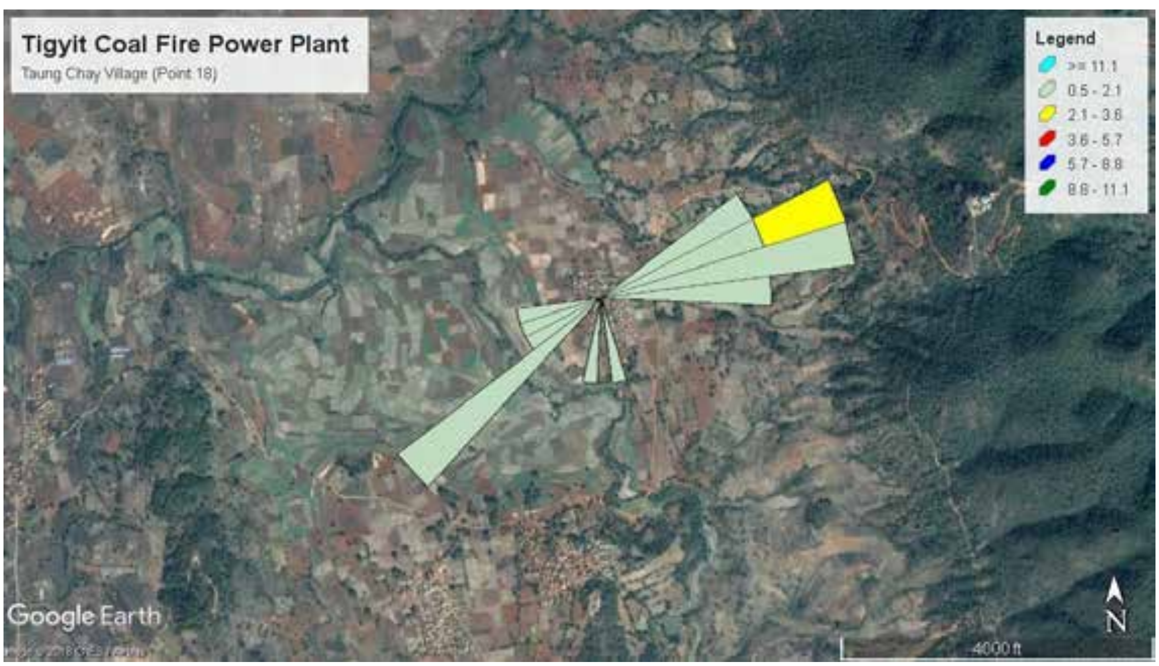
Dry Season

Wet Season

Figure 5.33 Wind Speed and Direction at A-17 (Mya Kan Thar Village)

Source: E Guard Study Team

Dry Season



Wet Season

Figure 5.34 Wind Speed and Direction at A-18 (Taung Chay Village)

Source: E Guard Study Team

5.4.4 Temperature and Humidity

The average humidity and temperature at each measured point are shown in Table (5.10).

Table 5.10 Humidity and Temperature in Project Area

Point	Location	Longitude and Latitude	Description of survey point	Season	Date	Temperature(°C)	Humidity
A-1	Junction of PyinThar and Thar Yar Gone	Lat: 20° 26‟ 0.813”N, Lon 096° 42‟ 19.709”E	0.53 km away from the Thigyit Coal Fired Power Plant	Dry Season	(30-31) March 2018	24.77	61.21
				Wet Season	(13-14) August 2018	20.51	37.63
A-2	Monastery of Taung Po Gyi	Lat: 20° 26‟ 28.760”N, Lon 096° 42‟ 20.519”E	1.11 km away from the Thigyit Coal Fired Power Plant	Dry Season	(31-1) March & April 2018	20.97	60.56
				Wet Season	(11-12) August 2018	23.38	63.84
A-3	Phayar Ngar Su Village	Lat: 20° 26‟ 47.705”N, Lon 096° 41‟ 53.205”E	1.73 km away from the Thigyit Coal Fired Power Plant	Dry Season	(1-2) April 2018	22.60	45.04
				Wet Season	(10-11) August 2018	21.84	61.52
A-4	Myin Twin Village	Lat: 20° 27‟ 52.778”N, Lon 096° 41‟ 36.149”E	3.79 km away from the Thigyit Coal Fired Power Plant	Dry Season	(3-4) April 2018	20.93	49.21
				Wet Season	(9-10) August 2018	21.88	40.77
A-5	Bank Mart Village	Lat: 20° 26‟ 53.390”N, Lon 096° 42‟ 45.445”E	2.08 km away from the Thigyit Coal Fired Power Plant	Dry Season	(4-5) April 2018	21.75	48
				Wet	(12-13)	22.46	55.24

Point	Location	Longitude and Latitude	Description of survey point	Season	Date	Temperature(°C)	Humidity
				Season	August 2018		
A-6	Mya Sein Taung Village	Lat: 20° 25“ 34.591”N, Lon 096° 43“ 02.364”E	1.61 km away from the Thigyit Coal Fired Power Plant	Dry Season	(5-6) April 2018	22.35	52
				Wet Season	(15-16) August 2018	22.26	69.02
A-7	Pin Mi Gone Village	Lat: 20° 25“ 00.073”N, Lon 096° 43“ 45.101”E	3.18 km away from the Thigyit Coal Fired Power Plant	Dry Season	(7-8) April 2018	21.36	47
				Wet Season	(16-17) August 2018	21.74	64.38
A-8	Monastery of Thigyit Myo Ma	Lat: 20° 25“ 05.099”N, Lon 096° 42“ 14.903”E	1.52 km away from the Thigyit Coal Fired Power Plant	Dry Season	(8-9) April 2018	19.14	68
				Wet Season	(7-8) August 2018	21.89	64.63
A-9	Junction of Gant Kaw Pin and Pin Sein Su Village	Lat: 20° 25“ 57.868”N, Lon 096° 39“ 50.103”E	4.08 km away from the Thigyit Coal Fired Power Plant	Dry Season	(20-21) April 2018	19.71	67.05
				Wet Season	(22-23) August 2018	24.50	47.91
A-10	Naung Mu Village	(Lat: 20° 25“ 14.20”N, Lon 096° 39“ 49.77”E)	4.27 km away from the Thigyit Coal Fired Power Plant	Dry Season	(21-22) April 2018	22.18	60.16
				Wet Season	(21-22) August 2018	23.18	65.45

Point	Location	Longitude and Latitude	Description of survey point	Season	Date	Temperature(°C)	Humidity
A-11	Moon Pin Village	Lat: 20° 25‶ 31.87”N, Lon 096° 41‶ 2.78”E	2.09 km away from the Thigyit Coal Fired Power Plant	Dry Season	(22-23) April 2018	21.67	61.48
				Wet Season	(24-25) August 2018	24.09	78.96
A-12	Sae Khaung Village	Lat: 20° 25‶ 30”N, Lon 096° 41‶ 39”E	1.14 km away from the Thigyit Coal Fired Power Plant	Dry Season	(23-24) April 2018	21.37	60.78
				Wet Season	(17-18) August 2018	26.07	64.19
A-13	Pat Ta Lae Village	Lat: 20° 27‶ 9”N, Lon 096° 40‶ 3”E	4.35 km away from the Thigyit Coal Fired Power Plant	Dry Season	(24-25) April 2018	22.16	65.68
				Wet Season	(19-20) August 2018	22.83	73.43
A-14	Lwin Village	Lat: 20° 26‶ 19.50”N, Lon 096° 40‶ 35.49”E	2.76 km away from the Thigyit Coal Fired Power Plant	Dry Season	(25-26) April 2018	20.81	65.45
				Wet Season	(20-21) August 2018	22.84	71.38
A-15	Naung Moon Village	Lat: 20° 24‶ 52.17”N, Lon 096° 41‶ 51.50”E	2.46 km away from the Thigyit Coal Fired Power Plant	Dry Season	(26-27) April 2018	21.29	60.48
				Wet Season	(18-19) August 2018	22.95	68.37
A-16	Mee Thway Chaung	Lat: 20° 23‶ 37.91”N, Lon	4.50 km away from	Dry Season	(28-29) April	22.88	58.58

Point	Location	Longitude and Latitude	Description of survey point	Season	Date	Temperature(°C)	Humidity
	Village	096° 43'' 5.19"E	the Thigyit Coal Fired Power Plant		2018		
				Wet Season	(23-24) August 2018	22.26	68.92
A-17	Mya Kan Thar Village	Lat: 20° 25'' 18.59"N, Lon 096° 42'' 13.59"E	1.1 km away from the Thigyit Coal Fired Power Plant	Dry Season	(7-8) May 2018	21.87	66.18
				Wet Season	(14-15) August 2018	24.22	68.83
A-18	Taung Chay Village	Lat: 20° 26'' 0.813"N, Lon 096° 42'' 19.709"E	4.9 km away from the Thigyit Coal Fired Power Plant	Dry Season	(8-9) May 2018	22.26	64.98
				Wet Season	(8-9) August 2018	20.27	77.46

Source: E Guard Study Tea

5.4.5 Water Quality

Water samples from Than Tae Creek and Balu Creek located near the Thigyit Coal Fired Power Plant to measure the existing water quality. Ten sample points donated as W1 to W10 were selected for water quality sampling along these two creeks. Sample points W7 and W8 were included presuming water contamination may take place at these locations as a result of waste water generated by the coal mine. Water samples from W1, W2, W3, and W4 along Than Tae Creek were collected twice before and after construction of Thigyit Coal Fired Power Plant in order to compare the quality of water under these two different circumstances. Over flow water from the process of water cooling system of Coal Fired Power Plant are discharged into Than Tae Creek. That residual water flowed along the Than Tae Creek after entering the sedimentation pond which reduces the water temperature. Water sample points W9 and W10 were taken before and after reaching to the reduction pond. Addition sample point W5 in Balu Creek before adding and flowing discharged water from Ngar Cement Plant was also included. A sample point at confluence of Than Tae Creek and Balu Creek (i.e. point W6) was also taken. Water quality samples were collected in both dry and wet season at the same points. Water samples of the first dry season were collected on April 1 and 2, 2018 and the second wet season sampling was carried out in July, 2018.

One gallon of water from each location was sampled at each point. A clean bucket of approximately 10 Liter capacity was used to collect the water samples. The bucket was dipped into the river, firmly held and plunged downwards to a depth of approximately 0.5m. Samples were then transferred to the laboratory (i.e. SGS Limited, ISO Tech Laboratory, Supreme and Occupational, and Environmental Health Laboratory, Myanmar). Their physicochemical data on acidity (pH) , Iron, Suspended solids, Dissolved solids, Temperature, Lead (Pb), Arsenic (As), Chlorine, Ammonia (NH3), COD, BOD, Zinc (Zn), Copper (Si), Mercury, Selenium, Oil and Grease, Cadmium, Chromium, Aluminium, Nickel content were assessed in the laboratory by standard procedures. The locations of water quality sampling and the equipment used are shown in Figure 5.35 and in Table 5.11 respectively.

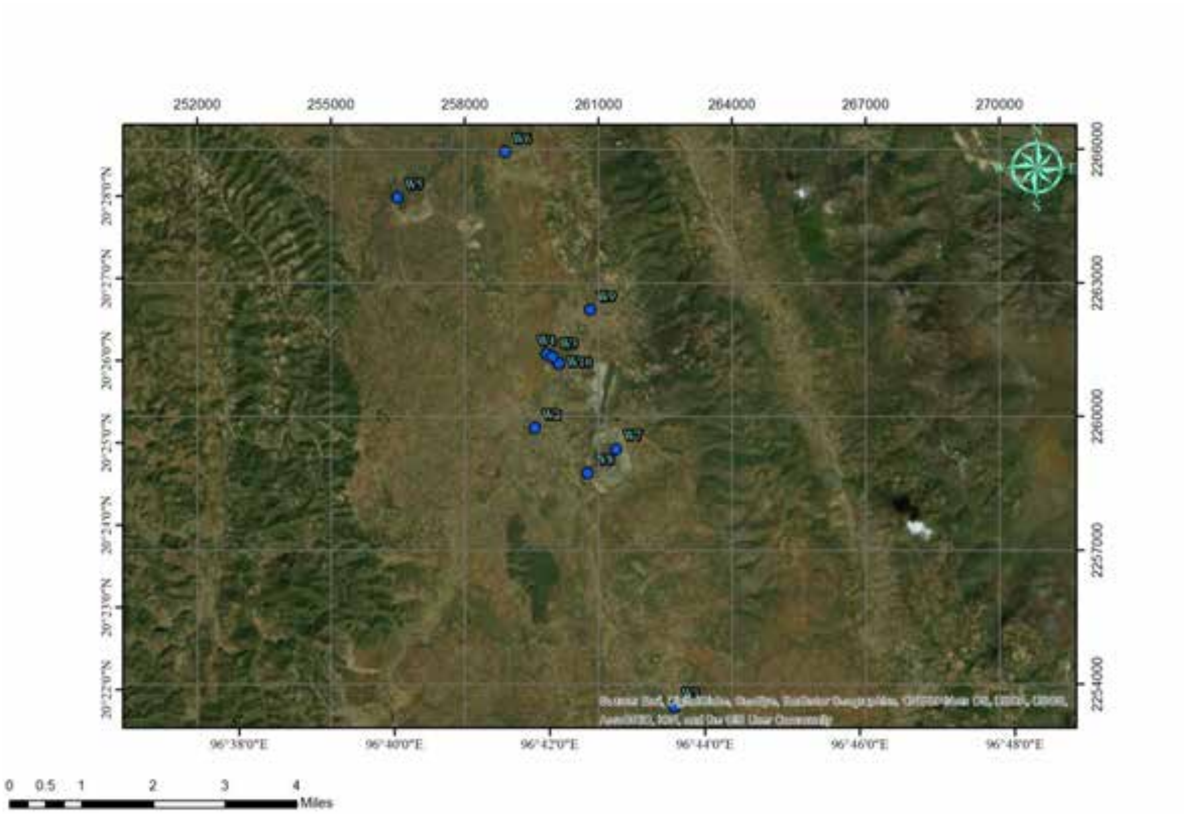


Figure 5.35 Locations of Water Quality Sampling Points

Source: E Guard Study Team

Table 5.11 Instruments Used for Water Quality Measurement

No.	Name and Model of Instrument Used	Measurement Items	Image
1	Horiba U-50	Temperature, pH, DO, EC, TDS and Salinity, Turbidity, water depth, oxidation, reduction potential (ORP)	

W-1 at Dry Season

W-1 at Wet Season

W-2 at Dry Season

W-2 at Wet Season

W-3 at Dry Season

W-3 at Wet Season

W-4 at Dry Season

W-4 at Wet Season

W-5 at Dry Season

W-5 at Wet Season

W-6 at Dry Season

W-6 at Wet Season

W-7 at Dry Season

W-7 at Wet Season

W-8 at Dry Season

W-8 at Wet Season

W-9 at Dry Season

W-9 at Wet Season

W-10 at Dry Season

W-10 at Wet Season

Photograph: 4 Water Quality Survey

Table 5.12 shows the results of water quality measurement carried out at W-1 (i.e. Than Tae Creek (Than Tae Bridge)), W-2 (i.e. Than Tae Creek (Near Sae Kaung Village)), W-3 (i.e. Junction of Than Tae Creek and Coal Fired Power Plant‟s discharged water), W-4 (i.e. Agricultural water which is channeled from Than Tae Creek), W-5 (i.e. Balu Creek before Nagar Cement Plant‟s discharged water point), W-6 (i.e. Junction of Than Tae Creek and Balu Cree), W-7 (i.e. Discharged water from Coal mine-1), W-8 (i.e. Discharged water from Coal mine-2), W-9 (i.e. Before Reduction Pond), and W-10 (i.e. After Reduction Pond) as explained in 3.2.2. The observed values were compared against the NEQ Guidelines.

The results indicated that iron concentration in water was higher than WHO Guideline value at sample points W7 and W8. Suspended solid concentration in water of points W4, W7 and W8 exceeded NEQ Guideline value whiles the values of the other points value were within the NEQ Guideline value. Suspended particles in water can cause turbidity and obstruct light transmission through the water which is an indicator for the presence of water contamination. At points W9 and W10, i.e. before and after passing the sedimentation pond mercury concentration was slightly higher than NEQ Guideline value. Measured alues at points W2, W3, W5, W7, W8 and W10 were higher in concentration of Oil and Grease than NEQ Guideline value. In wet season, chromium concentration at two stream points and discharge water from coal mine points was higher than NEQ Guideline value. Water quality tests and results of on-site and laboratory measurements are shown in Appendix (2) and (3).

Table 5.12 Results of Water Quality Measurement

No.	Parameter	Season	Than Tae Creek (Than Tae Bridge)	Than Tae Creek (Near Sae Kaung Village)	Junction of Than Tae Creek and Coal Fired Power Plant‟s discharged water	Agricultural water which is channeled from Than Tae Creek	Balu Creek before Nagar Cement Plant‟s discharged water point	Junction of Than Tae Creek and Balu Creek	Discharged water from Coal mine-1	Discharged water from Coal mine-2	Before Sedimentation Pond	After Sedimentation Pond	NEQ Guideline value	Unit	Name of Lab
			W1	W2	W3	W4	W5	W6	W7	W8	W9	W10			
1	pH	Dry Season	7.4	7.5	7.9	7.8	7.8	7.7	7.9	8	8.2	8.3	6-9		
		Wet Season	7.4	7.8	7.9	8	7.8	7.9	7.8	7.8	8.6	8.2		mg/L	ISO
2	Iron (Fe)	Dry Season	0.38	0.57	0.83	0.88	0.37	0.48	3.4	6.2	0.27	0.22	1	mg/L	ISO
		Wet Season	0.36	4.28	3.7	5.5	0.86	0.88	7.8	6.88	0.4	0.42			
3	Suspended solids	Dry Season	12	38	50	64	18	26	110	250	20	15	50	mg/L	ISO
		Wet Season	25	110	130	172	63	74	377	286	36	52			
4	Dissolved solids	Dry Season	283	253	236	239	213	207	237	230	205	204	–	mg/L	ISO
		Wet Season	247	176	188	189	147	148	244	236	149	155			
5	Temperature	Dry Season	28.89	27.73	28.18	30.18	29.31	28.21	27.73	28.88	31.08	27.27		°C	ISO

No.	Parameter	Season	Than Tae Creek (Than Tae Bridge)	Than Tae Creek (Near Sae Kaung Village)	Junction of Than Tae Creek and Coal Fired Power Plant‟s discharged water	Agricultural water which is channeled from Than Tae Creek	Balu Creek before Nagar Cement Plant‟s discharged water point	Junction of Than Tae Creek and Balu Creek	Discharged water from Coal mine-1	Discharged water from Coal mine-2	Before Sedimentation Pond	After Sedimentation Pond	NEQ Guideline value	Unit	Name of Lab
			W1	W2	W3	W4	W5	W6	W7	W8	W9	W10			
		Wet Season	21.88	22.92	23.89	23.88	22.31	23.31	23.18	24.86	30.60	26.41	<3		
6	Lead (Pb)	Dry Season	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	0.5	mg/L	ISO
		Wet Season	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil			
7	Arsenic (As)	Dry Season	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	0.5	mg/L	ISO
		Wet Season	0.006	0.006	0.007	0.006	0.006	0.007	0.007	0.006	0.006	0.006			
8	Ammonia (NH3)	Dry Season	Nil	Nil	Nil	Nil	Nil	Nil	1.8	2.5	1.1	1.1	–	mg/L	ISO
		Wet Season	2.22	3.30	3	4	2.44	3	5.5	4.4	1.2	2.4			
9	COD	Dry Season	32	32	32	32	32	32	64	64	32	32	–	mg/L	ISO
		Wet Season	32	64	64	64	32	32	64	64	32	32			

No.	Parameter	Season	Than Tae Creek (Than Tae Bridge)	Than Tae Creek (Near Sae Kaung Village)	Junction of Than Tae Creek and Coal Fired Power Plant‟s discharged water	Agricultural water which is channeled from Than Tae Creek	Balu Creek before Nagar Cement Plant‟s discharged water point	Junction of Than Tae Creek and Balu Creek	Discharged water from Coal mine-1	Discharged water from Coal mine-2	Before Sedimentation Pond	After Sedimentation Pond	NEQ Guideline value	Unit	Name of Lab
			W1	W2	W3	W4	W5	W6	W7	W8	W9	W10			
10	BOD	Dry Season	6	8	8	8	4	6	18	22	4	4	–	mg/L	ISO
		Wet Season	10	16	14	16	8	6	18	16	8	14			
11	Zinc (Zn)	Dry Season	NIl	Nil	NIl	NIl	NIl	NIl	NIl	NIl	NIl	NIl	1	mg/L	ISO
		Wet Season	NIl	Nil	NIl	NIl	NIl	NIl	NIl	NIl	NIl	NIl			
12	Copper (Si)	Dry Season	NIl	Nil	NIl	NIl	NIl	NIl	NIl	NIl	NIl	NIl	0.5	mg/L	ISO
		Wet Season	0.12	0.07	0.08	0.17	0.22	0.18	0.42	0.41	0.02	0.04			
13	Mercury (Hg)	Dry Season	NIl	Nil	NIl	NIl	NIl	NIl	0.001	0.001	0.006	0.006	0.005	ppm	OH
		Wet Season	NIl	Nil	NIl	NIl	NIl	NIl	NIl	NIl	NIl	NIl			
14	Selenium	Dry Season	0.032	0.03	0.024	0.028	0.025	0.025	0	0	0.01	0.009		ppm	OH

No.	Parameter	Season	Than Tae Creek (Than Tae Bridge)	Than Tae Creek (Near Sae Kaung Village)	Junction of Than Tae Creek and Coal Fired Power Plant‟s discharged water	Agricultural water which is channeled from Than Tae Creek	Balu Creek before Nagar Cement Plant‟s discharged water point	Junction of Than Tae Creek and Balu Creek	Discharged water from Coal mine-1	Discharged water from Coal mine-2	Before Sedimentation Pond	After Sedimentation Pond	NEQ Guideline value	Unit	Name of Lab
			W1	W2	W3	W4	W5	W6	W7	W8	W9	W10			
		Wet Season	0.001	0.000	0.000	0.008	0.000	0.000	0.000	0.000	0.004	0.000	–		
15	Oil and Grease	Dry Season	6.2	16.63	17.4	8.01	14.9	4.56	16.38	11.41	4.92	16.48	10	ppm	OH
		Wet Season	6.1	3.7	1.6	3.9	5.8	7.7	6.3	3.1	14.5	5.1			
16	Cadmium (Cd)	Dry Season	0.048	0.009	0.011	0.041	0.018	0.003	0.018	0.061	0.021	0.032	0.1	mg/L	Supreme
		Wet Season	0.046	0.044	0.056	0.048	0.05	0.022	0.068	0.036	0.048	0.047			
17	Chromium (Cr)	Dry Season	0.09	0.07	0.1	0.08	0.05	0.08	0.23	0.2	0.14	0.13	0.5	mg/L Cr	Supreme
		Wet Season	0.53	0.5	0.53	0.5	0.51	0.53	0.54	0.51	0.47	0.04			
18	Aluminium (Al)	Dry Season	0.04	0.06	0.32	0.07	0.07	0.06	0.004	0.06	0.004	0.07	–	mg/L	Supreme
		Wet Season	0.09	0.09	0.08	0.06	0.06	0.24	0.009	0.07	0.09	0.34			

No.	Parameter	Season	Than Tae Creek (Than Tae Bridge)	Than Tae Creek (Near Sae Kaung Village)	Junction of Than Tae Creek and Coal Fired Power Plant‟s discharged water	Agricultural water which is channeled from Than Tae Creek	Balu Creek before Nagar Cement Plant‟s discharged water point	Junction of Than Tae Creek and Balu Creek	Discharged water from Coal mine-1	Discharged water from Coal mine-2	Before Sedimentation Pond	After Sedimentation Pond	NEQ Guideline value	Unit	Name of Lab
			W1	W2	W3	W4	W5	W6	W7	W8	W9	W10			
19	Nickel (Ni)	Dry Season	0.38	1.39	0.6	0.39	0.36	0.2	0.39	0.43	0.2	0.19	–	mg/L	Supreme
		Wet Season	0.22	0.23	0.26	0.27	0.24	0.49	0.25	0.44	0.2	0.18			
20	Total Chlorine	Dry Season	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	0.2	mg/L	OH
		Wet Season	0.02	0.04	0.04	0.03	0.07	0.02	0.04	0.02	0.02	0.02			

*Measurement values that exceed the NEQ Guideline values are shown in a red word.

Table 5.13 Onsite Water Quality Monitoring

No.	Parameter	Season	Than Tae Creek (Than Tae Bridge)	Than Tae Creek (Near Sae Kaung Village)	Junction of Than Tae Creek and Coal Fired Power Plant‟s discharged water	Agricultural water which is channeled from Than Tae Creek	Balu Creek before Nagar Cement Plant‟s discharged water point	Junction of Than Tae Creek and Balu Creek	Discharged water from Coal mine-1	Discharged water from Coal mine-2	Before Sedimentation Pond	After Sedimentation Pond	Unit
			Lat: 20° 21‟ 53.436”, Long: 096° 43‟ 35.9”	Lat: 20° 25‟ 15.344”, Long: 096° 41‟ 44.993”	Lat: 20° 26‟ 07.488”, Long: 096° 41‟ 57.599”	Lat: 20° 26‟ 09.5”, Long: 096° 41‟ 53.397”	Lat: 20° 28‟ 02.158”, Long: 096° 39‟ 56.091”	Lat: 20° 28‟ 36.236”, Long: 096° 41‟ 19.147”	Lat: 20° 25‟ 00.79”, Long: 096° 42‟ 47.94”	Lat: 20° 24‟ 43.00”, Long: 096° 42‟ 26.35”	Lat: 20° 26‟ 42.00”, Long: 096° 42‟ 26.34”	Lat: 20° 26‟ 02.544”, Long: 096° 42‟ 03.010”	
			W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	
1.	pH	Dry Season	7.85	8.55	9.47	9.59	9.33	9.21	9.50	9.42	9.53	9.77	
		Wet Season	8.35	9.0	8.93	9.03	9.08	8.95	10.3	8.93	9.18	9.51	
2.	Temperature	Dry Season	20.32	21.81	25.34	24.00	21.37	22.72	25.92	26.31	33.37	32.96	°C
		Wet Season	21.88	22.92	23.89	23.88	22.31	23.31	23.18	24.86	30.60	26.41	
3.	EC	Dry Season	0.508	0.463	0.452	0.454	0.403	0.403	0.476	0.454	0.389	0.388	mS/cm
		Wet Season	0.435	0.323	0.370	0.364	0.278	0.287	0.470	0.486	0.287	0.184	
4.	TDS	Dry Season	0.325	0.301	0.294	0.295	0.262	0.262	0.309	0.295	0.253	0.252	g/L
		Wet Season	0.283	0.21	0.24	0.237	0.181	0.187	0.475	0.316	0.187	0.120	

No.	Parameter	Season	Than Tae Creek (Than Tae Bridge)	Than Tae Creek (Near Sae Kaung Village)	Junction of Than Tae Creek and Coal Fired Power Plant‟s discharged water	Agricultural water which is channeled from Than Tae Creek	Balu Creek before Nagar Cement Plant‟s discharged water point	Junction of Than Tae Creek and Balu Creek	Discharged water from Coal mine-1	Discharged water from Coal mine-2	Before Sedimentation Pond	After Sedimentation Pond	Unit
			Lat: 20° 21‟ 53.436”, Long: 096° 43‟ 35.9”	Lat: 20° 25‟ 15.344”, Long: 096° 41‟ 44.993”	Lat: 20° 26‟ 07.488”, Long: 096° 41‟ 57.599”	Lat: 20° 26‟ 09.5”, Long: 096° 41‟ 53.397”	Lat: 20° 28‟ 02.158”, Long: 096° 39‟ 56.091”	Lat: 20° 28‟ 36.236”, Long: 096° 41‟ 19.147”	Lat: 20° 25‟ 00.79”, Long: 096° 42‟ 47.94”	Lat: 20° 24‟ 43.00”, Long: 096° 42‟ 26.35”	Lat: 20° 26‟ 42.00”, Long: 096° 42‟ 26.34”	Lat: 20° 26‟ 02.544”, Long: 096° 42‟ 03.010”	
			W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	
5.	Salinity	Dry Season	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	ppt
		Wet Season	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.1	0.1	
6.	DO	Dry Season	8.64	3.64	6.83	8.41	9.48	10.26	9.17	9.02	6.90	8.22	mg/L
		Wet Season	7.57	8.43	8.54	8.23	9.09	8.11	7.23	9.23	7.49	8.27	

5.4.6 Soil Quality Survey

Soil samples were taken at 3 points within the surrounding field of Thigyit Coal Fired Power Plant, namely S-1 (field of Coal Fired Power Plant), S-2 (field of Thar Yar Gone Village) and S-3 (field near Coal Stock Pile). Exact location of soil sampling points is shown in Table 5.14.

Table 5.14 Sampling Points for Soil Quality Survey

No.	Survey Points	Location (Latitude and Longitude)
1.	S-1 (field of Coal Fired Power Plant)	Lat: 20° 26‟ 1.72”, Long: 96° 42‟ 0.2”
2.	S-2 (field of Thar Yar Gone Village)	Lat: 20° 26‟5.83”, Long: 96° 42‟ 7.55”
3.	S-3 (field near Coal Stock Pile)	Lat: 20° 25‟ 44.42”, Long: 96° 42‟ 17.59”

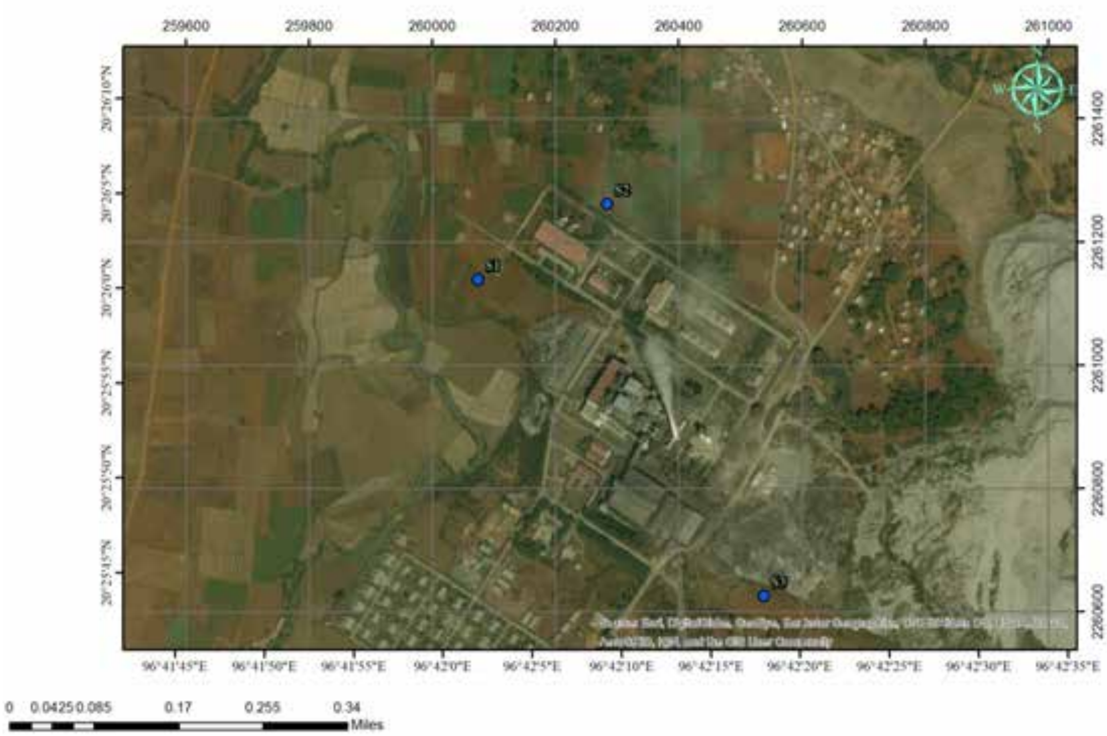


Figure 5.36 Locations of Soil Quality Points

Source: E Guard Study Team

Soil Sampling at S-1 (field of Coal Fired Power Plant)

Soil Sampling at S-2 (field of Thar Yar Gone Village)

Soil Sampling at S-3 (field near Coal Stock Pile)

Photograph: 5 Soil Sampling

Table 5.15 Soil Sample Results

Sample Mark	Resulted Parameters	Concentration Weight (%)
Tikyit Soil	Silicon (Si)	41.980
	Iron (Fe)	37.487
	Calcium (Ca)	13.131
	Titanium (Ti)	3.501
	Potassium (K)	2.838
	Zirconium (Zr)	0.521
	Manganese (Mn)	0.348
	Nickel (Ni)	0.079
	Strontium (Sr)	0.057
	Yttrium (Y)	0.057
	Arsenic (As)	Non-detectable

According to the result of soil sample from agricultural land which is near the damp site of bottom ash, the amount of silicon content is the highest among other parameters. The optimal level of silicon in agricultural soil is 28% of concentration by weight. Generally, silicon, which is as a trace element, is beneficial to many crops by strengthening the plant to protect form insect attacks and stimulation of growth and yield of plants, especially, which are high-value horticultural crops. The micronutrients such as iron (Fe), Calcium (Ca) and manganese (Mn) are good for plants and the amount of nutrients which is found in that soil are at an acceptable level but, on the other hand, the concentration weight of silicon exceeds the optimal level because of the induced impact of damp site of bottom ash.

5.4.7 Odor

Odor level measurement was carried out at six locations in dry season to identify which sources are the most irritating for the communities. Four selected points are located at the project boundary as sources and the other other two selected points are located at a nearby village and a monastery as receptors. Locations of the odor level measuring points denoted as Odor-P1 to Odor-P6 are shown in Table 5.16 and Figure 5.37, and the equipment used is shown in Table 5.17.

Table 5.16 Location of Odor Level Measuring

Point	Location (Latitude and Longitude)	Description of Survey Point
Odor-P1	20°25'48.94"N, 96°42'9.30"E	At Indoor Coal Yard
Odor-P2	20°25'52.32"N, 96°42'11.80"E	At DeSOx System
Odor-P3	20°25'54.15"N, 96°42'12.58"E	At Bottom Ash Sedimentation Tanks
Odor-P4	20°26'2.40"N, 96°42'2.60"E	At Sedimentation Pond
Odor-P5	20°26'9.03"N, 96°42'19.48"E	At junction of Pyin Thar and Thar Yar Gone Villages
Odor-P6	20°26'27.91"N, 96°42'20.41"E	At Taung Po Gyi Monastery

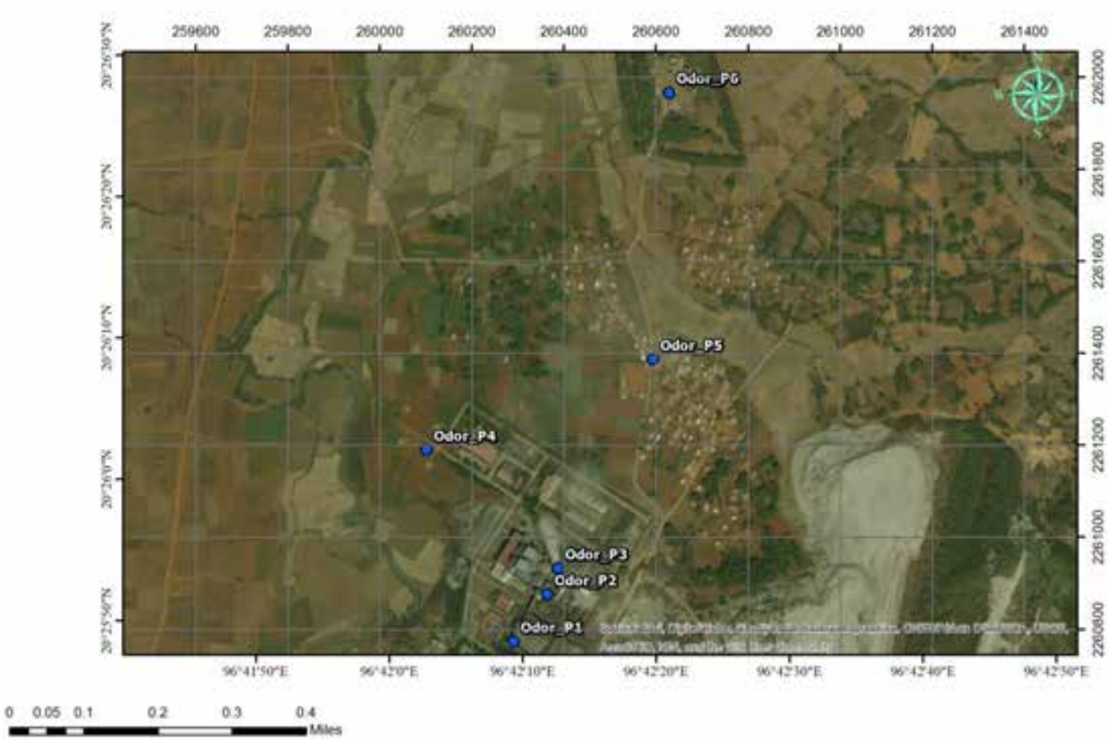


Figure 5.37 Locations of Odor Level Measurement

Source: E Guard Study Tea

Table 5.17 Instrument Used for Odor Level Measurement

No.	Name and Model of Instrument Used	Measurement Item	Image
1.	SKY2000-Odor	Odor Level	

Odor-P1

Odor-P2


Odor-P3


Odor-P4


Odor-P5

Odor-P6

Photograph 6 Odor Level Measuring

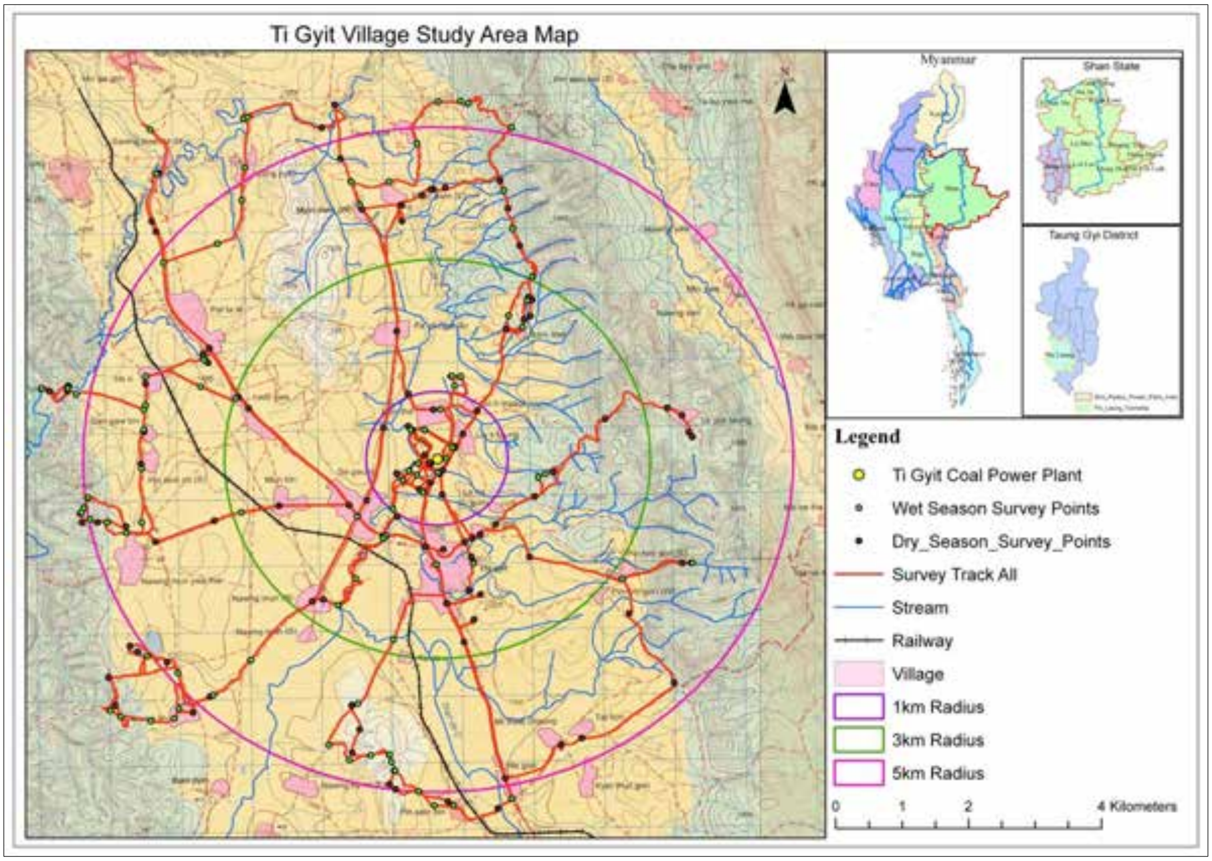
The detected values of sources points were within NEQ Guideline values whereas those of receptors were below the NEQ Guideline value.

Table 5.18 Results of Odor Level Measuring

Point	Location	Value (ppm)	National Environmental Quality (Emission) Guideline Value (ppm)
Odor-P1	At Indoor Coal Yard	0	5-10
Odor-P2	At DeSOx System	15	
Odor-P3	At Bottom Ash Sedimentation Tanks	4	
Odor-P4	At Sedimentation Pond	0	
Odor-P5	At junction of Pyin Thar and Thar Yar Gone Villages	6	
Odor-P6	At Taung Po Gyi Monastery	0	

5.4.8 Biodiversity

The study area was divided into three representative areas, namely, 1 km radius, 3 km radius and 5 km radius zones around the Tigyit coal-fired electric power plant. The circular area with 1 km radius is regarded as direct impact zone. Two circular areas with 3 km and 5 km radius are considered as the indirect impact zone. Within all these three representative areas, the assessment of biodiversity was carried out twice in dry season and wet seasons to evaluate the status and sesonal variation of flora and fauna in the two prevailing seasons of the project area. There are 3 villages in the 1 km radius direct impact zone. The nearest residential area to the plant is Pyintha village. The 14 villages that are located in the 3 km radius indirect impact zone are Tigyit, Le-gya, Le-na (Zingon), Lai-ti-taung (Tharyarkone), Loi-ti-myauk (Tharyarkone), Pyin-tha, Sea-kaung, Ban-met, Phayar-Ngar-Su, Lwin-ywa, Mun-loin, Naung-moon, Ta-da-u and Pin-hmi-gone whereas there are 35 villages in the 5 km radius of the indirect impact zone.



Source: E Guard Study Team

Figure 5.38 Map showing the location of Tigyit Power Plant and Survey points during Dry and Wet seasons

There is no natural vegetation in the 1 km radius of the direct impact zone although it includes some cultivated land areas. The majority of the area (about 40 %) is occupied by Thigyit Coal-fired Power Plant compound with 20 buildings including turbine and power generating rooms. The other 30 % of the area is occupied by the workers quarters. Cultivated lands and villages also occupied ~~in~~ the remaining 30% of the area.

In the 3 km radius zone, there is no forested area, but cultivated lands and orchards of fruit trees such as pears and avocados are found. In the 5km radius zone, there are some evergreen forest, pine forest and bamboo forest. There also exist some fruit tree cultivations in this zone.

Among many streams in the area two have names which are Balu creek and Than-dé creek. There are also small streams without a particular name. Balu creek is flowing from southwest to northeastern side of the project area, at a distance of 5 km from the plant. Than-dé stream is flowing from Southwest on the Western side of the project area. These two streams converge together and then flow into the Inle Lake, one of the famous natural heritages of the Shan State. Balu Stream is main stream supplying water to the Inle Lake. The Balu stream flows out of the Inlay Lake and becomes the first hydropower supplier for Myanmar in Kayar State.

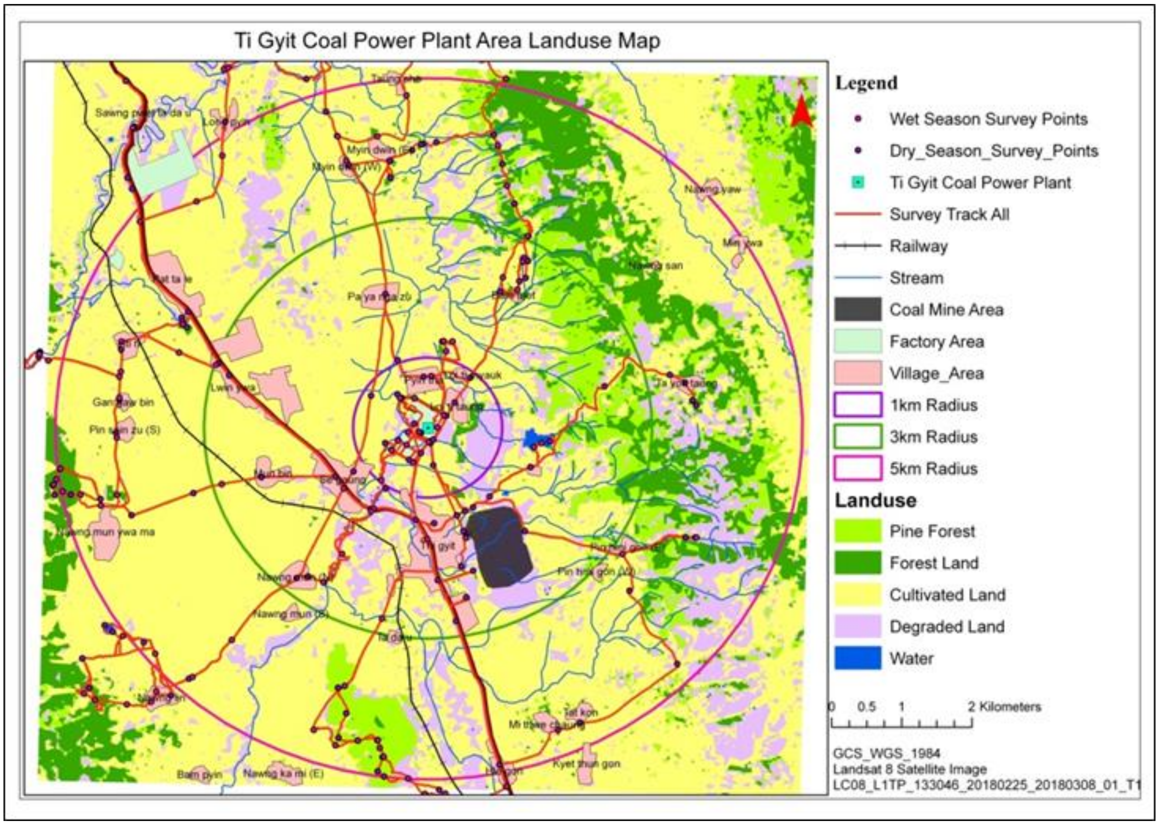
There are three ponds and three springs in the indirect impact zone; two natural ponds are located close to Naunglin Village and Tayoketaung Village, and one waste rock dump and earthen pond on the way from Thi gyit to Tayoketaung Village. Two natural springs are located close to Patlale Village and Bummet Village, and the third one is located near Tayoketaung Village.

The power plant uses water from Balu creek and the wastewater is discharged into the Than-dé creek. The communities of nearby villages also depend on these two streams and ponds as vital sources of water supply for their household uses and cultivations.

(1) Survey Methods

The present assessment focuses on the existing biodiversity resources and possible impacts of the project in the direct and indirect impact zones. The survey was carried out on 4th May 2018 to 10th May 2018 for dry season and on 16th July to 21st July for wet season. There is no natural vegetation within the area with 3 km radius. Cultivated lands owned by inhabitants of nearby villages are the only prevailing use of land in this zone. The natural forests like the pine forest, hill evergreen forest and bamboo forest are found within 5 km radius zone and within the area beyond 5 km radius.

Line transect method was used to record and list the plants found in the non-forest area. In the forested area, the quadrant method was used, to identify the type and quality of forest. Generally, forests are fragmented and degraded due to the expansion of farmlands in the forested area. The community also practiced turpentine extracting which led to forest degradation. Human encroachment into the forested areas also led to the decrease in fauna species population



Source: E Guard Study Team

Figure 5.39 Map Showing distribution of different types of Land Use in the Direct and Indirect impact Zones

Table 5.19 Schedule of Dry Season

Date	Location	Detail
May 04, 2018	Yangon to Tigyit Village	
May 05, 2018	- Tigyit Coal Fire Power Plant - Tigyit Coal Fire Power Plant to Bam met village - Pyin thar village (Taung Bo Gyi) to Myin dwin (E) village	Direct Area Day Season Survey Indirect Area Day Season Survey and Night Survey Indirect Area Day Season Survey

Date	Location	Detail
May 06, 2018	- Tigyit village to Naung lin village - Naung lin Village to Se gaung Village - Ba Lu Chaung Bridge to Tha de chaung junction - Tigyit village south-west area	Indirect Area Day Season Survey Indirect Area Day Season Survey Indirect Area Day Season Survey Indirect Area Night Survey
May 07, 2018	- Tigyit village to Pin hmi gon village - Tigyit village to Ta yoke taung village - Tigyit Coal Power Plant Area - Taung po hla lake (near Taung po hla village)	Indirect Area Day Season Survey Indirect Area Day Season Survey Direct Area Day Season Survey Indirect Area Night Survey
May 08, 2018	- Tigyit village to Naung mun village and Htiri village west - Hle gon village west and Pin sein pin village - Se gaung village area	Indirect Area Survey Indirect Area Survey Indirect Area Night Survey
May 9, 2018	- Tigyit Coal Fire Power Plant to Coal Mine and Bam met village North - Pat ta le lake (near Pat ta le village)	Indirect Area Day Season Survey Indirect Area Night Survey
May 10, 2018	Tigyit Village to Yangon	

Table 5.20 Schedule of Wet Season

Date	Location	Detail
July 16, 2018	Yangon to Tigyit Village	By private car
July 17, 2018	- Tigyit Coal Fire Power Plant - Tigyit Coal Fire Power Plant to Pyin thar village, Myin dwin (E) village and Taung she village - Taung she village to Bam met village - Taung po hla lake (near Taung po hla village) - Tigyit village to Pin hmi gon village	Direct Area Day Season Survey Indirect Area Day Season Survey Indirect Area Day Season Survey and Night Survey

Date	Location	Detail
		Indirect Area Day Season Survey Indirect Area Day Season Survey
July 18, 2018	- Tigyit village to Naung mun village and Hti ri village west - Tigyit village to Long Pyin village - Hle gon village west and Pin sein pin village - Ba Lu Chaung Bridge - Tigyit village south west area	Indirect Area Day Season Survey Indirect Area Day Season Survey Indirect Area Day Season Survey Indirect Area Night Survey Indirect Area Night Survey
July 19, 2018	- Tigyit village to Naung lin village - Tigyit Coal Power Plant Area	Indirect Area Day Season Survey Direct Area Day Season Survey
July 20, 2018	- Tigyit Coal Fire Power Plant to Coal Mine - A long the Tha de Stream Area - Pat ta le lake (near Pat ta le village)	Indirect Area Survey Indirect Area Survey Indirect Area Night Survey
July 21, 2018	- Tigyit Village to Yangon	

(2) Flora

(a) Survey Method

The floristic data and ecological data collection in the study area were conducted following methods.

(b) Sampling with fixed-area plots

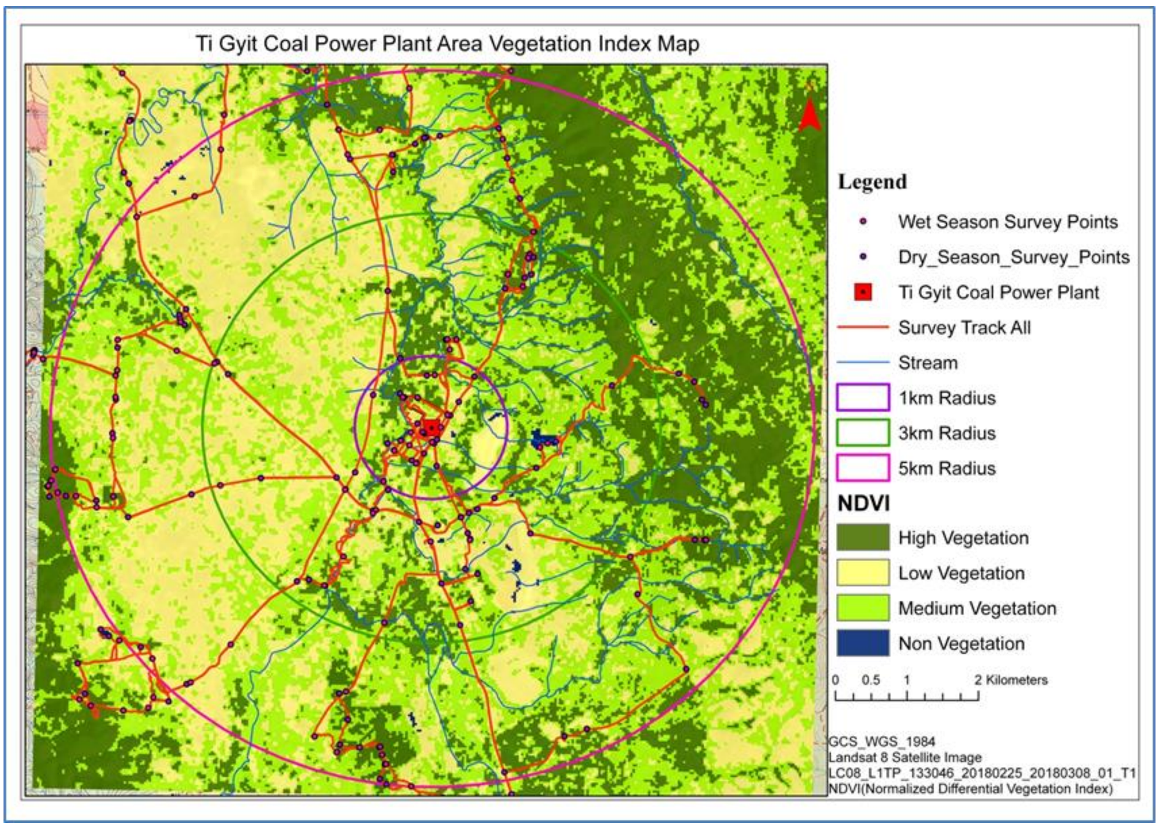
The Global Positioning System was used to navigate and mark the coordinates of the sample plots. In order to obtain essential data for predicting tree species composition and vegetation types in the forest, 20x20 and 30x30 meter quadrants were set up and tree species within the plot were identified and recorded, and number of tress for each species was also counted. For the Bamboo survey, 20x20 and 30x30 meter quadrants were set up, bamboo species were identified, and ~~a~~ number of culms for each species were counted. The species identification was carried out using the key to families of flowering plants and appropriate literature and confirmed by matching with herbarium specimens of the Department of Botany, University of Yangon.

(3) Random Transecting

To obtain representative lists of the tree species and bamboo species, plant collection was also carried out using random transect lines along the roadside and between the plots wherever possible. Specimens were collected within 10 meters on each side of the transect line.

(4) Mapping

Land cover maps are produced based on the Google earth image, Landsat 8-satellite image (LC08-L1TP-133046-20180225-20180308-01-T1), UTM map and WGS 1984 coordinate system to determine the forests of the project areas. The vegetation index map is also produced to describe the vegetation classification.



Source: E Guard Study Team

Figure 5.40 Vegetation Index Map of Tigyit Coal-Powered Plant

(5) Data Analysis

(a) Population of Individual Species (per hectare)

The population of species will show not only the composition of species but also the richness of the species in the study area. The population of individual species (per hectare) is determined by following formula. (Ref: R.He'dl, M Sva'tek, M. Dancak, Rodzay A.W., M. Salleh A.B., Kamariah A.S.(2009).

$$\text{Population of Individual Species} = \frac{\text{Total Individual species}}{\text{Total Plots Area } (m^2)} \times 10000m^2(1ha)$$

(b) Relative Density of Tree species

The density of a species refers to the numerical representation of its individual and the availability of space in a unit area. The density index shows not only the richness of the texa but also the relative distribution of the individuals. According to Curtis (1959), the density index is determined by the following formula.

$$\text{Relative Density of Tree species} = \frac{\text{No. of Individual species}}{\text{Total no. of all individual Species}} \times 100$$

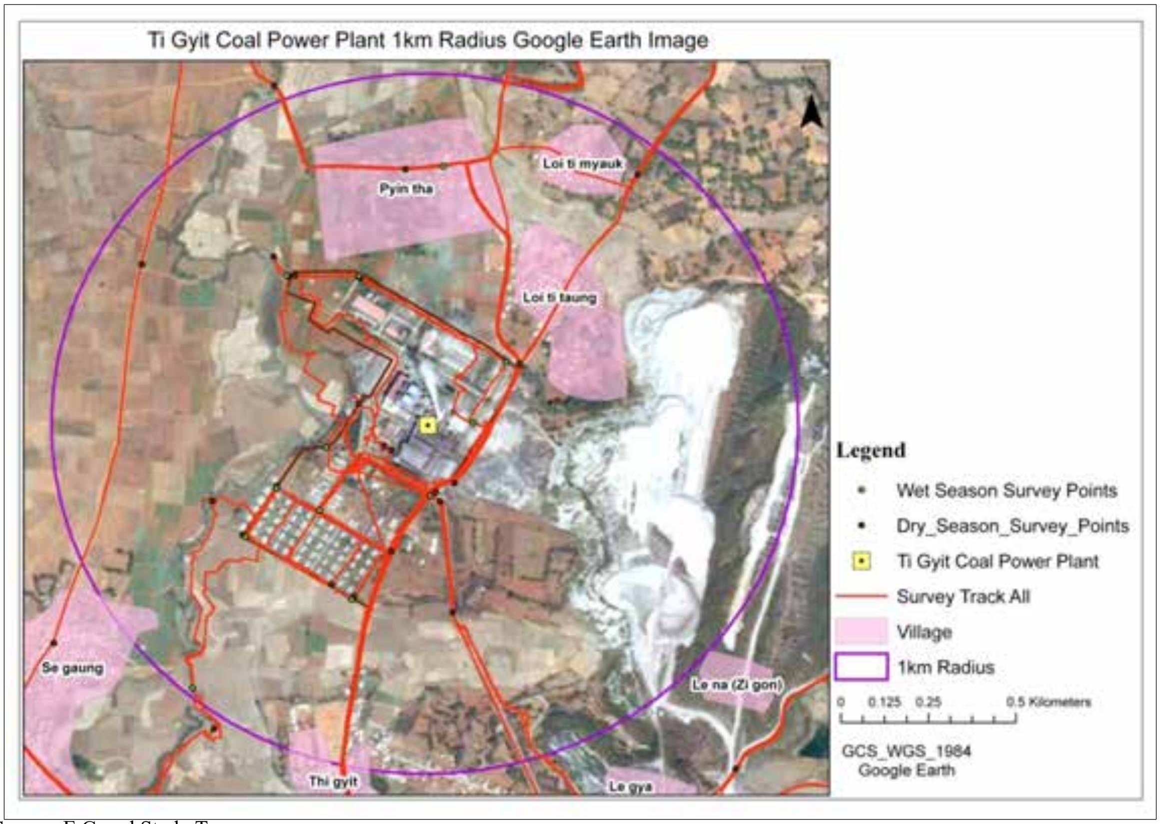
(c) Relative frequency of Tree species

The relative frequency of a species refers to the percentage occurrence of its individuals and shows the frequency of different species growing in the study area. The species, which fall in high-frequency class can be considered as the most common species in the study area. According to Curtis (1959), the relative frequency is determined by the following formula.

$$\text{Relative frequency of Tree species} = \frac{\text{No. of sample plot occurs}}{\text{Total no. of all species occur}} \times 100$$

(6) Direct Impact Zone

(a) The project compound and within 1 km radius



Source: E Guard Study Team

Figure 5.41 1km radius of Direct Impact Zone

In the direct impact zone there are altogether 160 plant species consisting of 15 climbers, 1 fern, 53 herbs, 8 grass species, 44 shrubs, 20 small tree species, and 19 tree species are recorded. During the wet season and additional 22 species were found, which consists of 2 climbers, 14 herbs, 1 grass species, 2 shrubs species, 2 small trees and 1 tree species.

(b) IUCN red list species of Direct Impact Zone in Dry Season

	
Ranunculus lingua	Grangea maderaspatana (L.)Poir
	
Cycas siamensis Miq	Equisetum hyemale

Source: E Guard Study Team

Photograph 7 IUCN red list species of Direct Impact Zone in Dry Season

Table 5.21 IUCN red list species of Direct Impact Zone in Dry Season

No.	Scientific Name	Common Name	Family Name	IUCN Criteria
1	*Acacia auriculiformis* A.Cunn	Ma-lay-sha-padauk	Mimosaceae	LC ver 3.1
2	*Capsicum frutescens*	Nga-yok	Solanaceae	LC ver 3.1
3	*Carica papaya* L.	Thin-baw-pin	Caricaceae	DD ver 3.1
4	*Colocasia esculenta*	Pein-yaing	Araceae	LC ver 3.1
5	*Commelina diffusa* Burm.f.	Wet kyut	Commelinaceae	LC ver 3.1
6	*Cycas siamensis* Miq.	Mon daing	Cycadaceae	VU A2cd ver 3.1
7	*Delonix regia* (Bojer ex Hook.)Raf.	Sein pan gyi	Caesalpiniaceae	LC ver 3.1
8	*Equisetum hyemale*	Not known	Equisetaceae	LC ver 3.1
9	*Euphorbia milii* Moutins.	Kiss-me-quick	Euphorbiaceae	DD ver 3.1
10	*Grangea maderaspatana* (L.)Poir.	Ye-tazwet	Asteraceae	LC ver 3.1
11	*Helianthus annuus* L.	Nay kyar	Asteraceae	LC ver 3.1
12	*Hydrocotyle javanica* Thunb.	Myin khwa	Apiaceae	LC ver 3.1
13	*Hydrocotyle ranunculoides*	Myin khwa	Apiaceae	LC ver 3.1
14	*Mangifera indica* L.	Tha-yet	Anacardiaceae	DD ver 2.3
15	*Mentha arvensis* L.	Pu si nan	Lamiaceae	LC ver 3.1
16	*Mimosa pudica* L.	Hti-ka-yone	Mimosaceae	LC ver 3.1
17	*Nerium oleander* L.	New-tha-gee	Apocynaceae	LC ver 3.1
18	*Persea americana* Mill.	Htaw-bat-thi	Lauraceae	LC ver 3.1
19	*Plantago major* L.	Ah-gyaw-paung-ta-htaung	Plantaginaceae	LC ver 3.1
20	*Ranunculus lingua*	Strewbarry yaing	Ranunculaceae	LC ver 3.1
21	*Saccharum spontaneum* L.	Kaing/Ta-byet-se	Poaceae	LC ver 3.1
22	*Swietenia macrophylla* King.	Ma haw ga ni	Meliaceae	VU A1cd+2cd ver 2.3

No.	Scientific Name	Common Name	Family Name	IUCN Criteria
23	*Tabernaemontana corymbosa*	Za lat sat kyar	Apocynaceae	LR/lc ver 2.3
24	*Toona ciliata* M.Romer	Thit-kado	Meliaceae	LR/lc ver 2.3
25	*Ziziphus jujuba* Lam.	Zi	Rhamnaceae	LC ver 3.1
DD=Data Deficient , LC=Least Concern, LR/lc=Lower Risk/least concern, VU=Vulnerable				

(c) IUCN red list species of Direct Impact Zone in Wet Season

Ludwigia octovalvis

Punica granatum L

Photograph 8 IUCN red list species of Direct Impact Zone in Wet Season

Table 5.22 IUCN red list of Direct Impact Zone in Wet Season

No.	Scientific Name	Common Name	Family Name	IUCN Criteria
1	*Alstonia scholaris* (L.) R. Br.	Taung-ma-yoe	Apocynaceae	LR/lc ver 2.3
2	*Globba winitii* C.H.C. Wright	Pa-dein-ngo	Zingiberaceae	LC ver 3.1
3	*Ludwigia octovalvis*	Lay-nyin-gyi	Onagraceae	LC ver 3.1
4	*Punica granatum* L.	Tha-le-thi	Punicaceae	LC ver 3.1
5	*Scutellaria galericulata*	Not known	Lamiaceae	LC ver 3.1
LC=Least Concern, LR/lc=Lower Risk/least concern				

(7) Indirect Impact Zone

(a) The project compound and within 3km and 5km radius

To identify and record the existing situation of the vegetation in area with 1 km and 3 km radius, transect method is used to identify and record the tree species and cultivation in the area. Types of forest in 5 km radius are identified and recorded. Main characteristics identified are dominant tree species, its population, density, and frequency.

The forest type in the area is identified as evergreen forest, pine forest, and bamboo forest.

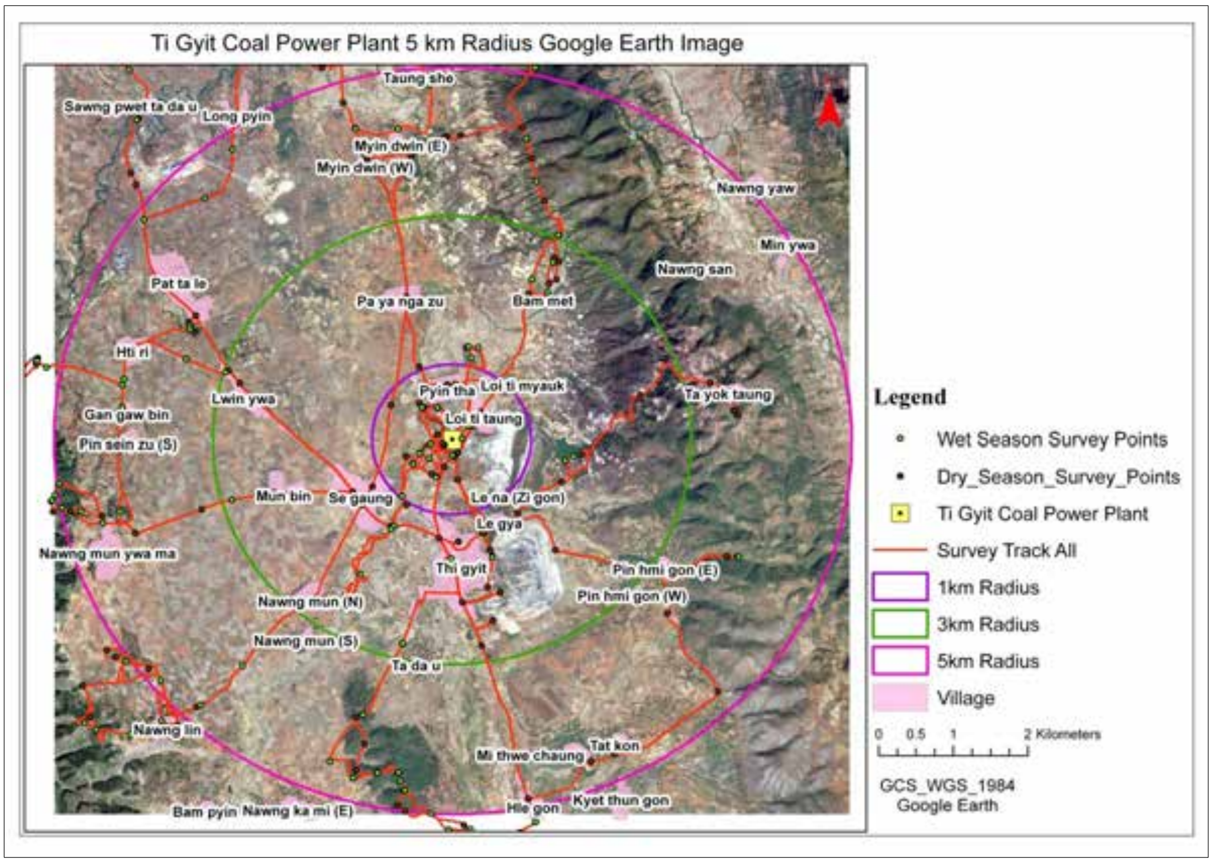


Figure 5.42 Impact area 3 km and 5 km radius


Surveying dry season in Indirect Impact Zone


Surveying wet season in Indirect Impact Zone

Evergreen Forest in Dry Season

Evergreen Forest in Wet Season

Bamboo Forest in Dry Season

Bamboo Forest in Wet Season

Photograph 9 Survey Photo

(b) Floristic composition

The total number of tree species collected in 2 representative sample plots in this area is 9 species belonging to 9 genera. The dominant species in this area are *Dendrocalamus strictus* (Roxb.) Nees (Wa-hti) followed by *Schima wallichii* (DC.) Korth. (Thit-yar), and *Cassia grandis* L. f. (Taw-cherry), *Anneslea fragrans* Wall. (Pan-ma), *Syzygium cumini* (L.)Skeels (Tha-bye), and *Phyllanthus emblica* L. (Zi-phyu).

Table 5.23 Tree Species Population

No.	Scientific Name	Total no. of individual/ha	Total no. of population/ha(%)
1	*Albizia chinensis* (Osbeck)Merr.	23.08	0.79
2	*Anneslea fragrans* Wall.	53.85	1.83
3	*Cassia grandis* L. f.	61.54	2.09
4	*Dendrocalamus strictus* (Roxb.) Nees	2615.38	89.01
5	*Phyllanthus emblica* L.	30.77	1.05
6	*Schima wallichii* (DC.) Korth.	76.92	2.62
7	*Schleichera oleosa* (Lour.) Oken	23.08	0.79
8	*Syzygium cumini* (L.)Skeels	38.46	1.31
9	*Terminalia bellerica* Roxb.	15.38	0.52
	Total	**2938.46**	**100.00**

(c) Pine Forest

Pine Forest in Dry Season

Pine Forest in Wet Season

Photograph 10 Pine Forest

In the indirect impact zone during the dry season, a total number of species found in the survey is 292 species consisting of 30 climbers, 4 ferns, 79 herbs, 9 grass, 49 shrubs, 47 small trees, 47 trees and 27 others. During the wet season additional 66 species consisting of 8 climbers, 1fern, 25 herbs, 3 grass, 13 shrubs, 5 small trees, 5 trees and 6 other species are found.

(d) IUCN red list species of Indirect Impact Zone in Dry Season

Potamogeton crispus

Najas minor

Dalbergia cultrata Grah

Plantago major L.

Photograph 11 IUCN red list species of Indirect Impact Zone in Dry Season

Table 5.24 IUCN red list species of Indirect Impact Zone in Dry Season

No.	Scientific Name	Common Name	Family Name	IUCN Criteria
1	*Amorphophallus paeoniifolius* (Dennst.)Nicolson	Wa u	Araceae	LC ver 3.1
2	*Bacopa monnieri* (L.)Pennell	Ye-myin-khwa	Scropphulariaceae	LC ver 3.1
3	*Bauhinia glauca* (Wall. ex Benth.)Benth.	Pha-lan	Caesalpiniaceae	LC ver 3.1
4	*Brassica oleracea* L. sub-sp. *botrytis*	Gaw phe pwint	Brassicaceae	DD ver 3.1
5	*Capsicum frutescens*	Nga-yok	Solanaceae	LC ver 3.1
6	*Carica papaya* L.	Thin-baw-pin	Caricaceae	DD ver 3.1
7	*Ceratophyllum demersum*	Khwe mi	Ceratophyllaceae	LC ver 3.1
8	*Commelina diffusa* Burm.f.	Wet kyut	Commelinaceae	LC ver 3.1
9	*Cyperus compressus*	Wet-la	Cyperaceae	LC ver 3.1
10	*Cyperus digitatus* Roxb.	Thone dauk myet	Cyperaceae	LC ver 3.1

No.	Scientific Name	Common Name	Family Name	IUCN Criteria
11	*Dalbergia cultrata* Grah.	Yin-daik	Fabaceae	NT ver 3.1
12	*Dendrocalamus membranaceus* Munro	Wa-ma	Poaceae	LC ver 3.1
13	*Derris scandens* (Roxb.)Benth.	Mi-chaung-nwee	Fabaceae	LC ver 3.1
14	*Engelhardtia spicata* Blume	Pan swe le	Juglandaceae	LR/lc ver 2.3
15	*Grangea maderaspatana* (L.)Poir.	Ye-tazwet	Asteraceae	LC ver 3.1
16	*Helianthus annuus* L.	Nay kyar	Asteraceae	LC ver 3.1
17	*Lasia spinosa* (L.)Thwaites	Za-yit	Araceae	LC ver 3.1
18	*Lygodium microphyllum*	Kauk-kwe-fern	Lygodiaceae	LC ver 3.1
19	*Mimosa pudica* L.	Hti-ka-yone	Mimosaceae	LC ver 3.1
20	*Najas minor*	Brittleleaf	Najadaceae	LC ver 3.1
21	*Nasturtium officinale* R.Br.	Ye-mon-nyin	Brassicaceae	LC ver 3.1
22	*Persea americana* Mill.	Htaw-bat-thi	Lauraceae	LC ver 3.1
23	*Phyla nodiflora*	Pa-zun-tha-bet	Verbenaceae	LC ver 3.1
24	*Picea farreri* C.N.Page & K.D.Rushforth	Not known	Pinaceae	VU D2 ver 3.1
25	*Plantago major* L.	Ah-gyaw-paung-ta-htaung	Plantaginaceae	LC ver 3.1
26	*Polygonum plebeium* R.Br.	Nga-yo-pin	Polygonaceae	LC ver 3.1
27	*Potamogeton crispus*	Not known	Potamogetonaceae	LC ver 3.1
28	*Potamogeton natans*	Not known	Potamogetonaceae	LC ver 3.1
29	*Pyrus communis* L.	Thit taw thi	Rosaceae	LC ver 3.1
30	*Ranunculus lingua*	Strewbarry yaing	Ranunculaceae	LC ver 3.1
31	*Rotala rotundifolia* (Buch.-Ham.ex	Not known	Lythraceae	LC ver 3.1

No.	Scientific Name	Common Name	Family Name	IUCN Criteria
	Roxb.)Koehne			
32	*Saccharum spontaneum* L.	Kaing/Ta-byet-se	Poaceae	LC ver 3.1
33	*Sagittaria latifolia*	Arrow head	Alismataceae	LC ver 3.1
34	*Tamarindus indica* L.	Ma-gyi	Caesalpiniaceae	LC ver 3.1
35	*Toona ciliata* M.Romer	Thit-kado	Meliaceae	LR/lc ver 2.3
36	*Ziziphus jujuba* Lam.	Zi	Rhamnaceae	LC ver 3.1
DD=Data Deficient , LC=Least Concern, LR/lc=Lower Risk/least concern, NT=Near Threatened, VU=Vulnerable				

(e) IUCN red list species of Indirect Impact Zone in Wet Season

Drosera peltata Sm.

Globba winitii C.H.C. Wrigh

Photograph 12 IUCN red list species of Indirect Impact Zone in Wet Season

Table 5.25 IUCN red list species of Indirect Impact Zone in Wet Season

No.	Scientific Name	Common Name	Family Name	IUCN Criteria
1	*Alstonia scholaris* (L.) R. Br.	Taung-ma-yoe	Apocynaceae	LR/lc ver 2.3
2	*Colocasia esculenta* (L.) Schott	Pein	Araceae	LC ver 3.1
3	*Crotalaria albida* Heyne	Not known	Fabaceae	LC ver 3.1
4	*Drosera peltata* Sm.	Sundrew	Droseraceae	LC ver 3.1
5	*Elodea canadensis*	Not known	Hydrocharitaceae	LC ver 3.1
6	*Euphrasia hudsoniana*	Not known	Scrophulariaceae	LC ver 3.1
7	*Globba winitii* C.H.C. Wright	Pa-dein-ngo	Zingiberaceae	LC ver 3.1
8	*Lemna aequinoctialis* Welw.	Be-sa-hmaw	Lemnaceae	LC ver 3.1
9	*Lipocarpha chinensis*	Not known	Cyperaceae	LC ver 3.1
LC=Least Concern, LR/lc=Lower Risk/least concern				

(8) Cultivated Species in the Study Area

Brassica oleracea L. sub-sp. capitata

Solanum tuberosum L.

Pyrus communis L. | *Camellia assimilis* Champ

Photograph 13 Cultivated Species in the Study Area

Table 5.26 Curtivated Species in the Study Area

No.	Scientific Name	Common Name	Family Name
1	*Abelmoschus esculentus* (L.)Moench	Yon ba te	Malvaceae
2	*Allium cepa* L.	Kyet-thon-ni	Alliaceae
3	*Allium sativum* L.	Kyet-thon-phyu	Alliaceae
4	*Allium tuberosum Roxb.*	Gyu-myit	Alliaceae
5	*Arachis hypogaea* L.	Myay pe	Fabaceae
	Brassica alba Hook.f. & T.	Mon-hnyin-byu	Brassicaceae
7	*Brassica oleracea* L. sub-sp. *botrytis*	Gaw phe pwint	Brassicaceae

No.	Scientific Name	Common Name	Family Name
8	*Brassica oleracea* L. sub-sp. *capitata*	Gaw phe htoke	Brassicaceae
9	*Capsicum annuum* L.*var. annuum*	Nga-yok-pwa	Solanaceae
10	*Capsicum frutescens*	Nga-yok	Solanaceae
11	*Carica papaya* L.	Thin-baw-pin	Caricaceae
12	*Colocasia esculenta* (L.) Schott	Pein	Araceae
13	*Daucus carota* L.	U-ni	Apiaceae
14	*Lactuca sativa* L.	Sa lat	Asteraceae
15	*Lycopersicon esculentum* Mill.	Kha-yan-chin	Solanaceae
16	*Oryza sativa L.*	Sa-ba	Poaceae
17	*Pisum sativum* L.	Shwe pe thi	Fabaceae
18	*Solanum tuberosum* L.	Arlu	Solanaceae
19	*Vigna catjang* Walp.	Pe dauk shay	Fabaceae
20	*Zea mays* L.	Pyaung-phu	Poaceae
21	*Zingiber officinale* Roscoe	Gyin	Zingiberaceae
Fruit tree and Camellia Plantation in the Study Area			
No.	*Scientific Name*	Common Name	Family Name
1	*Camellia assimilis Champ.*	La-phet	Theaceae
2	*Citrus limon (L.)Burm.f.*	Than-ba-yo	Rutaceae
3	*Citrus reticulata Blanco*	Lein maw	Rutaceae
4	*Pyrus communis L.*	Thit taw thi	Rosaceae

(9) Fauna

(a) Survey Methods

The survey was conducted over two seasons (Dry and Wet). The first time dry season survey started from 4th to 10th of May, 2018 and the second time wet season survey started from

16^{th} to 21^{st} July, 2018. Two different sites were chosen for both dry and wet season surveys. Using "The IUCN Red List of Threatened Species. Version 3.1" downloaded on 01 May, 2017 from www.iucnredlist.org globally threatened status of fauna species were categorized into four classes, namely, Critically Endangered (CR), Endangered (EN), Vulnerable (VU) and Near Threatened (NT). Following methods were used for each type of fauna:

(i) Birds: Survey of bird species, their population status and habitats were carried out by setting up line transects along footpaths during the period from morning to late afternoon. Geographic locations of the transect are recorded using GPS device.

(ii) Mammals: Survey was performed using two methods, namely, tracks and signs surveys and interview survey method. Direct observations of tracks and signs were applied, mainly on existing trails and following a route across the forest identified by local people. The indirect survey includes observing of tracks and signs such as footprints/spoors, feces/scats/dungs, resting sites, scratching places, salt licks etc. Records of structure and the measurements of footprints were also made for identification. In addition, a number of local people such as hunters or ex-hunters were interviewed from a village near survey area.

(iii) Amphibian and Reptile: Specimens were observed by visual encounter surveys supplemented with acoustic searching, turning rocks and logs, peeling bark, digging through leaf litter, and excavating burrows. Specimens were collected by hand or rubber ring and snake tongs were used to capture poisonous snakes.

(iv) Insect and other invertebrates: Survey applying standard method was conducted randomly around the survey area and along the trails or footpath in the survey area. Identification of Butterfly species was primarily made directly in the field. In some cases, if the encountered butterflies were not identified directly in the field, specimens were collected by using the long-handled aerial nets and identified at the camp with references.

(v) Fish: The fish specimens were collected using the long-handled nets, net patch 3 millimeters, ring size 20 inches diameter. Survey team fished along the stream using fishing net and three hoop net traps, discontinuously sampling all habitat types. All captured fish were held in a bucket of fresh stream water, identified, and enumerated.

(b) Results of Fauna

According to the survey result, a total of 201 fauna species of 160 genera belonging to 86 families under 29 orders were recorded in two survey sites, during the two survey periods (Dry and Wet season) from 4^{th} to 10^{th} of May 2018 and from 16^{th} to 21^{st} July 2018. A total of 114 bird species, 12 mammal species, six amphibians, and eleven reptiles and 48 insect and other invertebrates were respectively collected by fauna survey team. According to the IUCN conservation status, one vulnerable (VU) species was recorded in the dry season 13 species were recorded as Completely Protected Animals (CPA) whereas 20 species and 24 species were identified as Protected Wild Animals (PWA) and Seasonal Protected Animals (SPA) respectively.

(i) Dry Season

In total, 169 fauna species of 135 genera belonging to 77 families under 26 orders were recorded in two survey sites during the survey period from 4th to 10th of May 2018. 99 bird species, 10 mammal species, 4 amphibians and 10 reptiles and 47 insect and other invertebrates were respectively recorded by fauna survey team. According to the IUCN Red List data, one vulnerable species was recorded during this survey period. In the dry season survey, nine species were recorded as Completely Protected Animals (CPA), 16 species and 22 species were identified as Protected Wild Animals (PWA) and Seasonal Protected Animals (SPA) respectively.

(ii) Wet Season

In total, 169 fauna species of 137 genera belonging to 78 families under 28 orders were recorded in eleven survey sites during the survey period from 16th to 21st July 2018. 87 bird species, 9 mammal species, 3 amphibians, and 9 reptiles and 38 insect and other invertebrates were recorded by fauna survey team. According to the IUCN RedList data no threatened species were recorded during the survey.In the wet season survey, six species were recorded as Completely Protected Animals (CPA), 17 species and 20 species were identified as Protected Wild Animals (PWA) and Seasonal Protected Animals (SPA) respectively.

(10) Birds: Species Composition and Status

In dry season, a total of 99 bird species of 72 genera belonging to 42 families under 12 orders were recorded in two survey sites. According to IUCN Red List data no threatened species were observed. 9, 12 and 22 species were recorded as Completely Protected Animals (CPA), Protected Wild Animals (PWA) and Seasonal Protected Animals (SPA) respectively.

In the wet season, a total of 87 bird species of 66 genera belonging to 43 families under 13 orders were recorded in two survey sites. Among them, 11 bird species were recorded in addition to the list of previous dry season survey. No globally threatened species were observed in the survey area. 6, 14 and 19 species were recorded as Completely Protected Animals (CPA), Protected Wild Animals (PWA) and Seasonal Protected Animals (SPA) respectively.

(11) Mammals: species composition and status

In the dry season, a total of 10 mammal species of eight genera belonging to 8 families under 4 orders were recorded in two survey sites during the survey. No globally threatened species were observed in the survey area. Out of mammal species recorded, four were Protected Wild Animals (PWA) according to the Protection of Wildlife, Wild Plants and Conservation of

Natural Areas Act 15 Wild Plants and Conservation of Natural Areas Act 15(A), four species were recorded out as Protected Wild Animals (PWA).

In the wet season, a total of 12 mammal species of 10 genera belonging to 9 families under 5 orders were recorded during the survey period. Among them, two mammal species were recorded as new from the previous survey (dry season). Based on the globally threatened status of the recorded species, there were no globally threatened species in the survey area. According to the Protection of Wildlife, Wild Plants and Conservation of Natural Areas Act 15(A), 3 species were recorded as Protected Wild Animals (PWA) and one species was observed as Seasonal Protected Animals (SPA).

(12) Amphibians and Reptile: species composition and status

In the dry season, a total of 4 amphibians and 10 reptile species of 13 genera belonging to 9families under two orders were recorded in two survey sites during the survey period. No globally threatened species were found in the survey area.

In the wet season, a total of 5 amphibians and 7 reptile species of 10 genera belonging to 7 families under 2 orders were recorded in 11 survey sites during the survey. Among them, 2 amphibians and 1 reptile species were recorded additional to the list of previous dry season survey. No globally threatened species were observed in the survey area.

(13) Insect and other invertebrates: species composition and status

In the dry season, a total 37 insect and other invertebrate species of 30 genera belonging to 11 families under 3 orders were recorded in 2 survey sites during the survey period. In total, 27 butterflies, 4 dragonflies, and 6 beetles were recorded. There were no species observed as globally threatened and protected species in the survey sites.

In the wet season, a total of 48 insects and other invertebrate species of 39 genera belonging to 12 families under 3 orders were recorded in 2 survey sites during the survey period. Among them, 11 butterflies species were recorded additional to the list of previous dry season survey. No globally threatened and protected species were observed in the survey sites.

(14) Fish: species composition and status

In the dry season, a total of 9 fish species of 9 genera belonging to 7 families under 5 orders were recorded in 2 survey sites during the survey period. No globally threatened as well as protected species were observed in the survey area.

In the wet season, a total of 10 fish species of 10 genera belonging to 7 families under 5 orders were recorded during the survey period. Among them, 1 fish species was recorded as additional species to the list of previous dry season survey. No globally threatened or protected species were found in the survey sites.

(15) Impact Assessment

The potential impacts on biodiversity are identified and impacts significance is analised. Table 5.27 shows the potential impacts and mitigation measure.

Table 5.27 Potential Impacts and Migtigation Measures of Biodiversity

Source	Partial Impact Biodiversity	Extinct			Duration			Probability			Magnitude			Significance			Recommended measure
		L	M	H	L	M	H	L	M	H	L	M	H	L	M	H	
FLORA																	
1.	Expension of farm land into the forest		√			√				√		√			√		To introduce community forestry in order to reduce dependency of the community on forest and springs in the area.
2.	Fire wood extraction		√			√				√		√			√		To plant fast growing tree species in the community forest for fire wood. To supply electricity for the community.
3.	Extraction of turpentine from pine forest		√			√			√			√			√		To plant pine tree in community forest.
4.	Cumulative impacts		√			√				√			√			√	To assess the cumulative impact and implement the management plan.
FAUNA																	
1.	Decrese of fish population		√				√			√			√			√	To raise awareness of the people about the hazard of disposal of empty bottles and plastic bags into the stream. To prohibit disposing hazardous wastes by low enforcement.
2.	Hunting for bushmeat		√			√			√				√		√		To help the community promote of animal husbandry and aquaculture practices in

																the community.

L: Low, M: Medium, H: High

5.4.9 Social Environment

(1) Population and Demography

Thigyit Coal Fired Power Plant is located within the jurisdiction of Pinlaung Township in the Pa-O Self-Administered Zone of Shan State of Myanmar. The township lies along the National Road 54 from Loikaw in the north-west. Table 5.28 provides a general demographic overview of Pinlaung Township in comparison with two Townships, namely, Naung Ta Yar and Paung Loung.

Table 5.28 General Population in Pinlaung Township

No.	Township	No of Village Tract/Quarter	No of Village	Total Population			Male: Female Ratio	Population Growth Rate	No of House holds	No of Houses
				Total	Male	Female				
1.	Pinlaung	25	430	169,585	83,125	86,460	96.14	0.46	36345	33854
2.	Naung Ta Yar	3		4,526	2227	2299	96.86	0.11	894	823
3.	Paung loung	6		7,402	3,815	3,587	106.35	0.20	1774	1721

Source: Township GAD (2017)

(2) Religion and Race

According to the data from the GAD at the township level, population by religion in Pinloung Township along with Naung Ta Yar and Paung Loung Townships are as shown in Table 5.29. Residents by races living in the three townships are shown in Table 5.30.

Table 5.29 Religion in Pin Loung Township

No.	Township	Buddhist	Islam	Hindu	Christian	Other	Total
1.	Pinlaung	165049	4375	6	152	3	169585
2.	Naung Ta Yar	4,526	-	-	-	-	4,526
3.	Paung loung	6,858	544	-	-	-	7,402

Source: Township GAD (2017)

Table 5. 30Races in Pin Loung Township

No.	Township	Kachin	Kayah	Kayin	Chin	Mon	Bamar	Rakhine	Shan	Pa Ohe	Inn Thar	DaNu	Taung Roe	KaYane	Other
1.	Pinlaung	9	906	3248	35	7	7672	28	16,511	130,162	1,226	762	6,268	2,500	224
2.	Naung Ta Yar	1	-	-	-	-	100	-	33	4,272	25		16	1	78
3.	Paung Loung	-	-	-	7	-	6,551	-	17	47	-	-	-	780	-

Source: Township GAD (2017)

(3)Economic Status

Economic activities in Pinloung Township were examined based on the information provided by respective township GAD offices. Agriculture, livestock breeding and small-scale home businesses play an important role especially in rural areas while small- to large-scale businesses are common in sub-urban areas. Agriculture is main business of local population. Being located on highway route of Aungban- Pinloung-Moebyal-Loikaw track and Pinloung-Pyinmana track transport to and from Pinloung is generally good. The main products of the township are tea-leaf (Laphet), cabbage, tomato and potato which were exported mostly to Aungban region.

(4) Employment Status

According to the information from the township level GAD offices, the region comprising three neighbouring. Townships has an average unemployment rate of about 4.75% Reative to other two Townships Pinloung has the lowest rate of unemployment (see Table 5.31).

Table 5.31 Status of Employment in Pin Loung Township

No.	Township	No.of Workable Person	No.of Employed Person	No.of Unemployed Person	% of Unemployed Person
1.	Pin Loung	97,038	92,863	4175	4.50%
2.	Naung Ta Yar	2,789	2,501	288	11.51%
3.	Paung Loung	3,415	3,220	215	6.60%
Total (number/average)		103,262	98,584	4,678	4.75%

Source: Township GAD (2017)

(5) Educational Status

Table 5.32 shows the educational status of Pinloung and other two Townships as per township information. Statistics indicate that local population has access to primary and secondary education although higher education is not accessible in the region. The largest number of schools and literate were found in Pinloung because of the largest population relative to other two Townships.

Table 5.32 Educational Status in Pinloung Township

No.	Township	Pre-Primary School	Primary School	Middle School	High School	University	Total Schools	Literate
1.	Pinlaung	50	114	19	6	-	189	112409
2.	Naung Ta Yar	29	106	-	2	-	137	3368
3.	Paung Loung	4	29	1	1	-	35	4735

Source: Township GAD (2017)

(6) Health Condition

Table 5.33 shows the statistics of the most common diseases recorded at the hospitals of the three Townships. Cases of seven diseases, namely, malaria, diarrhea, tuberculosis, hepatitis, dysentery and HIV/AIDS were recorded in 2017. In all three Townships diarrhea was the most commonly recorded disease followed by dysentery and tuberculosis (TB). According to the table, the most recorded number of malaria cases with a total of 16 was found in Poung Loung. The data also shows overwhelmingly large number of cases of diarrhea with the highest being 1128 cases in Poung Loung. The highest numbers of and dysentery cases were also recorded in Poung Loung Township. The recorded cases of hepatitis were similarly distributed in Pin Loung and Poung Loung Township whereas no cases were recorded in Naung Ta Yar Township. The data also shows no recorded cases of HIV/AIDS in Poung Loung while the other Townships have recorded cases of the disease.

Table 5.33 Common Diseases and HIV Patients in Pin Loung Township

			Most Common Diseases					
No.	Township	No.of Hospital	Malaria	Diarrhea	TB	Dysentery	Hepatitis	HIV/AIDS
1.	Pinlaung	3	15	1077	88	147	16	4
2.	Naung Ta Yar	1	1	32	4	6	-	1
3.	Paung Loung	1	16	1128	100	159	16	-

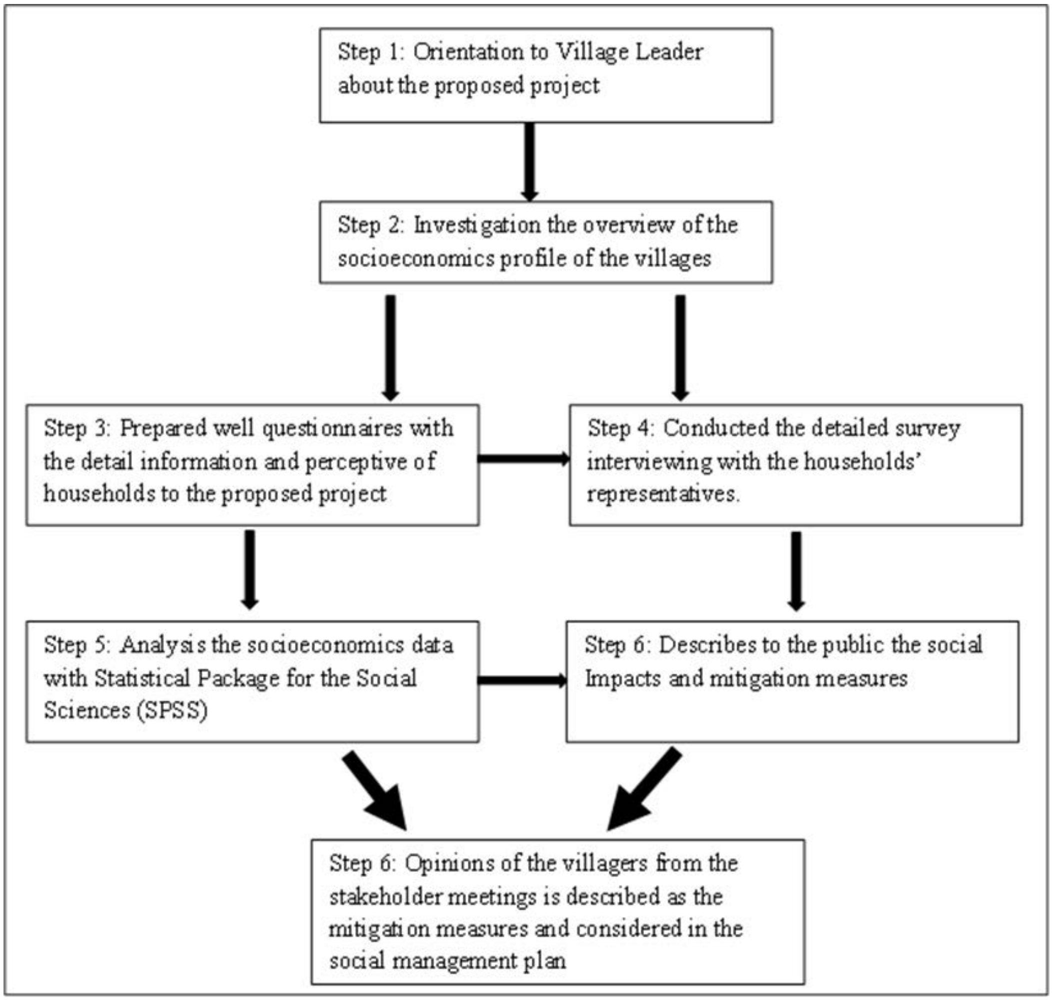
Source: Township GAD (2017)

(7) Baseline Socio-economics Condition

This part describes about the socioeconomics profile of the coal fired power plant area with the objective to gain insights into the demographic trends and economic performance of the area. Socioeconomics impact analysis examines how an act of development could potentially impact a community, the social and economic aspects of the potential impact, and the community"s attitude towards resulting changes. Potential impact outcomes include: demographic changes in the community, changes in the demand for public services, employment and income levels. The project goal is to assess the potential impacts of the construction and operation of the proposed coal-fired power plant on the net welfare of the local communities and economic development in the project area. In the context, the objectives of the study are to

- Develop an understanding of the strategic national importance the coal fired power plant.
- Develop an economic profile of the local areas and regions.
- Understand a basic social profile of the communities located in the local areas and regions.
- Identify the potential impact, including direct, indirect and cumulative.
- Interpret the results in relation to impact in the net social welfare and economic development.
- Make recommendations pertaining to possible mitigation measures.

Methodological Approach



(8) Design of Questionnaire

The goal of the questionnaire was to generate quantitative data related to demographic and socio-economic status of the project area. It was designed to capture the participant‟s demographic background, the income level, livelihood process, their attitude towards the coal fired power plant. For the baseline profile, the outcome consists of the following criteria:

- General household information
- Gender, Age, Ethnicity, Religious, Education, Family size
- Households Assets
- Land Assets, Livestock Assets, Utilities.
- Occupation Profile
- Main Occupation of each household.
- Annual Income of Households
- Changes of income level, maximum, medium, minimum income season in the project area.

- Annual expenditure of Households except form food expenditure
- Expenditures for various items; Health, Social, Transportation, Education, Religious, Others.
- Electricity Supply and Fuel consumption
- Transportation
- Health Status
- Common diseases occurred last 1yr.
- Satisfaction of living in the environment
- Main reasons for living in this environment.
- Satisfaction Level to the facilities of the environment.

Type of Facilities	(1) Very good	(2) Good	(3) Fairly	(4) Poor	(5) Very Poor	(6) Don't Know
School						
Transportation assets						
Communication						
Health facilities						
Peace in the environment						

- Acceptance of the impact to the coal fired power plant.
- Impacts to vibration, Noise, Air, Odor, Water changes, Fire hazards, changes in agricultural production in past operation phase, shut down phase, current operation phase.

No	Main Cause of Impacts	Nuisance of Impacts		Level of Acceptance		
		Yes	No	Yes	Medium	No
	Past Operation of Coal Fired Power Plant					
	Conveyor					
	Coal Mine Blasting					
	Mine Truck					

	Travelling					
	Others					

- Perception, attitude, knowledge and preferences about the proposed project.

Knowledge about the project, health hazards caused by the projects (ear, nose, throat diseases, lungs diseases), birth rates of down-syndrome children in the project area

Attitude of the project

	2. Increase annual income	
	3. Improve transporting	
	4. Compensation for land use	
	5. Improve environment	
	6. Electricity	
	7. Others	
	1. Increase Noise	
	2. Increase Air Pollution	
	3. Lose Farm Land	
	4. Lose Land	
	5. Employment/ Income disruption	
	6. Loss of House	
	7. Crime	
	8. Safety	
	9. Health	
	➢ 10. Others	

- Main difficulties to the environment

Main Difficulties	
Road transportation	
Electricity	
Water	
Sanitation	
Education	
Telecommunication	
Health Services	
Access to credit	
Others	

(9) Description of Sample Size of Villages

The socioeconomics sampling is conducted in 10 villages and staff housing of Eden and Thigyit Coal-fired Power Plant as the primary impact zone where 3 km far from the proposed coal fired power plant, and 13 villages as the secondary impact zone where 5 km far from the proposed coal fired power plant. An appropriate sample size is estimated to be 1,000 households out of the total population of about 13,500 households in both impact zones. About 40 percent of the total households in primary impact zone were surveyed and about 20 percent of the total households in secondary impact zone were surveyed. Table 5.34 shows the total households and sample size to be surveyed in each village.

Table 5.34 Description of total households and sample size of villages

Type of Impact Zone	Village Name	Land areas	Total Households	Sample Size
Primary Impact Zone (3km from the proposed project)	Aedin		108	25
	Kone Thein		47	19
	Mya Kan Thar		80	54
	Mya Sein Taung		32	19
	Phayar Ngar Su		105	30
	Pyin Thar		42	26
	Sae Kaung		250	108
	Tharyar Gone		94	61

Type of Impact Zone	Village Name	Land areas	Total Households	Sample Size
	Tigyit A Lae		199	72
	Tigyit North		167	61
	Tigyit South		246	86
	Staff Housing		101	32
Secondary Impact Zone (5km from the proposed project)	Bank Mat		29	5
	Gant Kaw Pin		60	10
	Kyat Thon Khone		94	21
	Lwin		132	16
	Mee Thway Chaung		116	21
	Moon Pin		87	10
	Myinn Twin		160	30
	Naung Moon		120	79
	Naung Muu		210	20
	Pat Ta Lae		140	13
	Pin Mi Khone		86	9
	Pin Sane Su		44	10
	Taung Chay		132	13

(10) Socioeconomics Survey

This part breaks down the general information of socioeconomics condition of the villages after analyzing the surveyed data collected with well-prepared questions. The focus group discussion with the village leader was held on 31st March to 3rd April, 2018, and the overview conditions of the villages were investigated. According to the socio-economics conditions, the detailed measurement questions for the households‟ conditions were prepared.

(11) General Information of Households

a) Respondents’ by Gender Distribution

The survey was conducted using above survey methodology. With a well-prepared questionnaire the survey team interviewed members of randomly selected households to obtain socioeconomic information. While the socioeconomics surveys are conducted, most of the respondents are households‟ members who are always living in their house. The following figures (5.43) and (5.44) break down of the respondents by gender according to the survey results. There are 320 (53%) male respondents and 280 (47%) female respondents out of total of (600) households surveyed in the primary impact zone. In the secondary impact zone, there are 178 (69%) male respondents and 79 (31%) female respondents out of a total of (257) households surveyed.

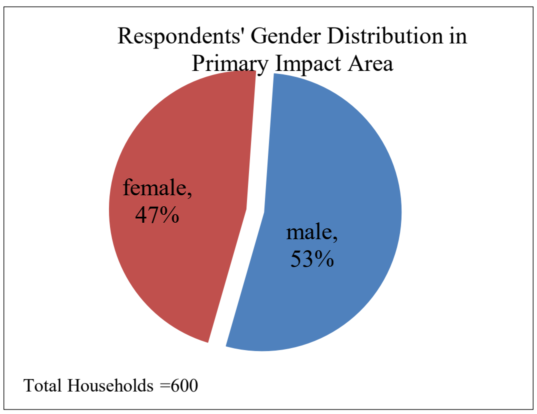


Figure 5.43 Gender distribution of Respondents in Primary Impact Area

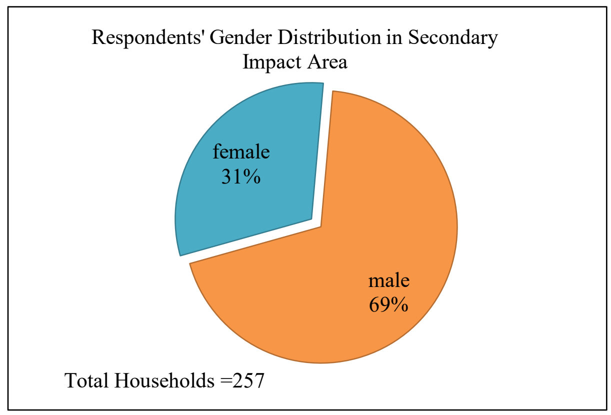


Figure 5.44 Gender distribution of Respondents in Secondary Impact Area

b) Age Distribution by Respondents

The following Figures (5.45) and (5.46) describe the age distribution of respondents who participated in the survey. In survey questionnaires, the ages of respondents were aggregated into four age classes as seen in the figures.

In the primary zone, the ages of most respondents surveyed are between 21 and 40 with 274 households (46%), followed by the age class between 41 and 60 with 264 households (44%) out of a total of 600 households surveyed. It is therefore found that the ages of respondents are mainly distributed within the range of working age between 20 and 60.

In the secondary impact zone, as per the survey outcomes, the ages of most respondents‟ surveyed are between 21 and 40 with 124 households (48%), and the age class between 41 and 60 stands at the second place with 99 households (39%) out of a total of 600 households surveyed. Similar to those of the primary zone, ages of respondents are also mainly distributed within the range of working age. Therefore, as the survey results show, respondents from two thirds of households surveyed in both primary and secondary impact zone are at the working age between 20 and 60.

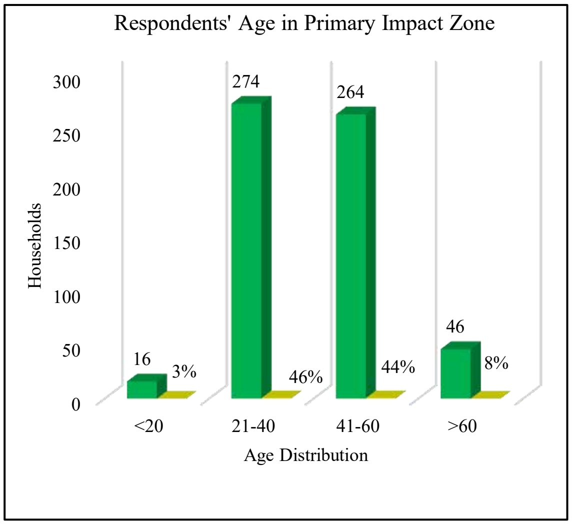


Figure 5.45 Distribution of Respondents' age in Primary Impact Zone

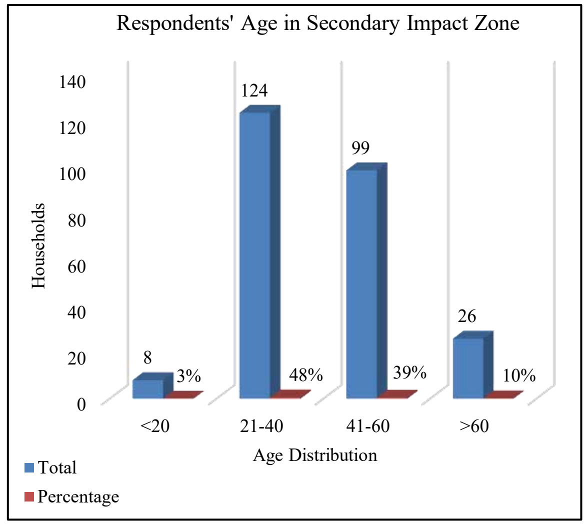
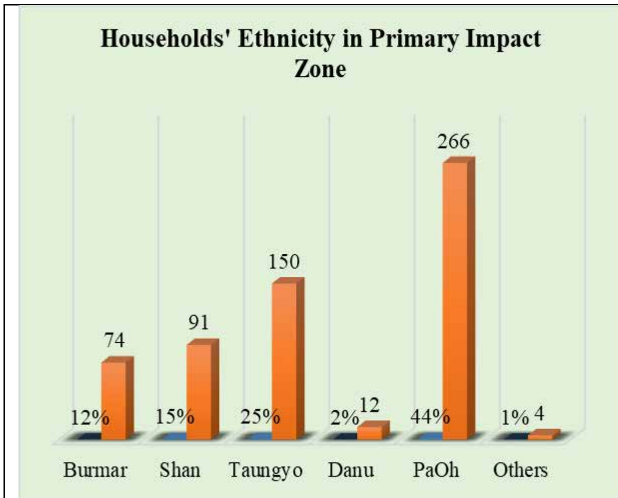
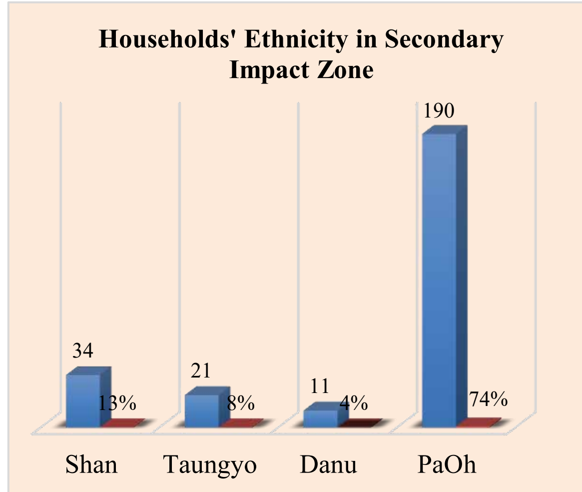


Figure 5.46 Distribution of Respondents' age in Secondary Impact Zone

c) Ethnicity by Households

Figures (5.47) and (5.48) break down the households‟ ethnicity in both primary and secondary impact zone. According to the surveyed results of the primary impact zone, 44% (266 households) and 25% (150 households) are Pa Oh people and Taung Yo people respectively whereas 15% (91 households) and 12% (74 households) are Shan and Bamar people respectively. In the secondary impact zone, 74% (190 households) and 13% (34 households) out of total of 257 households surveyed are Pa Oh and Shan People respectively. It is found that Pa Oh people and Taung Yo People are mostly distributed in the primary impact zone while Shan, Burmar, Chin and Danu people are slightly distributed in the primary impact zone. On the other hand, in the secondary impact zone, Pa Oh people and Shan People are mainly distributed ~~ethnics~~ groups whereas Taung Yo people and Danu people (total 12%) are slightly distributed.

 **Figure 5.47 Ethnics distribution in Primary Impact Zone**	 **Figure 5.48 Ethnics distribution in Secondary Impact Zone**

d) Household Distribution by Religion

Table (5.35) shows the religious of households in the project areas, Buddhism is the main religion of the villagers who are living in both primary and secondary impact zone. There is only one Islamic household residing in the primary impact zone out of the total survey 857 households surveyed.

Table 5.35 Religious distribution

Content	Buddhist	Islamic	Total
Households in Primary Impact Zone	599	1	**600**
Households in Secondary Impact Zone	257	0	**257**
Total	**856**	**1**	**857**

e) Education level of respondents' in the project area

Figures (5.49) and (5.50) bring up the level of education of the respondents living in the primary and secondary impact zone of the project area. The education level of the respondents refers to the average education level of the households and Myanmar language literacy of households. In order to classify the education level, the households surveyed are divided into six classes: graduated at the highest and illiterate at the lowest education level.

In the primary impact zone, according to the survey results, 190 households (32%) have primary education which means that the daily language is Myanmar with low attainments in reading and writing, and 136 households (23%) reach middle school level with moderate attainments in reading and writing of Myanmar language. 87 households (15%) and only 49 households (8%) out of total 600 households have accomplished high school and tertiary level education with a good command in Myanmar language. In contrast, 79 households (13%) out of total survey households have access only to monastic education with very low reading and writing skills, and 59 households (10%) are illiterate.

Out of a total of 257 households surveyed in the secondary impact zone, 113 households (44%) and 53 households (21%) have primary and monastic level education respectively. 34 households (13%) are illiterate, 29 households (11%) reach middle school level, and only 26 households (10%) have high school level education. Therefore, it is discovered that one thirds of surveyed households in both primary and secondary impact zone have primary level education.

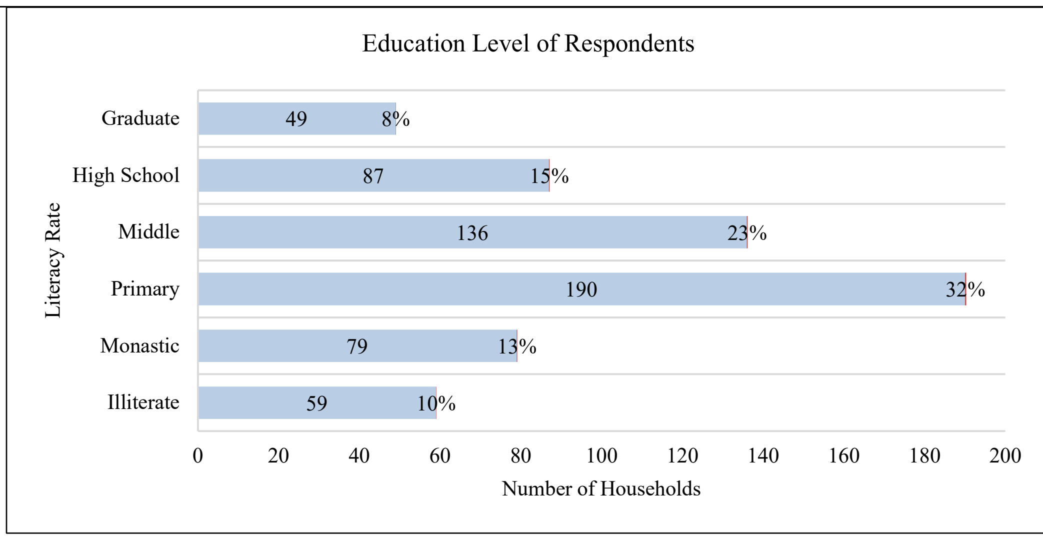


Figure 5.49 Education Level of Respondents in Primary Impact Zone

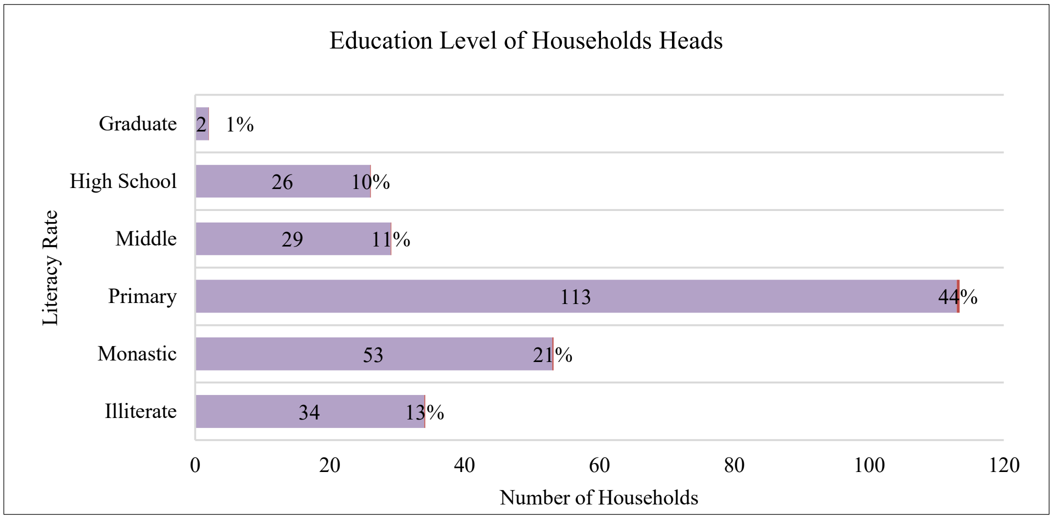


Figure 5.50 Education Level of Respondents in Secondary Impact Zone

f) Family size of the households in project area

To describe the family size status of the households, they are grouped into three classes, namely, less than four family members, between four and eight family members and above eight family members. Family size generally serves as a rough indicator of the birth rate and life expectancy in the project area. According to the survey results, 332 households (55%) and 262 households (44%) out of a total of 600 households serveyed in the primary impact zone have a family size with between four and eight family members, and less than four family members respectively. Only 6 households (1%) have above eight family members in this zone. In the secondary impact zone, 153 households (60%) and 103 households (40%) out of a total of 257 households consist of between four and eight, and less than four family members respectively. Therefore, two thirds of the surveyed households have between four and eight family members while one thirds have less than four family members according to the results of the survey. The following figures (5.51) and (5.52) display the family size of the households in the primary and secondary zone of the project area.

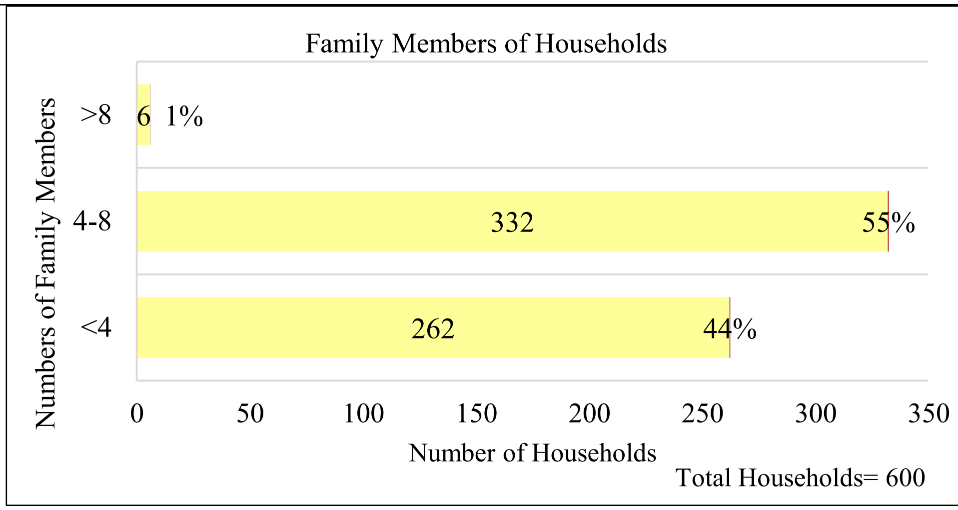


Figure 5.51 Family size of households in Primary Impact Zone

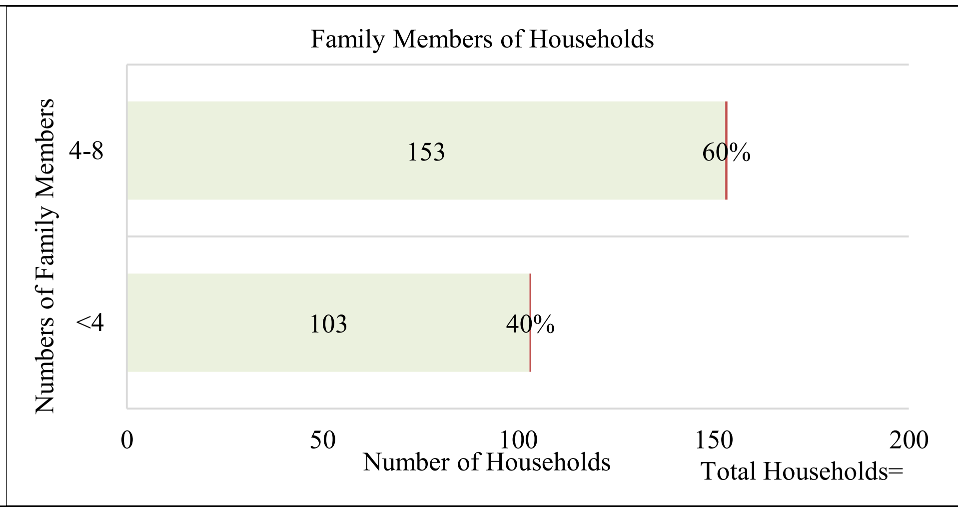


Figure 5.52 Family size of households in Primary Impact Zone

(12) Households Assets

a) Land Assets

Figure (5.53) and (5.54) show the land ownership status of each household in the primary impact zone of the project area. Figure (5.53) describes the residential land ownership. The types of ownership are categorized into four classes: owner, tenant, lease and others. According to the survey results, 536 households which is nine out of ten (536 housholds) are living on their own government granted land, and one out of ten (31 households) are tenant, and 29 households are classified as others, the different households of daughters or sons or relatives who are living in same house.

Figure (5.54) shows the ownership status of agricultural land in which households are categorized into four classes: owner, tenant, owner and lease, and none whose source of livelihoods is not agriculture. The survey results point out that there are 387 households which is half of the total 600 surveyed households are working in agriculture for their livelihoods. In contrast, there are 209 households depending on agriculture for their livelihoods. Out of total surveyed households, 320 households (53%) are owner of their agricultural land, and 67 households (11%) also have agricultural land ownership.

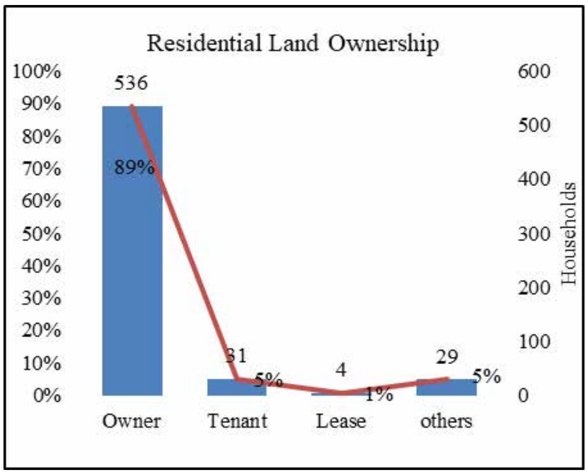


Figure 5.53 Residential Land Ownership in Primary Impact Zone

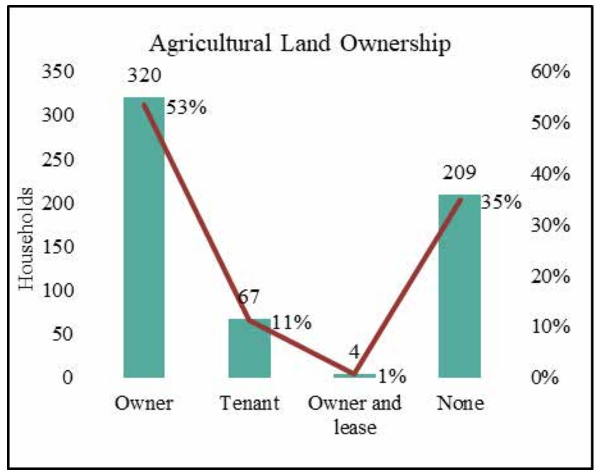


Figure 5.54 Agricultural Land Ownership in Primary Impact Zone

Figure (5.55) and Figure (5.56) point out the land ownership in the secondary impact zone. For the residential land, it is found that nearly 100% of total surveyed households has their own land for residential, and only 2 households out of 255 households are tenant. For the agricultural land, the survey results show that 227 households (89%) are working in agricultural production for their livelihoods, and only 27 households (11%) out of 257 households are not working in agricultural production. For those households who are working in agricultural production, 200 households own agricultural land granted by the government, and only 27 households are tenant from others for their agricultural production.

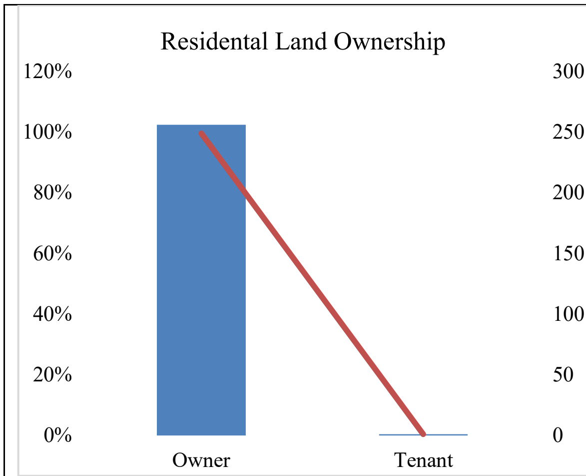


Figure 5.55 Residential Land Ownership in Secondary Impact Zone

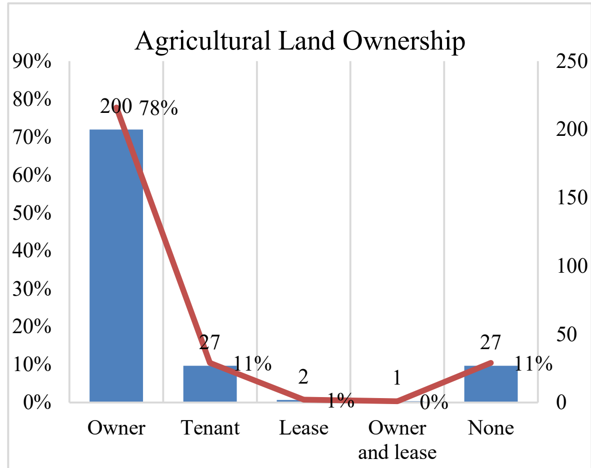


Figure 5.56 Agricultural Land Ownership in Secondary Impact Zone

Therefore, the survey results point out that over two thirds of the total survey population is working in agricultural production who is both land owners and tenants. The villages near the project area depend on the agricultural land, agricultural products for their livelihoods, and thus the quality of land, quality of water and soil fertility for agricultural production are vital to the local community.

b) Agricultural Land Acres

The survey results break down the area extent of agricultural land used by households in of the project area both primary and secondary impact zones, see in Figure (5.57) and (5.58). In the primary impact zone, over half of the households (329, 55%) are working in agricultural production with less than 5 acres of agricultural land, and only 3% (17 households out of 600 households) have greater than 5 acres, and 253 households (42%) of survey households who have not agricultural land are not working in agricultural production. In the secondary impact zone, 204 households (79%) out of 257 households are owned less than 5 acres of agricultural land for the production, and 22 households have between 5 acres and 10 acres. In contrast, there is only 27 households who has no agricultural land.

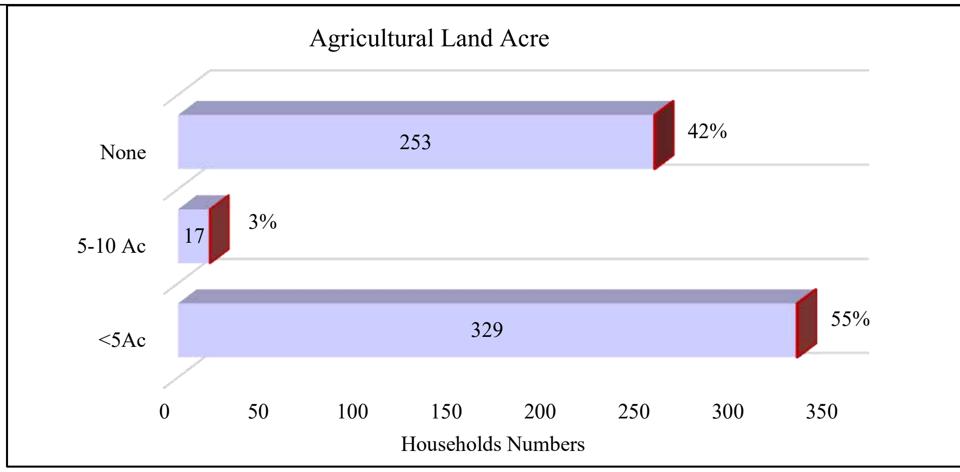


Figure 5.57 Agricultural Land Acres in Primary Impact Zone

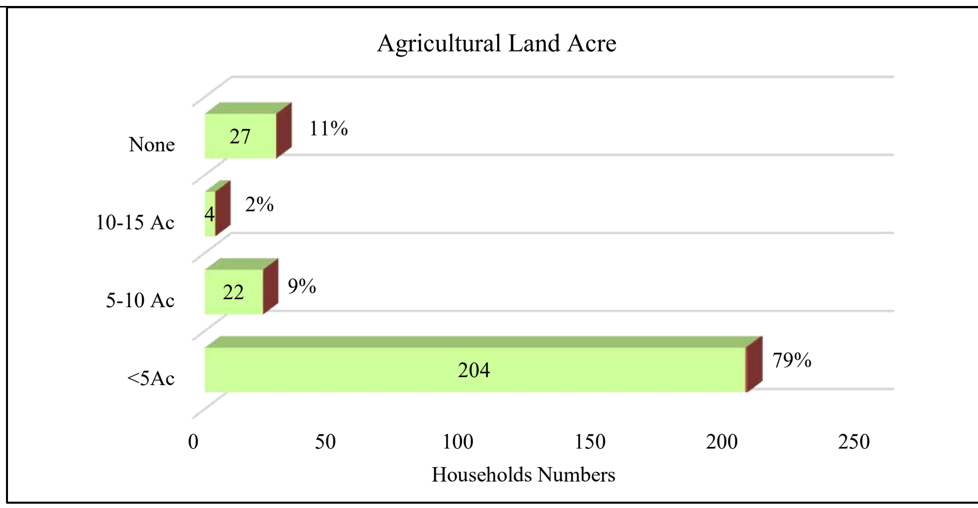


Figure 5.58 Agricultural Land Acres in Secondary Impact Zone

c) Livestock Assets

Table (5.36) shows the livestock assets of the surveyed households in the project area. The livestocks are goats, chicken, pigs, cows and buffalos, according to the survey interviews, pig, cow, buffalos are main livestocks in both primary and secondary impact zone. There are only 89 households who have pigs, 83 households who have cows and 67 households who have buffalos for livestock breeding out of total households (600 households) in the primary impact zone. Over 500 households are not working in livestock breeding for their livelihoods.

Table 5.36 Livestock Assets in primary impact zone

Number of Livestock	Types of Livestock Assets in Primary Impact Zone				
	Goat	Chicken	Pig	Cow	Buffalos
One	2	6	31	18	51
Two	1	10	25	40	9
Three	0	6	12	11	2
Four	0	4	6	8	3
>5	29	15	15	6	2
None	568	559	511	517	534
Total Livestock Assets	32	41	89	83	67

Table (5.37) mentions about the livestock assets of households in the villages of the secondary impact zone. In the secondary impact zone, cows and buffalos are mostly breeded livestocks, but only 86 households have cows, 30 households have buffalos, and 50 households have pig from 257 households working in livestock breeding. Nearly 200 households out of 257 households are not working in livestock breeding. According to the survey results, livestock breeding is not their main income source, and only one thirds of households in villages are working in livestock breeding. However, the households who are working in livestock breeding are only commercial products for their livelihoods. Figures (5.59) and Figure (5.60) show the purpose of livestock assets of households in both primary and secondary impact zone.

Table 5.37 Livestock Assets in Secondary Impact Zone

Number of Livestock	Types of Livestock Assets in Secondary Impact Zone			
	Chicken	Pig	Cow	Buffalos
One	2	3	17	19
Two	0	7	42	2
Three	0	0	9	3

Number of Livestock	Types of Livestock Assets in Secondary Impact Zone			
	Chicken	Pig	Cow	Buffalos
Four	0	1	10	2
>5	8	4	8	4
None	247	242	171	227
Total Livestock Assets	10	15	86	30

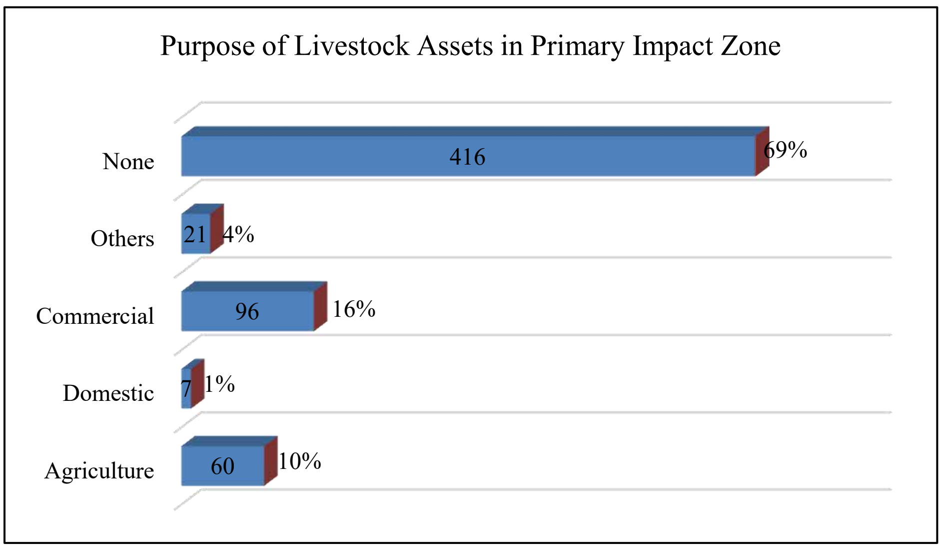


Figure 5.59 Purpose of Livestock Assets in Primary Impact Zone

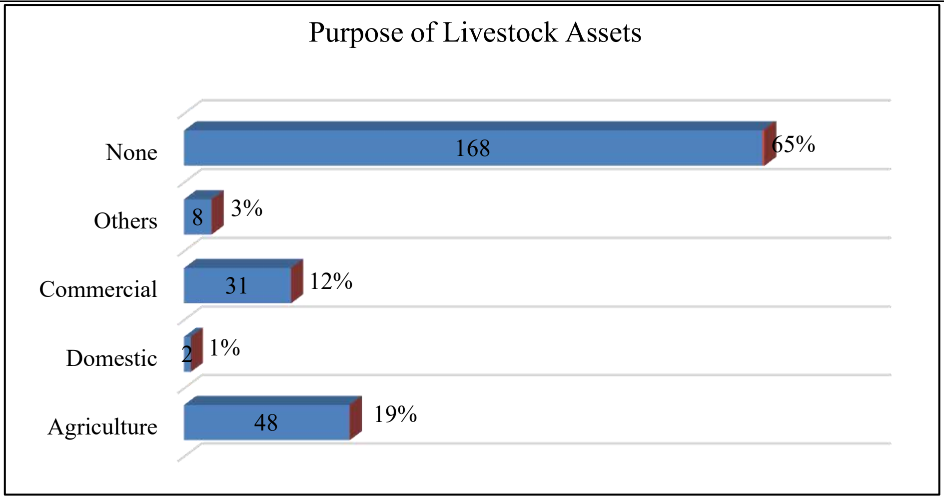


Figure 5.60 Purpose of Livestock Assets in Secondary Impact Zone

(13) Main Occupation

This section describes main occupation of each household in the primary and secondary impact zone of the project area. Main occupation not only indicates major income sources for their basic needs or daily use but also provides information to predict whether the proposed project can disturb their occupation or not. Figure (5.61) and (5.62) indicates that the distribution of occupation for each household in the primary impact area, 275 households out of total survey households (600 households) are farming agricultural crops like cabbage, mustard, potato, tomato, garlic and onion etc., and 60 households only 10% are farming rice. The second mainly distributed occupation is shop owner with 74 households (12%), and the remaining households of total survey households are doing odd jobs, wage workers, and some are working abroad.

Main occupation of households in the secondary impact zone is also farming crops and farming rice with 129 households (50%) and 86 households (33%) out of 257 households respectively. The remaining households from the survey households are farming other trees, doing odd jobs (2%), wage workers (2%) and handicraft makers (2%). Since farming is the main occupation of households in both primary and secondary impact zones, to possible disturbances to the agricultural production should be considered by the project proponent. In addition, it should be monitored whether operation of the coal fired power plant could change influencing factors on the agricultural production such as the quality of land, water, and other agricultural inputs.

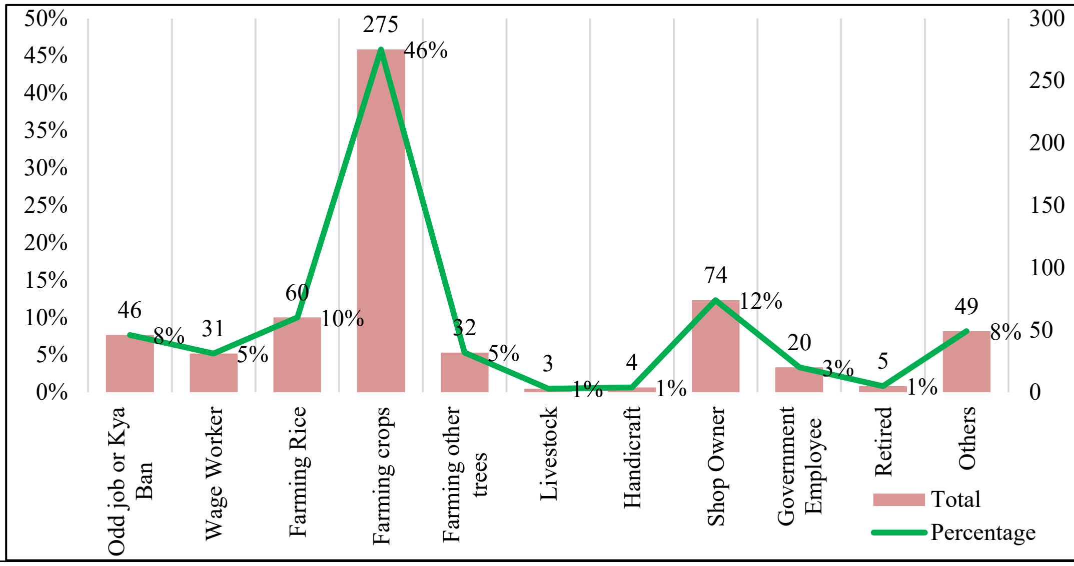


Figure 5.61 Main occupation of Primary Impact Zone

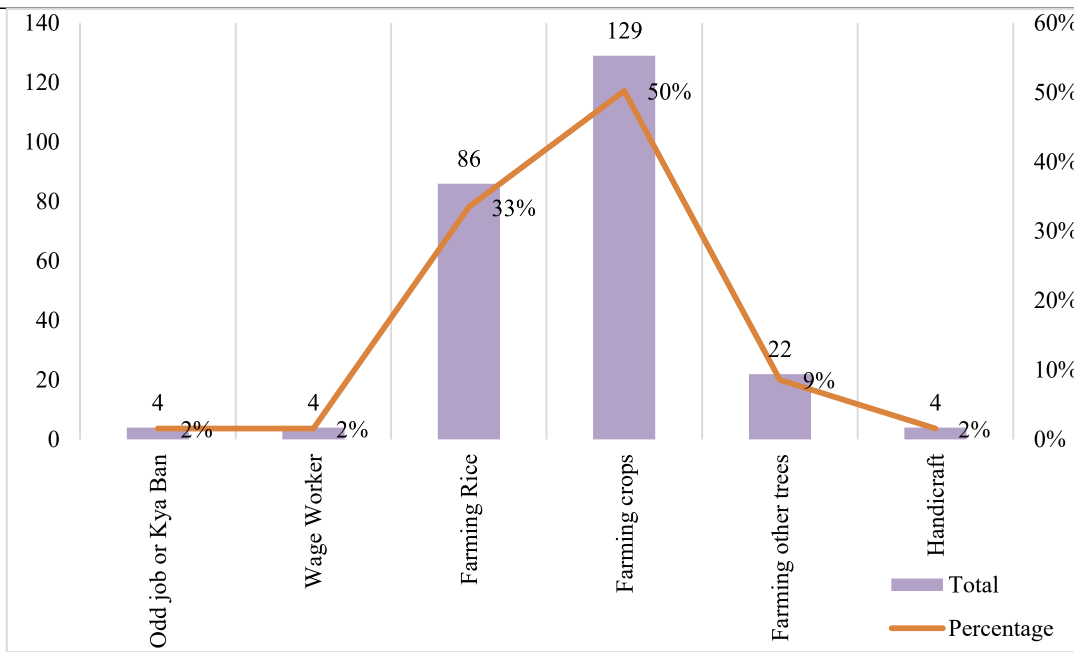


Figure 5.62 Main occupation of Secondary Impact Zone

(14) Monthly income of Households

a) Monthly income level of Households

Figures (5.63) and (5.64) describe the monthly income distribution of households in the primary and secondary impact areas. The monthly income is categorised into four classes, namely, less than 100,000 kyats, between 100,000 kyats and 300,000 kyats, between 300,000 and 500,000, and above 500,000. The monthly income can be regarded as an indicator of wealth and living standard as well as poverty level of households. Operation of the coal fired power plant is expected to lead to inequality of living standards, development and income growth in villages located near the project area.

In the primary impact zone, monthly income between 100,000 and 300,000 kyats is mostly distributed income range for each household. Monthly income range between 100,000 and 300,000 kyats and between 300,000 and 500,000 kyats are considered to enable a moderate standard of living for rural areas where costs for basic needs are relatively low. In the secondary impact zone, the income range between 100,000 kyats and 300,000 kyats is also mostly distributed income range for the villages with 140 households (54%) out of total survey households (257 households) followed by income less than 100,000 kyats per month. Therefore, the income ranges between 100,000 kyats and 300,000 kyats per month and less than 100,000 kyats are mostly distributed income in villages located near the project area. They can be seen as villages at the middle income level according to the monthly income rate.The following figures (5.63) and (5.64) show monthly income distribution in detail.

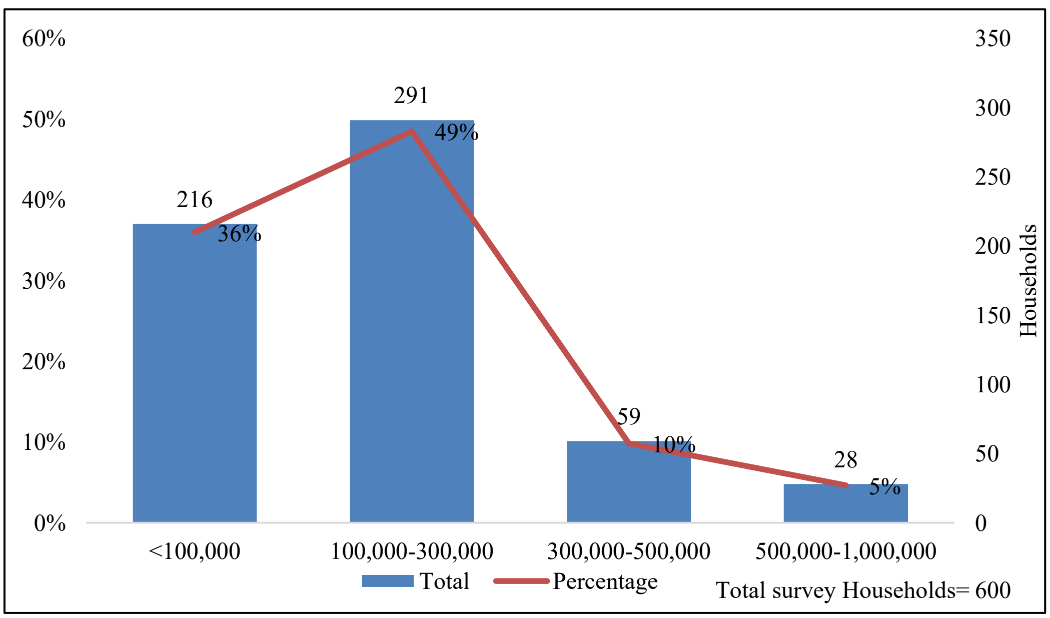


Figure 5.63 Monthly Income of Households in Primary Impact Zone

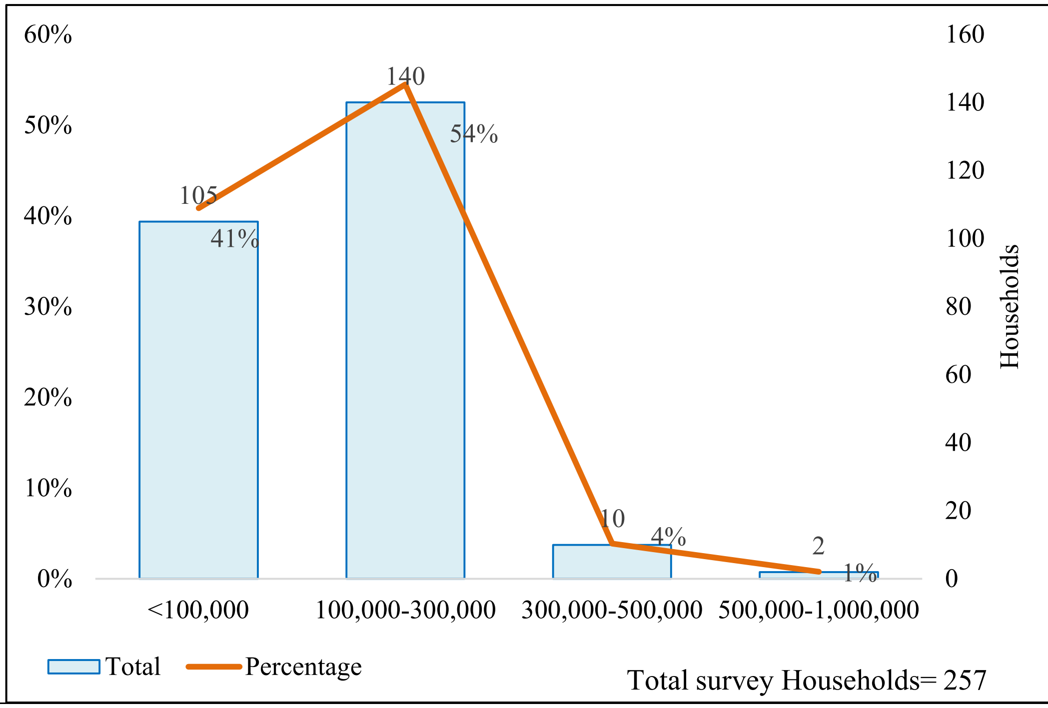


Figure 5.64 Monthly Income of Households in Primary Impact Zone

b) Changes in Income

Mostly distributed income range can be changed by positive or negative impact of the project. The income range changes need to be analyzed near the project area, so the survey team asked the respondents whether the income has changed or not during the project past operation, shut down phase and current operation phase. Figure (5.65) and Figure (5.66) describe the income changes in both primary and secondary impact zone. Respondents of 374 households (62%) in the primary impact zone and respondents of 204 households (79%) in the secondary impact zone answered that there are no changes of income. Only one third of total surveyed households in both primary and secondary impact zone answered that there are income changes. However, the project is not the only reason for those changes.

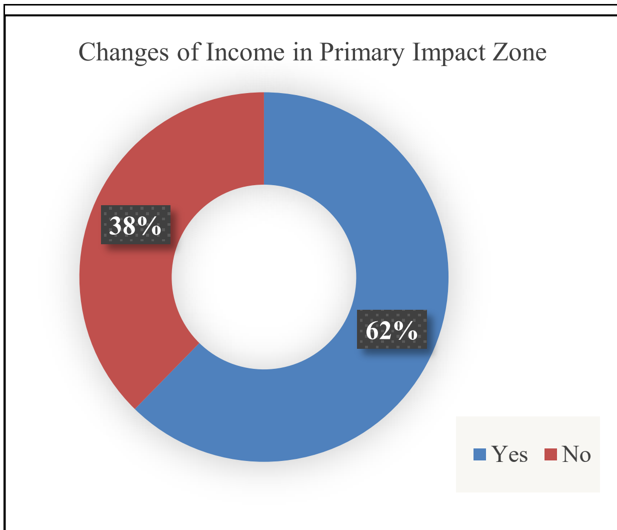


Figure 5.65 Income changes in Primary Impact Zone

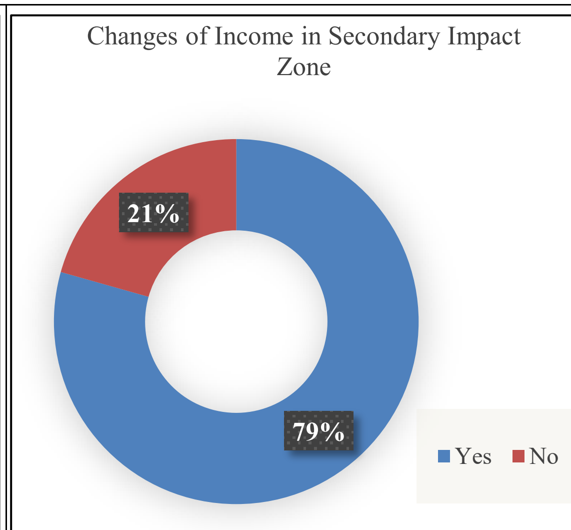


Figure 5.66 Income changes in Secondary Impact Zone

(15) Monthly Expenditures of Households in Project Area

a) Range of Monthly Expenditures

Monthly expenditures show the consumption power of each households for everyday needs such as food, clothing, housing (rent, preparation or reconstruction cost), energy, transportation, durable goods (TV, Cars, other leisure goods), health costs, leisure costs (travelling) and other miscellaneous costs. The amount of expenditure also indicates the living standards, wealth level of households and the worth of living for each household, and the development rate of villages in the project area. Figure (5.67) and Figure (5.68) describe the monthly expenditure range of the primary and secondary impact areas. The survey results show the expenditure range less than 100,000 kyats, and between 100,000 kyats and 300,000 kyats are mostly distributed expenditure range of both primary and secondary impact area. The expenditure range equivalent to less than 100,000 kyats is referred to as that of lease development countries and range between 100,000 kyats and 300,000 kyats as normal expenditure rate of developing countries.

For the primary impact zone, 292 households (49%) out of 600 households consumes less than 100,000 kyats per month for basic needs which is generally sufficient for the rural areas, while the consumption expenditure for the rural areas is commonly less than 100,000 kyats or the range between 100,000 kyats and 300,000 kyats. The second mostly distributed expenditure range is 100,000 kyats and 300,000 kyats per month with 267 households (45%) out of total households surveyed. For the secondary impact area, there are only two income ranges which is the mainly distributed expenditure less than 100,000 kyats per month with 153 households (60%)

and range between 100,000 kyats and 300,000 kyats with 102 households (40%) out of total survey households (257 households

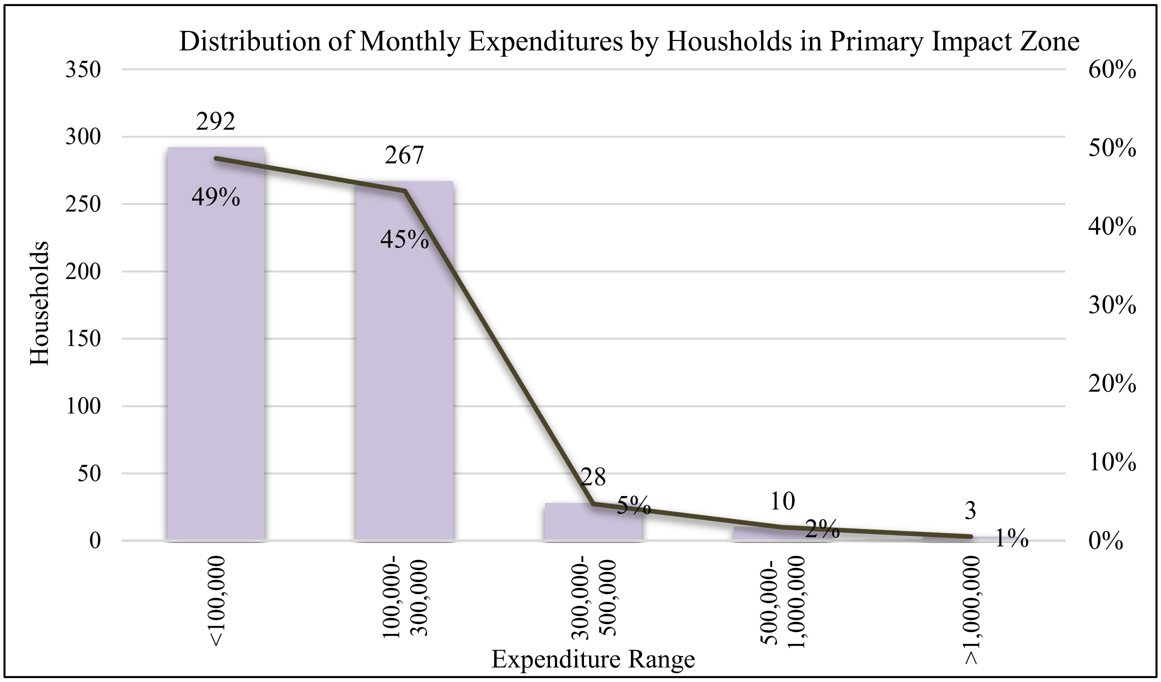


Figure 5.67 Monthly expenditures by Households Distribution in Primary Impact Zone

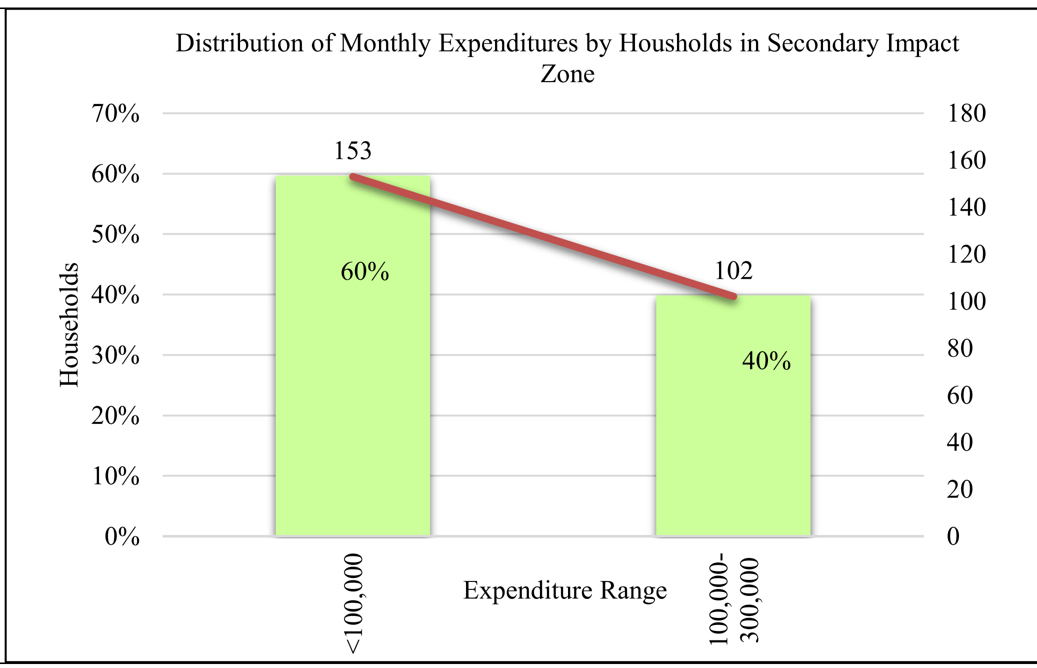


Figure 5. 68 Monthly expenditures by Households Distribution in Secondary Impact Zone

c) Types of Expenditures

Figures (5.69) and (5.70) show the types of expenditure such as health, religious activities, education, transportation, and other expenditure expect from subsistence and basic needs. The distribution of the expenditure types indicates which expenditure is the mostly used for households. If the households incur the highest expenditure for health, health of the people living near the project area would be the main issue to be considered to mitigate possible health problems caused by the proposed project.

In the primary impact zone, religious expenditure is the highest expenditure for households and other expenditures such as food, the households with 431 households (72%) and both education expenditure and social expenditure are the second mostly distributed expenditure with 239 households (40%) out of total survey households (600 households). Health expenditure which is the main case to be considered is 209 households (35%) out of total survey households (600 households). Only one third of surveyed households use the highest health expenditure not only for common diseases but also for serious illnesses which occur occasionally.

In the secondary impact zone, other expenditure is also the mostly used expenditure for households with 177 households (69%) out of total survey households (257 households), and education expenditure, social expenditure and health expenditure are respectively followed with 96 households (37%), 80 households (31%) and 66 households (26%). Health expenditure is also the one thirds of total survey households used the highest expenditure for the households. The detail information of health disease is described in the other section.mation of health disease is described in the other section.

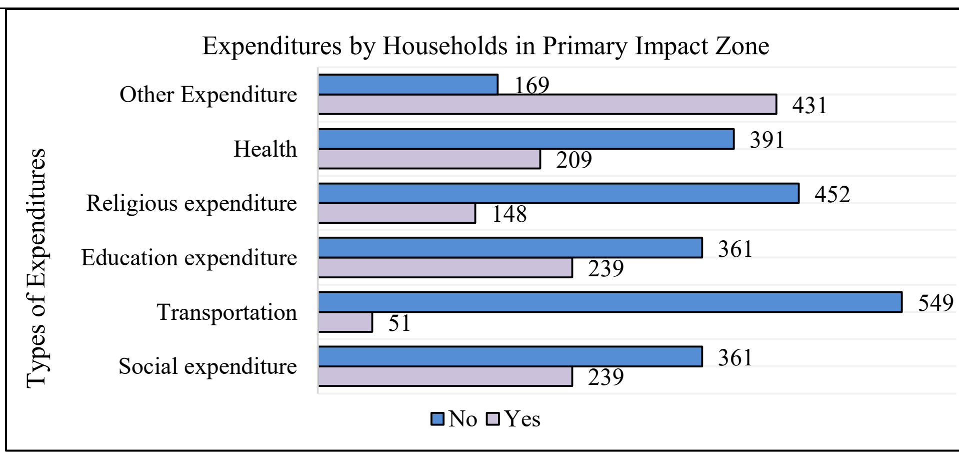


Figure 5.69 Expenditure by Households in Primary Impact Zone

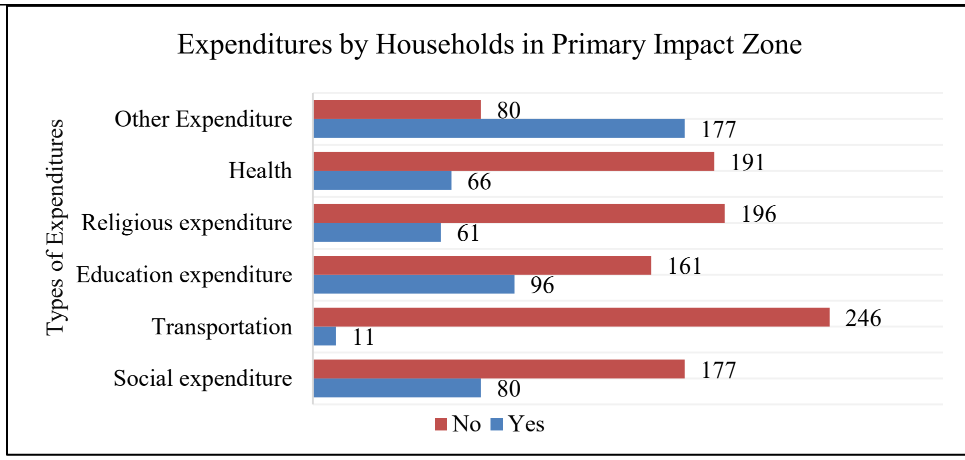


Figure 5.70 Expenditure by Households in Secondary Impact Zone

(16) Source of Electricity

a) Types of Electricity

Figures (5.71) and (5.72) show the source of electricity in both primary and secondary impact area. For both primary and secondary impact zone, national grid is the main source of electricity with 567 households (95%) out of 600 survey households, and 203 households (79%) out of 257 households. For the secondary impact zone, there is another source of electricity which is the community share not directly transferred from the national grid with 42 households (16%) out of total survey households (257 households). Therefore, the main source of electricity for both primary and secondary impact villages is the national grid whether directly or indirectly.

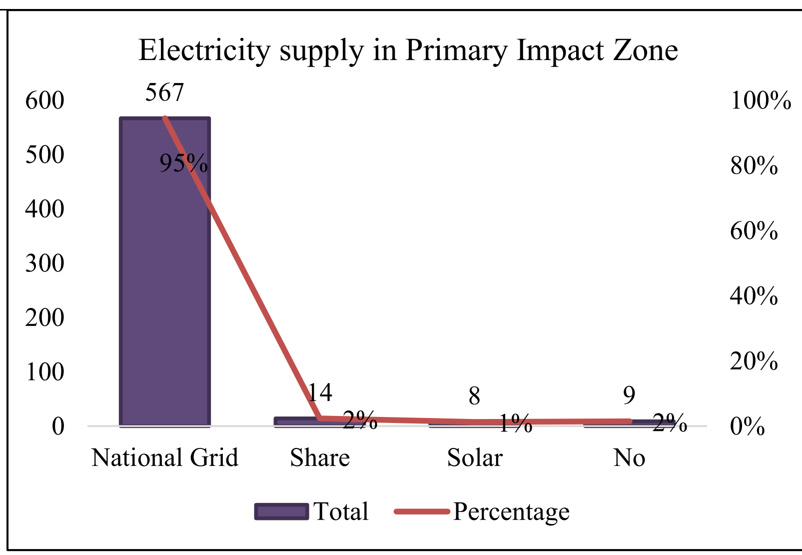


Figure 5.71 Source of Electricity in Primary Impact Zone

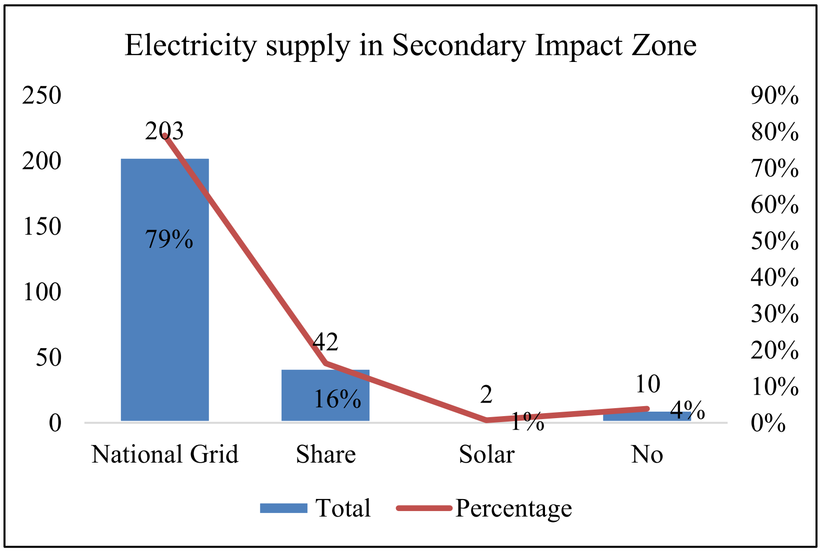


Figure 5.72 Source of Electricity in Secondary Impact Zone

b) Types of Fuel for households

Figures (5.73) and (5.74) describe the types of fuel for daily household in the primary and secondary impact zone. For both primary and secondary impact zone, wood is mostly consumed fuel for daily usage such as cooking, and coal is second mostly consumed fuel. 342 households (57%) out of 600 households in the primary impact zone and 197 households (77%) out of 257 households in the secondary impact zone used coal as fuel for daily usage, therefore, fuelwood and coal are the main source of fuel for daily uses.

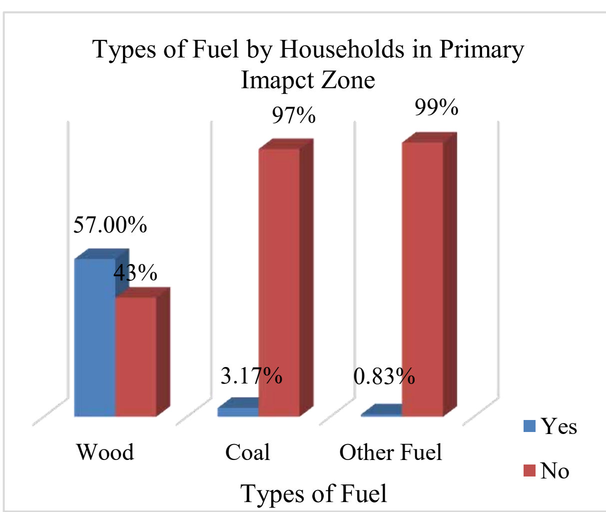


Figure 5.73 Types of Fuel in Primary Impact Zone

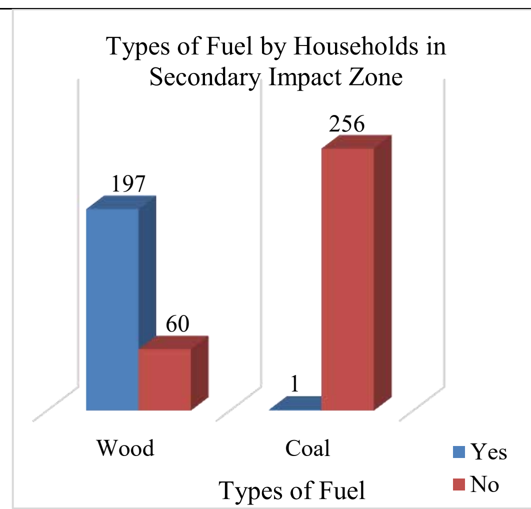


Figure 5.74 Types of Fuel in Secondary Impact Zone

(17) Types of Diseases commonly occurred in Households

Figures (5.75) and (5.76) describe the types of diseases commonly occurred in the primary impact zone. According to the surveyed results, fever is the most commonly occurred with the low occurrence in primary impact zone, while there is only 6.33% with only 38 households out of total survey 600 households. Moreover, secondly occurred disease is lung disease, and the most occurred other diseases are hypertension, heart-disease and headache etc. For the secondary impact zone, fever is also the most occurred disease 17 households (6.61%), malaria and diarrhea and lung disease is secondly occurred diseases 3 households out of 257 households. For the health disease, there are no seriously diseases in the project area and also no specifically diseases occurred because of the project according to the survey results. The detail information from the survey results are described in the following figures.

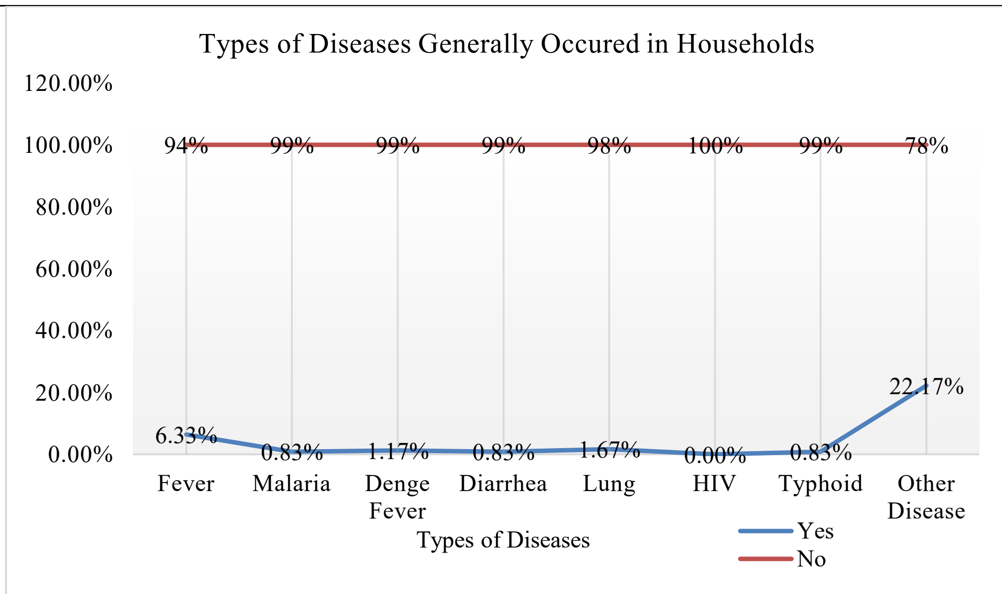


Figure 5.75 Types of diseases commonly occurred in Primary Impact Zone

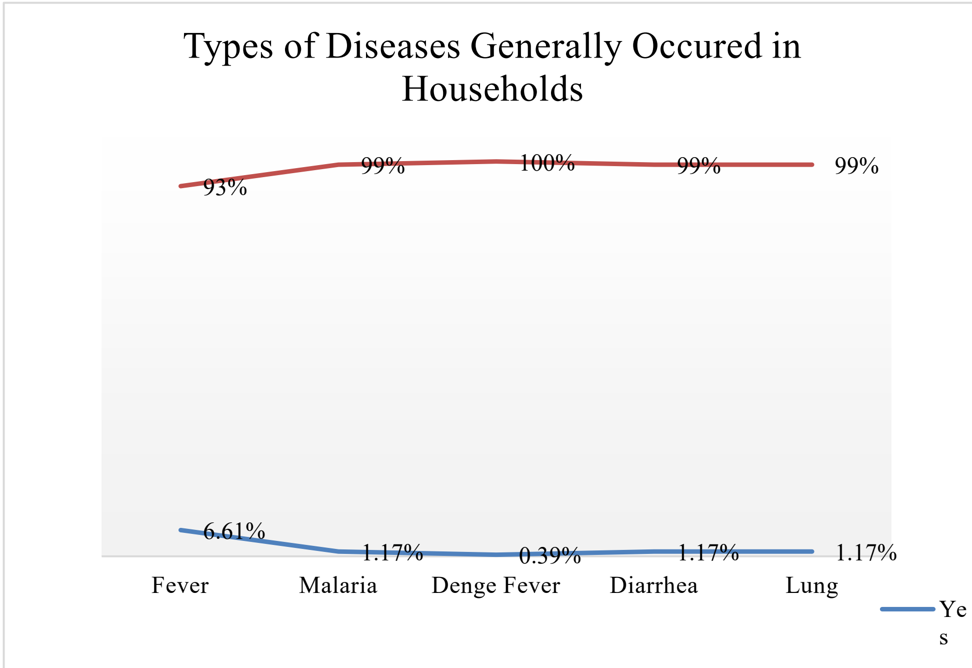


Figure 5.76 Types of diseases commonly occurred in Primary Impact Zone

(18) Main Reasons to their Environment Living

This section describes main reasons living in the environment of the project area in both primary and secondary impact zones. Figures (5.77) and (5.78) show the main reasons why they are living in that area. For both primary and secondary impact zone, 445 households (74%) out of 600 households and 232 households (90%) out of 600 households are living in that area because they are the natives of the area. Over two thirds of households from the survey households are living in the project area for the same reason.

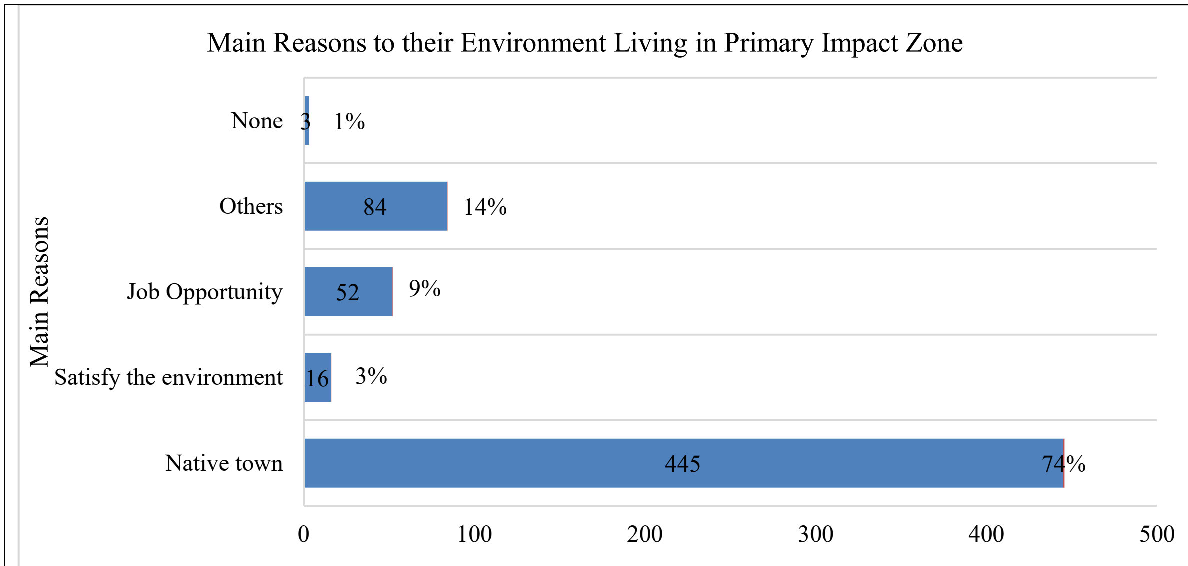


Figure 5.77 Main Reasons to their Environment Living in Primary Impact Zone

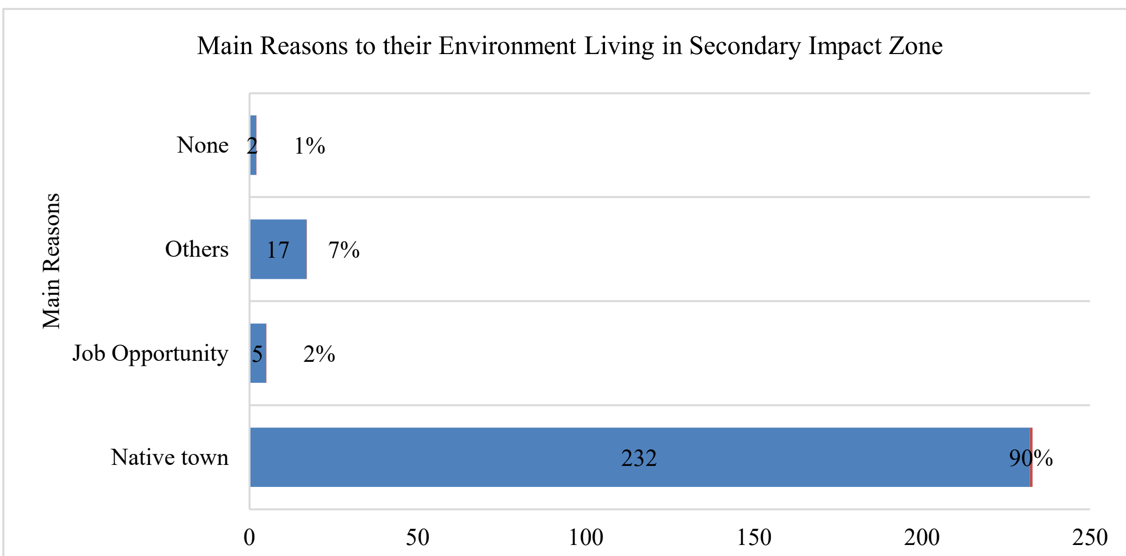


Figure 5.78 Main Reasons to their Environment Living in Primary Impact Zone

(19) Satisfaction Level to Social Conditions

This part describes the satisfaction level of villagers with social conditions in the villages‟ facilities. Social conditions included schools, transportation facilities, communication, tolerance among local communities and health care services. For the primary impact villages, 302 households (50%), 187 households and 75 households out of 600 total survey households were good, moderately and very satisfied with the school facilities as their educational supplement in the villages, although 17 households and only 4 households expressed poor and so poor satisfaction with the school facilities. For secondary impact zone, 113 households, 101 households showed good and moderate level of satisfaction with schools, but 25 households had poor satisfaction with schools supplement to the villages in the secondary impact zone. Therefore, there were over half of the survey households had moderate and good level of satisfaction with the school supplement for both primary and secondary impact zones.

The satisfaction level of transportation, there were good and moderate level of satisfaction with 306 households and 176 households out of total survey in primary impact zone villages. 100 households and 95 households out of 257 households in the secondary impact zone had moderate and good level of satisfaction with the transportation of villages in the project area. Therefore, over half of total survey households‟ satisfaction levels were also good and moderate with transportation in both primary and secondary impact zones.

For communication and tolerance level of satisfaction, over 300 households out of total survey households (600) households answered good satisfaction with the communication services and tolerance among the local communities, over 100 households out of total survey households (600) answered the moderate level of satisfaction ~~to~~ with communication and tolerance of the villages. Over 100 households showed good level of satisfaction with communication and tolerance, and one third of total survey households had moderate level ~~of~~ with communication and tolerance in the secondary impact zone.

For health service, 285 households (48%), and 178 households (30%) out of total survey households (600 households) answered good and moderate level in the primary impact villages. 104 households (40%) and 84 households (33%) also answered good and moderate level satisfaction with health care in the secondary impact villages. For health care services, over one third of total survey households in both primary and secondary impact zones responded the good and moderate level of satisfaction. The following tables (5.38) and (5.39) describe the level of satisfaction with social conditions in the environment.

Table 5.38 Satisfaction Level to Social Conditions in Primary Impact Zone

Satisfaction Level to Social Conditions					
	Satisfaction of School	Satisfaction of Transportation	Satisfaction of Communication	Satisfaction of Peace	Satisfaction of Health Care
Very Satisfaction	75	66	65	157	81
Good	302	306	330	306	285
Moderate	187	176	160	111	178
Poor	17	35	18	6	15
So Poor	4	3	1	3	2
Don't Know	15	14	26	17	39

Table 5.39 Satisfaction Level to Social Conditions in Secondary Impact Zone

	Satisfaction of School	Satisfaction of Transportation	Satisfaction of Communication	Satisfaction of Peace	Satisfaction of Health Care
Very Satisfaction	8	3	20	88	26
Good	113	95	153	118	104
Moderate	101	100	61	42	84
Poor	25	44	13	4	16
So Poor	4	8	1	1	3
Don't Know	6	7	9	3	22

(20) Impact of the Project by Respondents' Opinions

The following tables (5.40) and (5.41) describe about the people‟ opinions living in the project area during three periods, namely, the past operation phase, shut down phase and re-operation with considerable installation of treatment systems in the coal-fired power plant. According to the survey results, 452 respondents who living in the primary impact zone (75%) answered there were impacts of the project in the past operation of coal fired plant, and only 290 respondents (48%) reacted there were impacts caused by the project shut down phase. In the reoperation stage, 404 respondents (64%) out of total survey households (600 households) answered there were impacts of the project.

In the secondary impact zone, 167 households (65%), 163 households (63%) and 120 households (40%) answered there were impacts of the coal fired power plant in past operation phase, shut-down phase of coal fired power plant and re-operation stage respectively. Therefore, the respondents of both primary and secondary impact areas answered impacts were mostly occurred during the past operation stage of the project.

Table 5.40 Impact of the project by Households' opinion in Primary Impact Zone

Project Condition	Impact of the Project by Households' Opinion			
	Yes	Percentage	No	Percentage
Past condition of the Operation Phase	452	75%	148	25%
Project shut down phrase	290	48%	310	52%
Current condition of the Operation Phase	404	67%	196	33%

Table 5.41 Impact of the project by Households' opinion in Secondary Impact Zone

Project Condition	Impact of the Project by Households' Opinion			
	Yes	Percentage	No	Percentage
Past condition of the Operation Phase	167	65%	90	35%
Project shut down phrase	163	63%	94	37%
Current condition of the Operation Phase	120	47%	137	53%

(21) Nuisance and Acceptance Level of Vibration in Past Operation Phase, Shut-down phase and Re-operation phase

Table (5.42) shows the nuisance and acceptance level of vibration in the past operation phase, shut-down phase and re-operation phase of coal-fired power plant. 48% and 61% of total survey households answered that was the nuisance of vibration by the coal fired power plant and coal mine blasting in the past operation phase, while 38% and 45% cannot tolerate the nuisance of vibration by the coal fired power plant and coal mine blasting in the past operation stage. Over half of the respondents can accept the nuisance of vibration occurred by the coal fired power plant in the past operation stage.

For the shutdown phase of operation, there was only 27% of respondents answered that the nuisances of vibration by coal mine blasting occurred, and only 19% out of total surveyed households (600 households) cannot accept the nuisance level of vibration caused by the coal mine blasting. For the re-operation stage, though half of the respondents (50%) answered that there was nuisance of vibration caused by the coal mine blasting, only 35% of total respondents can accept the vibration nuisance of the coal mine blasting. Table (5.39) shows detail information of nuisance by the coal fired power plant, conveyor, coal mine blasting, mine truck, travelling and others.

Table 5.42 Nuisance of Vibration in past operation phase, shutdown phase and re-operation stage in Primary Impact Zone

Nuisance of Vibration (Past Operation Phase)						
	Coal Fired Power Plant	Conveyor	Coal Mine Blasting	Mine Truck	Travelling	Others
	(%)	(%)	(%)	(%)	(%)	(%)
Yes	48%	10%	61%	12%	3%	4%
No	52%	90%	39%	88%	97%	96%
Level of Acceptance						
Accept the impact of vibration	51%	90%	39%	89%	96%	96%
Medium	11%	2%	16%	2%	1%	1%
Cannot accept the impact of vibration	38%	8%	45%	9%	3%	3%
Nuisance of Vibration (Shut Down Phase)						
Yes	8%	3%	27%	7%	1%	2%
No	92%	97%	73%	93%	99%	98%
Level of Acceptance						
Accept the impact of vibration	93%	96%	77%	93%	98%	98%
Medium	2%	1%	4%	1%	1%	1%
Cannot accept the impact of vibration	5%	3%	19%	6%	1%	2%

Nuisance of Vibration (Reoperation Phase)						
Yes	29%	6%	50%	8%	1%	2%
No	71%	94%	50%	92%	99%	98%
Level of Acceptance						
Accept the impact of vibration	71%	93%	50%	92%	98%	97%
Medium	7%	2%	15%	1%	1%	1%
Cannot accept the impact of vibration	22%	5%	35%	7%	1%	2%
			Yes		No	
The vibration condition will be ***worse*** in the future.			41%		59%	
The vibration condition will be ***same*** in the future.			25%		75%	

(22) Nuisance of Vibration in past operation phase, shutdown phase and re-operation stage in Secondary Impact Zone

Table (5.43) shows the nuisance of vibration during the past operation phase, shutdown phase and re-operation stage in the secondary impact zone. 48% and 36% of respondents answered that there was the nuisance of vibration caused by the coal mine blasting and coal fired power plant in the past operation phase, and over 30% of respondents could not accept the impact of vibration from the coal fired power plant and coal mine blasting. In shutdown phase of coal fired power plant, only 12% of respondents responded that there was the nuisance of vibration caused by the coal mine blasting, and only 8% of respondent could not accept the impact of vibration. In re-operation stage of coal fired power plant, 42% and 28% of respondents responded that there was also the nuisance of vibration, and 34% and 26% of total survey respondents could not accept the vibration impact caused by the coal mine blasting and coal fired power plant.

Table (5. 43) Nuisance of Vibration in past operation phase, shutdown phase and re-operation stage in Secondary Impact Zone

Nuisance of Vibration (Past Operation Phase)						
	Coal Fired Power Plant	Conveyor	Coal Mine Blasting	Mine Truck	Travelling	Others

	(%)	(%)	(%)	(%)	(%)	(%)
Yes	36%	11%	48%	4%	1%	1%
No	64%	89%	52%	96%	99%	99%
Level of Acceptance						
Accept the impact of vibration	60%	84%	49%	93%	96%	95%
Medium	5%	2%	13%	2%	0%	1%
Cannot accept the impact of vibration	35%	14%	38%	5%	4%	4%
Nuisance of Vibration (Shut Down Phase)						
Yes	6%	2%	12%	1%	0%	4%
No	94%	98%	88%	99%	100%	96%
Level of Acceptance						
Accept the impact of vibration	93%	98%	87%	98%	99%	97%
Medium	2%	0%	5%	0%	0%	0%
Cannot accept the impact of vibration	5%	2%	8%	2%	1%	3%
Nuisance of Vibration (Reoperation Phase)						
Yes	28%	6%	42%	2%	2%	2%
No	72%	94%	58%	98%	98%	98%
Level of Acceptance						
Accept the impact of vibration	71%	93%	56%	96%	98%	97%
Medium	3%	1%	10%	1%	0%	0%
Cannot accept the impact of vibration	26%	6%	34%	3%	2%	3%

	Yes	No
The vibration condition will be ***worse*** in the future.	26%	74%
The vibration condition will be ***same*** in the future.	26%	74%

(23) Nuisance of Noise in past operation phase, shutdown phase and re-operation stage in Primary Impact Zone

Table (5.44) expresses the nuisance of noise caused by different sources of the coal fired power plant and acceptance level of nuisance in the past operation phase, shutdown phase and re-operation phase of power plant. Over 50% of the respondents answered that there was the nuisance of noise by coal fired power plant and coal mine blasting, and over 40% of the respondents could not accept the nuisance of noise in the past operation phase. Only 11% and 21% responded that there was the nuisance of noise and only 15% could not accept the noise caused by the coal mine blasting in the shutdown phase. For the re-operation phase, over 40% of the respondents out of total respondent (600 respondents) answered that there was the nuisance of noise caused by coal mine blasting and coal fired power plant, only one third of respondents could not accept the noise from the re-operation stage of coal fired power plant. The following table (5.43) shows detail information of nuisance and acceptance level.

Table (5. 44) Nuisance of Noise in past operation phase, shutdown phase and re-operation stage in Secondary Impact Zone

Nuisance of Noise (Past Operation Phase)						
	Coal Fired Power Plant	Conveyor	Coal Mine Blasting	Mine Truck	Travelling	Others
Yes	60%	25%	52%	18%	8%	5%
No	40%	75%	48%	82%	92%	95%
Level of Acceptance						
Accept the impact of noise	38%	77%	47%	82%	91%	96%
Medium	18%	3%	12%	5%	4%	2%
Cannot accept the impact of noise	45%	20%	41%	13%	5%	2%
Nuisance of Noise (Shut Down Phase)						

Yes	11%	6%	21%	8%	5%	6%
No	89%	94%	79%	92%	95%	94%
Level of Acceptance						
Accept the impact of vibration	89%	94%	78%	92%	95%	95%
Medium	7%	4%	7%	4%	4%	0%
Cannot accept the impact of noise	4%	2%	15%	4%	1%	5%
Nuisance of Noise (Reoperation Phase)						
Yes	48%	15%	45%	9%	6%	6%
No	52%	85%	55%	91%	94%	94%
Level of Acceptance						
Accept the impact of noise	51%	86%	53%	91%	94%	94%
Medium	15%	4%	20%	5%	4%	3%
Cannot accept the impact of noise	34%	10%	27%	4%	2%	3%
			Yes		No	
The noise condition will be ***worse*** in the future.			39%		61%	
The noise condition will be ***same*** in the future.			38%		82%	

(24) Nuisance of Noise in past operation phase, shutdown phase and re-operation stage in Secondary Impact Zone

Table (5.45) shows the nuisance and acceptance level of noise of the coal-fired power plant. In past operation phase, half of the respondents and one third of respondents answered that there was the nuisance of noise caused by the coal fired power plant and coal mine blast in the secondary impact zone, and one third of total 257 respondents could not accept the impact of coal fired power plant. In shut down phase condition, nearly 10% responded that there was the nuisance of noise, and could not accept the noise caused by the coal fired power plant. In re-operation stage, 43% and 39% of respondents mentioned that there was nuisance of noise caused by the coal fired power plant, and coal mine blasting, and only one third of respondents could not accept the nuisance of noise caused by coal fired power plant, and coal mine blasting.

Table 5.45 Nuisance of Noise in past operation phase, shutdown phase and re-operation stage in Secondary Impact Zone

Nuisance of Noise (Past Operation Phase)						
	Coal Fired Power Plant	Conveyor	Coal Mine Blasting	Mine Truck	Travelling	Others
Yes	56%	9%	39%	8%	5%	5%
No	44%	91%	61%	92%	95%	95%
Level of Acceptance						
Accept the impact of noise	40%	93%	57%	89%	94%	95%
Medium	15%	2%	11%	5%	4%	3%
Cannot accept the impact of noise	45%	5%	32%	6%	2%	2%
Nuisance of Noise (Shut Down Phase)						
Yes	10%	2%	13%	2%	2%	3%
No	90%	98%	87%	98%	98%	97%
Level of Acceptance						
Accept the impact of noise	88%	98%	85%	97%	97%	73%
Medium	4%	1%	3%	2%	1%	15%
Cannot accept the impact of noise	8%	1%	12%	1%	2%	12%
Nuisance of Noise (Reoperation Phase)						
Yes	43%	9%	39%	5%	5%	6%
No	57%	91%	61%	95%	95%	94%

Level of Acceptance						
Accept the impact of noise	55%	91%	58%	93%	95%	94%
Medium	11%	4%	14%	4%	3%	2%
Cannot accept the impact of noise	34%	5%	28%	3%	2%	4%

(25) Bring to bear ash, smoke and dust and level of acceptance in past operation phase, shutdown phase and re-operation phase in primary impact zone

Table (5.46) shows bring to bear ash, smoke and dust during the past operation phase, shutdown phase and re-operation stage in the secondary impact zone. 44% and 32% of respondents answered that there was bring to bear, ash, smoke and dust caused by the coal mine blasting and coal fired power plant in the past operation phase, and one third of respondents could not accept the bring to bear, ash, smoke and dust from the coal fired power plant and coal mine blasting. In shutdown phase of the coal fired power plant, only 8% of respondents responded that there was bring to bear, ash, smoke and dust caused by the coal mine blasting and coal fired power plant, and only 4% of respondent could not accept the impact of ash, smoke and dust. In the re-operation stage of coal fired power plant, 25% and 20% of respondents responded that there was also bring to bear ash, smoke and dust, and 18% and 12% of total survey respondents could not accept the bring to bear ash, smoke and dust‟s impact caused by the coal mine and conveyor. Table (5.46) expresses the main cause of bring to ash, smoke and dust and detail level of acceptance of the impacts caused by the coal fired power plant.

Table 5.46 Bring to bear ash, smoke and dust and level of acceptance in past operation phase, shutdown phase and re-operation phase in primary impact zone

Bring to bear ash, smoke and dust, the past operation of the coal mine							
	Coal Mine	Conveyor	Dynamite	Mine Truck	Travelling	Domestics Fire Place	Others
Yes	44%	20%	32%	15%	9%	5%	7%
No	55%	80%	68%	85%	91%	95%	93%
Not Answer	1%	0%	0%	0%	0%	0%	0%
Level of Acceptance							

Accept the impact of bring to bear ash	55%	79%	68%	84%	91%	94%	91%
Medium	10%	5%	11%	6%	4%	5%	6%
Cannot accept the impact of bring to bear ash	35%	16%	21%	10%	4%	1%	3%
Bring to bear ash, smoke and dust, Shut Down Phase							
Yes	8%	7%	8%	7%	4%	4%	5%
No	92%	93%	92%	93%	96%	96%	95%
Not Answer	0%	0%	0%	0%	0%	0%	0%
Level of Acceptance							
Accept the impact of bring to bear ash	92%	92%	91%	93%	96%	96%	95%
Medium	4%	5%	5%	4%	4%	4%	4%
Cannot accept the impact of bring to bear ash	4%	3%	4%	3%	0%	0%	1%
Bring to bear ash, smoke and dust, Reoperation Phase							
Yes	25%	17%	20%	9%	6%	5%	7%
No	74%	83%	80%	91%	94%	95%	93%
Not Answer	1%	0%	0%	0%	0%	0%	0%
Level of Acceptance							
Accept the impact of bring to bear ash	73%	83%	79%	90%	94%	94%	94%
Medium	9%	5%	12%	5%	5%	5%	3%
Cannot accept the impact of	18%	12%	9%	5%	1%	1%	3%

bring to bear ash							

(26) Bring to bear ash, smoke and dust and level of acceptance in past operation phase, shutdown phase and re-operation phase in Secondary Impact Zone

Table (5.47) shows the nuisance and acceptance level of ash, smoke, and dust by the coal-fired power plant. In the past operation phase, 30% and 13% of respondents answered that there was bring to ash, smoke and dust caused by the coal mine and dynamite in the secondary impact zone, and 23% and 10% of total 257 respondents could not accept the impact of coal fired power plant. In shut down phase condition, nearly 10% responded that there was the nuisance of ash, smoke and dust and 7% and 8% of respondent could not accept the coal fired power plant. In re-operation stage, 23% and 14% of respondents mentioned that there was the ash, smoke and dust caused by the coal mine and dynamite, and only 19% and 13% respondents could not accept the nuisance of ash, smoke and dust caused by coal mine, and dynamite.

Table 5.47 Bring to bear ash, smoke and dust and level of acceptance in past operation phase, shutdown phase and re-operation phase in secondary impact zone

Bring to bear ash, smoke and dust, the past operation of the coal mine							
	Coal Mine	Conveyor	Dynamite	Mine Truck	Travelling	Domestics Fire Place	Others
Yes	30%	9%	13%	9%	6%	2%	4%
No	70%	91%	87%	91%	94%	98%	96%
Not Answer	0%	0%	0%	0%	0%	0%	0%
Level of Acceptance							
Accept the impact of bring to bear ash	70%	90%	86%	90%	93%	98%	95%
Medium	7%	1%	4%	2%	2%	0%	2%
Cannot accept the impact of bring to bear ash, smoke and dust	23%	9%	10%	8%	5%	2%	3%
Bring to bear ash, smoke and dust, Shut Down Phase							
Yes	11%	3%	10%	2%	2%	1%	2%

No	89%	97%	90%	98%	98%	99%	98%
Not Answer	0%	0%	0%	0%	0%	0%	0%
Level of Acceptance							
Accept the impact of bring to bear ash	91%	96%	89%	98%	97%	98%	98%
Medium	2%	1%	5%	0%	1%	0%	1%
Cannot accept the impact of bring to bear ash, smoke and dust	7%	3%	6%	2%	2%	2%	1%
Bring to bear ash, smoke and dust, Reoperation Phase							
Yes	23%	10%	14%	2%	1%	1%	2%
No	77%	90%	86%	98%	99%	99%	98%
Not Answer	0%	0%	0%	0%	0%	0%	0%
Level of Acceptance							
Accept the impact of bring to bear ash	76%	89%	85%	98%	98%	98%	98%
Medium	5%	1%	2%	1%	1%	1%	1%
Cannot accept the impact of bring to bear ash, smoke and dust	19%	10%	13%	1%	1%	1%	1%

(27) Nuisance of Odor in past operation phase, shutdown phase and re-operation stage in Primary Impact Zone

Table (5.48) expresses the nuisance of odor caused by different sources of the coal fired power plant and acceptance level of nuisance in the past operation phase, shutdown phase and re-operation phase of the power plant. Over 35% of respondents answered that there was the nuisance of odor by coal fired power plant, coal mound and dynamite, and nearly 35% of the respondents could not accept the nuisance of odor in the past operation phase. Only 19% and 21% responded that there was the nuisance of odor and only 14% and 15% could not accept the odor caused by the coal mine blasting in the shutdown phase. For the re-operation phase, over 40% of the respondents out of total respondent (600 respondents) answered that there was the nuisance of noise caused by coal fired power plant and coal mound, only 23% and 29% of respondents could not accept the odor from the re-operation stage of the coal fired power plant. The following table (5.48) shows detail information of nuisance and acceptance level.

Table 5.48 Nuisance of Odor in past operation phase, shutdown phase and re-operation stage in Primary Impact Zone

Nuisance of Odor, Past Operation of Coal Fired Power Plant							
	Coal Fired Power Plant	Coal Mound	Conveyor	Dynamite	Mine Truck	Travelling	Others
Yes	45%	30%	14%	30%	7%	5%	4%
No	55%	70%	86%	70%	93%	95%	96%
Level of Acceptance							
Accept the impact of Odor	53%	69%	87%	69%	93%	95%	97%
Medium	12%	10%	6%	6%	4%	4%	2%
Cannot accept the impact of odor	35%	21%	7%	25%	3%	1%	1%
Nuisance of Odor, Shut Down Phase							
Yes	10%	19%	6%	21%	6%	5%	4%
No	90%	81%	94%	79%	94%	95%	96%
Level of Acceptance							
Accept the impact of Odor	89%	80%	94%	78%	94%	95%	96%
Medium	5%	6%	4%	7%	4%	4%	3%
Cannot accept the impact of odor	6%	14%	2%	15%	2%	1%	1%

Nuisance of Odor, Re-Operation Phase							
Yes	32%	39%	15%	29%	14%	11%	4%
No	68%	61%	85%	71%	86%	89%	96%
Level of Acceptance							
Accept the impact of Odor	67%	61%	86%	70%	86%	88%	0.3%
Medium	10%	10%	4%	10%	12%	12%	95%
Cannot accept the impact of odor	23%	29%	10%	20%	2%	0%	4.7%

(28) Nuisance of Odor in past operation phase, shutdown phase and re-operation stage in Secondary Impact Zone

Table (5.49) expresses the nuisance of odor caused by different sources of the coal fired power plant and acceptance level of nuisance in the past operation phase, shutdown phase and re-operation phase of the power plant in the secondary impact zone. Over 35% of the respondents answered that there was the nuisance of odor by the coal fired power plant, coal mound, and over 35% of the respondents could not accept the nuisance of odor in the past operation phase. Only 14% responded that there was the nuisance of odor and only 12% could not accept the odor caused by the coal mine blasting in the shutdown phase. For the re-operation phase, over 50% of the respondents out of total respondent (257 respondents) answered that there was the nuisance of noise caused by the coal fired power plant and coal mound, only 49% and 52% of respondents could not accept the odor from the re-operation stage of the coal fired power plant. The following table (5.49) shows detail information of nuisance and acceptance level.

Table 5.49 Nuisance of Odor in past operation phase, shutdown phase and re-operation stage in Secondary Impact Zone

Nuisance of Odor, Past Operation of Coal Fired Power Plant							
	Coal Fired Power Plant	Coal Mound	Conveyor	Dynamite	Mine Truck	Travelling	Others
Yes	51%	33%	12%	20%	4%	2%	4%
No	49%	67%	88%	80%	96%	98%	96%

Level of Acceptance							
Accept the impact of Odor	47%	66%	87%	79%	95%	98%	96%
Medium	11%	8%	4%	8%	2%	1%	2%
Cannot accept the impact of Odor	42%	26%	9%	13%	3%	1%	2%
Nuisance of Odor, Shut Down Phase							
Yes	9%	14%	4%	9%	2%	1%	1%
No	91%	86%	96%	91%	98%	99%	99%
Level of Acceptance							
Accept the impact of Odor	90%	86%	95%	91%	98%	99%	99%
Medium	3%	2%	1%	4%	0%	0%	0%
Cannot accept the impact of Odor	7%	12%	4%	5%	2%	1%	1%
Nuisance of Odor, Re-Operation Phase							
Yes	54%	55%	40%	41%	4%	3%	4%
No	46%	45%	60%	59%	96%	97%	96%
Level of Acceptance							
Accept the impact of Odor	44%	45%	60%	59%	96%	97%	96%
Medium	7%	3%	4%	7%	3%	3%	3%
Cannot accept the impact of Odor	49%	52%	36%	34%	1%	0%	1%

(29) Sources of water in Primary Impact Zone and Secondary Impact Zone

Table (5.50) expresses the sources of water for various usage in different seasons in primary and secondary impact zones. As per the survey results, there are two main source of water for various usage which are the spring water and others (water from the coal mine) in every seasons in the primary impact zone. For the secondary impact zone, spring water and others source of water are also the main sources of water in the area.

Table 5.50 Sources of water in Primary Impact Zone and Secondary Impact Zone

		Source of Water for Drinking		Source of Water of Domestic Usage		Source of Water for Agriculture		Source of Water of Livestock	
		Yes	No	Yes	No	Yes	No	Yes	No
Summer	Spring Water	29%	71%	30%	70%	23%	77%	19%	81%
	River Water	3%	97%	5%	95%	10%	90%	5%	95%
	Well Water	25%	75%	31%	69%	18%	82%	16%	84%
	Others	41%	59%	27%	73%	27%	73%	22%	78%
Rainy	Spring Water	29%	71%	30%	70%	22%	78%	19%	81%
	River Water	3%	97%	5%	95%	10%	90%	5%	95%
	Well Water	25%	75%	32%	68%	18%	82%	16%	84%
	Others	40%	60%	27%	73%	26%	74%	21%	79%
Winter	Spring Water	29%	71%	29%	71%	22%	78%	16%	81%
	River Water	3%	97%	6%	94%	10%	90%	5%	95%
	Well Water	28%	72%	32%	68%	19%	81%	16%	84%
	Others	39%	61%	25%	75%	25%	75%	25%	75%

Secondary Impact Zone									
		Source of Water for Drinking		Source of Water of Domestic Usage		Source of Water for Agriculture		Source of Water of Livestock	
		Yes	No	Yes	No	Yes	No	Yes	No
Summer	Spring Water	43%	57%	45%	55%	33%	67%	28%	72%
	River Water	9%	91%	19%	81%	26%	74%	18%	82%
	Well Water	12%	88%	15%	85%	10%	90%	9%	91%
	Others	39%	61%	23%	77%	24%	76%	20%	80%
Rainy	Spring Water	44%	56%	45%	55%	34%	66%	29%	71%
	River Water	9%	91%	19%	81%	27%	73%	18%	82%
	Well Water	12%	88%	15%	85%	11%	89%	9%	91%
	Others	40%	60%	23%	77%	25%	75%	19%	81%
Winter	Spring Water	44%	56%	45%	55%	34%	66%	28%	72%
	River Water	9%	91%	19%	81%	26%	74%	18%	82%
	Well Water	12%	88%	15%	85%	10%	90%	9%	91%
	Others	40%	60%	23%	57%	23%	77%	19%	81%

(30) Water Color and Odor changes in Primary and Secondary Impact zone

Table (5.51) shows detail information about the changes in colour and odor of water caused by the project in the primary and secondary impact zones. For color and odor of water, there was only less than 10% of respondents in both primary and secondary impact zones answered that there were changes in water‟s color and odor.

Table 5.51 Water Color and odor changes in Primary and Secondary Impact Zone

Water Color and odor Changes in Primary Impact Zone									
		Condition of Drinking Water Changes		Condition of Domestic Water Changes		Condition of Agricultural Water Changes		Condition of Livestock Water Changes	
		Yes	No	Yes	No	Yes	No	Yes	No
Summer	Spring Water	5%	95%	3%	97%	2%	98%	1%	99%
	River Water	1%	99%	1%	99%	3%	97%	0%	100%
	Well Water	1%	99%	2%	98%	1%	99%	0%	100%
	Others	2%	98%	1%	99%	5%	95%	2%	98%
Rainy	Spring Water	5%	95%	5%	95%	4%	96%	2%	98%
	River Water	1%	99%	1%	99%	3%	97%	0%	100%
	Well Water	1%	99%	2%	98%	2%	98%	1%	99%
	Others	2%	98%	1%	99%	4%	96%	2%	98%
Winter	Spring Water	3%	97%	5%	95%	2%	98%	1%	99%
	River Water	1%	99%	1%	99%	2%	98%	0%	100%
	Well Water	1%	99%	2%	98%	2%	98%	0%	100%
	Others	2%	98%	1%	99%	4%	96%	2%	98%
Water Odor Changes in Secondary Impact Zone									
		Source of Water for Drinking		Source of Water of Domestic Usage		Source of Water for Agriculture		Source of Water of Livestock	
		Yes	No	Yes	No	Yes	No	Yes	No
Summer	Spring Water	1%	99%	1%	99%	0%	100%	0%	100%
	River Water	1%	99%	3%	97%	3%	97%	0%	100%

	Well Water	0%		100%	0%	100%	0%	100%	0%	100%
	Others	10%	90%		11%	89%	12%	88%	8%	92%
Rainy	Spring Water	1%		99%	1%	99%	0%	100%	0%	100%
	River Water	2%		98%	3%	97%	4%	96%	1%	99%
	Well Water	0%		100%	0%	100%	0%	100%	0%	100%
	Others	10%	90%		13%	87%	11%	89%	9%	91%
Winter	Spring Water	1%		99%	1%	99%	0%	100%	0%	100%
	River Water	1%		99%	3%	97%	3%	97%	1%	99%
	Well Water	0%		100%	0%	100%	0%	100%	0%	100%
	Others	10%	90%		11%	89%	11%	89%	8%	92%

(31) Most Benefit and Negative impact of the Project in Primary Impact Zone

Table (5.52) informs about the most positive and negative impacts caused by the proposed coal fired power plant. In survey respondents‟ point of view, access to electricity and job opportunities are the main benefits to the local villagers who are the most positively impacted people by the project, and increasing noise level and air pollution are the main negative impacts on local people in the primary impact zone.

Table 5.52 Most Benefit and Negative impact of the Project in Primary Impact Zone

	Total	Percentage
Positive		
Job Opportunities	**133**	**22%**
Increase annual income	7	1%
Transportation	34	6%
Compensation for land	8	1%
Better Environment	6	1%
Electricity assets	**230**	**38%**
others	22	4%

None	160	27%
Negative		
Increase noise level	**142**	**24%**
Air pollution	**184**	**31%**
Agricultural Land loss	25	4%
Land loss	28	5%
Job/ decrease income	9	2%
Loss of House	6	1%
Crime	1	0%
Non Safety	12	2%
Health	56	9%
Others	37	6%
Not Answer	100	17%

(32) Main Difficulties

For the primary impact zone villagers, water supply and access to education are the main difficulties for the local people who are living in the project area. Table (5.53) express the local people opinions upon their difficulties.

Table 5.53 Main difficulties in Primary Impact Zone

Main Difficulties	***Respondents' Number***	***Percent***
Transportation	68	11%
Electricity	29	5%
Water	**186**	**31%**
Waste water treatment for industry	6	1%
Education	141	24%
Communication	10	2%
Health	90	15%

Waste water treatment for coal mine	6	1%
Don't know	49	8%
None	15	3%

(33) Most Beneficial and Negative impact of the Project in the Secondary Impact Zone

Table (5.54) expresses about the most positive and negative impacts caused by the proposed coal fired power plant. Survey respondents had a point of view that the access to electricity was the main benefit to the local villagers who are living in the secondary impact area, and increasing air pollution is the main negative impacts on local people in the secondary impact zone.

Table 5.54 Most Benefit and Negative impact of the Project in Secondary Impact Zone

	Total	Percentage
Positive		
Job Opportunities	12	5%
Increase annual income	4	2%
Transportation	17	7%
Compensation for land	5	2%
Better Environment	1	0%
Electricity assets	**112**	**44%**
others	2	1%
None	104	40%
Negative		
Increase noise level	45	18%
Air pollution	**126**	**49%**
Agricultural Land loss	8	3%
Land loss	2	1%
Job/ decrease income	2	1%

Loss of House	1	0%
Crime	2	1%
Non Safety	12	5%
Health	31	12%
Others	2	1%
Not Answer	45	18%

(34) Main Difficulties in the secondary impact zone

For the Secondary impact zone villagers, water and waste water treatment for industry are the main difficulties for the local people who are living in the project area. Table (5.55) expresses the local people opinions on their difficulties.

Table 5.55 Main difficulties in Secondary Impact Zone

Main Difficulties	***Respondents' Number***	***Percent***
Transportation	28	11%
Electricity	14	5%
Water	**132**	**51%**
Waste water treatment for industry	**35**	**14%**
Education	7	3%
Communication	25	10%
Health	10	4%
None	6	2%

The following photographs are socio-economic sureveying activities.






Middle Thigyit (18.5.2018)


Tharyar Gone Village (18.5.2018)




Naung Moon Village (19.5.2018)

Sae Kaung Village (19.5.2018)

South Thigyit (20.5.2018)

Mya Kan Thar Village (20.5.2018)

Mya Sein Taung

Bank Mart Village (20.5.2018)

Phayar Ngar Su Village (21.5.2018)

East Myin Twin Village (21.5.2018)

West Myin Twin Village (21.5.2018)


Lalthwe Village (21.5.2018)


Taung Chay Village (21.5.2018)


Kone Thain Village (22.5.2018)


Pat Ta Lae Village (22.5.2018)




Gant Kaw Pin Village (22.5.2018)

Pin Mi Gone Village (22.5.2018)

Pin Sein Su Village (22.5.2018)

Lwin Village (22.5.2018)


Moon Pin Village (22.5.2018)


Kyat Thon Gone Village (23.5.2018)


Naung Mu Village (23.5.2018)


Mee Thway Chaung Village (23.5.2018)


North Thigyit (28.8.2018)


Staff House of Thigyit Coal Fired Power Plant (29.8.2018)

Eden Coal Mine (30.8.2018)

Photograph 14 Social Survey Photo

6 Impact and Risk Assessment and Mitigation Measures

6.1 Method of Impact Evaluation

The project is required a full EIA under the EIA procedure (2015) in Myanmar. This section describes the methodology and the potential environmental and social impacts which are expected to take place during planning, construction, operation, decommission and closure and post-closure stages of the project.

Impact evaluation is conducted to predict what could happen to the social and natural environment as a result of the proposed project considering all sensitive receptors. An assessment process includes a range of prediction methods which provide inputs to formulation of environmental mitigation measures to be adopted in the project with an aim to properly contain negative impacts.

A number of possible impacts have been evaluated against the project, which was divided into three stages of the project; construction/renovation; operation; and decommissioning in accordance with the EIA procedure (2015). Impacts were classified to be either positive or negative, with the degree that ranges from A+/- (significant positive/negative impact is expected, B+/- (positive /negative impact is expected to some extent), C (extent of the impact is unknown) and D (no impact is expected). The following sections explain briefly the three stages of the project and environmental impacts that commonly arise at those phases.

6.2 Renovation/Construction Stage

The Project implementation stage includes all process and non-process facilities to be installed in the project site where production lines, loading and unloading area, warehouse, constructions and others facilities. For the installation of those facilities involve tremendous civil, mechanical and electrical works. Construction began in September 2002 and it was completed in April 2005 under the supervision of Ministry of Energy. At present, Wuxi Hua Guang (Myanmar) Limited Co., Ltd has signed a Memorandum of Understanding (MoU) with Ministry of Electric Power of Myanmar for renting Thi gyit (Tigyit) coal fired plant project for 30 years after the renovation works. All of the project renovation and construction stages have been completed in May 2018 according to their coal fired plant design of Wuxi Hua Guang Electric Power Engineering Co., Ltd

During the stage of the construction/renovation works deterioration of air quality and increase of noise levels often occur as a result of, among others, mobilization of vehicles and machinery and loading and unloading and transporting of materials. These impacts do not necessarily occur only at the construction sites, but can take place near the transport routes. Water may also be contaminated as a result of civil works. Nevertheless, the impacts are generated by this stage are temporary and thus considered to be manageable. No significant environmental impacts on the surrounding water bodies are expected at this stage.

Since the renovation, construction activities, and installation of machines for this project have been already completed in May 2018, specific study of environmental impact assessment and preparation of environmental management plan for renovation/construction phase are not included in this report.

6.3 Operation Phase

During the operation period, air pollutants such as NO2, SO2, PM10 and PM2.5 would be generated from stack as the coal combustion increases. On the other hand, installation of new boilers is expected which would to reduce air pollution and Electrostatic precipitator (ESP) will help to reduce the emission of air pollutants. Moreover, desulphurization and denitrification processes will also help to reduce the air emission pollutants. Bottom ash and flyash is also expected to be generated from boilers. However, discharged bottom ash can be used as raw material in manufacturing of block bricks at the factory run by Wuxi Hua Guang Electric Power Generation Co., Ltd. Although the noise level will rise due to the starting process of the engines construction of noise barriers will help to reduce the noise pollution.

6.4 Decommissioning Phase

The decommissioning stage typically consists of activities such as small scale earth works, use of construction of machinery and vehicles, and transportation of materials. Temporary air pollutants from exhaust gas and dust pollution can be anticipated from these activities. Normally, such impacts are not significant in magnitude and are expected to be limited in scale and period since nuisances of dust and emission gases are site-specific temporary events. As the project is located near Thaedae creek, it may also be contaminated by the construction works. However, the location of the project area is far from the sea and no major work is expected near a lake or a pond either. Hence, potential deterioration of the water quality will be confined only to the river, if any.

By nature, Thi gyit (Tigyit) coal fired plant project is likely to cause positive as well as negative impacts on the physical and social environments of the area during all renovation /construction, operation and decommissioning phases.

6.5 Evaluation of Possible Impacts

Predictions of the impacts were conducted based on the results of scoping study, analysis of the project components and the baseline data including field survey. The result of environmental and social impact assessment is shown in Table 8.1.48 along with the results of scoping study. A summary of the expected environmental and social impact assessments on the project during construction/ renovation stage (Co), operation stage (O), decommissioning stage (De) is shown in Table 6.1. Assuming that no specific measures against the impacts have been taken, the assessments are graded from A to D under three broad categories, namely, pollution, natural environment and social environment. Definition of the grades are as follows:

A+/- : Significant positive/negative impact is expected

B+/- : Positive /negative impact is expected to some extent)

C+/- : Extent of positive/ negative impact is unknown)

D: no impact is expected).

Table 6. 1 Environmental and Social Impact Assessment

No.	Item	Assessment			Sources of Impact
		CO	O	DE	
1	Air Pollution	B-	B-	B-	[Co] Earthwork, loading and unloading materials as well as construction machines, vehicles, movement of heavy machinery, buildings renovation and construction and other related activities will generate dust and emitted gases that will deteriorate the ambient air quality. [O] During operation phase, potential impacts from the stack emissions caused by coal combustion are expected. The main pollutants such as NOx, and SOx which are particulate matters, will be emitted from the plant stack. However, Electrostatic precipitator (ESP) will help to reduce the emission of air pollutants. The emissions will be further reduced by employing desulphurization and denitrification processes Coal will be the main fuel for the project but diesel oil will be the secondary fuel used onsite during start-up and periods of low load operation. The operation of the boiler will also emit particulate matter, NOx and SOx. The diesel oil will be used as a start-up fuel and for low operation hence the impacts shall not be deemed significant for these purposes. Operation of coal grinding and coal bumping machines as well as transportation of vehicles such as loader, forklift, etc. will lead to air. Dust emission will occur in indoor and outdoor coal yards. Bottom ash mound from brick manufacturing factory under Wuxi Hua Guang Electric Power Engineering Co.,Ltd. will also lead to air pollution. [De] Temporary air pollution is expected during the operation of decommissioning work.
2	Water Pollution	B-	B-	B-	[Co] Temporary water pollution is expected due to the following construction and renovation work: (i) run off of muddy water from small scale cutting, filling and excavation work (ii) spilling over of toxic materials such as oil and lubricants. [O] Water may be polluted due to the waste water from cleaning machines, oil and grease used in the machines, domestic wastewater and thermal effluent from cooling system. Reduction pond will reduce sediment, oil and grease, and especially water temperature. [De] Water may be polluted from the construction office and other facilities. However, the impact will be temporary and limited.
3	Soil Contamination	B-	B-	B-	[Co] Soil may be contaminated from leakage of lubricating oil from construction, vehicles and machines. However, the amount of oil used is limited and the impact is considered to be insignificant. [O] Soil contamination may take place by spilling and infiltration of oil and greases, from leakage of lubricating oil for machines and transportation vehicles, leaching of metals from the ash disposal site and contamination run off from the coal storage area. The impact is also considered to be insignificant. [De] Soil may be contaminated from leakage of lubricating oil from construction, vehicles and machines. However, the amount of

					oil used is limited and the impact is considered to be insignificant.
4	Waste Disposal	B-	B-	B-	[Co] Waste disposal is expected due to the renovation materials, recyclable and non-recycle packaging materials and construction materials (concrete waste, used bags and other construction waste). [O] Bottom ash and Fly ash from operation process and domestic waste from staff are expected. [De] Waste of existing devices will be generated from decommissioning of construction facilities.
5	Noise	B-	B-	B-	[Co] Noise will be generated by construction works including operation of vehicles and diesel generators but they will be temporary and geographically confined. [O] Coal delivery systems, grinding coal, starting engines, generator and vehicles will lead to noise generation in the vicinity of villages. [De] Machines and vehicles used for decommissioning works are expected to generate noise and vibration but they will be site specific and temporary.
6	Ground Subsidence	D	D	D	Ground water will not be used during construction and operation stage.
7	Offensive Odours	D	D	D	No notable impact is expected.
8	Sediment Quality	B-	B-	B-	[Co][De] Run off water from renovation/ decommissioning area and leakages of oil and chemical materials from renovation/ decommissioning activity will lead to degradation of sediment quality [O] Run off water from ash disposal site coal yard and leakages of oil and chemical materials are expected to affect the quality of sediment.
9	Protected Areas	D	D	D	There is no protected area is observed in the proposed project area. As the project area is located 17 kilometers away from the western watershed areas of the Inle lake, no impact is expected.
10	Ecosystem	D	D	D	[Co] [De] The principal discharges during construction and demolition activities will comprise drainage, sewage (i.e. black water, composed of human body wastes from toilets and urinals) and domestic wastewater (i.e. grey water, composed of discharges from kitchen, showers and wash areas) generated by the workers on-site during the construction and demolition phase. These wastewater discharges are generally characterized as having a high concentration of solids (suspended and dissolved), oil and grease, BOD and COD, ammonia and other organic material and micronutrient elements. They have the potential to result in adverse effect on aquatic life if released untreated.

					Indirect impacts on both terrestrial and aquatic habitats and associated fauna adjacent to work areas may potentially result from increased human activities. [O] The daily activities of the permanent workforce hired during operation phase may cause the impacts on the terrestrial hab itats including wildlife living in the vicinity of the project area. Upon discharge, chlorine concentration in the effluent will be quickly diluted with surrounding waters. Concentrations of res idual chlorine thus typically diminish rapidly with time and distance from the discharge point as well as the high temperature effluent. Impacts on surface water as a result of potential concentrations of residual chlorine and high temperature are expected to be of low severity and therefore minor significance.
11	Cross Boundary Impacts and Climate Change	B-	B+/-	B-	[Co] Operation of construction-related vehicles and machinery will lead to an increase in greenhouse gas (GHG) emissions although it will occur in a small scale during construction only. [O] An increase in the generator operation will in turn increase the GHG emissions. [De] Operation of construction-related vehicles will lead to an increase in GHG emissions but will be generated on a small scale and only during construction only.
12	Poverty	B+	B+	B+	[Co] [De] The project is expected to create a significant level of employment opportunities for local community and people from other localities. [O] The project will provide people, including local community more access to electricity which will lead to improve income and livelihood.
13	Local Economy such as Employment and Livelihood	B+	B+	B+	[Co] [O] [De] The project is expected to create a significant level of employment opportunities for community and people from other localities. It will employ local resident as much as possible and offer „livelihood restoration program" including job training to persons if desired. Agricultural awareness training serviced from Thi gyit (Tigyit) Coal Fired Power Plant will enhance local economy such as employment and livelihood.
14	Water Usage	D	B-	D	[P] No notable impact is expected. [Co] Balu Creek (Surface water) may be used for construction depending on the availability of water. [O] Surface will likely be used for boiler process and other maintenance work. However, the amount of water to be used and its impact on the surface water level is not expected to be significant enough to limit other water uses. [De] [Cl/PCl] No notable impact is expected.
15	Cultural	D	D	D	No cultural heritage has been identified near the project area.

	Heritage				
16	Landscape	D	D	D	No major earthwork is expected and its impact on the landscape is considered to be negligible.
17	Gender	D	B+	D	No notable impact is expected.
18	Rights of children	D	B+	D	[Co][O] [De] The project will not cause any adverse impact on children‟s rights.
19	Infectious Diseases such as HIV/AIDS	B-	D	B-	[Co] Due to an inflow of construction workers, infectious diseases such as STD (Sexually Transmitted Disease) may spread although at a limited scale. [O] No notable impact is expected. [De] Due to an inflow of construction workers, infectious diseases such as STD may spread although at a limited scale. [Cl/PCl] No notable impact is expected.
20	Work Environment (including work safety)	D	B-	D	[Co] [De] No notable impact is expected. [O] Diseases caused by air pollutants and noise by coal unloading activity if not properly controlled and managed.

A+/-: Significant positive/negative impact is expected; B+/-: Positive/Negative impact is expected to some extent; C: Extent of positive/negative impact is unknown; D: No impact is expected

[Co]: Construction Stage; [O]: Operation Stage; [De]: Decommissioning Stage

Source: E Guard Study Team

6.6 Environmental Mitigation Measures

This section presents the proposed measures to avoid, reduce or compensate for the potential adverse impacts. A summary of the environmental mitigation measures of the project and implementing organization are presented in Table 6.2

Table 6. 2 Mitigation Measures against Project Impacts

No.	Item	Mitigation Measures	Implementing Organization
1	Air Pollution	[Co] [De] - Load of vehicle transporting fine materials such as sand, soil and waste to and from the project site shall be covered to reduce the release of dust. - Water should be frequently sprayed on the ground at construction site and, near residential areas, as required. - Generators and other equipment that generate gases must be turned off when they are not in use. - Construction vehicles‟speed should be controlled to minimize air pollution. - Air quality should be regularly measured/monitored. [O] (1) Power Plant operational activities - To reduce PM emissions, Electrostatic Precipitator (ESP, around 99% efficiency)will be installed. - To reduce NO2 emissions, Selected non-catalytic reduction system (SNCR) will be installed. - To reduce SO2 emissions, FGD equipment (FGD; around 70 % efficiency) will be installed. - Emissions of dust and gases will be continuously monitored with the support of infrastructure/facilities as prescribed by the NEQS guidelines. (2) Coal Handing - A cover will be installed for the conveyer for coal transportation to coal yard - Spraying water in coal yard to keep the surface wet and prevent wind for blowing coal and dust. - Re-greening especially along boundary of plant site, surrounding coal yard with domestic plants (3) Gas Emission from Vehicles - Periodic maintenance and management of vehicles.	Wuxi Hua Guang (Myanmar) Limited
2	Water Pollution	[Co] [De] - Turbid waste water from construction sites shall be disposed at designated sites after treated at sedimentation ponds and waste water treatment tanks. - Waste water shall be treated properly in accordance with regional governments‟regulation system. - Water quality shall be monitored to ensure that surface water (Belu Creek and Thadae Cleek) is not polluted by	Wuxi Hua Guang (Myanmar) Limited

No.	Item	Mitigation Measures	Implementing Organization
		the project. [O] (1) Thermal effluents - Thermal effluents are discharged to reduce the impact on surrounding area. (2) Run off water - Run off water is colliected in the pond and discharged after employing appropriate treatment - Thermal effluents are discharged to reduce the impact on surrounding area. (3) Oil and Chemical materials leakage - Storage of oil and chemical materials in an appropriate tank with retaining wall to prevent leakages and applying method to prevent permeation into ground. (4) Wastewater - Installation of wastewater treatment system by neutralization, settling and oil separation so as to comply with NEQ Guideline. Water quality shall be monitored to ensure that surface water is not polluted by the project.	
3	Soil Contamination	[Co] [De] - All waste including oil and grease shall be stored and disposed in designated to minimize the risk of soil contamination. [O] - The bottom of ash disposal site should have an impermeable layer (less than 10-6 cm/sec) such as impermeable geo membrane, sheet and clay. Storage of oil and chemical materials in an appropriate tank with retaining wall and applying methods to prevent permeation into ground. Machines and vehicles should be regularly checked.	Wuxi Hua Guang (Myanmar) Limited
4	Waste Disposal	[Co] [De] - Waste generated from construction should be reduced and disposed only if they cannot be reused and/or recycled. Disposal must be in accordance with instructions of city development committees and regional governments. [O]	Wuxi Hua Guang (Myanmar) Limited

No.	Item	Mitigation Measures	Implementing Organization
		- Waste management program consisting of reduction, reuse, and recycling of materials - Systematic collection and protected storage - Waste disposal at appropriate location - Hazardous waste shall be treated in accordance with the related regulations - Prohibition of dumping any contaminating materials.	
5	Noise	[Co] [De] - Installation of a noise barrier and use of low-noise equipment shall be considered. - Construction work during night and early time should be avoided as much as possible. - Activities and schedule of the construction shall be made public to the surrounding communities in advance so that measures can be taken as found necessary. - Noise levels should be monitored. [O] - Installation of noise barriers - Maintenance of equipment - Adequate enclosure of equipment to reduce noise - Activities and schedule of the starting engines shall be made public to the surrounding communities in advance so that measures can be taken as found necessary.	
6	Offensive Odours	[Co] - The level of offensive odours should be monitored. - Mitigation measures will be considered depending on the source of odour. [O] - Taking appropriate measure for handling general waste - Prohibit illegal waste disposal	Wuxi Hua Guang (Myanmar) Limited
7	Sediment Quality	(1) Run off water - Run off water is collected in the pond and discharged after appropriate treatment - Thermal effluents are discharged to reduce the impact on surrounding area.	Wuxi Hua Guang (Myanmar) Limited

No.	Item	Mitigation Measures	Implementing Organization
		(2) Oil and Chemical materials leakage - Storage of oil and chemical materials leakage in an appropriate tank with retaining wall to prevent leakages and applying method to prevent permeation into ground. (3) Wastewater Installation of wastewater treatment system by neutralization, settling and oil separation so as to comply with NEQ Guideline.	
8	Ecosystem	[Co] - Tree cutting and natural vegetation clearance shall be minimized. - Sedmentation ponds shall be used to avoid waste water from flowing directly into the aquatic ecosystem. - Hazardous waste material shall be stored properly until final disposal.	Wuxi Hua Guang (Myanmar) Limited
9	Cross Boundary Impacts and Climate Change	[Co] [De] - Generators and other equipment that generate gases must be turned off when they are not in use. [O] - Machines and vehicles should be maintained well and regularly checked in order to reduce GHG emissions. - Use of USC of high efficiency for power generation.	Wuxi Hua Guang (Myanmar) Limited
10	Water Usage	[O] - Water should be used as efficiently as possible and excessive use of water should be avoided. Water from the power plant should be re-used to control the high consumption of water resources.	Wuxi Hua Guang (Myanmar) Limited
11	Infectious Diseases such as HIV/AIDS	[Co] [De] - In order to prevent spreading of infectious diseases such as HIV/AIDS, awareness training shall be provided to construction workers.	Wuxi Hua Guang (Myanmar) Limited
12	Work Environmen t (including work	[Co] [De] - Training shall be provided and adequate notice shall be put up for construction workers and local residents to prevent accidents.	Wuxi Hua Guang (Myanmar) Limited

No.	Item	Mitigation Measures	Implementing Organization
	safety)	- Cases and causes of accidents shall be recorded and analysed. - Construction sites should be properly and sufficiently lightened. [O] - Education shall be provided to workers on operation and safety. - Provide workers with appropriate protective equipment. - Cases and causes of accidents shall be recorded and analysed.	
	Communities and occupational health and safety	- By controlling the pollutants emission. - By providing safety training and awareness - By giving warning in time to the social community in emergency case - By checking environmental management plan, environmental monitoring plan and mitigation measures regularly.	Wuxi Hua Guang (Myanmar) Limited

P: Pre-construction Stage, Co: Construction Stage, O: Operation stage, De: Decommissioning Stage

Source: E Guard Study Team

7 Cumulative Impact Assessment

7.1 Cumulative Impact Assessment

The assessment of cumulative impacts was a key focus of the EIA study for the Thi gyit (Tigyit) coal fired power plant project. Cumulative impacts in relation to an activity are defined as the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities undertaking in the area.

In order to understand the manner in which the project will contribute to cumulative impacts, an understanding of the existing coal fired power plant operations by the past and present activities over space and time is essential. This will need the identification of existing and proposed projects within the region.

Table 7. 1 Major infrastructures near the project area

No	Factories and Mine	Distance From Thi gyit (Tigyit) Coal Fired Plant
1	Nagar Cement Factory	4.88km
2	Nagar Limestone Quarry Site	3.85km
3	Eden Coal Mine	2km
4	Residential Sector	

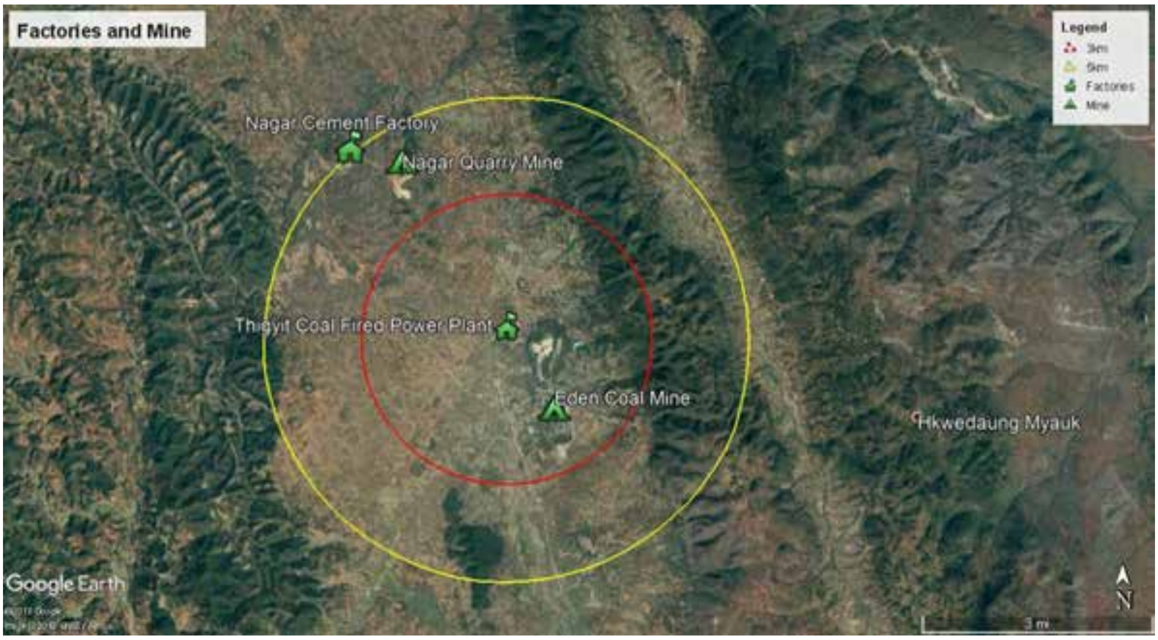


Figure 7.1 Major Infrastructures near the project area

When assessing cumulative assessment activities, it will focus on key significant issues that have been included in the findings of the impact assessment. The following factors are incorporated into the cumulative impact presented below:

Table 7.2 Cumulative impact of major infrastructures near the project area

No	Project Activities	Element/Issue to be impacted	Additional consideration
1	Construction of infrastructure and day to day activities of the coal fired power plant, mining and other projects such as coal grinding, using boilers, coal blasting and transport of coal and cement	Air quality deterioration due to dust nuisances and other gases within the region	Apart from the physical infrastructure such as waste rock dumps and other facilities increased dust generation caused by traffic volumes will exacerbate the impact.
2	Blasting of coals with the use of explosives	The main concern is fragmentation of coals which may be propelled into the nearby settlements causing harm.	Residents of nearby villages may be impacted during the blasting operation twice a day. Settlements could be affected by pieces of coal within. 152 m (500 feet) distance. However, the nearest village is 550 m (1800 feet) from the project site.
3	Existing coal fired plant, coal mine and cement plant are associated with various noise generation activities due to excavation of machinery, blasting coal, crushing and starting engines.	Cumulative noise impact due to back ground noise conditions.	Increase of noise impacts in the project area. Cumulative impact may cause nuisance, sleep disturbance. Besides, there is existing noise – sensitive receptors such as schools, hospitals close to the project site could be affected by the coal fired power plant and coal mine. However, the nearest residential area is 550 m (1800 feet) from the project sites. However, blasting times are generally different and take only a few minutes only.
4	The operations of coal fired power plant and other projects will result in the influx of migrants in search of employment opportunities	The cumulative impacts are related to those associated with HIV or Sexually Transmitted Disease (STD) due to the increase in migrant labor from the 4 projects	The impact of influx will also indirectly impact on the spread of criminal activities
6	All projects will generate various types of wastes (non-hazardous and hazardous) during operation phase.	If handled, stored and disposed improperly, such wastes could potentially contaminate the soil and groundwater resources.	Wastes include spoil, general and household refuse, sewage and wastewater, machinery parts and small amounts of hazardous wastes such as oil etc
7	The development of this kind of development will result in increase in expenditure in the region and increased employment	Increased spending within the region and employment opportunities within the local area	Additional potential positive cumulative impacts of these projects include an increase in tax revenue for the Government and other local economies

No	Project Activities	Element/Issue to be impacted	Additional consideration
			through the payment of payroll tax, commercial tax, property tax and other taxes and fees.
8	The development of project activities in the area will introduce training and skills developments to employees working in the quarry project.	Employees from surrounding communities will be provided with training and skills development.	On the job trainings, prior to construction, would be critical to achieving a high local employment rate.
9	With the development of these projects, the community will require a number of a number of infrastructure related projects such as schools, medical facilities, shops, housing, water, electricity, telecommunications, etc.	The local community will be developed with improved infrastructure	The enhanced positive cumulative impact is that as part of their CSR program, Thi gyit (Tigyit) coal fired power plant will be investing in upgrading local roads, building a school, providing a medical facilities and ambulances to the community etc.

Source: E guard Environmental Services

7.2 Emission Inventory Comparison in Project area

Since there was no previous Emission Inventory (EI) in the project area, the EI from this study was compared with other EIs in different source categories and different regions. Since the project area was located in rural area and had few industrial activities, the emissions from each source category were lower compared to other source emissions. The comparison was presented in Table 7.3.

Table 7.3 Comparison of EI Results with Other EI Works

Activity	Number of plant	PM10 (kg/yr)	SO2 (kg/yr)	NOx (kg/yr)
Thi gyit (Tigyit) Coal-fired Power Plant	1	8,475	72,522	56,783
Gas Fired Power Plant in Yangon	4	117,934	9	494,416
Delhi Coal-fired Power Plant	2	13,154*	18,597*	18,144*
Punjab Coal-fired Power Plant	3	30,844*	50802*	48,081*
Bihar Coal-fired Power Plant	3	28,123*	39,009*	35,834*
Madhya Pradesh Coal-fired Power Plant	4	90,719*	126,552*	118,388*
Cement Plant		7*	8,228*	1,123*
Households Cooking in Greater Yangon Area, 2015	-	475,365	47,174	205,024
Households Cooking in this study, 2017	-	35,353	70	9,153

Sources: Sarath, 2014; Questionnaire survey, 2018

Note: * Mega gram

7.3 AERMOD Model Inputs within Project Area

AERMOD model was designed to operate with readily available meteorological data and emission data of the sources. The meteorological data was collected from the Taunggyi station, 14 km north-east of the study area. Source input parameters varied based on the types of sources, pollutants, outputs to be specified. Emission inventory data were converted into the model input format which met the model requirements. As this study included three types of sources, detailed input parameters for each source were summarized in Table 7.4.

Table 7.4 Input Data to AERMOD Model

Sector	Activity	Data		
Power Plant	Emission Rate in g/s (QS)	PM_{10}	SO_2	NO_x
		0.27	2.29	1.79
	Exit Gas Velocity in m/s (VS)	1.36		
	Stack Exit Temperature in K (TS)	355		
	Stack Inside Diameter in m (DS)	3.82		
	Stack Height in m (HS)	80		
Cement Plant	Emission Rate in g/s (QS)	PM_{10}	SO_2	NO_x
		1.11	261	36
	Exit Gas Velocity in m/s (VS)	3.52		
	Stack Exit Temperature in K (TS)	393		
	Stack Inside Diameter in m (DS)	2.5		
	Stack Height in m (HS)	60		
Surface Limestone Mine	Aremis- area emission rate in g/(s- m^2)	PM_{10}	SO_2	NO_x
		1.72E-6	1.64E-16	2.24E-7
	Relhgt – release height above ground in meters	11		
	Xint – length of X side of the area	493		
	Yint – length of Y side of the area (optional)	1137		
Surface Coal Mine	Aremis- area emission rate in g/(s- m^2)	PM_{10}	SO_2	NO_x
		7.76E-7	2.31E-13	8.88E-6
	Relhgt – release height above ground in meters	6		
	Xint – length of X side of the area	197		
	Yint – length of Y side of the area (optional)	650		

Thi gyit (Tigyit) Village Group	Aremis- area emission rate in g/(s- m^2)	PM_{10}	SO_2	NO_x
		7.74E-8	1.62E-10	2.43E-8
	Relhgt – release height above ground in meters	1		
	Xint – length of X side of the area	4592		
	Yint – length of Y side of the area (optional)	5467		
Phayar Phyu Village Group	Aremis- area emission rate in g/(s- m^2)	PM_{10}	SO_2	NO_x
		2.10E-7	4.40E-10	6.60E-8
	Relhgt – release height above ground in meters	1		
	Xint – length of X side of the area	4406		
	Yint – length of Y side of the area (optional)	5833		
Myin Twin Village Group	Aremis- area emission rate in g/(s- m^2)	PM_{10}	SO_2	NO_x
		2.15E-7	4.50E-10	6.75E-8
	Relhgt – release height above ground in meters	1		
	Xint – length of X side of the area	1827		
	Yint – length of Y side of the area (optional)	3824		
Nan Tine Village Group	Aremis- area emission rate in g/(s- m^2)	PM_{10}	SO_2	NO_x
		1.25E-7	2.62E-10	3.94E-8
	Relhgt – release height above ground in meters	1		
	Xint – length of X side of the area	1949		

	Yint – length of Y side of the area (optional)	2345		
Lone Poe Village Group	Aremis- area emission rate in g/(s- m^2)	PM	SO	NO
	Relhgt – release height above ground in meters	1		
	Xint – length of X side of the area	1247		
	Yint – length of Y side of the area (optional)	1360		
Ban Pyin Village Group	Aremis- area emission rate in g/(s- m^2)	PM_{10}	SO_2	NO_x
		2.52E-7	5.27E-10	7.91E-8
	Relhgt – release height above ground in meters	1		
	Xint – length of X side of the area	1867		
	Yint – length of Y side of the area (optional)	2782		
Paw Yar Village Group	Aremis- area emission rate in g/(s- m^2)	PM_{10}	SO_2	NO_x
		2.03E-7	4.24E-10	6.36E-8
	Relhgt – release height above ground in meters	1		
	Xint – length of X side of the area	334		
	Yint – length of Y side of the area (optional)	651		

Source: Questionnaire survey, emission inventory, emission calculation for each source, 2018

7.3.1 Concentration of pollutants from coal-fired power plant

The AERMOD model estimated concentration of the modeled pollutants from the power plant at the locations of the receptor groups, Figure 7.2. The receptor groups in this study were villages surrounding the power plant where the villagers would be affected the impacts from emission of the sources in the area. According to the model results, the maximum SO_2 concentration was found in the nearest village group, Thi gyit (Tigyit) with the concentration of 0.17 µg/m^3, followed by Myin Twin at 0.09 µg/$m^3$and Nan Tine at 0.06 µg/m^3, while the concentration in other groups were below 0.03 µg/m^3. The other pollutants, NO_2 and PM_{10}, were found at the highest level in these three receptor groups, Thi gyit (Tigyit) (0.29 µg/m^3 for NO_2, 0.03 µg/m^{3}for PM_{10}), Myin Twin (0.5 µg/m^3 for NO_2 and 0.01 µg/m^3 for PM_{10}) and Nan Tine (0.1 µg/m^3 for NO_2, 0.01 µg/m^{3}for PM_{10}) because wind was dominantly blowing to that direction during the study period. However, all the concentrations of the pollutants were within the guideline limits at 20 µg/m^{3}for 24-hr SO_2, 200 µg/m^3 for 1-hr NO_2 and 50 µg/m^3 for 24-hr PM_{10} respectively.

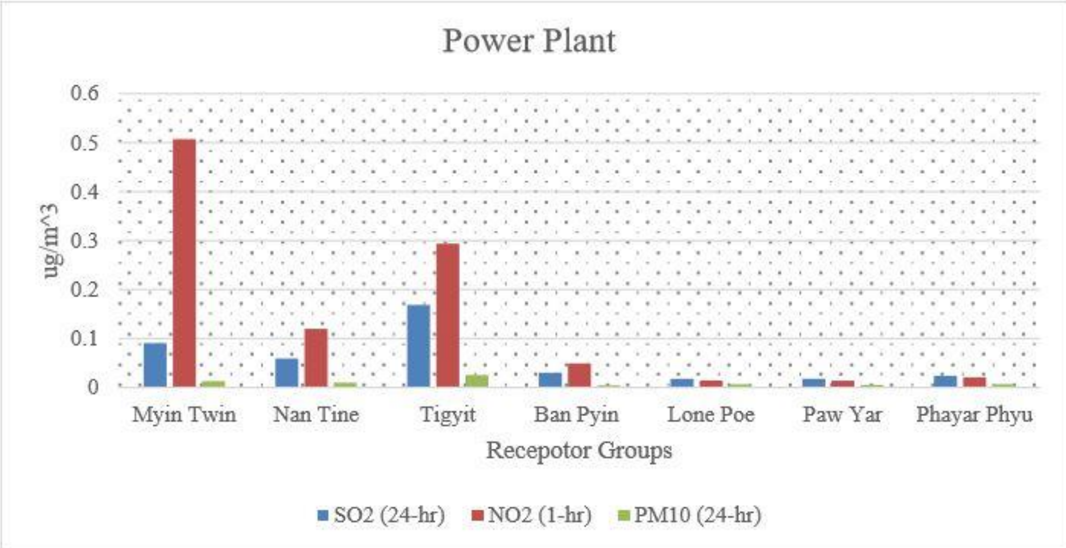


Figure 7.2 Concentration of modeled pollutants from power plant at the receptors

7.3.2 Concentration of pollutants from cement plant

The coal-fuel cement plant operated without emission control system of SO_2 and NO_2 emitted high level of pollutants to nearby receptors. As the plant located very close to Myin Twin and Nan Tine village groups, and these groups were located in downwind area, the concentration of SO_2 and NO_2 were found to be the highest on these village groups. The 24-hr SO_2 concentration exceeded the guideline values of 20 µg/m^3 at the mentioned two receptor groups, while the 1-hr NO_2 concentration for all receptors were within the guideline value, 200 µg/m^3 . PM_{10} concentrations for all receptors were almost zero as the ESPs installed at the plant had very high removal efficiency.

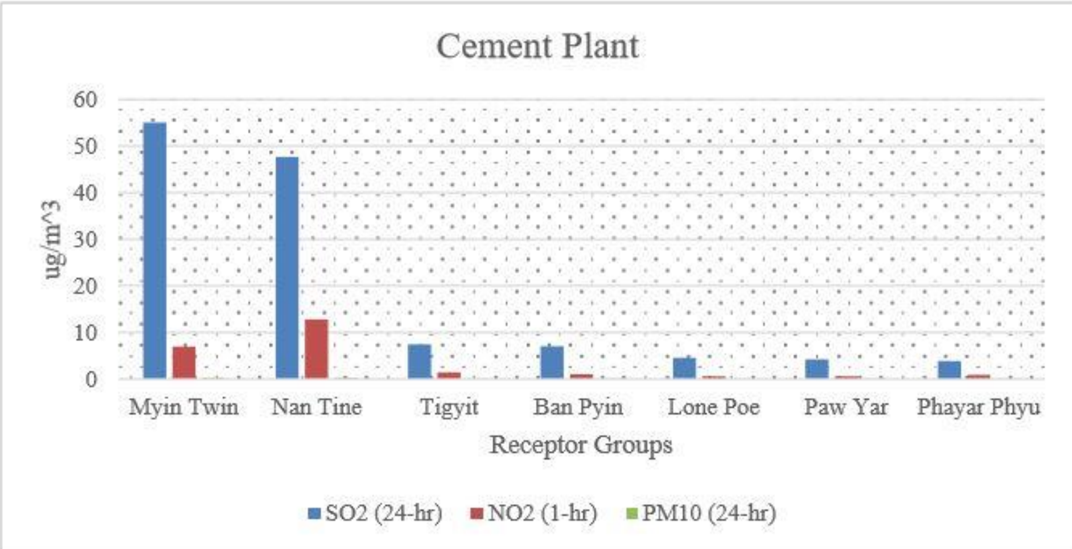


Figure 7.3 Concentration of modeled pollutants from cement plant at the receptors

7.3.3 Concentration of pollutants from limestone mine

Surface limestone mine, specifically mountain top removal mining, lies between the cement plant and power plant. All the potential sources such as drilling, blasting, dozing, loading, conveyor point, vehicles and excavator movement on unpaved road were included in the model run.

Dust emission is the major pollutant from the mining site. The model estimated that PM_{10} and NO_2 concentration were relatively high in downwind and nearby areas. PM_{10} concentration were found at the maximum in Myin Twin, Nan Tine and Thi gyit (Tigyit) village group with the concentration between 5-8 µg/m^3, but these values were still lower than the guideline value of 8 µg/m^3. Despite the first highest NO_2 concentration was observed in nearest village group, Myin Twin, the value was extremely lower than that of guideline value, 200 µg/m^3. There was no SO_2 emission found in the model result because there was no significant use of sulfur containing fuel, except for the diesel fuel which had extremely low sulfur content.

Figure 7.4 Concentration of modeled pollutants from limestone mine at the receptors

7.3.4 Concentration of pollutants from coal mine

The coal mine is an open pit type which is located about 2 km south of the power plant. Similar to the limestone mine, all the potential emission sources were included in the model run. However, according to the model results, downwind and nearby receptors were not affected by PM_{10} as the mine was an open pit type, and mining depth during the study period was about 90 m. The reasonable amount of NO_2 was emitted from the movement of dump trucks, dozers, excavators and other machineries with the concentration range 3-9 $\mu g/m^3$ for all receptors. The nearest receptor had the highest concentration but it was below the guideline values of $200 \mu g/m^3$. For the case of SO_2, it was similar to the limestone mine that there was no significant SO_2 emission source, except from the use of diesel fuel in vehicles.

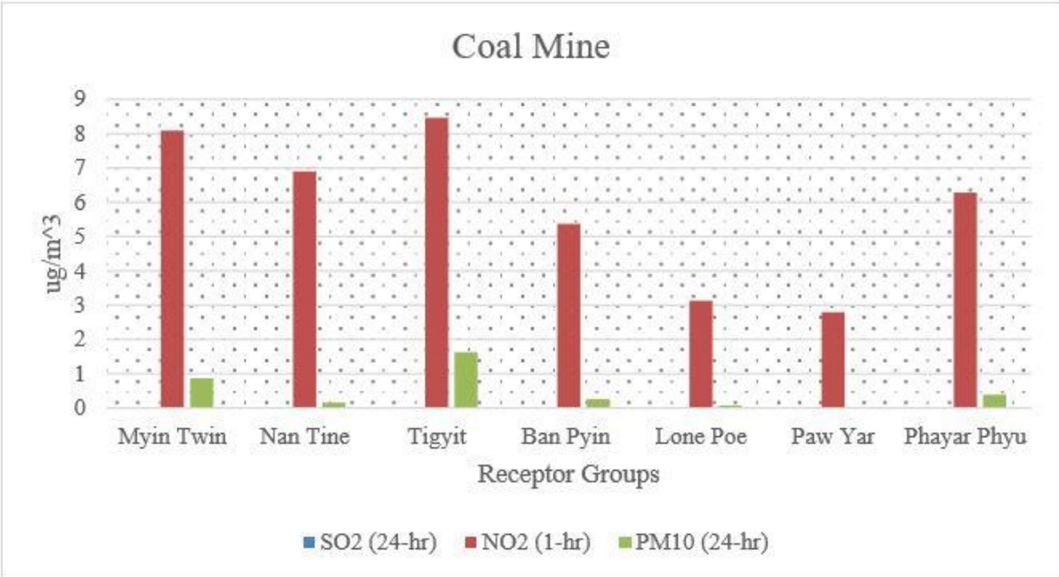


Figure 7. 5 Concentration of modeled pollutants from coal mine at the receptors

7.3.5 Concentration of pollutants from residential cooking

NO_2 and PM_{10} were the major pollutants from the residential sector. There was no SO_2 emission found in the area. Pollutants concentration level differed depending on the amount of fuel consumption. Myin, Ban Pyin and Phyar Phyu receptor groups were found with the highest concentration of NO_2 and PM_{10} because the cooking activities in these villages were mostly relied on firewood, while other village groups used fuel mix (firewood and electricity).

Figure 7.6 Concentration of modeled pollutants from residential cooking at the receptors

7.3.6 Total concentration of pollutants from the studied sources

There were 62 villages, under the seven receptor groups, located in the study area. The concentrations of each pollutant on each village from different sources were summed to the total concentration of pollutants at the receptors. The GIS based spatial distribution of pollutant concentration were developed for SO_2, NO_2, PM_{10}, and presented in Figures7.7.

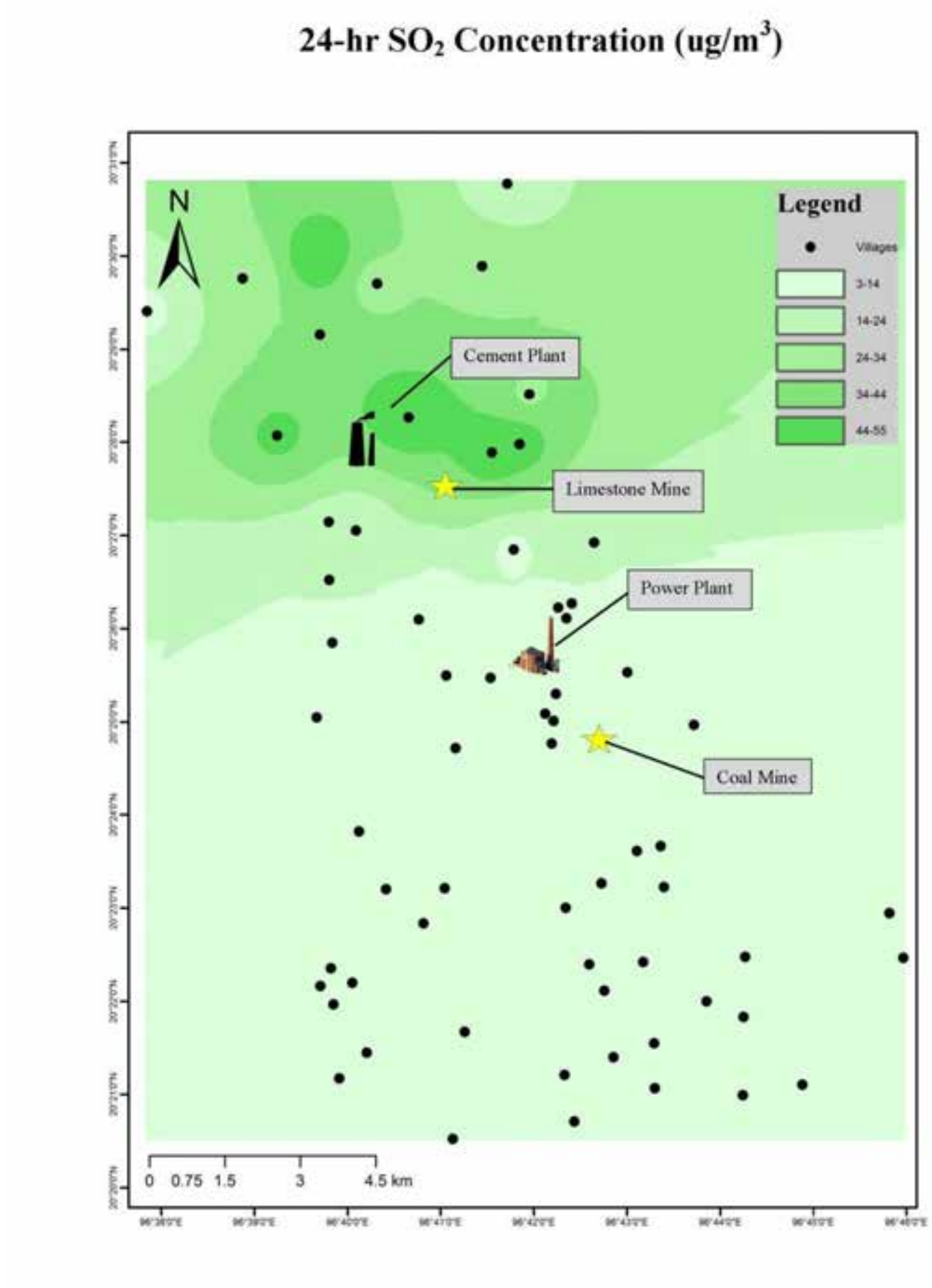


Figure 7.7 Spatial distribution of 24-hr SO_2 concentration (Guideline values = 20 µg/m^3)

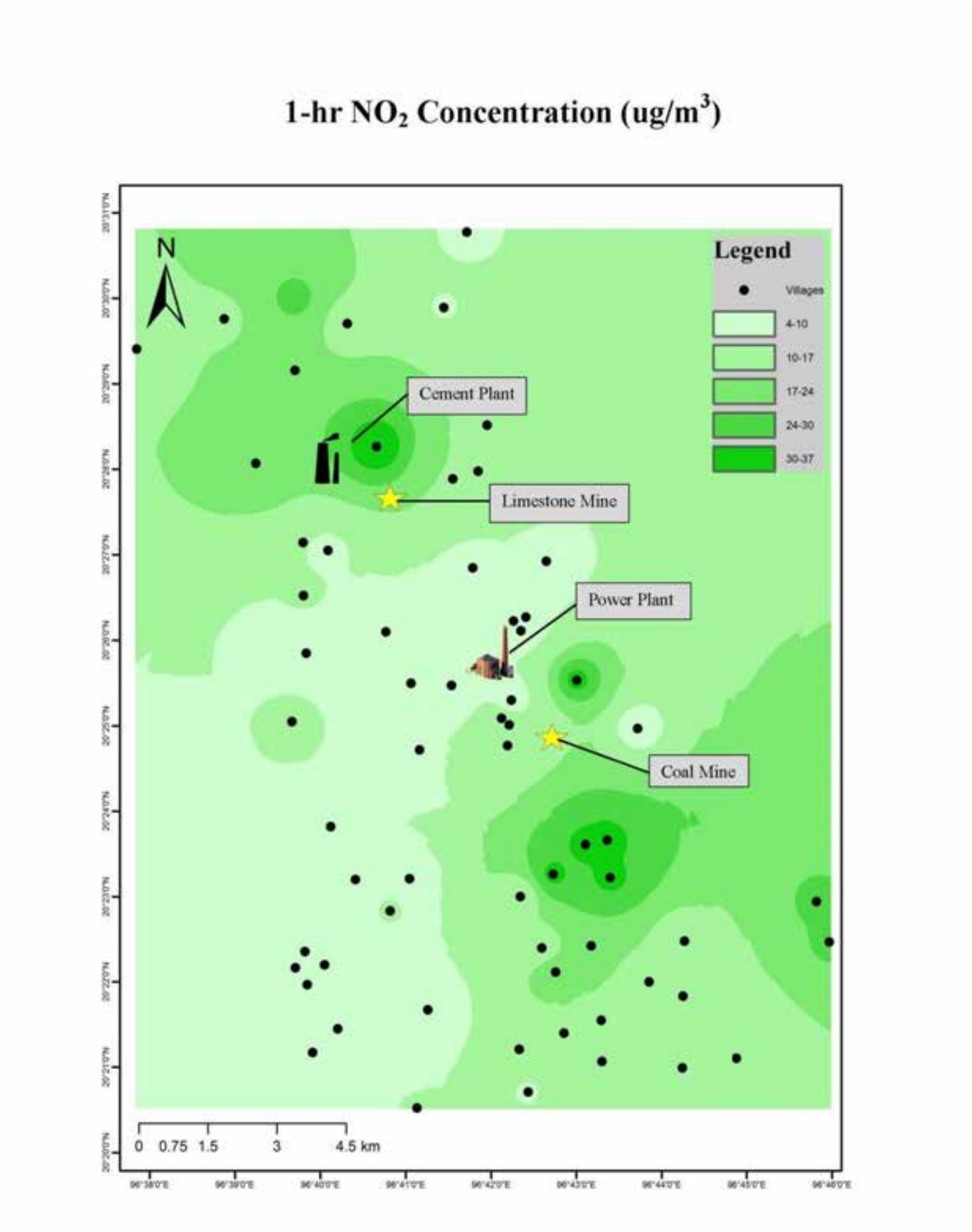


Figure 7.8 Spatial distribution of 1-hr NO_2 concentration (Guideline values = 200 µg/m^3)

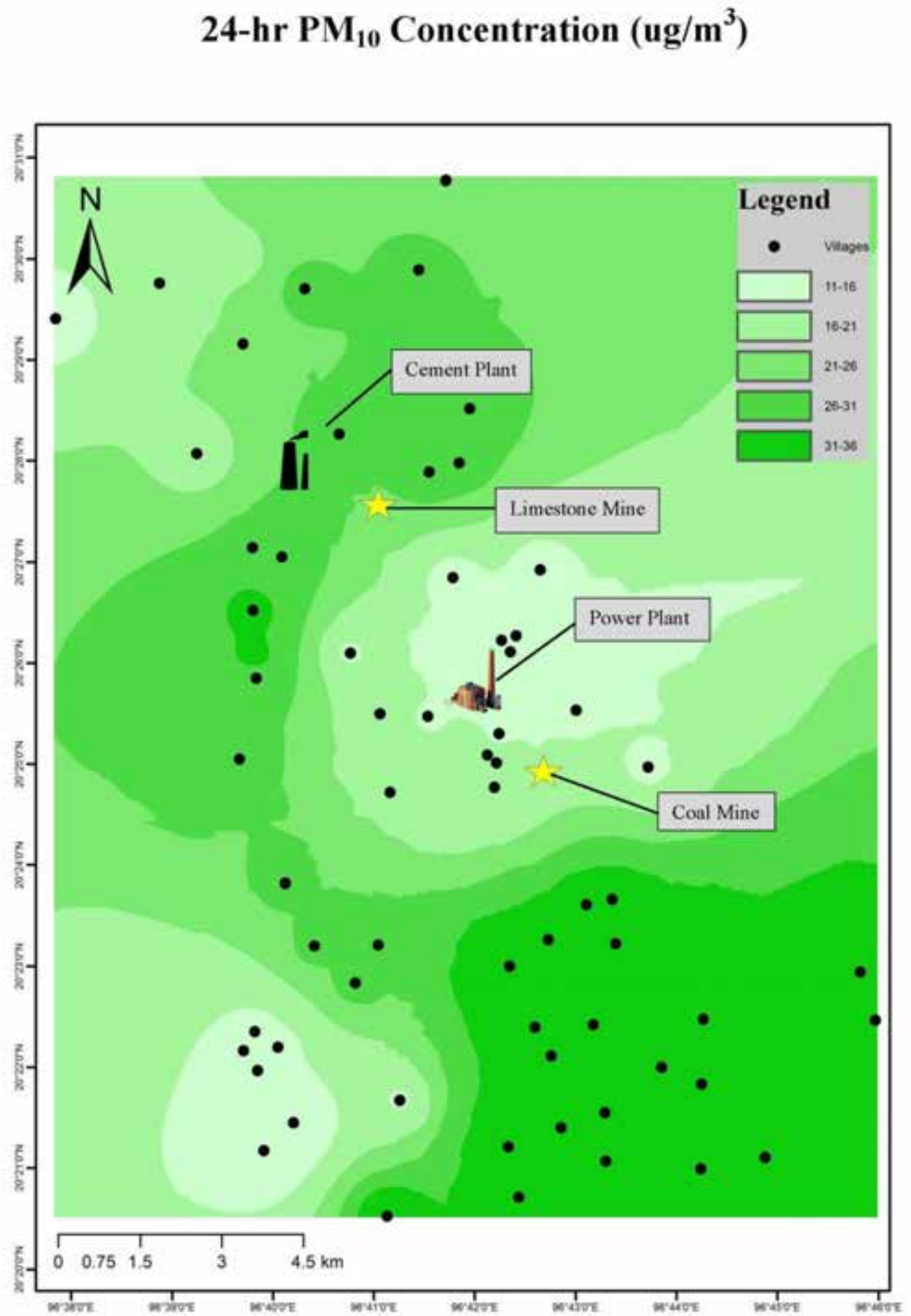


Figure 7.9 Spatial distribution of 24-hr PM_{10} concentration (Guideline values = 50 µg/m^3)

7.4 Performance Evaluation of AERMOD Model

Evaluation of the AERMOD results was performed by comparing with the Myanmar Emission Guideline values and the monitoring data at receptor locations. There were 14 receptors included in this comparison. These receptors were selected based on the availability of the measured data.

In this evaluation, the AERMOD simulation results for each pollutant from all sources were summed up and compared with the measured and the guideline values. Generally, the simulation results and monitoring results were comparable in some villages. The detail discussions were presented in Section 7.4.1-7.4.3.

7.4.1 SO2 evaluation

The first highest modeled concentration on Myin Twin (33 $\mu g/m^3$) and Nan Tine (51 $\mu g/m^3$) exceeded the guideline limit of 20 $\mu g/m^3$ where measured data indicated 3 $\mu g/m^3$ in both villages. The concentrations from the model were about 10-20 times higher than measured data. The coefficient of determination (r^2) between modeled and measured concentration for SO_2 was 0.06. The r^2 value was very low since the model was simulated based on input emission data estimated from the rate of mean annual fuel consumption that can vary between wet and dry seasons. Moreover, the model results represented the first highest 24-hour concentration throughout the study period (365 days) where the measurement was carried out on a particular day for 24-hr period (not a worst case). On the other hands, at some receptors (Sae Khaung, Pin Me Gone, Naung Mon, Mon Pin, Gant Gaw Pin and Pin Sane Su, in the circle in Figure 4.14), the concentration from the model was relatively similar to the measurement data. The index of agreement was 0.02 which represented that the modeled concentration did not have a good agreement with the monitored concentration. The model to measure 24-hr SO_2 concentrations were presented in Table 7.5 and Figure 7.10.

Table 7.5 Model to Measured Concentration for 24-hr SO_2

Village	Model Simulation (µg/m^3)	Measured Data (µg/m^3)
Taung Chay	33	3
Myin Twin East	51	3
Pat Ta Lae	17	3
Se Khaung	8	3
Pin Me Gone	5	3
Pyin Thar	14	3
Naung Mon	6	3
Ban Mat	14	3.
Mon Pin	8	4
Lwin	10	3
Gant Gaw Pin	10	3
Pin Sane Su	10	3
Naung Mu	10	5
Mee Thway Chaung	10	3

Sources: Questionnaire survey; E Guard, 2018

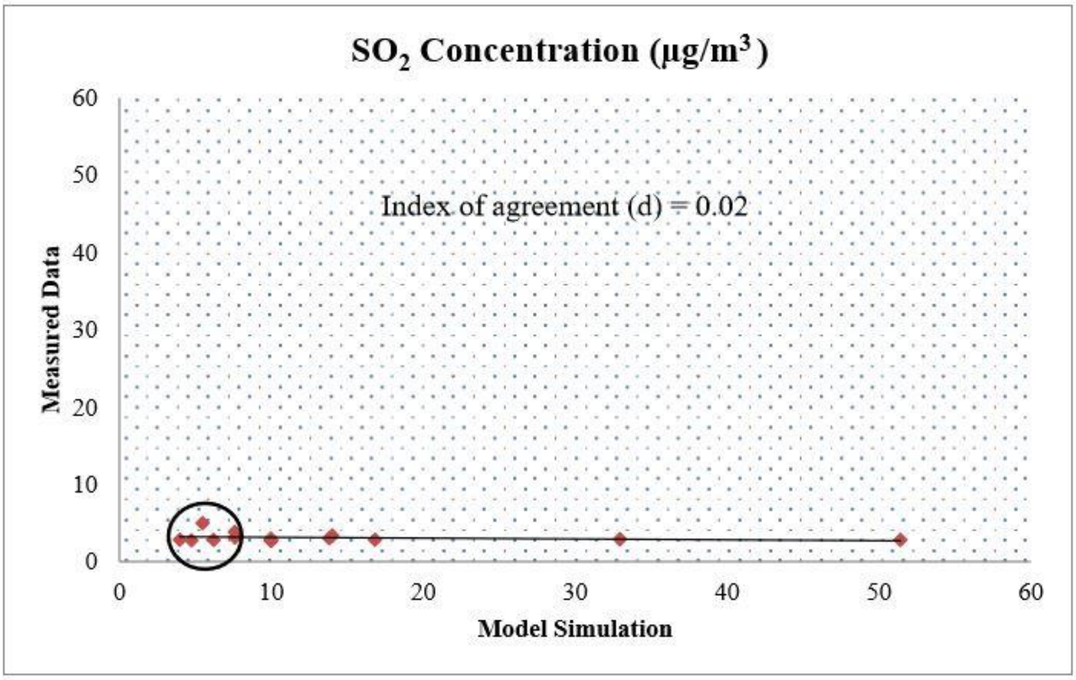


Figure 7.10 Model to measured data comparison of SO_2 concentration

7.4.2 NO_2 evaluation

The 1-hr NO_2 concentrations from measurement to model simulation were presented in Figure 4.15. The coefficient of determination (r^2) between modeled and measured concentration for NO_2 was 0.26. The highest concentration of 42µg/m^3 was observed from measured data when the simulation was 32µg/m^3 in Mee Thway Chaung village. The concentration from measured data was appeared 2-3 times higher in some villages such as Pat Ta Lae (10 µg/m^3 for model simulation and 16 µg/m^3 measured data), Lwin (8 µg/m^3 for model simulation and 23 µg/m^3 measured data) and Pyin Thar (9 µg/m^3 for model simulation and 18 µg/m^3 measured data). The concentrations from model simulation were relatively comparable to the measured data in villages, Taung Chae, Myin Twin east, Naung Mu at around 20µg/m^3. Nevertheless, all the concentration from simulated to measured data were within the guideline limit, 1-hr NO_2 concentration of 200 µg/m^3. The index of agreement was 0.58 which represented that the modeled and monitored concentrations were in a moderate agreement. The model to measure 1-hr NO_2 concentrations were presented in table 7.6 and figure 7.11.

Table 7.6 Model to Measured Concentration for 1-hr NO_2

Village	Model Simulation (µg/m^3)	Measured Data (µg/m^3)
Taung Che	15	18
Myin Twin East	17	16
Pat Ta Lae	10	16
Se Khaung	5	22
Pin Me Gone	6	2
Pyin Thar	9	18
Naung Mon	11	24
Ban Mat	7	13
Mon Pin	7	35
Lwin	8	23
Gant Gaw Pin	8	23
Pin Sane Su	8	23
Naung Mu	12	17
Mee Thway Chaung	32	42

Sources: Questionnaire survey; E Guard, 2018

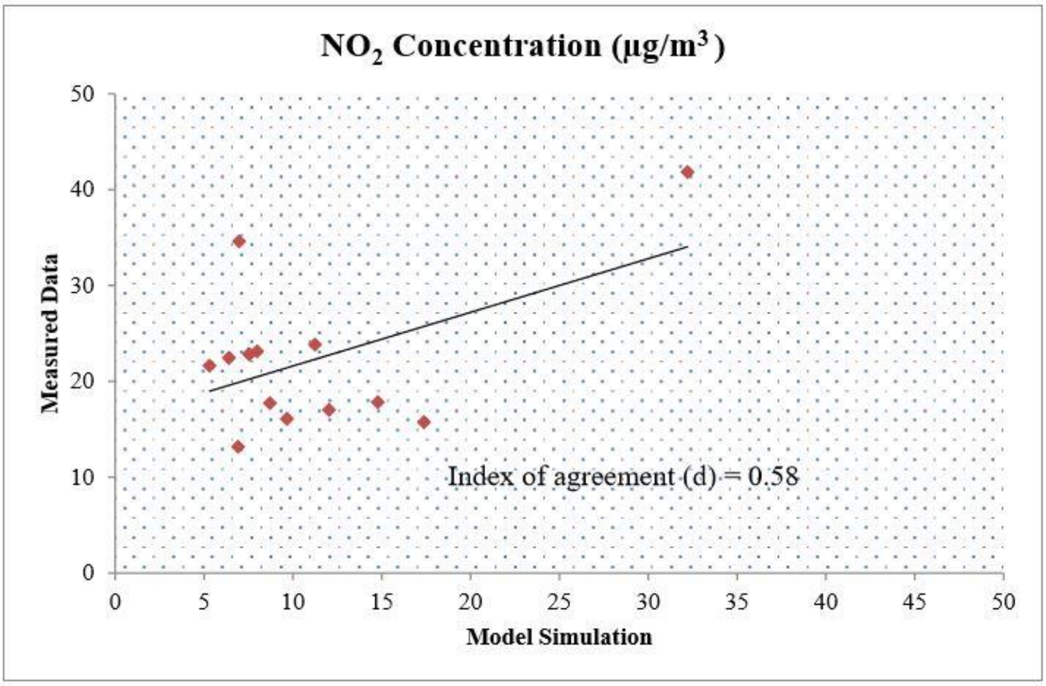


Figure 7.11 Model to measured data comparison of NO_2 concentration

7.4.3 PM_{10} evaluation

The simulated the 1st highest 24-hr PM_{10} concentration at Mon Pin village, was 16 µg/m^3 which exceeded the guideline value of 50 µg/m^3 while monitoring observed at 75 µg/m^3. The coefficient of determination (r^2) between modeled and measured concentration for PM_{10} was 0.04. The r^2 value was very low because the concentration from measured data 2-3 times higher than simulated concentration in some villages, such as Pyin Thar, Naung Mu and Mee Thwe Chaung. It was assumed that other pollution sources such as motorcycle movements on the unpaved village road and garbage burning and related activities caused high level of PM_{10} concentration during the 24-hr monitoring period in the area.The concentration from the model and the measurement of the remaining receptors were found very similar (Lwin at 14 µg/m^3 for model simulation, 13 µg/m^3 for measured data and Pin Sane Su at 14 µg/m^3 for model simulation, 17 µg/m^3 measured data). The index of agreement was 0.44 which represented that the modeled and monitored concentrations were in a moderate agreement. The model to measure 24-hr PM_{10} concentrations were presented in table 7.7 and figure 7.12.

Table 7.7 Model to Measured Concentration for 24-hr PM_{10}

Village	Model Simulation (µg/m^3)	Measured Data (µg/m^3)
Taung Che	30	44
Myin Twin East	29	21
Pat Ta Lae	29	34
Se Khaung	14	18
Pin Me Gone	13	18
Pyin Thar	13	23
Naung Mon	16	23
Ban Mat	13	28
Mon Pin	16	75
Lwin	14	13
Gant Gaw Pin	20	17
Pin Sane Su	14	17
Naung Mu	14	32
Mee Thway Chaung	14	38

Sources: Questionnaire survey; E Guard, 2018

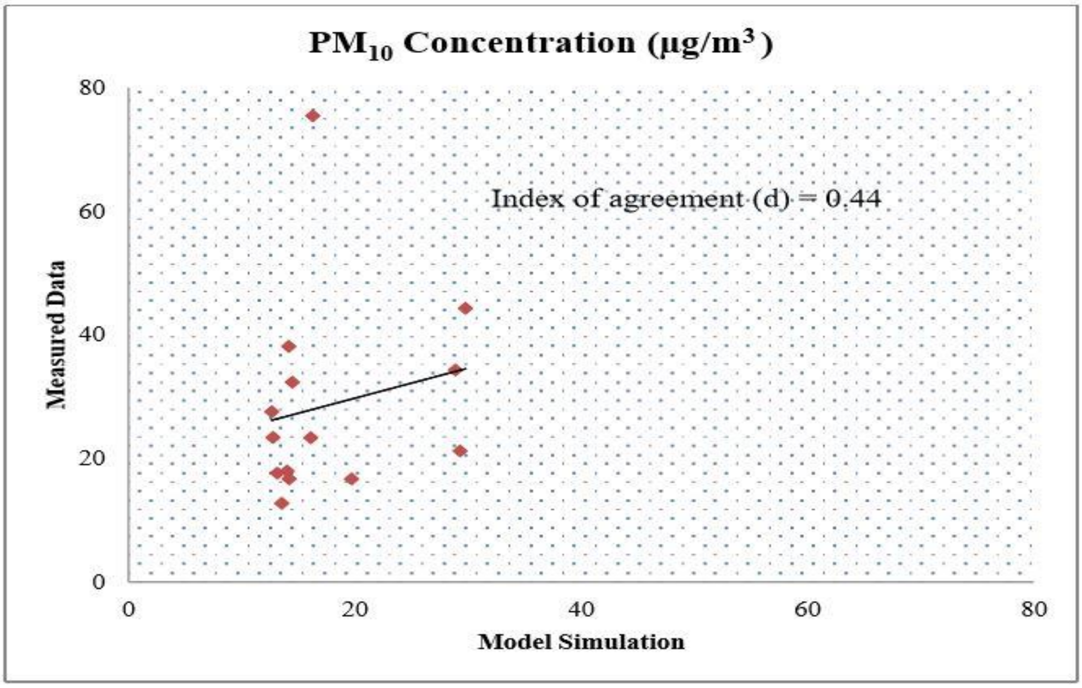


Figure 7.12 Model to measured data comparison of PM_{10} concentration

This study was conducted to develop the emission inventory of SO_2, NO_2 and PM_{10} for coal-fired power plant, cement plant, surface limestone mine, surface coal mine and residential cooking in the Thi gyit (Tigyit) area to identify the major pollutant sources in the project area. The questionnaire surveys were carried out to collect the activity data from each source category. Emission of SO_2, NO_2 and PM_{10} from selected sources, were developed for 2017. The spatial distribution of pollutants was also developed for individual source category and at different receptors (village) location using the AERMOD dispersion model. This study are summarized as follows:

- The total 2017 annual emission in the study area were 83 kt of SO_2, 1.3 kt of NO_2 and
- 0.09 kt of PM_{10}.
- Cement plant contributed 99 % of SO_2, 89% of NO_2 and 8 % of PM_{10} of the total emission while power plant shared 1% of SO_2, 4% of NO_2 and 10% of PM_{10} in the study area. PM_{10} emission was highly contributed by Limestone mine at 28 % while the coal mine shared at 13% of total emission.
- The AERMOD simulated that the village groups of Myin Twin, Nan Tine and Thi gyit (Tigyit) were highly impacted by all studied sources as these villages were located on the downwind direction of the emission sources.
- The pollutants concentration simulated by the model was compared with the monitoring data. The concentration from the model was comparable to the concentration from the monitoring for NO_2 and PM_{10} in some villages. For SO_2, the model performed well in some village groups while the predicted concentration can be as 10-20 times higher than the measurement data in some village groups. However, considering that the modeled concentration were the highest possible concentration (over 365 days), the modeled concentration should be higher than the one time measurement data.

8 Environmental Management Plan

The chapter describes the modalities provided in the project for the implementation of the proposed mitigation measures to its negative impacts. It proposes the institutional responsibilities for the implementation of the management actions, the implementation indicators, the time frame for monitoring and follow up and also the estimated cost for the implementation activities. The Environmental Management Plan of Thigyit coal fired power plant project is organized with the following sections:

1. Environmental Monitoring Plan
2. Air Quality Management Plan
3. Noise Management Plan
4. Coal Transportation and Management Plan
5. Water Quality Management Plan
6. Waer Usage Management Plan
7. Wastewater ans Strom Water Management Plan
8. Waste Mangement Plan
9. Transporation Management Plan
10. Occupational Health and Safety Plan
11. Boiler Management Plan
12. Emergency Preparedness Plan
13. Fire and Explosiion Hazards Plan
14. Wildlife Management Plan
15. Rehabilation and Revegetation Management Plan
16. Cumulative Impact Assessment and Management Plan for Biodiversiy
17. Greavance Mechanism
18. Corporate Social Responsibility Plan

Carrying out environmental management for the project involves a number of participants each with different positions, responsibilities and interests. In particular, Wu Xi Hua Guan Co., Ltd, supported by MOEE has the primary obligation to ensure that the people and the natural environment are adequately protected from the negative impacts generated from the project and they adequately and rightfully benefit from the positive impact. The following section presents the main players and their roles and responsibilities under the project.

(1) Wuxi Hua Guang (Myanmar) Limited

As the project proponent and leading executing body of the project, Wuxi Hua Guang (Myanmar) Limited carries overall responsibility for managing and protecting the social and natural environment to the extent that project may have an effect. It may directly or through a representative carry out such activities considered necessary for the said purpose.

(2) MOEE

As the supervising organization of Wu Xi Hua Guan, MOEE will support in implementing the EMP especially matters and other social issues that require cooperation with the regional government and other concerned government bodies.

(3) ECD (Shan State)

ECD (Shan State) is responsible for the general supervision and coordinating over all matters relating to the environment and also for providing guidance upon existing regulatory frameworks.

(4) Third-Party Consultant Firm

The Third-Party Consultant Firm will supervise Wuxi Hua Guang (Myanmar) Limited in implementing environmental mitigation measures and monitoring. If any issue is identified, the consultant will suggest the proponent to take appropriate countermeasures to improve any adverse impacts. The consultant will conduct environmental monitoring and report to the proponent. The consultant will also support the proponent in preparing environmental monitoring report to MONERC as required by the EIA procedure.

8.1 Environmental Monitoring Plan

A summary of the environmental monitoring plan, coast and implementation structure proposed to be carried out under the project are presented in the following table 8.1

Table 8.1 Environmental Monitoring Plan

No.	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
Operation Phase								
1	Air Pollution	NO2, SO2, PM (PM10 and PM2.5), and micro climate (temperature, humidity, wind speed and direction etc. for reference)	One weekday for 24 consecutive hours per location	18 locations within 5km project area (*same places as baseline survey in principle)	Biannually in operation period	Third party consultant firm hired by Wu Xi Hua Guan	Wu Xi Hua Guan	**USD 36,000** (USD 1,000 * 18 points * 2 times)
2	Water Pollution	BOD, COD, oil & grease, pH, total coliform, total nitrogen, total phosphorus and TSS	Sampling and measurement using field equipment and laboratory analyses	10 locations within 5 km project area (*same places as baseline survey in principle)	Biannually in operation period (*once during dry season and once during rainy season)	Third party consultant firm hired by Wu Xi Hua Guan	Wu Xi Hua Guan	**USD 20,000** (USD 1,000 * 10 points * 2 times)
3	Soil Contamination	Soil condition Voices and complaints from the local community	Confirmation of voices and complaints Visual observation of surface soil	Project site and surrounding area	Quarterly in operation period and when complaints are heard in this regard	Wu Xi Hua Guan	Wu Xi Hua Guan	-

No.	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
4	Waste Disposal	Volume of waste including soil, vegetation and garbage Voices and complaints from the local community	Confirmation of voices and complaints Visual observation	Project site	Quarterly in operation period and when complaints are heard in this regard	Wu Xi Hua Guan	Wu Xi Hua Guan	-
5	Noise	LAeq (noise) LV10 (vibration)	One weekday for 24 consecutive hours per location	18 locations within 5 km project area (*same places as baseline survey in principle)	Biannually in operation period	Third party consultant firm hired by Wu Xi Hua Guan	Wu Xi Hua Guan	**USD 18,000** (USD 500 * 18 points * 2 times)
6	Cross Boundary Impacts and Climate Change	Air quality	Refer to „1. Air Pollution"above.					
Decommissioning Phase								
1	Air Pollution	NO2, SO2, PM (PM10 and PM2.5), and micro climate (temperature, humidity, wind speed and direction etc. for reference)	One weekday for 24 consecutive hours per location	18 locations within 5 km project area (*same places as baseline survey in principle)	Biannually in decommissioning phase	Contractor	MOEE	**USD 36,000** (USD 1,000 * 18 points * 2 times)

No.	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
2	Water Pollution	BOD, COD, oil & grease, pH, total coliform, total nitrogen, Total phosphorus and TSS	Sampling and measurement using field equipment and laboratory analyses	10 locations within 5km (*same places as baseline survey in principle)	Biannually in decommissioning phase (*once during dry season and once during rainy season)	Contractor	MOEE	**USD 20,000** (USD 1,000 * 10 points * 2 times)
3	Soil Contamination	Soil condition Voices and complaints from the local community	Confirmation of voices and complaints Visual observation of surface soil	Construction site and surrounding area	Quarterly and when complaints are heard in this regard	Contractor under supervision of consultant	MoEE	-
4	Waste Disposal	Volume of waste including soil, vegetation and garbage Voices and complaints from the local community	Confirmation of records of waste generated Confirmation of voices and complaints Visual observation	Construction site	Quarterly and when complaints are heard in this regard	Contractor	MoEE	-
5	Noise	LAeq (noise) LV10 (vibration)	One weekday for 24 consecutive hours per location	18 locations within 5km (*same places as baseline survey in	Biannually in decommissioning period	Contractor	MoEE	**USD 18,000** (USD 500 * 18 points * 2 times)

No.	Category	Item	Method	Location	Frequency	Implementing Organization	Responsible Organization	Cost/Year
				principle)				
6	Cross Boundary Impacts and Climate Change	Air quality	Refer to „1. Air Pollution"above.					
7	Infectious Diseases such as HIV/AIDS	Number of infected patients Voices and complaints from the local community	Confirmation of health check list of workers (and preferably of local community) Confirmation of voices and complaints	Construction site and surrounding area	Monthly and when complaints are heard in this regard	Contractor in collaboration with regional government	MoEE	-

Source: E Guard Study Team

8.2 Air Quality Management Plan

Air quality monitoring should be carried out at proposed 18 villages two times a year. The quality of coal has to be maintained according to the design of the boiler. Electrostatic Precipitator (ESP), Flue Gas Desulphurization System (FGD System and also Selective Non-Catalytic Reduction System (SNCR) should be checked and maintained regularly to protect air pollution.

The following mitigation plan will be applied during operation phase.

1. Latest available and reasonable machines, equipment and methods are used to minimize air pollutions, such as installing Electrostatic Precipitator (ESP) to collect ash, Flue Gas Desulphurization System (FGD System) to reduce the emission of Sulphur dioxide and also Selective Non-Catalytic Reduction System (SNCR) to reduce the emission of Nitrogen oxides.
2. Flue Gas Continuous Emission Monitoring System is applied to check and keep the emission conditions of power plant within or not exceeding the standard values and to maintain a good operational condition.
3. Tree plantations are implemented around the Power Plant. This plantation can minimize dust dispersion generated from on-site transportation and coal stock pile.
4. Fence barriers are applied to minimize the air pollution at indoor and outdoor coal yard.
5. Wuxi Hua Guang Electric Power Engineering Co., Ltd. will have to form Environmental Management Committee under the guideline of MONERC, ECD and assign the Environmental Manager.
6. The Environment Manager shall be responsible for regular monitoring of emission level, inspection and testing of mitigation measures, environmental efficiency of the plant and regular reporting of the inspection.

8.3 Noise Management Plan

Noise level should be monitored two times per year at selected location within the power plant and at proposed eighteen villages within 5 km diameter centered from power plant. Tree plantation should be continued to carry out with the aim of minimizing the noise level. All equipment and mechanical machineries should have to be maintained and checked regularly. Noise from other source like vehicles associated with project should be controlled with acceptable mitigation measures.

8.4 Coal Transportation and Handling Plan

Conveyor belt is used to carry coal from coal mine which is located 1.43 km south-east direction from power plant. Indoor and outdoor coal yard with fence barriers are constructed in power plant to reduce dust emission. Mitigation measure for spontaneous combustion in coal should be implemented.

8.5 Water Quality Management Plan

Water quality sampling and monitoring should be carried out twice a year at selected location to control water quality changes of near creeks. Reduction pond of power plant should have to be maintained with good performance.

8.6 Water Usage Management Plan

Balu Creek is the main water source of power plant which is 10km away from the west side of the power plant. The water source is equipped with four intake pumps, which deliver the river water through the water pipeline to an industrial pool with a volume of 10,800 m^3. Water usage of power plant can be divided into two categories in which one is production water and the other is domestic and firefighting water. The main items of water usage are as follow:

1. Condenser‟s cooling water,
2. Cooling water for steam turbine oil cooler and generator air cooler,
3. Bearing cooling water,
4. Deaerator water supplementation,
5. Boiler slag washing water,
6. Rinse water for filter press,
7. Backwashing water for desulfurization tower and
8. Fire-fighting water and domestic water.

Water saving in power plant is an important task in conserving resources and energy. The main task of water saving is to use advanced technology to reduce water consumption and increase water reuse. Main works for water saving are

1. Increase the concentration ratio of circulating cooling water
2. Reasonable arrangement chemical device for backwashing water
3. Reasonable measures for boiler slag water
4. Reduce the amount of water usage during maintenance
5. Feasible management for fire-fighting water
6. Reasonable mitigation measures for wastewater from desulfurization tower
7. Prohibit the steam and water leakage in the production

8.7 Wastewater and Storm Water Management Plan

There are two kinds of power plant drainage. One is regular drainage and the other one is non-regular drainage.

Regular drainage is as follows;

1. Drainage of main workshop
2. Chemical water treatment plant drainage
3. Auxiliary equipment and machinery cooling water drainage
4. Domestic wastewater drainage
5. Regular discharge of boilers

Non- regular drainage comprises:

1. Wastewater from emergency maintenance of equipment
2. Wastewater from ash handling tank
3. Wastewater from chemical cleaning
4. Rainwater drainage

Overflow water from cooling tower named thermal effluent and wastewater from the drainage may decrease the water quality of the nearest creek where the wastewater is discharged. Reduction pond will reduce sediment, oil and grease, and especially water temperature. Sampling and monitoring of these discharged water and storm water should be carried out two times per year. If the monitoring results aren‟t within the national standard guideline value, feasible measures should be conducted in time.

8.8 Waste Management Plan

(1) Solid waste management plan

Solid waste generated from different sources like desulphurization system, office, staff housing, etc. must be efficiently collected, disposed at designated dump site. Especially, MgSO4 discharged from desulphurization system should be disposed separately at designated place. Recycle and re-use of waste should be carried out as a good practice.

(2) Ash management plan

Thigyit Coal Fired Power Plant discharged solid wastes such as fly ash and bottom ash etc. Power Plant must carry out mitigation measures as prescribed in the Environmental Management Plan. Fly ash msut be filtered and removed using electrostatic precipitator (ESP) and now fly ash is purchaseed to use in cement factory as ingredient. Discharged bottom ash had been dumped in the factory‟s yard systematically until last year but it was accumulated. Fortunately, the power plant found a good way that bottom ash can be reused in manufacturing of block brick. So brick manufacturing factory was built near water cooling tower of the power plant in April 2017.

8.9 Transportation Management Plan

In working area, the capacity of existing lanes should be checked and maintained to prevent any transportation accident case. Caution signs for speed limit and directions, etc. must be placed at appropriate places. Moreover, transportation of related products of power plant should be carried out within standard speed limit at daytime to prevent any transportation accident case in public area. There are seven main roads in the plant, for of which are transversal and 3 longitudinal. In order to meet the demands of the firefighting and transportation, a ring road along the enclosing wall is available. The widths of the roads are 8.0m, 6.0m and 4.0 m respectively. The radius of interior roads is 9.0m and 6.0m respectively. The road surface is C30 concrete surface, and the thickness is 20cm. The subsurface is 30 cm crushed stone.

There are two 8 m gates ate the southeast of the station. One is used by people and the other is used for transportation of coal and other materials. Coal is main materials transported to the plant by road but it is transported from Thigyit coal mine to the plant by enclosed conveyor. In addition to coal diesel oil and other material are also occasionally transported through the gate.

Qualified special vehicles must be used in the transportation of hazardous materials. Overloading and sprinkling are strictly prohibited in the transportation. Project should have a procedure in place that ensures compliance with the obligations of organization applicable to the transport of hazardous materials. The procedures for transportation of hazardous materials should include:

- Proper labeling of containers, including the identify and quantity of the contents, hazards, and shipper contact information
- Ensuring that the transportation of the volume, nature, integrity and protection of packaging and containers are appropriate for the type and quantity of hazardous material
- Ensuring adequate transport vehicle specifications
- Training of employees involved in the transportation of hazardous materials regarding proper shipping procedures and emergency procedures
- Providing the necessary means for emergency response on call 24 hours/day

(1) Preventive measures

The plan should include procedures to implement preventive measures specific to each transported hazardous material, including

1. Classification and segregation of hazardous materials in warehouses and transport units
2. Packaging and packaging testing
3. Marking and labeling of packages containing hazardous materials
4. Handling and securing packages containing hazardous materials
5. Marking and placarding of transport units

8.10 Occupational Health and Safety Plan (OHS Plan)

This occupational and safety plan is intended to implement during the construction and operation phases of the project. It aims to provide maximum safe and sound working environment for the workers on site. This plan will include the following aspects:

1. Health Care Services for Employees
2. Personnel Protective Equipment

(a) Health care services for Employees

1. Perform pre-medical checkup for employees at the time of employment
2. Provide annual medical checkup for all workers who are exposed to dusts
3. Provide appropriate first aid facilities at the plant
4. Organize first aid training for all employees
5. Monitor respiratory hazards like dusts produced due to transport, crushing, grinding and boiler operations.
6. Prevention mesures for workers with long exposure to fine particulate dust because they are at risk of contacting respiratory diseases caused by fine dust.
7. Appoint a medical officer to take care of any kind of sickness at worksite and treatment of employees
8. Prevention measures for physical injuries that may occur during the operation and maintenance activities

(b) Personnel Protective Equipment

1. Use of personnel breathing protection (e.g., masks respirators should be provided).
2. Workers may be exposed to excessive noise levels during machines operations. Noisy area should be identified at the plant and posted with signage to give warning to wear appropriate PPE.

8.11 Boiler Management Plan

(1) Boiler safety precautions to avoid boiler explosions

There are few common failures and causes of boiler explosion in power plants, such as failure of the safety valve, corrosion in boilers. Reckless management is the main cause of every accident. After extensive research on boiler explosion accidents and causes behind boiler blasts, we collected few industrial steam boiler safety precautions & tips for boiler maintenance staff.

1. Precautions to be carried out at Start in Steam Boilers
2. Precautions to be carried out Regularly
3. Precautions to be carried out Occasionally
4. Boiler Safety Precautions

(2) Precautions to be carried out at start in steam boilers

a. Hydraulic should be carried out at a defined pressure before the start of a boiler.
b. Check if the pump inlets are open at the start of a boiler.

c. Install an automatic ash removal system such as rotary valves in a boiler so as to prevent the accumulation of ash in a furnace or other equipment. The accumulation may result in the blockage or excessive heating of boiler parts resulting in its failure.
d. Pump priming must be done at the start of the boiler.
e. All loose and wrong connections must be checked and make sure to rectify the connections before starting your boiler.
f. A trained and a technical boiler operator must be hired for operating the boiler.

(3) Precautions to be carried out Regularly

a. Never operate boiler above the design pressure and check for the safe operation of Safety valves as well as fusible plugs.
b. Regular cleaning of the perforated line is necessary
c. Stainer must be installed before the pump & check for its proper functioning to remove dirt particles from boiler feed water as this prevents the blockage of a feed line.
d. Water must be treated before feeding it to the boiler to prevent the accumulation of dirt in a Boiler shell.
e. Regular inspection and maintenance of boiler including its accessories and valves to check for possible failures and cracks are necessary.
f. Make sure that the boiler vents are not restricted by any kind of obstruction such as cloth etc.
g. Always check for the leakages of steam, water, air and flue gases from any suspicious place.
h. Follow boiler manual for safe and efficient working of your boiler.
i. The panel should be cleaned regularly and should be kept in a cool and an isolated place away from your boiler.
j. Check if all the hot parts of the boiler are insulated, do not touch the parts with bare hands where the insulation is not provided.
k. Maintenance of both FD Fan and ID Fan is important and regularly check for greasing in all the movable parts for the ease of operation.
l. Regular cleaning of movable mechanical parts is necessary.
m. Do not increase the frequency of a drive above 50 Hz for the safe operation of motors.

14. Pressure switch, Mobley and Pressure Gauge should be checked for their proper functioning

(4) Precautions to be carried out occasionally

a. Occasionally clean the boiler tubes to prevent any ash deposition or scaling inside or outside the tubes. Failure to do so will affect the boiler efficiency and will eventually overheat the tubes leading to the tube leakage problems.
b. The ratio of primary and secondary air must be maintained in accordance with fuel feeding.
c. Periodically check burner operation back pressure and line pressure to prevent any thermal hazards.

(5) Boiler safety precautions

Info graphics have top tips for avoiding steam boiler explosions in steam plant. Steam Boiler safety precautions info graphics are print-friendly and use it as boiler safety manual for your boiler maintenance staff.

Safety Tips For Industrial Boilers	
1	**FOLLOW MANUFACTURE'S INSTRUCTIONS (USER'S MANUAL)** Boiler manufacturer"s instructions must be followed while operating boiler
2	**SAFETY FIRST** Boiler operator must wear safety shoes with non-skid soles
3	**TRAINING PROGRAMS** Boiler operator must be trained in safety prior to operation of the boiler & a training program should be established and maintained.
4	**EXHAUST VENTILATION** Effective exhaust ventilation must be provided to prevent air contamination
5	**ORDERLY ENVIRONMENT** Good housekeeping I essential for safety and good plant operation. A clean and orderly environment will foster safety.
6	**REGULAR CHECKUP** Periodically check and adjust burners operation to prevent any accident
7	**CARE OF NEIGHBORHOOD** Care must be exercised to prevent burns and other thermal hazards when near the boiler

8	**CAREFUL FUEL-PIPING CONNECTION** A working boiler utilizes fuels which are flammable and potentially explosive. Extreme care must be exercised when making fuel-piping connections.
9	**KEEP EYES ON LEAKAGE** A Rigorous leak check program must be implemented as part of the maintenance program
10	**REGULAR INSPECTION** Periodic inspection of boilers must be done to detect failure of components & metal cracking, etc.

8.12 Emergency Preparedness Plan

Addressing the preparedness for Emergency Management under the National Natural Disaster Management Law (2013) section 2 (b) states that "Natural Disaster means the destruction to the life and property, livelihood, infrastructures, safety and health of the public or to the natural environment due to natural or man-made accidents or dangers caused by industrial, chemical or nuclear accidents, oil spills or leakage of natural gas". Furthermore, according to section 15 (a) of the National Natural Disaster Management Law (2013), preparatory measures must be organized for planning emergency management before the Natural Disaster has occurred.

This is an emergency preparedness program for Thigyit coal fired power plant. A coal fired power plant like Thigyit is prone to have injury to its workers due to nature of operations.

The Manager has to send HSE Assistants to explain about the emergency preparedness plan written in Myanmar Language to the local administrators nearby and assist them to undergo on ground exercise, if in need. The Manager must have contact numbers of Local Fire Department, Police Department, and nearby Village Administrators, in case of emergency.

HSE Assistants has to explain to the local administrators that in case of emergency,

a. The manager will alert the public through open-air horn or siren and alarm systems
b. The manager will contact the local administrators and inform about the real situation of crisis to the local community in time
c. Emergency Response Team from the project must be vigilant to help assist any necessary support in that area, particularly for the villagers

(1) Emergency preparedness procedure

The equipment facilities required to deal with emergencies has to be identified at the very first situation. A list of actual equipment need to make available on site must include other sources of equipment that may be needed in the event of an emergency. Examples of equipment facilities include the following:

a. First aid supplies
b. Fire pumps and extinguishers
c. Rescue equipment
d. Equipment that can be assigned to an emergency task (e.g., bulldozer or excavator use to build roads and trails can be used in an emergency to dam or dyke a flood. Water truck for firefighting).
e. Industrial ambulance or emergency transport vehicle
f. Mustering points
g. External agencies that can source specific equipment, and
h. External agencies that can provide specific services

(2) First aid supplies

The most critical equipment required on site is adequate and appropriate first aid equipment and facilities. This equipment is essential for response to any illness or injury that persons may sustain. This first aid equipment must be adequate and appropriate.

a. Identify hazards which may cause an injury or illness (also consider workers‟ existing illness (e.g., diabetes, asthma, epilepsy, heart condition etc.)
b. Assess the risk based on the type and extent of injuries or illness that may occur.
c. Decide on the appropriate first aid equipment and facilities
d. Obtain the identified first aid equipment and facilities
e. Monitor and review first aid equipment facilities and services to ensure they continue to meet requirements
f. The first aid kit must be appropriate for the types of injuries and illness likely to occur at the coal fired power plant which will meet the immediate needs such as:
g. The first aid kit can be any size but must be large enough to fit all the required contents
h. A portable kit or multiple kits may be required
i. Consider placing appropriate kits in all mobile equipment
j. First aid kit locations must be clearly signed.
k. Include single use disposable items in the kit where possible. Reusable items must be cleaned, sterilized and disinfected.

(3) Training

All workers must receive basic first aid training as part of their induction. There is also a need to train some workers in more advanced first aid. Keep training records of the first aid training that workers have received. Names of first aid personnel and their competencies must be kept as part of the first aid team and displayed prominently in the work place.

Workers must have access at all times to trained first aid personnel who can undertake initial management of work related injuries or illness. If ongoing medical care or special medical care assistance is required, first aid personnel must recommend that a worker seeks further medical assistance.

First aid personnel must have current certified first aid qualifications. The level of these qualifications has to be based upon the following:

a. Be reliable
b. Be competent and familiar with the ERP and first aid equipment on site.
c. Have current certified first aid qualifications
d. Undertake the initial management of injuries and illness
e. Record details of first aid given, and
f. Remain calm in an emergency

(4) Communication

Effective communication is often the hardest element to initiate and sustain. The communication process must be outlined and needed to ensure workers along with external agencies are contacted and information transferred.

The following has to be considered:

a. There must be emergency alarm system so at to alert the worker in case of an accident, if possible flashing light system has to be adopted for the workers with earphones.
b. Regular drills have to be conducted on the alarm system.
c. Establish a list of emergency contacts and display this list near phones and radios
d. How will workers be accounted for during an emergency and where will they assemble (assembly point or muster point)
e. Assign a dedicated emergency frequency for radios
f. Find best coverage on site for mobile phones
g. Always have backup communication
h. Have spare batteries and power sources
i. Have regular meetings to keep workers informed of the emergency progress
j. Always have someone on site available for contact: don‟t leave phones or radios unattended
k. Identify how to control communications leaving site and persons seeking information from the site.

(5) Contact list

For Thigyit coal fired power plant, there must be a contact list for assistance in case of emergency. As a result, on becoming aware of an emergency they have to contact external help as soon as possible.

Wuxi Hua Guang (Myanmar) must post all contact persons or agencies phone numbers that may need to be contacted during an emergency at important places at the site.

Emergency Phone Numbers

- Fire Department
- Hospital
- Ambulance
- Police Department
- Township Administration Department
- Ministry of Natural Resources and Environmental Conservation
- Forest Department
- Information and Security Department
- Relief and Resettlement Department
- Social Welfare Department

8.13 Fire and Explosion Hazards

(1) Coal storage and preparation

Coal is susceptible to spontaneous combustion, most commonly due to oxidation of pyrite or other sulphidic contaminants in coal. Coal preparation operations also present a fire and explosion hazards due to the generation of coal dust, which may ignite depending on its concentration in air and presence of ignition sources. Coal dust therefore represents a significant explosion hazard in coal storage and handling facilities where coal dust clouds may be generated in enclosed spaces. Dust clouds also may be present wherever loose coal dust accumulates, such as on structural ledges. Recommended techniques to prevent and control combustion and explosion hazards in enclosed coal storage include the following:

Storing coal piles so as to prevent or minimize the likelihood of combustion, including:

a. Compacting coal piles to reduce the amount of air within the pile,
b. Minimizing coal storage times,
c. Avoiding placement of coal piles above heat sources such as steam lines or manholes,
d. Constructing coal storage structures with non-combustible materials,
e. Designing coal storage structure to minimize the surface areas on which coal dust can settle and providing dust removal systems, and
f. Continuous monitoring for hot spots (ignited coal) using temperature detection systems. When a hot spot is detected, the ignited coal should be removed.

Access should be provided for firefighting;

a. Eliminating the presence of potential sources of ignition, and providing appropriate equipment grounding to minimize static electricity hazards. All machinery and electrical

equipment inside the enclosed coal storage area or structure should be approved for use in hazardous locations and provided with spark-proof motors;
b. All electrical circuits should be designed for automatic, remote shutdown; and
c. Installation of an adequate lateral ventilation system in enclosed storage area to reduce concentrations of methane, carbon monoxide, and volatile products from coal oxidation by air, and to deal with smoke in the event of a fire.

Recommended techniques to prevent and control explosion risks due to coal preparation in an enclosed area include the following:

a. Conduct dry coal screening, crushing, dry cleaning, grinding, pulverizing and other operations producing coal dust under nitrogen blanket or other explosion prevention approaches such as ventilation;
b. Locate the facilities to minimize fire and explosion exposure to other major buildings and equipment;
c. Consider controlling the moisture content of coal prior to use, depending on the requirements of the gasification technology;
d. Install failsafe monitoring of methane concentrations in air, and halt operations if a methane concentration of 40 percent of the lower explosion limit is reached;
e. Install and property maintain dust collector systems to capture fugitive emissions from coal-handling equipment or machinery.

The procedure for firefighting is as follows:

a. In the event of fire near fuel depot, notify the office and evacuate
b. If you discover a fire in an early stage, notify the office by radio/phone fight with a fire extinguisher. When in doubt evacuate.
c. For any fire which could not be fought with a fire extinguisher, contact Pin Laung Township Fire Department, if required.
d. In Thigyit village tract, there is one fire sub-stations with 2 firefighting vehicles with 6 staff and also there is one firefighting vehicle in the coal fire power plant.

8.14 Wildlife Management Plan

The term wildlife is grouped into mammals, reptiles, amphibians, aves (birds) and entomophos (insects). These wildlife and their natural habitats are already degraded and their populations also decrease due to the establishment of industries and mining 15 to 20 years ago when natural environment, ecosystems and value of ecosystem components were not duly considered and properly meanged. To mitigate and conserve the existing situation the following implementation should be carried out:

a. To reduce bushmeat extraction by increased worker population, the management plan may include provision of environmental training on management issue, laws regulations and relevant penalties for the workers.
b. To educate raise awareness of the villagers and workers about the wildlife conservation law.
c. To establish the animal husbandry training and fish culture training and collective husbandry and fish culture practice in the community and workers. For this emplementation the investor should raise a fund from CSR fund.
d. Habitat restoration program has to be developed in the intact forest areas at the developer‟s expense.
e. The foraging areas of resident and migratory birds are to be protected and prepared for corridor habitat.

8.15 Rehabilitation and Revegetation Management Plan

The vegetation in the area can be classified as mix evergreen forest, pine forest and bamboo forest. The dominant plant species are *Schima wallichii* (DC.) Korth., *Cassia grandis* L. f. *Anneslea fragrans* Wall., *Syzygium cumini* (L.)Skeels, and *Phyllanthus emblica* L. in mix evergreen forest; *Pinus insularis* Endl., *Syzygium cumini* (L.) Skeels and *Ficus semicordata*; and *Dendrocalamus strictus* (Roxb.) Nees, and *Dendrocalamus membranaceus* Munro,. The cultivated vegetables are *Brassica oleracea* L. sub-sp. *capitata, Solanum tuberosum* L., *Lycopersicon esculentum* Mill,. and *Daucus carota* L.. The cultivated crops is *Oryza sativa* L.,. The fruit tree plantations are pear cultivation and avocado pear cultivation.

The forest restoration and revegetation should be implemented in the areas under the guidance and with the assistance of forest department. The buffer vegetation cultivation between the power plant compound and community villages should be implemented by planting the fast-growing tree species advised by forest department. The cost of restoration should be covered by the developer. When the coal-fired power plant started operation, approximately 5% of CSR funds will be used to support reforestation and revegetation program. The community forests should be developed in the degraded forest area for the local community who lost their vital ecosystem services of forest. For plantations of community forest and degraded forest restoration, ten native dominant species listed below should be planted.

Table 8.2 Ten dominant native species

No.	Common Name	Scientific Name	Family Name
1	Bon-me-za	*Albizia chinensis* (Osbeck)Merr.	Mimosaceae
2	Gyo	*Schleichera oleosa* (Lour.) Oken	Sapindaceae
3	Pan-ma	*Anneslea fragrans* Wall.	Theaceae

4	Taw-cherry	*Cassia grandis* L. f.	Caesalpiniaceae
5	Tha-bye	*Syzygium cumini* (L.)Skeels	Myrtaceae
6	Thit yar/Tha-khu-mu	*Schima wallichii* (DC.) Korth.	Theaceae
7	Tin-shu/Mee-ngo	*Pinus insularis* Endl.	Pinaceae
8	Wa-hti	*Dendrocalamus strictus* (Roxb.) Nees	Poaceae
9	Wa-ma	*Dendrocalamus membranaceus Munro*	Poaceae
10	Zi-phyu/Tha-la-me	*Phyllanthus emblica* L.	Euphorbiaceae

8.16 Cumulative Impact Assessment and Management Plan for Biodiversiy

Cumulative Impact Accessment (CIA) and management are complex, costly and time consumin. Cumulative impacts are those that result from incremental impacts of a project when added to other existing, planned, and/or proposed future projects and development.

The cumulative impacts include

1. Effect of ambient conditions such as incremental contribution of pollutant emusion in an airshed
2. Increase in pollutant concentration in water body, in soil or sediments or their bioaccumulation
3. Increase in sediment loads to the to watershed or increase erosion
4. Reduction in water flow in watershed due to multiple withdrawals
5. Interference with migratory route or wildlife movement
6. Decreased wildlife population due to increased hunting, roadkills, forestory operations
7. Depletion of forest as a results of logging or land use change by developing project

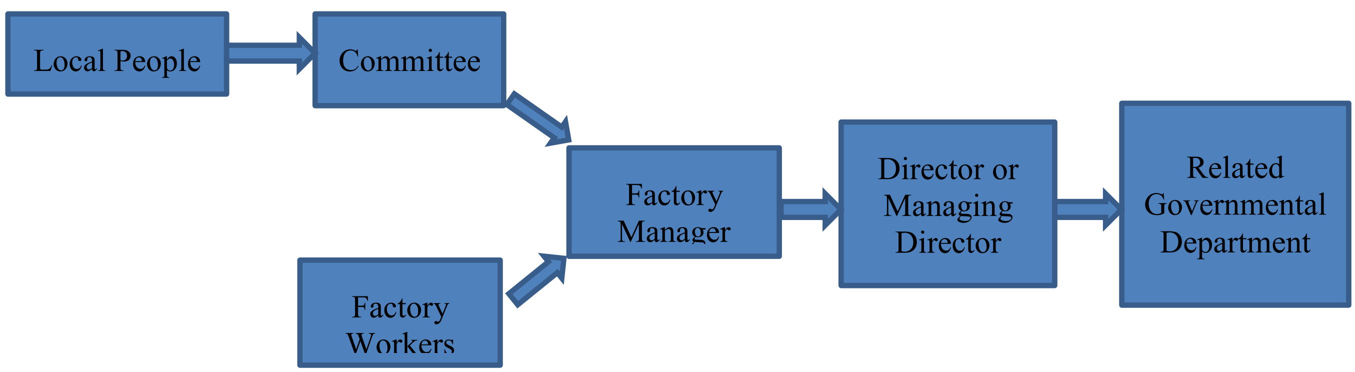
The scope of CIA must be properly defined. The good practice of CIA is to focus the assessment and management strategies over Valued Environmental Components (VECs). VECs are environmental and social attributes that are considered to be important in assessing risk. They may be

1. physical feature
2. habitat
3. wildlife population
4. ecosystem condition (i.e biodiversity)
5. social condition (i.e health, economics)
6. cultural aspects

The present survey area is a complex area in which industries and mining are located close to each other without buffer vegetation between them. Long-term operation will definately leads to the complex cumulative impacts. That is why cumulative impact assessment and management is vital.

8.17 Grievance Mechanism

To implement Grievae Mechanism Thigyit Coal-fired Power Plant established a committee which included local people from primary and secondary impact zone as members. Local people can disclose and submit the argument or unease with the committee member. Factory manager and committee member meet and discuss each other to solve the problems and complaints of community at briefing hall of Thigyit Coal-fired Power Plant every month. Factory workers can complain their grievances to their factory manager.



8.18 Corporate Social Responsibility Plan

Wu Xi Hua Guang (Myanmar) Limited will implement the Corporate Social Responsibility (CSR) Plan which intends to support 2% of annually profits for developing in economic condition for livelihoods of local people who are suffering from the impact of project. Funded for the intended for CSR plan will be managed under the authorization of Shan State Government, Electric Power Generation Enterprise (EPGE) and authorities of Pa-Oh Self-Administered Zone. The intended amount for CSR plan will have to be used in community developing plan for infrastructure such as electricity access, road construction, tube well construction and basic necessaries for schools and others.

8.19 Implementation of EMP and Environmental Monitoring Plan

The effective implementation and operation of EMP depends on regular monitoring. Wuxi Hua Guang (Myanmar) Limited should establish a directorate headed by a environmental health and safety manages. The organogram of the proposed monitoring directorate may be as shown in the following Figure.

9 Public Consultation and Disclosure

9.1 Stake Holder Engagement

Stake holder engagement and public consultation were carried out with concerned government organizations, persons affected by the project, NGOs and INGOs and others at least 7 times. The following table (9.1) shows the undertaking of Public Consultation.

Table 9. 1 Public Consultation Activities

No.	Date	Particular	Attendees
1.	24.4.2016	Environmental Impact Assessment (Scoping Stage) Stake Holder Meeting	Members from House of Nationalities, House of Representatives, Government Departments. NGOs/INGOs. Local Companies. Medias. Local People.
2.	8.11.2017	Explaining about the Environmental Impact Assessment Study concern with Thi gyit (Tigyit) Coal-fired Power plant to Dr. Nyi Nyi Aung, Minister of Natural Resources and Environmental Conservation	Minister of Natural Resources and Environmental. Members of Shan State Government. Members of Thi gyit (Tigyit) Coal Fired Thermal Power Plant and E Guard Environmental Services.
3.	23.10.2018	Site Visiting at Thi gyit (Tigyit) Coal-fired Power Plant and Explaining about EIA	Myanmar Centre for Responsible Business (MCRB) မှ Managing Director Ms. Vicky Bowman and members
4.	22.2.2019	Obtaining attitude and comments from Dr. Nyi Nyi Aung, Minister of Natural Resources and Environmental Conservation about the holding of Thi gyit (Tigyit) Public Consultation for EIA study (Village Level)	Minister of Natural Resources and Environmental. Members of Shan State Government. Minister of Roads and Transport.
5.	22.2.2019	Obtaining attitude and comments from U Khun San Lwin, Chairman of Pa'O Self-Administrative Zone about the holding of Thi gyit (Tigyit) Public Consultation for EIA study (Village level)	Chairman of Pa Oh Self Administration Zone. Members of Related Departments.
6.	From 23.2.2019 to 25.2.2019	Event for EIA prodcedure and Public Consultation (Village Level) of Thi gyit (Tigyit) Coal-fired Power Plant	Head of Village Tract, Head of Villages. Local People. Members of Thi gyit (Tigyit) Coal Fired Thermal Power Plant and E Guard Environmental Services.

7.	7.5.2019	Environmental Impact Assessment Public Consultation	Members from House of Nationalities, House of Representatives, Government Departments. NGOs/INGOs. Local Companies. Medias. Local People.

Table 9.2 Meeting with concerned government organizations

E Guard Environmental Services Co., Ltd. **Meeting Minutes**	
Description: Obtaining attitude and comments from Dr. Nyi Nyi Aung, Minister of Natural Resources and Environmental Conservation about the holding of Thi gyit (Tigyit) Public Consultation for EIA study (Village Level)	**Date:** 22nd February, 2019
Place: Shan State Government Office (Taunggyi)	**Time:** 9:00am to 12:00pm
Attendents list: Government = 6 E Guard Environmental Services = 4 Wuxi Huaguang Electric Power Engineering Co., Ltd. = 3 Total = 13	

Agenda

1. Presentation of Environmental Impact Assessment (EIA) process Thi gyit (Tigyit) coal fired power plant by **E Guard Environmental Services Co., Ltd.** and obtaining altitude from Dr. Nyi Nyi Aung, Minister of Natural Resources and Environmental Conservation about the holding of Thi gyit (Tigyit) Public Consultation for EIA study (Village level)

2. Obtaining comments from Dr. Nyi Nyi Aung, Minister of Natural Resources and Environmental Conservation.

Comments

(1) As for E Guard Environmental Services, the actual potential impacts of the power plant on the environment and their mitigation measures have to be precisely presented when describing the environmental impact assessment of the power plant.

(2) For effective assessment of air pollution, fuels used for cooking (eg. firewood, coal) and for vehicles (eg. motorcycle, trailer) by each household obtained from the result of social survey conducted on 24 villages have to be clearly described.

(3) Among the results of noise measurements in 18 villages, noise levels for most villages are found to be higher than the National Environmental Quality (Emission) Guideline. Therefore, the reason for why it is higher than the guideline has to be clearly stated.

(4) As for **Wuxi HuaGuang (Myanmar) Limited**, Sound Level Meter should be equipped in the project site and they have to continuously monitor the noise level in project area.

(5) The main difficulty of the villages, where social survey is conducted, is the availability of water and hence if the power plant plans and manages for water distribution to these villages, their attitudes toward the power plant will become more positive. Development fund should be distributed according to CSR Plan and also in line with the village level water supply plan implemented by Ministry of Agriculture, Livestock and Irrigation.




Meeting Records

Table 9.3 Meeting with authorities of Pa'O Self Adminstrative Zone

E Guard Environmental Services Co., Ltd. **Meeting Minutes**	
Description: Obtaining attitude and comments from U Khun San Lwin, Chairman of Pa'O Self-Administrative Zone about the holding of Thi gyit (Tigyit) Public Consultation for EIA study (Village level)	**Date:** 22nd February, 2019
Place: Pa‟O Self-Administrative Zone Office	**Time:** 1:00pm to 3:00pm
Attendents list: Government = 6 E Guard Environmental Services = 4 Wuxi Hua Guang (Myanmar) Limited = 3 Total = 13	

Agenda

1. Presentation of Environmental Impact Assessment (EIA) process Thi gyit (Tigyit) coal fired power plant by **E Guard Environmental Services Co., Ltd.** and obtaining altitude from U Khun San Lwin, Chairman of Pa'O Self-Administrative Zone about the holding of Thi gyit (Tigyit) Public Consultation for EIA study (Village level)

2. Obtaining comments from U Khun San Lwin, Chairman of Pa'O Self-Administrative Zone

Comments

(1) In village level public consultation, **E Guard Environmental Services** has to be clearly presented the measured results of environmental monitoring process so that there will be no misunderstanding among the local people.

(2) There is a Pat Ta Lae spring within 5km from the power plant. Since it serves as a major water source for nearby villages, we would like to know the water quality of that spring. As a chairman of Pa"O self-administrative zone, I think we can fulfill water demand of nearby villages from that spring and so I would like to request you to cooperate with us for implementing this plan.

(3) As for **Wuxi Hua Guang (Myanmar) Limited**, they have to try their best to control every potential error in their process to minimize the impacts on environment and people. They should also dispose all the produced wastes in an environmentally friendly manner and should implement plantations around the power plant to improve the visual amenity.

(4) Although the brick made of Bottom Ash is good in quality, we heard that its demand in the local market is still low and so **Wuxi Hua Guang (Myanmar) Limited** should focus more on this issue. If not, more and more bricks will become left for storage in the project area and that may eventually lead to soil degradation in future which in case may incur more cost to company. In my opinion, providing home delivery service may increase the brick selling rate.

Meeting Records

Table 9.4 Public Consultation (Village Level)

<table>
<tr><td colspan="2">E Guard Environmental Services Co., Ltd.</td></tr>
<tr><td>Content-
Event for EIA prodcedure and Public Consultation (Village Level) of Thi gyit (Tigyit) Coal-fired Power Plant</td><td>Date- From 23/February/2019 to 25/February/2019</td></tr>
<tr><td>Places-
1. Shan Cherry Hall, Tigyit Village
2. Taung Po Monastery
3. Naung Mon Monastery
4. Naung Mu Monastery
5. Mee Thway Chaung Monastery
6. Myin Twin Monastery
7. Pin Mhi Kone Monastery</td><td>Time-
Morning- From 9:00 AM to 12:00 PM
Noon- From 1:00 PM to 3:00 PM</td></tr>
<tr><td colspan="2">Attendance List -
Residents- Southern Tigyit (10)၊ Northern Tigyit (1)၊ Central Region of Tigyit (4)၊ Mya Kan Thar(5)၊ Pyin Thar (3)၊ Thar Yar Kone (5)၊ Benh Mat (2)၊ Phayar Ngar Su (0)၊ Se Khaung (15)၊ Mon Pin (19)၊ Kone Thein (4)၊ Naung Mon (9)၊ Naung Mu (25)၊ Pin Mhi Su (1)၊ Kant Kaw Pin (2)၊ Lwin (၂)၊ Pat Ta Lei (3)၊ Mee Thway Chaung (66)၊ Kyat Thon Kone (0)၊ East of Myin Twin (37)၊ West of Myin Twin (38)၊ Taung Chay (17)၊ Mya Sein Taung (2)၊ Pin Mhi Kone (87)၊ other villages (8)
Tigyit Coal-fired Power Plant-3
Adin Energy Company Limited-1
Police Station-2
Total- 371
Note: Only counted the people who signed in the attendance list.</td></tr>
</table>

The explanation about the Environmental Impact Assessment and the public consultation for village level event was held at Shan Cherry Hall (Southern Tigyit) and six monasteries. The event is for the 24 villages where social survey has done. The main purpose is to present the environmental quality results and social survey results which were done by E Guard Environmental Services to the villages. So the residents can openly discuss about the power plant.

The Agenda

1. Explaining about the public consultation for village level by Wuxi Hua Guang Electric Power Engineering Co., Ltd.
2. Presenting about the procedure of Environmental Impact Assessment-EIA), the results of environmental quality and social survey by E Guard Environmental Services.
3. Discussing by the attendances.

(1) Location	**- Shan Cherry Hall (South of Tigyit)**
Time	**- Morning (9 AM to 12 PM)**
Date	**- 23 Febuary 2019**
Attended Village	**- South Tigyit, North Tigyit, Middle Tigyit, Mya Kan Thar Village**.

Questions and Answers

(a) U Win Thant (Local, Mya Kan Thar Village)

Question: About Land Acquisition, we would like to ask you to give us back lands beside conveyer line which were acquired.

U Win Htay (Deputy Chief Engineer, Thi gyit (Tigyit) Coal-fired Power Plant)

Answer: Lands beside conveyer line were acquired by ministry since they were defined lands. Moreover, Dry Coal Plant was being planned to build in these areas. So that Department of Agriculture and Land Management Statistics acquired those lands.

(b) U San Lwin (Villager, South Tigyit)

Question: Inherited lands were acquired by coal mine and we do not receive compensation.

U Soe Win (Manager, Adin Power Company)

Answer: When we defined the land for coal mine in 2013, lands which were mentioned by U San Lwin were shown as without owners. Those ownerless lands were included in the area of Farmland Rules (39). Moreover, grandparents of U San Lwin lived in South Tigyit. However, the lands lived by your grandparents do not include in the area of Farmland Rules (39). Although the compensation case was already proposed officially, it was happened in 2013-2014 and there were changes in 40 Departments of Agriculture and Land Management Statistics. So when we proposed about the compensation, we faced some difficulties.

U Aye Thiha (Managing Director, E Guard Environmental Services)

Answer: Although it is not related to coal mine and plant, I would like to say is that when Department of Agriculture and Land Management Statistics stated if ownerless lands were acquired, there might be no compensation. I want to advise you to discuss with each other about the problems. Moreover, we will write about this case in report.

(c) Tin Own (Representative of Hundred Households, South Tigyit)

Question: We would like to ask you to do landfill in the area of pagodas which were collapsed during coal mining. We also want you to consider the local people for employees.

U Soe Win (Manager, Eden Power Co., Ltd.)

Answer: The landfilling is the must do process for us. Moreover, we will promise to fill all the lands which were bulldozed. The other thing is in total of (540) employees, (340) of them are from Taung Gyi, Aung Pan, Tigyit, Kalaw, Nant Taing and Naung Tayar. We are also planning to employ local people in professionals‟ field. In addition, U Aye Thiha (Managing Director of E Guard Environmental Services Co., Ltd.) aslo said to submit the application forms who would like to apply the jobs.

(d) U Maung Sein (Villager, South Tigyit)

Question: In the places where blasting of mine has been doing, there are high chances to happen landscape and collapsing of homes. So it would be better to reduce blasting.

U Soe Win (Manager, Eden Power Co., Ltd.)

Answer: Since it is coal mining, blasting is a part of process that we have to do. But during blasting, the villagers have to suffer some uncomfortable conditions due to the vibration, we were planning to use small scale mine.

Consultation with Attendees (Shan Cherry Hall)

(2) Venue - **Taung Po Gyi Monastery**
Time - **Afternoon (1pm to 3pm)**
Date - **23 Febuary**
Attended Villages - **Pyin Thar Village, Thar Yar Gone Village, Bank Mart Village and Phayar Ngar Su Village**

Questions and Answers

(a) U Zar Yein (Farmer, Lal Thwe (South))

Question: The impacts caused by the project have been decreased later and it is convenient for us because of your effort in controlling the impacts. In previous time, we needed to clean our houses three to four times a day due to the accumulation of excessive ash and smoke. Now the situation becomes better and we would like to encourage the responsible persons to keep up their efforts to their best. Local people will tell the truth whatever it is good or bad for them. In the case of development funding, although the villages distant to the project have received the development fund, some affected villages have not received the fund. For us, we have suffered the impacts and our farms and properties have also been seized during the project implementation. So, we would like to live better without having to experience like this again and would like to receive more development funding for us. We also would like to get the electricity.

U Win Htay (Deputy Chief Engineer, Thi gyit (Tigyit) Coal-fired Power Plant)

Answer: For those villages that have not received the development fund should submit the formal letter to the responsible department by describing the reasons why they should get the development fund more than other villages. We have already been implementing for providing the electricity.

(b) U Soe Min (Farmer, Pyin Thar)

Question: There had been one destruction case caused by power plant. Before the end of rainy season, the discharged water from power plant has been overflowed into the village‟s water ditch and the crops have been destroyed because of that. It had been two years ago and after that there has been no similar case.

U Win Htay (Deputy Chief Engineer, Thi gyit (Tigyit) Coal-fired Power Plant)

Answer: Back then, the water pumped from sediment settling pond had been used for spraying over grasses which accidentally overflowed into the surrounding farms land and caused the destruction. We had been recorded that case and try our best not to happen like this again in the future. Now the discharged water from the plant can be used in farming. Is there anyone who currently used water from power plant for farming?

U Ba Aung (Farming| Lal Thwe (North))

Answer: Yes, I am and those discharged water from power plant is helpful for me in farming.

U Win Htay (Deputy Chief Engineer, Thi gyit (Tigyit) Coal-fired Power Plant)

Answer: You can also suggest your opinion freely on the usage of these discharged waters to responsible department.

(c) U Soe Min (Farmer, Pyin Thar)

Question: Development fund distribution seems to be unfair. It should be given based on the significance of the impacts. Earlier, you said that we should submit the formal letter to responsible department. However, we simply don‟t want responsible person or department to act only when they received such kind of letter. Moreover, we don‟t know where to submit the letter and it is also difficult for us to reach to the high rank officials. For power plant side, they try their best to make us convenient.

U Win Htay (Deputy Chief Engineer, Thi gyit (Tigyit) Coal-fired Power Plant)

Answer: For this case, what I would like to suggest is that you can write the letter first and then submit it when the high rank officials are coming to your village or when you get chance to submit it. I also would like to suggest you to write the development fund request letter by combining four or five villages instead of one village. It would be more effective.

(d) U Soe Min (Farmer, Pyin Thar)

Question: Have you performed the environmental impact assessment every year? **U Win Htay (Industrial Manager, Tigyit Coal Fired Power Plant)**

Answer: Environmental impact assessment will be carried out by third-party organization and they will undertake this process according to the contract with us. However, environmental monitoring process will be continued continuously after the preparation of the EIA report.

U Aye Thiha (Managing Director, E Guard Environmental Services)

Answer: As a third-party organization, we will release environmental impact assessment (EIA) report to the public transparently and in that report, there will be environmental monitoring implementation programs together with the company commitment letter to follow these programs. In the case when the company doesn‟t follow the program, you can complain it to the ministry about that.

(e) U Khun Do Yay (Farmer, Bam Met)

Question: We would like to request you to construct sports ground in our village. Currently, our children needed to go to other villages for sports due to the lack of sports ground in our village. I would like to request to carry out appropriate action so that our children will be convenient.

U Win Htay (Deputy Chief Engineer, Thi gyit (Tigyit) Coal-fired Power Plant)

Answer: Please submit proposal for constructing sports ground in your village. I will also report it back to the responsible persons in power plant.

Consultation with Attendees (Taung Po Gyi Monastery)

(3) Place - **Naung Moon Monastery**

Date - **24 Febuary 2019**

Time - **Morning (9:00 AM to 12:00 AM)**

Attended Villages - **Sae Gaung Village, Moon Pin Village, Kone Tein Village, Naung Moon Village**

<u>Questioning and Answering</u>

(a) U Htun Hlaing (Village Administrator, Sal Gaung Village)

Question: We have known that there has been a positive and negative impact in the environment by the project. And we also know that air, water, odor and noise are emitted by the coal fired plant. Therefore, how will you do and take actions for the health of residents. Besides, the stream from the Than Tae Creek which is near the Sae Gaung Village is precipitated and turbid by the coal mine. So how would you clean up the turbidity? Furthermore, the project proponent needs to arrange the educational seminars of environment for improving the knowledge of residents.

U Aye Thiha (Managing Director, EGuard Environmental Services Co., Ltd)

Answer: Environmental monitoring (e.g. air monitoring, water monitoring, etc.) has not finished yet. Air, water, odor and noise are monitored and reported to the related government in every three months and will announce subsequently to the public. In the case of having the suspended solids along the stream, we will have to discuss with Aden Coal Mine and report soon. For the residents, we will report the relevant government and hold the educational seminars of environment for knowledge.

Consultation with Attendees (Naung Moon Monastery)

(4) Venue - **Naung Mu Monastery**

Date - **24 Febuary 2019**

Time - **Morning (9:00 AM to 12:00 AM)**

Attended Villages - **Naung Mu Village, Pin Sein Su Village, Gant Kaw Pin Village Lwin Village and Pat Ta Lae Village**

<u>Questions and Answers</u>

(a) U Thein Aung (Kant Kaw Pin Village)

Question: Since the advantages and disadvantages are always together, the people who can get advantages will always good. For example; if residents have to suffer some effects, which kind of methods can be used to reduce those effects or what kind of methods to reduce carbon dioxide not to affect the health and environment? If the road construction is being planned, it would be better to use bitumen.

Daw Yu Wai Yan Thein Tan (Senior Consultant, E Guard Environmental Services)

Answer: The plant has to measure the qualities of air, water, and smell once in four months. They also made a promise to do the measurement and it is also included in a report officially. If they do not follow the rule, they can be sued. For the measurements, only the third party which is not from government or from the plant has the authority to do. The results will be checked by Ministry of Natural Resources and Environmental Conservation. We found that some of the household store the chemical fertilizer in their home during social survey; this one also can affect the health. So these chemical fertilizers should be kept outside of the houses. Since most of the farms are on the mountains, people cut the trees which can lead to deforestation. This can also cause drought. So we also suggest using the other fuels instead of firewood.

U Win Htay (Deputy Chief Engineer, Thi gyit (Tigyit) Coal-fired Power Plant)

Answer: We will make sure to measure the air, water, noise, etc. qualities. Since the mining area is also close to the plant, the effects are not directly from the plant. To get water in Kant Kaw Taw Village, we are planning to install monitor which has 400 kilowatt according to CSR plan. We are also planning to install the dried coal plant system to extract full electricity near the farm which is close to the machine carrying the coals from mining area to plant.**(b) U Saw Aung (Pin Sein Su Village)**

Question: Since the ashes are dumped near Pin Sein Su village, there are dusts whenever the cars pass.

U Win Htay (Deputy Chief Engineer, Thi gyit (Tigyit) Coal-fired Power Plant)

Answer: Even though, the road was made by rocks in the past, we could not afford to use sand after years. That‟s why the rocks from the base come to surface. So we are also planning to construct the road again by using rocks before rainy season.

(c) U Zaw Hla (Naung Mu Village)

Question: The smell and noise effects can be felt clearly. It would be better to explain like this for the air, soil and water quality to let people know more clearly.

Daw Yu Wai Yan Thein Tan (Senior Consultant, E Guard Environmental Services)

Answer: The plant has to write a report about the environmental qualities they measure once in four months. They also have teams who study and examine the dust by using instrument twice in a week. We also suggested to the plant to reveal the measured results to the public.

U Win Htay (Deputy Chief Engineer, Thi gyit (Tigyit) Coal-fired Power Plant)

Answer: Since we have some difficulties to show the results to the public, everyone who wants to know can contact the Industry. We also installed the system to monitor the gas emission for 24 hours at the chimney. After 24 hours, we also have to send the results to the Shan State Government, Local Department and ministries. There are also control factors in extracting the electricity. Trees are also planted to reduce the dispersion of dust. The ashes are also sold by related department. The tiles produced from the industry are now bought from the outside.




Consultation with Attendees (Naung Mu Monastery)

5. Location - **Mee Thway Chaung Monastery**

Date - **24 Febuary 2019**

Time - **Afternoon (1 PM to 3 PM)**

Attendance Villages - **Mee Thway Chaung Village, Kyat Thon Kone Village**

Questions and Answers

(a) U Sai San Paw (Chairman, Mee Thway Chaung Village)

Question: Even though our village is near, we do not receive any compensation. But Pan Pee Village which is far away from the project received the compensation.

U Win Htay (Deputy Chief Engineer, Thi gyit (Tigyit) Coal-fired Power Plant)

Answer: I remember that you also mentioned that case at Taung Pot Kyee Monastery. Since the factory is not directly related to the distribution of compensation, you have to propose with letter whether you must deserve the compensation or not. We are not in the place to decide which village should get compensation. Now we are explaining is about the survey of the villages around 2 or 3 miles of Factory and we have to submit the results to the government. E Guard Environmental Services Team has to present the public perception and finding. Although the compensation is not related to this matter, you have to propose with official letter.

Question: The situation is not the same as before. In the past, there was no water shortage but nowadays we face that kind of problem and the soil is also damaged. So we wonder, these problems are because of coal.

U Win Htay (Deputy Chief Engineer, Thi gyit (Tigyit) Coal-fired Power Plant)

Answer: If we have to answer, there are a lot of possibilities like it could be coal or factory.

(b) U Soe Thein (Farmer, Mee Thway Chaung Village)

Question: Three months ago, the other team came and tested water, air and soil condition and did public consultation about the factory. But there are some factors which are little bit different between that team said and you did. The professionals said that because of the factory, there might be some danger for local people. But now the way you said looks like there might be less danger. Moreover, how much insurance for the instruments you used?

Daw Yu Wai Yan Thein Tan (Senior Consultant, E Guard Environmental Services)

Answer: Our Company is licensee from Government. Moreover, I am not the only one who wrote the report. There were many professionals who participated. Our survey questionnaire was also allowed by the government of Shan State before asking the local people. Not only our company is licensee, but also each of our professionals also has. The instruments that we used are also certificate for regular checking. So we can guarantee that the instruments can be trusted. We are the third party, not from factory or government. So about the perception of public which was written in the report are all true. Our company is also not supported by international or any party. That is the reason why you can trust our company fully since we are fair. We had done survey, and also went to Tigyit Hospital finding out that there were some abortions but it only happened once in a year. There was no death from lung cancer due to the dust emitted from factory. We also found out that the people in Thar Yar Gone Village and Pyin Thar Village store their onions and fertilizers under their houses. This also have impacts on local people like factory. We also informed the people to open the windows to get fresh air and to store their onions separately. The sources of the impacts can be factory or mine or cement factory or storing of fertilizer and onions at the houses.

Question: In our country, it is true that we need electricity. But the way you said looks like there is no danger. From my point of view, even the government said that coal can be danger.

U Aung Myint Myat (Associate Consultant, E Guard Environmental Services)

Answer: For our country, the easiest, cheapest and the most advantageous way to get electricity is from the production of coal. That is the reason why we produce electricity from coal-fired factory. However, the methods to reduce the environmental impacts are mentioned in ESIA. Moreover, the Shan State Government will also monitor.

Question: If mine is extended in the future, our farmers will lose farmland.

Answer: ESIA report that is being done by us is only for Tigyit Coal-fired power plant, not for mining.

Question: Since we do not get enough electricity, people in our country have to work abroad. If mine is extended in the future, we may lose our farmland to work and may also go abroad.

Answer: If you have official papers to prove that the farmland is owned, then there is no need to be worry about. Moreover, you can also solve this kind of problem legally as long as you have evidences to show.

Consultation with Attendees (Mee Thway Chaung Monastery)

(6) Avenue	**- Myinn Twin Monastery**
Date	**- 24 Febuary 2019**
Time	**- Afternoon (1:00 PM to 3:00 PM)**
Attended Villages	**- Myinn Twin Village (East), Myinn Twin Village (West), Taung Chay Village**

<u>Questioning and Answering</u>

(a) U Oak (Village Administrator, Myinn Twin Village (East))

Question: We like having the dust control system of the project. But we are affected more or less by the project. For village, monastery road and village roads need to be good. Sometimes, we could not drink the water from Than Tae Creek because there is oil, grease and suspended solids in the water. And also we get a little water for agriculture. So how will you do and manage.

U Zaw Ko Ko Latt (Superintendent Engineer, Tigyit Coal-fired Power Plant)

Answer: You can get and take fly ash for access road construction at any time. And you can also take and get it for construction and village development activities at any time.

U Aye Thiha (Managing Director, eGuards Environmental Services Co., Ltd)

Answer: We will engage these requirements with the responsible person of power plant and perform well. If there is oil and grease in the water or unsatisfied situation, you can inform the power plant. On the other hand, the power plant manages not to discharge the impurities or suspended solids into the creek. In the case of having a little oil and grease in the water, it may be happened by dumping the domestic wastes or washing the cars and motorcycles near the village stream.

(b) U Htwat Pu (Village Administrator, Myinn Twin Village (West))

Question: Although our villages are included in the first decision of getting CSR, ours are not included in the second decision. Our three villages do not get any CSR. So, why did not we get CSR and how will you do that.

U Zaw Ko Ko Latt (Superintendent Engineer, Tigyit Coal-fired Power Plant)

Answer: We (power plant) are not decided to distribute CSR for the villages. We only inform and report the budget of CSR to the local authorities and Hluttaw Representatives and then they decide which village gets CSR or not. We (power plant) do not have authority to decide it.

U Aye Thiha (Managing Director, eGuards Environmental Services Co., Ltd)

Answer: We will make a list for not getting CSR of villages and report to the relevant government. As for us, we will report to the relevant government for the villages which did not get CSR for getting CSR as priority.

Consultation with Attendees (Myin Twin Monastery)

(7) Location - Pin Mhi Gone Monastery

Date - 25 Febuary 2019

Time - Morning (9 AM to 12 PM)

Attendance Village - Mya Sein Taung Village, Pin Mhi Gone Village

Questions and Answers

(a) U Maung San (Taung Yar, Pin Mhi Gone Village)

Question: In rainy season, the students have some difficulties on the way to school so we would like you to support the reasonable and convenient road around the village. The vibration which is appeared by blasting of the coal mine also should be needed to reduce. For village, we need hall, chairs and plates.

U Zaw Ko Ko Latt (Superintendent Engineer, Tigyit Coal-fired Power Plant)

Answer: The ash emitted from the factory is third class of cement and can be used in road and building construction. You can ask the ash from the factory if you need something for village. For vibration from coal mine, the authorized person from Adin Coal Mine will answer your questions.

(b) U Aung Thar (Farmer, Pin Mhi Gone Village)

Question: How to reduce vibration from mining?

U Zaw Ko Ko Latt (Superintendent Engineer, Tigyit Coal-fired Power Plant)

Answer: We will discuss about the methods to reduce the vibration from mining. For village, we are willing to provide vehicles if you need for construction.

(c) U Khun Aung Naing (Farmer, Mya SeinTaung Village)

Question: Even though our village is the nearest to the village, we do not get CSR. We asked about CSR and we need more CSR in next year.

U Zaw Ko Ko Latt (Superintendent Engineer, Tigyit Coal-fired Power Plant)

Answer: About CSR, Wuxi Hua Guang Electric Power Engineering Co., Ltd. has no liberty to manage the fund of Corporate Social Responsibility (CSR) Plan. It is managed by the authorized person. In coming years, we will submit to those authorized person to be provided CSR"s fund for the villages which did not received.

(d) U Khun Aung Naing (Farmer, Mya Sein Taung Village)

Question: We asked three lampposts and 7000 feet wires for village.

Answer: Since **Wuxi Hua Guang (Myanmar) Limited** has responsibility for lampposts, we will discuss about it and give you answers as soon as possible.

Question: Adin Mining provided us ten million for the village hall, and we would like to ask the factory to provide us 600,000 kyats.

Answer: U Zaw Ko Ko Latt answered that he will discuss that matter with the authorized person as soon as possible.

Question: I would like to ask to check the villagers‟ health condition once in a month.

Answer: U Aye Thiha, the Managing Director of E Guard Environmental Services answered that Wuxi Hua Guang have to provide health professors to check the health condition of villagers by free charge.

Consultation with Attendees (Pin Mhi Gone Monastery)

Table 9. 5 Public Consultation of EIA at Taung Po Kyee Monastery

E Guard Environmental Services Co., Ltd.	
Subject- Presentation of Environmental Impact Assessment (EIA) and Public Consultation of Thi gyit (Tigyit) Coal Fired Thermal Power Plant	**Date- 7 May 2019**
Place- Taung Po Gyee Monastery, Thi gyit (Tigyit) Village, Pin Laung Township, Southern Shan State	**Time- From 9:00 AM to 12:00 PM**
Attendee Lists **Local- South of Thi gyit (Tigyit) (6), North of Thi gyit (Tigyit) (0), Center of Thi gyit (Tigyit) (4), Mya Kan Thar (6), Pyin Thar (28), Thar Yar Gone (83), Banh Mhat (31), Phayar Ngarr Su (53), Sel Khaung (3), Mon Pin (2), Kone Thein (2), Naung Mon (1), Pin Sein Su (2), Kant Kaw Pin (2), Lwin (2), Mee Thway Chaung (95), Kyat Thon Kone (0), Myin Twin (3), Taung Chay (4), Mya Sein Taung (4), Pin Mhi Kone (29), Other Villages (12), Naung Mu (0), Pat Ta Lei (0), Interested Party (2).** **House of Nationalities – 1** **House of Representatives- 4** **Government Departments – 59** **NGOs/ INGOs- 21** **Public Companies- 25** **Medias- 20** **Total- 506** **Note:** Only counted the people who signed in the attendance list.	

The presentation of Environmental Impact Assessment (EIA) and Public Consultation of Thi gyit (Tigyit) Coal Fired Thermal Power Plant was held on 7th May, 2019 at Taung Po Gyee Monastery. Monks, Shan State Government, Ministry of Electricity, Energy and Industry, House of Nationalities, House of Representatives, government staff, Staff from Pa'O Self Aministration Zone, Representatives of State Assembly, NGOs/ INGOs. Medias and local people attended the event.

Agenda:

Agenda 1	Opening the Ceremony
Agenda 2	Opening Remarks by U Ku Ta La, Presiding Monk at Taung Po Gyi Monastry
Agenda 3	Opening Remarks by U Sai Shan Ta Lon, the Minister of Electricity, Energy and Industry (Shan State)
Agenda 4	Opening Remarks by U Khun San Lwin, Chairman of Pa"O Self Administration Zone
Agenda 5	Presentation of Background History by U Soe Win, Chief Engineer of Electric Power Generation Enterprise, Ministry of Electricity and Energy
Agenda 6	Presentation of Project Summary by Mr. Shen Guaqiang, General Manager of Wuxi Huaguang (Myanmar) Co., Ltd.
Agenda 7	Presentation of Environmental Impact Assessment by U Aye Thiha, Managing Director of E Guard Environmental Services.
Agenda 8	Discussion
Agenda 9	Additional Comment by Dr. Zaw Win Myint, Member of Electricity and Energy Development Committee, Pyithu Hluttaw
Agenda 10	Closing Remarks by U Sai Shan Ta Lon, the Minister of Electricity, Energy and Industry (Shan State)
Agenda 11	Closing the Ceremony

1. Opening Remarks by Sayardaw U Ku Ta La, Presiding Monk at Taung Po Gyi Monastery

Firstly, Presiding Monk at Taung Po Gyi Monastery, Sayardaw U Ku Ta La gave the five percepts to the audience and then wishes everyone to be free from enmity and danger. He also told the audience to carry out the consultation process peacefully without any disputes He also suggested everyone to discuss with positive attitude and should only tell the truth without any bias. Sayardaw also said that Shan State Government and responsible persons have the responsibility to implement the project without causing any impacts on human and environment. In conclusion, he wishes the power plant to continue in future and he also told the audience to discuss in peaceful manner whether the project continues or not in future.

2. Opening Remarks by U Sai Shan Ta Lon, the Minister of Electricity, Energy and Industry (Shan State)

Firstly, the Minister greets all the audience coming to the public consultation. He then gave the following opening remarks. "Today public consultation is held with the purpose of discussing with local people about the project transparently. Within 3 year period of our government, our main purpose is to provide the basic facilities, such as transportation, water and electricity, to public. Among these facilities, we mainly focus on electricity as it is one of the essential requirements for the development of our country. Current electrical demand of our country is still beyond our production capacity and hence we try our best to overcome this challenge in every possible ways. I also would like to encourage all the audience to support the government in implementing this goal. In today consultation, results and findings of current EIA study and other information related to the Thi gyit (Tigyit) Coal Fired Power Plant will be presented by respective persons. In conclusion, the Minister encourages all audience to participate the consultation in positive attitude and to support the government in respective sectors."

3. Opening Remarks by U Khun San Lwin, Chairman of Pa'O Self Administration Zone

U Khun San Lwin first paid homage to the presiding monks of various monasteries nearby and thanks to presiding monk of Taung Po Gyi Monastery for allowing holding today public consultation for Thi gyit (Tigyit) Power Plant Project. He also wishes all the audience to be free from enmity and danger and then gave the following opening remarks. "Both local people and respective authorities need to be cooperating with each other in order to achieve our aim of building our country and providing enough infrastructures is the fundamental requirement. Both national and state level governments implement development projects according to their level of authorities and I, as the main responsible person for Pa�much O self-administrative zone, have also tried my best to improve socioeconomic condition of people in our self-administrative zone: Hopong, Hsi Hseng and Pinlaung townships. I have already been taking the responsibility to reduce poverty in our region for about 8 years since I have been elected. In my opinion, it is the most important to have good communication network and electricity for the development of our region. Without these two, we cannot hope for any investments in our region and so I have tried my best to implement these two fundamental infrastructures in our region in a way that we can achieve our goals sustainably. By doing so, we will not only know what we still don't know but also can apply these knowledge in future works so that there will be minimum errors in future. In establishing development projects, we should focus for long term and should mainly view from multiple viewpoints in order to obtain the optimum solution. Our current electrical demand is 3500MW and we expect that demand will be increased to 6000MW in 2022. If we don't prepare for that expected demand, we shall not be able to grasp the investment opportunities. So, I strongly would like to suggest all to cooperate with us and we will try our best to reduce impacts on social and environment. In the case of environmental matter, we should not compare with other standards while our country has its own standards and guidelines. We should approach these matters within these standards and guidelines provided by our government. In conclusion, as per the remark of Sayardaw U Ku Ta La, I would like to encourage all audience to stand for truth without any bias and as for me, I, on behalf of others, will also act my best in upright manner."

4. Presentation of Background History by U Soe Win, Chief Engineer of Electric Power Generation Enterprise, Ministry of Electricity and Energy

Firstly, U Soe Win, Chief engineer of EPGE from MOEE, greets all the audience and introduce about himself. He then presented about the background of Thi gyit (Tigyit) Coal Fired Power Plant. "Under EPGE, there are two main departments namely: Thermal Power Department and Renewable Energy and Hydropower Plants Department. Thermal Power Department include coal fired power plant and natural gas power plant whereas Thi gyit (Tigyit) coal fired power plant is the only main coal fired power plant in our country. His excellency, Minister of Electricity, Energy and Industry (Shan State) has already explained the current electrical condition of our country and our country still has more electric demand than production capacity. Under that condition, Thi gyit (Tigyit) coal fired power plant take part in its role to provide electricity to nationwide. In the past, the power plant can only provide 20-30MW and then temporarily shut down its operation. After that, according to the need of national electric demand, the power plant restarted its operation with the increased in production capacity of 100MW by contracting agreement between Wuxi Huaguang (Myanmar) Co., Ltd and our department. The main requirements in contract agreement are to control and reduce gaseous emissions of power plant according to the national standards and guidelines by means of using advanced technologies and to regularly monitor the environmental qualities." And then he also briefly presented summarized history of how power plant tries to control and reduces the environmental impact by means of using advanced technology. "In the past, the power plant did not equip with emissions control measures. Now, we equipped with emissions control measures in our system especially for NO_2, SO_2 and particulate matters. As well, control technologies such as SNCR and SCR for NO_2, ESP for particulate matter and FGD system for SO_2 are also equipped for boiler system. Gaseous emissions from stack are also continuously monitored and these results are shown to public transparently by comparing with National Standards at the front of our power plant main entrance. Now, it has been 2 years since we allowed the power plant for its test run. During this period, many public consultations have already been performed and in today presentation, our third-party consultant firm, E Guard will be presented about the EIA process of Thi gyit (Tigyit) coal fired power plant including the current condition of the power plant related to environmental field. In addition, CSR works are also included in our contract with Wuxi Huaguang Company. It has been agreed to spend 2% of net profit for CSR according to our contract. In conclusion, Thi gyit (Tigyit) coal fired power plant has already been operating its process according to the national standards and guidelines for 2 years and in today consultation process, all information related to power plant will be presented transparently to the public and after that audience can be asked whatever they want to know and we will discuss about Thi gyit (Tigyit) power plant openly and freely."

5. Presentation of Project Summary by Mr. Shen Guaqiang, General Manager of Wuxi Hua Guang (Myanmar) Limited.

Firstly, Mr. Shen Guaqiang greets all the audience and introduces himself. And then he presented the brief summary of Thi gyit (Tigyit) project. He said that Wuxi Huaguang Company has made long term contract with the MOEE to run Thi gyit (Tigyit) coal fired power plant and now it has been 2 years since the government allowed us for test run and among this period, the power plant provided up to 3% of national electrical production and has been contributed greatly to Myanmar Electric Sector. We have also run the power plant according to our contract by controlling the environmental qualities under the national standards and guidelines. Our company also spent 260 million kyats and 250 million kyats for CSR in surrounding villages in 2017 and 2018 respectively. Our company also provides job opportunities for local people and currently there are total (256) Myanmar employees. We also provides career development opportunities for them. Our company strongly commit to follow all the rules and regulations of Myanmar according to our contract and also promise to operate Thi gyit (Tigyit) power plant in more and more efficient manner.

6. Presentation of Environmental Impact Assessment by U Aye Thiha, Managing Director of E Guard Environmental Services.

U Aye Thiha, the Managing Director of E Guard Environmental Services presented about the processes of Environmental Impact Assessment (EIA) in detailed.

7. Discussions

U Aung Kyaw Moe (MATA)

Question: The first thing I would like to ask is that the representative from Wuxi Hua Guang Co., Ltd told that this plant used American Technology in 2016, April at Myo Ma Monastery. Concerning with that case, the representatives from American Embassy told us that they did not have any related case with

Chinese Government or Wuxi Hua Guang Co., Ltd. I want to know about this case. The next question is that it was said there were 2 turbines in plant last time. In the contract, each turbine produces 60 Mega Watt and total in 120 Mega Watt. But in reality, I want to know whether both turbines are running. Moreover, how much Mega Watt that each turbine can produce currently. As far as we know, with the current condition of our country, this plant cannot produce the enough amount of electricity. Because there is a rumor that only one turbine can be worked and it produces 28 to 30 Mega Watt. We should check whether this can give advantages to country or not. The next one I want to know is that the amount of coal that a turbine use. In 2016, it was told that when both turbines were running, 2000 tonnage of coal and 40000 gallons of water were used in a day. I want to know clearly these amounts are true or not. The reason is our Country has to by coal from Eden Company with the cost of 4000 to 4800 kyats for a tonnage of coal. Is it profitable for government? Moreover, there are people from Environmental Conservation Department and E Guard Environmental Services. Does carrying out the EIA/SIA while the plant is currently running comply with the Environmental Conservation Law? As much as I know, it has to be carried out before the project starts. I also would like to ask to Shan State Government and ministries. In media and press conference, if the Thi gyit (Tigyit) Coal Fired Thermal Power Plant has extended the contract a year after year, this became the second time. According to the contract, if it is going to produce economically, then the plant is needed to be ready to run. On the other hand, the rental has to be paid if the plant can produce economically. I want to know that this plant already paid the rental to government. The other one is it compliance with the law or not? As mentioned last time, this plant had been extended to one more year. There is a commitment that if the impacts on social and other cases can be proved, the plant will be shut down immediately. That commitment was made by Shan State Government. We also have a report that includes the results of water, air, and soil quality measurement by MATA. The results are also out from ALARM which is officially registered in Myanmar. Moreover, the results in the report are also from the laboratories of government. They were examined by professionals and we did this to protect the local people. According to the report, we measured water quality in 13 points. Among these points, we assumed that 11 points are poisonous. The sources of those impacts are due to the unsystematic discharged of ashes which lead to the poisonous in water. Concerned with that case, there was no mentioned in EIA report from E Guard. If it is not fixed, this can harm the whole environment. We also examined the ash in related laboratories. Moreover, we also sent the hairs of local children to Australia. The history of civil society is to help the government as much as we can. It is also a history of government whether they consider it or not. Thanks for letting me to discuss.

U Aung Kyaw Soe (Center of Thi gyit (Tigyit))

I am here as a representative of Center of Thi gyit (Tigyit). I would like to discuss about the impacts of the environment of the plant. There are four sectors; health, social, business and regional development. For the first, I would like to talk about health. I am living 4 furlong away from the plant and so I am worried about the health of my family. On the other hand, I also do not see any significant health problems caused by the coal fired thermal power plant. I saw once in a broadcast of the interview of Deputy Chief Engineer of Power Plant. He was asked how many years he has been working in this plant and he answered 18 years and he has no health problems. If he does not have disease then I believe we also will not have any problems. In our quarter, there are adults who are over 80 years old. At previous government, smell of coal and particles were all over the village. I, as a leader, reported this case to General Than Lwin. At that time, we stopped the case because they told us to be sued. There were also cases even people could be in danger due to the explosion from coal mine. Nevertheless, if we report the similar cases to the current government, they respond immediately like preventing the dust by covering with net. We also glad knowing that they use modernized methods to reduce the emission of carbon dioxide and ashes from plant. It can be also seen that ashes are also stored in bags systematically. For secondly, the Thi gyit (Tigyit) village was not a good market economy. However, the population became increased due to the plant, the business of this region improves more than before. In addition, the rate of young people getting job also improved. The agribusiness has also been developed due to the water supply for the farms from Coal Fired Thermal Power Plant. The electric current produced from this plant can also be a good help in creating the developed country. We are also hoping that government can help us to develop the Thi gyit (Tigyit) natural spring.

U Sein Thaung (Local)

Question: In the constitution of The Republic of The Union of Myanmar (2008), section 45, the Union shall protect and conserve the natural environment is included. I also would like to request the Shan State Government, Professionals to walk around the environment. I want to ask the representatives from Eden Company Limited. The government asked to do EIA and SIA. If EIA is in progress, I want to know in which stages that is currently being done. I also want to know about the extension. As far as I know, the project is needed to be stopped while EIA/SIA is in progress. Excuse me if I made mistakes.

Member of Local Monitoring Committee

Question: Although I did not receive invitation letter, I want to tell something. On April, 30th 2019, there was a rumored that a local social department gathered the people from 3 or 4 villages which are located north of Monastery. They also said that they will support financially according to CSR plan to that villages. I think it should not be like that. Even though I do not have videos to prove, I have other provable things. I want to know this is what the local social department supposed to do. I also want to ask to E Guard. In which stages that the EIA report by E Guard has reached? Was it really submitted to the ministry? As far as we know, this report was not received by Ministry.

U Aye Thiha (Managing Director of E Guard Environmental Services)

Answer: As far as I remember, I want someone to answer the question about the American Technology. I will explain about the EIA Report. As I mention in Presentation, the scoping report was submitted to Environmental Conservation Department in March. I will answer in which stages that our EIA report has reached. After Environmental Conservation Department confirms the report, then we call it as Final Report. There are a lot of processes before we submit the EIA report. This report will also be downloaded. All of our reports can be read by public. The next one that I am going to tell is that the air quality measurement of this region was carried out by the leading of Chief Minister of Shan State. At that moment, air quality monitoring equipment is in Ta Chi Leik, there might be some difficulties to get. It would be better if representatives from Shan State Government and Regional Environmental Conservation Department. The question is whether the projects have the permission to run before doing EIA. As I said before, I have done many projects like Yangon-Dala Bridge, Yangon Outer Ring Road, Yangon-Mandalay Railway. If the project is urgent for the union, the negotiation is needed with related departments to run. This project is also run after negotiating with Shan State Government, Paʻ'O Self Administrative Organization. If it is necessary, I want to request the Chairman of Paʻ'O Self

Administrative Organization. For the health case, Township Medical Officer also explained about the health in last event.

U Win Htay (Deputy Chief Engineer)

Answer: I am the Deputy Chief Engineer of Thi gyit (Tigyit) Coal Fired Thermal Power Plant. I will answer for the questions about turbines and how much electricity does each turbine produce. This power point shows the amount of generated electricity on April 9. In this power point, there are (2) sections. It shows the amount of electricity generated by Unit-1 for a day. The original Install Capacity is 60 MW. There are (2) stages and the project was in repaired stage at first stage. However, before we reached the second stage, we repaired the Capacity Efficient as much as we can and tried to generate electricity. The turbine (1) generates 52 Mega Watt out of 60 Mega Watt. This is the speed of the turbine. If I have to explain it more clearly, the vapor produce water after the turbine runs. The temperature of vapor that runs turbine is 5 times of boiling point. The vapor pressure of Unit-1 Boiler is almost 1190 lb. The electricity is generated by steam. It goes the same with turbine (2). It also generates 50 Mega Watt out of 60 Mega Watt at the first stage. This is the speed of turbine (2). The generated electricity is distributed to two places. This one is generated to Kalaw, from Kalaw, it also generated to Taunggyi and Tharsi. The rest is also generated to Napyitaw, Taungoo with Lawpita 230 KV by joining with BaLaKa (1) (2) (3).

U Aung Kyaw Moe (MATA)

Sir U Win Htay talked about for the April 9, 2019, did not you?

U Win Htay (Deputy Chief Engineer)

Answer: Yes, I did and both turbines are currently running.

U Aung Kyaw Moe (MATA)

Question: If you mean the turbines were running in April 9, we can assume that it was presented by lying to the government and civil. We have documents to prove. We cannot trust you based on your facts.

U Wn Htay (Deputy Chief Engineer)

Answer: Coal Fire Power plant is not running all the time. Sometimes, due to mechanical error and other factors, the power plant has to shut down for a while for the repair. Concerning with the repairing phase, we always have to carry out connection with the ministry. We do not have to trick anyone in such business as distributing electricity to the public. We have the daily and monthly record to show whether the power plant is running or not. We always report Shan State Government and the ministry. We announce that the records are available for everyone who wants to see. As U Aung Kyaw Moe, you should check the factory. You can clearly check whether the power plant is running and the output of the factory. We have received the book from MATA. And I will present to the public what we have noted. Air pollutants are written in page number (9). It has written that Thi gyit (Tigyit) Coal Fire Power plant does not use Selective Catalytic Reduction (SCR) for desulphurization system and reduction of nitrogen oxide. Our factory use SNCR (Selective Non-Catalytic Reduction) non-catalytic nitrogen oxide reduction system. And, we use SCR (Selective Catalytic Reduction) System by using catalyst to reduce nitrogen. We have shown practically equipped machines for the public to be seen clearly. For FGD System, we use

MgO as raw material. Sulfur dioxide is cleaned by spraying MgO solution to the flue gas. Then, they were rinsed with water from above. MgO is reacted to MgSo4 and this method is practically used. FGD System is practically used by pumping MgO solution from solution tank. Which is why the fly ash does not come out from the stack? I have seen that U Sein Thaung has written that toxic gases are exhausted during cold season. But we also spray with water after spraying lime water so that the flue gas temperature is decreased from 132 to 50 degree. So, we need to heat the flue gas with the steam from the turbine. It can be seen as exhausted steam from the stack at morning period and night times in cold season. If I have to add, the steam exhausted from the turbine is cooled in cooling tower. Heat is exchanged by rotating coolant in the cooling tower. Then, the water is sprayed and steam from the tower exhausts. These steams can only be seen in cold season. If you want to know more, you can come and check the process. Discharged water from the boiler can also be checked. We also have factory discharged water laboratory results from Yangon University Research Centre.

General Manager (Wuxi Hua Guang Myanmar Co., Ltd.)

Answer: Equipments used in power plant reached the international standards. The utilizing technologies are already included in Deputy Chief Engineer‟s explanations. The factory is running with World Bank‟s guidelines. And there is no case like supporting financially to villagers at the back.

U Aung Kyaw Moe (MATA)

Question: What I would like to ask is during scoping study back in April 2016, you have said that the renovation process would be done by using American Technology. But when we asked Embassy of America, they have answered that there is no technology exchange with Wuxi Hua Guang Co., Ltd or Embassy of China. If about using American Technology is not true, your company has to apologize to the public.

U Win Htay (Deputy Chief Engineer)

Answer: American technology we have said means that American Technology based equipments will be manufactured in China. Concerning with the case, there might be various models in the power plant factory. Models improve step by step from the lower one. Concerning with the coal fire power plant, there is no American Technology or China Technology. Japan and China, similarly, also use technology that we used. The basic of Wuxi Hua Guang technology is also American technology. But it is not originated from America.

U Aung Kyaw Moe (MATA)

Question: I understand what you say. But the company have expressed that the power plant use American Technology at that time. If it is not true, I would like the company to apologize the public for the expression. And, the company also need to apologise the government for using wrong expression.

U Win Htay (Deputy Chief Engineer)

Answer: I would like to read out the Q&A record back in 2016. Has Wuxi Hua Guang Co., Ltd already gotten business license? Has the project already gotten the permission? Has the company already contracted with the related department? What kind of power plant is planning to build? For these questions above, we have answered that we have already had the license from Myanmar Investment Corporation and project permission from the related department. We also had answered that as for Wuxi Hua Guang Co., Ltd, we will produce American Technology based machines in China.

U Soe Win (Manager, Eden Co., Ltd)

Answer: There is a question asking how long our EIA procedure reached has. We are heading to EMP stage. We have already shown revised EMP report after first submission to No. (1) Mining Enterprise with reference letter of 2019, April (1).

U Sein Thaung (Local People)

Question: EMP is known to be a procedure after EIA and SIA process. Is EMP without EIA and SIA procedures compliant with the Environmental Conservation Law

U Aye Thiha (Managing Director, E Guard Environmental Services)

It is separated as EIA, SIA, IEE and EMP. Since Eden Coal Mine has established since 2013-2014, I would like the Eden Company representatives to explain about it.

ECD District Assistant Director

Answer: Environmental Conservation Law of section (55), sub- section (D) has already issued by the Environmental Conservation Department. All the projects permitted before this law have to review and revise EMP report. The report has submitted to the Ministry of Mines.

U Win Htay (Deputy Chief Engineer)

Answer: There is a question about the lease of Thi gyit (Tigyit) Coal Fire Power Plant. Concerning with the lease the company has to pay the government, our office head of finance department will answer.

U San Oo (Office Head of Finance Department, Thi gyit (Tigyit) Coal Fire Power Plant)

Answer: I am U San Oo, office head of finance department. The lease agreement has started from 21.10.2015. We have already supplied one year lease of 1.18 million (from 21.10.2015 to 20.10.2016) and one year lease of 1.18 million (from 20.10.2017 to 20.10.2018). We still have to supply 6 month lease (from 21.10.2018 to 21.4.2019).

U Sai Shen Tit Lone (Minster of Electricity, Energy and Industry, Shan State Government)

Answer: There is a question asking if the government actually stand for the civil. We do not have to hold such consultation unless we stand for the civil. We always follow the rules and laws if we have to make something. We welcome all organizations. We would like to go forward in a positive way and we do not want any antagonism. We cannot dig up the issues throughout the ages. We are getting to a better future with approaching ways by learning good things and bad things from the history. We have said earlier about the economic losses during the power plant operation period. It is just a service to the public by the government. We are not aiming for the profit. The power plant has already been ready to operate and it has already contracted when the new government has changed. The investor has already invested by following the regulations from the contract. If we to stop the power plant operations without knowing it‟s advantages and disadvantages, the big loss would be suffered by the government. And it can affect all the investments in the future. As asked earlier, in asking about if EIA, SIA procedures have done, there is something to be questioned. We went to the trial operation stage to be seen clearly of how to keep moving forward the procedures that are have not done throughout the ages. We also set the trial period based on the laws and rules. It needs to check based on how much people will be suffered negative impacts from non-operation period to operation period. I assume local people around this area know well. To be able to record the impacts, we have to check the situations happened during 1 or 2 year of trial period. It is need to know that we are servicing to the public and we are not aiming any profit from the public. The country has lost many things throughout the ages. We are not making it since it is economical. Currently, electricity supplies are being reduced and there are a lot of requirements. Electricity distribution is getting less. The government is leading to the service by suffering losses. It needs to review the effects in starting upcoming projects. Your houses are also receiving our services. We are aiming for everyone to access such opportunities. We are trying to keep distributing electricity in 2020. We are ready to discontinue if the upcoming projects have more losses than profits for the government. We still have a long way to go forward. It has just only been 3 years since the start. There are a lot of enterprises in the future. I would like to say all the enterprises to proceed according to its limits, disciplines, and frameworks. For example, instead of telling the rumours about the factory, I suggest that it would be better to cooperate with the nearby regional representatives. I would like to conclude saying that there is a long way to go on for the future of the country.

8. Additional Comment by Dr. Zaw Win Myint, Member of Electricity and Energy Development Committee

Doctor Zaw Win Myint (House of Representatives, Member of Electricity and Energy Development Committee)

I am Doctor Zaw Win Myint from Mandalay Region, Singu Constituency. And I am also a member of Electricity and Energy Development Committee. In earlier, there is a question asking if the federal government knows about the lease issues and the earnings. In our country, there are 3 main components that is proceeding. We are mainly in part of the legislative component. Since the question asked earlier is only answerable from Electricity and Energy Department which is directly responsible for the executive component. I am attending here according to the order of the speaker of the House of Representatives. The Speaker assigned us to listen attentively the discussions. From this meeting, I have heard the ideas from responsible persons from related companies, the public and interested persons. I have also seen the hard work of liable state government, related ministry and the head of the region. What I would like to add is that our country is trying hard in every aspect. Communication, electricity, health and education sections are changing and transporting sections are improving a lot. Our country has only (3000) MW while our neighbouring country, Thailand, has over (1000000) MW. During this (3) year, our new government is standing with many hardships. Hydropower is most common in distribution of electricity in our country. We are trying to generate (1300) MW and (1200)MW plants using LNG gas. Tanintharyi Region is a portal city which does not even have any national grid at commercial spots although the region has plenty of resources to generate electricity. If Thi gyit (Tigyit) compares with such regions, Thi gyit (Tigyit) has better transportation. Since the company has reformed the factory, it is known to be less impact. It is much more satisfying comparing with the past. We found that there are also good and bad results in observations. All results do not need to be good. There must be bad ones. The main factor is how to resolve the bad results. If the coal fire power plant is built, there will be unwanted side effects concerning with coal. How to recover is the main point. If Thi gyit (Tigyit) power plant does not generate electricity, there is no other way to generate. Hydropower and LNG plants cannot generate electricity within two years. The construction phase of hydropower plant will take at least (7) years, (8) years or may be (10) years. In Ye-Ywar Hydropower project, there are generation processes and things to renovate. NEP Plan is being carried out in cooperation with Electricity and Energy Development Committee and Department. We would like to give electricity to the villages. Distributing electricity is the last part of the generating process. We have to produce electricity to distribute. Although we want to distribute electricity to over 60000 villages, there is no improvement in electricity distribution. In such situations, according to NEP, we cannot distribute electricity without production of electricity. Other countries are generating with nuclear which is much more harmful than coal. Nuclear is extremely dangerous. There were many issues happened such the Chernobyl disaster in Russia, and in Japan. If I have to conclude, our government is selected by the people. And we also appreciate to the environmental conservation activists who stand for the public. We also care for the public as they do since we are people‟s government. We are not such corrupt government that bias towards the company and neglect the risks been facing by the people. What the activists needs not to forget is that we are going to remove any risks which people will suffer. E Guard is accredited organization. Time will prove how the guidelines are true or not. There might be requirements and risky situations. If these happen, only close discussion with each other can overcome such situations. I would like to conclude by asking everyone to consider the ways to help the electricity needs of the country.

Closing Remarks by U Khun San Lwin (Chairman of Pa Oh Self Administration Zone)

U Khun San Lwin (Chairman of Pa-Oh Self-Administration Zone)

E Guard and related organization has already explained well. U Aung Kyaw Moe, representative of MATA, is also my friend. We have already explained a lot. It will take many times if we keep discussion. We already have known the situations with the least impacts to the people. We are also liable for this. We need to meet and discuss with chief minister among public representatives concerning with the data we have received from U Aung Kyaw Moe. At my point of view, this cannot be passed. An agreement is need to obtain. We welcome U Aung Kyaw Moe to come and observe to the factory. You can come and check anywhere you are suspected in the factory. What I would like to say is that the factory has already contracted with the federal government. Since MATA is a legal organization, I suggest that it would be convenient for MATA to get a pass and discuss with us about what to do, what to reform and about how much difficulties during operation phase according to the social economic survey. Other representatives can also follow and see if you want. If we keep discussing like this, we cannot reach our goal. And I would like E Guard and environmentalists, if needed, to participate in discussion. Civil society organizations can contact to my PSO number, 09-5011375 to know more information about Pa-Oh Self-Administration Zone. We want 3 Wins. As MPs explained, everyone is participating. According to the current situation, with the leading of deputy chief officer, I would like liable persons from Wuxi Hua Gaung, E Guard, Medias and organizations to take a close observation. If something needs, I think that it may be convenient by carrying out according to its sections such as which point is important, is the region responsible to these points, is the federal responsible, etc.,. Local people need to understand the current situation. If there is something to discuss, me, U Khun Saw Aung and U Khun Hla San are here. We will be back in one or two days. At that time, there might be some facts that the public want. And if there is something to re-discuss, you can discuss frankly.

10 Conclusion and Recommendation

A consolidated list of environmental and social impacts and mitigation measures to be committed by Wuxi Hua Guang (Myanmar) Limited are provided in Table 10.1. It is expected that the company will adopt these commitments in order to manage and mitigate potential impacts associated with the project development.

Table 10. 1 List of Commitments

Commitment Source	Commitment
Chapter 3	• Thi gyit (Tigyit) Coal-fired Power Plant commits to follow National Laws and Rule relevant to the Coal-fired Power Plant. Also, the project will comply with the provisions of the National Environmental Quality (Emission) Guideline. • Thi gyit (Tigyit) Coal-fired Power Plant specifically commits to implement the pollution prevention by applying the reliable technique to reduce and control the pollution. • Thi gyit (Tigyit) Coal-fired Power Plant specifically commits to minimize the utility of natural resources and to promote the reduction and recycling the waste products if possible.
Chapter 3 Air Quality Standard	• Thi gyit (Tigyit) Coal-fired Power Plant commits to follow National Environmental Quality (Emission) Guideline and World Bank Standards for Air Quality.
Chapter 3 Effluent Standard	• Thi gyit (Tigyit) Coal-fired Power Plant commits to follow National Environmental Quality (Emission) Guideline for Effluent.
Chapter 3 Ambient Noise Standard	• Thi gyit (Tigyit) Coal-fired Power Plant commits to follow National Environmental Quality (Emission) Guideline for Ambient Noise Level.
Chapter 4	• Thi gyit (Tigyit) Coal-fired Power Plant commits to apply the modernized equipment and maintain the facilities designs as described in Project description for Coal-fired Power Plant.
Chapter 5 Existing Environmental Conditions	• Thi gyit (Tigyit) Coal-fired Power Plant commits not to disturb the Existing Environment Conditions expressed in Chapter 5.
Chapter 5 Environmental Socioeconomic Baselines	• Thi gyit (Tigyit) Coal-fired Power Plant commits to consider the baseline condition of environmental and socioeconomic of the surrounding area during the operation phase.
Chapter 6 Impact and Risk Assessment and Mitigation Measures	• Thi gyit (Tigyit) Coal-fired Power Plant commits to certainly follow the mitigation measures described in Table 6.2 for avoiding and reducing the potential environmental and socio-economic impacts during the renovation, operation and decommissioning phases.
Chapter 6 Air Pollution	• Thi gyit (Tigyit) Coal-fired Power Plant specifically commits to follow the mitigation measures for air pollution during the renovation, operation and decommissioning phases. (Describes in Table 6.2)

Chapter 6 Water Pollution	• Thi gyit (Tigyit) Coal-fired Power Plant specifically commits to follow the mitigation measures for water pollution during the renovation, operation and decommissioning phases. (Describes in Table 6.2)
Chapter 6 Soil Contaminantion	• Thi gyit (Tigyit) Coal-fired Power Plant specifically commits to follow the mitigation measures for soil contamination during the renovation, operation and decommissioning phases. (Describes in Table 6.2)
Chapter 6 Waste Disposal	• Thi gyit (Tigyit) Coal-fired Power Plant specifically commits to follow the mitigation measures for waste disposal during the renovation, operation and decommissioning phases. (Describes in Table 6.2)
Chapter 6 Noise Polltion	• Thi gyit (Tigyit) Coal-fired Power Plant specifically commits to follow the mitigation measures for noise pollution during the renovation, operation and decommissioning phases. (Describes in Table 6.2)
Chapter 6 Offensive Odours	• Thi gyit (Tigyit) Coal-fired Power Plant specifically commits to follow the mitigation measures for offensive odours during the renovation, and operation phases. (Describes in Table 6.2)
Chapter 6 Sediment Quality	• Thi gyit (Tigyit) Coal-fired Power Plant specifically commits to follow the mitigation measures for sediment quality during the renovation, operation and decommissioning phases. (Describes in Table 6.2)
Chapter 6 Ecosystem	• Thi gyit (Tigyit) Coal-fired Power Plant commits to precisely follow the mitigation measures for ecosystem during the operation phase. (Describes in Table 6.2)
Chapter 6 Cross Boundary Impacts and Climate Change	• Thi gyit (Tigyit) Coal-fired Power Plant commits to follow the mitigation measures for cross boundary impacts and climate change during the renovation, operation and decommissioning phases. (Describes in Table 6.2)
Chapter 6 Infection Diseases	• Thi gyit (Tigyit) Coal-fired Power Plant commits to follow the mitigation measures for infection diseases during the renovation and decommissioning phases. (Describes in Table 6.2)
Chapter 6 Work Environment	• Thi gyit (Tigyit) Coal-fired Power Plant commits to follow the mitigation measures for work environment during the renovation, operation and decommissioning phases. (Describes in Table 6.2)
Chapter 6 Communities and Occupational Health and Safety	• Thi gyit (Tigyit) Coal-fired Power Plant must arrange the safety awareness training during the renovation, operation and decommissioning phases. (Describes in Table 6.2)
Chapter 8 Environmental Monitoring Plan	• The compliance monitoring report will be reported annually along with the environmental monitoring plan (Describes specifically in Table 8.1) for operation and decommissioning phases.
Chapter 8 Environmental Management Plan	Thi gyit (Tigyit) Coal-fired Power Plant commits to specifically implement the following plans • Air Quality Management Plan • Noise Level Management Plan • Coal Transportation and Handling Plan • Water Quality Management Plan

	• Water Usage Management Plan • Wastewater and Storm Water Management Plan • Waste Management Plan • Transportation Management Plan • Occupational Health and Safety Plan • Boiler Management Plan • Emergency Preparedness Plan • Fire and Explosion Hazards • Implementation of EMP and Environmental Monitoring Plan
Chapter 8 Grievance Mechanism	• Thi gyit (Tigyit) Coal-fired Power Plant has established a Grievance Mechanism with local people to solve the problems and complaints concerns with the Coal-fired Power Plant.
Chapter 8 Corporate Social Responsibility Plan	• Thi gyit (Tigyit) Coal-fired Power Plant implemented the Corporate Social Responsibility Plan to support 2% of annually profits for developing community development and improving socio-economic condition of local people. (Describes in section 8.16)

10.1 Conclusion

The purpose of this report is to identify the report of the Environmental and Social Impact Assessment (ESIA) for the Thi gyit (Tigyit) Coal Fired Power Plant Project. The report has been prepared in consideration of the environmental and social conditions of the coal fired power plant and surrounding area and likely environmental and social effects associated with the development, together with details of the methodology proposed for the specialized technical assessments.

The findings of the ESIA study show that the most significant adverse impacts associated with the project relate to:

1. An ambient air quality assessment was conducted 18 points within 5 km of project area. The nearest receptor to be affected by emissions is workers and residential in Thi gyit (Tigyit) village tract area from not only coal-fired power plant but also cement plant, surface limestone mine, surface coal mine and residential cooking in the Thi gyit (Tigyit) village tract area. Measured concentrations of PM2.5 and PM10 are over the range of EQEG air quality guideline values in dry season and are acceptable in wet season. Average gas levels such as CO, CO2, NO2 and SO2 are well within the acceptable limits of EQEG guidelines in dry and wet season. The AERMOD simulated that the village groups of Myin Twin, Nan Tine and Tigyit were highly impacted by all sources as these villages were located on the downwind direction of the emission sources.
2. The noise level assessment was conducted at two points near boiler and near cooling water tower as noise sources, at two points such as staff housing (1)&(2) and at 18 villages as noise receptors are found to be above the acceptable limit of EQEG guidelines (residential level) at dry and wet seasons.
3. Baseline data for water quality was measured at dry and wet season. The parameters measured are: For onsite measurement: pH, temperature, EC, TDS, salinity and

Dissolved Oxygen.For Laboratory tests: (pH) , Iron, Suspended solids, Dissolved solids, Temperature, Lead (Pb), Arsenic (As), Chlorine, Ammonia (NH_3), COD, BOD, Zinc (Zn), Copper (Si), Mercury, Selenium, Oil and Grease, Cadmium, Chromium, Aluminium, Nickel. Though the results indicated that most of data were well within the EQEG guidelines, total suspended solid and iron from streams and discharge from coal mine were found to be quite numerous. As the measurements are taken in the dry season, mecury from the points of before and after sedimentation pond of coal fired power plant was a little bit high. At wet season, chromium concentration at two stream points and discharge water from coal mine points was higher than NEQ Guideline value.

4. According to the result of soil sample from agricultural land which is near the damp site of bottom ash, the amount of silicon content is highest among other parameters. The micronutrients such as iron (Fe), Calcium (Ca) and manganese (Mn) are good for plants and the amount of nutrients which is found in that soil are acceptable level but, on the other hand, the concentration weight of silicon exceeds the optimal level of silicon because of the induced impact of damp site of bottom ash.
5. In terms of flora 434 plant species are identified and recorded and among of them, 61 species were classified as threatened species (Lease concern) under the IUCN Red List of Threatened Species 2016 Version 3.1. In both dry and wet season, a total of 201 fauna species of 160 genera belonging to 86 families under 29 orders were recorded as 114 bird species, 12 mammal species, six amphibians, and eleven reptiles and 48 insect and other invertebrates respectively. According to the IUCN conservation status, one vulnerable (VU) species was recorded in the dry season during the two-survey period (Dry and Wet Season) Moreover, 13 species were recorded as Completely Protected Animals (CPA), 20 species were carried out as Protected Wild Animals (PWA) and 24 species were observed as Seasonal Protected Animals (SPA).
6. The socio-economic study was carried out within 5km of the project area. There are 320 (53%) male respondents and 280 (47%) female respondents out of total survey (600) households in primary impact zone. For the secondary impact zone, there are 178 (69%) male respondents and 79 (31%) female respondents out of total survey (257) households. Survey respondents‟ point of view, access to electricity and job opportunities are the main benefits for the local villagers who are the most impacted people by the project, and increasing noise level and air pollution are the main negative impacts for local people in the primary impact zone. Access to electricity is the main benefit for the local villagers who are living in the secondary impact area, and increasing air pollution is the main negative impacts for local people in the secondary impact zone. The main difficult for the local people who are living in the project area is water supply.

10.2 Recommendation

In order to prepare an evidence-based and sound EIA report, E Guard Environmental Services co., ltd had collected and analyzed physical, biological and social data such as people's perceptions, concern, opinion, and expectation on the project for the environment and guiltless society during and after the development of the project. Any type of development activity has both beneficial and adverse impacts on the socioeconomic situation and environment in which it operates. The impacts are identified and evaluated by the project proponents to reduce their negative impacts and maximize the positive effects on the surrounding environment.

Findings and suggestion of EIA study in project operation should be considered and implemented with strong monitoring. The power plant should be operated ensuring all pollution abatement measures e.g. desulphurization system (FGD) for reduction of SOx, Selective non-catalytic reduction (SNCR) and selective catalytic reduction (SCR) system for reduction of nitrogen dioxide (NOX) and electrostatic precipitator (ESP) for reduction of ash emission. Continuous emission monitoring system (CEMS) has to be employed to control the pollution. Continuous air monitoring stations should also be installed at the downwind areas to monitor the pollution level simultaneously.

As described above, if appropriated facilities are installed and the plant is properly operated, the adverse impact expected from the project is considered to be minor in general. Practical mitigation measures and monitoring plan proposed by E Guard has agreed to put them in place to effectively reduce such adverse impacts. Information on the project and the EIA has been made available to the public widely. In view of these circumstances, coupled with the profound contribution the project is expected to make to the national economy and to meet electricity requirement in Myanmar, it is recommended that the project be implemented without delay. In doing so, Wuxi Hua Guang (Myanmar) Limited should continue working closely with organizations such as MOEE, Shan State Government, Pa Oh Self Administration and steadily move forward together with the public.

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