ENVIRONMENTAL IMPACT ASSESSMENT
for
The Project to Upgrade Max Myanmar Cement
at
Taung Philar Area, Lei-way Township, Nay Pyi Taw Council Area

Max Myanmar Manufacturing Co., Ltd

(Myanmar Environment Sustainable Conservation)

October 2016

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DECLARATION

(By Max Myanmar Manufacturing Co., Ltd)

Max Myanmar Manufacturing Co., Ltd pledges to comply with the Environmental Laws, Rules and Regulations. The company also pledges to undertake the mitigation measures and implement all the Environmental Impact Accessment (EIA) including Environmental Management Plans (EMP) and Monitoring Plan (MP) prescribed in this report.

U Moe Thu Zaw

General Manager

Max Myanmar Manufacturing Co., Ltd

DECLARATION

(By MESC)

We hereby, declare that the information submitted in this report is, to the best of our knowledge, true and accurate up to the date of submitting this report.

The report is confidential between Max Myanmar Manufacturing Company Limited and the consultant firm Myanmar Environment Sustainable Conservation (MESC) until the report is submitted to the authorities concerned.

The report has been prepared by MESC with utmost effort with all reasonable skills, care and diligence within the term of contract with the client (Max Myanmar Manufacturing Co., Ltd). Recommendations are based on our experience, using professional judgment and based on the information that is available to us.

Above all, the preparation of this report strictly followed the environmental regulations and guidelines set up, and particularlythe IEE/EIA/EMP format laid down, by the Environmental Conservation Department, formerly Ministry of Environmental Conservation and Forestry (MOECAF), now the Ministry of Natural Resources and Environmental Conservation (MONREC).

U Myint Kyaw Thura,
Managing Director
Biodiversity Specialist and IEE/EIA/EMP practitioner and appraiser
Myanmar Environment Sustainable Conservation (MESC)

EXECUTIVE SUMMARY

Max Myanmar Manufacturing Co., Ltd has proposed to upgrade its cement factory with its associated quarries at Taung Phi Lar, Lei-way Township, Nay Pyi Taw Council Area.

The existing factory produces 500 ton of Portland cement per day. The upgraded factory will have a capacity of 2100 ton/day. The production technology of existing factory applies the "wet process" technology but this will be switched to the "dry process" in the upgraded factory. The "dry process" has many advantages over the "wet process" given the fact that less energy, electricity and fuel, is required.

At the moment the factory is shutdown for the construction of some new infrastructures and the installation of certain new components and equipments.

The project site is located at G.P.S coordinates of N. Lat.19° 30' 54.9" and E. Long.96° 23' 57.0". It is situated at a distance of 1 mile south west of Aung Nan Cho village, Lei-way Township, close to the foot of Taung Phi Lar Mountain.

The site is 10 miles east of Yangon-Mandalay Highway; 25.5 miles South east of Nay Pyi Taw Council Area and 178 miles north of Yangon.

The total area of the project site is 484.5 acres comprising 44.5 acres of the factory and its premise; 230 acres of quarry limestone and 50 acres of reserved quarry.

The budget for the factory, so far, is 31603.15 million kyat and 6.8 million US$. The project cost for upgrading the factory is estimated to be 34.3375 million US$.

Electricity is sourced from the main grid line (33 KV line) at Thae Phyu village, 13 miles away. The total power demand is 4.15 MW but after the factory is upgraded the estimated power demand will be 13.3 MW.

Water is sourced from a small stream, Yay Pu stream, as ground water is not readily available yet (artesian tubes tested, so far, are not successful yet). A weir that can hold 3,000,000 gallons of water is constructed and the water is pumped into distribution tank with a capacity of 250,000 gallons. Water requirement for the dry processed and upgraded factory is estimated to be 1,270,000 gallons per day.

The raw materials are limestone, clay, laterite and gypsum and their requirements are 876,900 ton/yr, 111,000 ton/yr, 40,200 ton/yr and 44,100 ton/yr, respectively. The demand for coal is 107.100 ton/yr. Limestone, clay and laterite are readily available. Gypsum is procured from Thibaw and Mauk-mei, while coal is procured from Kalay-wa, Naung-cho and Padann.

Summary of EIA activities

The activities undertaken by MESC for EIA works included site survey covering the cement factory and premise, designated mining areas, data and information (both primary and secondary) collection and recording and the subsequent analysis work.

The EIA conducted by MESC team covered all the four phases of the project, namely, the Preconstruction Phase (Planning Phase), the Construction Phase, the Operation Phase and the Decommissioning Phase/Mine closure Phase/Rehabilitation Phase. Emphasis was given on the Construction and Operation Phase. The potential impacts, both negative and positive, were predicted, identified and assessed and mitigation measures for all negative impacts were prescribed.

The Environmental Management Plans (EMP) together with Monitoring Plan (MP) were drawn up and implementation of the plans were described. A public hearing and public consultation was also held.

The EIA report was prepared and written according to the guidelines, the procedures and the format prescribed by the Environment Conservation Department, Ministry of Environmental Conservation and Forestry (MOECAF), now the Ministry of Natural Resources and Environmental Conservation (MONREC).

The project alternatives

The mining/quarrying of limestone is site specific and the project has to be located near a limestone mountain. The limestone at Pyi Nyaung area is of good quality and the area has an ideal landscape for the large scale production of cement. The EIA team, therefore, could not suggest a better site or location alternative for the project.

As regards technological alternative the EIA team members are not specialized in mining engineering and are not in a position to suggest a better technological alternative. But the team had learnd that the "dry process" technology to be applied is a better alternative over the conventional "wet process" technology.

Environment to be affected by the project

The area is a mountainous and forested rural area. The main component of the environment to be affected is the biological component. The accumulated impact on flora and fauna will be in the form of loss of mainly vegetation and certain fauna and destruction and loss of habitats. This could be very significant indeed given the long term duration during both the Construction and Operation Phase and the wide area.

Another accumulated impact in the form of the loss of natural resources (limestone) and the subsequent alteration of relief and landscape (or even the disappearance of the whole mountain) will be also very significant.

The impact on the physical environment such as air, water and soil will be in-significant to relatively significant but could be generally mitigated.

The impact on the socio-economic component of the environment in this isolated rural area will be minor one. There are no substantial farms or cultivated land to be impacted.

There are also no cultural or visual components to be impacted by the implementation of the project. There is no historical, religious and cultural monument and archeological site to be impacted. There is also no important landmark or area of scenic beauty to be impacted by the implementation of the project.

Potential impacts

The 2 potential negative impacts anticipated and identified during the Preconstruction Phase are:

- Potential instigation by anti-big business activists that can lead to polarization of local people into pro- and anti-project groups.
- Potential hike in the price of land property.

The 15 potential negative impacts anticipated and identified during the Construction Phase are:

- Impact on biodiversity
- Impact of workers camp on site
- Impact: mobilization, preparation activities
- Impact on traffic on main road
- Impact on soil
- Impact on water (surface water)
- Impact on air quality
- Impact: noise and vibration
- Impact of waste disposal
- Impact: contamination of soil and ground water
- Impact: lack of emergency and health services
- Impact of project on potential social illness and vice versa
- Impact of project on HIV/AIDS and STD and vice versa
- Impact: potential security issue
- Visual impact and lighting

The 15 potential negative impacts anticipated and identified during the Operation Phase are:

- Impact: blasting, quarry activities
- Impact: change in relief; alteration of landscape
- Impact on biodiversity
- Impact: stockpiling of mined out meterials; overburden
- Impact: loss of non-libing natural resources
- Impact on air quality
- Impact on water quantity and quality
- Impact: noise and vibration
- Impact of power supply on national demand and vice versa
- Impact: waste disposal
- Impact on traffic
- Impact: lack of emergency, safety and health
- Impact: social impact; social illness
- Impact: potential security
- Impact: public perception

The 2 potential negative impacts anticipated and identified during the Mine closure Phase are:

- Potential residual impact
- Potential impact on the aesthetics of the landscape.

All these are described in **Chapter-5**.

The positives impact such as the provision of temporary jobs up to 1000 during the Construction Phase and 302 permanent jobs during the Operation Phase together with other benefits are also described.

The mitigation/corrective/remedial measures for each and every negative impact during the Pre-construction, Construction, Operation Phase and Decommissioning/Mine closure Phase are also prescribed. All the impacts and mitigation measures are described in detail in **Chapter-5**.

The significant cumulative impact in the form of successive addition of impacts such as the accumulative impact on biological components; cumulative impact on natural resources

(limestone); cumulative impact of blasting activities and the accumulation of dust and ash are addressed in **Chapter-6**.

Public consultation

A public consultation was held during the EIA study. The stakeholders/locals were invited and were explained about the project in general. They were invited and encouraged to give comments, express their opinions and views and also to lodge any complaints or grievances, if any. Pieces of plain paper were distributed to them to write down any comment or complaint if they feel reluctant to speak frankly infront of others. (A previous public consultation meeting was already held in November 2014)

During both meeting villagers were given the chance to lodge their complaints regarding land grabbing, the promise for compensation, the issue of smoke, the issue of overburden and the issue of vibration and also to express their needs.

The locals expressed his concern or anxiety for further forced relocation if more companies are coming and doing business in this area. Some villagers expressed their needs for permit for expanding their form lands into the reserved forest; the needs for electricity, library and clinic and also for the permission for retail purchase of cement from the factory.

The detail of public consultation meeting is mentioned in **Chapter-8**.

One day before public consultation meeting Key Informant Interview (KII) was conducted for gathering secondary information. Focal Group Discussion (FGD) was also conducted on the same day after the public consultation meeting for ranking the needs of the village. Transect walks and visual inspections of the village and community profile were also carried out. These are described in detail in **Chapter-8**.

(It was learnt that the proposed factory authority had previously already held several meetings with the villagers and had already settled the land acquisition issue by means of providing effective compensations.)

Environmental Management Plan

Environmental Management Plan was drawn for each and every above-mentioned negative impacts (significant and in significant) identified. (2, 15, 15 and 2 for Preconstruction, Construction, Operation and Decommissioning/Mine closure Phase, respectively.) The implementation for each and every plan was also prescribed.

The Monitoring Plan (MP) was also drawn up and these included: 13 parameters, 22 parameters and 2 parameters to be monitored during the Construction Phase, Operation Phase and Decommissioning Phase, respectively.

The need to organize and set up an effective EMP cell with few members and the need to set aside 0.5-1.0% of the total budget for the implementation of EMP were all described in **Chapter-7**.

Economic analysis for impacts evaluation

The pragmatic way of analysis is to estimate the overall benefits the project will bring to the area (and the nation) and estimate the existing economic benefits the land is providing to the area. When these two are compared and a cost benefit analysis is made it is quite clear that the project will bring great benefits not only to the area but to the nation (in term of infrastructure development, construction sector development and industrial development etc.). The area is not within an economic sensitive area--no major farming, no industrial zone or economic zone to be impacted. So the economic loss for the area will be negligible when compare to the benefits to be gained after the operation of the factory.

As regards the economic analysis for impacts evaluation and their management it would be actually a costly undertaking. The company has to hire a consultant firm for conducting EIA for assessment and evaluation of the impacts. An EMP has to be set up and 0.5-1.0% of the budget has to be set aside for the effective implementation of EMP and MP. EMP has to be implemented from the very Preconstruction Phase through the Construction, Operation to Decommissioning/Mine closure Phase. Certain employees have to be trained and certain equipment has to be procured for the effective implementation of EMP.

However, in this era of environmental awareness where all developmental projects have to be environmentally sound and socially sustainable, the investment for EMP implementation is actually a worthwhile investment. This is for the long term benefit for the company and the environment. EMP has become mandatory for all developmental projects in most part of the world.

Conclusion and recommendation

Myanmar as a developing country has still a long way to go when it comes to developing its infrastructure. The country needs more cement than ever for its infrastructure development. On the other hand cement production and associated quarry activities have negative impact on the environment. However, if state-of-the-art technology like the application of electrostatic precipitator and a variety of filter systems are applied, together with effective mitigation/corrective measures are implemented as far as possible, the cement business can become an environmentally sound business that will lead to sustainable development of the nation.

The consultant firm, MESC, on its part has no reason to object to the proceeding of this project. The project is recommended for implementation because in the final analysis it is quite clear that the advantages of the project outweigh the disadvantages in many aspects. The country will benefit from increased employment, increased earnings, increased tax revenue, increased investment and also infrastructure development of the nation.

ACRONYMS AND ABBREVIATION

ADB	Asian Development Bank
ASEAN	Association of South-East Asian Nations
BOD	Biochemical Oxygen Demand
CCR	Computer Control Room
CF	Community Forest
CGM	Complaints and Grievances Mechanism
CI	Cumulative Impacts
CIA	Cumulative Impacts Assessment
CIM	Cumulative Impacts Management
COD	Chemical Oxygen Demand
CSR	Corporate Social Responsibility
dBA	Decibel A- weighting
ECD	Environmental Conservation Department
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EITI	Extractive Industry Transparency Initiative
EMP	Environmental Management Plan
ESP	Electro Static Precipitator
EU	European Union
FGD	Focal Group Discussion
GBH	Girth at Breast Height
GDP	Gross Domestic Products
GHGs	Green House Gases (Glass House Gases)
IBA	Important Bird Area
ID	Identity Card
IEE	Initial Environmental Examination
IFC	International Finance Corporation
ISO	International Standard Organization
IUCN	International Union for Conservation of Nature and Natural Resources

KII	Key Informant Interview
LDC	Least Developed Country
MESC	Myanmar Environment Sustainable Conservation
MIC	Myanmar Investment Commission
MOAI	Ministry of Agriculture and Irrigation
MOECAF	Ministry of Environmental Conservation and Forestry
MOM	Ministry of Mines
MONREC	Ministry of Natural Resources and Environmental Conservation
MP	Monitoring Plan
NGO	Non-GovernmentOrganization
NO_2	Nitrogen Dioxide
PAS	Protected Area System
PEB	Payment for Ecosystem Benefits
PES	Payment for Ecosystem Services
PM	Particulate Matter
$PM_{2.5-10}$	Particulate Matter between 2.5-10 microns
PPE	Personnel Protection Equipment
RSPM	Respiratory Suspended Particulate Matter
4Rs	Reduce, reuse, recover and recycle
SIA	Social Impact Assessment
SO_2	Sulphur Dioxide
SPM	Suspended Particulate Matter
SS	Secondary Source
STD	Sexually Transmitted Diseases
TDS	Total Dissolved Salts
TSS	Total Suspended Solid
TSPM	Total Suspended Particulate Matter
UXO	Unexploded Ordnance
VESC	Valued Environmental and Social Component
VSK	Vertical Shaft Kiln
WHO	World Health Organization
YCDC	Yangon City Development Committee

1. INTRODUCTION

The introduction of market economy after a change in political system in 1988 had lead to the remarkable development of Myanmar economy. There were also many investments in the infrastructure development of the country. Since then there was a boom in construction up to this year. The momentum has considerably reduced this year as regards the construction of apartments in Yangon, yet the increase in construction works for other main infrastructural development throughout the country remained the same as before.

When it comes to infrastructure development Myanmar still lags behind its neighbours and Myanmar still has to import about 50% of cement from abroad for the national demand. As cement is the basic building materials it should be readily available at reasonable price throughout the country.

In this context Max Myanmar Manufacturing Co., Ltd has proposed to upgrade its existing cement plant at Taung Philar with an existing capacity of 500 ton/day to 2100 ton/day, a more than four-fold increase. This will contribute greatly to fulfilling the need for the construction sector of the country. The existing production technology known as "the wet process" will be discarded and the more efficient and advantageous "dry process" technology will be applied.

As an endeavour for the environmentally sound production of Portland cement, smoke and dust reduction instrument and equipment such as electrostatic precipitator (ESP) as well as bag filters will be installed. Sustainable quarry and extraction of limestone will be also practiced.

Brief description of the project proponent

Max Myanmar Manufacturing Co., Ltd was officially registered in 2007 and renewed as a limited company in January, 2015. (Document: 1230/2007-2008, Date: 2-1-2015 **See ANNEX.**)

Name of the project proponent	:	Max Myanmar Manufacturing Co., Ltd.
Address	:	No.123, Alan-pya Pagoda Road, Dagon Township, Yangon Region, Myanmar
Telephone	:	01 530776
Fax	:	01 682168
E-mail	:	maxmyanmar@maxmyanmar.com
Contact person	:	U Moe Thu Zaw

Phone : 09 8623955

E-mail : mtzsdpmax@gmail.com

Location of project site : Aung Nan Cho village, Taung Philar Area, Lei-way Township, Nay Pyi Taw Council Area.

Phone : 09 49205023-24

Objectives : To upgrade Max Myanmar Cement Plant at Taung Philar from a production capacity of 500 ton/day to 2100 ton/day

Particulars of executive and administrative body

Name	Nationality & National Registration Card No.	Address of resident	Designation	Other business occupation
U Pho Zaw (a) U Zaw Zaw	Myanmar 12/Ba Ha Na (N)084544	No.9, Inya Yeikthar Street, Mayangone Township, Yangon	Chairman and Managing Director	Merchant
U Soe Tint	Myanmar 12/Ka Ma Ta (N)018745	No.14/15, Thiri Mingalar Street (2), (8) Quarter, Kamayut Township, Yangon	Vice chairman and Director	Merchant
U Ohn Kyaw (a) U Aye Thwin	Myanmar 14/Ya Ka Na (N)017084	No.11/12, Thiri Mingalar Street (2), (8) Quarter, Kamayut Township, Yangon	Vice chairman and Director	Merchant
Daw Htay Htay Khine	Myanmar 12/Ba Ha Na (N)007040	No.9, Inya Yeikthar Street, Mayangone Township, Yangon	Director	Merchant

The company is 100% owned by nationals, all shareholders are nationals and foreigners are not involved in this investment.

Each share is worth 10,000 (kyatsten thousand only).

The total number shares allotted are 150,000 shares.

Four executive (allottees) members have taken the number of shares as follow:-

U Pho Zaw (a) U Zaw Zaw has taken - 100,000 number of shares

U Soe Tint has taken - 18,750 number of shares

U Ohn Kyaw (a) U Aye Thwin has taken - 18,750 number of shares

Daw Htay Htay Khine has taken - 12,500 number of shares

About the consultant firm, Myanmar Environment Sustainable Conservation Co., Ltd (MESC)

MESC is a consultant firm officially registered in 2014 as a limited company (a consultant/service company) at the Ministry of National Planning and Economic Development. Document: YaKa-8(Ga) 001/2014(004720), dated: 6th June, 2014. Registration No. 830/2014-2015, (20-5-2014).

The firm has yet to be registered at the Environmental Conservation Department, MONREC, waiting for detail instructions from environment authority.

Contact Address **:** Room no. (B -5), Building no.72, Marlar-Myaing 6th Street, 16 Ward, Hlaing Township, Yangon

Contact person **:** Myint Kyaw Thura

95 9 420105071

Contact number **:** 95 9 73044903

E-mail : myanmar.esc@gmail.com

Members of MESC who are IEE/EIA appraisers, or IEE/EIA practitioners or who are involved in this IEE/EIA project are as follows:-

Name	Nationality & National Registration Card No.	Designation
U Myint Kyaw Thura	Myanmar 12/Da Ga Ta (N)028349	Managing Director, Biodiversity Specialist (Fauna), EIA practitioner and EIA Appraiser
Daw Khin Nway Naing	Myanmar 9/Pa Kha Ka (N)001252	Biodiversity Specialist (Flora), Environment Researcher
U Tin Tun Aung	Myanmar 12/U Ka Ma (N)172111	Engineer and EIA practitioner
U Than Soe Oo	Myanmar 9/Ma Na Ma (N) 050808	EIA practitioner
Daw Thin Thin Yee	Myanmar 12/Tha Ga Ka (N)039292	Chemical Environment Researcher, Computer Programmer
U Oakka Kyaw Thu	Myanmar 7/Ya Ta Ya (N) 090371	Geologist
U Saw Han Shein	Myanmar 10/Ma La Ma (N)008173	Retired Professor, EIA Practitioner and Appraiser

MESC has also part time members working as free lances.

The firm is not in a position to employ all its part time members on a permanent basis.

These are botanists, zoologists, ornithologists, ecologists, aquatic ecologists and social scientists working with this firm.

For the physical and chemical environmental studies MESC has to hire experts, say for example, from the Health Department and from registered laboratory in Yangon. Since portable test kits are sometime not reliable, experts from the Health Department have to be hired for the analysis of air quality. Experts from a registered laboratory were hired for the analysis of water (or samples have to be sent to the laboratory).

Members of MESC have quite a lot of experiences with IEE, EIA and SIA works.

So far, starting from 2014 MESC has conducted some EIA and IEE projects. These were:

1. EIA for State House Hotel Development Project at the Combined Office in Downtown, Yangon (Prime Residence Co., Ltd). 2014
2. Environmental Impact Assessment on Myanmar Typical Production Iron & Steel Plant at Myaung Tagar Industrial Zone, Yangon (Myanmar Typical Production Co., Ltd). 2014
3. ESIA of Taung Philar cement factory for Max Myanmar Manufacturing Co., Ltd. 2015
4. ESIA of Kalaywa Coal Mine for Max Myanmar Co., Ltd at Kalaywa Township, Sagaing Region. 2015
5. EIA for Upgrade of Jet Fuel Storage Tanks Farm and Facility at Mingalardon Airport, Yangon. 2015
6. ESIA for Htoo International Industry Group Coal Mine at Kalaywa Township, Sagaing Region. 2015.
7. IEE for the Construction and Operation of "Sittway Hotel" at Kyay Pin Gyi Ward, Sittway. 2015
8. EIA for Construction and Operation of Cement factory at Pyi-nyaung, Tharzi Township for Blue Diamond cement Co., Ltd. 2015
9. Environmental Impact Assessment (EIA) for the mining of coal, by Shwe Taung Mining Co., Ltd at Paluzawa area, Kalaywa Township, Sagaing Region 2015.
10. EIA for Construction and Operation of Cement factory at Kupyin village, Tharzi Township, Mandalay Region for Shwe Taung Cement Co., Ltd. 2015.
11. Environmental Impact Assessment (EIA) for the mining of coal, by Tun Thwin Mining Co., Ltd Co., Ltd at Kalaywa Township, Sagaing Region 2016.
12. Environmental Management Plan (EMP) for Kalaywa coal mine by Max Myanmar Co., Ltd at Kalaywa Township, Sagaing Region 2016.

13. Environmental Management Plan (EMP) for Kalaywa coal mine by Tun Thwin Mining Co., Ltd at Kalaywa Township, Sagaing Region 2016.

14. Environmental Management Plan (EMP) for Kalaywa coal mine by Htoo International Industry Group of Company at Kalaywa Township, Sagaing Region 2016.

15. Environmental Management Plan (EMP) for the operation of BAT Myanmar cigarette factory by British American Tobacco Myanmar Limited at ShweThan Lwin Industrial Zone, Hlaing Tharyar Township, Yangon 2016.

16. Environmental Management Plan (EMP) for Prospecting, Exploration and Feasibility Study of Gold, Copper and Associated Minerals by Myanmar Reserves Development (MRD) Co., Ltd at Aingyi Area, Kawlin Township, Sagaing Region 2016.

17. Environmental Management Plan (EMP) for Prospecting, Exploration and Feasibility Study of Gold, Copper and Associated Minerals by Myanmar Reserves Development (MRD) Co., Ltd at Okshitpin and Kaba Area, Pinlebu Township, Sagaing Region 2016.

18. Environmental Management Plan (EMP) for Prospecting, Exploration and Feasibility Study of Tin and Tungsten by Southern Nonferrous Metal Co., Ltd in Phekon Township, Shan State 2016.

19. Environmental Management Plan (EMP) for Limestone mining at Pha-yar-kone Mining Block (50 acres) Taung Philar Area by Max Myanmar Manufacturing Co., Ltd in Lei-way Township, Nay Pyi Taw Council Area 2016.

20. Environmental Management Plan (EMP) for Limestone mining at Taung-philar Mountain Block (230 acres) Taung Philar Area by Max Myanmar Manufacturing Co., Ltd in Lei-way Township, Nay Pyi Taw Council Area 2016.

21. Environmental Impact Assessment (EIA) to upgrade Max Myanmar cement factory at Taung Philar. (Just completed 2016)

On going project

1. Environmental Impact Assessment (EIA) for the granite quarry operated by Htoo Naing Lin Co.,Ltd (formerly Joe Yadanar Co., Ltd) in Paung Township, Mon State.

2. Initial Environment Examination (IEE) for the granite quarry operated by Linn Shwe Sin Co., Ltd (formerly Htun Tauk Sa Co., Ltd) in Paung Township, Mon State.

3. Environmantal Impact Assessment (EIA) for Petroleum Storage and Distribution Terminal near Mandalay, by Puma Energy Asia Sun Co., Ltd.

2. ENVIRONMENTAL POLICY, LEGAL AND ADMINISTRATION FRAME WORK

2.1 Corporate Environmental policy of Max Myanmar Manufacturing Co., Ltd

Max Myanmar Manufacturing Co., Ltd, one of the leading cement production companies in Myanmar has environmental policy of its own. The first and foremost policy is to obey, abide and comply with all laws and rules relating to physical and social environment. Most of all, it will follow all the rules and regulations set up by the Environmental Conservation Department, the main agency responsible for environmental management in Myanmar. The company pledges to do a cement business that will be environmentally sound as far as possible.

The company shall endeavour to:

- operate the limestone quarry with an environmentally and socially responsible manner and to comply with laws and regulation
- prevent pollution of surrounding area; monitoring and adopting suitable measures for environment protection
- implement EMP effectively to mitigate pollution of water, land, air, noise and dust and proper disposal of waste
- develop green belt in available space
- conserve natural resources and energy as far as possible
- if possible recycling of waste through the principles of 4 Rs (reduce, reuse, recover, recycle), and
- create environmental awareness among employees and local community through education and training

Corporate Social Responsibility (CSR) and community development

The company very well realizes that the ethic code of 21th century big business is not to make profit at the expense of the environment and the local community. And that the big business should not focus only on economically viable venture but also on environmentally and functionally sound, ecologically viable as well as socially sustainable venture.

CSR has become mandatory in many countries and it is also now an official policy of most big companies. Max Myanmar Manufacturing Co., Ltd had already implemented CSR programmes as far as possible and will continue to do so and carry out community assistance and community development. Generous compensation would be provided if there is any loss or damage due to the implementation of this project. Moreover charity works and donation works had been carried out and this trend will be continued.

So far Max Myanmar Manufacturing Co., Ltd spent more than Ks 525,860,000 for infrastructure development area plus assistance and donation in materials and kinds for CSR activities such as community development, charity works and donations.

Another form of CSR is the reforestation of mine area after mine closure. Max Myanmar Manufacturing Co., Ltd is already reforested 500 acres of land with teak.

2.1.1 Environmental Policy and Legal Frame work

There were/are several laws since the colonial days which were/are one way or another pertaining to the environment of the country.

The Protection and Conservation of the Environment was the priority of successive governments.

The National Commissions of Environmental Affairs (NCEA) was formed in 1990. Myanmar Agenda-21 was outlined which contains social, economic, institutional and infrastructural improvement programmes and, most of all, environmental conservation programmes.

Respective ministries devised 56 environmental policies and regulations directly related with environmental conservation and protection.

The National Environmental Conservation Committee (NECC) was formed in 2011 with the aim to achieve sound environmental management in the country.

With a view to effectively implementing the protection and conservation of the environment the new government in 2016 has created the new ministry, Ministry of Natural Resources and Environmental Conservation (MONREC). It is believed that effective and meaningful management of the environmental affair will be achieved. The Environmental Conservation Department (ECD) is the focal and coordinating agency for the overall and detail environmental management through out the country.

2.1.2 Myanmar Laws relating to environment

The Ministry of Environmental Conservation and Forestry (MOECAF) under the previous government has published a book "National Biodiversity and Action Plan" where 54 Laws and Acts relating to environment were listed.

In doing cement business Max Myanmar Manufacturing Co., Ltd shall comply with the following Laws and Acts:

1. Myanmar Mine Law, 1994
2. The Protection of WildLife and Protected Area Law, 1994
3. Conservation of Environmental law, 2012
4. Conservation of Environmental Rules, 2014
5. The Forest Law, 1992

6. The Explosive Substances Act, 1908
7. The Protection and Preservation of Cultural Heritage Region Law, 1998
8. Myanmar High Way Law, 2000
9. Myanmar Insurance Law, 1993
10. Fire Brigade Law, 2012
11. Myanmar Citizen Investment Law, 2012
12. The Social Security Law, 2012
13. Workmen's Compensation Act, 1923
14. Minimun Wages Law, 2013, and
15. The Public Health Law, 2012

International and Regional Conventions and Protocols

Myanmar has either signed or ratified no less than thirty treaties, conventions and protocols concerning environment, it is learnt.

Some of the regional conventions or protocols signed or ratified by Myanmar are:

(i) ASEAN Agreement on Conservation of Nature and Natural Resources. Kuala Lumpur, 1985

(ii) Agreement on Aquatic Centre in Asia and Pacific Bangkok, 1988

(iii) ASEAN Agreement on Tran-boundary Haze Pollution, 2002

(iv) Establishment of ASEAN Regional Centre for Biodiversity, 2005

Some of the international conventions and protocol which are of importance are:

(i) Convention on Wetlands of internationally importance, RAMSAR 1971 and amended, 1987

(ii) Convention for the protection of World Culture and National Heritages. Paris, 1972.

(iii) Convention on International trade in Endangered Species of wild Fauna and Flora. Washington, 1973, and amended, Bonn, 1979.

(iv) International convention for the prevention of pollution from ships. London, 1973.

(v) Agreement to promote compliance with International Conservation and Management measures by fishing vessels on the high sea. Bonn, 1973

(vi) Convention on the prevention of marine pollution from land based sources. Paris, 1974.

(vii) Convention on Law of the Sea. UNCLOS, 1982

(viii) Convention on conservation of migratory species of wild animals. Bern, 1983.

(ix) Vienna convention for the protection of Ozone Layer. Vienna, 1985.

(x) Convention on Biological Diversity. Rio-de-Janero, 1992

(xi) U N Frame work Convention on Climate Change, 1992.

(xii) Kyoto Protocol on the frame work convention on climate change. Kyoto, 1998

(xiii) Protocol on Bio safety. Cartagena, 2000

(xiv) Convention on Persistent Organic Pollution (POP). Stockholm, 2004

2.1.3 Institutional frame work of the project proponent and Myanmar Government responsible for IEE/EIA/EMP

Max Myanmar Manufacturing Co., Ltd was officially registered as a limited company in 2007 and renewed in 2015. The company is partially involved in limestone quarry and cement production business. The executives are also involved in other business such as merchant.

There are 4 executive members; one chairman and managing director, two vice chairman and directors, one director. The company institutional structure at the cement factory is 302 staffs including 38 staffs at quarry site and also a few dozen daily wagers. After the cement plant is upgraded and in full operation more staffs will be employed.

Regarding Myanmar Government responsible for IEE/EIA/EMP the Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation (MONREC) is responsible for all the management of EMP, IEE, EIA and SIA activities. Especially the Environmental Conservation Department, (ECD) is officially responsible for the management of IEE, EIA and SIA activities taking places all over in the country. The department is also the focal and coordinating agency for the overall environmental management in the country.This department is actually a directorate headed by a Director-General, and then a Deputy Director-General. Under the directorate there are four departments, namely, the Administration Department; the Department of Policy, International Relation, Training and Research; the Environmental Protection Department and the Department of Resources Conservation and Envoronmental Impacts Assessment. These four departments are headed each by a Director. The Directorate is responsible for

- implementing environmental conservation policy
- designing and implementing monitoring programmes

- prescribing environmental quality standards and,
- conducting activities relating to waste management and conducting environmental impacts assessments

Recently various Environmental Conservation Departments at States and Regional levels under the Directorate were established in all the 14 States and Regions of the nation. This will surely greatly enhance the conservation of the environment and especially the management of the environment of the country.

Some of the regulations or guidelines for conducting EMP, IEE and EIA in Myanmar are:

(i) Environmental Impact Assessment Rules. (Draft), 1999 by the then Ministry of Environment, of the previous government.

(ii) Directives No.20/2013 (dated 13-3-2013) on Environmental Impact Assessment Regulation. MOECAF

(iii) EIA Guideline (excerpt from proceeding of Meeting held in Nay Pyi Taw regarding EIA, 23-9-2013. MOECAF

(iv) EIA Guideline 2014, from website of MOECAF, www.fdmoecaf.gov.mm/com.

(v) The Environmental Conservation Law, the Pyidaungsu Hluttaw Law No. 9/2012

(vi) Administrative Instruction of Environmental Impact Assessment Procedure. MOECAF Notification No…./2015, Nay Pyi Taw, 2015

The regional EIA guideline set up by Asian Development Bank (ADB) in 2006 includes the following principles which are in essence, similar to the guideline of ECD, MOECAF. They are:

- protect the environment for future generations
- ensure safe, productive and aesthetically pleasing environment
- attain all beneficial uses of the environment without any undesirable consequences
- preserve important historic, cultural, religious and natural aspects of national heritage
- enhance quality of renewable sources, recycle delectable resources
- identify critical environment problems, find solution
- obtain public participation for collective decision
- harmonize development and conservation
- predict and monitor impacts, access its cumulative impact and mitigate the impacts

- analyse the cost and benefit

2.1.4 Standards for Environmental and Social Sustainability

The ethic code for 21th century big business is not to make profit at the expense of the environment and the local community.

The big company should not focus only on economically viable venture but also on functionally sound and ecologically viable as well as socially sustainable venture.

Corporate Social Responsibility (CSR)

CSR has become mandatory in most developed countries. It has also become mandatory for big companies doing business in developing countries. In fact it has become an official policy of many big companies worldwide.

A big company that is doing business in an area must commit itself to environmental and social sustainability. The motto is "**do not harm the environment and the people**".

The company must take the responsibility for community development as far as possible. A certain amount of budget or 2 percent of the net profit has to be allocated for CSR activities, it is learnt.

Many view CSR as a form of compensation for the environmental and socio-economic components impacted. The main objective of CSR is more than mitigation and compensation; but also for the economic and social development of the community impacted by the project. The compensation for land or property lost or damaged due to project, the construction of school, and clinic, the improvement for infrastructure and the provision of alternative livelihoods, donations, charities etc. are parts of CSR activities. The CSR activities must be meaningful and effective, not a mere formality.

The main essence of CSR is taking the responsibility for the community development. And the main principles of CSR are:

- not to destroy the environment
- not to infringe on human rights
- not to get involve in child labour or forced labour, and
- not to get involve in bribery and corruption in league with corrupt officials or authorities when doing business.

Extractive Industry Transparency Initiatives (EITI)

EITI has also become mandatory in most developed countries.

When a big company is involved in extractive industry business activities (oil, gas, coal, minerals, gemstones etc.) the company must promote transparency of revenue payment from

extractive industry project to the government. The company must publically disclose it material project payment to the government (such as royalties, taxes, revenues and profit sharing).

As part of EITI the locals in the project should have the required information about the project to a certain extent, though not necessary all the details. At least the company must provide the information on the objective of the project, the duration of the project, the estimated quantity of the deposit (oil or minerals), the rate to be extracted (per month or per year), the price of the extracted mineral and the estimate budget for the whole project and so on.

The anticipated negative impacts and the preventive or mitigation measures to be applied should also be explained to the locals. The beneficial (positive) impacts as a result of the project should be also explained.

EITI applies not only to the extraction of non-living resources (mineral, coal, oil, gas, gems etc.) but also to the extraction of living natural resources (timber, charcoal, food, other forest products etc.) from land and fish and aquatic living resources from the sea.

Payment for Ecosystem Service (PES)

Ecosystems, large or small, have been providing their services to mankind from time immemorial. In this era of environmental awareness the ethic of 21^{th} century big business is not to take the service of ecosystem for granted. Every service provided by an ecosystem must not be considered as free of charge but must be paid for.

The ecosystem services could be categorized into (7) parts:

1) Ecosystem service in the form of harvested goods."Harvested goods" can be in the form of living resources (food, timber, fish etc.) or in the form of non-living resources (oil, gas, minerals, coal etc.)

2) Ecosystem service in the form of aesthetic beauty. For example, scenic spot of tourist attraction which is a source of that generates income for the local or the country.

3) Ecosystem service in the form of provision of drinking water, for instance, lakeecosystem, river ecosystem, reservoir

4) Ecosystem service in the form of purification of water, for instance, wetland ecosystem; conservation of water and soil, for instance, watershed ecosystem

5) Ecosystem service in the form of provision of sanctuary for birds and wildlife animals of interest for the people; for example, birds sanctuary, wildlife park, national park

6) Ecosystem service in the form of generation of O_2 from plants; for instance, forest, jungle ecosystem, aquatic plant ecosystem and,

7) Ecosystem service in the form of sequestration of CO_2 and stabilization of climate by plants; for instance, forest, jungle ecosystem, aquatic plant ecosystem.

When a small ecosystem such as a forest or jungle is to be impacted by a project the company must take the responsibility of restoring the ecosystem (forest). The easy and pragmatic way is planting trees at the affected area and carrying out the reforestation task. This is tantamount to payment for ecosystem service (PES), or in other word, payment for the ecosystem service provided by the biological (biotic) component of the ecosystem (that is the forest). In the same way the conservation and maintenance of a drinking water reservoir is tantamount to payment for ecosystem service (PES) provided by an abiotic (non living) component of the ecosystem (that is the reservoir).

International Finance Corporation (IFC), Policy on Environmental and Social Sustainability (2012)

There are eight performance standards for a big company to do business in a new area.

I) Assessment and Management of Environmental and Social Risks and Impacts

- identify and evaluate environmental and social risks and impacts of the project
- adopt mitigation measures to avoid, or if avoidance is not possible, minimize or mitigate the impact; compensate for the impacts on people and on the environment
- promote improved environmental and social performance through the effective use of management system
- ensure that grievances from the effected people are responded and managed appropriately
- promote and provide means for adequate engagement with the community throughout the project period

II) Labour and Working Conditions

- promote the fair treatment, non-discrimination and equal opportunity of workers
- establish, maintain and improve the worker-management relationship
- promote compliance with national employment and labour laws
- promote safe and healthy working conditions and the health of workers
- avoid the use of forced labour and child labour

III) Resource Efficiency and Pollution Prevention

- avoid or minimize adverse impacts or human health and the environment by avoiding or minimizing pollution from project activities

- promote more sustainable use of resources, including energy and water
- reduce project-related GHG emissions

IV) Community Health, Safety and Security

- avoid adverse impact on the health and safety of the community during the project life
- ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the community

V) Land Acquisition and Involuntary Resettlement

- avoid, and when avoidance is not possible, minimize displacement by exploring alternative project designs
- avoid forced eviction
- avoid, or where avoidance is not possible, minimize social and economic impacts from land acquisition or restriction on land use by
  (i) providing compensation for loss of assets at replacement cost (value of asset plus transaction costs), and
  (ii) ensure that resettlement activities are implemented with appropriate disclosure of information, consultation and the informed participation of those effected
- improve or restore, the livelihoods and standards of living of displaced persons

VI) Biodiversity Conservation and Sustainable Management of living Natural Resources

- protect and conserve biodiversity
- maintain the benefits from ecosystem services
- promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities

VII) Indigenous Peoples

- ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of indigenous peoples
- avoid adverse impacts of project on indigenous people, or when avoidance is not possible, minimize and/or compensate for such impacts
- promote sustainable development benefits and opportunities for indigenous people in a culturally appropriate manner

- establish and maintain an ongoing relationship with these people throughout the project period

- respect and preserve the culture, knowledge and practices of indigenous peoples

VIII) Cultural Heritage

- protect cultural heritage from the adverse impacts of project activities and support its preservation

- promote the equitable sharing of benefits from the use of cultural heritage

2.1.5 Environmental and/or Health Standards related to the project

2.1.5.1 Air Quality

The followings are from the general guidelines for air emission (from Notification No.615/2015, December 2015, by ECD, MOECAF)

Parameter	Averaging Period	Guideline Value μg/m^3
Niriogen dioxide	1-year 1-hour	40 200
Ozone	8-hour daily maximum	100
Particulate matter PM_{10}[a]	1-year 24-hour	20 50
Particulate matter $PM_{2.5}$[b]	1-year 24-hour	12 25
Sulfur dioxide	24-hour 10-minute	20 500

[a] Particulate matter 10 micrometers or less in diameter

[b] Particulate matter 2.5 micrometers or less in diameter

2.1.5.2 Water quality

The general guideline for waste water and others (from Notification No.615/2015, December 2015, by ECD, MOECAF)

(Waste water, storm water runoff, effluent and sanitary discharges (general application))

Parameter	Unit	Guideline value
5 day biochemical oxygen demand	mg/l	50
Ammonia	mg/l	10
Arsenic	mg/l	0.1
Cadmium	mg/l	0.1
Chemical oxygen demand	mg/l	250
Chlorine (total residual)	mg/l	0.2
Chromium (hexavalent)	mg/l	0.1
Chromium (total)	mg/l	0.5
Copper	mg/l	0.5

Cyanide (free)	mg/l	0.1
Cyanide (total)	mg/l	1
Fluoride	mg/l	20
Heavy metals (total)	mg/l	10
Iron	mg/l	3.5
Lead	mg/l	0.1
Mercury	mg/l	0.01
Nickel	mg/l	0.5
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Phenols	mg/l	0.5
Selenium	mg/l	0.1
Silver	mg/l	0.5
Sulphide	mg/l	1
Temperature increase	ºC	<3[b]
Total coliform bacteria	100 ml	400
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50
Zinc	mg/l	2

Site runoff and waste water discharges (Construction Phase)

Parameter	Unit	Guideline value
Biochemical oxygen demand	mg/l	30
Chemical oxygen demand	mg/l	125
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Total coliform bacteria[4]	mg/l	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

IFC emission and effluent guidelines

Sr. No	Pollutants	Units	Guideline value
1.	Total suspended solid (TSS)	mg/l	50
2.	pH	SU	6-9
3.	COD	mg/l	150
4.	BOD	mg/l	50
5.	Oil and grease	mg/l	10
6.	Arsenic	mg/l	0.1
7.	Cadmium	mg/l	0.05
8.	Chromium (VI)	mg/l	0.1
9.	Copper	mg/l	0.3
10.	Cyanide	mg/l	1.0

11.	Cyanide free	mg/l	0.1
12.	Cyanide WAD	mg/l	0.5
13.	Iron (total)	mg/l	2.0
14.	Lead	mg/l	0.2
15.	Mercury	mg/l	0.002
16.	Nickel	mg/l	0.5
17.	Phenols	mg/l	0.5
18.	Zinc	mg/l	0.5
19.	Temperature	°C	< degree defferential

2.1.5.3 Noise Level

The general guideline for noise (from Notification No.615/2015, December 2015, by MOECAF)

Receptor	**One hour LAeq (dBA)[a]**	
	Daytime 07:00 - 22:00 (10:00 - 22:00 for public holidays)	**Nighttime 22:00 - 07:00 (22:00 - 10:00 for public holidays)**
Residential institutional educational	55	45
Industrial, commercial	70	70

[a] Equivalent continuous sound level in decibels

Note: Noise leve must not be 3 dBA higher than standards level. If higher mitigate or reduce.

2.1.5.4 Odour

Guideline standard for odorant unit is between 5 and 10.

The overall guidelines and standards for mining can be downloaded from the internet. Here are some examples:

i) IFC Good Practice Guideline for mining construction materials. http//www.icmm.com>document, 2007

ii) IFC Environmental, Health and Safety Guidelines for mining, including limestone. IFC>wam.2007

iii) IFC. Environmental, Health and Safety General Guidelines. 2007.

The standards are for developed countries but Max Myanmar Company should try to follow the standards as far as possible.

3. PROJECT DESCRIPTION AND ALTERNATIVE

3.1 Background of the project

In order to meet the demand of cement in the country and to enhance the construction sector Max Myanmar Manufacturing Co., Ltd had made an effort to produce cement locally. Taung Phi Lar area, Lei-way Township, Nay Pyi Taw Council Area, was selected for the establishment of a Portland cement factory. Planning and designs were drawn up in 2006. A contract was signed with Jaingsu Pengfei Group Co., Ltd (China) on 2-8-2007. The site (land property) was officially procured from the Ministry of Environmental Conservation and Forestry. Document: se-man-kane (planning)/sa-19/(3915-16/2008); signed by Director General of Forest Department; chalan (receipt) no.48 (dated 23-9-2013). The construction work was commenced on 2-8-2008. After completion of construction a test run was conducted on 1-11-2009. Actual production of cement was started on 16-2-2010. At the moment the factory is shut down for upgrading the production capacity from 500 ton/day to estimated 2100 ton/day. The production technology will be also switched from "the wet process" to "the dry process". The factory is now in the process of building new structures, and installation of new components and instruments.

The site was formerly part of the Mei-hor Reserved Forest, which was already degraded to a big extent before the establishment of the factory. Mei-hor Reserved Forest encompasses the flat terrain around the factory as well as the mountain ranges in the East and N.E of the site. The land was leased for 10 years with possible renewal after the 10 years lease expired.

Prior to Max Myanmar factory there already existed a cement factory owned by Yangon City Development Committee (YCDC). That YCDC factory is less than one mile N.E of the site.

The Taung Phi Lar Mountain was chosen as the quarry sites for both YCDC and Max Myanmar factories. The permit for quarry last for 10 years, starting on 18-8-2009 and ending on 17-8-2019; the document: permit (0001/2009). The mountain runs from N to S and the height at the northern peak is 1083 feet above mean sea level while the height at the southern peak is 950 feet above mean sea level.

The quarry site that belongs to Max Myanmar is on the eastern side of the mountain and the area is about 230 acres. The quarry site that can be seen from Max Myanmar factory belongs to YCDC while Max Myanmar's quarry is hidden from the view (that is on the northern side). In addition Max Myanmar has a reserved quarry, about 50 acres, at Pha-yar-kone hill lock.

3.2 Project details

Title of the project	:	The Project to upgrade Max Myanmar Cement Plant at Taung Phi Lar, Lei-way Township, Nay Pyi Taw Council Area.
Proposed by	:	Max Myanmar Manufacturing Co., Ltd
Address	:	123, Alan-pya Pagoda Road, Dagon Township, Yangon Region
Fax	:	01 682168

Telephone	:	01 530776
E mail	:	maxmyanmar@maxmayanmar.com
Location of project	:	Taung Phi Lar area, Lei-way Township, Nay Pyi Taw Council Area
GPS positions of factory	:	N. Lat. 19° 30' 54.9"
		E. long. 96° 23' 57.0"

Figure-1: Map showing the proposed project site (Lei-way Township)

Figure-2: Satellite image of project site and environs

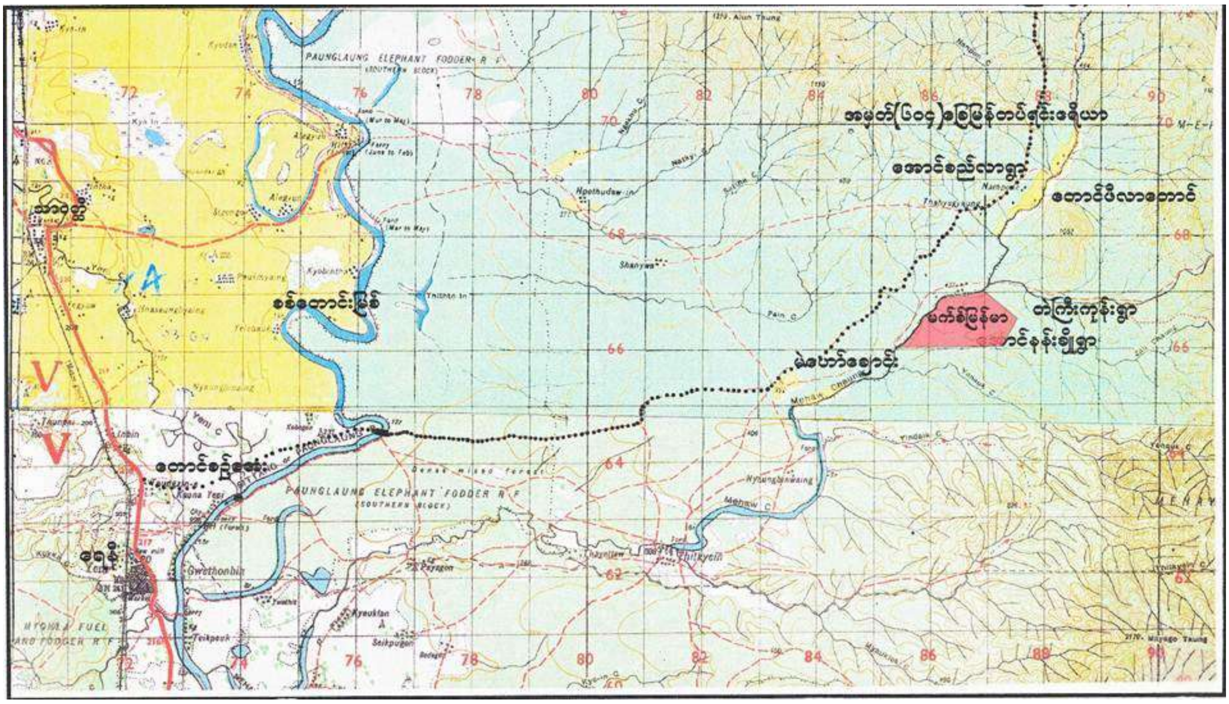

Figure-3 : Map of eastern part of Lei-way Township showing project site

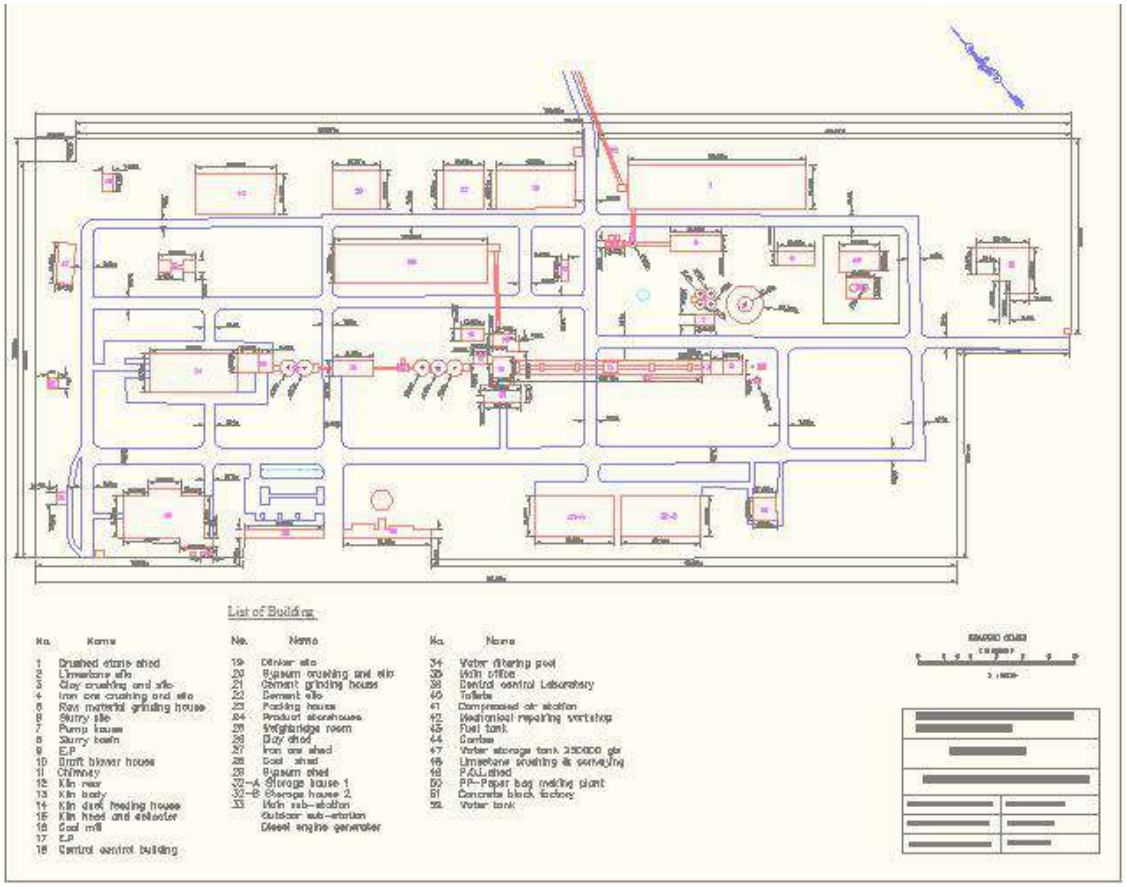

Figure-4: Layout plan

3.2.1 Area

The total area of the project site is 484.5 acres comprising 44.5 acres of the factory and its premise, and the combined area of quarry sites, 280 acres.

3.2.2 Investment

	Kyat (million)	
Machinery and equipment	10987.09	plus 6.8 million US$
Construction (civil + electrical)	12118.91	
Others	8497.15	
	31603.15	

Estimated budget for upgrading the factory:	Machinery	19.8375	million US$
	Civil construction	7.5000	million US$
	Mechanical installation	7.0000	million US$
	Total	**34.3375**	**million US$**

3.2.3 Main Components of the factory

(Only production sector; office, workshop, store, laboratory etc. excluded)

Crusher Department

Conveyor Line

Reclaimer (for crushed limestone)

Raw Mill Department

Coal Mill Department

Cement Mill Department

Rotary kiln and kiln line

A series of silos - (silos for limestone, laterite, clay, gypsum clinker, cement)

Packing Department

Figure-5: Main building (office is on the left side)

Figure-6: Workshop

Figure-7: CCR building

Figure-8: Inside the laboratory

Figure-9: Conveyor line

Figure-10: Limestone silo

Figure-11: Cement silo

Figure-12: Clinker silo

Figure-13: New structure in the process of construction

3.2.4 Capacity of main machining

Sr. No.	Machinery	Capacity	Remarks
1.	Crushers		
	(a) Primary (Jaw) crusher	300 ton/hr	12 hr/day
	(b) Secondary (Hammer) crusher	300 ton/hr	12 hr/day
2.	Reclaimer	150 ton/hr	-
3.	Vertical Raw mill	170 ton/hr	20 hr/day
4.	Vertical Coal mill	18 ton/hr	14 hr/day
5.	Blending Silo	3000 ton/day	2 Nos.
6.	Rotary Kiln	2100 ton/day	24 hr/day
7.	Gypsum additive crusher	50 ton/day	-
8.	Cement mill		
	(a) Existing mill	28-30 ton/hr	17 hr/day
	(b) New mill	100 ton/hr	18 hr/day
9.	Packer		
	(a) Existing	90-120 ton/hr	-
	(b) New	120 ton/hr	-
10.	Cement Silos		
	(a) Existing	4000 ton	2 Nos.
	(b) New	3000 ton	2 Nos.

Production capacity

Existing capacity 500 ton/day

Estimated capacity after upgrade 2100 ton/day

3.2.5 Raw Materials Requirement

Sr. No.	Raw Materials and grade	Requirement (ton/year)	Remarks
1.	Lime stone (a) 85% (b) 87%	 856800 876900	(Based on 300 working days with 12 working hours per day
2.	Clay (a) 10% (b) 11%	 100800 111000	(Based on 300 working days with 12 working hours per day
3.	Laterite (a) 3% (b) 4%	 30300 40200	(Based on 300 working days with 12 working hours per day
4.	Gypsum (a) 5% (b) 7%	 31500 44100	(Based on 300 working days with 12 working hours per day

Fuel requirement

(i)	Coal		107,100	ton/year		
(ii)	Natural gas (estimated)		300	million cubic feet/year		
(iii)	Diesel	(a) at quarry	1,608	gals/day	= 482,295	gals/year
		(b) at factory	350	gals/day	= 105,000	gals/year

Requirement for explosive and accessories per year

(i)	Emulsion explosives	180,000	kg
(ii)	Cordite	207,000	m
(iii)	No.8 plain detonator	1,800	nos
(iv)	Safety fuse	4,500	m

Raw material and fuel (coal) procurement

Limestone is readily obtained from quarries. It is estimated that the main quarry site contains 19.47 million tons of limestone/alabaster while the reserved site contains 13.9 million tons (a total of 33.37 million tons).

As the annual requirement is at most 900,000 tons the quarry sites can last for at least 30 years (according to estimation by geologists and engineers.) The constituents of limestone are Ca O = 52.2%, Mg O = 0.43%, Si O = 5.32%.

Clay and laterite are readily available from the vicinity.

Gypsum is procured from Thibaw and Mauk-mai, 280 miles N.E and 150 miles N.E away, respectively. Coal is procured from Kalaywa, Naung Cho and Padann, 288 miles N.W, 250 miles N.E and 125 miles north away, respectively.

Raw materials and fuel (coal only) storage and capacity (shed or open warehouse)

i)	Limestone shed (reclaimer)	10,000	tons
ii)	Clay shed	7,000	tons
iii)	Iron (laterite) shed	5,000	tons
iv)	Gypsum shed	6,000	tons
v)	Coal shed	6,000	tons

Figure-14: Mined/quarried out limestone

Figure-15: Shed for mined out materials

3.2.6 Water and electricity sources

Water

In order to acquire reliable water supply ground water was explored; test artesian wells were sunk but without success. So a weir with a dimension of 576 feet x 196.5 ft x 19.5 ft that can hold 3 million gallons was constructed damming the water from the small stream, Yay Pu Chaung. The water from the weir is pumped into the main distribution tank (capacity 250,000 gallons) and then to another pond (circulation pool) with a capacity of 100,000 gallons. From the circulation pool water is distributed to the factory as well as for domestic uses.

Water requirement for industrial use (production use) is 400,000 gallons/day while the requirement for other uses (batching plan, domestic, residential area, office, monastery etc) is 870,000 gallons totalling 1,270,000 gallons per day.

Figure-16: Water storage tank

Figure-17: 3 million gallons weir

Electricity

Electricity is sourced from the National main grid line (33 KV line) at Thae-Phyu village 12.9 miles away. The main transformer capacity for the existing 500 ton/day factory is 4.15 MW; for the upgraded 2100 ton/day factory it will be 13.3 MW (maximum load).

The daily electricity consumption ranges from a minimum of 218,904 units to a maximum of 280,800 units. For the monthly consumption it ranges from minimum of 6,567,120 units to a maximum of 8,424,000 units.

Figure-18: Electricity sub station

3.2.7 Vehicles and heavy machinery

Sr. No.	Particulars	Quantity (number)
1.	2 ton Ferry	4 nos.
2.	4 ton Nissan truck	3 nos.
3.	Wheel loader	4 nos.
4.	Fire engine (truck)	1 nos.
5.	Fork lift	1 nos.
6.	Water bowser	1 nos.
7.	Dumper (Komatsu)	8 nos.
8.	15 ton Dump truck	3 nos.
9.	Back Hoe Excavator	9 nos.
10.	Dozers (Komatsu + Shantui)	3 nos.
11.	Drilling machines	3 nos.

Figure-19: Heavy machinery (excavator, wheel loader, dozer etc)

3.2.8 Staffing

A total of 302 staffs 32 officers and 270 staff (from manager to watchman) their monthly salaries range from Ks 140,000 to Ks 400,000.

Staff organization (sections)	No. of staff	
Administration	35	
Human Resources	2	
Finance	14	
Warehouse, inventory and planning	19	
Civil/water supply	11	
Electrical	30	
Work shop	16	
Raw mill	30	
Coal mill	17	
Quality control	19	
Cement mill	21	
Crusher	9	
Heavy machinery	2	
Cement packing	10	
Kiln and CCR	29	
Quarry	38	
Total	**302**	**(See ANNEX for staff organization)**

105 employees are local people from Aung Nan Cho, and Aung Chan Thar villages and Myo Hla Town.

3.3 Brief description of the process of manufacturing cement

The properties (quality) of the raw materials should be within or in the vicinity of the following values:

- limestone $CaCO_3$; CaO_3> 50% ; lump size < 900mm
- laterite (iron stone) FeO_3> 25% ; lump size ≤ 25mm
- clay Al_2SiO - AlO_3> 40% ; lump size < 350mm
- gypsum CaSO4 $2H_2O$ > 70% ; lump size < 200mm
- Coal (subbituminous), C > 50% ; lump size ≤ 50mm

The three main activities in cement production process are:

- Quarry and raw materials preparation
- Clinker production
- Cement grinding and distribution

Generally there are 7 major steps in the production of cement:

1) Quarrying – (blasting and excavation)
2) Crushing and pre-homogenization of raw materials limestone, laterite and clay
3) milling (pulverization), homogenization and storage of raw materials, limestone, laterite and clay
4) pre-heating and clinkerization (coal burner in the form of powder coal)
5) clinker cooling and storage
6) clinker grinding and gypsum addition
7) cement storage, packing and distribution

3.3.1 The process

The limestone generated from the quarry is transported to the crusher plant by dumpers/trucks. Limestone crushing is carried out in two stages, the primary stage with Jaw crusher and secondary stage with hammer crusher. The crushed pellets or crystal size should be 0-25 mm. The crushed limestone is transported by means of belt conveyor to the reclaimer (storage shed). Corrective/additive materials, laterite and clay are also crushed by hammer crusher.

The crushed raw material (limestone) is conveyed to raw grinding mill and pulverized to the form of talcum powder. The crushed raw material is dried simultaneously in the grinding mill furnished with cyclone separator. For drying process hot gas from rotary kiln meant for the purpose is introduced into the grinding circuit. Clay and laterite are also ground to powder.

The ground raw material (limestone) is then conveyed pneumatically into the homogenization silo. In the homogenization process corrective or additive materials such as clay and laterite are added and thoroughly mixed. The corrected powder, that is, the properly homogenized powder, of limestone, laterite and clay is stored in storage silo to be fed to the kiln (rotary kiln) which is furnished with suspension pre-heater.

After flowing through the heat exchanger and the kiln at an extremely high temperature of 1400°C the powder is physically and chemically transformed into clinker; this process is known as clinkerization. Coal burner, in the form of powder is used as fuel for heating.

The next step is the cooling and storage of clinker. The hot clinker is cooled in the cooler and conveyed to clinker silo.

The next step is clinker grinding and the addition of gypsum. The clinker together with the gypsum (preferably 5% to 7%) is ground together in a grinding mill which is fed by means of gravimetric dosing devices. In this way the finished product, cement, is formed. The standard quality of the Portland cement is; specification: EN-197.1 (2000), strength class 42.5 MPa to 52.5 MPa.

The finished product, cement, is conveyed and stored in cement storage silo. The last step is packing and distribution.

Max Myanmar Manufacturing Co., Ltd used to manufacture its own cement bags. But as it is too labour intensive and not so economically feasible cement bags will be ordered from manufacturer in Yangon in the near future.

The cement distribution centre is in Nay Pyi Taw. But as demand for cement is always high cement merchants usually come to the factory with their trucks and buy the cement directly from the factory warehouse. This greatly solved the logistics issue for the manager. The factory dose not has to maintain a large number of trucks for transporting the manufactured product.

After upgrading the factory the production technology will switch from "wet process" to "dry process".

In dry process the raw materials are ground, homogenized and fed to the kiln in a dry state. In other aspects the wet and dry processes are generally the same.

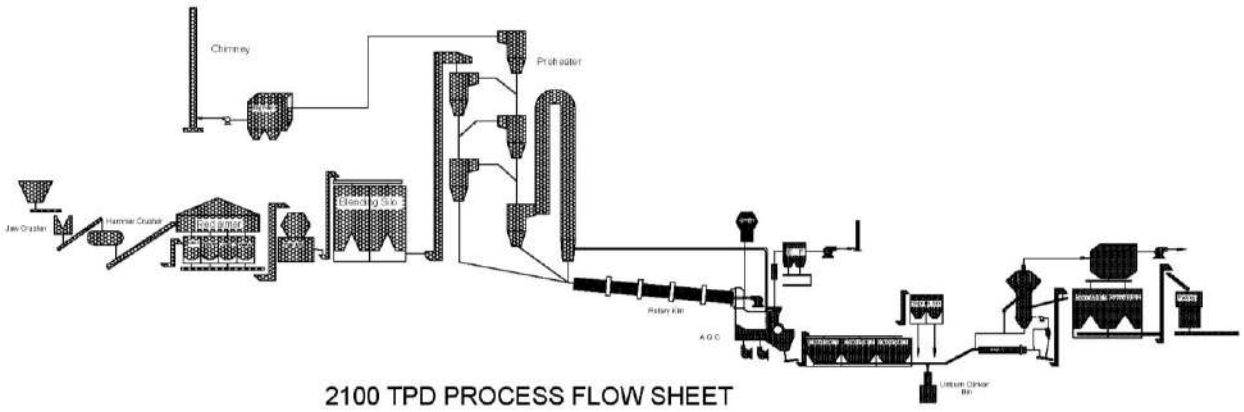

Figure-20: Flow chart diagram for manufacturing process

3.3.2 The dry process and clinkerization in brief

As mentioned earlier the "wet process" technology will be discarded and the "dry process" technology will be introduced after the factory is upgraded. The wet process of manufacture is uneconomical in view of the high fuel consumption. The dry process technology is therefore widely preferred and practiced due to saving in fuel cost.

The Vertical Shaft Kiln (VSK) technology under the dry manufacturing process will be introduced, it is learnt. This VSK technology is based on the so-called black metal process in which all the raw materials namely, limestone, laterite, and clay and the fuel coal burner are throughly ground to a fineness of about 10 percent retained on 170 microns mesh and throughly homogenized. The raw material is formed into nodules of 8-10 mm in size. This is done by the addition of relatively small quantity of water is a nodulizer pan that rotates at a suitable speed and at a suitable inclination. These nodules formed are fed into Vertical Shaft Kiln with suitable refractory inside through a rotary feed which also distributes the nodules evenly on bed. In the kiln the nodules are dried heated and burnt into clinker.

The clinker is than cooled and discharged in the kiln by a rotary grate at the bottom of the kiln through a triple air lock discharge device. (The more advanced gamma ray controlled material block tube system can be also applied.) The combustion air generated by a root blower to the kiln also serves the purpose of substantially cooling the clinker (to about 60°C) thus economize the cost of cooling process.

The clinker is conveyed into the cement where it is ground together with gypsum additive (5-7% gypsum with about 85% purity) and formed into the finished product, Portland cement. (**See ANNEX** for the process and steps for manufacturing of cement)

3.3.3 Certain changes and replacement

To upgrade the factory and to switch from wet to dry process certain changes and replacement are necessary. Slurry basin, slurry silos, measuring bin for slurry and associated component, such as pumps are no longer necessary and so will be discarded.

Certain new structures have to be built and component and system have to be installed or modified. For instance, in addition to electrostatic precipitator new filter bag house which is supposed to be more efficient will be installed. The kiln will be replaced.

As already shown in the table for capacity of main machinery or components, cement mill, packer and cement silos have to be extended to increase their capacities.

There will be no changes or replacement for the majority of the main components or machinery.

The requirement for electricity will increase from 4.15 MW to 13.3 MW due to the increase in production rate of cement from 500 ton/day to 2100 ton/day.

Thank to the dry process the requirement for water will not be increased even though there will be a four folds increase in production.

3.4 Project Alternative

Sometimes it is necessary to have Plan A and Plan B (alternative plan) for the implementation of a proposed project. This can ensure the project to progress smoothly and successfully even if a change in plan has to be undertaken. The alternative plan can be in form of alternative site for the project or alternative method or technology for the operation of the project.

In the case of selection of project site if the original Plan A site is not appropriate the Plan B should be duly selected. For instance if Plan A site has the following issues:

i) it is inside a protected area or wildlife sanctuary or bird sanctuary

ii) it is too close to big lake or reservoir that serves as water drinking source for a city

iii) it is inside or too close to historical cultural and religious monuments or sites including archaeological ones

iv) it is inside or too close to agricultural land or animal farms

v) it is prone to natural disasters – floods, violent storm, land slide etc. and

vi) the issue of land disputes or land grabbing.

All these above-mentioned issues, particularly the last one, can provokes loud public outcry or mass protest and can eventually leads to political instability of the region, if not the whole country. In such a case there is no other choice but to discard Plan A and select Plan B for the long term benefit of the project. In this context we see no necessary alternative or better alternative for switching from Plan A to Plan B. The factory is now in the Operation Phase, producing cement since 2010. There was/is no public outcry or mass protest and it seems the factory is in a certain degree of harmony with the local community.

In the case of alternate method or technology Max Myanmar factory is now in the process of switching from Plan A (wet process) to Plan B (dry process) for the betterment of the factory, and hence the company. At the moment the factory is shut down and all operations ceased. The building of new structures and the installation of new systems and new components are under way. The alternative technology (the dry process) has many advantages: the production capacity will increase from 500 ton/day to 2100 ton/day; the improvement will be not only in quantity but also in quality; and the new dry process technology will also considerably economize the cost of the operation given the fact this process requires less fuel and less electricity, following the basic principle of sustainably sound production of cement.

Another minor technology alternative is seen in the fire stoking and heating process. The previous technique of fire stoking prescribed by Chinese engineers was not so efficient, resulting in the premature destruction (integration) of fire bricks and as a result frequent

replacements of new bricks have to be undertaken. Another alternative technique was adopted and better result was achieved. The fire bricks become more durable and could last for 7 months.

As regards demand alternative the EIA team suggested the company using electricity energy more efficiently rather than building more alternative generating capacity. The EIA team also suggested the application of solar panels for domestic uses such as for offices, living quarters and guest houses.

Regarding input or supply alternative the EIA team suggested the harvesting and use of rainwater as far as possible for the conservation of water resource. Rain water could be used for watering plants, suppressing dust, washing machinery and vehicles and other domestic uses.

This last option (alternative) is the "no go alternative" or "no project alternative". This last option (alternative) would mean no more development in the infrastructure of the country. The abundant natural resources (limestone) will remain unexploited and unused, while the infrastructure of the country eg. roads, bridges, buildings and structures, will remain undevelopment. Or more cement will have to be imported from abroad and will have impact on the hard earned foreign exchange currency. The area will remain an unproductive degraded reserved forest area. None of the benefit generated from the limestone resources will be realized by the nation which still remains an LDC (Least Developed Country). This will have a significant impact on the infrastructure of the country and subsequently curtail the long term socio-economic development of the country.

Regarding input or supply alternative the EIA team suggested the harvesting and use of rainwater as far as possible for the conservation of water resource. Rain water could be used for watering plants, suppressing dust, washing machinery and vehicles and other domestic uses.

The company should be prepared for any better alternative in the near future. As new technologies are emerging quite rapidly nowadays the company should be ready to adopt any state-of-the-art technology or any better alternative. This could also involve a change or an alternative in the design in structure and organization of the factory.

4. DESCRIPTION OF THE SURROUNDING ENVIRONMENT

The study area is a flat terrain within the degraded Mei-hor Reserved Forest. Max Myanmar cement factory is about half mile west of the foot of Taung Phi Lar Mountain (the quarry site) and about 3 miles south and south East of the mountain ranges. The area in the south-west, south, and south-east of the factory is a flat terrain about 16 sq miles. This flat terrain is bounded in the east and north-east by the mountain range and in the west and south-west by Mei-hor Rivulet.

About one mile N. East of the factory is Aung Nan Cho village while Aung Chan Thar village is 3 mile S west. About half mile N. East of the factory is YCDC factory while two miles east and hidden from view is the quarry site of Asia World Company (for the production of chips or pebbles for road construction). Two miles S. East of the factory is a small paddy field while there are sugar cane fields and sesame farms and other farms (ground nut, bean etc) around Aung Chan Thar villages.

4.1 Setting the study limit

The study area encompassed all the project areas, that is, the cement factory and office compound, residential area and the quarry site totalling 484.5 acres.

Max Myanmar Cement Plant is about one and a half mile west of the Taung Philar foot hill and about one mile south west of Aung Nan Cho village YCDC cement factory in about half mile north east. Two miles in the south west is Aung Chan Thar village. The survey area therefore thus covered most of the flat terrain, the Taung Phi Lar Mountain and the base of the larger mountain range. EIA was also focussed on the aquatic ecology of Yay-pu Stream, which is the source of water for the factory and for Aung Nan Cho village.

Aung Nan Cho village was also incorporated into the area of study. The whole study area was between N. Lat 19º 30' 52" and 19º 32' 56" and between E. Long 96º 23' 55" and 96º 23' 59".

4.2 Methodology for data collection and analysis

EIA work involved the visual inspection of the area, the surveying work and collection of baseline environmental and social data.

The physical data such as air quality, particulate matter (PM), SO_2, NO_2 and noise were all primary data, collected through field survey. The data for water analysis were also primary data. Soil data were secondary data from geologists contracted by the company who had carried out geological survey of the area in earlier.

Data on biodiversity; flora, fauna (birds, mammals, reptiles and amphibian and aquatic organisms) were all primary data collected through this study. Some data for large mammals were secondary data from hunters.

The social data included both primary data collected through visual inspection and transect work, and secondary data acquired through Key Informant Interview (KII) or other secondary source (SS).

4.2.1 Methodology

The testing and measurement of air quality, ambient air, PM, SO_2 and NO_2 involved the use of relatively sophisticated and bulky equipment and so technicians (on leave) from the Health Department have to be contracted. The portable air test kits has the advantage of measuring the in situ (on the spot) condition but not so reliable.

For measuring total suspended particulate matter (TSPM) and Respiratory Particulate Matter (RSPM-$PM_{2.5}$-PM_{10}) the bulky high volume air sampler (Respirable Dust Sampler, Environtech APM 460 NC) furnished with glass fibered filters was used. The principle applied gravity metric volume method and measured by using microbalance.

For the measurement of SO_2 and NO_2 chemicals were involved, such as absorbent liquid for each gas; the procedures involved titration method.

The duration of measurement was 24 hours. (NO_2 was also separately measured again for one hour.)

Portable water test kits were also not so reliable and water samples have to be brought back to Yangon for analysis at a registered private laboratory. The technicians at this laboratory carried out the analysis work.

Noise level was measured on the spot using a portable Digital Noise Level Detector, VICTOR, which was quite reliable.

All geological data were secondary data from the findings of geologists who have done geological survey of this area in 2006. Their methodology involved Satellite image analysis, geological outcrop mapping, lithogeo-chemical survey, gravity investigation and mechanical drilling for extraction of samples at various depths, it was learnt.

All meteorological data, monthly rainfall, monthly maximum and minimum temperature, humidity, wind speed etc. were secondary data. They were obtained from Pyinmana Distric Meteorology Office.

The data on the biological components particularly flora were all primary data. All data on flora, birds, reptiles, amphibian as well as the large majority of aquatic organisms were collected through this field surveys.

During this trip it was not possible to catch or trap certain wildlife and fish which were known to exist in the area. Some data have to be gathered by interviewing hunters and fisherman who were very few. In such few cases the EIA team has to consent with only the secondary data. In a few cases the EIA team have to rely on the tell-tale signs of wildlife such as foot print, scats, traces and scratches etc. (this is of course standard method in biodiversity study). These large animals very temporarily forage for food in this area and then return to their secured habitats else where.

As wildlife are very scarce or almost depleted the flora remain the main biological component for study. The flora study involved the overall view of the forest and classification of forest type; distribution pattern based on elevation; transect walk through the forest and on the spot identification of species. In addition specific ecological niches for bryophytes and certain epiphytes were also taken into account.

As for fauna, different methods of study have to be applied for different major taxonomic groups, namely, Aves, Amphibia, Reptilia and Mammalia. This will be discussed later in **Section (4.4.3)**. The study of Insecta was omitted due to lack of expertise.

The essential tool for EIA work includes computer, GPS, camera, telescopes (especially for birds) binoculars, hand lens, microscope (especially for aquatic microorganisms), compass, portable water and air test kits, anemometer, herbarium press, measuring tapes, ropes, pruners and cutter, tool for catching and trapping wild life (snare, trap, scoop, nets including plankton net, stakes etc), lamp and torch for night survey for nocturnal animals. Chemical preservatives (alcohol, formalin) together with plastic containers of various sizes for the preservation of specimens (especially those that could not be identified during the survey trip but to be identified later) were also necessary.

Google Earth satellite imagery was also applied for the overview of forest structure, generalized distribution pattern, forest gradients, opened forest, canopied forest and for the possible detection of peculiar micro-ecological niches (for both plants and animals).

As regards socio-economic data most were secondary data. These were gathered by means of conducting Key Informant Interview (KII) and also from certain Secondary Source (SS). Certain primary data were acquired by means of visual inspection, transect walks and focal group discussion (FGD).

As for cultural components there were no important cultural, religious, historical and archeological monuments or sites in the area. The exceptional case: the Shwe Phone Pwint Pagoda and the associated Buddhist monastery built by Max Myanmar Company and there was no likelihood to be impacted by the project.

In the case of visual component the landscape of the mountain would be impacted after many decades of operation and this would be discussed in impact assessment in **Chapter-5**.

4.3 Physical components

4.3.1 Climate

The climate is tropical monsoon climate with a hot and dry season (premonsoon), a rainy season with moderate rainfall (monsoon) and a cool season (postmonsoon). The area also has partially Dry Zone Climate of Myanmar.

The hot dry season (summer) generally starts from March to June and is a period of hot spell. The monthly record for temperature from 2010-2016 is shown in **Table-1**. The monthly maximum temperature for 2010-2016 was recorded at 44.5ºC in May (2010). The monthly minimum temperature for 2010-2016 was recorded at 9.0ºC in January (2012).

The rainy season (monsoon season) generally starts from the middle of June to the end of September. The monthly record for rainfall from 2010-2016 is shown in **Table-2**. The monthly heaviest rainfall for 2010-2016 was record at 15.86 inches in August (2014). The cool season (winter) generally starts from November to and continue till the end of February.

Table-1: Monthly minimum and maximum temperature (ºC) of Pyinmana District during 2010-2016

Month	Total temperature per month													
	Maximum							Minimum						
	2010	2011	2012	2013	2014	2015	2016	2010	2011	2012	2013	2014	2015	2016
January	36.0	33.5	33.5	33.5	32.5	34.0	34.0	10.0	11.5	9.0	10.5	13.0	11.3	11.7
February	39.0	38.0	38.5	40.0	37.0	36.6	37.7	12.0	12.5	11.0	13.0	14.5	14.0	14.0
March	41.5	41.0	40.0	40.2	39.8	40.2	39.5	16.5	15.0	13.5	15.5	17.0	16.6	21.0
April	43.5	40.5	41.0	41.5	41.0	41.5	43.3	21.0	19.5	18.0	20.0	21.0	20.4	23.0
May	44.5	37.1	40.5	40.0	39.0	40.8	43.5	20.0	22.5	20.0	21.5	22.0	22.0	22.9
June	38.5	36.5	36.0	36.0	39.0	37.6	36.0	23.5	23.0	20.7	22.5	22.5	21.6	22.4
July	35.5	35.0	35.0	34.0	34.0	34.9	35.5	23.5	23.0	22.5	22.5	22.6	21.0	23.2
August	35.5	33.5	33.5	33.5	34.1	35.0	33.5	21.4	23.0	22.0	22.5	22.3	23.0	23.3
September	35.0	35.0	34.5	34.7	35.5	35.7		22.0	22.5	23.0	23.0	23.0	23.5	
October	37.5	35.5	36.5	35.5	35.5	35.0		20.0	21.0	19.0	21.7	20.0	22.0	
November	35.0	35.2	36.5	34.0	36.5	35.0		16.5	15.0	19.0	20.1	14.6	18.3	
December	35.0	35.0	33.0	33.5	34.5	33.8		11.5	14.0	12.0	11.6	14.2	10.5	

Table-2: Monthly rainfall (inch) of Pyinmana District during 2010-2016

Month	Total rainfall per month (inch)						
	2010	2011	2012	2013	2014	2015	2016
January	0.04	1.77	-	0.32	-	0.16	0.08
February	-	0.12	-	-	-	-	-
March	0.12	1.14	0.16	-	-	-	0.55
April	Trace	2.95	1.22	0.55	0.94	1.93	0.08
May	7.40	6.93	1.30	7.48	2.56	3.74	3.66
June	7.56	9.53	7.99	7.48	10.55	7.83	8.66
July	10.35	3.94	10.67	5.35	7.37	12.68	6.38
August	10.63	12.91	9.18	14.41	15.86	5.27	11.50
September	7.17	14.65	3.46	11.18	4.41	6.11	6.14
October	9.13	9.37	0.39	9.37	2.37	4.76	
November	-	0.19	0.12	0.04	0.86	-	
December	0.59	0.24	2.52	2.28	-	0.28	
Total rainfall	**52.99**	**63.74**	**37.1**	**58.46**	**44.92**	**42.76**	**37.05**

Table-3: Monthly humidity (%)

Month	Humidity (%)						
	2010	2011	2012	2013	2014	2015	2016
January	59	68	60	71	74	68	74
February	50	58	50	60	63	55	59
March	50	59	51	55	54	53	58
April	50	64	60	57	64	58	57
May	64	81	66	73	70	70	68
June	79	68	88	83	82	84	86
July	85	84	86	84	86	90	88
August	84	90	88	92	90	88	91
September	82	86	85	90	86	88	
October	83	86	83	89	82	86	
November	65	73	78	80	80	78	
December	68	72	74	79	71	76	

Table-4: Prevailing winds speed (mile/hr) in Pyinmana District during 2010-2016

Month	Winds speed						
	2010	2011	2012	2013	2014	2015	2016
January	1.0	0.8	0.5	0.9	1.1	2.0	1.7
February	0.9	1.0	0.5	1.1	0.8	1.4	1.4
March	1.5	1.4	0.4	0.8	0.8	1.2	1.4
April	2.8	1.2	0.8	1.3	1.5	1.5	2.4
May	1.9	1.4	1.0	1.8	1.8	2.4	2.2
June	2.2	1.6	1.0	1.5	2.4	2.5	2.2
July	1.4	1.2	0.8	1.7	1.4	2.7	2.0
August	1.4	0.8	0.8	1.0	1.1	1.6	1.9
September	1.2	0.6	0.5	1.2	1.0	1.7	
October	1.2	0.4	0.9	0.9	0.8	1.5	
November	1.6	0.1	0.6	1.4	0.8	1.7	
December	2.2	0.2	0.6	1.2	1.0	1.7	

Table-5: Monthly evaporation (mm) of Pyinmana District during 2010-2016

Month	Evaporation (mm)						
	2010	2011	2012	2013	2014	2015	2016
January	141.87	156.95	61.66	72.45	65.33	68.55	64.32
February	195.78	162.39	75.51	153.02	88.09	91.19	84.05
March	282.33	221.84	100.60	157.50	128.26	145.31	130.80
April	268.66	167.16	113.73	131.31	125.35	147.46	158.25
May	245.83	107.54	102.54	133.52	123.16	139.47	139.56
June	163.35	70.64	62.39	105.63	107.53	82.88	73.51
July	138.17	123.75	52.42	80.01	80.13	58.12	65.79
August	110.65	99.39	66.25	65.90	66.58	74.58	54.72
September	90.76	100.29	97.66	89.05	84.01	71.17	
October	99.55	93.52	98.48	84.17	88.14	79.36	
November	107.01	88.87	90.39	76.17	65.98	67.87	
December	106.85	65.25	45.92	56.16	64.66	60.81	

A comparison of the values of mean monthly humidity (%) for the years 2010-2016 showed that the highest value, 93, was recorded in August, 2013 while the lowest value, 50, was record in February, March and April 2010.

The generalized prevailing wind system for the country as a whole shows the following system.

- S.W during the rainy (monsoon) season
- N.E during the cool (winter) season
- Erratic prevailing wind direction during the hot (summer) season

The following table shows the prevailing winds speed for 2010-2016. Due to the topography features surrounding the region and due to partial influence from the South China Sea the

directions of the prevailing are rather erratic, that is, not consistent year after year. The highest wind speed of 2.8 mph was recorded in April, 2010.

During the dry hot season there was no known prevailing wind or dominant wind. The climatic condition in the South China Sea sometimes influences the meteorological conditions of the area, bringing light to median rain the area.

The hightest evaporation value of 282.33mm was recorded in March 2010, while the lowest evaporation value of 45.92mm was recorded December 2012.

4.3.2 Topography

The area is a flat terrain with partially degraded forest and was within the Mei-hor Reserved Forest Area. But in the eastern and southern parts are limestone mountains ranges including Taung Philar Mountain ranges which runs from north to south, and smaller hills. The mountains and hills have karst topography, that is, area of limestone formation with valleys and ravines. There are small ravines that transverse the slope with ephemeral spring. Due to relatively thick top soil the mountains and hills are covered with green forest, that is, greener than the forest at the flat terrain.

The mining/quarry site is at the foot hill and the lower slope of the Taung Philar Mountain range. The elevation at the factory and surrounding flat plain is about 500 feet asl. The highest peak (northern peak) of the range is 1083 feet asl while southern peak has height of 950 feet asl.

4.3.3 Basic geology (local geology)

The local geology is based on the secondary data obtained from the findings of the geologists who had carried out survey work in the area in 2006.

There are five types of formations.

i) Young and old alluvial soil (rock)

   Found in southern part of the survey area in the Yay-pu Chaung area while the old alluvial type is found in south and west of the survey area.

ii) Mergui-Mawchi series

   Consists of schists of yellow to brownish colour and quartzite schist of red brown to gray colour and found in the eastern part of the survey area in a north to south direction with an inclination of 60º to the west.

iii) Alabaster (calcite)

   Found between layers of schist and red brown quartzite schist and formed in a south to north direct with an inclination of 60º to the west.

iv) Mogoke series

Granite, alabaster and calcium silicate dominate and are found in the eastern part of the survey area and formed in a north to south direction. Alabaster (calcite) $CaSO_4$ $2H_2O$, is one of the varities of limestone good for the production of quality cement. The colour ranges from white to light grey to grey.

v) Granite igneous rock

Granite of fire grain to coarse grain is found in the north east and south of Taung Philar Mountain.

While the mountain are generally limestone mountain the soil of the flat terrain especially along the streams and rivulets are sandy loam. Limestones are part of the south western portion of the Shan Plateau while the area on the other side of the Mei-hor rivulet can be regarded as the eastern periphery of the Dry Zone. Generally the whole area is an immediate region between the south western part of the Shan Plateau and the south eastern part of the Dry Zone which is geologically speaking, a continental sediment zone.

4.3.4 Rocks

The rocks consist of fine-grained compact limestone and red sand stone and are designated as rocks of Jurassic Period (Middle Mesozoic Era).

The rocks of this limestone mountain area are also known as Plateau Limestone Group (series) and mainly consist of carbonate rocks. According to some geologist this group could be divided layer wise into upper Plateau Limestone or calcite limestone and the lower Plateau Limestone or dolomite limestone.

Limestone is soft, massive or fine grained and occurs in the form of massive beds or extensive stratified formation or thinly bedded. The colours are brownish grey or brown to light grey. The chemical composition essentially consists of $CaCO_3$ up to 70% and mixed frequently with $MgCO_3$ and SiO_3. The geologists of the company have estimated that the main quarry site (Taung Philar Mountain) contains 19.47 million tons of limestone while the reserved site (Pha-yar Taung) contains 13.9 million tons (a total of 33.37 million tons).

Clay and iron (laterite) are also found in the rocks of the area. The general constituents of limestone of the area are CaO = 52-60%, MgO = 0.35-0.5% and SiO = 4-8%. The limestone consists mainly of calcite but alabaster is also found in large quantity together with limestone.

4.3.5 Soils

The basic soil is cresol; sandy loam with pockets of dark brown friable clay loam. Most of the top soils in the area are residual soils (intermingled with lime powder and nodules). There are also top soil of organic humus at certain patches here and there particularly in relatively thick forested spots. In the lower layers are sheer limestone, shale and sand stone.

Clay, $Al_2\ SO_4\ 2H_2O$ is also present in the area; the colour is reddish brown, and of good quality as raw materials for the production of cement.

4.3.6 Sediments

Because the secondary forest on the mountain tops and slopes is still in relatively good condition, the forest, especially the intricate root systems could retain the soil effectively. No visible case of sedimentation process such as severe erosion and sedimentation/deposition were found. However there is no doubt that due to steep slope there will be erosion to a certain extent during the rainy season. This is evident in the present of residual soils in many places. When the forest are cleared either for construction work and for quarrying work there is no doubt that erosion process will become more prominent.

The fast flowing mountain stream does not favour sedimentation; no sediment deposits were observed.

4.3.7 Surface water hydrology

There are three small streams, namely Yay-pu Chaung, Zali Chaung and Kyauk Phy Chaung which generally flow from east to west into the Mei-hor rivulet. This rivulet generally flows from north west and drain into the Paung Laung River.

The Yay-pu Chaung stream is a fast flowing mountain stream where the depth of the water is generally about one foot. The gradient of the stream bed (from upstream to downstream) is relatively high resulting into fast flowing water. According to information from the villagers there was no precedent of flooding during the rainy season. And there is no plain in the vicinity to be flooded during wet season.

4.3.8 Surface water quality

The small stream, Yay-pu Chaung, is close to the factory and the water from this stream is utilized for industrial as well as domestic purpose, but not for drinking.

The factory so far, has to rely on the surface water (the water of Yay-Pu-Chaung stream) as testing for underground water was not successful. Probably the underground aquifer is very much deeper than anticipated. The weir that contains the water from Yay-Pu-Chaung with a capacity of 3 million gallons cannot last for a week if the small stream dried up. It happened once, about 10 years ago, according to the village elders. The responsible persons of the factory should make new effort to find the underground aquifer. From hydrological point of view aquifer is much more reliable than the surface water of a small stream, especially when very large amount of water has to be utilized.

The samples of the stream water collected from the main tank were taken back to Yangon for analysis at a registered laboratory. The result is shown in **Table-6**.

Table-6: **Analysis of water quality from the weir (cement factory)**

ISO TECH LABORATORY

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W1114 266

WATER QUALITY TEST RESULTS FORM

Client	MESC
Nature of Water	Stream Water
Location	လယ်ဝေး
Date and Time of collection	21.11.2014
Date and Time of arrival at Laboratory	21.11.2014
Date and Time of commencing examination	21.11.2014
Date and Time of completing	26.11.2014

Results of Water Analysis			WHO Drinking Water Guideline (Geneva - 1993)
pH	7.1		6.5 - 8.5
Colour (True)		TCU	15 TCU
Turbidity	21	NTU	5 NTU
Conductivity	262	micro S/cm	
Total Hardness	106	mg/l as $CaCO_3$	500 mg/l as $CaCO_3$
Calcium Hardness	70	mg/l as $CaCO_3$	
Magnesium Hardness		mg/l as $CaCO_3$	
Total Alkalinity	122	mg/l as $CaCO_3$	
Phenolphthalein Alkalinity		mg/l as $CaCO_3$	
Carbonate ($CaCO_3$)	Nil	mg/l as $CaCO_3$	
Bicarbonate (HCO_3)	122	mg/l as $CaCO_3$	
Iron		mg/l	0.3 mg/l
Chloride (as CL)	6	mg/l	250 mg/l
Sodium chloride (as NaCL)		mg/l	
Sulphate (as SO_4)	Nil	mg/l	200 mg/l
Total Solids	157	mg/l	1500 mg/l
Suspended Solids		mg/l	
Dissolved Solids		mg/l	1000 mg/l
Manganese		mg/l	0.05 mg/l
Phosphate	Nil	mg/l	
Phenolphthalein Acidity		mg/l	
Methyl Orange Acidity		mg/l	
Salinity	0.1	ppt	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature: Zaw Hein Oo
Name: B.Sc (Chemistry) Chemist
ISO TECH Laboratory

Approved by
Signature: Soe Thit
Name: B.E (Civil) 1980, Technical Officer
ISO TECH Laboratory

(a division of WEG Co.,Ltd.)

No.18, Lanthit Road, Nanthargone Quarter, Insein Township, Yangon, Myanmar.
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ISO TECH LABORATORY

Laboratory Technical Consultant: U Saw Christopher Maung
B.Sc Engg: (Civil), Dip S.E (Delft) Lecturer of YIT (Retd), Consultant (Y.C.D.C), LWSE 001.
Former Member (UNICEF, Water quality monitoring & Surveillance Myanmar)

ISO 9001:2008 Cert. No.688283

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WATER QUALITY TEST RESULTS FORM

Client	MESC
Nature of Water	Stream Water
Location	ဝယ်ခေါ
Date and Time of collection	21.11.2014
Date and Time of arrival at Laboratory	21.11.2014
Date and Time of commencing examination	21.11.2014
Date and Time of completing	26.11.2014

Results of Water Analysis			WHO Drinking Water Guideline (Geneva - 1993)
Temperature (°C)		°C	
Fluoride (F)		mg/l	1.5 mg/l
Lead (as Pb)		mg/l	0.01 mg/l
Arsenic (As)		mg/l	0.01 mg/l
Nitrate ($N.NO_3$)		mg/l	50 mg/l
Chlorine (Residual)		mg/l	
Ammonia (NH_3)		mg/l	
Ammonium (NH_4)		mg/l	
Dissolved Oxygen (DO)		mg/l	
Chemical Oxygen Demand (COD)	32	mg/l	
Biochemical Oxygen Demand (BOD) (5 days at 20 °C)	10	mg/l	
Cyanide (CN)		mg/l	0.07 mg/l
Zinc (Zn)		mg/l	3 mg/l
Copper (Cu)		mg/l	2 mg/l
Silica (Si)		mg/l	

Remark: This certificate is issued only for the receipt of the test sample.

Tested by
Signature:
Name: Zaw Hein Oo, B.Sc (Chemistry), Chemist, ISO TECH Laboratory

Approved by
Signature:
Name: Soe Thit, B.E (Civil) 1980, Technical Officer, ISO TECH Laboratory

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4.3.9 Ground water

The testing for ground water is so far not successful. The underground aquifer is much deeper than anticipated. A few artisans wells were sunk but the results so far are not satisfactory.

At the moment nothing is known about the ground water of this area. Such cases are quite common in the Dry Zone Area of Myanmar where aquifers are at depths of more than one thousand feet.

4.3.10 Ambient air quality

Parameters

Total Suspended Particulate Matter, Respiratory Particulate Matter (PM_{10}), Sulphur dioxide (SO_2) and Nitrogen dioxide (NO_2) in 24hrs mean and Nitrogen dioxide for 1hr.

Frequency

The report covers the observations for the baseline data obtained in one cross-sectional survey.

Method

Ambient air sampling was conducted at above mentioned two sites. Each sampling period was based on 24-hour measurement level of TSPM and PM_{10} using high volume air sampler with glass-fibered filter and SO_2 and NO_2 with absorbent liquids for each gas. The principle of TSPM and PM_{10} sampling applied gravity metric-high volume method and measured by using microbalance. For SO_2 and NO_2, the titration method is used to quantify the level.

Sample No.	Description	TSPM (µg/m³) 24Hrs	PM_{10} (µg/m³) 24Hrs	SO_2 (µg/m³) 24Hrs	NO_2 (µg/m³) 24Hrs	NO_2 (µg/m³) 1Hr
1	At Max Myanmar cement factory	140.05	48.04	0.004	5.04	21.41
2	Near primary school, Aung Nan Cho village	69.27	28.85	0.003	11.74	42.91

Total Suspended Particulate Matter (TSPM)

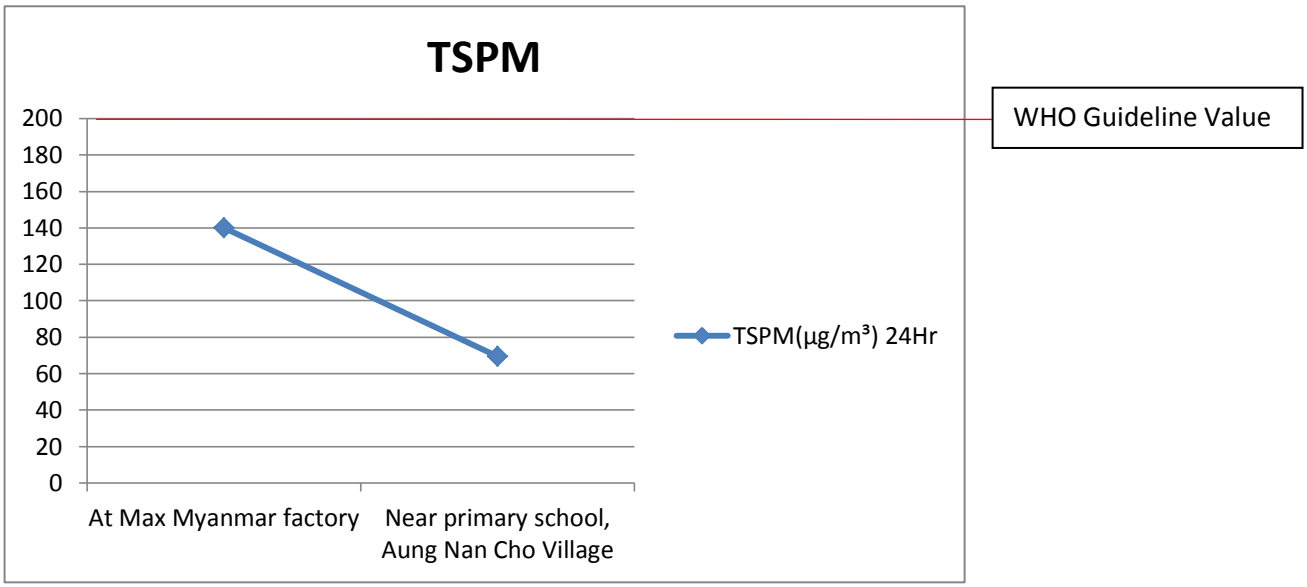

Figure-21: Total Suspended Particulate Matter (TSPM) concentration

The result of Total Suspended Particulate Matter (TSPM) from both sample sites showed lower than guideline values (200 µgm/m^3).

Respiratory Particulate Matter (PM_{10})

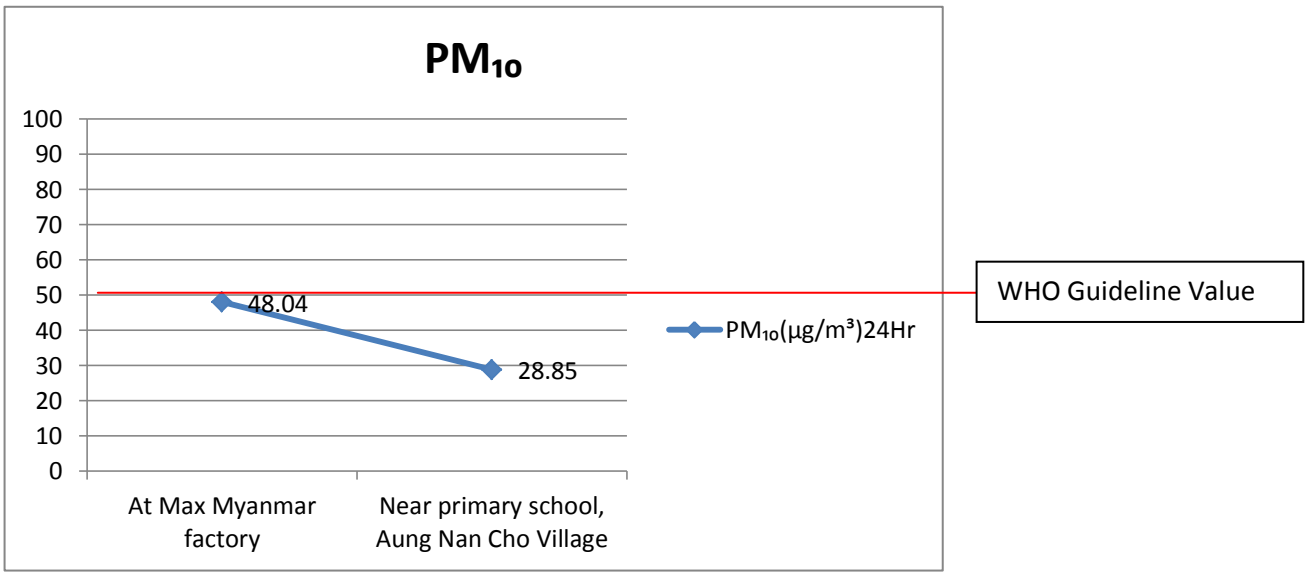

Figure-22: Respiratory Particulate Matter (PM_{10}) concentration in sample sites

The results of Respiratory Particulate Matter (PM_{10}) from both sample sites are 48.04 µgm/m^3 and 28.85 µgm/m^3 respectively and lower than WHO and the National guideline (ECD) values (50 µgm/m^3).

Sulphur Dioxide (SO_2)

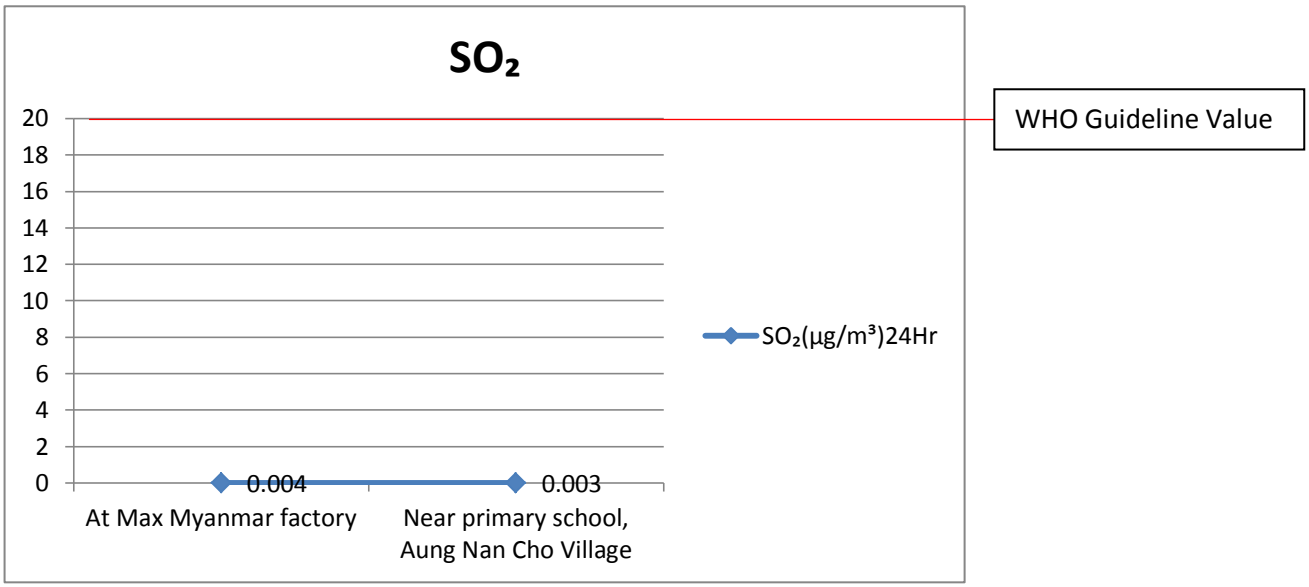

Figure-23: Sulphur Dioxide (SO_2) concentration in sample sites

The result of Sulphur Dioxide (SO_2) concentrations obtained from both sample sites were 0.004 µgm/m^3 and 0.003 µgm/m^3 and much lower than WHO and the National guideline (ECD) values (20 µgm/m^3) in all sites.

Nitrogen Dioxide (NO_2)

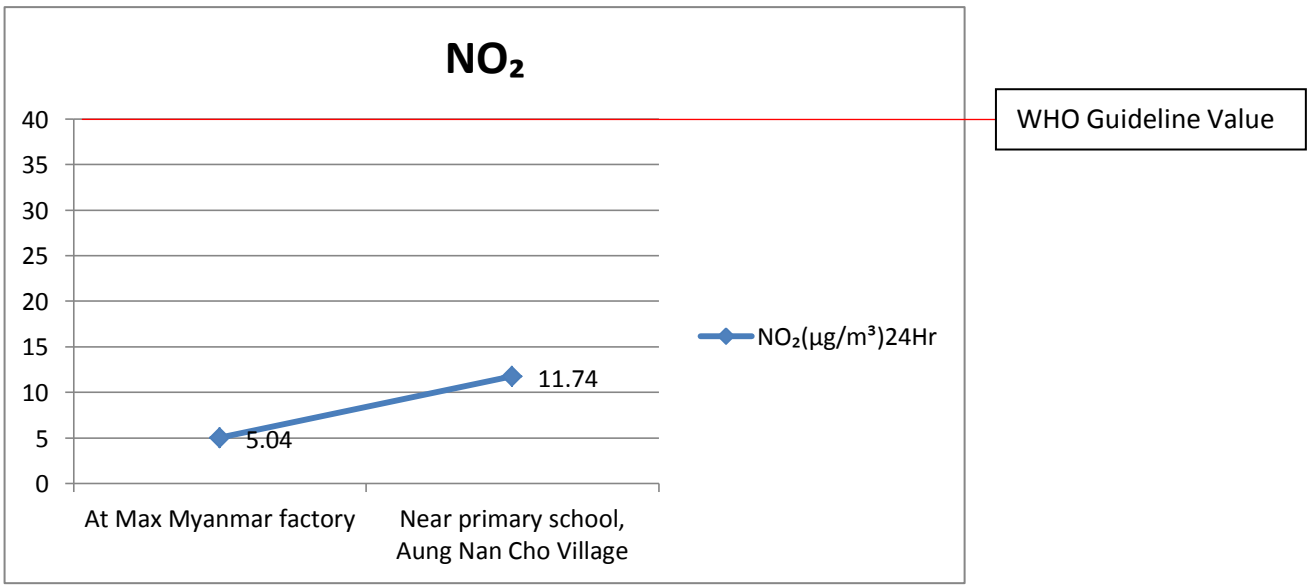

Figure-24: Nitrogen Dioxide (NO_2) concentration for 24hrs mean in sample sites

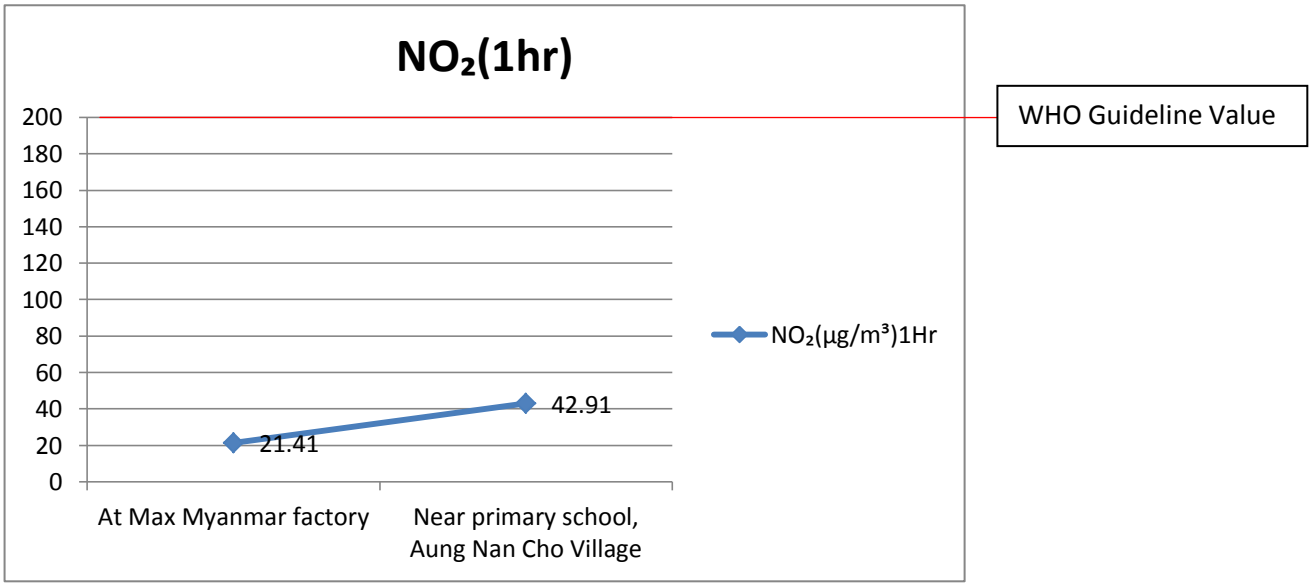

Figure-25: Nitrogen Dioxide (NO_2) concentration for 1 Hr in sample sites

The result of Nitrogen Dioxide (NO_2) from both sample sites for 24 hrs mean demonstrated as 5.04 µgm/m^3 and 11.74 µgm/m^3 and lower than the WHO guideline values (40µgm/m^3) in all sites.

The result of Nitrogen Dioxide (NO_2) from both sample sites for 1hr mean pointed out as 21.41 µgm/m^3 and 42.91 µgm/m^3 and also relatively lower than WHO and the National guideline (ECD) values (200µgm/m^3) in all sample sites.

4.3.11 Ambient noise and vibration

Acoustic testing was conducted during the EIA and the result is shown in **Table-7**.

Table-7: Noise level at the site

Date	Noise level dBA at PM	Wind speed m/sec	Temperature °C
22-8-2014	57.5	0.7	26.6
23-8-2014	55.7	3.5	29.3

The acoustic level test during the preliminary EIA was just for baseline data collection as the factory was shut down and values of noise level was low (like those of a rural quiet area). The values were within reference values of WHO and EU, and also within the National (ECD) values.

After the shut down and the factory is in operation the noise level form the crusher department will be very high. The noise level from the blasting site (excavation site) will be exceedingly high and so too will be the level of vibration. But these will be only for a very short period, within seconds.

4.3.12 Potential natural hazards of the area

Not found and not anticipated.

The area is well-sheltered and for away from the coast in the south. The factory is on a flat terrain but is not a low land plain (elevation 500 asl) and there are no great rivers or riverine system, no low wetland or no low lying plain to be flooded during the rainy season. The area does not have heavy rainfall but rather have a relatively dry zone climate.

There is no major fault line in the area.

There were no precedent of natural hazards such as violent storms, floods and earthquake in the area within memories of 5 decades, it was learnt.

4.4 Biological components

4.4.1 Forest

The whole area used to be part of Mei-hor Reserved Forest. The forest type of the flat terrain is basically semi-decidious secondary forest. As the vegetation is cleared for the construction of factory and compound and access road only degraded residual forest remain. However on the slopes and top of the mountain and hills the forest still remain relativerly green with relatively high biodiversity. Max Myanmar Company has a restoration programme where 500 acres of land is now reforested with teak. There is a small paddy field in the south east while in the north-west, west and south west are cultivated land of sugar cane fields, farms of sesame, ground nut, bean etc.

In this flat terrain lowland area no big trees (GBH of 300cm) remain. But on the mountain or hill slope big trees with GBH (Girth at Breast Height) of 300cm constitute about 2% of the trees.

The local people from Aung Nan Cho, Aung Chan Thar and Let Pan Ku cut the trees on the mountain slopes for use as fuel wood. However poor people cut the trees of pole size (not big enough for extraction of timber) for use as construction materials for building their houses or huts.

4.4.2 Flora species

The survey work on flora was carried out on the flat terrain, along the streams, on the slopes and tops of the mountain and hills.

The methodology applied was simple classic taxonomic and ecological study method. No attempt was made to calculate diversity index, species eveness and species richness that involved rather complex formulae intended for pure academic purpose or pure research purpose. After all, most, if not all, trees in the lease area would be gone sooner or later within 30 years as a result of quarry. Effective rehabilitation has to be implemented later.

Diversity

A total of 200 species of plants belonging to 67 families were found, identified and recorded. The inventory of plant species is shown in **Table-8**.

Among them, 2 species were categorized as Endangered (EN), 1 species as Near Threatened (NT) and 9 species as Least Concerned (LC) were listed according to the IUCN red list (2014).

Table-8: Inventory of flora species found in the area

No	Scientific Name	Common Name	Family Name	Habit
1	*Acacia chundra* Willd	Sha	Mimosaceae	T
2	*Acacia pennata* (L.) Willd	Suyit	Mimosaceae	C/C
3	*Acacia pruinescens* Kurz	Ka-mon-chin	Mimosaceae	C/C
4	*Achyranthes aspera* L.	Kyet-mauk-supyan	Amaranthaceae	H
5	*Adiantum capillus-veneris* L.	Hair-Fern	Pteridaceae	H
6	*Aegle marmelos* (L.) Correa	Okshit	Rutaceae	T
7	*Ageratum conyzoides* L.	Khwe-thay-pan	Asteraceae	S
8	*Albizia chinensis* (Osbeck) Merr	Bon-me-zar	Mimosaceae	T
9	*Albizia lebbek* Benth	Anya-koko	Mimosaceae	T
10	*Alternanthera sessilis L.*	Pa-zun-sa-yaing	Amaranthaceae	H
11	*Alysicarpus vaginalis* (L.)DC	Thanma-naing-kyauk-manaing	Fabaceae	S
12	*Amaranthus spinosus* L.	hinnu-new subauk	Amaranthaceae	H
13	*Amaranthus viridis* L.	hinnu-new yaing	Amaranthaceae	H
14	*Andrographis paniculata* (Burm.F.) Wall ex.	Saga-gyi	Acanthaceae	A
15	*Annona muricata* L.	Duyin-awza	Annonaceae	ST
16	*Annona squamosa* L.	Awza	Annonaceae	ST
17	*Anogeissus acuminata* Wall.	Yon	Combretaceae	T
18	*Anthocephatus morindaefolius* Korth	Ma-u-let-tan-shae	Rubiaceae	T
19	*Antidesma ghesaembilla* Gaentn	Kin-balin	Euphorbiaceae	ST
20	*Apluda mutica* L.	Myet-wa	Poaceae	G
21	*Ardisia solanaceae* Roxb.	Kyetma-ok	Myrsinaceae	S
22	*Aristolochia indica* L.	Indian-birthwort	Aristolochiaceae	C/C
23	*Aristolochia roxburghiana* Klotzsch.	Aristolochia	Aristolochiaceae	C/C
24	*Arundo donax* L.	Alo-kyu	Poaceae	G
25	*Asparagus racemosus* Willd	Shint-ma-tet	Asparagaceae	C
26	*Bambusa burmanica* Gamble	Thaik-wa	Poaceae	B
27	*Bauhinia acuminata* L.	Swe-daw	Caesalpiniaceae	ST
28	*Begonia roxburghii* A.DC	Kyauk-chin-pan	Begoniaceae	H
29	*Bidens alba* DC.	Ta-sae-ark	Asteraceae	H
30	*Boerhavia repanda* Willd.	Pa-yan-na-wa	Nyctaginaceae	H
31	*Bombax ceiba* L.	Let-pan	Bombacaceae	T
32	*Bombax insigne* Wall	De-du	Bombacaceae	T
33	*Bothriochloa pertusa* (L.) A. Camus	Padaw-pyu	Poaceae	G
34	*Bridelia ovata* Decne	Seik-che	Euphorbiaceae	T
35	*Buchanania lanzan* Spreng.	Lunbo	Anacardiaceae	T
36	*Butea parviflora* Roxb.	Pauk-new	Fabaceae	C/C
37	*Calotropis procera* (Ait.)R.Br.	Mayo	Asclepiadaceae	S
38	*Carallia brachiata* (Lour.) Merr	Mani-awga	Rhizophoraceae	T
39	*Cardiospermum halicacabum* L.	Kala-myet-si	Sapindaceae	C/C
40	*Carica papaya* L.	Thin-baw	Caricaceae	ST
41	*Cassia fistula* L.	Ngu	Caesalpiniaceae	T
42	*Cassia occidentalis* L.	Dan-gywe	Caesalpiniaceae	S

43	*Cayratia trifolia* L.	Taw sabyit	Vitaceae	C/C
44	*Ceiba pentandra* (L.) Gaertn.	Le-moh-pin	Bombacaceae	T
45	*Centella asiatica* (L.)Urb	Myin-hkwa	Apiaceae	H
46	*Chloris barbata* Sw.	Lay-gwa-myet	Poaceae	G
47	*Chromolaera odorata* L.	Bi-zet	Asteraceae	S
48	*Cleome burmanii* Wight & Arn	Taw-hin-ga-lar	Capparaceae	H
49	*Colocasia affinis* Schott.	Pein	Araceae	H
50	*Combretum acuminatum* Roxb.	Nabu-new	Combretaceae	C/C
51	*Commelina benghalensis* L.	Wet-kyok	Commelinaceae	H
52	*Commelina communis* L.	Wetkyok	Commelinaceae	H
53	*Corchorus acutangulus* Lam.	Pilaw	Tiliaceae	S
54	*Corchorus aestuans* L.	Pilaw-hka	Tiliaceae	S
55	*Corchorus capsularis* Lam.	Pilaw	Tiliaceae	S
56	*Costus speciosus* Sm.	Phalan-taung-hmwe	Costaceae	H
57	*Cratoxylum nerrifolium* Kurz.	Bebya	Hyperaceae	T
58	*Crocus sativus* L.	Gon-ga-man	Iridaceae	H
59	*Crotalaria sericea* Retz	Taw-paik-san	Fabaceae	S
60	*Croton oblongifolia* Roxb.	Thetyin-gyi	Euphorbiaceae	ST
61	*Curcuma petiolata* Roxb.	Marlar	Zingiberaceae	H
62	*Cyathuta prostrata* L.	Kyet-mauk-pyan	Amaranthaceae	H
63	*Cycas rumphii* Miq	Mondai	Cycadaceae	ST
64	*Cynodon dactylon* (L.) Pers	Myay-sar-myet	Poaceae	G
65	*Cyperus compressue* L.	Wetlar-myet	Cyperaceae	H
66	*Cyperus rotundus* L.	Myet-mon-nyin	Poaceae	G
67	*Cyrtococcum patens* (L.) A. Camus	Pa-taw-myet	Poaceae	G
68	*Dactyloctenium aegyptium* (L.) Willd	Myet-lay-gwa	Poaceae	G
69	*Dalbergia cultrata* Grah.	Yin-daik	Fabaceae	T
70	*Dalbergia foliaceae* Wall	Daung-talaung	Fabaceae	C/C
71	*Dalbergia oliveri* Gamble	Ta-ma-lan	Fabaceae	T
72	*Dalbergia sisoo*Roxb.	Kala-padauk	Fabaceae	T
73	*Decaschistia trilobata* Wight	Taw-chin-baung	Malvaceae	H
74	*Delonix regia* (Bojer ex. Hook)	Sein-pan-gyi	Caesalpiniaceae	T
75	*Dendrocalamus longispathus* Kurz.	Wanet	Poaceae	B
76	*Dendrocalamus strietus* Nees	Hmyin-wa	Poaceae	B
77	*Desmodium gyrans* DC.	Say-ka-myin	Fabaceae	S
78	*Desmodium pulchellum* Benth	Taung-damin	Fabaceae	S
79	*Dillenia pentagyra* Roxb.	Zin-byun	Dilleriaceae	T
80	*Dioscorea bulbifera* L.	Myauk -u	Dioscoreaceae	C/C
81	*Dipterocarpus alatus* Roxb.	Kanyin	Dipterocarpaceae	T
82	*Dipterocarpus pilosus* Roxb.	Timber	Dipterocarpaceae	T
83	*Dipterocarpus tuberculatus* Roxb.	In	Dipterocarpaceae	T
84	*Echinochloa colona* Link	Be-sar-myet	Poaceae	G
85	*Echinochloa staginina* (Retz.) P.Beauv.	Myet-thi	Poaceae	G
86	*Eclipta alba* Hassk.	Kyeik-hman	Asteraceae	H
87	*Elephantopus scaber* L.	Sin-chae	Asteraceae	H
88	*Eleusine indica* (L.) Gaertn	Sinngo-myet	Poaceae	G
89	*Emblica officinalis* Gaertn	Zibyu	Euphorbiaceae	T
90	*Eragrostis barbulata* Stapf.	Thaman-myet	Poaceae	G
91	*Eugenia kurzii* Duthie	Thabye-nyo	Myrtaceae	T
92	*Eupatorium odoratum* L.	Taw bezat	Asteraceae	S
93	*Euphorbia heterophylla* L.	Kywe-kyaung-myin-si	Euphorbiaceae	S
94	*Euphorbia hirta* L.	Kyae-kaung-minsay	Euphorbiaceae	S
95	*Ficus glomerata* Roxb.	Tha-phan	Moraceae	T
96	*Garuga pinnata* Roxb.	Chinyok	Burseraceae	T
97	*Globba orixensis* Roxb.	Waso-pan	Zingiberaceae	H
98	*Gmelina arborea* Roxb.	Yamanae	Verbenaceae	T

99	*Gossypium arboreum* L.	Wah-gyi	Malvaceae	S/ST
100	*Grewia hirsute* Vahl	Kyet-tayaw	Tiliaceae	S
101	*Habiscus tiliaceus* L.	Shaw	Malvaceae	ST
102	*Heliotropium indicum* L.	Sin-hna-maung	Boraginaceae	H
103	*Heterophragma adenophylla* Wall.	Phet-than	Bignoniaceae	T
104	*Heteropogon contortus* L.	Mwe-lein-myet	Poaceae	G
105	*Hibiscus surattensis* L.	Taw-chin-baung	Malvaceae	S
106	*Hiptage benghalensis* (L.) Kurz.	Bein-new	Malpighiaceae	C/C
107	*Hymenodictyon excelsum* (Roxb) W	Khu-than	Rubiaceae	T
108	*Indigofera tinctoria* L.	Me-net	Fabaceae	S
109	*Ipomoea angustifolia* Jacq	Not known	Convolvulaceae	C
110	*Jatropha glandulifera* Roxb.	Taw-kyetsu	Euphorbiaceae	S
111	*Jussiaea repens* L.	Ye-ka-nyut	Onagraceae	H
112	*Jussiaea suffruticosa* L.	Taw-lay-nyin-gyi	Onagraceae	H
113	*Kaempferia candida* Wall.	Pa-dat-sa	Zingiberaceae	H
114	*Lagerstroemia tomentosa Presl.*	Leza	Lythraceae	T
115	*Lagerstroemia villosa* Wall	Zaung-bale	Lythraceae	T
116	*Lagerstroemin macrocarpa* Kurz.	Pyin-ma ywet-gyi	Lythraceae	ST
117	*Lannea coromandelica* (Houtt) Merr	Na-be	Anacardiaceae	T
118	*Lasia spinosa* (L.) Thw	Za-yit	Araceae	H
119	*Leea* sp.	Naga-mauk	Leeaceae	S
120	*Leucaena leucocephala* (Lam)	Baw-za-gaing	Mimosaceae	T
121	*Leucas aspera* Spreng	Taw-pin-sein	Lamiaceae	S
122	*Leucas cephalotes* Spreng	Pin-gu-hteik-peik	Lamiaceae	S
123	*Litsea glutinosa* (Lour.) C.B.Rob.	On-don	Lauraceae	T
124	*Macaranga siamensis*	Phet-wun	Euphorbiaceae	T
125	*Mangifera* sp.	Taw Thayat	Anacardiaceae	ST
126	*Mansonia gagei* Drum	Kalamat	Sterculiaceae	T
127	*Markhamia stipulata* (Wall.)	Ma-hlwa	Bignoniaceae	T
128	*Melanorrhoea usitata* Wall.	Thitsi	Anacardiaceae	T
129	*Melastoma malabathricum* L.	Nyaung-ye-o-pan	Melastomataceae	S
130	*Microcos paniculata* L.	Mya-ya	Tiliaceae	ST
131	*Millettia brandisiana* Kurz	Thit-pagan	Fabaceae	T
132	*Millettia extensa* Benth	Win-u	Fabaceae	S/C
133	*Millingtonia hortensis* L.F.	Indian-cork tree	Bignoniaceae	T
134	*Mimisa rubicaulis* Lam	Bilatt-tikayon	Mimosaceae	H
135	*Mimosa pudica* L.	Hti-ka-yon	Mimosaceae	H
136	*Momordica dioica* Roxb.	Kyet-hin-kha	Cucurbitaceae	C/C
137	*Monochoria vaginalis* (Presl)Kunth	Kadauk-sat	Pontederiaceae	Aquatic
138	*Moringa oleifera* Lamk	Dan-da-lun	Moringaceae	T
139	*Mucuna pruriens* (L.)	Khwe-laya	Fabaceae	C
140	*Mukia maderaspatana* (L.) M.Roem	Sar-thkhwa	Cucurbitaceae	C/C
141	*Musa* sp.	Nget-pyaw	Musaceae	H
142	*Neoalsomitra sarcophylla* (Wall.) Hutch	Kyi-ah	Cucurbitaceae	C
143	*Ocimum americanum* L.	Hoary basil	Lamiaceae	H
144	*Ocimum sanctum* L.	Kalar-pin-sein	Lamiaceae	H
145	*Oldenlandia corymbosa* L.	Su-la-na-pha	Rubiaceae	H
146	*Oroxylum indicum* (L.) Kurz	Kyaungsha	Bignoniaceae	T
147	*Paedera foetida* L.	Pe-bok-new	Rubiaceae	C/C
148	*Paracalyx scariosus* (Roxb.) Ali	Taw-pe	Fabaceae	H
149	*Pennisetum purpureum* Schum	padaw-ni-myet	Poaceae	G
150	*Pennisetum* sp.	Not known	Poaceae	G
151	*Phyllanthus acidus* L.	Taung-zi-phyu	Euphorbiaceae	ST
152	*Phyllanthus niruri* L.	Kyet-tha-hin	Euphorbiaceae	S
153	*Physalis minima* L.	Bauk-pin	Solanaceae	H
154	*Picrorhiza kurroa* Royle.	Saung-may-ga	Scrophulariaceae	H

155	*Pterocarpus indicus* Willd.	Padauk	Fabaceae	T
156	*Pterocarpus macrocarpus* Kurz	Thit-pa-dauk	Fabaceae	T
157	*Pterospermum acerifolium* (L.) Willd.	Taw-kalamet	Sterculiaceae	ST
158	*Randia uliginosa* DC.	Hman-phyu	Rubiaceae	ST
159	*Rauvolfia densiflora* (Thwaites)	Bonma-yaza	Apocynaceae	S
160	*Ricinus communis* L.	Kyet-su	Euphorbiaceae	ST
161	*Saccharum spontaneum* L.	Kaing	Poaceae	G
162	*Samanea saman* (Jacq) Merr	Ko-Kko	Mimosaceae	T
163	*Schleichera trijuga* Willd	Gyo	Sapindaceae	T
164	*Schrebera swietenioides* Roxb.	Than-thay	Oleaceae	T
165	*Scoparia dulcis* L.	Dan-na-thu-kha	Scrophulariaceae	H
166	*Sesbania grandiflora* (L.)	Pauk-pan-byu	Fabaceae	ST
167	*Sesbania paludosa* Roxb.	Nyan	Fabaceae	S
168	*Sesbania procumbens* (Roxb.)W&Arn	Nyan-thein	Fabaceae	S
169	*Setaria lutescens* Hubb.	Yon-sar	Poaceae	G
170	*Shorea obtuse* Wall.	Thit-ya	Dipterocarpaceae	T
171	*Shorea siamensis* Kz.	Ingyin	Dipterocarpaceae	T
172	*Sida acuta* Burm	Tabyet-si-ywet-chon	Malvaceae	S
173	*Sida cordifolia* L.	Tabyet-si-ywet-wine	Malvaceae	S
174	*Smilax china* L.	Sein-nabaw-lay	Smilacaceae	C/C
175	*Smilax glabra* Roxb.	sein-nabawgyi	Smilacaceae	C/C
176	*Smilax macrophylla* Roxb	Katcho	Smilacaceae	C/C
177	*Solanum torvum* Sw.	Kazaw-kha	Solanaceae	S
178	*Sterculia versicolor* Wall	Shaw-phyu	Sterculiaceae	T
179	*Stereospermum suavedens* DC.	Tha-kut	Bignoniaceae	T
180	*Sterospermum personatum* Chatt.	Thakut-po	Bignoniaceae	T
181	*Sterospermum suaveolens* (Roxb.) A.DC.	Kywema-gyolein	Bignoniaceae	T
182	*Strychnos nux-vomica* L.	Kabaung	Loganiaceae	T
183	*Synedrella nodiflora* (L.) Gaertn.	Bizat-hpo	Asteraceae	H
184	*Tamarindus indica* L.	Magyi	Caesalpiniaceae	T
185	*Tectona grandis* L.	Kyun	Verbenaceae	T
186	*Terminalia arjuna* Wight & Arn	Tauk-kyan	Combretaceae	T
187	*Terminalia bellerica* Roxb.	Thit-seint	Combretaceae	T
188	*Terminalia chebula* Retz	Phan-kha	Combretaceae	T
189	*Thyrsostachys oliveri* Gamble	Thana-wa	Poaceae	B
190	*Trema orientalis* (L.)	Kywe-sa	Ulmaceae	ST
191	*Tridax procumbens* L.	Hmwezok	Asteraceae	H
192	*Triumfetta bartramia* L.	Kat-si-nae-thay	Tiliaceae	S
193	*Urena lobata* L.	Kat-si-nae-gyi	Malvaceae	S
194	*Vernonia cinera* (L.) Less	Kadu-pyan	Asteraceae	H
195	*Vitex glabrata* R.Br.	Tauksha	Verbenaceae	T
196	*Vitis discolor* Dalzell	Ngwe-gya	Vitaceae	C/C
197	*Waltheria indica* L.	Bauk-phyu	Sterculiaceae	S
198	*Xylia xylocarpa* (Roxb.) Taub	Pyin-ka-doe	Mimosaceae	T
199	*Ziziphus oenoplia* Mill	Taw-zi-new	Rhamnaceae	S/C
200	*Ziziphus rugosa* Lam	Taw-zi	Rhamnaceae	ST

S - Shrub

H - Herb

T - Tree

ST - Small tree

C - Climber

C/C - Climber/ Creeper

G - Grass

B - Bamboo

Out of these 200 species, 61 Tree (T); 18 Small Tree (ST); 1 wooden Shrub or Shrub/Small Tree (S/ST); 17 Grass (G); 33 Shrubs (S); 2 Shrub/Climber (S/C); 40 Herb (H); 4 Bamboo (B); 4 Climber (C); 18 Climber/Creeper (C/C) and 2 Aquatic plant (A) were recorded.

On the whole in term of biodiversity the Family Poaceae dominated all other families followed by Euphorbiaceae and Fabiaceae.

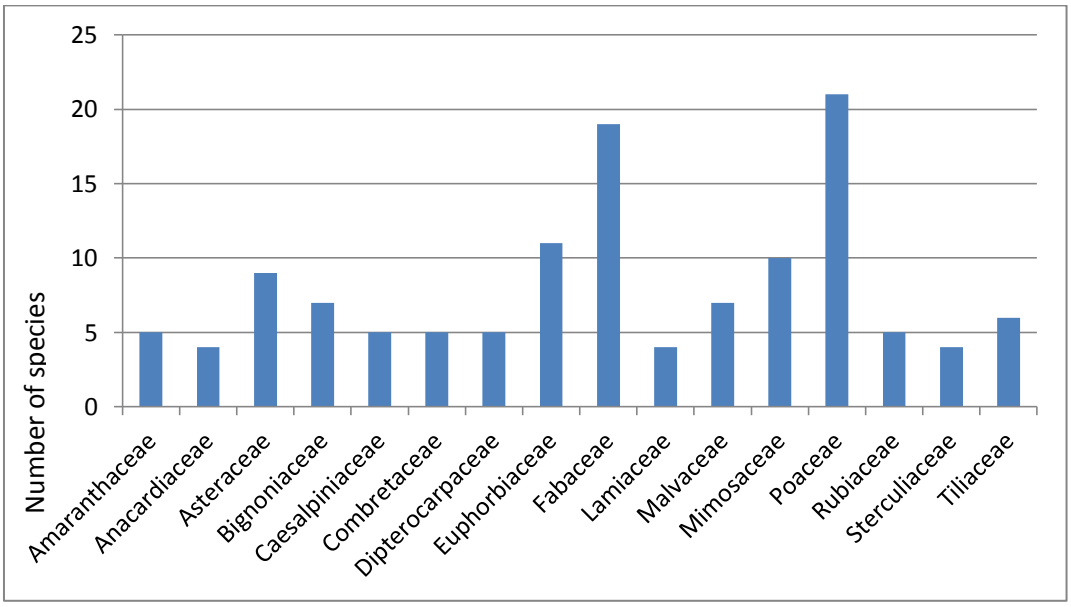

Figure-26: Family wise species composition of major family

Abundance/dominance general pattern

The most abundant plant families in term of number are grass, herbs or small plants. Again species of the Poaceae dominated over all other families. Although not conspicuous they dominate over all other plants in number (quantity).

Small trees under the family Euphorbiaceae are abundant in the area.

In term of conspicuousness big trees of the family Dipterocarpaceae dominated over all other big and small trees.

Rare and vulnerable species

On the whole big trees were very rare. Big trees with GBH of 300cm represented less than 3% of the whole study area. Those large trees were indeed trees that were neglected by loggers due to low quality wood. Trees of quality timber such as *Tectona grandis* and *Xylia xylocarpus* remained only as small trees, rare and sparsely scattered and inconspicuous among others.

According to IUCN data list 2014, at least 12 species were recorded in the area. The break down was as follow:

- Endangered : *Dalbergia oliveri* (Ta-ma-lan)

  Dipterocarpus alatus (Ka-nyin)

- Near threatened : *Cycas rumphii* (Mondai)

- Least concerned : *Adiantum Capillusververis*

  Aurndo donax

  Bauhinia acuminate

  Commelina bengalensis

  Cyperus rotundus

  Dipterocarpus tuberculatus

  Mimosa pudica

  Saccharum spontaneum

  Shorea obtusa

There is no doubt that Ta-ma-lan and Ka-nyin become endangered due to over exploitation.

Species of socio-economic interest

As mentioned earlier the local community relies on this forest for fuel wood and building materials. This partially degraded secondary forest still provides fuel wood for the locals. Illegal logging and illegal production of charcoal are still taking places (outside the study area) it is learnt. In the survery area almost all big trees with the exception of those with very low quality timber wood were already gone. There are still certain isolated big trees of medium wood quality uspecially those of the family Dipterocarpaceae.

Medicinal plants still exist in this partilly degraded secondary forest. For instance, *Alysicarpus vaganilis, Aristolochia roxburgiana, Boerhavia repands, Emblica officinalis, Mansonia gagei* and *Rauwolfia densiflora*. These were found only in small quantity and not economically viable. Rudimentary bamboo thicket could be still found here and there. Mushrooms and bamboo shoots are still available, though no longer plentiful, during the rainy season, it is learnt.

The long term impact of the project on the biodiversity, particularly natural vegetation will be quite significant. This will be mentioned later in **Chapter-5**.

4.4.3 Fauna species

4.4.3.1 Avian fauna (birds)

Methodology in brief

High power telescopes, binocular and camera (tele-lens) were the main tools used for avian study.

The whole area densignated for survey (about 16 square miles) was covered. These were areas north, east, south and west of the factory. Focus was also made on the area south east of the factory.

The survey work was carried out from 06:30 hrs till dark, with only one recess from lunch. Usually more birds are found in early morning and in the evening.

Diversity

A total of 54 avian species under 31families were found, identified and recorded.

Inventory of bird species found are shown in **Table-9**.

Table-9: Bird species recorded in the area

Sr. no	Family name, Common name & *Scientific name*
	PHASIANIDAE: PERDICINAE Partridges, francolins, quails
1	Chinese Francolin *Francolinus pintadeanus*
	ARDEIDAE: ARIDEINAE: Herons & egrets
2	Pond-heron *Ardeola* sp.
3	Little Egret *Egretta garzetta*
	FALCONIDAE: FALCONINAE: Falcons
4	Common Kestrel *Falco tinnunculus*
	FALCONIDAE: ACCIPITRINAE: Hawks, eagles & allies
5	Oriental Honey-buzzard *Pernis ptilorhynchus*
6	Black Kite *Milvus migrans*
7	Shikra *Accipiter badius*
	VANELLIDAE: Lapwings & allies
8	Red-wattled Lapwing *Vanellus indicus*
	SCOLOPACIDAE: TRINGINAE: Godwits, dowitchers, curlews, sandpipers & allies
9	Common Sandpiper *Actitis hypoleucos*
	COLUMBIDAE: COLUMBINAE: Typical pigeons & doves
10	Rock Pigeon *Columba livia*
11	Spotted Dove *Streptopelia chinensis*
	PSITTACIDAE: PSITTACINAE: Parrots & parakeets
12	Grey-headed Parakeet *Psittacula finschii*
	CUCULIDAE: CENTROPODINAE: Coucals
13	Greater Coucal *Centropus sinensis*
	CORACIIDAE: Rollers
14	Indian Roller *Coracias benghalensis*

	ALCEDINIDAE: HELCYONINAE: Larger kingfishers
15	White-throated Kingfisher *Halcyon smyrnensis*
16	Black-capped Kingfisher *Halcyon pileata*
	MEROPIDAE: Bee-eaters
17	Little Green Bee-eater *Merops orientalis*
	PICIDAE: JYGNINAE: Wrynecks
18	Eurasian Wryneck *Iynx torquilla*
	CAMPEPHAGIDAE: Cuckooshriles, trillers, minivets & allies
19	Large Cuckooshrike *Coracina macei*
	ARTAMIDAE: Woodswallows
20	Ashy Woodswallow *Artamus fuscus*
	AEGITHINIDAE: Ioras
21	Common Iora *Aegithina tiphia*
	DICRURIDAE: Drongos
22	Ashy Drongo *Dicrurus leucophaeus*
23	Black Drongo *Dicrurus macrocercus*
24	Hair-crested Drongo *Dicrurus hottentottus*
	CORVIDAE: Crows, nutcrackers, magpies, jays, treepies & allies
25	Eastern Jungle Crow *Corvus levaillantii*
26	Rufous Treepie *Dendrocitta vagabunda*
	LANIIDAE: Shrikes
27	Brown Shrike *Lanius cristatus*
	NECTARINIIDAE: Sunbirds & spinderhunters
28	Purple Sunbird *Cinnyris asiaticus*
	ESTRILDIDAE: LONCHURINAE: Java Sparrow, munias, parrotfinches & allies
29	Scaly-breasted Munia *Lonchura punctulata*
	PASSERIDAE: Sparrows & allies
30	House Sparrow *Passer domesticus*
31	Plain-backed Sparrow *Passer flaveolus*
32	Eurasian Tree-sparrow *Passer montanus*
	MOTACILLIDAE: Wagtails & pipits
33	Olive-backed Pipit *Anthus hodgsoni*
34	White Wagtail *Motacilla alba*
	STURNIDAE: STURNINAE: Mynas, starlings & allies
35	Common Myna *Acridotheres tristis*
36	Vinous-breasted Myna *Acridotheres burmannicus*
	MUSCICAPIDAE: SAXICOLINAE: Shortwings, robins, redstarts, rock-thrushes, chatsforktails, whistling-thrushes & allies
37	Siberian Rubythroat *Luscinia calliope*
38	Blue Rock-thrush *Monticola solitarius*
39	Eastern Stonechat *Saxicola maurus*
40	Pied Bushchat *Saxicola caprata*
	MUSCICAPIDAE: MUSCICAPINAE: Old World flycatchers & allies
41	Ultramarine Flycatcher *Ficedula superciliaris*
42	Taiga Flycatcher *Ficedula albicilla*
43	White-rumped Shama *Copsychus malabaricus*

	PYCNONOTIDAE: Bulbuls
44	Streak-eared Bulbul *Pycnonotus blanfordi*
45	Red-vented Bulbul *Pycnonotus cafer*
	HIRUNDINIDAE: HIRUNDININAE: Martins, swallows & allies
46	Barn Swallow *Hirundo rustica*
	PHYLLOSCOPIDAE: *Seicercus & Phylloscopus* warblers
47	Yellow-browed Warbler *Phylloscopus inornatus*
48	Dusky Warbler *Phylloscopus fuscatus*
	TIMALIIDAE: Babblers
49	Yellow-eyed Babbler *Chrysomma sinense*
50	Puff-throated Babbler *Pellorneum ruficeps*
51	White-throated Babbler *Turdoides gularis*
	CISTICOLIDAE: Cisticolas, tailorbirds, prinias & allies
52	Common Tailordbird *Orthotomus sutorius*
53	Grey-breasted Prinia *Prinia hodgsonii*
54	Plain Prinia *Prinia inornata*

Distribution, abundance/dominance

Generally more birds were found in the north east, east and south east, that is, on the foot hill, slopes of the mountain range However, quails, sparrows, bee eaters, drongo one bulbul species, mynas and crow (even jungle crow) were more common in the flat terrain area.

Two species of Kingfisher were found along the stream areas. One species of swallow found was no doubt an aerial species spending most of its time in flight.

In term of biodiversity the family Muscicapidae was the dorminante family with 7 representative species. That was followed by the family Falconidae with 4 representative species. The families Dicruridae, Passeridae, Timaliidae and Cisticolidae were represented by 3 species each. The remaining 25 families were represented by only one or two species each.

In term of abundance in number (individuals) the family Caraciidae was the most abundant, comprising 18% of all the total number of birds found. That was followed by the members of families Ardeidae and Columbidae each comprising 15% of all bird found. The individual members of the family scolopacidae consisted of 9% of all the number of bird found.

The following Pie chart diagrams show the species and individual percentage composition of the birds found in the area.

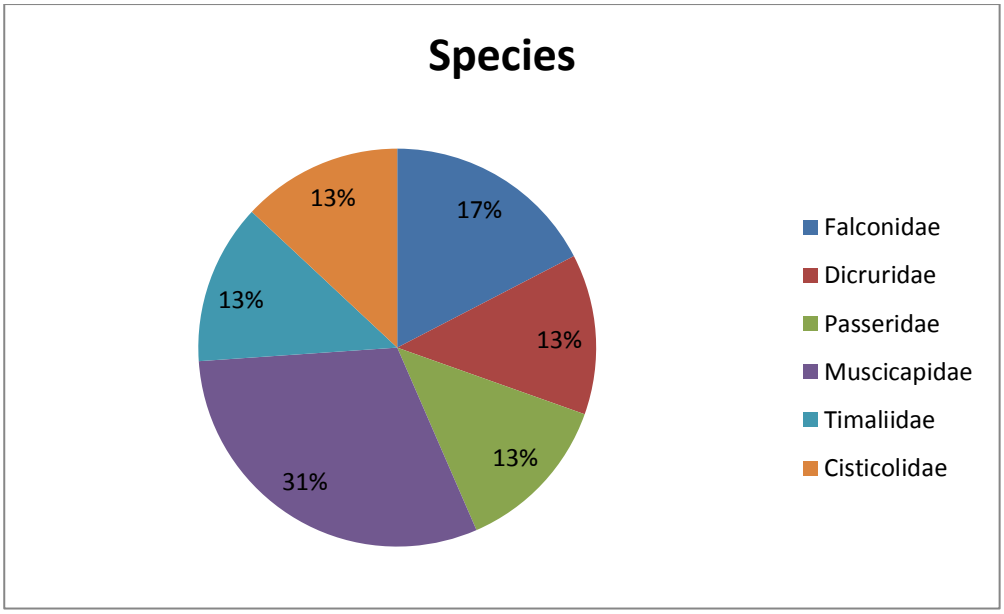

Figure-27: Family wise species percentage composition of main avian fauna

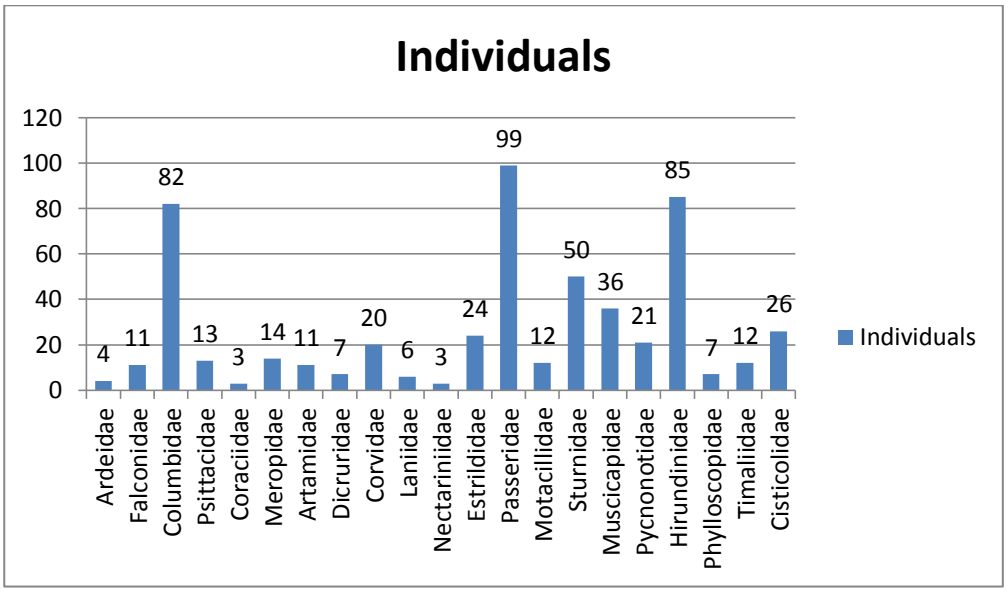

Figure-28: Family wise individuals percentage composition of avian fauna

Rare and endangered species

While members of the families Coracidae, Ardeidae, Columbidae and Hirundinidae were common to very common on the whole birds were relatively rare.

In the cases of nine very rare species (in the study area context) only one individual bird for each species were observed.

No threatened species (according to IUCN red list, 2014 of Critically Endangered, Endangared, Threatened, Near Threatened, Least Concern etc.) were observed during the survey period.

The area was not in the designated Important Bird Area (IBA) or Protected Area System (PAS) of Myanmar.

All the birds found were native or idegenous species; none of them were in the migratory species category.

Species of Socio-economic interest

All kinds of birds are edible in Myanmar and the local will eat any bird if they have the chance to do so. But there are no bird hunters or trappers, it is learnt.

Species of bulbul, *Pycnonotus* spp. (Family Pycnonotidae) and spotted dove, *Streptopelia* sp. (Columbidae) are prized as pet birds in Thailand and many local people in the boder areas of Kayah, Kayin and Mon States and Tanintharyi Regions are involved in trapping and illegal trading of these birds. But there are no trapping and illegal trading of bird in this area, it is learnt.

The inevitable destruction of the forest due to quarry activities will affect the avian fauna to a certain extent. But unlike land animals birds are very mobile and can fly away easily to suitable habitats elsewhere. The area is not isolated but contiguous with high mountain and thick jungle in the north east, east and south east.

4.4.3.2 Herpetofauna (Amphibians and reptiles)

Methodology in brief

As the habitats of amphibian and reptiles on the whole are site specific, for instance, water pools, shady and moist area, under old logs and big stones, and under litters, random survey was conducted throughout the study area.

On the other hand detail survey was concentrated, on the above-mentioned micro habitats or niches. For species that are mainly sedentary, that is, not active wanders, there were specific niches to be studied.

The survey work mainly involved walking and visual inspection. No traps or snares were used. Surveys were carried out twice a day; one during day time and the other one during night. Virtually all amphibians are nocturnal and many reptiles are also nocturnal in habits. They are more active at night and the chance for encounter is much higher. The animals were captured with specially modified stakes, net and scoops. Small rubber rings were also used to shoot at small reptile (lizards and skinks) and small amphibian (frog). The idea was not to kill the small animals but only to daze them by shooting at the head. With the exception of a few to be killed and preserved in formalin or alcohol for later detail study, most were released after observation and recording. The study involved the morphometric characters: - size, shape, pattern of spots, stripes, colour, body weight and body length. The measurement of length included total length, head, length and width, snout vent length, tail length, scales and scales row (for reptiles). For amphibian the more or less same methods was applied (care has to be taken when handling dazed snakes).

Since herpetofauna tends to inhabit moist or wet spots the survey was mainly concentrated along the bands of Yay-pu stream or other ecological riches eg. under logs, stones among leaves litters, around pools etc.

Diversity

A total of 19 species of herpetofauna belonging to 9 families were found, identified and recorded. 10 species were reptiles while 9 species were amphibian (all frogs but only one toad). Of the 10 species of reptiles 6 were lizards and skinks while 4 were snakes. One venomous snake, the pit viper, was found. The species recorded were shown in **Table-10**.

Table-10: Checklist of Herpetofauna species recorded from the survey area during survey period

No.	Family Name	Common Name	Scientific Name	IUCN
1	Bufonidae	Common Toad	*Duttaphrynus melanostictus*	LC
2	Dicroglossidae	Common Floating Frog	*Occidozyga lima*	LC
3		Floating Frog	*Occidozyga martensii*	LC
4		Crab-eating Grass Frog	*Fejervarya cancrivora*	LC
5		Paddy Frog	*Fejervarya limnocharis*	LC
6		Paddy Frog	*Fejervarya* cf *limnocharis*	
7		Kaing Land Frog	*Rana tigerina*	
8	Microhylidae	Common Bull Frog	*Kaloula pulchra*	LC
9		Ornate Narrow-mouthed Frog	*Microhyla ornata*	LC
10	Agamidae	Blue-crested Forest Lizard	*Calotes mystaceus*	
11		Garden Fence Lizard	*Calotes versicolor*	
12	Gekkonidae	Tocky Gecko	*Gekko gecko*	
13		House Gecko	*Hemidactylus frenatus*	LC
14		Garnot's Gecko	*Hemidactylutts garnotii*	
15	Scincidae	Common Sun Skink	*Eutropis multifasciata*	
16	Colubridae	Long-nosed Whip Snake	*Ahaetulla nasuta*	
17		Brown Cat Snake	*Boiga orchacea*	
18	Viperidae	White-lipped Pit Viper	*Cryptelytrops albolabris*	LC
19	Natricidae	ChequeredKeelback Water Snake	*Xenochrophis piscator*	

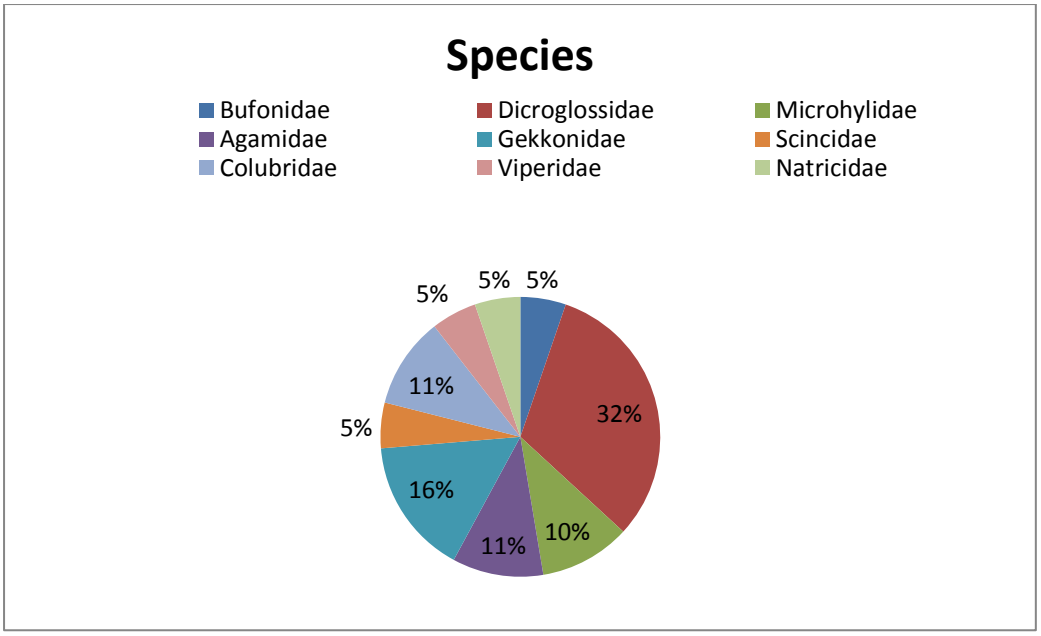

Figure-29: Family wise species percentage composition of herpetofauna species from the survey area

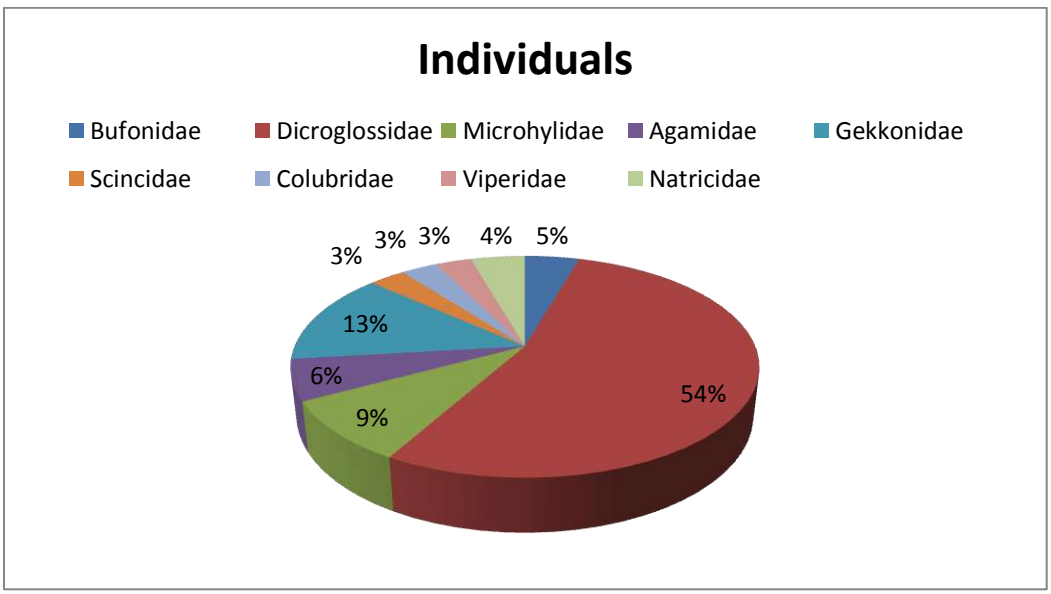

Figure-30: Family wise individuals percentage composition of herpetofauna species from the survey area

Distribution, abundance/dominance

The large majority of reptiles and amphibians were found at night; many were found along the streams or special ecological niches. The foot hill area was a better habitat than the flat terrain, it was noticed.

Frogs were rare as the period was not during the rainy season. The gliding lizards were not found due to scarcity of tall trees in the area.

In term of biodiversity the family Dicroglossidae was the dominant family represented by 32% of all individual herpatofauna found. That was followed by Bufonidae (toads) with 16% of the total. The lizard family Agamidae and the snake family Colubridae stood third with 11% each of the total.

In term of individual abundance the family Dicroglossidae with 54% of the total number of herpetofauna found, clearly dominated over all other families. That was followed by Bufonidae 13% and Colubridae 9%. Of particular interest were the floating frog and paddy frog (family Dicroglossidae) which were plentiful and widely distributed even though the season of survey was not the rainy season and the area was not dominated by paddy fields.

Rare and endangered species

On the whole the herpetofauna were relatively rare. There is no doubt that more frogs will be found if the survey was carried out during the rainy season.

Seven species frogs, namely, *D. melanostiatus, O. lima, O. martensi, F. Cancrivora, F. limnocharis, K. pulchra* and *M. ornata* are in the IUCN list of Least Concern (LC).

One species of lizard (gecko), *H. frenatus* and one species of snake, *C. albolabris* are also in the IUCN list of Least Concern (LC).

None of the species found are in the severe red list such as Endagened, or Threatened.

Species of socio-economic interest

All the frogs under the family Dicroglossidae are edible and some local people catch them for food, especially during the early part of the rainy season when they are more abundant. But that is done just for household consumption not for commercial purpose, it is learnt.

The local people consume the meat of snake if it is available. However, there are no villagers hunting for snake as in the neighbouring country, Thailand. There is also no illegal trading of snakes for export to China, taking place in the area.

There is no clear evidence that the cement factory has severe impact on the herpetofauna of the area.

4.4.3.3 Mammalian fauna

Methodology in brief

As the wildlife was very rare and the chance for encounter was exceedingly low no systematic transect line, plots and points were designated.

The survey work mainly involved prowling stealthily in the forest looking for mammals. It was a direct intensive search carrying out day and night. Night time survey was more

important for large mammals on ground. Day time survey was good for small tree dwelling mammals, such as squirrels. Photographs were taken whenever possible. Focus was also made at expected spot, such as in the valley with luxuriant grass; at spring where mammals were supposed to came and drink water in the afternoon; and at the foot of certain trees which bear fruits, supposed to be eaten by mammals during night time and also in well-shaded spot and undergrowth where the animals were supposed to rest.

The survey method also involved searching for tell-tale signs or evidences such as new or fresh scats, foot prints, scratches, tracks and trails etc. Scats and foot prints are specific and so the animal could be identified quite correctly based on these two evidences.

As wildlife is getting rare it is not possible to observe them during only one survey period. Secondary data have to be gathered from the local elders or old hunters. At least the history of the wildlife of the area can be obtained.

The EIA team have also to rely on the tell-tale signs of wildlife such as foot prints, scats, traces, scratches and resting spots (of course standard methods in biodiversity study).

Another main work was gathering information from hunters (who were very few indeed) and also from old and retired hunters. That was simply gathering secondary data, and looking for recently acquired trophies (horns), leathers and other body parts of the wild animals, if any.

Diversity

A total of 13 species of mammals including those actually found (primary data) and those gathered from the information (secondary data), were recorded. They belong to 10 families under 6 orders.

The families were Manidae (pangolin), Hylobatidae (gibbon), Mustelidae (badger), Viverridae (civet), Herpestidae (mongoose), Felidae (jungle cat), Suidae (wild pig), Cervidae (muntjac), Leporidae (hare) and Muridae (rat).

Table-11: The checklist of mammal species from the study area

Sr. no.	Order	Family	Common Name	Scientific Name	IUCN Red list	CITES	Type of evidence	Track & Sign	Information
1	Pholidota	Manidae	Sunda Pangolin	*Manis javanica*	CR	II	information		√
2	Primates	Hylobatidae	White-handed Gibbon	*Hylobates lar*	EN		information		√
3	Carnivora	Mustelidae	Large-toothed Ferret Badger	*Melogale personata*	DD		information		√
4		Viverridae	Small Indian Civet	*Viverricula indica*	LC	III	information		√
5			Large Indian Civet	*Viverra zibetha*	NT	III	information		√
6			Common Palm Civet	*Paradoxurus hermaphrodites*	LC	III	information		√
7		Herpestidae	Small Asian Mongoose	*Herpestes javanicus*	LC		information, footprint	√	√
8		Felidae	Jungle Cat	*Felis chaus*	LC		information		√

Sr. no.	Order	Family	Common Name	Scientific Name	IUCN Red list	CITES	Type of evidence	Track & Sign	Information
9			Leopard Cat	*Prionailurus bengalensis*	LC		information		√
10	Atriodactyla	Suidae	Eurasian Wild Pig	*Sus scrofa*	LC		information		√
11		Cervidae	Red Muntjac	*Muntiacus muntjak*	LC		information		√
12	Largomorpha	Leporidae	Siamese Hare	*Lepus peguensis*	LC		information		√
13	Rodentia	Muridae	House Rat	*Rattus rattus*	LC		sighting	√	

As can be seen in the table all the information are only secondary information (recent) gathered from the locals. Only rats and foot prints of mangoose were actually seen.

Distribution, abundance/dominance

It is not possible to discuss the distribution abundance and /or dominance as the wildlife were not actually found or their presence noticed, except rats and mongoose.

Although mammalian species were relative abundant and wide spread 20 years ago, they have greatly decreased almost to total depletion now because of exploitation for commercial purpose. The sunda pangolin (CR) and white-handed gibbon (EN) were not seen of any evidences, just only information could be obtained. Many people are encroaching in the reserved forest due to their requirement for food and fire wood. And due to development of roads, illegal logging was carried out by more local people both by car and motorbike at night. Therefore, the current distribution of mammals is now highly fragmented in much of this range.

According to the villagers wild animals such as white-handed gibbon, *Hylobates lar*, myauk-hlwei kyaw (Family Hylobatidee); Siamese hare, *Lepus peguensis*, yon (Family Leporidae); jungle cat, *Felis chaus*, taw-kyaung (Family Felidae); Eurasian wild pig, *Sus scrofa*, taw wet (Family suidae); and red muntjae; *Muticus muntjak*, gye (Family Cervidae) were quite abundant in the area many years ago.

Now white-handed gibbon had moved to far away mountain with thick jungle. Red muntjac and wild pig rarely enter the area but jungle cat and hare can be also found sometimes in the partially degraded area.

Rare and endangered species

All the species mentioned above, with the exception of rats, mongooses and certain civets, are extremely rare or no longer exists in the area. According to IUCN red list 2014, Sunda pangolin is Critically Endangered (EN); White-handed gibbon is Endangered (E); Large India Civet is Near Threatened (NT) and Ferret badger is in the category of Deficient Data (DD). The remaining 9 species including civet, mangoose, cat, rat etc. are in the category of Least Concern (LC).

The impact of the cement factory on the wildlife of the area will be insignificant since very little or none are left to be impacted.

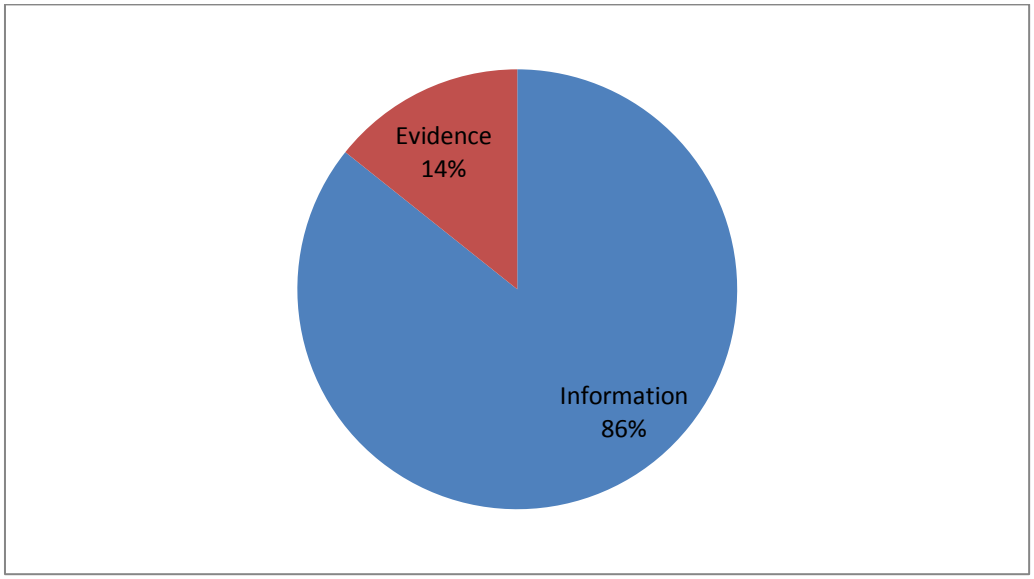

Figure-31: Comparison of information and evidence regarding wild mammals

4.4.3.4 Aquatic organisms (fish, prawn and plankton)

Methodology in brief

Plankton study was made for basic aquatic taxonomy and ecology. Fish study was for icthyological and fisheries resource study.

Plankton

A plankton collecting station was designated in the stream near the proposed site. Plankton were collected with a standard plankton net. Plankton were preserved in 4% formaldehyde solution for detail microscopic later in Yangon.

Fish

The two methods for fish study were the capture by a cast net and a survey visit to the fish market.

The EIA team was not able to study fish and prawn of Yay-pu-chaung stream as there was no fisherman to catch the fish and prawn. The villagers from time to time fish in the stream using scoop net or cast net and the catch per trip was small, barely enough for one or two meals. No villager can eke out a living by catching fish alone; they have to do other job for a living.

Diversity

a) Plankton

A total of 38 species of phyplankton and 24 species of zooplankton all together totalling 62 species were recorded.

Bule green algae was represented by one species of *Aphanizomenon* and 3 species of *Oscillatoria* while diatom was represented by species of *Cyolotella, Synedra, Diatoma, Fragilloria Climawsphenia, Navicula, Pleurosigma, Cymbella and Nitzschia*. Green algae were represented by species of *Crucigenia, Mougeotia, Hormidium, Rhizoclonium* and *Oedogonium*. Dinoflagellate was represented by species of *Glenodinium, Ceratium* and *Gonyoulox*.

All species found were typical fresh water species of mountain streams. The exceptional cases was *C. Kofoidi*, which is known to be a marine or brackish water species. The occurence of *C. Kofoidi* in a fresh water stream is probably a new record for fresh water phytoplankton.

As regared zooplankton protozoan were represented by species of *Centropyxis, Difflugia, Paramesium, Frontoniella* and *Holophrya.*

Cladoceran was represented by species of *Diaphanosoma* and *Ceriodaphnia* while ostracods were represented by one species of *Cyris* and one unidentified ostracoda. Copepods were mainly represented by the ubiquitous *Cyclops* species and related genera, *Microcyclops* and *Eucyclops*. Only one calanoid genus, *Eodiaptomus* was found.

The nauplius larval stages and copepodite stages (mostly stage I to III) were observed in abundant number, dominating all other members of zooplankton.

Rotifer was the second most abundant and represented by species of the ubiquitous genera, *Brachionus* and *Keratella*. Much smallernumber of species of *Asplanchna, Trichocera* and *Filinia* were encountered.

One unidentified tychozooplankton, nematode was also found.

In phytoplankton species of diatoms dominated (60%) all others followed by green algae (17%), dinoflgellates (13%) and blue green algae (10%).

In zooplankton rotifers dominated (32%) all others, followed by protozoa (29%), copepods (17%), ostracods and clodocerons (both 9%) and nematodes (4%).

The classified list of plankton is as follow:

1) Phytoplankton

Phylum	Cyanophyta
Class	Cyanophyceae
Order	Oscillatoriales
Family	Oscillatoriaceae
Genus	*Oscillatoria*
Species	*O scillatoria curviceps*
	O. limosa
	O. tenuis
Order	Nostocales
Family	Nostocaceae
Genus	*Aphanizomenon*
Species	*Aphanizomenon flos.aquae*
Phylum	Bacillariophyta
Class	Bacillariophyceae
Order	Centrales (Centricae)
Family	Coscinodiscaceae
Genus	*Cyclotella*
Species	*Cyclotella stellagira*
Order	Pernales (Pernate)
Family	Tabellariaceae
Genus	*Climacosphenia*
Species	*Climacosphenia moniligera*
Family	Diatomaceae
Genus	*Diatoma*
Species	*Diatoma elongatum*
Family	Fragilariaceae
Genus	*Fragilaria*
Species	*Fragilaria capucina*
	F. construens
	F. crotonensis
	F. virescens
Genus	*Synedra*
Species	*Synedra acus*
	S. affinis
	S. tabulata
Family	Naviculaceae
Genus	*Pleurosigma*
Species	*Pleurosigma fasciola*
Genus	*Navicula*
Species	*Navicula anglica*
	N. lacustris
	N. lanceolata
	N. radiosa
	N. viridis
Family	Cymbellaceae
Genus	*Cymbella*
Species	*Cymbella affinis*
	C. ventricosa
Family	Nitzschiaceae
Genus	*Nitzschia*
Species	*Nitzschia acicularis*
	N. amphibian
	N. frustulum
	N. scalaris
Phylum	Chlorophyta
Class	Chlorophyceae
Order	Chlorococcales (Centricae)
Family	Scenedesmaceae
Genus	*Crucigenia*
Species	*Crucigenia* sp.

Order Ulotrichales
Family Ulotrichaceae
Genus *Hormidium*
Species *Hormidium Subtile*

Order Oedogoniales
Family Oedogoniaceae
Genus *Oedogonium*
Species *Oedogonium plusiosporum*

Order Cladophorales
Family Cladophoraceae
Genus *Rhizoclonium*
Species *Rhizoclonium hieroglyphicum*

Order Zygnematales
Family Zygnemataceae
Genus *Mougeotia*
Species *Mougeotia japonica*
M. scalaris

Phylum Dinophyta (Pyrrophyta)
Class Dinophyceae
Order Dinoflagellata
Family Glenodiniaceae
Genus *Glenodinium*
Species *Glenodinium* sp.

Family Ceratiaceae
Genus *Ceratium*
Species *Ceratium cornutum*
C. hirundinella
C. kofoidi

Family Gonyaulaceae
Genus *Gonyaulax*
Species *Gonyaulax* sp.

2) Zooplankton

Phylum Protozoa
Class Sarcodina
Order Testacea (Lobosia)
Family Arcellida
Genus *Difflugia*
Species *Difflugia globulosa*
D. limnetica
D. urceolata
Difflugia sp.

Genus *Centropyxis*
Species *Centropyxis ecornis*

Class Ciliata
Order Holophricha
Family Holophryidae
Genus *Holophrya*
Species *Holophrya simplex*

Order Trichostomina
Family Paramecidae
Genus *Paramecium*
Species *Paramecium* sp.

Family Frontoniidae
Genus *Frontoniella*
Species *Frontoniella* sp.

Phylum Trochelminthes
Class Rotifera (Rotatoria)
Order Monogononta
Family Brachionidae
Genus *Brachionus*

Species *Brachionus caudatus*
B. falcatus
B. forficula
B. quadridentatus

Genus *Keratella*
Species *Keratella valga*
K. valga var. asymmetrica
K. valga var. tropica
K. valga var. valga

Family Asplanchnidae
Genus *Asplanchna*
Species *Asplanchna priodonta*

Family Trichocercidae
Genus *Trichocerca*
Species *Trichocerca longiseta*

Order Floscullariaceae
Family Testudinellidae
Genus *Filinia*
Species *Filinia opoliensis*

Phylum Nemathelmin thes
Class Nematoda
Species *Unidentified nematode*

Phylum Arthropoda
Class Crustaceae
Sus class Entomostraca
Order Cladocera

Family Sididae
Genus *Diaphanosoma*
Species *Diaphanosoma lorachyurum*

Family Daphnidae
Genus *Ceriodaphnia*
Species *Ceriodaphnia* sp

Order Ostracoda
Family Cypridinidae
Genus *Cypris*
Species *Cypris* sp

Species Unidentified Ostracod

Sus class Copepoda
Order Calanoida
Family Diaptomidae
Genus *Eodiaptomus*
Species *Eodiaptomus japonicus?*

Order Cyclopoida
Family Cyclopidae
Genus *Cyclops*
Species *Cyclops* sp.

Genus *Microcyclops*
Species *Microcyclops* sp.

Genus *Eucyclops*
Species *Eucyclops* sp.

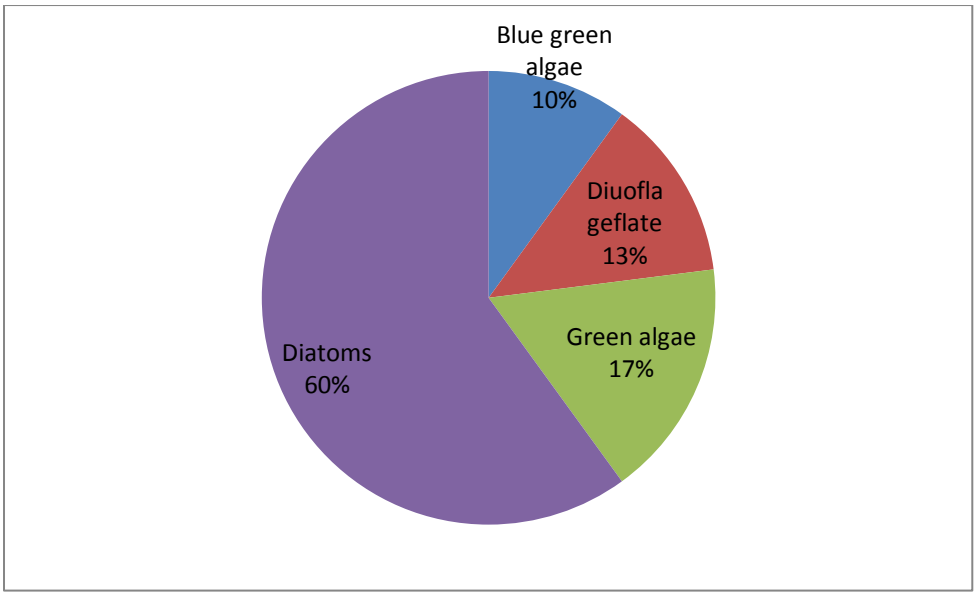

Figure-32: Species percentage composition of phytoplankton

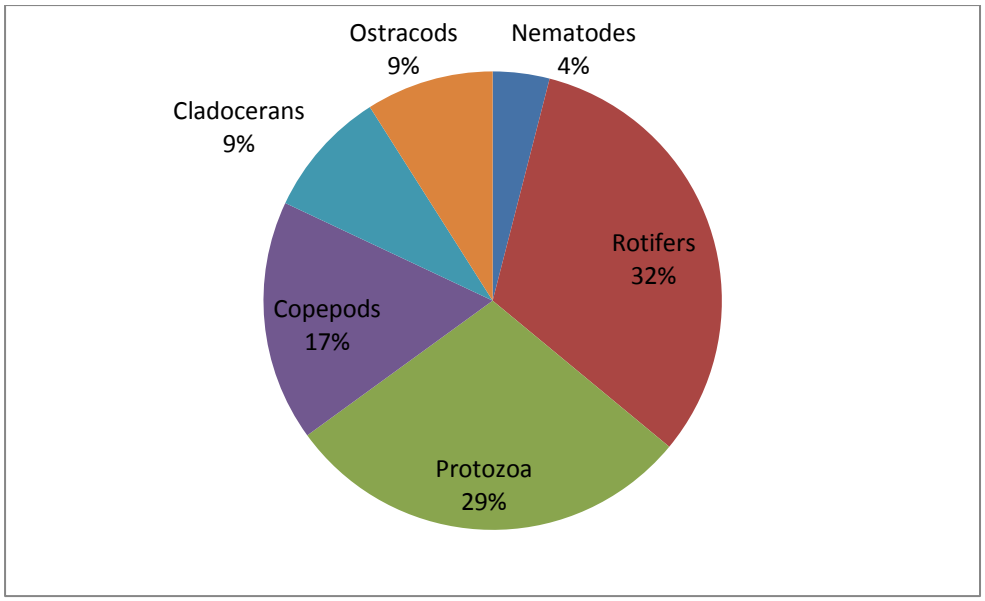

Figure-33: Species percentage composition of zooplankton

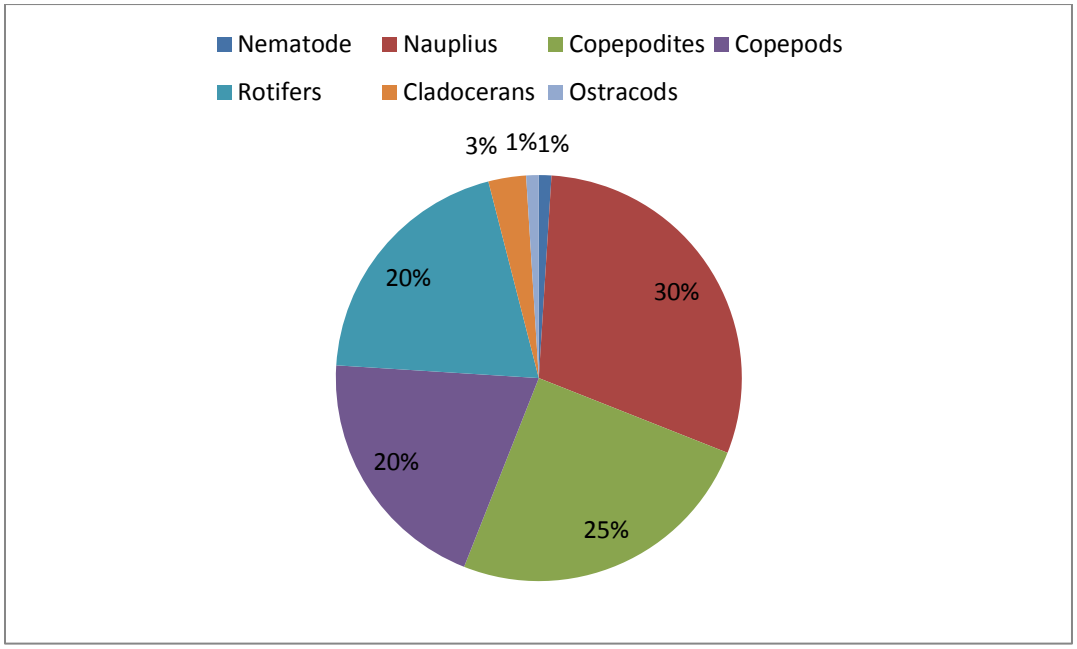

Figure-34: Percentage composition in quantity (numbers) of zooplankton

Distribution, abundance/dominance

In phytoplankton, species of diatoms dominated (60%) all others followed by green algae (17%), dinoflgellates (13%) and blue green algae (10%).

In zooplankton, rotifers dominated (32%) all others, followed by protozoa (29%), copepods (17%), ostracods and clodocerons (both 9%) and nematodes (4%).

As regards number of individual in zooplankton nauplius larvae of copepod dominated (30%) all others; followed by copepodites youngs (25%), copepods and rotifers (both 20%). Cladocerans, ostracods and nematodes were rare.

The very shallow (less than 1m depth) and rapid water did not favour the stratification of water into upper layer (epilimnion) and lower layer (hypolimnion) that could lead to different mini-distribution pattern. The fast flowing water (lotic water) influences all the aquatic organisms into a homogenous lotic water environment (all are lotic water species).

The weir of 3 million gallons of water serves as a lentic water (none moving or stagnant water) environment for the plankton. There can be stratification into epilimnion and hypolimnion layers during the hot season. But this stratification was not noticed during this period of survey. The distribution of plankton seemed to be homogenous. The diurnal vertical migration of zooplankton (as used to occur in big rivers or seas) was not also noticed.

Rare and endangered species

Blue green algae very commonly found in fresh water environment in Myanmar were rare in this lotic water environment.

Dinoflagellates were very rare.

The phytoplankton and zooplankton were not yet included in the IUCN Red list (probably due to small size and not easily recognizable).

Socio-economic interests

Fresh water plankton are not utilized as food in Myanmar (only certain marine plankton species, were utilized, especially macro and megalo-zooplankton species).

b) Fish and prawn

Diversity

The EIA team was not able to study fish and prawn of Yay-pu-chang stream as there was no fisherman to catch the fish and prawn. The villagers from time to time fish in the stream using scoop net or cast net and the catch per trip was small, barely enough for one or two meals. No villager can eke out a living by catching fish alone; they have to do other job for a living.

From information gathered, the fish usually caught in the stream were: *Punticus burmanicus* and *P. stigma*, barb, nga-khone-ma (Cyprinidae); *Crossochilus latia*, carp, nga-loo (Cyprinidae); *Chana bachua*, brown snake head, nga-yant-gaung-toe (Channidae); *Arabas testudineus*, climbing perch, nga-byay-ma (Anabantidae); *Lepido cephalichrys guinea*, loach or sand eel, nga-tha-lei-doe (Cobitidae); *Ompok pato* and *O. bimaculata*, butter cat fish, nga-nuu-thann (Siluridae); *Clarius batrachus*, walking cat fish, nga-khoo (Clariidae); *Heteropnenustes fossilis*, stinging cat fish, nga-gyee (Clariidae); *Mystus cavasius*, river cat fish, nga-sin-yaing (Bagridae); *Mastacembelus armatus*, sping eel, nga-mwei-doe (Mastacembelidae) and *Macrognathus* sp, zip-zig eel, mwei-na-gar (Mastacembelidae).

List of fish species (from secondary information)

Sr. No	Scientific name	Common name	Local name	Family
1.	*Punticus burmanicus*	Barb	Nga-khone-ma	Cyprinidae
2.	*P. stigma*	Barb	Nga-khone-ma	Cyprinidae
3.	*Crossochilus latia*	Carp	Nga-loo	Cyprinidae
4.	*Chana bachua*	Brown snake head	Nga-yant-gaung-toe	Channidae
5.	*Anabas testudineus*	Climbing parch	Nga-byay-ma	Anabantidae
6.	*Lepido-cephali-chrys guinea*	Loach/sand eel	Nga-tha-lei-doe	Cobitidae
7.	*Ompok patio*	Butter cat fish	Nga-nu-thann	Siluridae
8.	*O. bimaculata*	Butter cat fish	Nga-nu-thann	Siluridae
9.	*Clarius batrachus*	Walking cat fish	Nga-khoo	Clariidae
10.	*Heteropnenustes*	Stinging cat fish	Nga-gyee	Clariidae
11.	*Mystus cavasius*	River cat fish	Nga-zin-yaing	Bagridae
12.	*Masta cembelus armatus*	Spring eel	Nga-mwei-doe	Mastacembelidae
13.	*Macrognathus* sp	Zip-zig eel	Mwei-na-garr	Mastacembelidae

There was no information on prawn or shrimp of the stream.

Rare and Endangered species

None of these fish were in the IUCN Red List.

Socio-economic interest

All were edible fish and consumed by the local community. The locals caught the fish just occasionally for household consumption only or in a few cases for supplementing their meagre incomes. Due to scarcity of fish no villager could eke out a living as a fisherman; he has to do other odd jobs for survival. Yay-pu Chaung stream or the larger Mei-hor stream could not support even a small scale subsistence fishery.

4.4.4 Biodiversity up to the ecosystem level and habitats change

Flora

The cumulative impacts on the flora starting from the species level, through the population and community levels would greatly affect the biodiversity at the ecosystem level. The mini-ecosystem of the degraded secondary forest had changed to a large extent during the last years.

At the species level under the ecosystem the overall condition seemed still generally in good condition, at least from simple biodiversity perspectives. The biodiversity of the area (the forest) was still relatively high (200 species). It was probable that very few species actually disappeared. That was evident in the fact that many trees of economic values (good quality timber) still exist in the area, although only as small trees and rare and no longer conspicuous (the species were not lost but remained). There were also evidences of rare residual plants formerly thought to be already disappeared, still found in the area.

However at the population level under the ecosystem there had been great change and the population of plants, particularly those of economic importance, had been greatly depleted. The lost of great trees altered the canopy of the forest leading to the succession of other species hence a change in species distribution. The chance for the original species to emerge at that spot was almost non-existence. Such evidences were found in the area.

The severe depletion at the population level had great impact on the community level of the plants. It was no longer easy to define the different communities of the forest of the study area. Some communities simply disappeared or merged due to the effect of deforestation and over exploitation of the trees and subsequent succession process. Due to variation in altitudes and topography and rugged terrain the biodiversity at the community level was still relatively high, even though a change in community structure had taken place over the years. There was no doubt that several decades ago there would be 5 to 6 distinct communities of plants in the study area, especially when the forest was still a primary or a semi-primary forest. The patches of woody shrub and small trees that dominates the flat terrain are not original. The severe or almost total depletion of the big trees in that easily accessible flat terrain have lead to the emergence of these patches as a result of succession process. (The succession process

taking place after the total depletion of original plants gradually lead to the emergence of a new community and hence the forest type.) This was observed during this trip.

The cutting of even a few large trees with large canopies could alter the community structure to a great extent. When a new open space, even a small one, appeared succession process and competitive growth of species, especially the opportunistic species, would change the original community structure significantly.

Since the biodiversity at the community level was still relatively high it generally followed that the biodiversity at the ecosystem level was also still relatively high.

At the highest ecosystem level the above-mentioned changes would be irreversible. A change or lost at the community level would at least reduce or lower the status of the ecosystem level (an ecosystem should have many communities). The change of basic forest type from primary to secondary or tertiary forest was indeed the lowering or degrading of the ecosystem status.

View from the project site area the habitat loss for plants in the study area is not so conspicuous because there is no Taung-yar or clearing of forest for other purposed. Actually a few Taung-yars are on the other side of the mountain hidden from view. However the clearing of the forest at the beginning the Construction Phase and the clearing of the forest that would take place in the commencement of the quarrying activities would have significant impact on the habitat of the plant.

The quality, as well as availability of habitats for plants was still good and the proof for this statement could be seen if reforestation could be effectively carried out. Plants generally do not need special protection or special habitat for their growth development. The existing soil and the existing water conditions were good for the restoration of reforestation.

As the Operation Phase went on for one to two decades the availability of habitat for plants would be greatly reduced. The only solution for the sustainability of the forest ecosystem would be the effective restoration or rehabilitation to be undertaken during the Decommissioning Phase of the project.

Fauna

As regards fauna the severe habitat loss for wildlife was already witnessed at the study area, even before the implementation of this project. Due to exploitation for fuel woods and other uses and illegal logging most of the habitats for fauna in general, and those of big animals in particular, were already disappeared.

Unlike the passive plants which have to bear the brunt of all impacts the mobile and sensitive animals could easily abandon their original habitats and move away.

Unlike the vegetation (and forest) which could be rehabilitated quite easily the rehabilitation of the fauna was difficult. But there were evidences elsewhere (including countries from abroad) that if the forest was effectively restored or rehabilitated the wild life would more or

less, or in one way or another, re-inhabit the rehabilitated forest (with the exception of some large animals that were already totally depleted or gone.)

The ecosystem service

From the information gathered from the elders of the village the ecosystem services provided by the forest (the biotic component of the ecosystem) in the past was significant indeed.

The services were in the forms of provisions of good timber and building materials (wooden poles, quality bamboo and rattan) fuel wood, natural vegetables, and medicinal plant. In those days there were a few hunters who had made a living by hunting alone. In the rainy season bamboo shoots and mushrooms including the small ball mushrooms of leave litter were plentiful.

Due to degradation and depletion of the biotic component of the ecosystem (the forest) the ecosystem services provided were no longer as significant as in those earlier days. However the locals could still exploit the forest for their various needs, such as fuel woods, wooden poles, bamboo, rattan and mushroom and bamboo shoot during rainy season. A few still illegally cut wood for extraction of medium quality timber.

As regards the abiotic (non-living) component of the ecosystem (the mountain and rocks) the service provided in the form of provision of limestone and clay was very significant. The area was an ideal landscape for the production of cement. The service provided was only for the company, not the local people.

The company must consider for the implementation of Corporate Social Responsibility (CSR) activities and other community assistance as far as possible. On the other hand these CSR and community assistance should not become a burden for the company, but should be affordable assistance.

The ethic of the twenty-first century is not to take any service for granted. As a form of payment for ecosystem service at the end of the Operation Phase, that is the Decommissioning Phase, the company must duly carry out rehabilitation task for the impacted environment. (This would be discussed in the Decommissioning Phase **Chapter-5, 5.4**.

4.5 Socio-economic components

The study area encompasses the eastern periphery or the flat plain where the factory exists and parts of the mountain range where quarry sites exist.

The nearest village, Aung Nan Cho in the east is near the foot hill. As cultivated land is very limited many villages are still involved in shifting cultivation of rice (Taung-yar) on the other side of the mountain. Another two villages, namely, Aung Silar in the north-east and Aung Chan Thar in the west have wide flat terrain around the villages and most of the flat plain is cultivated. There are a variely of farms such as corn, sugar cane, sesame fields and smaller

paddy field; and farms for groundnut and mung bean. Sugar cane, corn and sesame are the main crops of the region. The large majority of villagers of these two villages are farmers.

4.5.1 Existing and planned use of the territory

Most of the flat plain around Aung Silar and Aung Chan Thar villages is cultivated lands where the crops mentioned above are cultivated in relatively large scale. As the locals of Aung Nan Cho have limited land for cultivation many rely on the natural forest.

Many are wood cutters mainly for fire wood while a few are charcoal makers. Some make a living by harvesting goods from the secondary forest, for instance, dog fruit (danyinn), *Albizia jringa* and cardamonum (Phar-lar), *Elettaria cardamomum*. Many are doing odd jobs.

The flat terrain south of the project area is dominated by woody shrubs and small trees. There is also a company's teak plantation about 500 acres. The teaks are now about 20 feet high.

The upland mountain and hills is dominated by reserved forest of second forest type.

Since three big companies, namely Max Myanmar, YCDC and Asia World and two smaller companies are operating in the area part of the area has become something like a small industrial zone.

In order not to destroy the environment due to quarry activities and cement manufacturing activities the company has to comply with the rules and regulations set up by the Ministry of Natural Resources and Environmental Conservation (MONREC).

The regulations laid down by the Forest Department includes among others:

1) The permit was 10 years for the extraction of limestone (Renewable)
2) The company has to pay a tax at the rate of Ks 5000/per acre/per year; and that the rate was changeable according to the forest department.
3) The permit must not be transferred or sold or let to others.
4) The mined out areas, pits, dents, voids etc must be backfilled.
5) If it was inevitable big trees have to be cut or cleared permission should be asked from the forest department in advance.
6) Reforestation or the establishment of new forest must be undertaken after Operation Phase.
7) If the company want to use the logs from the trees that were felled the company must buy these logs at a price fixed by the forest department.
8) With the exception of building temporary shed or hut no permanent building must be built in the designated mining areas.
9) The impact on the environment must be minimized as far as possible.

The regulations set up by the Department of Mines includes, among others:

1) The permit for the quarry of limestone was 10 years (renewable).
2) The company had to pay a 3% mineral tax and a dead rent of Ks 2000/sq.km/year.
3) The permit must not be transferred or sold or let to others.
4) Local authority must be informed prior to the operation of the mining.
5) If other minerals or archeological objects, were found the ministry must be promptly informed.
6) In case of serious injury or death the inspector general of the ministry of mining must be informed; appropriate compensation in accordance with labour law must be also duly given.
7) Permit from the forest department must be also duly obtained.
8) Impact on the environment must be minimized as far as possible
9) The company must follow new regulations or directives, if any that might come out from time to time.

There was no known national or regional development plan for the area.

4.5.2 Basic demography

Population **:** The village has a households of 135 and apopulation of 782 (males 446, females 336).

: Percentage ratio; males 57%: females 43%

Occupation : The large majority of the villagers are farmers. They are rice farmers or farmers of other crops, particularly cereals.

: 53% work in taung-yar cultivation (cultivation of rice and other crops on hills or mountain sides; shifting cultivation that has great impact on the forest)

: 17% work as paddy field farmers

: 5% work as motor cycle taxi drivers

: 3% work as employees of Max Myanmar cement plant

: 1% work as employees of YCDC cement plant

: 2% work as employees of other companies, for instance Asia World Co., Ltd

: 1% work abroad (mostly in Thailand)

: 19% are involved in odd jobs (mostly cutting trees for firewood, making charcoal ,collection of natural resources from the forest and odd jobs, a very few are part time hunters but no part time fisherman)

: 17% work as paddy field farmers

Religion : The large majority of the villagers are Christians --

: Christian 89%; Buddhist 11%. Half of Christians belongs to Roman Catholic Church while the remaing half belongs to Anglican Church (Church of England)

Education status : 38% of the villagers have primary education

: 31% have middle school education

: 20% have high school (secondary school) education

: 2% are graduates

: While 9% are illiterate

4.5.3 Minority and/or vulnerable groups

The pertanges of ethnic groups: Kayan 40%; Kayin 30%; Bamar 30%; two Rakhine and Pao each.

4.5.4 Local economy

The economy is quite typical of a rural area; the majority of people are poor to very poor. As already mentioned above 53% of the villagers are Taung-yar cultivator, 17% are paddy field farmers, 6% work in two cement plants and quarry companies; 19% are involved in odd jobs; 1% works abrood while less then 1% are government employees.

Economic status : The majority are poor to extremely poor people

(Income) : 3% have annual income of less than 5 lakh kyats

: 20% have annual income of 5-10 lakh kyats

: 53% have annual income of 10-20 lakh kyats

: 10% have annual income of 20-30 lakh kyats

: 7% have annual income of 30-50 lakh kyats

: 7% are too poor and ignorant and so cannot give a rough estimation of their income

Material possession

The large majority of houses, 79% are wooden houses with moderately high posts; 16% are made of bamboo while 2% are one-storey brick houses.

4.5.5 Existing and past land use pattern

Prior to the establishment of Max Myanmar and YCDC cement plants and their associated quarries, Asia World Quarry and another two smaller quarries the whole area (including Aung Nan Cho village) was within the Mei-hor Reserved Forest area.

Now the land use pattern has changed greatly. The flat terrain south of the factory was once a secondary forest but now only woody shrub and small tree remain. A 500 acres teak plantation has come into existence in part of this flat terrain. A large portion of Taung Philar Mountain has become quarry site (limestone,alabaster, laterite, clay, granite) and the original vegetation is partially gone. Most part of the whole mountain remains green with partially degraded secondary forest. The few Taung-yars are on the other side of the range.

4.5.6 Industrial area and future development

So far there is no known industrial development plan to be implemented either by the Regional Government or Union Government. However three big companies and two small companies operating in this area have in one way or another boosted the local economy to a certain extent. The construction of the 10 miles hard top road together with the bridge across the Mei-hor Rivulet have plays a leading role in the infrastructure development of the region and hence the social and economic development as well. Other infrastructure developments (eg. schools, library, clinic, monastery, etc.) have also taken place.

As the mountain range and associated hills have ideal landscape for the production of limestone, alabaster, granite etc. there is the probability that more companies will arrive and the quarry/mining industry developed further. But sustainable development should be always borne in mind.

4.5.7 Agricultural area

As mention earlier the flat land area around Aung Silar and Aung Chan Thar villages are fertile agricultural area. The flat land areas north-west, west, south and south-east of the project site are either fertile farms or fields. The main crops are sugar cane, corn and sesame while rice, ground nut and mung bean are also cultivated.

As the cultivable land around Aung Nan Cho is limited many villagers rely on Taung-yar rice cultivation on the other side of the mountain range.

4.5.8 Areas with recreational, educational, historical or aesthetic value

There are no areas with recreational, educational, historical or aesthetic value.

4.5.9 Public infrastructure and access to public service

Before these two cement factories and one major quarry company came to existence there was virtually no public infrastructure and access to public service. Aung Nan Cho village is about only 10 miles away from Ye-ni town on Mandalay-Yangon Highway as well as Mandalay-Yangon Railway line. But it took usually one day for one Aung Chan Thar or Aung Nan Cho villager to go to Ye-ni for shopping and return home.

The construction of the 10 miles hard top road by Max Myanmar Company has greatly improved the transportation and communication sectors of the area.

Other public facilities

There is no post office, and no hospital or clinic. The nearest hospital, the sub-township Hospital at Ye-ni is 10 miles away while the Lei-way Township Hospital is 32 miles in the west.

Max Myanmar Company has built a clinic intended for its employee but now villagers can get their treatment free of charge.

Electricity

Prior to the existence of Max Myanmar Cement Plant, Aung Nan Cho village had no access to electricity. The company had set up lamp posts along the streets of the village and had provided the village with electricity up to the lamp posts for lighting at night. Some houses still rely on solar lighting (The villagers are going to procure a transformer for a sub-station for village electrification sourced from the company factory).

Education facilities

There is a Basic Education Middle School (BEHS) which was recently upgraded from a primary school to a middle school. There are two men teachers, 15 women teachers and 433 students.

Max Myanmar Company had made major renovation of the school, the construction of new building (annex), donation of school furniture, exercise book and provision of stipend for the students.

Religious facilities

One Buddhist monastery and two churches; one is Roman catholic and another one is Anglican. The Buddhist Monastery was built and donated by Max Myanmr Company. The Shwe Phone Pwint Pagoda was also built and donated by the company.

As the village is a predominantly Christian village the male and female staff members of the company serve as permanent Da-kar (lay man or donor) and Dar-yee-kar-ma (lay women or donar) of the monastery.

4.5.10 Water source

Water for drinking and domestic uses is sourced from shallow wells. A few fatches water from the stream. Although there is no serious issue of water in the dry mouths the villagers are going to sink one or two tube wells in the bed of the stream for the near future domestic uses.

Being a rural village there is no public water system, aqueducts, sewers and pipelines. There is no community water pond or specially built water-collection installation.

4.5.11 Health status

The health status was quite low, typical of a rural poor and backward village. As already mentioned earlier there was no dispensary (not to mention hospital because there was no hospital at village level but only at township level only, or in special cases, at sub-township level), and no regular health services by local nurses or midwives.

Malaria is still a big issue even though eradication campaigns have been undertaken from time to time. There were no available data on mortality, and morbidity, nutrition levels, tuberculosis, HIV/AIDS and STD of the area (and this was quite normal for a rural area). And of course, there were no known cases of death from HIV/AIDS. And as already mentioned earlier the access to official health service was at the Ye-ni Sub-township Hospital and Lei-way Township Hospital, 10 miles and 35 miles away, respectively.

80% of the households have toilet or laterines while the remaining 20% still practice open defecation.

4.5.12 Unexploded ordnance (UXO)

There was no precedent of the local people finding unexploded bombs, shells and grenades or left over old ammunition in the area. And there was no precedent of local people killed or maimed by big mines or small anti-personnel mines.

During the second Great War (WW II) no known battles were fought in the area. During the period of civil war and insurgency that had taking places in most parts of the country the people were lucky not to witness any battle and fighting taking place in the area, it was learnt.

4.6 Cultural components

As already mentioned earlier there is the Shwe Hpone Pwint Pagoda and monastery, built and donated by the company, in the east. There is no likely hood of these religious monuments to be impacted.

89% of the locals of Aung Nan Cho are Christians (Roman Catholic and Anglican). The Christian religion is simple: there is only on god (the almighty god) to worship and pray to. There are only two alternatives: either go to heaven or to hell.

The Buddhists on the other hand believe in the 31 abodes or realms of life. The lowest abode of *nat* spirits is close to human being and these *nat* spirits are worshiped by many Buddhists.

Many still keep the tradition of worshiping or rather propitiating the nat spirits, while the main faith is Buddhism. This was quite different from certain minority groups in the remote or far flung area such as in Chin and Kachin states where their main religion (or their main belief) was the worship of nat-spirits. Especially in areas where there were limited means for propagation of Buddhism.

On the other hand the local people here were just like many Bamar Buddhist whose main belief was in Buddhism but simply propitiated the nat spirits sustaining the old tradition that had existed even before the arrival of Buddhism into this part of the country about 1000 year ago during the reign of the great King Anaw-ra-hta. Offertory (hnget-pyaw-pwei, ohn-pwei) for the nat spirits usually included one coconut and three or five combs of bananas arranged on a receptacle, usually a large bowl or tray. Or the offertory could be a coconut (nat-ohn-thee) hung up in some homes as an offering to the nat spirits widely practiced by many Bamar in the middle part and upper part of the country. The Buddhist villagers of Aung Nan Cho being Bamar also keep this tradition.

Bamars believed in so many nat sprits while the different minority groups or ethnic groups Mon, Kayin, Kachin, Chin, Shan etc, also have their own nat spirits. One tradition was to eat traditional feast at the time of propitiation of a nat spirit, and this was known as nat-sarr.

There was no known annual or seasonal festival for nat spirits in the area.

Regarding cultural heritage there were no historical monuments, no archaeological site or site of natural or cultural or spiritual values in the area. There were no sacred sites, sacred rocks, sacred trees etc in the area.

The construction contractor and construction workers should be instructed to report back promptly if they happen to find any archaeological evidences and, of course, UXO while doing the construction work.

4.7 Visual components

As the area was a rather remote rural forested area there was no important visual component to be affected by the purposed project. No historical monument as well as new prominent building, and no valued landscape existed in this area.

The big factory with big silos and other structures and the 90m tall smoke stock are not in harmony with the surrounding.

The mined out YCDC limestone quarry in the back ground is also an ugly sight. In other word there is the issue of negative impact on the natural scenery of the area. This can be considered as visual negative impact or simply sight pollution. Only effective rehabilitation will tackle this serious issue.

The limestone mountain was actually the major landmark of the area. The cement project would surely significantly impact the mountain but that was inevitable. After 30 years of operation most or all of the mountain would be gone. That would be tantamount to the

sacrifice of a small ecosystem for the sake of infrastructural development, hence national development. And that was the way all countries were developed and there was no other way around.

Before the factory come into existence conditions are dark at night. The bright light from the factory compound has changed the visual component at night. Excessive use of light at night should be avoided so as not to have lighting offensive to the locals.

5. IMPACTS ASSESSMENT AND MITIGATION MEASURES

5.1 Impact assessment methodology and approach

Impact can be either negative (adverse) or positive (beneficial); both may be direct or indinect and be cumulative and synergetic.

As regards socio-economic aspects impact can be sometimes a two-way interactions. For instance, the cement factory can have impact on the local communities and vice versa.

The methodology was based mainly on prediction and this was based from personal practical experience and also from theoretical knowledge from available references for conducting EIA.

Prediction and identification of the impacts, both negative and positive, and subsequent assessments were made after comprehensive group discussion with EIA practitioners and appraisers.

The visual inspection of the proposed project site was essential for the prediction, identification and assessment of the impacts.

As regards identification of positive or beneficial impacts it is abstract in nature, that is, the impacts cannot be easily seen or felt. However materialistic progress of the area due to positive impacts, such as infrastructure and service development, improvement of living standard, can be seen or heard quite easily. It is however quite difficult to know the attitude and perception of the communities regarding the operation of the project.

It is much easier to identify and access the negative impacts which are many. The visual inspection and acoustic detection or sensing are among the easiest way for identification of negative impacts. Instruments and apparatuses are used for detection, measurement and testing of environmental parameters for physical, chemical and biological environment. This will greatly help the assessment of impact. As for accurate analysis this should be conducted in certified laboratories in Yangon.

Existing negative impacts can be easily identified and accessed; potential negative impacts have to be determined based on experiences. Sometimes prediction of negative impacts has to be applied.

Mitigation should be the last resort for solving negative impact issues. First prevention measure or alternative to avoid the negative impacts should be considered. If that is not possible minimization of impact should be considered. It minimization is still not possible reduction of impact should be considered. If that is not possible then, finally as a last resort mitigation measures should be considered and implemented.

Regarding assessment of the negative impacts criteria should be categorized, for instance, nature, extent, duration and intensity of impact. In this way appropriate mitigation measures can be applied.

As the project involved large area of land and forest, 484.5 acres, the impact on the biodiversity would be significant. Based on the visual inspection of the flora and fauna in general, and on the primary baseline data collected in particular, prediction on the negative impacts on the biological component of the ecosystem was made. The village, Aung Nan Cho, area was incorporated into the study area for prediction of impact on the socio-economic and cultural components.

5.2 Identification of impacts

2, 15, 15 and 2 negative impacts for the Preconstuction Phase, Construction Phase, Operation Phase and Mine closure Phase, respectively, are anticipated and identified.

The positive/beneficial impacts during the Construction and Operation Phase were also mentioned. While it was very necessary to mitigate negative impacts it was also very necessary to optimize or enhance the positive impacts.

5.2.1 Potential negative impact during the Pre-construction Phase

Generally speaking there should be no negative impact during this Planning Phase. However, sometimes there can be negative impacts on the socio-economic sphere of the local area. Radical environmentalists who are usually against all infrastructure developments and activists who are usually anti-government, anti-big business and anti-cronyism may protest against the establishment of the factory. Whether they are doing this with good intention, for the sake of human rights, or merely for publicity stunt is sometimes questionable. Agitation and manipulation by radical activists can even lead to public outcry and political instability of the region. At least it can polarize the villagers into pro-project and anti-project groups.

Another main impact is the hiking of the price of land property by greedy speculators. The price of land can goes up considerably even before the construction of the factory. Even rumours can lead to the hiking of land and property price. This is what is really happening now in this area. The establishment of the cement factory together with the easy access to the area due to the construction of hard top (concrete) access road to the factory has now resulted in the excessive increase of land price.

Before the emergence of the factory there was virtually no precedent of selling or buying of land property. Now the prices of land in this area are as follows:

i) 60 feet x 80 feet plot of land by the main road (access road) side 3,000,000 Kyats

ii) 60 feet x 80 feet plot of land away from the main road 1,000,000 Kyats

The prices stated are the selling price but the bargain price may be a little lower.

5.2.2 Potential negative impacts during the Construction Phase

The Construction Phase starts after the Planning Phase. In this Max Myanmar factory context the Construction Phase lasted two years.

The works during the Construction Phase generally involve the fencing of the site, clearing of land, construction of temporary housing facilities for workers, sourcing of water and electricity, mobilization of materials and workers to site and the actual construction of the factory.

There will be, no doubt, many negative impacts during this phase. The followings are real or potential impacts identified or predicted and assessed.

5.2.2.1 Impact on biodiversity

The first main negative impact during the Construction Phase is on the biodiversity of the area. The clearing of vegetation and land for the site and for the 10 mile access road will have substantial negative impact on the flora and fauna eventhough the area was a partially degraded reserved forest. At least 45 acres of forest or bush has to be cleared first for the construction of the factory. Vegetation on both sides of the dirt road already in existence from Yangon-Mandalay Highway to Mei Hor Stream (7 miles) has to be cleared. As for the remaining 3 miles trail from the stream to the factory more vegetation has to be cleared.

The impact on the biodiversity especially plants is, no doubt, substantial. The clearing of forest or bush, the excavation of earth, the noise and visual intrusion arising from land clearing activities and transportation activities have great negative impacts on the fauna of the area. The more than 1,000 workers in the construction site during this phase often resulted in increase pressure on living natural resources of the area and the disturbance of the wildlife, due to habitat fragmentation. The illegal hunting or trapping of wild animals, big or small,if any, will only exacerbate the problem.

The main negative impacts will be in the forms of habitats disturbance, habitat fragmentation, habitat damage, destruction and loss.

5.2.2.2 Impact of worker camps on site

More than 1,000 construction workers are to be deployed during construction phase which will last for 2 years. The impacts include destruction of natural vegetation, grass, herbs and small bush and generation of waste water and solid waste issues. There can be potential contamination of ground due to waste water and solid waste issues.

There can be litter such as plastic bags and other used and discarded materials.

5.2.2.3 Impact: mobilization action and preparation action

Mobilization action, preparation action and transportation action in early phase and later phase of construction can cause nuisance to the public or road users.

The rapid mobilization of large volume of building materials, timber, bricks, cement, sand, gravel, iron materials, etc. can overspill inside or outside the site and on the road side. These can cause nuisance and also hinder the smooth and easy movement of people in the area and also vehicles and motorcycles.

5.2.2.4 Impact of traffic on main road (Yangon-Mandalay Highway)

This is related to the pervious impact. The mobilization of huge quantity of construction materials of all sorts by means of heavy trucks and also the mobilization of heavy machinery will represent a noticeable increase in the number of heavy trucks travelling along the highway.

There can be no problem on the 10 mile concrete access road as the only traffic is by motorcycle or pedestrians. But the intersection at the highway can represent a potential hazard to other road users (drivers) as slow moving large trucks entering and turning off the highway which has relatively heavy traffic. Heavy trucks will increase the wear and tear of the highway road.

5.2.2.5 Impact on soil

During the Construction Phase there can be potential and real impact on soil due to ground clearing, excavation work, digging and moving of large quantity of earth. There can be potential destruction of soil profile by mixing of top soil and sub-soil.

There can be movement of sediment and pollutants into water courses. Erosion was not an issue during the dry months of the years. But it could be an issue if the construction activities are carried out during the rainy season. Silt runoff from the construction operation, the dumping of silt, earth and construction spoils and tailings could have negative impact such as siltation and sedimentation impact on the drainage system and can also cause ground water contamination.

5.2.2.6 Impact on water (surface water)

The company so far relies only on surface water from a stream. Although the demand for water during the Construction Phase may not be as high as during the Operation Phase the need for water during the Construction Phase is not so low either. Relatively large quantity of water has to be used in mason work or concrete work such as the mixing of cement, sand, lime with water. The domestic consumption of the water by 1,000 workers can also have impact on the water of the stream.

5.2.2.7 Impact on air quality

a) Nature: dust

Dust is the main issue during Construction Phase. Wind direction plays an important role in the impact. The clearing of land and earth works such as excavation, digging and refilling of earth greatly generate dust. Vehicular movement as well as operation of other equipment, engines, pumps and the mixing of cement with sand, lime, water, emit lot of dust. Nuisance and health impact are associated with increased level of dust.

b) Nature: smoke (fugitive emission)

Smoke generated during Construction Phase will be low. The source of emission is from vehicles and some machines used during construction works, such as engines and pumps.

Health impact associated with smoke increased with level of smoke. The emission of Green House Gas can leads to global climate change.

5.2.2.8 Impact: noise and vibration

During the Construction Phase the source of noise are from construction work such as carpentry work that involve noisy saws and planes, noisy drilling machine and the sound of hammers etc. The noise from cement mixing machine and also from engines and pumps are also high. Movements of vehicles, loading and unloading of materials etc. also produce noise. Concrete roads also produce more noise than tarred ones.

Environmental noise level that is acceptable rating level for noise (International Standard) is around 45 dBA during daytime and 35 dBA at night. Internationally accepted noise level in the work place should not exceed 85 dBA, (ALICE, Frankfurt, Germany 2014).Acoustic environment monitoring performed in Myanmar also follows the standard procedures adopted by American Conference of Governmental Industrial Hygienist (ACGIH) where the acceptable level is little higher than Germany's (EU) standard. Prolonged exposure above 85 dBA can impair hearing and can be a major health impact. Noise generally causes nuisance and disturbance to the community.

Vibration is generated from machinery or mechanical operation during construction work and also from heavy vehicles on the access road. Vibration is usually associated with loud noise; it can damage machines and equipments and also buildings or structures.

5.2.2.9 Impact of waste disposal

Solid waste generated during the Construction Phase will be large quantity of debris in the form of construction tailings, bits and pieces of building materials, iron materials, timber, soft wood, bamboo, used as scaffolds, left over bricks, sand, gravel, and so on.

Many of the leftover materials are unused or surplus materials because even well-experienced planning and design engineers may not be able to estimate the exact quantity of building materials to be used. There will always be unused or surplus timbers, iron rods, cement, brick etc., not to mention iron nails. Unless systematically resold, reused and recycled and systematically disposed off these materials can pose a great impact on the area. After two years of construction work, ill-disciplined workers without good house-keeping practice can also litter the site to a great extent.

As little water will be used during the Construction Phase and as there is no chance of waste water entering the drainage system liquid waste may not be an issue.

5.2.2.10 Impact: contamination of soil and ground water

There can be contamination of soil due to spill of fuel oil and other oils from vehicles, cranes and machinery. The impact of small oil spill even from vehicle machinery can have an impact on the ecology of the soil.

There can be also domestic sewage which can percolate into ground water.

5.2.2.11 Impact of lack of emergency and health (hospital) service

The lack of emergency and health service can be a constraint regarding provision of health care for workers in potential emergency. If an accident that effect many people occurs the available service in the area may be prone to inadequate. The township hospital at Lei-way of course, cannot solve such a serious problem. Most of the serious health cases are to be referred to the main hospital in Nay Pyi Taw Council Area. This hospital is about 26 miles away but it has adequate health facility, probably the best public hospital (government institution) in Myanmar. The cost of treatment is not so high. There are certain private hospitals in Yangon (178 miles away) where there may be better treatment system but the cost is exorbitant.

Natural disasters such as violent storms and great floods are ruled out for this area; there is no precedent of such a disaster within memory. (Earthquake is not taken in consideration. It is a case of the fall of sky as a Burmese saying goes which means all have to suffer if the sky falls, so why bother?) But there can be potential for fire break out as intensive heat has to be used in the plant. (This is discussed in detail in Operation Phase.)

5.2.2.12 Impact of project on the potential social illness and anti-social behavior and vice versa

This impact can be a two-way impact. The project which attracts a large number of construction workers can have an impact on the workers which come from different parts of the country. On the other hand, these workers can have an adverse impact on the project.

Such an issue usually occurs during the Construction Phase. When a large number of workers are camped inside the site there is always the potential of the occurrence of undesirable social issues. Some examples are: disputes, quarrels, brawls among themselves or with locals; theft;

misappropriation of materials and money, vandalism, unethical sexual practices or sexual offences and so on. All these have potential to hinder the progress of construction works.

5.2.2.13 Impact of project on HIV/AIDS and vice versa

The Construction Phase which last for 2 years with about 1,000 workers can have social impact. The impact can be a two-way interaction. The project which attracts a large number of workers can have an impact on HIV/AIDS and other sexually transmitted diseases (STD); the spread of disease among the workers.

On the other hand HIV/AIDS can have an impact on the project; the loss of workers due to disease, which also means the loss of skills required.

The cases of HIV/AIDS usually occur during the Construction Phase. There were unreported and unofficial cases of construction workers of both sexes contracting STD during the Construction Phase of big projects.

The actual HIV or STD infection rate in Myanmar is not known but there is no doubt the rate is quite high. Myanmar people tend to downplay and underestimate this issue. As Buddhists and out of the culture of modesty (hiri-aw-tapa) this is considered a taboo to discuss.

The big project attracts a large number of workers, men and women, from different part of the country. There is always the potential to increase the rate of infection when large numbers of workers are away from their families for a long time, two years. HIV or STD can be spread among the workers themselves or among the local community when intermingling of people happen.

The uneducated blue collar construction workers of both sexes usually tend to have little regards for ethic or moral values and this is the reason why the high rate of HIV or STD occurs in such groups.

Actually the infection rate is high in all poor developing countries in Asia, Africa and Latin America due to inadequate education campaign.

5.2.2.14 Impact: potential security issue

The Construction Phase is the period when it is usually difficult to maintain security. The working atmosphere is rather fluid and dynamic in nature. The in (entering the jobs) and out (quitting the jobs) of workers tend to happen almost all the time. This is the period when cases of thefts, misappropriations and vandalisms happen most.

Unlike the permanent employees during the Operation Phase who are well-disciplined, the temporary workers during the Construction Phase are usually quite difficult to discipline. The building contractor usually has no chance to hand pick them but to select them in haste due to the nature of construction work.

There is always the potential security issue for the cement plant. If left unchecked the construction workers can pose a potential threat for security issue.

Aung Nan Cho and Aung Chan Thar villages are 1 mile and 3 miles away, from the factory site, respectively. So the factory is not so isolate. Some of the local people may also pose a potential security issue.

5.2.2.15 Visual impact and light

As noise is considered pollution bright light at night is also considered pollution. Children living in bright cities no longer have the chance to enjoy looking at the twinkling stars high up in the sky at night. Some environmentalists view this as an infringement on the basic human right of the children.

In the latter part and at the end of Construction Phase the cement factory will come into view. The big silos and other big structures together will the 90 m tall smoke stack are conspicuous in an area with bush and degraded forest. The factory is not in harmony with its surrounding and therefore, no doubt, has certain impact on natural scenery of the area. This can be considered as visual negative impact or simply sight pollution.

Conditions are dark at night in this area prior to the establishment of factory. So the local community, even from a distance, can have the so-called lighting offensive at night. Especially bright light on the facade or front of the factory can have potential to increase the visual impact at night. Bright white light at night has the potential to attract hundreds of insects from the vicinity and kill them.

Table-12: Summary of criteria for 15 negative impacts during the Construction Phase

Sr. No	Nature of impact	Extent	Duration	Intensity
1.	Impact on biodiversity	Near and far vicinity	Long term	Medium
2.	Impact of workers camp on site	Factory foot print	2 years	Medium
3.	Impact: mobilization, preparation actions	Factory foot print	2 years	Medium to high
4.	Impact of traffic on main road	Along the road	2 years	Low
5.	Impact on soil	Factory foot print	2 years	Low
6.	Impact on water (surface water)	Yay pu stream	2 years	Low
7.	Impact on air quality	Factory foot print	2 years	Low
8.	Impact: noise and vibration	Factory foot print	2 years	Medium to high, Low
9.	Impact of waste disposal	Factory foot print	2 years	Medium to high
10.	Impact: contamination of soil and ground water	Factory foot print	2 years	Low
11.	Impact of emergency and health service	Factory foot print	2 years	Unknown
12.	Impact of project on potential social illness and vice versa	Factory foot print and beyond	2 years	Unknown
13.	Impact of project on HIV/AIDS and STD and vice versa	Factory foot print and beyond	2 years	Unknown
14.	Impact: Potential security issue	Factory foot print	2 years	Low
15.	Visual impact and lighting	Factory and vicinity	Long term	Low to medium

5.2.3 Positive (beneficial) impacts during the Construction Phase

The positive or beneficial impacts during the Construction Phase are in socio-economic aspects. The economic benefits to the region are expected to be substantial.

The proposed project will invigorate and boost the local economy and will bring economic benefits to people who are involve in extraction/production and sale of building materials of all sorts, both raw materials and manufactured goods.

Contractors of raw materials such as sand, gravel and bricks get the chance for doing lucrative and brisk business in providing these raw materials for sales. The extraction or production of these raw materials will also provide jobs for many locals.

Timber merchants and merchants of soft wood and bamboo (for scaffolding) as well as merchants of construction merchandize such as iron rods, bars, iron works and nails, roofing, aluminum sheet, glass panels, cement and so on can promote their sales. At the same time more jobs for the locals can be provide by these merchants; small business men and small sub-contractors will be also benefited by the production, extraction and sale of these building merchandize.

The proposed project will provide jobs for about 1,000 construction workers for two years. This is quite a substantial contribution to provision of jobs for young people and unemployed people, partially solving unemployment problem when unemployment is high in the country. Many unskilled workers will have the chance to become skilled workers during the period of one year.

Max Myanmar Manufacturing Company should bear in mind that while negative impacts should be mitigated or minimized positive impacts should be promoted or enhanced.

5.2.4 Negative impacts during the Operation Phase

There are many negative impacts during the Operation Phase, the most important phase of the project, which will last for 20-30 years. (The land lease is 10 years with possible renewal after the lease expires.)

The two main negative impacts associated with cement production are, (a) the quarrying activity for the extraction of raw materials, limestone, alabaster,laterite, clay etc. and (b) the burning of coal in the production process of cement.

The highest impact on the environment is that of the mining activity than any other activity in the cement factory.

The blasting of a limestone mountain and the burning of coal are the two big anathemas for pure environmentalists or emotional environmentalist. Actually most environmentalists view the quarry or mining activities as the destruction of the ecosystem and burning of coal as a severe pollution of the atmosphere.

Cement industry is considered a significant contributor to global carbon dioxide emission.

But when it come to infrastructure development of the country, which is still a Least Developed Country (LDC) a pragmatic way of thinking and reasoning should override emotional view associated with the environment.

5.2.4.1 Impact: Blasting and quarry activities

To extract the raw materials for cement such as limestone, blasting has to be carried out first. The company uses emulsion type explosive for blasting the rock. The impacts posed by blasting includes physical injury (accidentally), loud noise and vibration.

Physical injury or even fatality can happen if chunks or pieces of rock burst out (fly rock) and fall upon employees due to huge explosion associated with blasting.

The sound of explosion is very loud indeed and this can easily impair hearing and pose a major health issue. The sound of explosion is the most severe noise pollution of the project and can has impact on the local people of Aung Nan Cho which is just about one mile away.

Other quarry activities such as drilling (before blasting), excavation,shoveling, stockpiling, crushing, grinding, screening, collection and transportation of limestone and other materials inevitably cause noise pollution at least in the quarry site.

Vibration associated with loud explosion will have certain impact on the environment. It will scare wildlife away and can have impact on tall building or at least 2-storey brick houses in the vicinity. Repeated explosions and vibrations over a long time can substantially damage any brick building.

Minor land slide can occur in the mountain side due to explosion and vibration.

5.2.4.2 Impact: a change in relief (topography) and the eventual alteration of landscape

The quarry operation usually last for the whole Operation Phase (20-30 years). The quarry operation can result in the change in mountain relief in the first few years to an alteration of the environment at landscape and ecosystem level in the remaining years. By the end of the Operation Phase the whole mountain can be gone. This is the most severe impact as far as landscape is concerned.

The excavation of raw materials (limestone, laterite, clay) and the creation of quarry (mine) voids also alter the soil profile, hydrology, topography and nutrient status of the substrate. Stream flow and drainage pattern may also alter due to quarrying activity, especially during rainy season. Soil erosion, increase in sedimentation and alteration of water course can also happen if the quarry is not far from a stream or rivulet.

5.2.4.3 Impact on biodiversity

The impact on biodiversity during the commencement of the Construction Phase is already mentioned. The impact due to quarry activities is often higher than during the Construction Phase. Forest has to be cleared for quarry; the drilling, blasting, excavation and transportation activities will scare all the wildlife away. While the Construction Phase last for two years

quarry activities will last for 20-30 years (the whole Operation Phase). So there is no doubt that the impact on the biodiversity will be high. The site selected for the factory was previously a partially degraded forest. The quarry site, however, was previously a mountain with lush green vegetation.

Moreover the area of the factory and its premise is only 44.5 acres while the combined areas of two quarry sites is 440 acres. This can be simply calculated that the impact of quarries on the ecosystem is ten times higher than that of the factory.

5.2.4.4 Impact: stockpiling of mined out (quarried out) materials and overburden

Huge amount of quarried out materials (limestone,abalaster,clay, laterite etc) and overburden are generated in quarry activities. A wide area is needed to stockpile them. While the required materials (limestone etc) is evacuated and replaced from time to time the overburden usually remains forever, unless there is a chance to utilize it.

The over burden will have great impact on the area, altering the soil profile, changing or blocking the natural drainage system of the area and also the stream if there is one nearby, severely impacting the aquatic life of the stream. Erosion and sliding of overburden are usually the main issues that impact the environment.

Overburden also has an impact on the relief and topography of the area.Large mounds of overburdens at the quarry sites is really an ugly sight.

5.2.4.5 Impact: loss of non-living natural resources

Not only living natural resources (biodiversity) are impacted by quarry activities but also non-living natural resources (limestone, alabaster,clay, laterite etc.) are impacted. These non-living natural resources are lost forever since they are not renewable. So the impact is inevitable, and irreversible. By the end of the Operation Phase the whole limestone mountain can be gone.

5.2.4.6 Impact on air quality

Dust

In cement industry dust is generated from the quarry site as well as inside the factory and its premise.

Quarry operations contribute towards air pollution through generation of dust due to drilling, blasting, excavation, loading and unloading of limestone. The transportation of limestone from quarry to crusher house also generates dust. And the transportation of crushed limestone from crusher house to the plant through conveyor belt also generates dust to some extent. Large quantity of dust is generated in clinker, cement mill and coal mill. Dust is also generated in the packing and storage house of cement and during the loading of cement on trucks for distribution. The erosion of the ground surface due to the strong wind also produces dust. Strong wind can also generate dust from coal stockpile or stock pile of cement dust.

Dust is also generated due to vehicular movement and other machinery (crane, dozer, loader etc.) movement. And finally relatively large quantity of dust is generated in the cement factory as cement dust. This the so-called dust associated with smoke.

Dust components usually include heavy metal such as lead, mercury, cadmium and also, thallium, iron oxide, calcium, carbon, manganese, silicon compounds etc. Dust imposes health hazard for the employees and also health concern for the neighbours. Strong wind can spread dust to the village and onto the agricultural land.

Dust is mainly in the form of suspended particulate matter (SPM or PM) which are mainly larger particles. However the smaller respiratory particulate matter (PM_{10}, $PM_{2.5}$) is sometimes associates with dust and poses more health hazard than the larger PM.

Smoke, fugitive gas emission

Cement factories are vulnerable to air pollution and this is a primary concern. After coal-fired thermal plants that produce electricity, cements plants are considered to be among the second most polluters of the atmosphere. Excessive production of smoke and fugitive gas emission leads to excessive concentration of CO_2 in the atmosphere which can lead to global warming and eventually to global climate change. This is of international concern today.

Smoke and fugitive gases are health hazard for the employees as well as neighbours. The impact of smoke is not only in the foot print of the factory but beyond, depending on the direction and speed of the wind.

Emission from smoke stack includes mainly SO_2, NO, NO_2, CO, CO_2, hydrocarbons and particulate matters (PM) mainly the smaller respiratory particulate matter (PM_{10}, $PM_{2.5}$). While it is quite easy to protect dust with nose or mouth covers it is not easy to protect $PM_{2.5}$ with ordinary nose or mouth covers. Smoke therefore poses more risky than dust.

5.2.4.7 Impact on water, quantity and quality

Even though the manufacturing technology will be switched from "wet process" to "dry process" the factory still has to utilize huge quantity of water as the production will be increased more than four-folds, 500 ton/day to 2100 ton/day. This will still has high impact on the water resource of the area. The domestic consumption of water by about 300 employees and families plus the monastery have also substantial impact on the water resources.

As the testing of groundwater is not, so far, satisfactory the cement factory has to rely on the surface water resource; a weir of 3 million gallons capacity that collect water from the small stream, Yay Pu Chaung. As it is a small stream the rate of replenishment (refilling) of water after a one day operation of the factory is low indeed. From information gathered from the villagers there was one precedent of the stream drying up a little more than 10 year ago. If this happens again this will totally disrupt the running of the factory for many days.

The waste water associated with the operation of the factory is negligible. All the water drawn up for production work is virtually used. So there is almost no industrial water waste to impact the surrounding area.

The domestic waste water flows through the drainage system into septic tank and adjoined soak pit.

5.2.4.8 Impacts: noise and vibration

Extremely loud noise and severe vibration are generated during the blasting of the limestone, laterite etc. But this is limited to a few seconds every other day. Excavation and transportation of the raw material (limestone) would inevitably cause noise pollution in the area. (This is already mentioned in the impact of blasting.)

Activities at primary and secondary crushers also generate loud noise. In the factory compound the main noise generating sources are generators and compressors. On the whole the noise level inside a cement factory is low or relatively low.

Vehicular movements and movement of heavy machinery also generate noise.

Increase of ambient noise level will cause disturbance or nuisance for the employees, but working in noisy workplace for long hours can impair hearing.

There can be damage to local structures due to vibration. Vibration and loud noise are one way or another, associated.

5.2.4.9 Impact of power supply on national demand and vice versa

The total electricity consumption after the factory is upgrade will be 13.3 MW. This is a substantial increase in national power demand given the fact that the whole national consumption is only about 2000 plus MW.

The nation is witnessing power outage from time to time due to defect in electricity or due to natural disaster or due to deliberate load shedding. Because there is no efficient means of regulating power supply so far, the easiest and pragmatic way is load shedding whenever there is case of over load. This is probably the pragmatic policy of electricity authority. There were/are precedents of load shedding practiced in the industrial zone of Yangon, and other parts as well. The company should not rely entirely on the national grid line.

5.2.4.10 Impact of waste disposal

The waste generated from the factory during the Operation Phase can be in the form of solid waste, waste water and spill or leak that contaminated the soil.

Solid waste generated during the Operation Phase will be in the form of industrial waste, domestic waste, office waste and hazardous waste.

Waste water will be in the form of industrial waste and domestic waste. Spills or leaks (of oils, chemicals) could be considered hazardous waste.

The main industrial waste is cement dust. From time to time a substantial amount of office waste (paper, toners, packing materials) could be generated. The food and kitchen waste produced by more than 300 employees and families is also considerable in quantity.

As regards industrial waste water the impact will be negligible as virtually all water is used up in the production of cement, no considerable amount of water flow out of the factory as waste water.

5.2.4.11 Impact on traffic

This is already mentioned in the Construction Phase but the potential impact in the Operation Phase will be long term.

As the production capacity will be increased four-folds the logistics of procurement of raw materials, coal from Kalaywa, Naung Cho and Padann and Gypsum from Maukmai and Thibaw will also increase approximately four-folds. In the same way the logistics for the delivering of cements will also increased four-folds. These will have substantial impact on the traffic.

The company has kept few trucks of its own but relies on the contractor basis for the procurement of raw material and the distribution of cement.

As the demand for cement is always high cement traders usually come with their own trucks or hired trucks right to the company warehouse and buy bags of cement right away. The company has a distribution centre in Nay Pyi Taw.

As the trucks of the contractors or traders are not under the control of Max Myanmar Manufacturing Company the mitigation measures for the impact on traffic are, of course, not necessary.

However, the company should at least take responsibility on the traffic on its 10 miles access road.

5.2.4.12 Impact: lack of emergency, safety and health practices

This is already addressed in the Construction Phase. But the potential impacts during the Operation Phase are long term. When employees are working at a workplace for many months attentiveness tends to slacken and cases of accidents and emergencies can occur from time to time.

The lack of good engineering practice, good working practice good house keeping practice, good safety practice and lack of health education and awareness and hygiene can all lead to undesirable consequences and have negative impacts on the project.

5.2.4.13 Social impacts: social illness, anti-social behaviours and HIV/AIDS

These are already mentioned in the Construction Phase. Such cases are unlikely to occur during the Operation Phase as all workers are handpicked by the executive members of the

factory. Unlike the blue collar construction workers who are employed for short term (two years) the workers in the Operation Phase are permanents workers. It is expected that they are better well-disciplined than the construction workers.

Any way the authority of the factory has to deal with these workers on a long term basis. Measures for creating a peaceful and productive atmosphere should be taken into account.

5.2.4.14 Impact: potential security

This is already mentioned in the Construction Phase when about 1,000 workers were employed. Unlike the hectic nature of work during the Construction Phase the working atmosphere during the Operation Phase is stable, with fewer workers.

However security situation tends to slacken when a factory is running for several years. So for the long term Operation Phase the plan for security should be more practical. It is expected that the employee hand-picked by the factory authority will not pose any security threat to the factory. But outsiders, the local people, at one time or another can cause security problems such as theft, vandalism etc.

In this era of terrorism sabotage by terrorists cannot be ruled out. Also sabotage by destructive elements with anti-big business, anti-corporate and anti-cronyism mind set cannot be ruled out.

5.2.4.15 Impact: public perception

This is already mentioned in the Construction Phase. It is quite difficult to identify the public perception. Activists and radical environmentalists can make the local communities to have a negative perception on the factory. Ill-disciplined and rowdy workers, particularly construction workers, can leads to negative perception on the factory by the locals.

During the Construction Phase the local people may have high hope and expectation for employment. But later they may become disillusioned if their hope of employment is not realized to full extent as the factory can never employ each and every one who wants a job.

Good relation with the local community will have positive impact on the factory while the impact will be negative if the relation is bad.

Table-:13 Summary of criteria for negative impacts during the Operation Phase

Sr. No	Nature	Extent	Duration	Intensity
1.	Impact: blasting, quarry activities	Quarry site and vicinity	Long term	High
2.	Impact: change in relief; alteration of landscape	Quarry site and beyond	Long term	High
3.	Impact on biodiversity	The whole area	Long term	Medium to high
4.	Impact: stockpiling of mined out materials; overburden	Quarry site	Long term	Medium

5.	Impact: loss of non-living natural resources	Quarry site	Long term	High
6.	Impact on air quality	Factory foot print and beyond	Long term	Low to Medium
7.	Impact on water quantity & quality	Factory foot print and the vicinity	Long term	Medium to high
8.	Impact: noise and vibration	Quarry site and factory and vicinity	Long term and intermittent	Low at factory, high at quarry
9.	Impact of power supply on national demand and vice versa	Beyond the factory	Long term	Low to medium
10.	Impact: waste disposal	Factory foot print	Long term	Low
11.	Impact of traffic	Access road and main road	Long term	Low
12.	Impact: emergency, safety and health	Factory foot print	Long term	Low
13.	Social impact: social illness	Factory and vicinity	Long term	Low
14.	Impact: potential security	Factory foot print	Long term	Low
15.	Impact: public perception	In the local communities	May last for a certain period	Low

5.2.5 Positive or beneficial impacts during the Operation Phase

There are many positive or beneficial impacts during the Operation Phase and they are long term in duration.

The main positive impacts in brief are:

The creation of permanent jobs as will as part time jobs; fostering the economy of the local area, local region and also the nation; upgrading of physical infrastructure such as school, clinic, library, monastery and roads; decrease public health risk and in one way or another raising the living standard of many locals; and finally contribution to the improvement of the construction sector and hence, infrastructure of the country.

The first positive impact that can be easily seen is the creation of jobs. 302 workers are employed permanently (during the Operation Phase) ;there are alao a few dozens of daily wagers. There can still be employment opportunities for vacant posts from time to time. The door is still open for this.

The factory has already boosted the local economy to some extent; teashop, food shop, grocery and stalls have sprung up in Aung Chan Thar village and nearby. Many villagers are now involved in the service sector, rendering their services and catering for the needs of the factory employees. The factory in one way or another has improved the standard of living of the locals.

The benefit goes beyond the region. Companies or enterprises that produce raw material such as coal and gypsum have now the chance to do or expand the business and thus indirectly

providing more jobs. Business men involve in wholesale distribution or retail sales can boost their business and thereby in one way or another indirectly create job opportunities.

In the local perspective the infrastructure development is materialized in the form of the construction of two school buildings in Aung Nan Cho village and one in Aung Chan Thar village. There are also one library and one clinic set up by the company.

This will contribute to improving health condition and the advancement of knowledge for locals. The construction of one monastery and the building of a pagoda also enhance the socio-religious life of the community.

The infrastructure development can be witnessed in the construction of the hard top (concrete) access road which is 10 miles long. This wide access road together with the temporary pedestrian bridge across the Mei Hor rivulet have played a leading role in the infrastructure development of the region and hence the economic and social development as well. The access road had solved the logistics issue faced by the communities of the three villages and beyond, for generations. Once it usually took one day to travel from Aung Nan Cho village to the highway and back home, it is learnt. The access road greatly improves communication and transportation and makes life convenient for the locals. They can now sell their agricultural products at the main markets in towns and cities quite easily.

The infrastructure developments of the region (schools, clinic, library, monastery, road, bridge) are the result of comprehensive and integrated CSR actions taken by Max Myanmar Manufacturing Company.

On national level the benefits will accrue to the country in the form of direct investment of Ks 31603.5 millions plus U$ 6.8 millions and in the form of an increase in the Gross Domestic Product (GDP) of the country.

The country shall benefit from increased investment, increased employment, increased earring, increased duties, taxes and revenues etc.

While Max Myanmar Manufacturing Co., Ltd should mitigate or minimize all negative impacts it should, on the other hand, maximize the positives impacts to their optimum.

5.2.6 Potential negative impacts during the Decommissioning/Mine closure Phase

Because this will happen 20 or 30 years from now this will be dealt not in detail but only in general. The company can simply walk away and leave the plant and site if it is no longer use after operation phase (This is also known as Abandonment Phase and sometimes practiced in a few developed countries with surplus land during the last fifty years or so). The abandonment of an old dilapidate cement factory will make the place look ugly and can have a negative impact on the landscape of the area. The mined out quarry will look ugly.

If decommissioning is not well-managed and if rehabilitation is not implemented the project can have serious long term negative visual impact on the nature and aesthetic beauty of the area.

5.3 Determination of significance of those impacts

5.3.1 During the Pre-construction Phase

Two potential indirect negative impacts, namely, the instigation by activists and the hike in price of property in this area context were insignificant. So far there was no serious issue regarding these two potential impacts.

5.3.2During the Construction Phase

Most of the physical impacts during this phase were of minor significance given the fact that the factory was in the rural area at the foot of a mountain.

The impact of mobilization of materials and workers and the impact on traffic would be insignificant in a rural area with very low traffic density.

The impact on air in the form of smoke would be negligible; dust generated from land clearing, earth work and vehicular movement would be quite significant, but intermittent, and could be mitigated.

Impacts of noise and vibration; impact on soil and water would be insignificant as no toxic chemicals would be involved. All these direct impacts could be effectively mitigated.

The impact on biodiversity in the form of habitat destruction and habitat loss would be significant, given the area of land to be cleared for construction was 45 acres for factory and premise and the vegetation to be cleared for the construction of the 10 miles hard top road. The impact would be mostly irreversible. However, effective reforestation and rehabilitation would mitigate the impacts to a great extent.

The social impacts in the term of social illness and anti-social behavior among construction workers could be quite significant if not effectively managed. The negative economic impact on the area was negligible; on the other hand the positive impact was quite significant during this phase. The project would provide jobs for up to 1000 workers during the period of two years. Many unskilled workers would have the chance to become skilled construction workers. There would be transfer of skilled and technology from the foreign technicians.

The lack of management plan for emergency, safety and health could have significant impact and so this should be prioritized.

5.3.3 During the Operation Phase

The impact of blasting for the extraction of limestone is significant. The impact on air quality in the form of dust could be quite significant during the activities taking place in the Operation Phase. Some impacts like smoke would be of the less significance than dust since electrostatic precipitator and filter houses would be installed; the stack height was up to standard.

The noise and vibration impacts generated from blasting would be very significant but would be very short duration. Vibration was actually synergistic impact. The high noise level emitted from the crusher department and mill could be also significant.

The impact of power supply on the National Grid line could not be so significant; on the other hand the impact of the grid line (such as power outage) on the factory could be significant. The impact on soil and contamination of underground water could be insignificant since no toxic chemical were involved. In spite of the application of "dry process" large quantity of water has still to be used but the impact on water resource would be minor as there was abundant supply of water -- from the springs and from Yay-pu Chaung Stream. The chance of industrial waste water entering the stream was remote as the process used up all water leaving no waste water. Domestic waste water could be well-managed and the impact could be mitigated.

The loss of non-living natural resource, that is, limestone would be very significant after 1-2 decades of operation; this was irreversible impact.

The destruction of vegetation due to mining/quarry activities would indirectly lead to erosion and flooding if not well-managed.

The impact on biodiversity during the operation would be very significant indeed, and this would be more so than during the Construction Phase. The combined area of two designated mining/quarrying sites was about 400 acres. The destruction of habitats and the loss of habitats would be severe. Mitigation measures would be described in the following section. Remediation had to be undertaken at the end of the Operation Phase and reforestation or rehabilitation of the forest had to be duly carried out. This significant impact could be reversible if effective measures were taken.

Social impact such as social illness and ill social behaviour could be insignificant during this long Operation Phase as the permanent workers would be hand-picked and would be well disciplined than the construction workers.

Lack of management for emergency, safety and health could have significant impact on the project and so priority should be given for mitigation of the impact.

The positive impact during the Construction Phase was already mentioned earlier. The positive/beneficial impact during the operation would be greater, the long term employment of 302 workers and dozens of daily wagers.

There was no cultural component to be impacted by the project. As regards visual impact the alteration of the whole landscape (the disappearance of the mountain) would take place at the end of the Operation Phase. Remediation measures for this impact should be the establishment of a forest (reforestation) on the whole area. That was the creation of a forest in the place where a mountain once had existed.

5.3.4 During the Decommissioning/mine closure Phase

Because this phase would take place 30-50 years from now it was difficult to predict the significance or in-significance of the impact. The Decommissioning Phase usually last for 2 months. The impacts would be more or less similar to those during the construction but in a reverse aspect.

Since the project being a mining/quarrying operation in a rural area the most likely hood scenario could be abandonment of the site after the end of the Operation phase when all limestone were gone. However abandonment must be carried out only after rehabilitation of the area. Rehabilitation process could take at least one year.

5.4 Mitigation measures

5.4.1 Mitigation measures to be taken during the Preconstruction (Planning) Phase

5.4.1.1 Mitigation/corrective measures for polarization of local people into anti- and pro-project due to instigation by anti-big business activists

Of course there is no quick fix measure for this social impact. Transparency and the good will shown by the company will tackle most of the issues. The Corporate Social Responsibility (CSR) action taken by Max Myanmar Company is an effective measure for solving the issue. Prioritizing the local people for employment in the factory is an effective way of corrective measure for the negative impact. (This is exactly what the company is doing).

5.4.1.2 Mitigation/corrective measures for a hike in the price of land and property

There is no remedy for inflation in price of land and property. The prices of land property are always on the high and this can be only stoically or rationally considered simply as a way of life in this country.

It is important that employees of the cement factory, especially the executive and management members should not personally get involve in land price speculation.

5.4.2 Mitigation/corrective measures to be taken during the Construction Phase

5.4.2.1 Mitigation/corrective measures for to be taken for impact on biodiversity

Partial rehabilitation of some parts of the site must be implemented; plant fast growing trees to partially restore the original landscape. Consider for the establishment of green zone or green belt and aesthetic landscaping after the construction phase. Leave original big trees, if any, as intact as possible.

Avoid unnecessary clearing of land and cutting of vegetation. The construction should be progressive, that is, implement as soon as a portion of the site is ready for construction.

Do not clear vegetation too far advance of construction. Also avoid unnecessary clearing of land and cutting of trees along both sides of the access road to the factory.

Keep original big trees, intact. Plant trees and grass in vacant spot and consider for the establishment of green zone or green belt.

Prohibit hunting or trapping of wild animals, even small ones including rodents and birds.

Effective planting of trees and grass should be started as soon as the construction works are completed. Refuge area (nesting, resting, breeding and feeding) should be defined for small animals such as birds and rodents.

More trees of various species must be planted during the operation phase, not only in the premise of the factory but also in the vicinity. This will help restore the damaged mini-ecosystem of the area. Avoid planting of only one species of economic important plant, for instance, teak. From economic perspective this is viable. But from ecological perspective this will only lead to the emergence of mono-specific teak plantation, which is not ecologically viable. Only a forest with a variety of trees can restore the ecosystem to a certain extent.

5.4.2.2 Mitigation/corrective measures to be taken for impact of worker camp on site

Select suitable site for setting up camp (housing) for the workers.There must be separate housing for female and male workers and the two should be appropriately far apart. Discipline the workers for good house-keeping, for example, do not litter, do not dirty your toilet facility, keep your place tidy and clean, do not smoke while working and do not smoke near fuel store and so on. Demand the building contractor to discipline his workers and to take responsibilities for their conducts.

Set up proper sanitation, for instance, small septic tank and adjoined soak pit for better treatment of sewage and waste water during the construction period.

5.4.2.3 Mitigation/corrective measures for impact of mobilization and preparation actions

The area used to be a quiet remote area. The actions mentioned above during the Construction Phase can cause nuisance to the local people. Restrict the movement of trucks according to schedules.

All materials for construction should be systematically piled up or stored within the site. Do not overspill them outside the site or on the road side. There is the potential issue of theft.

5.4.2.4 Mitigation/corrective measures for impact of traffic on main road (Yangon-Mandalay)

Avoid over loading vehicles; loading must comply with the requirement of the Road Authority; always check the total weight when loading heavy machinery; for instance, excavator, crane, lift, dozer etc. on large truck.

Educate the truck drivers; heavy trucks should be driven slowly and practice defensive driving; set up speed limit on the access road; set up traffic sign board at the intersection.

5.4.2.5 Mitigation/corrective measure for impact on soil

When doing the clearing work or excavation of earth remove top soil with vegetation (grass, herbs) on it. Stockpile top soil in conical heaps; allow grass and herbs to grow on top soil. Remove and stockpile subsoil separately. Maintain the topsoil against erosion when filling of earth has to be done; replace, first, the subsoil and then the top soil on top. This will greatly help in greening or landscaping work.

Schedule the construction works so that large area of soil were not laid bare during the monsoon months. Do not clear the land in advance more than necessary. Phase the earth work (in the early period of construction) so that it was limited to workable size only to a minimum area.

Resurface and stabilized the exposed ground surface as soon as possible, that is, after earth work.

To prevent subsequent settlement, drain or ditch must have adequate backfill and after completion of back fill the surface should be restored to its original condition.Severely compacted soil due to repetitive vehicular movement should e raked from time to time.

Manage the overall erosion and sedimentation control during the Construction Phase, particularly during the rainy season.

5.4.2.6 Mitigation/corrective measures for impact on water

Water conservation; minimize use, and recycling should be practiced. Regularly inspect tanks and pipes for leaks. Minimize use of water by using low consumption appliances. Discipline worker for conservation of water for domestic uses. Harvest rain water for various uses later during the rainy season.

5.4.2.7 Mitigation/corrective measures for impact on air quality

Mitigation for dust

When clearing the ground vegetation must be removed together (mixed) so that the plant material helps to hold the soil. Or vegetation can be stripped and spread on the newly made soil stockpile; this will minimize emission of dust due to wind. As mentioned earlier, avoid clearing vegetation too far advance of construction.

Spray water regularly for suppression of dust. Plant trees at vacant spots; select hardy, fast growing species and create green zone and green belt. Trees play an important role in minimizing dust; they reduce wind speed and trap a lot of dust.

Provide personnel protection equipment (PPE) such as face mask, nose and mouth cover, to workers exposed to dust during cement mixing and so on.

Mitigation for smoke

Regularly check the engine of vehicles and other machines; well-maintained and operated engines reduce smoke emission; use fuel oil with low sulphur; use environmentally friendly up-to-date instrument, for example, engine with higher fuel efficiency; equip instruments and machines with air pollution control devices to minimize exhaust emission. (These may not be readily available but Max Myanmar should consider this for the near future.)

Avoid vehicles and instruments left running unnecessary; avoid open burning of solid wastes of all kinds, through segregate, recycle and then for disposal at approved dump site (land fill).

Provide PPE such as noise and mouth covers and face masks to workers exposed to smoke. Trees in the site will effectively sequestrate (remove) CO_2 in the smoke.

5.4.2.8 Mitigation/corrective measures for noise and vibration

As the cement factory is isolated (the nearest village is about one mile away) noise is not an issue for the community. Noise can have minor impact on the employees.

The best way to mitigate noise is at its source. Noise specification of equipment and vehicles should be taken into consideration when ordering equipments and vehicles. (This will be mentioned in EMP in Planning Phase.)

All noisy machines and equipment should be fitted with noise muffler or silencers. Place noisier machines away from other working units. No construction work at night.

Install temporary noise barrier, if possible, during construction work. Instead of a fence build a 2 m high concrete wall around the premise.

Big trees around the factory and dense vegetation in the site effectively absorb noise.

Provide adequate PPE such as ear muffs, ear plugs etc. to workers at all activities/locations that exceed permissible occupational noise level limit standard (85 dBA).

As mentioned earlier, because the factory is isolated and away from residential area the noises generated during the Construction Phase are negligible.

However the blasting activities and the crushing of limestone during the Operation Phase will have great impact on the environment, as far as acoustics is concerned.

Vibration due to heavy truck from road can be mitigated by ensuring a flat and smooth road surface; paved road is much better than unpaved road; tarred road is better than concrete road.

Well-maintained and well-operated machine produce less vibration, therefore, give priority to maintenance and efficient operation of machines. Foundation for the installation of the machine should be firm and durable even for short construction period. This reduces vibration and protects machinery and equipment from damage. It is standard practice to mount machines in such a manner to minimize vibration.

5.4.2.9 Mitigation/corrective measures for impact of waste disposal

All unused or surplus building materials can be sold to others who need it. The large majority of debris can be also put up for sale since most can be reused or recovered. Even left over broken bricks, gravel, sand etc. can be sold. Those that should be disposed off should be disposed at an approved land till. Avoid open burning of debris.

The best thing to do would be to hire a contractor for the clearing job after the Construction Phase

There will not be any substantial waste water during the Construction Phase. All required water will be used up during mason work or concrete work.

Domestic waste water from temporary housing or camp will go to a small septic tank and associated soak pit. Instead of toilets, pit latrines are provided during the Construction Phase and so there will be no sewage from toilets. From purely environmentalist point of view, pit latrines are not so eco-friendly since it can have impact or ground water. But this is so far the pragmatic way of implementing sanitation during the temporary Construction Phase.

Discipline workers for good house-keeping practice; demand the building contractor to do this and ask him to take responsibility for the conducts of his construction workers.

5.4.2.10 Mitigation/corrective measures for impact of contamination of soil and ground water

Maintain all vehicles and machinery to prevent spill of fuel oil and hydraulic oil. Avoid washing down oil spill with water because this will only help percolate oil underground. Soak oil spill and then dispose the soak at approved disposal site. Saw dust can be also used for soaking oil spills. Pave vehicles and cranes parks and collect run off; bund the fuel depot to prevent spreading of spilled oil.

For disposal of domestic waste water construct a small septic tank together with soak pit to collect the sewage from kitchen, bath etc. Occasionally sprinkle sand or dirt into the pit latrines to mitigate the impact indeed. So the pit latrines may not be a serious issue for ground water as the Construction Phase last for only two years).

5.4.2.11 Mitigation/corrective measures for lack of emergency and health (hospital) service

Careful planning of emergency procedures such as training some workers in first aid and some in firefighting must be planned.

Provide adequate First Aid Kits and Fire Extinguishers. (A factory should have a fire engine, truck, for effective management of major fire outbreak.)

For emergency response, organize mock drills for first aid works and also mock drills for firefighting on a regular basis.

Phone numbers and addresses of nearest Red Cross Society, Ambulance Service, Fire Brigade, Police Station, Clinics and Meik-hti-la Hospital as well as Nay Pyi Taw Council Area Hospital Ambulance Unit must be displayed so that every worker can see easily. (This will be discussed in detail in Operation Phase and EMP.)

5.4.2.12 Mitigation/corrective measures for potential social illness and anti-social behavior

Education and disciplinary action are necessary. Of course Max Myanmar Manufacturing Company is not responsible for this; the building contractor is. The company should demand the building contractor to take responsibility for the conducts of his workers and to undertake disciplinary action. Ask the contractor not to hesitate to take action and apply punitive measures such as suspension or sacking of the wrongdoer.

Keep separate camps (housing) for females and males employees and the two camps should be appropriately far apart.

Ban the drinking of alcohol in the site for 2 years (the Construction Phase).

5.4.2.13 Mitigation/corrective measures for impact on project on HIV/AIDS and vice versa

Workers education and awareness campaign programmes should be organized. Make condoms readily available to employees; keep separate camps (housings) for men and women employees at a distance. Ask the building contractor to discipline his construction workers.

Do not underestimate the issue. HIV is not contagious, but bewares of the contagious nature of some STDs when many workers are crowded in a camp.

As the Construction Phase is only two years voluntary HIV or STD testing may not be necessary. (This should be considered for permanent employees in the Operation Phase.)

5.4.2.14 Mitigation/corrective measures for impact of potential security issue

The fencing or walling of the factory compound must be effective and reliable enough to keep the intruders at bay.

Access control must be implemented. Security gates must be set up; set up watch towers if necessary; no unauthorized access is permitted. The company and the building contractor must prohibit the workers from entering the two neighboring villages without preauthorization from the company or the elders of the villages. All entering and leaving of the factory site should be checked. Do not let the construction workers mingle freely with the locals.

Heavy building materials (which cannot be lifted easily) such as iron bars, iron rod, big timber etc. and materials of less value, for example, bricks, sand, gravel etc. can be piled up in the open. Materials of certain value, for instance, iron work, timber work, frame, iron nails,

and associates, corrugated iron sheets, glass panels, bags of cement etc. must be kept in store or warehouse under lock and key.

Ask the contractor to discipline his construction workers.

The condition should include punitive measures if found to be in contravention of the requirement, for instance, suspension or termination of the employment.

5.4.2.15 Mitigation measure for visual impact and light

Create green lawns, green zone and green belt as soon as construction work has completed. (Trees can be planted in available vacant plots even during the Construction Phase). Reforestation of the area surrounding the factory premise must be also implemented; the sooner the better. This will greatly mitigate the visual impact, without green lawn and green trees the factory will looks like an outcropping complex amid a partially degraded forest.

There was/is no tourist establishment or scenic feature in this area that could attract establishment of tourism and so the visual impact imposed by the newly built factory is negligible.Actually there is no scenic spot of tourist attraction to be impacted.

Provide appropriate lighting only for security reason. Avoid excessive use of light at night. Follow the principle of Singapore (Dim City) that save energy rather than that of Hong Kong (Bright City) which uses excessive lighting for advertisement and for ostentatious purpose.

A lamp installed at the top of the 90 m high stack will ensure that the stack does not pose hazard for air planes.

5.4.3 Mitigation/corrective measures to be taken during the Operation Phase

5.4.3.1 Mitigation/corrective measures for the impact of blasting and quarry activities

- select only mineralized spot (that is spot where limestone exist) for blasting. If the whole mountain is solid limestone then carry out systematic blasts (portion after portion or block after block of the mountain). Do not blast randomly which will result in ugly voids or dents occurring here and there all over the mountain

- if possible fence off the blasting area to prevent children and pets (dogs, cats) straying into the area

- select appropriate explosives (not explosives for military purpose). (uses emulsion type.)

- keep explosives in maximum security depot, magazine, approved by military engineers (Re: the Explosive Substance Act 1908)

- install lightning rod for prevention of lightning strike

- all drilling and blasting must be strictly supervised (to be careful is not enough-utmost care should be taken when handling explosives)

- use standard detonation fuse, materials for blasting
- ensure that the temporary shelter during blasting is safe
- blasting must be restricted to a limited part of the day (designate definite hour for routine blasting) Max Myanmar team leader has designated 11 AM to 1.0 PM and 5PM to 6 PM every in other day for blasting.
- loud and clear sound of warning siren should be given just before blasting
- the timing for blasting must be set to produce minimum vibration
- avoid blasting when strong wind is blowing or when there is heavy rain
- if blasting has to be done 1-3 days after heavy rain re-inspect the site before blasting as undesirable land slide can occur
- provide adequate PPEs, ear plugs, ear muffs, helmet for employees; keep a separate First Aid Kit for quarry site.

5.4.3.2 Mitigation measure for the impact of a change in relief (topography) and the eventual alteration of landscape

There is actually no easy measure to mitigate the change in the relief and the eventual alteration of the landscape due to prolonged period of quarrying activities.

The practical way is to restore forest in the periphery of the quarry site. Select natural trees that are locally occurring species which need not to adapt with the environment and can grow easily.

Do not clear the forest more than necessary before starting quarry activity.

Carefully select mineralize area, that is, spots where there is limestone or clay etc. Avoid blasting the area (spot) on the mountain side with no mineral (limestone).

If the whole mountain is solid limestone rock then there is no need to select special blasting area. However blasting should be systematically carried out, one portion or block of mountain at a time, rather than random blasting here and there leaving ugly large holes, voids and dents everywhere.

5.4.3.3 Mitigation/corrective measures for impact on biodiversity

Avoid clearing more trees than really necessary for quarry activity. Also avoid clearing more trees than necessary for the site for stockpiling limestone and the over burden.

Effort must be made to plant trees in the periphery of the site. Try to save as many original trees as possible. Also try to restore the remaining original trees as far as possible. Protection strategy is better than replacement approach when mitigating impact on biodiversity. Therefore select locally occurring trees rather than introducing new ones when planting trees.

Overburden must be systematically stockpiled; keep top soil and subsoil separately. Top soil is of great value in the creation of green zone, planting trees.

1) Corrective measures (factory premise andvicinity):

- corrective measure should be taken throughout the Operation Phase
- plant trees and create green lawns and green belts inside the premise of factory
- plant trees for reforestation in the vicinity of the factory -
- encourage small animals (rodents, birds, reptiles, amphibians) to return to the partially restored or reforested area, and let them use the area as their habitat for breeding, nursing , feeding, growing etc; do not disturb them
- prohibit hunting, trapping or discriminate killings of these wild animals including amphibians (frogs etc) and reptiles (with the exception of poisonous snakes).

2) Corrective measures (Quarry site & vicinity):

- plant trees in the dents,gaps or voids during the rainy season; select naturally growing indigenous species;
- protect and keep the remaining natural trees as intact as possible
- also plant new trees in the periphery of the quarry site
- consider in advance for rehabilitation work after the closure of the quarry.

5.4.3.4 Mitigation/corrective measures for the impact of stockpiling of mined out (quarried out) materials and overburden

- To mitigate impact on biodiversity do not clear more vegetation than needed for temporarily stockpiling of mined out limestone/clay.
- systematic removal and stockpiling of overburden; do not dump overburden on slope, in valley; the overburden must not block the natural drainage system and change the course of water flow during rain
- stabilize overburden; first level the ground for stockpiling of overburden; the height must not be more than 30 feet, the slope must not be greater than 37^{o}; plant herb or grass or let them grow on the overburden
- always avoid spill from overburden reaching stream, village and cultivated land
- always check erosion and flooding during the rainy season
- refilled mined out/quarried out pits with overburden
- separate top soil and subsoil of overburden; top soil for creation of green belt (planting of trees), sub soil could be used for construction work, earth filling work
- used the unused overburden later for rehabilitation work after mine closure

- take utmost care not to cause collateral damage to the surrounding

5.4.3.5 Mitigation/corrective measures for the loss of non-living resources (limestone, clay etc.)

As the loss of the limestone mountain (non-living natural resource) is inevitable and irreversible there can be no tangible mitigation measure for this. This matter should be considered on a very pragmatic way. The loss of the mountain and the resources is compensated by the gain in infrastructure development and hence the national development (since cement is the essential material for infrastructure development). After all there are thousands of mountains of limestone in the country and so the loss of one is not a serious loss. To gain a thousand kyat one has to give away a hundred kyat (htaung-myin-yar-sunt) as a Burmese saying goes.

Geologists of the company should try to estimate the capacity of the mountain as accurate as possible. (At the moment it is estimated that the main quarry site, the mountain, contains 19.47 million tons of limestone.) Quarry engineers should check and calculate the extraction rate of limestone (and also clay, laterite) on a weekly, monthly and yearly basis. This is to spare the mountain from over extraction which will eventually leave huge piles of limestone unused and overburden after the completion of the Operation Phase, 20 or 30 years later.

5.4.3.6 Mitigation/corrective measures for impact on air quality

Mitigation/corrective measures for dust

Avoid blasting when strong wind is blowing to prevent the spread of dust. Excavation and loading should be also stopped for a while when strong wind is blowing.

Conveyer belt with cover or tubular conveyor belt is very effective for the protection of dust during conveying process. Such a tubular conveyor belt should be installed.

Dust control measure should be considered in the packing and in the storage house. Minimize drop height during loading and unloading of cement bags to minimize the generation of dust. Truck loaded with cement bags should be covered with tarpaulin to prevent spread of dust during the trip, so too are trucks loaded with coal, gypsum etc.

Water down dusty work area and spray water on road and ground regularly to suppress dust.

Maintain stock piles of coal and cement dust at minimum height and form long term stock pile into optimum shape (for stabilization) to reduce wind erosion that will generates dust. The roofing of the sheds should be relatively low and curve in shape to reduce wind effect. The cement dust collected during manufacturing process may be recycled back.

Green zone (trees) traps dust and so trees should be planted in all available spaces.

Provide adequate PPEs such as face masks, nose and mouth covers to workers exposed to dust in the work place, for instance, at the quarry, at the crusher house, at the cement mill and at the packing and storage place etc.

Mitigation/corrective measures for smoke

The practical way to reduce emission is the efficient burning of coal. Effective burning at high temperature ensure complete combustion, minimization of smoke, ash and also many harmful substances, compounds and elements.

To maintain efficient burning coal should be kept in dry condition in any season including the rainy season. If coal is wet there will be a decrease in calorific value and complete combustion cannot be achieved and resulting in generation of more smoke, more ash and also decline in output capacity of coal mill. Therefore, a coal dryer is necessary.

Emission mitigation includes application of instruments that reduce emission such as electrostatic precipitators, filter bags house, activated charcoal absorption filters, fabric filters, which are known to absorb up to 95% of the particulate matters in the gases emitted.

The flue gases from the kiln can be treated in a special wet scrubber or dry scrubber for cleaning before releasing into the atmosphere.

The cement dust should be recycled or used as construction material.

Excessive level of SO_2 and NO_2 (two most predominant gases) can be reduced by means of flue gas desulphurization and denitrification (Not applicable here yet but should be considered for the near future)

The practical way to reduce SO_2 and NO_2 is to select coal with low sulphur content, preferably first grade anthracite coal (unfortunately not available in Myanmar; coal mines in Myanmar produce only lignite and bituminous coal). Processed coal or coke could be also used as coal burner. Generally all gaseous pollutants can be reduced by increasing lime dozing (not practical yet).

One easy measure to tackle smoke issue outside the mill but inside the factory premise is to avoid open burning of solid waste and debris that will generates large volume of smoke.

One practical way of mitigation is to provide adequate PPEs such as face masks, nose and mouth covers for workers at the work place.

Some of the theoretical aspects for generalized emission mitigation optimum include energy efficiency, improvement of new process, a shift to low carbon fuel, application of waste fuels, increased use of additives in cement making (such as steel slag), and the invention of alternate cements and CO_2 removal from flue gases in clinker and kiln.

Of course, the so-called "clean coal technology" is still a wishful thinking when it comes to large scale production of cements. Clean coal technology is applicable only in laboratories or in research phase. The company is planning to utilize natural gas, not yet as a substitute for coal, but as duel system energy utilization, and this is the right decision in the right place. Coal should not be discarded and the use of coal should not be stopped. It is estimated that the global coal reserves can last for at least one and a half century while the global natural gas reserves can last, at most, for only a generation (25 years) (Internet news, 2011).

Thick green belt (trees) inside and outside the factory compound greatly mitigates smoke effectively in sequestration (removal) of carbon dioxide gas.

The smoke stack, formerly 75 m tall and extended to 90 m, is in compliance with the required standard height.

As gases emission and smoke is the chief polluter of the atmosphere Max Myanmar Manufacturing Company should spare no effort to reduce or mitigate air pollutants.

Emission from stack and mill as well as ambient air quality should be monitored on a regular basis.

The ambient air quality tested during EIA work was simply to record baseline data of the site since the factory was not in operation and was shut down temporary for upgrade.

Since there was no operation at the moment the values for TSPM, PM_{10}, NO_2 and SO_2 were all within the environmental guideline values of WHO, EU and USA.

5.4.3.7 Mitigation/corrective measures for the impact on water (quantity and quality)

Reduce water consumption as far as possible; carefully supervise water consumption. Water saving measures such as recycling of water, collection of washing and cooling water andthe reuseof treated waste water for watering plants and lawn and also for dust suppression must be implemented. Also collect storm water for use in dust suppression and watering plant.

Conduct routine inspection and maintenance of water tanks, ponds, equipments, pipes etc. to minimize or stop water leak or spill. Promote good housekeeping practice for employees for sanitation and for saving water.

Collect rain water as much as possible during the rainy season or raining days for later use. Build new ponds, and install new tank for water.

Develop a detail monitoring plan to monitor spring water at the foot hill and the surface water level in the stream; select water quality parameter such as temperature, pH and total alkalinity for monitoring.

5.4.3.8 Mitigation/corrective measures for noise and vibration

Provide adequate PPEs such as ear muffs, ear plugs and ear protectors for employees at the quarry site and crusher departments (noisy locations that exceed permissible occupational noise level limit standard.)

Select low noise equipment; install mufflers at air inlets or outlets of the fan and air compressors. Install sound insulation cover (lattice work of woods) or barrier wall of the work place. Place noisier sources farther away in overall design. Build sealed or semi-sealed workshops.

Grow high rise and thick trees around the factory compound and quarry site to abate noise for the environment.

Conduct regular noise monitoring to ensure that noise level during all times are within noise exposure standard. (Portable small noise test kit is very useful.)

For mitigation of vibration install vibration insulators or vibration absorbers (shock absorbers) on machine that vibrate violently. Prolonged vibration can damage machinery and instruments.

Suitable foundation design should be implemented at the earliest Planning Phase of the project, for the long term operation. Vibration in the vicinity must be below acceptable level.

Fortunately there is no tall structure in the village to be impacted by vibration from the blasts at the quarry site.

5.4.3.9 Mitigation measures for the impact on power supply on national demand (grid line) and vice versa

Plan to minimize power consumption; this includes selection of machinery and equipment that minimize energy consumption. Apply direct solar water heating if necessary. Use low energy efficient lighting. Educate employees to save energy as much as possible.

Establish an independent power generation facility or substation. Design contingency measures and/or downtime procedures to implement in case of power failure. Backup system or backup generators must be installed.

Have regular consultation with electricity authority.

Regularly monitor and check the consumption of electricity – consumption must be within the workframe.

5.4.3.10 Mitigation/corrective measures for impact of waste disposal (solid waste and waste water)

Solid waste

- segregrate solid waste into four categories (four coloured bins of red, black, grey and green) for appropriate recycle or disposal. (dispose at approved land fill or dump site)
- track all waste generated
- no disposal of solid waste inside or outside the plant; no open burning of waste
- food and kitchen waste must be deposed at an approved land fill
- follow the 4 Rs principles of waste minimization (reduce, recover, recycle, reuse) as far as possible
- discipline all workers for good housekeeping practice -- do not discard solid waste

Waste water

- no discharge of untreated waste water into the open or into Yay-pu stream
- drain domestic waste water (industrial waste water, if any) into common water treatment tank or septic tank (or soak pit for domestic water)
- drainage system to separate waste water from storm water which can be reused without any treatment
- wash vehicles and reuse as much water as possible (more than 90% re-circulated and also aim for zero discharge for ideal cement plant)
- reuse crude re-circulated water for dust suppression and for watering plants
- consider for procurement of water test kits and consider for waste water testing at certifies laboratory annually or bi-annually

5.4.3.11 Mitigation measures for impact of traffic

- set up sign board at road intersection (of access road and highway) to direct heavy truck drivers to reduce speed at this intersection
- vehicular movements to be scheduled to avoid peak hours
- heavy trucks with big load to be travelled at reduced speed
- educate the company drivers in defensive driving
- also ask all other truck drivers who are involve in the transportation of the raw materials and the finished products (cement) of the company to comply with rules regarding Highway Law, 2000
- keep a log book each for all company vehicles
- -check the arrival of all trucks loaded with raw materials (coal, gypsum etc.) and the departure of all trucks loaded with cement bags; and also arrival and departure of all office cars.

5.4.3.12 Mitigation/corrective measures for the impact of lack of emergency and health (hospital) services

1) Measure for occupational hazard and health

- all workers must pass a medical examination prior to being employed
- train workers, both at factory and at quarry site, for safety awareness
- provide adequate PPEs for workers that are exposed to dust, smoke, emission, loud noise, heat etc

- implement safe and effective procedure for storage and transport of hazardous materials
- bund all storage area of fuel, lime, chemicals etc
- strictly supervise all blasting activities; extra-care to be taken when handling explosives

2) Measures for major accident and emergency

- Basic first aid and basic Fire Fighting trainings for workers
- Draw detail plan for prevention of fire and emergency plan for fire out break (Max Myanmar Manufacturing Co., Ltd has already has planned for this: fire prevention document: Max Myanmar- Ma Ma Ma /Htway-si/Fire prevention/01/2016. Dated 15-1-2016); Max Myanmar- Ma Ma Ma /Htway-si/Disaster/02/2016. Dated 15-1-2016).
- provision of fire fighting suits and equipments (fire engine, truck), water jet pumps, installation of hydrants around the plant; water ponds to be always filled with water etc.
- training and drill work on emergency procedures including contingency measures
- effective emergency response plan (including displaying of phone number and address of nearest Fire Brigade, Ambulance Service, Hospital and Police Station)
- to take out Insurance for the Cement plant and Insurance for Fire; Life Insurance for each and every employee should be taken into consideration

3) Measures for Health and Hygiene:

- train workers for awareness of health and hygiene
- proper sanitation facility--bath rooms, toilet etc
- regular waste collection, pest control, training for good house-keeping practices
- full medical care for workers including regular medical check up
- manage to meet all statutory requirements (rules, regulation, Factory Act, Labour Act)

Educate and train workers for good working practice, good safety practices, health education and hygiene.

5.4.3.13 Mitigation/corrective/preventive measures to be taken for social impact

Educate employees to be good workers who are dutiful, well-disciplined and diligent. Give them proper training on factory and work place regulation, and code of conducts.

As for dealing with local community educate them regarding local cultural behavior and awareness to achieve responsible and healthy community interactions.

The company should deal with the employees on a fair and square basis. The company should be aware of widespread cases of workers unrest in Yangon as a result of overworked, underpaid, and unhealthy relation between the employees and the factory authority.

In addition to regular medical checkup, voluntary HIV testing on the workers is necessary as they are permanent workers of the factory.

- consider hiring locals in the future when there are vacant posts, especially unskilled jobs
- try to reduce the potential impact to quality of existing life style of the local community in the area
- implement CSR programme for the community (certain CSR actions had been already taken by Max Myanmar Company)
- maintain cordial relation with the local community
- listen to the views, thoughts and opinion of the local people, heed to their concerns

5.4.3.14 Mitigation/corrective measures for potential security issue

Security should be planned for the long term. The wall of the factory compound should be good and reliable enough to keep the intruder at bay. Educate security personnel of the factory to be attentive and dutiful. Always restrict the access to the factory; if necessary set up watch towers.

All workers, both white and blue collar, should wear factory uniform and keep ID card for easy identification.

Security should be tight throughout the entire Operation Phase.

- regularly check the fence and wall of the factory compound to ensure adequate security
- no unauthorized person on site
- security guards at entrances; and patrol inside at night
- keep things under lock and key as far as possible; take regular locks inspection
- also post security guards or watch men at quarry site

5.4.3.15 Mitigation/corrective measures for public perception

There is no quick fix solution or remedy for this issue. Try to achieve good relation with the local community. Appoint one or two relation officers/ liaison officers to deal with the locals. Heed to the views, opinions and concerns of the locals as far as possible.

Communicate the availability of job opportunities to the locals from time to time.

Maintenance and immediate repairing of any damages caused by project operation on public or private structures, for instance, road, water network supply, irrigation canals electric cables

etc. (Max Myanmar had constructed a by-pass road for easy access to the village and beyond).

Consider and implement social assistant programme, the CSR, in the area. (Max Myanmar had already implemented this; this is mentioned in **Chapter-7** and the CSR.

For the long term success of the factory a peaceful social environment is necessary.

5.5 Mitigation/corrective measures to be taken during the Decommissioning/Mine clousure Phase

5.5.1 Mitigation/corrective measures for decommissing of the factory and for mine closure and rehabilitation

The authority should plan for a proper decommissiong procedure. The decommissioning contractor should be hired and ask the contractor and party to remove all lebris and waste. The factory premise must be rehabilitated by planting tree and create green belt.

Systematic closure of mine/quarry must be under taken. All pits, dents, holes, cracks should be back filled; the ground should be leveled. And finally effective rehabilitation in the form of creating green zone or green spots should be under taken.

5.6 Determination of any residual impacts

No residual impacts are anticipated during the Construction, Operation and Decommissioning Phase of the project.

There can be oil spills (diesel, petroleum, engine oil, lubricant etc.) but these will be immediately remedied (Already mentioned earlier).

There can be spills of chemical products such as emulsion paint, varnishes, sprays, epoxy resin, adhesives etc. during the finishing works of construction. Such spill will be cleared after each working session.

The chemical would not be used in daily operation of cement production.

It is probable that pesticides and rodenticides may be used from time to time but always in very small quantity. Mitigation measures are already mentioned earlier.

Chlorine for the treatment of water will goes directly into the drainage system.

So it could be simply stated that there will be no significant residual impacts in the operation of the cement factory.

5.7 Risks assessment

Risk assessment is a process that involves measurement of risk to determine, prioritizes and to enable identification of appropriate level of risk treatments (used also to describe the overall process of risk management).

Risk is a function of likelihood and consequence. Likelihood is the chance that the hazard might occur. Since the rick of any hazard is dependent upon the chance that it will occur (likelihood) and the impact of an occurrence (consequence) therefore risk score will be:

Risk score = Likelihood x Consequence

In some cases personnel are only exposed to the hazard for part of the time. Hence, a more detailed analysis of the risk ranking can be carried out by taking risk exposure (% of time personnel are present) and probability (chance that they will be injured) into consideration. Thus:

Risk score = (Probability x Exposure) x Consequence

Note: Value used for likelihood, consequence, exposure or probability need to be agreed by the risk assessment team, and professional judgement is very necessary.

Risk rating -- is the category, level, or risk assigned following risk assessment and is usually categorized into: High, Medium and Low.

Risk ranking -- can be determined by qualitative and quantitative means. According to pundits no one method is best or perfect. The best choice of method will depend on the circumstances and preferences at the work places either at the cement factory or at the limestone quarry site, at the time the exercise is done. However regardless of the method establishing risk ranking will set priorities for harzard control. The most important purpose in hazard identification, risk assessment, and ranking is to draw up and implement plans to control these hazards (Hazard = source of potential harm, injury or loss).

Pundits from different nations have formulated a great variety of risk ranking criteria based also from different occupational aspects.

When the nature of work at the cement factory is compared with the work at limestone quarry the later work place is considered more risky.

A creiteria table for quantitative risk ranking to be used for mining/quarry in India (and many third world countries) is as in the following **Table-14**.

Table-14: Risk Ranking Criteria

Scale for Consequence	Scale for Exposure	Scale for Probability
Several dead: 5	Continuous: 10	May well be expected: 10
One dead: 1	Frequent (daily): 5	Quite possible: 7
Significant fatality chance: 0.3	Seldom (Weekly): 3	Unusual but possible: 3
One permanent disability/less chance of fatality: 0.1	Unsual (Monthly): 2.5	Only remotely possible: 2
Many lost time injuries: 0.01	Occasional (Yearly): 2	Conceivable but unlikely: 1
One lost time injury: 0.001	Once in 5 years: 1.5	Practically impossible: 0.5
Small injurity: 0.0001	Once in 10 years: 0.5	Virtually impossible: 0.1
	Once in 100 years: 0.02	

On the basis of the above scoring format, and after a perusal of the resultant scores, professional judgment was exercised in selecting the following scale for assessing risk levels:

- Level 1: > 15; i.e., requiring immendiate action
- Level 2: < 15 but > 5; i.e., requiring management action
- Level 3: < 5; i.e., low risks requiring periodic review

After a series of risk assessments for the subject mine/quarry dwelling on the likely hazards faced at the sites were conducted and after much deliberation among experts and pundits the results of risk assessment are given below in the **Table-15**.

Table-15: Hazards Faced in Limestone Mining Operations

Sr. No.	Activity	Hazard Description (Risk)	Score				Risk level
			Consequences	Exposure	Probability	Risk Score	
1.	Site planning and layout	Travel in moving vehicle in uneven terrain	1	2	1	2	Level 3
2.	Storage of explosives	Unintended explosions (exposure to overpressure)	1	5	3	15	Level 1
3.	Charging of explosive	Unintended explosions or exposure (exposure to overpressure)	1	3	1	3	Level 3
4.	Blasting	Hit by fly rock (bodily injuries)	1	2	1	2	Level 3
5.	Bench Formation	Rock falls or slide due to lack of bench face stability (bodily injuries)	5	1.5	2	15	Level 1
6.	Crushing and sizing of ROM	Hit by Machineries – Electrical Equipment (bodily injuries)	1	3	3	9	Level 2
7.	Transportation of minerals	Vehicle Accident (bodily injuries)	5	5	2	50	Level 1
8.	Transportation of minerals	Accidental 1 fire in vehicle (bodily injuries, exposure to heat radiation)	1	5	1	5	Level 3

By the arranging the above hazards from highest to lowest, the hazards are rearranged as per their risk level.

Table-16: Hazards Ranked by Risk Level

Sr. No.	Activity	Hazard Description (Risk)	Risk Score	Risk Level
1.	Site planning and layout	Travel in moving vehicle in uneven terrain	2	Level 3
2.	Storage of explosives	Unintended explosions (exposure to overpressure)	15	Level 1

3.	Charging of explosives	Unintended explosion or Exposure (exposure to overpressure)	3	Level 3
4.	Blasting	Hit by fly rock (bodily injuries)	2	Level 3
5.	Bench Formation	Rock falls or slide due to lack of bench face stability (bodily injuries)	15	Level 1
6.	Crushing and sizing of ROM	Hit by Machineries – Electrical Equipment (bodily injuries)	9	Level 2
7.	Transportation of minerals	Vehicle Accident (bodily injuries)	50	Level 1
8.	Transportation of minerals	Accidental 1 fire in vehicle (bodily injuries, exposure to heat radiation)	5	Level 3

The hazard analysis for the above-mentioned examples cover explosive handling, working at heights, slope and banch stability, limestone/mineral transport, processing and force majeure condition (rainfall, flooding, lighting strike etc.). The mechanisms due to which hazards may actually occur are shown in the the following **Table-17**.

Table-17: Cause Analysis for Hazards

Sr. No.	Hazard Description (Risk)	Risk Score	Risk Level	Cause Analysis
1.	Travel in moving vehicle in uneven terrain	2	Level 3	- Poor visibility - Incompetent driver - Poorly maintained vehicles
2.	Unintended explosions (exposure to overpressure)	15	Level 1	- Defective explosives - Outdated explosives - Improper storage of explosives - Force majeure conditions such as lightning strike - Fire (can be caused by unsafe practices or as ignition) - Sabotage
3.	Unintended explosion or Exposure (exposure to overpressure)	3	Level 3	- Defective explosives - Outdated explosives - Improper storage of explosives - Force majeure conditions such as lightning strike - Fire (can be caused by unsafe practices or as arson) - Sabotage
4.	Hit by fly rock (bodily injuries)	2	Level 3	- Poorly access control of blast area - Poor blasting practices (leading to excessive fly rock)
5.	Rock falls or slide due to lack of bench face stability (bodily injuries)	15	Level 1	- Improper design of bench - Force Majeure (such as heavy floods or rainfall) - Improper blasting practices - Incompetent blasting personnel
6.	Hit by Machineries – Electrical Equipment (bodily injuries)	9	Level 2	- Improper design of equipment - Improper maintenance

				- Non usage of equired PPE - Incompetent Personnel
7.	Vehicle Accident (bodily injuries)	50	Level 1	- Head on collision between vehicle and another vehicle (due to poor visibility or incompetent drivers) - Poorly vehicle maintenance - Accident to vehicle carrying fuel, and subsequenct ignition of spilt fuel
8.	Accidental 1 fire in vehicle (bodily injuries, exposure to heat radiation)	5	Level 3	- Improper storage of fuel, in MS drums, leading to spillage followed by ignition - Driving with loaded material on uneven terrain, and subsequentignition of spilt fuel

The examples given abore are just for theoretical purpose. These are the works of expertise -- mathematicians, statisticians, computer programmers, engineers, social scientists etc. and purely accdemic in nature.

The EIA team of MESC can only provide the basic and simple risk assessment. The EIA team did not anticipate any extremely significant risk such as massive accidental explosion or fire.

The extraction of limestone involved blasting but the use of explosive was very limited in quantity. The time was also very limited -- just a few seconds per blasting, and just one blasting per day or every other day. Veteran demolition experts (ex-army personnels) would be deployed.

Each and every blasting activity would be strictly supervised; all precautionary and preventive measures were taken. The magazine where explosives were stored was more like and undestructable semi-underground bunker. The risk was negligible.

The vibration generated from blasting could probably cause small scale landslide especially during the rainy season, but the chance was too remote. There was no known precedent of small scale landslide due to blasting at quarry/mining site in Myanmar.

In the factory context there would be no risk of chemical explosion as no chemicals were used in the manufacturing processes of cement. At the kiln and calciner the temperature would be extremely high, 1400 ºC, and the heat would be immense, but this was just the normal operation process in the production of cement. No worker would be at risk as the processes were controlled and regulated from an automated and computerized control room. The likelihood of accidental explosion or fire was almost non-existence as no explosive or flammable substance would be involved in these processes.

6. CUMULATIVE IMPACT ASSESSMENT

Definition

Cumulative environmental effects can be defined as effects on the environment which are caused by the combined result of past, current and future activities. Over time, direct or indirect human activities combine to collectively impact the environment.

Cumulative impacts are those that resulted from the successive, incremental and/or combined effect of an action, project or activity (usually collectively refered to as development) when added to other existing planned and/or reasonably anticipated future ones.

Cumulative Impacts Assessment (CIA)

This is more or less similar to negative impacts assessment but usually for the long term impacts assessment or combined impacts assessment.

Cumulative Impacts Management (CIM)

This is the management for avoidance or minimization or reduction or mitigation for negative impacts. Of coure effective Cumulative Impacts Management (CMI) can avoid or prevent or minimize or reduce or at least mitigate most, if not all, negative impacts.

In this proposed project context it is actually the management for the decommissioning of the cement factory and its premise and the management for mine closure. It is also the management for rehabilitation of the old factory site and the old quarry site(s).

Cumulative Impacts Assessment and Cumulative Impacts Management are necessary whenever there is concern that a project under review may contribute to cumulative impact, on one or more Valued Environmental and Social Components (VESC). For instance, when a series of cement and quarry projects occur within an area where they will impact the same VESC.

Processes or steps

General process or steps for implementing CIA involve 5 steps:

Step 1 - Scoping Phase

Step 2 - Establish information or baseline status of VESC

Step 3 - Assess CI on VESC

Step 4 - Assess significance of predicted CI

Step 5 - Management of CI; plan design and implementation

As regards the processes for CIA these could be put in this way:

CIA is:

a) a process of analysizing the potential impacts and risks of proposed project in the context of potential effects of human activities and natural environmental and social external drivers on the chosen VESC over time

b) a process of proposing concrete measures to avoid, reduce, or mitigate such CIs and risks to the extent possible

The management for implementation of negative impacts during the Construction, Operation and Decommissioning/ Mine closure Phases are actually integral parts of Cumulative Impacts Management (CIM). The logic is that if effective mitigation measures over the years, that is, during the Construction, Operation and Decommissioning/ Mine closure Phases were implemented the cumulative impacts will be minimized or reduced.

Responsibility for CIM

The project proponent is responsible for the management of cumulative impacts due to the implementation of the project.

Shared responsibility for management of Cumulative Impacts (CI) is necessary when a series of projects are operating in an area (eg. Max Myanmar, YCDC, Asia World, and smaller companies operating in Taung Philar area).

Simplified CIA

In developed and industrialized countries the subjects of CIA and CIM have developed to an advanced phase. But actually these subjects are the works of scholars or pure academicians that involve the application of a variety of computer programmings, complex mathematical models or a mathsmatical formulae and statistics calculations and manipulations. These are outside the domain of ordinary people including the businessmen (the project proponent/and the EIA/IEE consultants.

In this Taung Philar cement factory and quarry context a very simplified way of addressing CIA is mentioned.

Cumulative impact could be either successive addition of impacts over a long period or the addition of impacts from other sources (other factories) or both.

The large scale production of cement (1500 ton/day) involved the use of large swatch of land both for the establishment of a big cement plant and for the extraction of large quantity of raw materials (limestone and clay in this Taung Philar context).

Therefore the cumulative impact (the successive addition of impacts) resulting from the large scale operation that would go on for several decades (1-3 or 5 decades) could be very high

indeed. However as already mentioned above the cumulative impact in term of risk for human (not flora and fauna) would be relatively low.

After 1-2 decades of mining and extraction of large quantity of limestone and clay the cumulative impact (the successive addition of impacts) resulting from the inevitable clearing of vegetation before the commencement of mining/quarrying would be very significant. The mining and excavation sites were temporary; when the limestone was mined out/excavated out a new site had to be selected within the designated mining areas more than 400 acres).

Most or all of the vegetation in the designated mining area would be gradually gone (severe destruction and loss of habitats). The loss of vegetation could lead to erosion and flooding during rainy season.

Another major cumulative impact would be the gradual change in relief and hence landscape or the disappearance of the whole mountain in the designated mining/ quarrying area. If the whole mountain is not mined out completely ugly big dents and holes would be left here and there due to random mining. This would make the landscape very ugly and inan-environmentally unhealthy condition.

Another cumulative impact could be in the form of mounds and mounds of large unused overburdens that remained here and there, which would be also environmentally incompatible.

Of course most, if not all, cumulative impacts could be effectively mitigated or at least mitigated to a great extent. (Mitigation measures were already described earlier.) The backfilling of mined out/quarried out holes, and dents with overburdens would tackle most of the issues. This should be done during the Operation Phase of the project. The top soil of the overburdens could be used for the creation of green belt, (the planting of trees).

The surplus, unused overburdens could be utilized in a variety of construction works.

The rehabilitation task to be taken after mine closure would solve many problems associated with the cumulative impacts. The whole mined out/quarried out area should be first leveled and reforestation should be undertaken. Given the appropriate climate, relatively good rainfall and mild weather, reforestation task could be effectively achieved. The loss of forest was therefore, quite reversible and the fauna (probably most) would re-inhabit the area.

The alteration of landscape or the disappearance of the limestone mountain was irreversible. But if a new lush green forest emerge in the place of a limestone mountain that had gone, that would be, no doubt, agreeable from an environmentalist perspective.

Of course, the only tangible remediation of the cumulative impacts could be the rehabilitation particularly reforestation of the impacted areas.

As regards cumulative impact (successive addition of impacts) inside the factory compound the accumulation of dust (dust generated and collected from main dust collector, clinker

cooler dust collector, cement mill dust collector, coal mill dust collector etc. and cement dust) would be significant.

The dust, if not well-managed, could become a serious issue. Dust should be stock piled at a well-protected dust shed and regularly disposed of at an approved land fill.

The dust when mixed with cement could be manufactured into roofing tiles or cement slabs if there were potential buyers.

From another perspective the cumulated impact would be in the form of accumulation or addition of impacts from other sources (other factories). Another cement plant, YCDC cement plant, is less than one mile away in the north-east with a designated mining area of several acres.

Another big company Asia World is involved in quarry/minine of limestone, granite and laterite for construction materials is 3 miles away.

When Max Myanmar after upgrade is in operation the cumulative impact from these three big factories would be very significant indeed.

The mountains and hills of this region mainly composed of sheer limestone and so the region had an ideal landscape for the large scale production of cement. A few mountains and hills (the mini-ecosystem) would have to be sacrificed for the sake of national infrastructure development and that was the way all countries were developed.

The three companies on their parts must have Environmental Management Plan (EMP) and take all necessary measures. These three companies must share the responsibility for the effective implementation of Cumulative Impacts Management (CIM) The clearing of forest and the extraction of limestone and clay were inevitable works to be done in the production of cement. However, the three companies as well as the other two smaller companies involve in quarry must take full responsibility for the meaningful and effective rehabilitation of the damaged mini-ecosystem after mine closure.

As regards cumulative impacts of PM, NO_2 and SO_2, these could not be known as Max Myanmar cement factory is at the moment shut down for upgradation. However, from theoretic perspective the overall impact during the Operation Phase would be high to very high for a short average period of one hour; relatively high for an average period of 24 hours but low for an average period of one year. When Max Myanmar cement factory is in operation again the cumulative impact (addition impact) could be known if the two other factories allow the EIA team to measure the air quality within their factories and compounds.

7. ENVIRONMENTAL MANAGEMENT PLAN

7.1 Executive summary

Max Myanmar Manufacturing Co., Ltd had proposed to upgrade its cement factory with its associated quarry at Taung Philar, Lei-way Township, Nay Pyi Taw Councial Area.

The existing factory produces 500 ton of Portland cement per day. The upgraded factory will have a capacity of 2100 ton/day. The production technology of existing factory applies the "wet process" technology but this will be switched to the "dry process" in the upgraded factory. The "dry process" has many advantages over the "wet process" given the fact that less energy, electricity and fuel, is required.

The total area of the project site is 484.5 acres comprising 44.5 acres of the factory and its premise; 230 acres of quarry lime stone and 50 acres of reserved quarry. The budget for the factory, so far, is 31603.15 million kyat and 6.8 million US$. The project cost for upgrading the factory is estimated to be 34.3375 million US$.

The main aim of the project proponent was to do cement production business that was environmentally friendly as far as possible socially acceptable and economically viable. Moreover, impacts, if any, on the physical, biological, socio-economic, cultural and visual components of the environment will be minimized as far as possible.

EMP is the key to ensure that the environmental quality of the area does not deteriorate due to the operation of the cement plant. EMP involves the management of the overall environmental issue including the physical, biological, socio-economic, cultural and visual issues. EMP is a long term systematic approach from planning, development, implementation, monitoring and feedback. EMP also involves management for quality of the project.

The overall EMP includes planning and design of an environmentally friendly cement factory that fully utilized eco-friendly machinery, equipment and vehicles that emit less smoke, lower noise level, and those that are fuel and energy efficient; and also the conservation of water and recycling of water and waste as far as possible. EMP covers so many aspects of the project it is difficult to consider all the aspects of EMP.

Monitoring Plan (MP) is an integral part of EMP and the objectives of EMP and MP are:

- to control the work environment of the cement factory during the short Construction Phase and OperationPhase of the project
- to minimize the negative impacts and enhance the positive impacts
- to ensure compliance with relevant rules, regulations and statutory requirements
- to demonstrate and enhance sound environmental performances in doing cement production business

- to ensure social acceptability of the project by neighbours, and
- to encourage highest performance for individual employee of the cement factory.

Two potential negative impacts (one was quite significant) were identified for the Pre-construction Phase. 15 potential negative impacts (three were quite significant) were identified for the Construction Phase.

15 potential negative impacts (four were quite significant) were identified for the Operation Phase.

Mitigation and EMP are different side of the same coin and mitigation measures are an integral part of EMP. So each and every EMP will be based on potential negative impacts and subsequent mitigation measures.

Proposed mitigation measures from the perspectives of EMP and Monitoring Plan will be described in the later part of this **Chapter-7**.

7.2 Introduction

The details of the proponent and the study team have been already mentioned in the Introduction **Chapter-1** of this EIA report. These will not be repeated here.

7.3 Description of the project

The description of the project has been already made earlier in the **Chapter-3** of this EIA report. This will not be repeated here.

7.4 Environmental Policy, Legal and Institutional Frame work

These have been already mentioned in **Chapter-2** of this EIA report. These will not be repeated here.

7.5 Governing Parameters

Environmental standards and guideline values for air, noise and water environment as well as for social sustainability were already mentioned earlier in **Chpater-2** of this EIA report. However a short list of the standard values/reference values that are relevant to this project will be given.

7.5.1 Water quality

Water quality standard (Guide line values), WHO 1993.

Parameters	WHO Drinking water guideline values (1993)
pH	6.5-8.5
Colour	15 TCU
Turbidity	5 NTU

Total hardness (as $CaCO_3$)	500 mg/l
Iron	0.3 mg/l
Manganese	0.05 mg/l
Chloride (Cl)	250 mg/l
Sulphate (SO_4)	200 mg/l
Total solids	1500 mg/l
Dissolved solids	1000 mg/l
Fluoride (F)	15 mg/l
Lead (Pb)	0.01 mg/l
Arsenic (As)	0.01 mg/l
Nitrate ($N\text{-}NO_3$)	50 mg/l
Cyanide (CN)	0.07 mg/l
Zinc (Zn)	3 mg/l
Copper (Cu)	2 mg/l

7.5.2 Air Quality

Air quality standards (Guide line values).Internationally accepted, 1994.

Air/odour emission standards (Internationally accepted 1994).

Parameters	Average Periods	Guideline values
SO_2	1 hr	350 µg/m^3
	24 hr	150 µg/m^3
	1 yr	60 µg/m^3
NO_2	1 hr	400 µg/m^3
	24 hr	150 µg/m^3
CO	1 hr	30,000 µg/m^3
	8 hr	10,000 µg/m^3
Suspended particulate matter and dark smoke	24 hr	150 µg/m^3
	1yr	60 µg/m^3
Total Suspended Particulate Matter (TSPM)	24 hr	230 µg/m^3
	1 yr	90 µg/m^3
Respiratory Suspended Particulate Matter (RSPM) ($PM_{2.5\text{-}10}$)	24hr	150 µg/m^3
	1yr	70 µg/m^3
EU Suspended Particulate Matter for (RSPM)	24 hr	50-75 µg/m^3
	1 yr	30-40 µg/m^3

More stringent WHO Guide Line values for:

SO_2	1 yr	20 µg/m^3
NO_2	24 hr	40 µg/m^3
(TSPM)	24 hr	200 µg/m^3
(RSPM) ($PM_{2.5-10}$)	1 yr	50 µg/m^3

Note: Provision of Personnel Protective Equipment (PPE) for workers.

7.5.3 Noise Level (Guideline values)

Maximum permissible limit for noise level 85-90 dBA

Condition	Guideline values dBA		
	Day	**Evening**	**Night**
Dwelling suburb, together with an existing weak traffic movement	50	45	40
Dwelling zone including business centre, public place, public road	60	55	50
Commercial/Administration zone, downtown	65	60	55

Note: Noise level in workplace should not exceed 85-90 dBA. (Provision of PPE for workers) (International limit: 90; EU limit: 85)

The allowed level of noise which does not interfere with health is 45 dBA.

7.5.4 Soil (Guideline)

- no radioactive substance
- no toxic substances and chemicals, (cyanide, arsenic-each less than 0.1 mg/l)
- if possible, no heavy metals-lead, mercury, cadmium etc (lead, cadmium less than 0.1 mg/l, mercury less than 0.01 mg/l)
- stability and consistency of soil; not prone to subsidence and sink hole
- engineering bed rock (firm base) at appropriate depth; (for construction purpose)

Note: (soil microbiology, soil nutrient status, physical and chemical parameter are beyond the scope of this EIA study)

7.5.5 Occupational health and safety standards

(a) Air quality at work place

- SO_2 must not exceed 350 µg/m^3 (1 hr period)
- NO_2 must not exceed 400 µg/m^3 (1 hr period)
- COmust not exceed 30,000 µg/m^3 (1 hr period)
- Total suspended particulate matter (TSPM) not exceed 230 µg/m^3 (24 hrs)

- Respiratory suspended particulate matter (RSPM-$PM_{2.5-10}$) not exceed 150 µg/m^3 (24 hrs)
- Suspended Particulate Matter and dark smoke (SPM-DS): not exceed 150 µg/m^3 (24 hrs)

Note: Provide Personnel Protection Equipment (PPE) - face mask, mouth/nose cover especially for workers exposed to long period of smoke and dust.

(b) Noise and vibration at work place

- Noise level not exceed 85-90 dBA

Note: Provide PPE- ear protector, ear muff to workers exposed to long period of high noise level.

(c) Solid and hazardous waste

- No radioactive substance, no toxic substances

Note: Provide PPE- hand gloves, rubber boots to worker handling any solid waste; train them first.

(d) Waste water

Disposal of liquid waste

Criteria for treated industrial waste water discharged into canal, water way, river etc.

(The two most important disinfectants are Chlorine at 5 mg/l and Monochloramine at 3 mg/l)

Parameters	Limiting criteria
Temperature	35°C (or) not more than 3°C of receiving water temperature
pH	6 - 9
Colour	Colourless
Absorbent activated O_2	20 mg/l
Chemically consumed O_2 (dichromate)	30 mg/l
Chemically consumed O_2 (permanganate)	10 mg/l
TDS	800 mg/l
Ash of dissolved solid matter	700 mg/l
Suspended materials	30 mg/l
Sulphate	1 mg/l
Phosphate	1 mg/l

Oil & grease	5 mg/l	
Nitrate	30 mg/l	
Phenol	0.001 mg/l	
Fluoride	0.5 mg/l	
Residual chloride	1 mg/l	
Mercury	0.001 mg/l	
Lead	0.05 mg/l	
Cadmium	0.01 mg/l	
Arsenic	0.05 mg/l	
Industrial detergent	0.05 mg/l	
Colony count MPN/100 ml	2500 mg/l	(individuals)

Note. **Myanmar Environmental Quality Standard** will come to existence in 2017, it is learnt. (Daily Eleven News: 15-6-2015).

(e) Drinking water

Water quality standard (Guide line values), WHO 1993 (Same as **7.5.1**).

Guideline values (Reference values) for naturally occurring chemicals which are of health significance in drinking water

Arsenic	0.01 mg/l
Barium	0.7 mg/l
Boron	0.5 mg/l
Chromium	0.05 mg/l
Fluoride	16.5 mg/l
Manganese	0.05 mg/l
Malybdnum	0.07 mg/l
Uranium	0.015 mg/l

(Also refers to IS: 10500 (1991) Norm and IS: 2296 Class C norm)

(f) Safety management

Manage to meet the air quality, SO_x, NO_x, RSPM and TSPM. Manage so that any possible leakage or emission of air pollutants will not affect worker's health and safety. Also maintain temperature and humidity.

Provision of PPE is necessary if workers are exposed for long hours.

Manage for effective waste water treatment and discharge (Already mentioned in **Chapter 5, section 5.4** of this EIA report).

Provision of PPE to workers handling waste water.

(g) Communicative diseases including HIV/AIDS

- All workers must pass medical examination prior to being employed.
- Manage for the prevention and control of outbreak of epidemic or communicative diseases-such as dengue fever, cholera, eyesores, influenza etc
- Make condoms available for the prevention of sexually transmitted diseases (STD) including HIV/AIDS. (This may or may not be appropriate in a conservative society with Buddhist belief, culture and tradition.)

Table-18: IFC guidelines for air emission levels for cement Manufacturing

Sr. No	Pollutants	Units	Guideline value
1.	Particulate matters	Mg/Nm^3	50
2.	Dust (including other sources eg. clinker cooling, cement grinding)	Mg/Nm^3	50
3.	SO_2	Mg/Nm^3	400
4.	NO_x	Mg/Nm^3	600
5.	HCl	Mg/Nm^3	10
6.	Hydrogen fluoride	Mg/Nm^3	1
7.	Total organic carbon	Mg/Nm^3	10
8.	Dioxins-furans	Mg/Nm^3	0.1
9.	Cadmium and Thallium	Mg TER/ Nm^3	0.05
10.	Mercury	Mg/Nm^3	0.05
11.	Total metals (including arsenic, lead, cobalt, chromium, copper, Manganese, Nickel, vanadium, Antimony)	Mg/Nm^3	0.05

Table-19: IFC guidelines for effluent levels

Sr. No	Pollutants	Units	Guideline value
1.	pH	S.U	6-8
2.	Total suspended solids	Mg/L	50
3.	Temperature increase	^oC	< 3

Table-20: IFC industry bench mark for resource and energy consumption

Sr. No	Inputs per unit of product	Units	Industry benchmark
1.	Electric energy (cement)	KWh/ton equipment cement	90-150
2.	Electric energy (clinker grinding)	KWh/ton	40-45
3.	Materials (substitute raw materials clinker)	%	2-10
4.	Materials (substitute raw materials used in production of cement)	%	- 0-7/80 with blast furnace slag - 0-30 with fly ash

Table-21: IFC industrial bench mark for emission and waste generation

Sr. No	Outputs per unit of product	Units	Industry benchmark
1.	Waste	Kg/t	0.25-0.6
2.	Emissions Dust	I/t equivalent cement	20-50
3.	NO_x	I/t equivalent cement	600-800
4.	SO_x	Kg/t	0.1-2.0
5.	CO_2	Kg/t equivalent cement	400-525

7.6 Summary of the impacts

2, 15, 15 and 2 potential negative impacts for the Preconstruction Phase, Construction Phase, Operation Phase and Decommissioning/Mine closure Phase, respectively, are anticipated and identified. There are already mentioned in detail in **Chapter-5, (5.2.1, 5.2.2, 5.2.4, 5.2.6)** of this EIA report. These will not be repeated here.

7.7 Proposed mitigation measures in tabulated form for the 4 phases of the project

Table-22: Proposed mitigation measures and EMP in tabulated form during the Pre-construction Phase

Sr. No	Negative impacts (significant and insignificant)	Mitigation measures and EMP
1.	Potential instigation by anti-big business activists and polarization of locals into pro- and anti-project group	- early public meeting and consultation - prioritize hiring locals over hiring personal from beyond
2.	Potential hike in the price of land and property	- early public meeting and consultation - no tangible mitigation measure

Table-23: Proposed mitigation measures and EMP in tabulated form during the Construction Phase

Sr. No	Negative impacts (significant and insignificant)	Mitigation measures and EMP
1.	Impact on biodiversity (a) Flora	- plan for the protection and conservation the flora as far as possible. (The quarry site is insideMei-hor Reserved Forest area. The forest is already partially degraded but the impact can be significant if the work is not well-managed.) - plan for minimum disturbance to the flora when conducting quarry activities; - do not clear vegetation than necessary for the construction of access road and quarry site; restrict the removal of vegetation; avoid as far as possible the cutting of big trees - control and minimize dust and eventual disposition of dust on leaves on plants restricting photosynthesis - prevent the spillages of hydrocarbons which has negative impact on plants especially on the root system - drip trays and designated bunded side should be used to protect vegetation from hydrocarbons - storage of fuel and storage of used fuel should be done in a designated bunded site - restrict the movement of vehicles to the access rood; not to impact grass, herbs and small plants - restrict the collection of fire wood; do not cut trees for fuel wood but collect fuel wood from fallen trees, dried logs or branches or use charcoal for cooking - fire for cooking should only be made in dedicated spot cleared from vegetation - avoid open burning of debris - educate workers for fire awareness and protection; prohibit the discard of burning cigarette butts carelessly; get rid of all debris that can cause fire - provide basic fire fighting training for a few workers - identify sensitive species and habitats and try to avoid such spots as far as possible - promote environment awareness to workers - try to stop illegal logging; inform the authority if there is any - implement rehabilitation to promote natural vegetation establishment after completion of quarry at a site
	(b) Fauna	- plan and implement the protection and conservation of wildlife as far as possible. (The protection and conservation of forest is tantamount to protection and conservation of wildlife) - ensure that quarry works have minimal disturbance or wildlife - restrict vehicular movement to the access road to prevent habital disturbance of birds and animals - prohibit the hunting and/or trapping of wild animals big and small including rodents, birds, reptiles and amphibians by workers - promote environmental awareness for workers

		- prevent the potential injury or death of wildlife due to vehicular movements especially during night time - prevent the potential injury or death of wildlife due to spillages of hydrocarbons, drill fluids and chemicals - avoid the use of excessive bright light for long hours at night to prevent the aggregation and eventual death of large number of insects (offensive bright light in the forest at night will also scare away wild animals from their natural foraging or breeding ground) - identify sensitive species which need to be avoided; avoid the disturbance of animal habitat such as nest and breeding ground as far as possible
2.	Impact of worker camp on site	- draw up a plan and select suitable site for camp - do not clear vegetation more than necessary for setting up of worker camp - set up separate camps for men and women workers - restrict the collection of fire wood; use fallen trees or log or charcoal - fire for cooking should be only made in dedicated spot cleared from vegetation - avoid open burning of debris; educate workers for fire awareness - discipline workers for good housekeeping practice; demand the construction contractor to do this - proper sanitation for workers latrine, bath, small septic tank and adjoined soak pit for treatment of waste water
3.	Impact: mobilization and preparation actions	- plan for sustainable construction of access road; do no clear vegetation more than necessary - use drainage ditches to ensure that water leaves the road with minimal erosion - if possible avoid construction of access road on steep slope to minimize the need for cut and fill - do not also clear vegetation more than necessary for the preparation of factory and premise site; avoid cutting of big trees as far as possible - logistic plan for heavy trucks - plan to prevent the spilling of building materials outside - fence the site - systematic storage of all building materials
4.	Impact on traffic	- draw up a traffic management plan - schedule the timing for vehicular movements - educate the drivers to practice defensive driving - set up speed limit for vehicles
5.	Impact on soil	- plan for the management and conservation of soil - during earth work the top soil should be separately stockpiled from other sub-surface soil or rocks - top soil removed should be stored on higher ground outside the normal flood level; excavated top soil should be removed from all areas where physical disturbances (wind, water) of the surface occur - top soil should not be used for maintaining access road or for building - stockpiles of top soil should be grassed or allowed to naturally

		vegetate for stabilization and prevent erosion - during rehabilitation top soil should be effectively used to promote the natural growth of vegetation; top soil fertility, and biological quality should be monitored and a management plan should be implemented (if necessary) - oil spilled should be cleaned up immediately; do not wash down with water but used absorbents or saw dust placed in a 25 litres container to be treated as semi-hazardous waste - prevent wash water from carrying earth and materials into drainage system - vehicles and machinery should be adequately maintained to prevent fuel leaks resulting to soil contamination - drip trays and designated bunded site should be used to protect soil from hydrocarbons, greases, drill fluids etc. - all waste materials (earth, rocks) resulting from construction work should be disposed of at a designated spot - solid waste and liquid waste from field camp should be also disposed of at designated spot - educate and train the workers for good house keeping practice; do not litter; do not pollute the area - after completion of construction work at a site rake the compacted soil at site or camp and respread the stockpiled top soil to naturally revegetate the area
6.	Impact on water (a) Surface water	- if there is a stream or river plan and manage so that quarry activities will not impact the surface water(There is a small natural pond not far from the site) - avoid water bodies as far as possible when constructing or upgrading area roads - when clearing for site remove vegetation prior to top soil removal in order to limit the effect of site clearance on surface water flow dynamics - storage of fuel oil as well as used fuel oil should be done in a designated bunded side until removal - drip trays and designated bunded site should be used to protect surface water from hydrocarbon spills - maintain vehicles and machinery adequately to prevent spillages resulting in surface water contamination - when handling fuel oil avoid accidental spillages into the surface water; should spillages occur implement appropriate clean up immediately - avoid disposing of waste (both liquid and solid) into water bodies; only release waste water if quality is acceptable or after treatment - top soil should be allowed to naturally vegetate in order to stabilize soil particles and thus preventing erosion and limiting siltation to surface water - if quarry site is along a river or stream regularly monitor surface water quality (or at least monitor surface water general condition by means of visual inspection) regularly. (There is no stream nearby)
	(b) Ground water	- plan and manage to prevent the contamination of soil and enventually groundwater

		- plan to manage quarry activities so that there will have no severe negative impact on ground water - for storage of fuel drip trays and designated bunded site should be used to protect soil (and hence ground water) from hydrocarbon - the same should be done for used oil and grease - adequately maintain vehicle and machinery to prevent spillages resulting in groundwater contamination - avoid spillage during the handling of fuel oil - should accidental spillages occur implement appropriate clean up immediately; do not wash down spill with water; use absorbents or saw dust for clean up - plan for management of temporary latrines to prevent eventual contamination of groundwater; spread soil or ash into the latrines from time to time; when backfilling all the pits, holes, dents etc. resulting from quarry also backfill the latrines
7.	Impacts on air quality: dust and smoke	- draw up a plan for air quality management to meet statutory requirement (rules, regulations, Municipal Act) - plan in the Pre-construction Phase for the procurement of equipment, vehicles that emit less smoke (to be certified for emission compliance) - keep equipment and vehicles well-maintained - use machinery and vehicle with low emission rate; use fuel with low sulphur content - avoid open burning of debris - spray water for suppression of dust - restrict vehicular movement; maintain road clear of mud and dirt - limit open stockpile of earth, sand etc - minimize drop height during loading and unloading - provide PPE to workers who are exposed to smoke or dust for long period - try to meet statutory requirement and guideline values for emission - local community should be able to file complaint regarding dust and smoke
8.	Impacts noise and vibration	- plan in the Pre-construction Phase for procurement of equipment, and vehicles that emit lower noise level - plan for noise management, to meet statutory requirement (rules, regulations) - install silencers and mufflers - switch off or throttle down equipment during idle period - avoid construction work at night - schedule high noise activity only during day time hours - provide PPE to workers exposed to prolonged high noise level - manage vibration of machine, equipment and vehicle - if possible install vibration absorbers - design for stable foundation, even for temporary purpose - limit the speed of vehicles - local community should be able to file complaint regarding noise vibration
9.	Impact of waste	- draw up a plan for management of solid waste

	disposal	- manage to meet a statutory requirement, (rules, regulation, Municipal Acts) - avoid open burning of debris - clear the ground regularly; ensure dumping at approved landfill - educate workers for goodhousekeeping; do not litter - at the end of Construction Phase put up construction spoils, left over materials for sale - a void spillage of fuel oil-; should spill occur immediately clean by means of absorbent or saw dust (do not wash down with water) - plan for management of temporary latrines for worker camps; regularly spread soil or ash into the pit; back fill all latrines after completion of Construction Phase
10.	Impact: contamination of soil	- draw up a plan for prevention and mitigation of contamination - manage to meet statutory requirement (rules, regulation, Municipal Act) - prevent spill of fuel oil and chemicals; clean up spill with absorbent promptly (do not wash down with water) - properly instruct workers with respect to handling of fuel and chemical and cleanup of spills - bund fuel or chemical depot to prevent spreading of spill - display warning signs; identify high risk spill area (generator, fuel tank) - avoid spillage and percolation of any waste water into ground water - manage the hygienic condition of the temporary latrines and back fill the pits when no longer use
11.	Impact: lack of emergency and health (hospital) service	- careful planning of emergency procedures (this must be continued to Operation Phase) - organize and provide first aid training and fire prevention and fighting training - provide adequate First Aid Kit, and Fire extinguishers; keep water tanks always full for firefighting - for emergency response organize mock drills and rehearsals - phone numbers and address of Red Cross Society, Ambulance service, Fire Brigade, Police station, Lei-way Hospital etc. must be displayed so that everyone could easily see - create safety condition for work places (mining/quarry) site, and associated area eg. crushers; grinders, screeners and stockpile sites) - educate and train workers for good working practice, good engineering practice, good safety practice and good house keeping practice so that these good practices will be ingrained in each and every worker's mind - prevent and avoid accidents and try to achieve zero accident at work places - educate and train them for health education and hygiene
12.	Impact of project on potential social illness and vice versa	- draw up a plan for management of social illness and ill-social behaviour - educate and discipline the workers; apply punitive measures such as suspension of the wrongdoer - educate the workers on appropriate behaviour in the local

		community pertaining to local customs and etiquette for healthy community interaction - strictly prohibit the drinking of alcohol in the site - apply punitive measures for the wrong doer - maintain the good ongoing relation between the company and the locals - conduct public consultation so that the locals will have a positive perception on the project
13.	Impact of project on HIV/AIDS and STD and vice versa	- plan for the management of STD - organize and educate workers - made condoms readily available for workers - separate housing for men and women employees - ask the construction contractor to discipline his workers - apply punitive measures for sexual offences - educate workers for health education and hygiene
14.	Impact: potential security issue	- draw up a security management plan - effective walling of the compound - all accesses musts be controlled; set up security gates, adequate guards - do not let the workers (mostly construction workers) enter the neighbouring village, without preauthorization; do not let workers mingle freely with locals - store building materials under lock and key as far as possible - ask the building contractor to discipline his workers - apply punitive measures, such as suspension or termination of employment if necessary
15.	Visual impact and lighting	- plan and execute mining/quarry which is focused on visual appeal (random mining will leave ugly dents, pits and holes here and there on the slope) - carefully select site and conduct systematic blasting and mining are portion or one block at a time rather than random blastings and minings - do not clear vegetation more than necessary before mining (eg. during preparation for mining site) - backfill the voids, pits and dents after completion of a work site - revegetate the site (plant trees) - Also plan and execute the construction of cement factory and premise which is focused on visual appeal (shape of structure, colour of paint, back ground condition) - plan and execute mining/quarry which is focused on visual appeal (random mining will leave ugly dents, pits and holes here and there on the slope) - carefully select site and conduct systematic blasting and mining at one portion or one block at a time rather than random blastings and minings - do not clear vegetation more than necessary before mining (eg. during preparation for mining site) - backfill the voids, pits and dents after completion of a work site - revegetate the site (plant trees)

Table-24: Proposed mitigation measures and EMP in tabulated form during the Operation Phase

Sr. No	Negative impacts (significant and insignificant)	Mitigation measures and EMP
1.	Impact: blasting and quarry activities	- plan and manage for systematic and safe blasting; select best blasting design - select only spot with limestone; careful observation of quarry/mining faces - if possible fence off the blasting area to prevent children and animals straying into the area - comply with rules and regulation eg. Re: the Explosive Substance Act, 1908 - follow acceptable blasting practices eg. those that resulted in more rock fragmention and lower vibration (eg. relatively shallow slanting drill holes method) - select appropriate explorsives eg. use emulsion type - keep explosives in maximum security depot/magazine - install lightning arrestor (rod) - use standard detonation fuses and materials; store detonators and explosives separately; do not use outdated explosives - fly rock happens if there is too much energy in the explosion; minimize blast damage - all drillings and blasting must be strictly supervised by competent demolition experts - provide adequate training for blasting and the safety storage, handling and application of explosives - distribute quarry/mining operation manuals to workers - conduct blasting according to a consistent time table eg. at 09:00 hrs every day or every other day or every Monday and etc - sound the sirens 5 minutes before blasting - inform the nearby local community in advance about the consistent timetable for blasting - provide adequate PPE, ear, muffs, ear protectors, safety goggles to workers; first aid equipment - also provide adequate training for other mining/quarry activities such as excavation and extraction, crushing, grinding and screening works, safety transportion and stockpiling of mined out limestone and also top soil and overburden
2.	Impact: change in relief; alteration of landscape	- execute quarry plan which is focused on visual appeal - carefully select mineralized area or spot where there limestone (random quarrying/mining will leave ugly dents, pits and holes here and there) - after completion of quarry/minig at a site backfill all the dents and pit - revegetate the spot; use top soil - reserve green areas as far as possible - continue the creation of green belt/zone; plant more trees as far as

		possible - manage the mounds of overburden; level the ground as far as possible after completion of quarry; plant more trees
3.	Impact on biodiversity (a) Flora	- plan and manage for the protection and conservation of the biological component of the environment - comply with law, rules and regulation (the Protection of WildLife and Protected Area Law, 1994; Conservation of Environment Law 2012 and Regulation 2014) - plan for the protection and conservation the flora as far as possible. (The quarry site is inside Mei-hor Reserved Forest area. The forest is already partially degraded. The impact can be significant if the work is not well-managed.) - plan for minimum disturbance to the flora when conducting mining/quarry activities; - do not clear vegetation than necessary for the construction of access road, quarry and mining site; restrict the removal of vegetation; avoid as far as possible the cutting of big trees - control and minimize dust and eventual disposition of dust on leaves on plants restricting photosynthesis - prevent the spillages of hydrocarbons which has negative impact on plants especially on the root system - drip trays and designated bunded side should be used to protect vegetation from hydrocarbons - storage of fuel and storage of used fuel should be done in a designated bunded site - restrict the movement of vehicles to the access road; not to impact grass, herbs and small plants - restrict the collection of fire wood; do not cut trees for fuel wood but collect fuel wood from fallen trees, dried logs or branches or use charcoal for cooking - fire for cooking should only be made in dedicated spot cleared from vegetation - avoid open burning of debris - educate workers for fire awareness and protection; prohibit the discard of burning cigarette butts carelessly; get rid of all debris that can cause fire - provide basic fire fighting training for a few workers - identify sensitive species and habitats and try to avoid such spots as far as possible - promote environment awareness to workers - try to stop illegal logging; inform the authority if there is any - implement rehabilitation to promote natural vegetation establishment after completion of quarry at a site
	(b) Fauna	- plan and implement the protection and conservation of wildlife as far as possible. (The protection and conservation of forest is tantamount to protection and conservation of wildlife) - ensure that mining/quarry works have minimal disturbance or wildlife - restrict vehicular movement to the access road to prevent habital disturbance of birds and animals - prohibit the hunting and/or trapping of wild animals big and small

		including rodents, birds, reptiles and amphibians by workers - promote environmental awareness for workers - prevent the potential injury or death of wildlife due to vehicular movements especially during night time - prevent the potential injury or death of wildlife due to spillages of hydrocarbons, drill fluids and chemicals - avoid the use of excessive bright light for long hours at night to prevent the aggregation and eventual death of large number of insects (offensive bright light in the forest at night will also scare away wild animals from their natural foraging or breeding ground) - identify sensitive species which need to be avoided; avoid the disturbance of animal habitat such as nest and breeding ground as far as possible
4.	Impact: stock piling of overburden and top soil	- plan for effective management for systemic stockpiling of mined out limestone, overburdens and top soil; minimize impacts on the environment - do not clear vegetation more than necessary for stockpiles - keep top soil and overburden separately - manage for the stockpiling of overburden and top soil; no spill over, no sliding, no erosion, no blocking of natural drainage system; no entering into stream, cultivated areas and village area - never choose a slope as a dumpsite but level the slope first for stabilization - the stockpiles (of top soil or overburden) must have a minimum slope of not more than 37º for effective stabilization - let the grass or herb grow on the overburden for stabilization biologically (spread a thin layer of top soil on overburden) - if possible construct retaining wall to stop erosion or sliding; furnish the wall with weep holes to drain out water during the wet season - regulate runoff from overburden and top soil dump by construction small check dams; sediment traps or drains - back fill mined out/quarried out pits, holes, with overburden - when limestone is exhausted (when mining is complete) re-vegetate the area; use top soil for planting trees - avoid all collateral damages due to mining and stockpiling of overburden and top soil as far as possible
5.	Impact: loss of non-living resources (limestone)	- plan for long term sustainable exploitation of limestone - mining engineers must investigatethe mining area in detail and draw up a plan for systematic and effective mining at mineralized spots or area (to avoid blasting the spots with no limestone) - if the whole mountain was sheer limestone as supposed to be then systematic mining of portion after portion to be carried out - avoid over extraction (more than necessary); conserve natural resources - check and calculate the extraction rate on a monthly and yearly basis
6.	Impact on air quality dust and smoke	- draw up a plan for air quality management for the long term Operation Phase - try to meet all statutory requirements (rules, regulations); follow the guideline values prescribed by ECD, MOECAF (2015)

		- do not clear the vegation (grass) and leave the land have more than necessary - consolidate and compact all area to prevent generation of dust due to wind - apply dust extractor and filter at drilling or apply wet drilling - do not blast when storng wind is blowing; also stop excavation/extraction for a while when strong wind is blowing - if possible, apply wet processing at crusher, grinder, screering site - spray water adequately to suppress dust - reduce the speed of vehile to reduce dust generation - restrict vehicular movement; maintain road, clear of mud and dirt - limit open stockpile of earth and sand - minimize drop height during loading and unloading - avoid open burning of debris or solid waste - keep equipment and vehicles well- maintained to reduce smoke - use fuel with low emission rate (eg. fuel with low sulphur content) - provide PPE (eg. face masks, mouth and nose covers, gas masks) to workers exposed to long hours of dust and smoke; fit excavator with air conditioned cabin for operators - local community should be able to file complaint regarding noise
7.	Impact on water quality (a) Surface water	- plan and manage for preventing pollution on the water environment - follow rules and regulations (eg. Conservation of Water Resources and River Law, 2006; Conservation of Environment Law 2012 and Rule 2014) - if there is a stream neary by manage so that mining/quarry activities will not impact the surface water - manage for the stability of top soil and oveburden to prevent erosion and sliding and siltation; not to impact surface water flow dynamic or alter water courses and not to impact on aquatic biodiversity - fuel oil depot should be away from a stream; the depot should be bunded to protect surface water from oil spill - when handling fuel oil avoid accidental spillages into surface water; should spillage occur implement appropriate clean up immediately - avoid disposing of waste (liquid and solid) into water bodies - manage water conservation; reduce water consumption; if possible use recycle water for dust suppression and watering plants; harvest rain water - apply a monitoring plan for water quantity and quality based on simple parameter eg. temperature, pH and total alkalinity
	(b) Ground water	- Plan and manage to prevent the contamination of soil and enventually groundwater - plan to manage quarry activities so that there will have no severe negative impact on ground water - for storage of fuel drip trays and designated bunded site should be used to protect soil (and hence ground water) from hydrocarbon - the same should be done for used oil and grease - adequately maintain vehicle and machinery to prevent spillages resulting in groundwater contamination - avoid spillage during the handling of fuel oil - should accidental spillages occur implement appropriate clean up

		immediately; do not wash down spill with water; use absorbents or saw dust for clean up - plan for management of temporary latrines at site to prevent eventual contamination of groundwater; spread soil or ash into the laterines from time to time; backfill the latrine and use another new one
8.	Impacts: noise and vibration	- plan for the management of noise vibration - avoid blasting and all other mining/quarry activities at night (should be restricted to the hours between sunrise and sunset) - restrict or limit vehicular and heavy machinery movements - plan for appropriate choice of machinery and vehicles (that emit low noise level); method of working, efficient material handling - installation of noise abating devices eg. silencers, mufflers at air inlet and outlet of far and compressor; place noisier sources far away in overall design - well-operated and well-maintained vehicles and machinery generate lower noise level and prevent undesirable noise level - modified old machinery, vehicles and equipment by incorporating minor design change for reducing noise level - if possible erect barrier or create enclosure to block, redirect or reduce noise level - develop green belt (plant trees) around the mining/quarry site; trees abate noise and serve as noise sink (pollution sink) - create smooth road surface as far as possible to mitigate vibration due to vehicular and heavy machinery movement - create suitable foundation design for machinery and equipment (eg. crusher, grinder, screen etc.) to mitigate vibration - if necessary install vibration absorbers or vibration absorbers or vibration abators - provide adequate PPE eg. ear muffs, ear protectors to workers exposed to long hours of high noise level; fit excavator, bulldozer with air conditioned cabin for operators - conduct regular noise monitoring to ensure that the levels are within noise exposure standard (not higher than 85-90 dBA) - the local community should be able to file complaint regarding noise
9.	Impact of power supply on national demand (gridline) and vice versa	- draw up a plan for the conservation of energy - ensure that the consumption of electricity be in the workframe as stated earlier - use equipment and machinery that are energy efficient - install renewable energy system (solar panels) if possible - use backup generator during power outage for limited period - regularly monitor electricity consumption - have regular consultation with electricity authority
10.	Impact of waste disposal	- plan for the management of solid waste - manage to meet statutory requirements (rules, regulations, Municipal Acts) - properly instruct workers in the handling of waste - follow the 4 Rs principle: reduce, reuse, recover, recycle, wherever possible - separate solid waste into categories, use separate bins, disposed at

		approved landfill - dispose waste only after all waste preventive and recycling strategies have been undertaken - draw up a plan for the management of waste water - reduce and minimize the use of water; - wash vehicles and equipment in designated area - drainage system to separate waste water from storm water - no disposal of waste water outside (on land or into water body) - treat all waste water before discharge - educate and train workers for good house keeping practices
11.	Impacts on traffic	- draw up a traffic management plans (even though the traffic was light; road users were mostly motorcyclists and pedestrians) - schedule the logistics especially for trucks - set up signage at the intersection of the access road and highway - avoid overloading heavy truck - educate the driver (especially heavy trucks drivers) for driving at reduced speed and adhere to the principle of defensive driving - comply with motor vehicle law, 2015 - if possible, use conveyor line rather than trucks for transportation of crude or pulverized limestone - local community should be able to file complaint regarding traffic
12.	Impact: lack of emergency and health (hospital) services	- draw up a plan for emergency; carefully plan effective emergency contingency response and procedures - train some workers for fire fighting while some for first aid programme - provision of firefighting equipments and tools; provision of first aid kits and adequate medicines - organize mock drills for firefighting and first aid programme regularly - provide adequate PPEs - give priority to installation of lightning rods and arresters - apply safe and effective procedures for storage of fuel and chemical - display warning signs - accidents, or near-missed to be duly reported - display addresses/phone numbers of Fire Brigade, Ambulance Service, Hospital, Police Station - take out insurance for the cement plant and also fire insurance - educate workers for safety awareness and also awareness of health and hygiene - provide proper sanitation facility, eg. bath rooms, toilets etc. - draw up a plan for emergency; carefully plan effective emergency contingency response and procedures - train some workers for firefighting while some for first aid programme - provision of firefighting equipments and tools; provision of first aid kits and adequate medicines - organize mock drills for firefighting and first aid programme regularly - provide adequate PPEs - give priority to installation of lightning rods and arresters - apply safe and effective procedures for storage of fuel and chemical - display warning signs - accidents, or near-missed to be duly reported

		- display addresses/phone numbers of Fire Brigade, Ambulance Service, Hospital, Police Station - take out insurance for the cement plant and also fire insurance - educate workers for safety awareness and also awareness of health and hygiene - provide proper sanitation facility, eg. bath rooms, toilets etc.
13.	Impact on project on potential social illness and vice versa	- draw up a plan for management of ill social behaviour and social illness - educate workers to be good workers; dutiful and well disciplined - proper training on work place regulation, code of conducts; - educate workers on appropriate behaviours when dealing with locals; maintain healthy community interaction - apply punitive measures such as suspension of the wrong doer - strictly prohibit the drinking of alcohol during working hours - deal with employees on a fair and square hasis - avoid unhealthy relationship with worked and underpaid - maintain good relation with the locals.
14.	Impact: potential security issue	- draw up a plan for the management of security - deploy adequate security personnel day and night; implement strict security - check all entering and leaving of the factory premise - provide uniforms and ID for all workers for easy identification - if necessary, set up watch tower - security should be both for the cement factory and premise and the quarry site and facility - special security for magazine
15.	Impact: public preception	- plan and manage for building good relation with the local community; - appoint a public relation officer (liaison officer) to deal with the locals - maintain the ongoing good relation with the villagers - implement CSR activities and other social assistant programme - prioritize the hiring of locals over hiring personnel from beyond; promote employment of women - uphold the culture and tradition of the area - educate on appropriate behaviours in the neighbourhood pertaining to local culture and etiquettes - implement an appropriate complaint and grievance (if any) procedures with feedback mechanism; keep a log book for all complaints or grievances - heed to the views and opinions of the villagers - communicate the availability of job opportunities to the locals from time to time if there is any vacancy in job

7.8 Summary of overall EMP

EMP should also cover the following main aspects of environmental management for doing environmentally sound business.

- EMP for application of environmentally sound idea and methodology

- EMP for procurement of ecologically friendly equipment and machinery that generate less smoke, less noise level and vibration; equipment that are fuel efficient and energy efficient
- EMP for air pollution management
- EMP for water pollution management
- EMP for land pollution management
- EMP for good working practices and good safety practices
- EMP for conservation of water, fuel and energy
- EMP for rehabilitation after completion of project and
- EMP for maintenance of high environmental performance standard

Finally it should be borne in mind that EMP will serve no purpose if it is not implemented with true spirits. Only working with true spirits can achieve effective and meaningful EMP implementation.

7.9 Monironing programme

Environmental monitoring plan is of paramount importance for the effective execution and successful implementation of EMP.

Environmental monitoring focuses on the work environment which includes, pollution control, waste management, health and safety of workers, safety of the facilities; and also on the biological, socio-economic, cultural and visual components of the environment. Minitoring works should also specially focus on all activities that have been identified to have potentially significant impacts on the environment. There should be also specific occupational health and safety monitoring programme. The objectives of monitoring are:-

- to measure impacts that occur during the four phases of the project
- to ensure compliance with statutory requirements
- to determine the effectiveness of mitigation measures and other measures, and
- to assist in the implementation of EMP

First a small EMP cell consisting of 2-5 members has to be formed; the manager should be the EMP authority. If possible these cell members should be deployed full time for doing monitoring and inspection works.

Monitoring has to be carried on a regular basis; the findings or observation have to be systematically catalogued and documented and effective feedback (report back) must be duly done. The authority has to take action in a timely manner.

Monitoring frequency should be sufficient to provide representative data for the parameters being monitored. Monitoring should be conducted by members of EMP cell or trained personnel using properly calibrated and maintained equipment.

The two potential impacts during the Pre-construction Phase are socio-economic in nature and so monitoring work is not necessary.

However daily monitoring might be necessary during the Construction Phase of 2 years duration. Regular or occasional monitoring will be required during the long operation periods (30 years). It might be necessary to monitor Decommissioning Phase which will take 1-2 months, and Rehabilitation Phase, 1 year.

7.9.1 Summary of monitoring programme

Table-25: Summary of monitoring programme in tabulated form for Construction Phase

Sr. No	Components	Parameters to be monitored	Frequency
1.	Weather	- monitor weather - listen to weather news (meteorology news), forecasts	- Daily - Daily
2.	Mobilization and preparation works	- monitor the haulage of trucks - monitor stockpiling, storage of building materials	- Daily - Weekly
3.	Traffic	- monitor schedule of vehicle movements	- Weekly
4.	Air environment	- monitor SO_2, NO_2, PM and others, if possible	- Once
5.	Noise and vibration	- monitor noise level in dBA	- Once
6.	Contamination of soil and ground water	- monitor spillage of fuel oil, grease, hydraulic oils etc	- Weekly
7.	Erosion and siltation	- monitor earth work and drainage system	- Weekly (during rainy season
8.	Water environment	- monitor pH, oil & grease, TDS, TSS, BOD, COD, sulphate, nitrate, chloride	- Once
9.	Waste (solid), construction tailings, debris	- monitor type, amount generated, reused, recycled, transported off site and disposal	- Weekly
10.	Biodiversity component	- monitor clearing of forest - monitor the nursery of saplings for planting during Operation Phase	- Monthly - Monthly
11.	Social illness; disciplinary action	- monitor the conducts of workers - monitor the effectiveness of disciplinary action	- Weekly or monthly - From time to time
12.	Emergency, health and safety	- monitor facilities for emergency preparedness - monitor emergency and response programme - monitor training (firefighting and first aid) and drills and their effectiveness	- Quarterly - From time to time - Regularly

13.	Potential security	- monitor performance of security staffs	- From time to time
14.	Construction work	- monitor overall construction work for health and safety	- Daily
15.	Material procurement and consumption	- monitor procurement of building materials, and consumption	- Weekly or monthly
16.	Fuel oil consumption	- monitor oil purchased, used, used oil generated, oil waste	- Weekly or monthly
17.	Routine operation of equipment	- monitor operation hours of equipment - distance traveled of vehicles - log books	- Weekly - Weekly - Weekly

Table-26: Summary of monitoring programme in tabulated form for Operation Phase

Sr. No	Components	Parameters to be monitored	Frequency
1.	Weather	- monitor weather - listen to weather news, forecasts	- Daily - Daily
2.	Blasting activity	- monitor preparation for blasting - monitor blasting and aftermath	- Every blast - Every blast
3.	Excavation/extraction work (extraction of crude linestone)	- monitor manual excavation - monitor excavator performance - monity limestone quantity extracted - monitor stockpiling	- Daily - Daily - Daily - Daily
4.	Limestone processing; crushing, grinding, screening, transport, stockpiles	- monitor crusher, grinder, screen performance - stockpile of pulverized limestone (quantity) - truck or conveyor	- From time to time - From time to time - From time to time
5.	Air quality	- monitor SO_2, NO_2, PM and other, if possible	- Annually
6.	Air emission	- monitor SO_2, NO_2, PM, GHG if possible - wearing of PPE (if necessary)	- Annually - Regularly
7.	Noise and vibration	- monitor noise level in dBA - wearing of PPE at quarry/mine site	- Quarterly - From time to time
8.	Overburdens	- monitor locations, size and stability condition	- Monthly (rainy season)
9.	Erosion and siltation	- monitor overburden, natural drainage system	- Weekly (rainy season)
10.	Extraction of coal	- monitor and calculate amount of extraction	- Monthly
11.	Water	- monitor water consumption - monitor flow rate and water level at stream	- Weekly - Monthly
12.	Solid waste	- monitor industrial, domestic, office wastes, debris; amount generated, recycled, or reused; check work place	- Monthly
13.	Waste water (sewage)	- monitor amount generated, treatment (septic tank, common treatment tank)	- Monthly
14.	Traffic	- monitor schedule of vehicle movement, log book for each vehicle	- Weekly
15.	Water quality	- test pH, oil & grease, TSS, TDS, BOD, COD chloride etc	- Annual
16.	Materials procurement	- monior all materials purchased, consumed and unaccounted for	- Monthly

17.	Fuel oil consumption	- monitor oil purchased, used, used oil generated, oil waste	- Monthly
18.	Routine operation of equipment	- monitor operation hours of equipment and machines - monitor distance travelled of vehicles - monitor log books	- Weekly - Weekly - Weekly
19.	Biodiversity	- inspect selection of new quarry site - monitor clearing of vegetation - monitor reforestation effort	- Before starting a new site - Ditto - Monthly
20.	Social illness	- check disciplinary action taken - monitor conducts of workers	- From time to time - Regularly
21.	Emergency	- inspect facilities for emergency preparedness - monitor training (firefighting and first aid) and drill for emergency - monitor overall occupational healt and safety including occupational accident and diseases	- Quarterly - Regularly - From time to time
22.	Security	- monitor performance of security staffs	- Weekly
23.	Capacity building	- monitor effectiveness of capacity building programme and other training including first aid	- From time to time
24.	Environmental performance standard	- monitor the overall programme for high environmental performance standard - monitor the overall effectiveness of pollution management	- Monthly - Monthly
25.	Compliance with regulation, a legal requirement	- monitor all main activities to ensure compliance with legal requirement and corporate commitment	- Monthly
26.	Effectiveness of mitigation measures	- monitor mitigation measures taken and check their effectiveness	- From time to time
27.	Rehabilitation for each site (after completion of mining at a site)	- monitor tree planting and rehabilitation for each site after completion of mining for that site	- After completion for a site

7.10 Reporting requirement

Reporting is necessary for the effective and successful implementation of EMP.

7.10.1 Internal monitoring and inspection reporting

The physical and social parameters to be monitored are already mentioned earlier. Each and every monitoring/inspection work carried out by members of EMP cell must be catalogued in relevant log books. The internal monitoring and inspection will also have to involve in checking the performance of machinery, equipment and vehicles or at least the regular monitoring/checking of the log books of machinery, equipment and vehicle. All these findings or observations have to be reported.

Members of the EMP and MP cell will also have to check the log book or registered book weekly or monthly. Member of MP cell do not need to report on their work on daily basis. However there should be a monthly reporting session for effective communication with the EMP leader or authority.

7.10.2 Incident, accident and emergency reporting

In cases of incident and accident (including near miss) prompt reporting has to be carried out. This must be in the form of verbal reporting follows by written statement, after emergency and contingency procedures have been undertaken.

The written statement should be more comprehensive and should include the location and cause of accident, the time, extent and intensity and how actions for emergency and contingency procedures were taken. Estimate of loss will have to be followed later. A good reporting will help the EMP leader and authority to take future action, to learn lesson from the incident or accident and enable them to draw future plan for health, safety risks and emergency management.

Reporting on incidents of misbehaviour such as quarrels, and brawls etc may not be necessary. It is actually the duty of the security staff to take action.

7.10.3 Measuring performance indicators and interpreting and acting on the indicators

Based on the finding or observation from the monitoring or inspection on the performance of EMP and MP cell members a report on the performance including the assessment of the performance and it effectiveness or success has to be submitted to the authority. This will have to be undertaken on a regular basis and the performance has to be documented and registered.

It is very important to report regularly on evaluation of mitigation/corrective measures taken. Evaluation should be made during regular monitoring/inspection works.

There must be a mechanism for auditing the EMP and its implementation processes. This will involves reviewing all the log books, registered books, documents and reports. This will help in reviewing and verifying the EMP implementation and also assist in assessing the effectiveness or success of the EMP.

As mentioned earlier there must be a separate log book for registering complaints and grievances, if any. Prompt reporting on complaints and grievance is necessary and the authority has to take necessary measures in a timely manner.

7.10.4 Reporting on training programmes

As mentioned earlier there must be regular monitoring and inspection of all training programmes provided, namely, capacity building training, training provided for safety such as firefighting training and training provided for health such as First Aid Training; also training for quick response and preparedness such as drills and mock drills.

It is not necessary to monitor every session of a training programme and its process. But it is necessary to monitor, inspect and watch every drill, mock drill or rehearsal.

EMP cell members conducting monitoring and inspection works must be able to interpret and assess the overall condition of the training processes especially assessment of the effectiveness and applicability of each training.

A report on the training including assessment on its effectiveness must be submitted at the end of each and every training programme.

Finally Annual review should be prepared and an Annual Environmental Management Report should be submitted.

This annual report/review will summarize the key activities and environmental performanace for the preceeding 12 months. It will also include comprehensive review of monitoring results and complaints records, if any.

7.11 Emergency plan

The chance for major accident to occur in a well-managed quarry and the mining site was very remote.

Violent storm and earthquake could be ruled out for his area; there was no precedent of such disasters within memory and the area was not on a fault line. Up to 2014 flood was ruled out; but what had happened in July and August of last year (2015) indicated how major floods could be unpredictable in this era of climate change or rather climate disruption. There were major floods in 11 out of 14 states and regions of the country resulting in catastrophe.

Accident like fire break out, especially bush/forest fire could not be totally ruled out given the nature of the work. In this EMP report emergency plan would mainly focus on emergency and contingency plan for outbreak of fire.

7.11.1 Emergency procedures (generalized)

- first draw up a plan for prevention/mitigation measures for fire accident (the company has already drawn up plans for fire prevention and fire fighting)
- carefully plan for emergency response and procedures (the company has already done this)
- provide firefighting training for some workers
- provide adequate firefighting facility, water ponds, hydrants, water jet pumps, and fire extinguishers; provide adequate PPEs such as firefighting suits, if possible. (The company has two fire engines, firefighting vehicles.)
- regularly check the firefighting facility, its readiness; ponds to be always filled with water

- organize mock drills regularly and assess the effectiveness of drills and training; assess the readiness, quick response and quick evacuation processes
- provide First Aid Training to some workers
- provide adequate first aid facility-such as stretchers, equipment, first aid kits including medicines; regularly check the condition of first aid facility
- display addresses and phone numbers of Fire Fighting Brigade, Ambulance Service, Hospital's emergency department, police station etc so that everyone can see easily
- set up effective alarm system and control system
- take out insurance for the company;also insurance for fire and for disaster
- effectively install lightning arrestors, lightning strips and rods, down lead and grounding electrodes
- deploy tight security all the time (arson and sabotage could not be totally ruled out due to anti-big business, anti-tycoon and anti-crony mindset of certain people)

7.11.2 Emergency response and contingency procedures (in brief)

The objectives of Emergency reponse are:

- to minimize confusion through effective delegation of responsibitities
- to minimize danger or safety risks by providing first aids
- to minimize damage to property and the environment by isolating the incident
- to minimize operation and ervepres business assest as far as practical

a) For fire accident (generalized)

- sound the fire alarm (electronically or manually)
- switch off main switch
- implement rapid and effective firefighting process
- rapid evacuation process for workers, important materials, belongings
- first aid treatment, if any injury, and subsequent admission to hospital for serious cases
- implement effective relief programme
- implement followup rehabilitation programme

b) For storm and flood (generalized)

- emergency and contingency procedures mainly include; evacuation of workers and important materials
- taking shelter at appropriate place, to higher ground for flood; to reliable shelter for storm
- first aid treatment if necessary
- provision of temporary shelter, water and food
- rescue operation during disaster and aftermath
- implement rapid relief programme
- implement followup rehabilitation programme

c) For devastating earthquake (generalized)

- take immediate shelter such as undertable, under bed or inside cupboard etc
- rapid evacuation of workers property to safe location
- provide temporary shelter, water and food
- first aid treatment if necessary
- immediate rescue work only in the aftermath
- implement rapid relief programme
- implement follow up rehabilitation programme

d) For accident at work place or sudden illness

- for accident --- immediate first aid treatment and quick admission to the hospital
- for sudden illness like cholera, diarrhea immediate treatment and admission to hospital necessary
- snake bites or injury caused by poisonous insects, animals--- also need immediate treatment and admission to the hosiptal

7.12 Capacity building and trading

EMP and environmental monitoring is a new subject even in developed western countries. EMP cell leader and EMP cell members should try to be aware of the latest information regarding environment and environmental activities carried out in developed countries.

EMP cell leader or EMP officer should be able to recommend measures to improve environmental condition. He/she should be able to implement control and protective

measures for effective implementation of EMP. He/she should be also able to ensure suitability, edequacy and effectiveness of the MP implemented.

Training is essential for effective and efficient implementation of EMP and MP. However it is not yet practical to plan for capacity building of the EMP cell members up to standard of developed countries. Training needs should be identified based on the existing and available capacity of the company and project personnel.

The approach should be a pragmatic one based on the availability of qualified personnel and materials and equipment.

The two pragmatic training programmes, Fire Fighting and First Aid Training are already addressed. One capacity building and training of importance for EMP cell members will be practical training for conducting monitoring and inspection and for assessment of the finding or observation. The parameters to be monitored and inspected are already mentioned earlier.

The training programme for monitoring and inspection work involves the selection or location of the spot/place and the parameter to be monitored. As already mentioned earlier the parameters include physical ones---air, noise level, water, waste as well as social aspects already mentioned, and inspecting the performance of workers and workers compliance with environmental requirements.

The capacity building and training programme should also cover other basic aspects such as:

- conduct environmental awareness to the staffs/workers
- conduct safety programme to create safety awareness among staffs/workers
- train staffs/workers on general safety measures and, if necessary, conduct safety rehearsal or safety drill to educate them

The training programme will instruct EMP and MP cell members how to keep log books or registered books and how to carry out observations and findings. They will be provided with abbreviated specific forms (short to the point) for filling; and also abbreviated forms for reporting incidents and accidents, or grievances.

As regards the actual monitoring and inspection this will be carried out in the form of visual inspection only. It is not practical at the moment yet for the members of EMP and MP cell to monitor (test) the physical parameters that involves the use of equipment and chemicals for this purpose, for instance, air test kit, water test kit, noise level detecting kit etc. These portable kits are sometimes not reliable and intended for high school students in developed countries during their excursion trip, mainly just for training purpose not for accuracy.

For the sake of accuracy to a certain extent relatively sophisticated equipments as well as relatively complex chemical analysis are required. Therefore specially trained technicians or experts, for instance, from the Health Department or from YCDC have to be hired for air quality analysis and water samples have to be sent to registered laboratory in Yangon for analysis.

Max Myanmar Manufacturing Co., Ltd has at the moment a quality control laboratory (for cement quality). The company can procure the equipment and chemicals necessary for monitoring and testing the environmental parameters. The company can train its EMP cell members in the operation of these equipments and the application of chemicals for EMP implementation, especially for testing and analysis of air and water quality. This should be considered in advance because in the near future EMP implementation will become mandatory or compulsory.

7.13 Public consultation

This would be discussed in detail in the following **Chapter-8** of this EIA report.

7.14 Work plan and implementation schedule

This is merely the work plan and schedule for the effective implementation of EMP during the four phases, namely, Preconsturction, Construction, Operation and Mine closure/ Rehabilitation Phase, of the project life. In other word, this is not the main work plan and schedule for the main business of limestone mining/quarry, cement marketing during the four phases of the project life.

EMP plans and implementation should be formulated since in the early Preconstruction Phase through the Construction Phase, Operation Phase and up to the early Mine closure Phase.

MP plans and implementation should be started at the early Construction Phase through the Operation Phase to the end of Mine closure/ Rehabilitation Phase.

A generalized timeframe for planning and implementation of EMP and MP is shown in the **Figure-35** below.

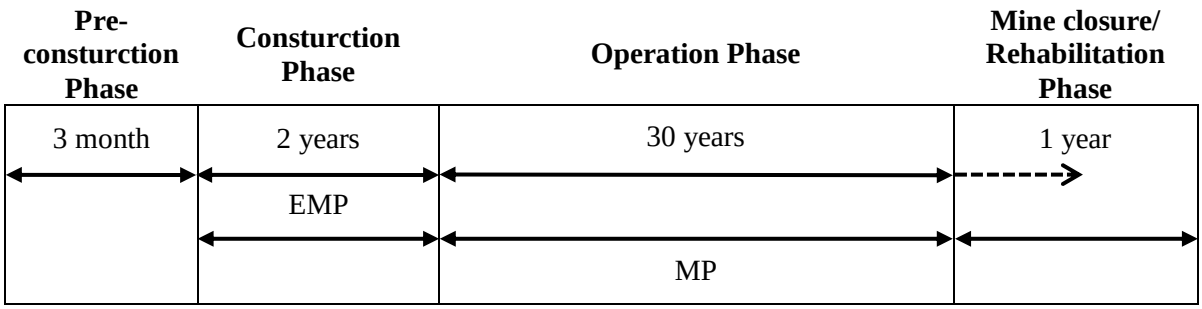

Figure-35: Generalized time frame for planning and implementation of EMP and MP during the four phases of project life

7.14.1 During the Preconsturction Phase

EMP should be taken into serious consideration in the very early planning stage for the Preconstruction Phase works. For instance, the procurement of environmentally friendly tools, equipment, machinery and vehicles etc. for the cement plant as well as the quarry

works. This will include the purchase of tools that are durable, and reliable but not so expensive; purchase of machinery equipment and vehicles that emit less smoke and generate lower noise level and vibration; and machinery and vehicles that are fuel efficient, those that consume less fuel, less energy and use less water for conservation purposes. In other words, tools and methodology that are of practical application for sustainable construction activities and the long term operational activities shall be applied.

Plan for this phase will include this procurement for drilling equipment and accessories; explosives and detonators and accessories; excavators and dozers (together with air-conditioned cabin to be installed for operator); dump trucks, crushing machines and accessories, grinding machines, screening machines, filters etc.

In addition devices such as noise and vibration abators, silencers, a variety of PPE such as masks, face mask, gas masks; goggles, ear muffs, gloves, boots, safety belts, special outfits, etc should be procured in advance.

Hand tools such as hammers, spikes and chisels and also facilities for first aids and for fire fighting (eg. fire extinguisher) should be procured in advance.

There should be detail plan for the selection and procurement of a variety of major machinery and equipment to be installed in the factory and the selection of building materials eg. sand, gravel, bricks, cements, timbers to iron rods, glass panel, sheet, roofings and so on. Also plan for procuring the materials for installation, furnishing and finishing works- eg. plumbing system, electric system, paints and varnishes etc, in short, all the detail plan for the construction of buildings and structures at the mine/quarry site. When planning for the procurement of all the above-mentioned material items serious consideration should be taken for the selection of ecologically friendly materials. After planning for procuring implementation of procurement will follow.

The three mitigation measures to be taken and the EMP to be implemented in the Preconstruction Phase were already described earlier in **Section-6**. MP is not necessary yet in this phase.

7.14.2 During the Construction Phase

It is estimated that this phase will last for 2 years and the main task will be construction of major buildings and structures for the factory as well as at mine site.

As regards EMP the 10 mitigation measures to be taken and the EMP to be implemented during this phase were already described earlier in tabulated form. Members of EMP cell should follow this instruction and carry out their duties efficiently.

As regards MP the 16 components and parameters to be monitored during this construction Phase were already described earlier in tabulated form.

7.14.3 During the Operation Phase

It is estimated that this long term phase will last for up to 30 years.

As it is the most important phase of the whole project effective EMP and MP should be implemented during this phase. The long term sustainable success of the whole project also depends very much on the effectiveness of EMP and MP implementation by efficient EMP cell members.

The 16 mitigation measures to be taken and the EMP to be implemented during the Operation Phase where already mentioned earlier in tabulated form.

The 28 components and parameters to be monitored were also already mentioned earlier in tabulated form.

7.14.4 During the Decommissioning/Mine closure Phase

It is estimated that this phase will last for 1 year.

During this phase the factory will be decommissioned and the quarry/mining site will be closed. Works involve the removal of machinery, equipment, vehicles, the dismantling and tearing down of building and structures; the reuse or put up for sale for some materials; the disposal of unwanted materials and removal of contaminated soil; and the clearing of the site. Other main works will include backfilling of pits and dents resulted from mining/quarrying activities and leveling of the ground.

After that the rehabilitation task will have to be implemented, mainly in the form of re-vegetation of the factory premise as well as the quarry sites.

EMP for factory decommissioning and for mine closure and subsequent rehabilitation should be formulated in advance. The mitigation measures to be taken and EMP to be implemented during this Factory Decommissioning and Mine closure/Rehabilitation Phase were already mentioned earlier in tabulated form.

The two components and parameters to be monitored were also already described in tabulated form.

The factory decommissioning and mine closure and subsequent rehabilitation were once considered unimportant and unnecessary. But in this era of environmental awareness effective decommissioning and mine closure and environmentally sound rehabilitation has become mandatory. A factory decommissioning and mine closure plan that incorporates both physical rehabilitation and socio-economic consideration must be now an integral part of the project life cycle. These should be considered:

- future public health and safety are not compromised after decommissioning and mine closure

- the after-use of the old site (the factory premise as well as quarry site) is beneficial and sustainable to the local community in the long term, and
- adverse socio-economic impacts after factory decommissioning and mine closure are minimized while socio-economic benefits are maximized.

7.14.5 Fund for Environmental Management Plan (EMP)

A fund for EMP must be set up for the smooth and effective implementation of EMP. A small percentage of the budget, preferably 0.5-1.0% must be set aside for the setting up of EMP fund. (This is quite different from fund for implementation for CSR programme which is raised normally from 2% of the net profit). This EMP fund could not cover the whole project periods of 30 plus years. This should be considered as seed money; as time went on more money would have to be added. Unfortunately if major accident happens the executives of the company would have to make new decision concerning EMP fund (Emergency, contingency, health and safety, even welfare plans were all parts of EMP).

Finally there should be Management Review for EMP.

This should be reviewed on an annual basis. The review will include:

- finding of internal and external environmental audits
- achievement against the environmental objectives and targets
- environmental objectives and targets for the coming year
- stakeholders concerns and other informations, and
- aspects and impacts in relevant to the up coming operation and environmental policy

8. PUBLIC CONSULTATION AND DISCLOSURE

Public consultation is an integral part of both EIA and IEE. Involving the public participation in the EIA work is fundamental to increasing the understanding and acceptance of the project.

Public consultation and participation should be started at early as possible in the preparation of EIA. And it has to be a continuous process, especially during the Operation Phase, carry out from time to time.

8.1 Purposes of the consultation during the preparation of the EIA report

- to enlighten the locals/stakeholders about the project
- to increase the understanding and acceptance of the project

- to give the locals/stakeholders the opportunity to present their views, opinions, perception of the project, express their concerns, complaints, grievances etc
- to identify impacts and issues that are not immediately obvious to project proponent and the EIA team
- to access social assistant and community development needs for the locals/stakeholders
- to gain community consent and to interact with the people to further strengthen existing cordial relationship
- to tap local knowledge and to negotiate for mutually beneficial future that is sustainable and locally relevant

Requirements for public consultations:

- public consultation should be conducted in the early phase of project
- must ensure the direct involvement of the locals/stakeholders
- must ensure that all locals/stakeholders who are interested will have the chance to fully participate, especially the vulnerable and marginalized group,
- it should be a continuous process --- throughout the entire phase of the project, especially during the long Operation Phase, and
- there must be an action plan or response programme such as complaints and grievances mechanism (CGM) to tackle any issue.

8.2 Methodology and approach

Standard methodology applied here includes:

(i) **Consensus building:** First of all a pre-sensitizing visits to the local authority (Village Administrator and party, elders) and briefing on the proposed project to be carried out and ask for their approval and assistant for holding the public consultation.

(ii) **Transect walk:** site visit (visit to the village) and conduct visual inspection.

(iii) **Actual public consultation meeting:** mainly involves disclosure of the proposed project and giving complete and accurate information; consultation mainly in the form of two-way conversation --- listening and talking; waiting for their response; further discussion.

(iv) **Interviews and discussions:**

- in the form of KII/SS, (Key Informant Interview/Secondary Source) for the gathering of secondary baseline socio-economical data and community profile with the aid of questionnaires

- in the form of FGD (Focal Group Discussion); interview with few selected people (authority, knowledgeable persons) especially for ranking the pressing need of the locals for prioritizing the needs for community assistance and implementation of CSR.

8.3 Consultation meeting (public hearing)

8.3.1 Previous consultation meeting

Several meetings have already taken places between the company officials and the villages since the cement factory was established in 2008. (Actually meetings have been conducted even in the Preconstruction Phase, that is, prior to 2008.)

Those previous meetings had encompassed a variety of agendas: such as employment of the locals at the factory, and implementation of generous and effective CSR programme and so on the pervious public consultation meetings have resulted in the provision of permanent and temporary jobs to the locals; the upgrade of infrastructure (a 10 miles hard top road, 2 schools, one new clinic, one new library, two new monasteries and one new pagoda); and the electrification of the village, schools and monastery; and finally the community assistance in the form of charities and donations.

8.3.2 Previous consultation meeting including EIA team

That previous consultation meeting between the officials of the company, the EIA team of the consultant firm, MESC and the local community took place in November 2014 at the Resident of the village Administrator, Aung Nan Cho village.

During that EIA study the socio-economic of the villages and community profile were studied in detail one day before the meeting.

The summary of comments expressed by the villagers during that public meeting were as follow.

Complaints: The issue of land grabbing and the promise for compensation.

i) First they complained that the company had grabbed the land of 50 villagers about 100 acres. And that the company had promise to compensate for this at a rate of Ks 200,000 per acre. And that, that compensation scheme is not, so far, materialized.

ii) Another complaint was about smoke from the factory sometimes entering the village when the wind is blowing to the direction of the village, causing asthema, brorchitis and other respiratory or lung diseases.

iii) One complained on the dumping of overburden, waste and chemical into Yay-pu stream.

iv) One complained that vibrations from blasting activities have resulted in the occurrence of a few small cracks in a one-storey brick house. Another claimed that vibrations from the blasts have affected the growth of cultivated plants.

Concerns

i) One local said that his main concern was for the long term environmental condition. He said that now there were so many cement factories and quarries in this area, namely Max Myanmar Cement factory and quarry, YCDC cement factory and quarry, Asia World's quarry and the quarries of two smaller companies.

ii) One local expressed his concern for another probable forced eviction and relocation when these companies expand their business or when new companies arrived in this area.

Needs

i) One local expressed the need for permission from the authority to expand their farm land, and that due to increase in population they need more land to survive.

ii) One expressed the need for effective village electrification. Max Myanmar had already provided electricity for village streets lighting; that the electricity from the factory has reached only to the lamp posts. What he asked for now was access to electricity to every house hold.

iii) One local would like to see the village library in the process of construction by Max Myanmar Company to be completed soon, as there was a certain delay for sometimes.

iv) One local said the village need a clinic and hope the company would build one for them.

v) One local said if they want to buy small quantity of cement the company should arrange a retailer sale for them.

How comments were taken into account

Complaints

i) The issue of land grabbing and the promise for compensation

The EIA team leader said that he would immediately report this to the authority of the company and also document it in the EIA report.

As everyone can imagine land grabbing is a widespread phenomenon in this country and has become a real headache for the government. In remote rural areas there are usually no official records or documents pertaining to the ownership of land property. Taking advantage of this weak point rich business men in league with corrupt government officials can easily grab the lands of the poor grass root communities. Many government departments were also involved in land grabbing. These unfortunate local people are not in a position to go to court and bring up charges against the land grabbers. It is always the grass root people that have to suffer. Max Myanmar Manufacturing Company should seriously consider the complaint made by the Aung Nan Cho villagers.

The SIA team on its part could not verify the complaint of the villagers. None of them can provide official records or documents to support their claim concerning the ownership of

the land they alleged that the company has confiscated. Without official documents or papers the SIA team could not also verify the acreage claimed by the villagers. It is quite sure that no such records or papers exist in the office of the department of land survey. Without official records or papers their complaints and allegations will go nowhere, and will probably lost in thin air.

But on the other hand one should take into account the so-called customary rights or traditional rights concerning the ownership of land in remote areas or hilly areas. Customary right is something like a defacto rule or regulation practiced in remote areas. The principle of dah-ma-oo-chart (the first person who cleared the forest for cultivation of crops own the land he has cleared) was/is applied in remote areas. This person can bequeath the land to his off springs. In this way people in remote areas inherited the land from their fathers.

However, in this Aung Nan Cho village context this issue is a tricky or complicated one. The village is a relatively new village established in 1992. Unlike the old villages in remote areas (which are more than 100 years old) there is no offspring who had inherited the land. The village itself was founded in accordance with the decree of the then commander of the Central Command, Major General Htun Kyi. (As mentioned earlier the village was the result of forced resettlement of local people from some hamlets under the control of the insurgents).

The area was actually a reserved forest area and the SIA team could not be sure if the resettlement programme was carried out after consultation and agreement with the Ministry of Environmental Conservation and Forestry. In this 21th century the founding of a village merely by the decree of an army commander is rather dubious. Actually the Ministry of Home Affairs is responsible for the establishment of a village.

As this is beyond the scope of SIA study the SIA team simply would like to suggest the company to seek the help of legal experts to tackle this issue.

(**Note:** In the second EIA/EMP survey carried out in September, 2016 the EIA team has learned that the company simply gave in to the demand of the villagers and compensated Ks 200,000 per acres to the villagers who were affected by the project. This was done for the sake of building good relation with the local.)

ii) Smoke sometimes entering the village.

The EIA team leader replied that in the EIA report to be prepared the mitigation measures to be taken for smoke and dust would be prescribed in relative detail. And he believed that the company would comply with the regulation and personally asked the compary to do so.

(**Note:** The EIA team believed that such a statement of incidents of asthema, bronchitis and respiratory or lung diseases was a far-fetched one. As the statement was not made by doctors or medical officers it was quite difficult to verify. After all, asthma and respiratory ailments can occur in any towns or villages regardless of

the distance from a smoke stack. Probably the statement was made out of theoretical knowledge or from the dictation of environment activists.

The factory was shut down for upgrade and so the EIA team was not able to witness the smoke and its direction. But the factory of Yangon City Development Committee (YCDC) was less than one mile away and so the team has got the chance to study the smoke. The smoke was light brown or whitish in colour (very different from dark billows of smoke produced from stack during the nineteen sixties and nineteen seventies). The tall stacks of both factories were of standard height and so the chance of smoke getting into the village is almost zero. Moreover the elevation of the factory compound was higher than that of the village.)

iii) Dumping of waste, overburden into the stream.

The EIA team leader said that he would report this to the authority of the factory and also document this in the report. He went on to explain that mitigation measures for the impact and the management of overburden would be prescribed in detail in the EIA report to be prepared. And he would urge the company to comply with the regulation or requirements. He also said that he was sure no quarry uses any chemicals for quarry activities.

(**Note:** The EIA team, however, has learned that Asia World Company that involved in quarrying for granite or leterite for road construction from time to time used to accidently dump the overburden into the stream. Since the EIA team was working only for Max Myanmar it was not responsible for the deeds of other companies.)

iv) vibration due to blasting

The EIA team leader said that the he would report this to the authority of the factory and also document this report. He went on to explain that mitigation measures for the impact and the management of blasting would be prescribed in detail in the EIA report to be prepared. And he would urge the company to comply with the regulation or requirements.

(**Note:** The statement by one villager that vibration due to blasting have affected the growth of cultivated plants might be on over-blown statement.

The vibrations, no doubt, have impact on brick buildings especially tall buildings. To the best of our knowledge there is no scientific proof that vibrations have impact on the growth of plants. The vibration from a blast usually last only a very few seconds.

Actually the quarry near the village belongs to the cement factory of YCDC, not Max Myanmar. Max Myanmar Manufacturing's quarry site is further east and hidden from view.

Concerns

i) Concern for sustainable environment

The EIA team leder said that he appreciated their concern. Since Taung Philar area has an ideal landscape for the quarries of limestone, alabaster, laterite, clay etc. there was no surprise that four or five companies were operating in this area. Actually this was a world wide phenomenon. There were/are clusters of mines or quarries in regions or areas that have ideal landscape for mining or quarries. However if mitigation measures to be taken for the negative impacts due to mining or quarry activities were effectively taken the impacts would not be so serious. He would ask the company to take all the mitigation measures that would be prescribed in the follow up EIA report. If there was a chance we would like to convey this message to YCDC Company and Asia World Company.

ii) Concern for further probable forced eviction and relocation if more companies arrive.

The EIA team leader replied that he appreciated their concern given the fact that they (the locals) have already suffered once due to forced eviction from their small villages/hamlets and relocation at this Aung Nan Cho village by the decree of the then Commander of the Central command.

But he was sure that even if more companies arrive and operate in this area the villages of Aung Nan Cho would not have to be relocated elsewhere again. He also explained that the overall political situation has improved greatly since 2010 and so the scenario of forced relocation or resettlement could never happen again.

Needs

i) The need for permit for expansion of their farm lands.

The EIA team leader replied that this was beyond the scope of EIA study; and also beyond the control of the company. The village is actually still officially in the Mei-hor Reserved Forest area and therefore, they should ask for permission from the Forest Department or the authorities concerned.

ii) The need for village electrification (up to each and every household)

The factory official replied that he would report this to the authority. But he said that this might not be easy, because the cement factory did not produce its own electricity (eg. own coal thermal palnt). The factory has to source electricity from the National Main Grid Line. The factory has to regulate and maintain the electric power load within the work frame. Whether the factory could provide electricity to all households or not was questionable. The decision to provide electricity to all 130 households should be made/or not made only after careful calculation by electric engineers.

iii) The need for village library

The factory officer said he would report this to the authority.

The EIA team leader said that the company should continue the construction of the library since it was already half-completed

(**Note:** During the second survey carried out in September, 2016 the EIA team has seen that the library was already opened.)

iv) The need for village clinics

The EIA team leader said that he would report this back to the authority of the company and also document it in the report.

Actually the Ministry of Health is responsible for establishment of a village clinic and also responsible for the health of the villagers. The ministry is also responsible for the provision of nurses, midwives and health workers as well as medical supply.

The Corporate Social Responsibility (CSR) practiced in many countries now usually includes the provision of schools and clinics as the main CSR activities. So Max Myanmar Manufacturing should consider this only after consultation with the Ministry of Health. Only the authorities from Ministry of Health can decide whether a clinic is necessary or not for a village with so and so population.

v) The need for retail purchase of cement.

The EIA team leader said that he would report this back to the authority of the company and also document it in the report.

The last need they mentioned is to purchase cement in small quantity from the factory. Normally the factory sells the cement wholesale and does not want to be bothered with retail sale. But the factory authority should take favourable consideration for this matter provided that the villagers buy at least one bag of cement (not a small quantity to be taken out from a bag).

8.3.3 The latest public consultation meeting (September 2016)

Date : 11 September 2016

Time : 10:30 hrs

Venue : Nursery school, Aung Nan Cho Village

Attendance : 51 persons

This public consultation meeting was held at Aung Nan Cho village.

Each member of all households (130 households) was invited and the attendance rate was about 40%. There was no community group (local based civil organization) in the area.

Figure-36: Signboard of the village

Topic

The official disclosure of the proposed limestone/alabaster project and explained in relative detail, providing clear, accurate and relevant information. The locals were explained on the environment assessment work to be couducted for EIA and EMP for the proposed site. The potential impacts on the physical, biological, social, cultural and visual components of the environment to be identified and mitigation measures to be taken together with the EMP and MP to be implemented were explained. Community assistance and development and the CSR actions already taken and to be taken in the future by the company were also discussed later.

Figure-37: Public consultation meeting

Figure-38: KII interview

Figure-39: Focal Group Discussion (FGD)

8.4 Consultation meeting (public hearing)

a) Previous consultation meeting

Several meetings have already taken places between the company officials and the villages since the cement factory was established in 2008. (Actually meetings have been conducted even in the Preconstruction Phase, that is, prior to 2008.)

Those previous meetings had a encompassed a variety of agendas: such as employment of the locals at the factory, and implementation of generous and effective CSR programme and so on the pervious public consultation meetings have resulted in the provision of permanent and temporary jobs to the locals; the upgrade of infrastructure (a 10 miles hard top road, 2 schools, one new clinic, one new library, two new monasteries and one new pagoda); and the electrification of the village, schools and monastery; and finally the community assistance in the form of charities and donations.

b) The consultation meeting during EMP study and minutes of the meeting

This was held on 11-9-2016.

Minutes of the meeting

First a member of the village administrator, U Kyaw Yar, very briefly explained to the participants, locals, stakeholders, why this public meeting was held.

The officer of the company U Win Aye explained to the locals/stakeholders about the proposed project, as far as possible, in relative details and gave clear, accurate and relevant information on the proposed project.

The officer went on explaining how a lease of 10 years was granted; how the company has to pay 3% mineral tax and a dead rent of Ks 2000/sq.km/year to the Department of Mines; how the company had to pay a tax rate of Ks 5000/acre/year to the Forest Department since the site is within the Mei-hor Reserved Forest.

Lastly there would be income tax to be duly paid. All these will contribute to the national revenue.He also mentioned the CSR activities so far undertaken by the company for the good of the people and area.

Then the EMP team leader U Myint Kyaw Thura explained to them about the EIA and EMP study to be conducted in the coming days and that all the findings, both potential negative and positive impacts, together with mitigation/corrective/remedial measures to be duly taken would be reported. And that the EIA report would also contain MP for sustainable operation of the quarry.

He also told them that this MESC consultant firm which is going to conduct EIA is a third party and is strictly neutral, having goodwill towards both the company (project proponent) and the stakeholders/locals. And that the EIA members are pragmatic rather than emotional people when it comes to environmental issues and with genuine national development always in mind.

The locals/stakeholders were then invited and encouraged to give comments; to express their views, opinions, concerns and perception; and also to lodge or present their complaints and grievances, if any.

At the same time sheet of papers were distributed to the locals/stakeholders to express their views, opinions, concerns and perceptions; and also to lodge or present their complaints and grievances in written statement if they feel reluctant to speak frankly in front of others; and that they could return the paper today or tomorrow at their convenience, but before the EIA team leave the study area for Yangon.

The participants were again invited and encouraged to lodge or present complaints or grievance, if any.

One local, U Aung Shein, said that the company has established the village library, and for this, he is grateful; he wants the company to improve that portion of the road (built by the company) near the village and to expand the village electrification scheme to each and every householdd (not only to all the lamp post for street lighting only).

U Zaw Min Oo, said that what we really want is for the effective village electrification; and that in the future more villagers should be prioritized for employment at the cement factory or mining site.

On local U Saw Tin Myat wanted to know for sure whether the health condition of the locals will be effected or not due to project including both the factory and the mining site.

U Mya Soe Oo wanted to know if there are risks due to the present of overburden.

U Zaw Lin said that there are only a couple of brickhouses in the village but in one or two houses small cracks appeared due to the effect of blasting. And he was not sure which companies was most responsible sine there are three companies, namely, Max Myanmar, YCDC, and Asia World and also a few smaller ones operating limestone mining, all of them not very far from the village. They should all reduce the intensity of the explosion when blasting.

U Ba Mya wanted the company to sell the cement in retail for the sake of convenience for the villagers.

U Ohn Pe said he wanted Asia World Company to fix the exact and consistent time table for blasting (as what Max Myanmar has done) and want all companies to reduce the scale of blasting.

U Saw Peter Win expressed his view that Max Myanmar Cement and the village have acquired a mutual reliance or a symbiotic relationship. The village has witnessed development in many aspects due to this cement plant. He wanted the officials of the factory to pay more visits to the village to see what they can do for the betterment of the village.

U Nay Win Aung wanted to know why the consultant firm, MESC, is doing survey work only for Max Myanmar. There are other big companies like the cement plant of YCDC, Asia World and other smaller ones doing limestone quarry. EIA/EMP should also cover those companies' activities. He realized that those companies have come into existence due to national cement demand. And the village has developed to a great extent due to the existence of these companies. At the moment what they need is effective village electrification.

Now he knows that Max Myanmar Cement will upgrade its production capacity from 500 ton/day to 2100 ton/day. He would like to ask the company for mitigation of smoke as far as possible because smoke of small magnitude sometimes reaches the village area.

If the company does not take full responsibility for effective village electrification the villagers will try to procure a transformer for a sub-station and the company continues the existing provision of electricity.

U Antony said that he wanted to expand his farm but the factory officials prevented him for doing so because the plot is within the 500 acres reforestation scheme implemented by the company.

U Soe Naung wanted to know how the village monitoring group (monitoring committee) shall be formed and their duty.

Lastly, three locals said that the local community is not against the existing project and the proposed project (new limestone quarry). The main thing they want is effective village electrification.

The villagers then proposed the setting up of a village monitoring committee comprising the flowing villagers:-

1) U Kyaw Yar - member of village administrator
2) U Saw Nay May Kaw Htoo
3) U Saw Kyaw Swar Htun
4) U Zaw Min Oo
5) U Saw Tin Myint
6) U Thant Zin Aung
7) U Zaw Linn
8) U Nay Win Aung
9) U Wilson Thein Htay
10) U Roland Htun

(Five villagers who were late comers have not signed in the attendance sheets.)

When asked about their public relation with the company they said that the relationship is quite good. And that the company should find a way for the mutual benefit - a win - win situation, for the company and the village and that assistance should continue.

Before the public consultation meeting was over the EIA team leader said that this would not be the first and only meeting but that the consultation programme was a continuous process. He then informed the stakeholders/locals that a Complaints and Grievance Mechanism (CGM) would be set up for the whole project period and that if there were any grievance to lodge now and in the future any one could do this in written statement directly to the authority of the company. The authority would duly take prompt action. And that this CGM and feedback procedures would be prescribed in the EIA report to be submitted later.

The public consultation meeting was over at 12:00 hrs.

A Key Informant Interview/Secondary Source (KII/SS) gathering was conducted one day earlier on 10th September 2016. Only few people, one member of Ward Administration, a clerk, a few knowledgeable elders and interested people were involved. It was simply gathering secondary baseline socio-economic data and assessing community profile.

The interview was a structured one in the form of questionnaires.

After the public consultation, another small meeting, Focal Group Discussion (FGD) was held. Only selected few were involved, one member of the ward authority and knowledgeable persons. Discussion involved ranking the pressing needs of the locals and prioritizing the needs mentioned earlier during the consultation meeting.

8.5 Summary of main comments received from the stakeholders/locals

There was no complaint or grievance concerning land grabbing, which was expected before the meeting. There was also no evidence of land grabbing, forced eviction and forced relocation.

The followings were comments expressed by the local during the public consultation meeting:

Needs

- The need to improve or renovate the portion of road the (built by the company) near the village.
- The need for effective (entire) village electrification (not only for street lighting but also for electricity for every household). They will procure a transformer if necessary.
- The need to prioritize the employment of locals.
- Want the company, to do retail sale of cement for villager's convenience.
- The need for other companies, namely, Asia World, YCDC Cement and other smaller ones to conduct EIA.
- The need for Asia World Company to fix exact timetable for blasting.
- The need for the company to do more mitigation for smoke impact, eventhough insignificant, when the upgraded plant is in operation.
- The need to set up a Monitoring Committee.
- The need for all companies to reduce the scale of explosion during blasting.

Concerns

- Concern for the health condition of the villagers.
- Concern for the risk due to the existence of overburden and top soil stockpiles.

Complaints

- Vibrations from blasting has resulted in small cracks in two houses (luckily the large majority of houses are wooden or bamboo houses).

- One local wants to expand his small farm but was prevented from doing so by the factory officials.

8.6 How comments were taken into account

All the comments (complaint, concern, need, opinion) were noted and documented and later kept in the file of consultant firm (MESC) office and were also included in the EIA report.

The comments were reported back to the cement plant authority for taking necessary action.

The responsible persons of the company and EIA team members on their parts have also promptly tried to answer all the comments on the spot as far as possible.

1) Needs

- To renovate the portion of road (built by Max Myanmar Company) near the village.

  The officer of the company replied that he will report this to the company's authority promptly.

- The need for effective (entire) village electrification.

  The EIA team leader said that this is not the first time the locals are asking for village electrification. He had decomunted this during his first survey. So the company should take this into serious consideration.

  The company's officer replied that he will report this to the company's authority. The EIA team leader said that since streeting lighting at all the lamp posts has already achieved it will be quite easy for each household to access the electricity. The village elders can set up a fund and implement this. The idea of procuring a separate transformer for the sub-station is also a very good idea.

- The need to prioritize the employing of the locals.

  The company's officer replied that the company is exactly doing this, and that when these two new mining/quarry sites materialize more locals can be employed.

- Want the company to do retail sale of cement.

  The company's officer replied that this seems quite simple but actually not so simple since the company factory is totally involved only in wholesale marketing of the cement. He would however report this matter to the factory; authority.

- Want the company to continue the good CSR work.

  The company's officer told the local to be rest assured for this. They could easily compare the CSR activities of Max Myanmar Cement with those of other companies operating in this area. They could see the great difference. The authority of the company has philanthropic mindsets.

- The need for other companies, namely Asia World, YCDC Cement, and others also to conduct EIA/EMP.

  Both the company's officer and EIA team leader said that they where not in a position to suggest this to those companies. It is their responsibility. If possible the local community should ask for this.

- For the need for Asia World Company to fix exact time table for blasting.

  Again both the company officer and EIA leader replied that they were not in a position to suggest this to Asia World Company. Instead the villagers should ask or demand for this.

- The need for Max Myanmar Company to do more mitigation for smoke when the plant is upgraded and in operation.

  The company officer and EIA team said they would report this back to the company's authority and try their best for this. The villagers could see that new technology would result in emission of less smoke.

  As for the new proposed mining/quarry site dust would be generated. A more detail mitigation measures would be prescribed in this EIA report. Smoke and dust of course could be mitigated.

- The need to set up a monitoring committee.

  A committe comprising 10 villagers was organized during the meeting. The EIA team leader said that officials from the cement factory should be also included in the final set up.

  This committee has the responisibility to monitor all companies that is, all cement companies, mining/quarry companies operating in this area for the sake of maintaining healthy environment for the whole area.

- The need for all companies to reduce the scales of explosion during blasting.

  The company's officer replied that he would report this matter back to the factory's authority prompty.

  The EIA team leader said that there were exact mitigation measures prescribe for blasting. In the real world it is not possible to minimize the very high noise level but only mitigate it to a great extent. The mitigation measures to be prescribed in this EIA report would be based on the best available technology.

2) Concerns

- Concern for the health condition of the villagers.

  The EIA team leader said that since this was a generalized concern it was quite difficult to answer. Limestone mountains were/are ideal landscapes for the production of cement and minings were taking places the world over. Since limestone is the essential raw building materials essential for the development of the infrastructure of every nation limestone is mined or quarried throughout the world. Actually this is the way infrastructures of countries are developed and there is no other way round. In virtually every country there are thousand and thousand of people living near or around limestone mines/quarries. For these people mining or quarrying of limestone and associated activities have become a way of life. There were/are no well-known specific or severe cases of health problem for the people living in those areas. Serious issue or problem, if any, is usually due to the instigation of activists and radical environmentalist who usually are against all developmental projects or against all big businesses.

  In some developed and prosperous countries with perfect infrastructure system limestone or granite mountain are already gone due to severe exploitations of these resources taking places for centuries. These mountains may be a resourse "curse" for the local community living near or around mines or quarries but actually a "blessing" for the country in the form of essential infrastructure development of the nations. Sometimes it is necessary to sacrifice a mountain or a micro-ecosystem for the sake of development of a nation.

- Concern for the risk due to the existence of stockpiles over of burdens and topsoil.

  The EIA team leader said that there are surely the potential negative impacts in the form of erosion, sliding, blocking of natural drainage system, blocking of water courses (rivulet, streams) and effecting aquatic ecosystem, siltation of water courses and siltation of cultivated land and so on.

  But if all the mitigation measures to be taken as prescribed in the EIA report are strictly follow the risk will surely be minimized.

3) Complaints

- Small cracks appeared due to vibration associated with blasting.

  The company's officer said he will look into this matter personally and report back to the factory authority. Compensation or repairing of wall with small cracks should be made. The EIA team leader said that there were/are precedents of small cracks in many building in Hpa-an City which is on the eastern side of the Thanlwin River. The limestone mining/quarry site near Myaing-ka-lay village is on the western side of the river about 3 miles away. He has so far heard nothing of any compensation taken by the big cement factory at Myaing-ka-lay. But in this era of environmental awareness

and environmental conservation there has to be compensation for any damage, big or small.

- One local wants to expand his small farm but was prevented by factory's officials.

  The company's officer said action has to be taken as the villager was encroaching into Max Myanmar land property where reforestation programme is being carried out. (Aung Nan Cho village is a young village which came into existence in 1992. The village was founded in accordance with the decree of a major general who was then the Commander of the Central Command. It fact it was a result of forced resettlement of local people from some hamlets under the control of the insurgents. The village is inside the Mei-hor Reserved Forest. Whether the farms or fields owned by the villagers have official papers/documents or not is unclear. The compensation scheme of Ks 200,000 for each acre carried out by Max Myanmar Company was in accordance with Customary Rights usually executed in remote rural area.)

8.7 Information Disclosure

Public consultation made at the project site on 11-9-2016 involving the local community, responsible persons from the company and EIA team was made public. The information was released and the news appeared, in brief, in a Daily Newspaper, The Voice Daily, on 15-9-2016. (**See ANNEX** for part of the newspaper)

CSR programme implamented, so far

As a result of CSR scheme 14 villagers have been employed permanently with their salaries ranging from Ks 120,000 to Ks 180,000. Several dozers were provided temporary job during the Construction Phase of the cement project about 2 years. The previous CSR programmer implementation in the form of the construction of 10 miles hard top road which directly benefited the two villages, the building of one bridge across the Mei-hor rivulet; the building of 2 schools, 1 clinic and 1 library and the donation and building of one pagoda (the Shwe Hpone Pwint Pagoda) and two monasteries; and the electricfication of the monastery, schools and the village (to all the lamp posts of the village but not to every household yet).

The previous CSR scheme also involved the compensation for land acquisition. Twenty five villagers were compensated at the rate of Ks 200,000 per acre (the total acreage about 100 acres). This was arranged through Customary Law or Customary Right, perspectives.

Previous CSR scheme also also involved charity and donations.

Figure-40: 10 miles hard top road

Figure-41: Mei-hor Bridge

Figure-42: Schools at Aung Nan Cho village (Left) and at Aung Chan Thar village (Right) donated and built by Max Myanmar Company

Figure-43: Village library donated and built by Max Myanmar Company

Figure-44: Shwe Hpone Pwint Pagoda built by Max Myanmar Company

Figure-45: Two monasteries, left and right, built by Max Myanmar Company

8.8 Recommendation for future consultation

As mentioned earlier public consultation must be a continuous process throughout the project period, from the Pre-construction Phase, through the Construction Phase and Operation Phase to the Decommissioning Phase. As regards the long Operation Phase (30 years) there should be regular public consultations annually or bi-annually depending on the situation, or from time to time whenever there is a need for public consultation. This is very important for maintaining the long term cordial relationship with the locals and hence the long term benefit for quarry business.

The Complaints and Grievances Mechanism (CGM) programme should be implemented throughout the entire Operation Phase period. It should be practical and applicable and effective. The public relation officer and EMP cell leader should always give special attention to CGM.

The complaints handling and response must be effective. A hotline for complaint must be set up. The date and time of complaints, detail of complaint, action taken and if no action is required the reason why must be all recorded and documented. There can be also follow up contact with complainant.

Future public consultation should involve the continuation of CSR programme (affordable programme) and donation and charity works as far as possible.

9. CONCLUSION AND RECOMMENDATION

This EIA study has been carried out in accordance with the rules, regulations, guidelines and most of all, the format for EIA designated by the Environmental Conservation Department, the Ministry of Environmental Conservation and Forestry (MOECAF), now the Ministry of Natural Resources and Environmental Conservation (MONREC).

The potential impacts (both negative and positive) have been identified and assessed and the consultant firm, MESC, has put in place adequate measures, to eradicate or minimize or mitigate the potential negative impacts. The EIA/EMP and MP prescribed will also contribute to the long run effective and successful implementation and operation of the project, the cement business.

The project is considered viable because it is very clear that the benefits will outweigh the manageable negative impacts in many aspects. As already mentioned the cement factory had created temporary jobs, together with improved skills, for over 1,000 workers during the Construction Phase. It also creates 302 permanent jobs and dozens of daily wagers during the long Operation Phase. The project fosters the local economy and eventually contributes to the development of the construction sector of the country, infrastructure of the country, and hence national development.

The consultant firm, MESC would like to urge Max Myanmar Manufacturing Co., Ltd to strictly follow the environmental laws, rules and regulation in doing the cement business.

The company will have to effectively implement all the mitigation/corrective measures prescribed in this EIA report; and also implement all the EMP and MP described in the report.

The consultant firm, MESC, on its part has found no reason to object to the proceeding of the project. This project is recommended for implementation because in the final analysis the positive impacts far outweigh the negative impacts. Myanmar will benefit from increased employment, increased earning, increased revenue; increased investment and from infrastructure development of the nation.

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ANNEX

သက်တမ်းတိုး

ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်အစိုးရ 005819

အမြီးသားစီမံကိန်းနှင့် စီးပွားရေးဖွံ့ဖြိုးတိုးတက်မှုဝန်ကြီးဌာန

ကုမ္ပဏီမှတ်ပုံတင်လက်မှတ်

အမှတ် ....၁၂၃၀...../ ၂၀၀၇-၂၀၀၈

မြန်မာနိုင်ငံ ကုမ္ပဏီများ အက်ဥပဒေအရ မက်စ်. (မြန်မာ). ထုတ်လုပ်မှု ကုမ္ပဏီ. လီမိတက်

.....အား ပေးရန်တာဝန် ကန့်သတ်ထားသော လီမိတက်

ကုမ္ပဏီအဖြစ် ၂၀၀၇..နှစ်၊ ..ဒီဇင်ဘာ...လ၊ ၁၇..ရက်နေ့တွင် မှတ်ပုံတင်ထားခြင်းအား

၂၀၁၅..နှစ်၊ ..ဇန်နဝါရီ...လ၊ ၂.....ရက်နေ့မှစ၍ သက်တမ်းတိုး ခွင့်ပြုလိုက်သည်။

ညွှန်ကြားရေးမှူးချုပ် (ကိုယ်စား)

(နီလာမူ၊ ဒုတိယညွှန်ကြားရေးမှူး)

ရင်းနှီးမြှုပ်နှံမှုနှင့်ကုမ္ပဏီများညွှန်ကြားမှုဦးစီးဌာန

THE GOVERNMENT OF THE REPUBLIC OF THE UNION OF MYANMAR
MINISTRY OF NATIONAL PLANNING AND ECONOMIC DEVELOPMENT

CERTIFICATE OF INCORPORATION

NO. 1230 of 2007-2008

I hereby certify that the tenure of MAX (MYANMAR) MANUFACTURING COMPANY LIMITED incorporated under the Myanmar Companies Act on 17th DECEMBER, 2007 is renewed with effected from 2nd JANUARY, 2015

For Director General
(Nilar Mu, Deputy Director)
Directorate of Investment and Company Administration

ကုမ္ပဏီနှင့်သက်ဆိုင်သည့်အချက်အလက်များ

(က) အုပ်ချုပ်မှုဒါရိုက်တာအမည်၊ ဦး...(၁၂/ဗဟန(နိုင်)၀၈၄၅၄၄.).

(ခ) ကုမ္ပဏီ ရုံးခန်းလိပ်စာ၊ အမှတ်(၁၂၃)၊ အလံပြဘုရားလမ်း၊.....
ဒဂုံမြို့နယ်၊ ရန်ကုန်မြို့။.....

(ဂ) ဆက်သွယ်ရန် ဖုန်းနံပါတ်၊ ၀၁-၂၅၅၈၃၉၊ ၀၁-၂၅၅၈၃၃.....

(ဃ) ဒါရိုက်တာများ အမည်စာရင်း-(၁). ဦးစိုးတင့်.....
၁၂/ကမတ(နိုင်)၀၁၈၇၄၅၅
(၂) ဦးအုန်းကျော် (ခ) ဦးအေးသွင်
၁၄/ရကန(နိုင်)၀၁၇၀၈၄
(၃) ဒေါ်ခွေးခွေးခိုင်
၁၂/ကမရ(နိုင်)၀၀၇၀၄၀

မှတ်ချက်။ (၁) ဤကုမ္ပဏီမှတ်ပုံတင်လက်မှတ်သည်မှတ်ပုံတင်ရက်စွဲ(၁၇-၁၂-၂၀၁၄)မှ (၁၆-၁၂-၂၀၁၉)ရက်နေ့အထိ(၅)နှစ်သက်တမ်းအတွက်သာ ဖြစ်သည်။ သက်တမ်း မကုန်ဆုံးမီ (၃)လအလိုတွင် သက်တမ်းတိုးရန် ရင်းနှီးမြှုပ်နှံမှုနှင့် ကုမ္ပဏီများ ညွှန်ကြားမှု ဦးစီးဌာနသို့ လျှောက်ထား ရမည်။

(၂) ကုမ္ပဏီ အနေဖြင့် သင်းဖွဲ့မှတ်တမ်းတွင်အဆိုပြု တင်ပြထားသော လုပ်ငန်းရည်ရွယ်ချက်များကိုသာ လုပ်ကိုင်ရမည်။

(၃) သင်းဖွဲ့မှတ်တမ်းပါ ရည်ရွယ်ချက်များသည် သက်ဆိုင်ရာ ပြည်ထောင်စု ဝန်ကြီးဌာန၏ တည်ဆဲဥပဒေ၊ နည်းဥပဒေ၊ လုပ်ထုံးလုပ်နည်း များနှင့်အညီ ခွင့်ပြုချက် ရရှိမှသာ ဆောင်ရွက်ခွင့် ရှိမည် ဖြစ်ပါသည်။

(၄) လုပ်ငန်းရည်ရွယ်ချက် ပြောင်းလဲ လုပ်ကိုင်လိုပါက ပြောင်းလဲ လုပ်ကိုင်လိုသည့် လုပ်ငန်း ရည်ရွယ်ချက်များအား သင်းဖွဲ့မှတ်တမ်းတွင် ပြင်ဆင်မှတ်ပုံတင်ရန်အတွက် ဒါရိုက်တာအဖွဲ့(BOD)၏ အထူး အစည်းအဝေး ဆုံးဖြတ်ချက် မှတ်တမ်းနှင့်အတူ ရင်းနှီးမြှုပ်နှံမှုနှင့်ကုမ္ပဏီများ ညွှန်ကြားမှု ဦးစီးဌာန သို့ လျှောက်ထား ရမည်။

ညွှန်ကြားရေးမှူးချုပ် (ကိုယ်စား)
(မော်မော်စိုး ၊ လက်ထောက်ညွှန်ကြားရေးမှူး)

လာရောက်ထုတ်ယူသည့် ရက်စွဲ၊

ပြည်ထောင်စုမြန်မာနိုင်ငံတော်အစိုးရ
သတ္တုတွင်းဝန်ကြီးဌာန
ဝန်ကြီးရုံး
ဓာတ်သတ္တုအကြီးစားထုတ်လုပ်ရန်ခွင့်ပြုမိန့်

ခွင့်ပြုမိန့်အမှတ် ၁၀၁၁ / ၂၀၀၉ — ရက်စွဲ ၂၀၀၉ ခုနှစ် [illegible] ရက်

အောက်ဖော်ပြပါ အဖွဲ့အစည်းအား မြန်မာ့သတ္တုတွင်းဥပဒေအရ အောက်ပါအချက်အလက်များနှင့်အညီ ဓာတ်သတ္တုအကြီးစားထုတ်လုပ်ရန်ခွင့်ပြုလိုက်သည် -

၁။ ခွင့်ပြုမိန့်ရသူ၏
(က) အမည်နှင့် မှတ်ပုံတင်အမှတ် -
(ခ) အဖွဲ့အစည်းအမည်နှင့် - မက်စ်မြန်မာကုမ္ပဏီအုပ်စု
အဖွဲ့အစည်းမှတ်ပုံတင်အမှတ် - ၆၀၉/၂၀၀၀-၂၀၀၁
(ဂ) ဆက်သွယ်ရန်နေရပ်လိပ်စာ - အမှတ်(၁)၊ ရွာမကျေး၊ ဘုရင့်နောင်လမ်း၊
တယ်လီဖုန်းအမှတ် ဖက်(စ်)အမှတ် - အကွက်အမှတ်(၂)၊ လှိုင်မြို့နယ်၊ ရန်ကုန်မြို့
ဖုန်း - ၀၉၅၀၉၂၆၆၃/၀၆၇-၄၁၄၉၉၇

၂။ ခွင့်ပြုဧရိယာ၏
(က) တည်နေရာ (ကျေးရွာ၊ မြို့နယ်၊ - တောင်ဇီလာဒေသ၊ လယ်ဝေးမြို့နယ်၊
ခရိုင်၊ ပြည်နယ်/တိုင်း) - နေပြည်တော်
(ခ) အကျယ်အဝန်း (စတုရန်းကီလိုမီတာ) - ၂၃၀ ဧက(၀.၉၃ စတုရန်းကီလိုမီတာ)
(ဂ) မြေပုံညွှန်းနှင့်နယ်နိမိတ်သတ်မှတ်ချက် [illegible] - မြေပုံညွှန်း၊ ၉၄-ဧ/၆ [illegible]
(ပူးတွဲမြေပုံပါအကျယ်အဝန်းအတိုင်း)

၃။ ခွင့်ပြုဧရိယာ၏နယ်မြေ - လယ်ဝေးမြို့နယ်အေးချမ်းသာယာရေးနှင့်ဖွံ့ဖြိုးရေးကောင်စီ
အုပ်ချုပ်မှုဆိုင်ရာအဖွဲ့အစည်း -

၄။ တစ်ဆင့်သွားလာဝင်ထွက်ခွင့် - လယ်ဝေးမြို့နယ်

၅။ ခွင့်ပြုသည့်ဓာတ်သတ္တုအမျိုးအစား - ထုံးကျောက်(စက်မှုတွင်းထွက်ကုန်ကြမ်း)

၆။ ခွင့်ပြုသည့်ဓာတ်သတ္တုတူးဖော်မှုနှင့် - မြေပေါ်ဟင်းလင်းဖွင့်တူးဖော်သည့်နည်း
ဆင့်တက်မြှင့်မှုနည်းစနစ် -

၇။ ခွင့်ပြုသက်တမ်းကာလ - (၁၀) နှစ်

၈။ စတင်လုပ်ကိုင်ခွင့်ပြုသည့်ရက်စွဲ - ၁၈. ၈. ၂၀၀၉

၉။ ခွင့်ပြုမိန့်ကုန်ဆုံးသည့်ရက်စွဲ - ၁၇. ၈. ၂၀၁၉

၁၀။ ပုံသေမြေငှါးရမ်းခ (Dead Rent) - တစ်စတုရန်းကီလိုမီတာလျှင် ၂၁၁၀/ နှုန်းပေး ဆောင်ရန်

၁၁။ ဓာတ်သတ္တုခွန် - ၃%

၁၂။ စည်းကမ်းချက်များ - တစ်ဖက်ပါစည်းကမ်းချက်များကို တိကျစွာ လိုက်နာရမည်။

ဝန်ကြီး
သတ္တုတွင်းဝန်ကြီးဌာန

ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်အစိုးရ
သတ္တုတွင်းဝန်ကြီးဌာန
ဝန်ကြီးရုံး
တတ်သတ္တုအကြီးစားထုတ်လုပ်ရန်ခွင့်ပြုမိန့်

ခွင့်ပြုမိန့်အမှတ်၊ ဝဝ၁၅ / ၂၁၁၅ ရက်စွဲ၊ ၂၀၁၅ ခုနှစ်၊ ဇွန်လ ၂၈ ရက်။

အောက်ဖော်ပြပါ အဖွဲ့အစည်းအား မြန်မာ့သတ္တုတွင်းဥပဒေအရ အောက်ပါအခွင့်အလမ်းများနှင့်အညီ ဓာတ်သတ္တု အကြီးစားထုတ်လုပ်ရန်ခွင့်ပြုလိုက်သည်-

၁။ ခွင့်ပြုဧရိယာ၏

(က) အမည်နှင့် နိုင်ငံသားစိစစ်ရေးကတ်ပြားအမှတ်-

(ခ) အဖွဲ့အစည်းအမည်နှင့် - မက်စ်(မြန်မာ)ထုတ်လုပ်မှုကုမ္ပဏီတုပ်စု

အဖွဲ့အစည်းပုဒ်ပုံတင်အမှတ် - ၁၂၃၀/၂၀၀၇-၂၀၀၈

(ဂ) ဆက်သွယ်ရန်နေရပ်လိပ်စာ - အမှတ်(၁၂၃)၊အလံပြဘုရားလမ်း၊ ခရိုင်မြို့နယ်၊

တယ်လီဖုန်းအမှတ်၊ ဖက်(စ်) အမှတ် - ရန်ကုန်တိုင်းဒေသကြီး
ဖုန်း- ၀၁-၂၇၅၈၁၉၊ ၀၁-၂၇၅၈၃၈

၂။ ခွင့်ပြုဧရိယာ၏

(က) တည်နေရာ (ကျေးရွာ၊ မြို့နယ်၊ - ဘုရားတုန်းလုပ်ကွက်၊ တောင်ဗိလာဒေသ၊
ခရိုင်၊ ပြည်နယ်/တိုင်းဒေသကြီး) - လယ်ဝေးမြို့နယ်၊ နေမြည်တော်

(ခ) အကျယ်အဝန်း (ဝတ္ထုရန်းကီလိုမီတာ) - ၅၀ စတု (၀.၂၀၂၃ ဝတ္ထုရန်းကီလိုမီတာ)

(ဂ) နယ်နိမိတ်သတ်မှတ်ချက် - မြေပုံညွှန်းစဉ် ဘေ/၆၊၇(၈၈၂၆၅၉၊၈၈၃၀၆၅၅၊၈၈၃၀၆၅၅၊
၈၈၃၀၆၄၉၊၈၈၂၆၄၉)(ပူးတွဲမြေပုံပါအကျယ်အဝန်းအတိုင်း)

၃။ ခွင့်ပြုဧရိယာ၏နယ်မြေ - လယ်ဝေးမြို့နယ်အထွေထွေအုပ်ချုပ်ရေးဦးစီးဌာန
အုပ်ချုပ်မှုဆိုင်ရာအဖွဲ့အစည်း

၄။ တစ်ဆင့်ဆွေးလာဝင်ထွက်ခွင့် - လယ်ဝေးမြို့နယ်

၅။ ခွင့်ပြုသည့်ဓာတ်သတ္တုအမျိုးအစား - ထုံးကျောက်(စက်မှုတွင်းထွက်တုန်ကြမ်း)

၆။ ခွင့်ပြုသည့်ဓာတ်သတ္တုတူးဖော်မှုနှင့် - မြေပေါ်ဟင်းလင်းဖွင့်တူးဖောက်ခြင်း၊အမှတ်(၃)သတ္တုတွင်းလုပ်ငန်း
မှ ဆောတူခွင့်ပြုသော ဆင့်တက်မြြင်ခြင်းနည်းစနစ်

၇။ ခွင့်ပြုသက်တမ်း - (၁၀) နှစ်

၈။ စတင်လုပ်ကိုင် ခွင့်ပြုသည့်ရက်စွဲ - ၁၈ . ၃ . ၂၀၁၅

၉။ ခွင့်ပြုမိန့်ကုန်ဆုံးသည့်ရက်စွဲ - ၁၇ . ၃ . ၂၀၂၅

၁၀။ ပုံသေမြေငှားရမ်းခ (Dead Rent) -

(က) ထူထောင်ပုံကာလ - ပထမနှစ် တစ်စတုရန်းကီလိုမီတာအတွက် ၁၄၀၀၀၀၀ ကျပ်နှုန်း

(ခ) ထုတ်လုပ်မှုကာလ - တစ်စတုရန်းကီလိုမီတာအတွက်တစ်နှစ်လျှင် ၂၀၀၀၀၀၀ ကျပ်နှုန်း

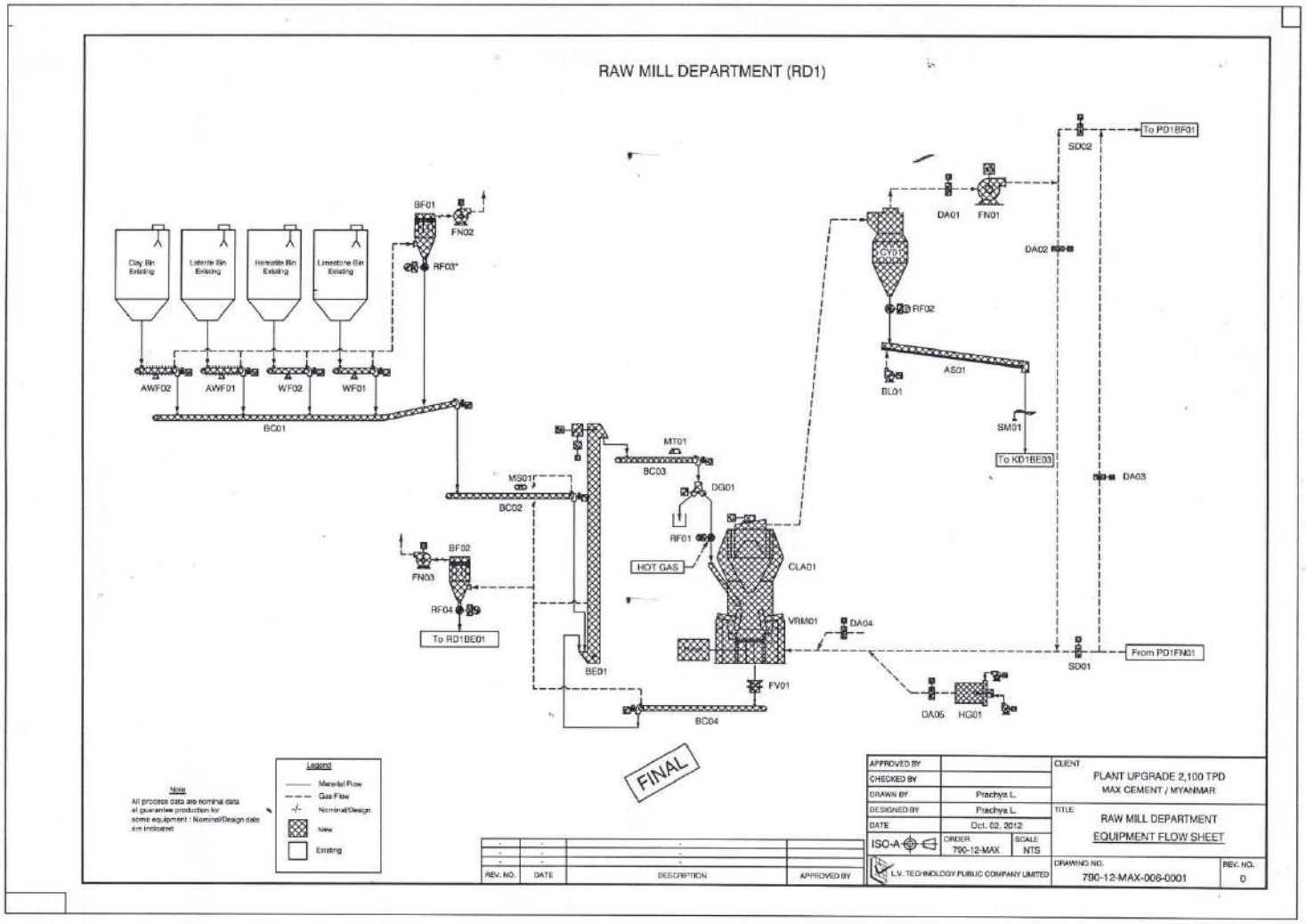
၁၁။ တတ်သတ္တုခွန် - (၃ %)

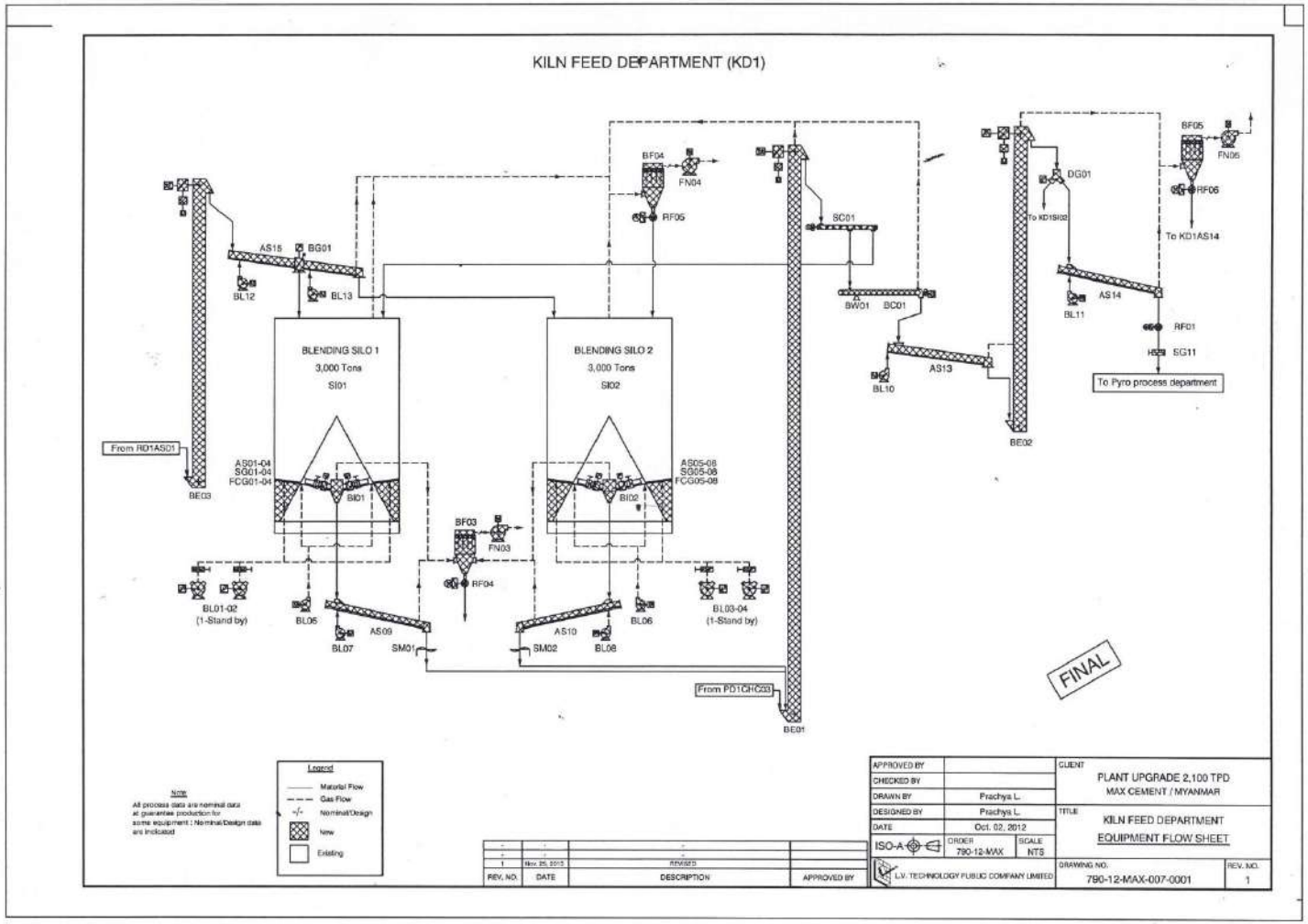
၁၂ စည်းကမ်းချက်များ - အောက်ပါစည်းကမ်းချက်များအတိုင်းတိကျစွာလိုက်နာရမည်။

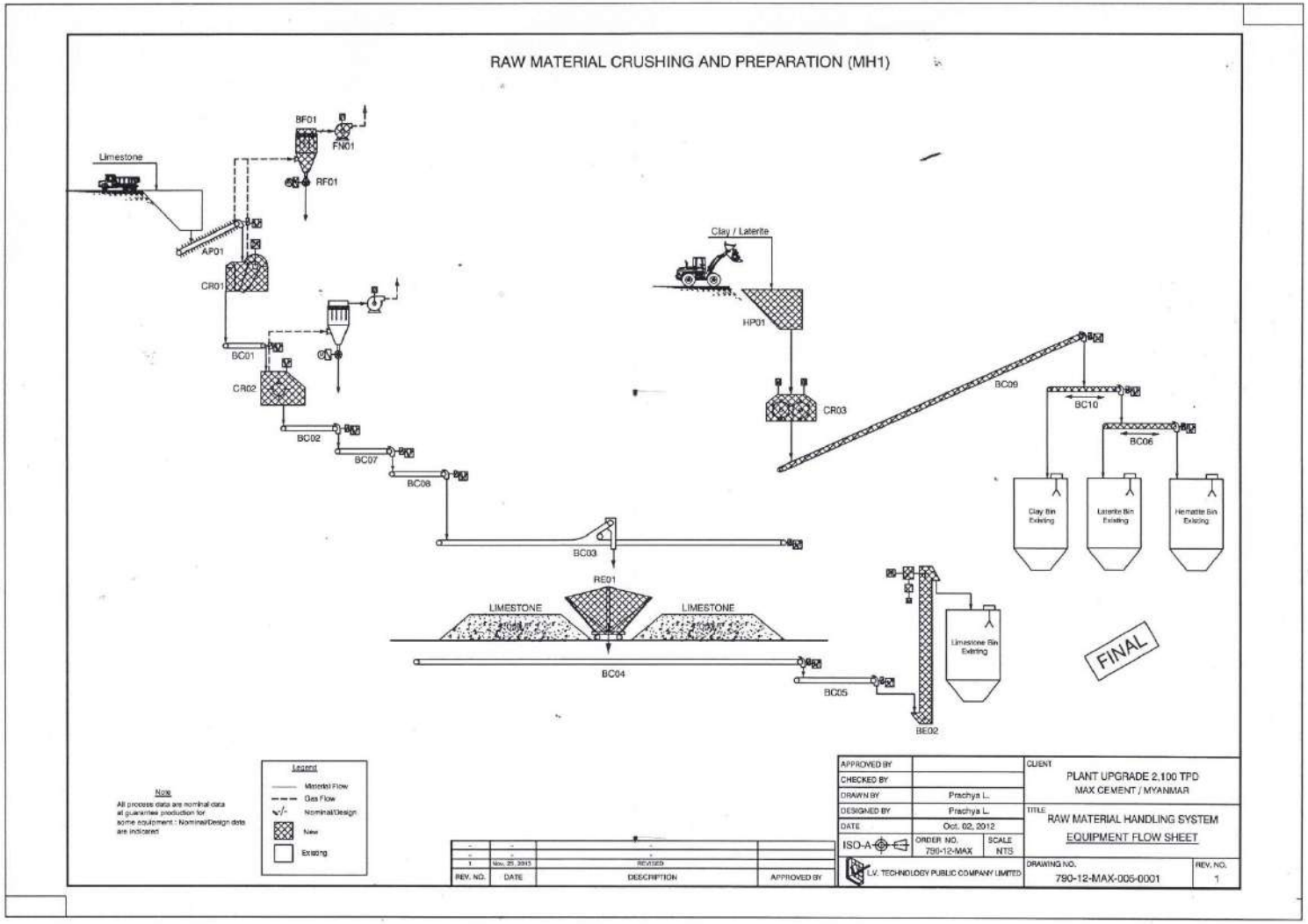
စည်းကမ်းချက်များ

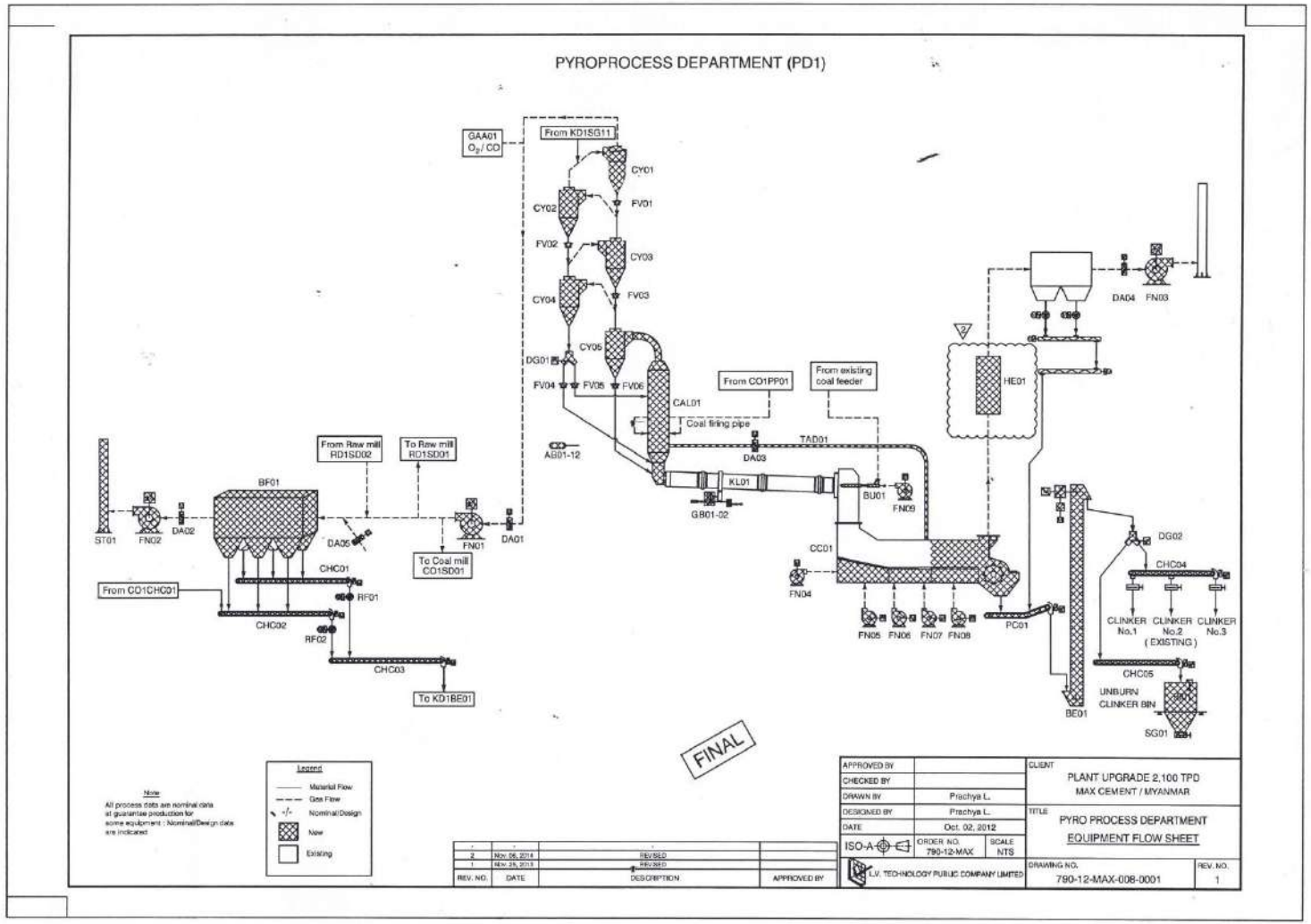
၁။ ဓာတ်သတ္တုထုတ်လုပ်ရန် ခွင့်ပြုမိန့်ရရှိသူသည်-

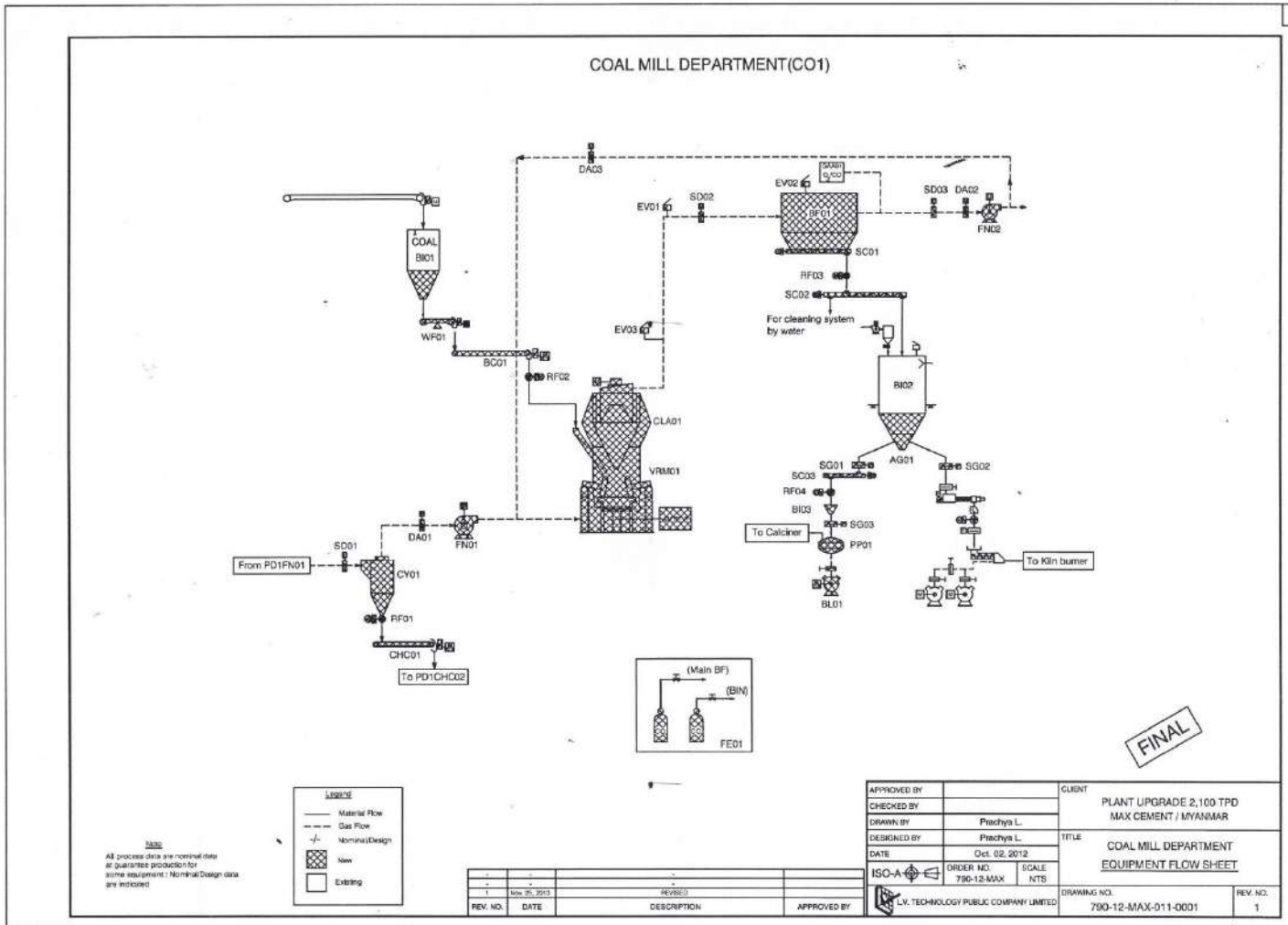
(က) ခွင့်ပြုဧရိယာသို့ဥပဒေနှင့်အညီ ဝင်ရောက်လုပ်ကိုင်ခွင့်ပိုသည်။

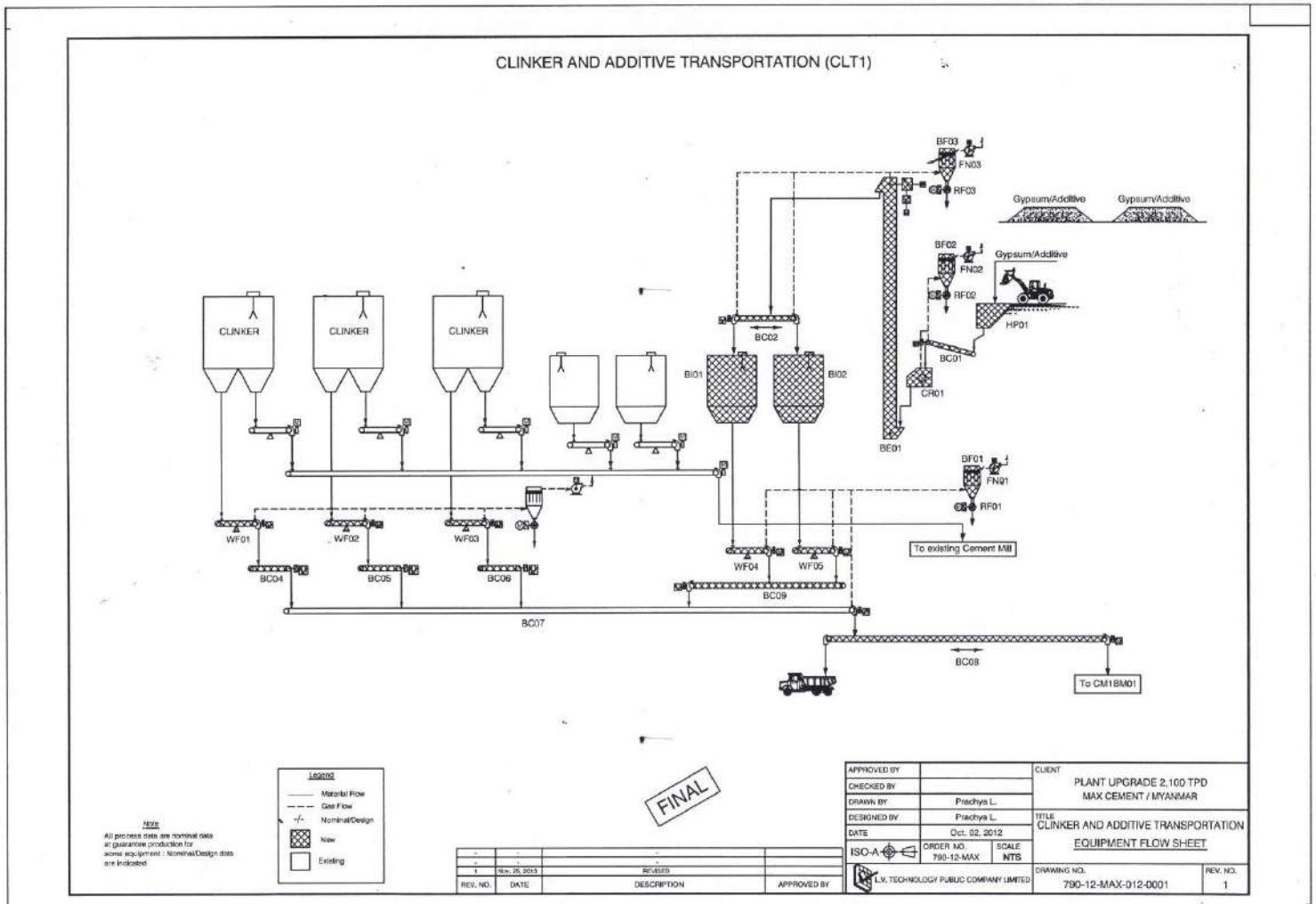

RAW MILL DEPARTMENT (RD1)
Clay Bin Existing
Laterite Bin Existing
Hematite Bin Existing
Limestone Bin Existing
AWF02
AWF01
WF02
WF01
BC01
BF01
FN02
RF03*
BC02
MS01
MT01
BC03
DG01
RF01
HOT GAS
CLA01
BF02
FN03
RF04
To RD1BE01
BE01
VRM01
DA04
FV01
BC04
DA05
HG01
From PD1FN01
SD01
DA01
FN01
SD02
To PD1BF01
CY01
RF02
DA02
AS01
BL01
SM01
To KD1BE03
DA03
FINAL
Note
All process data are nominal data at guarantee production for some equipment : Nominal/Design data are indicated
Legend
Material Flow
Gas Flow
Nominal/Design
New
Existing
REV. NO.
DATE
DESCRIPTION
APPROVED BY
APPROVED BY
CHECKED BY
DRAWN BY
Prachya L.
DESIGNED BY
Prachya L.
DATE
Oct. 02, 2012
ISO-A
ORDER
790-12-MAX
SCALE
NTS
L.V. TECHNOLOGY PUBLIC COMPANY LIMITED
CLIENT
PLANT UPGRADE 2,100 TPD
MAX CEMENT / MYANMAR
TITLE
RAW MILL DEPARTMENT
EQUIPMENT FLOW SHEET
DRAWING NO.
790-12-MAX-006-0001
REV. NO.
0

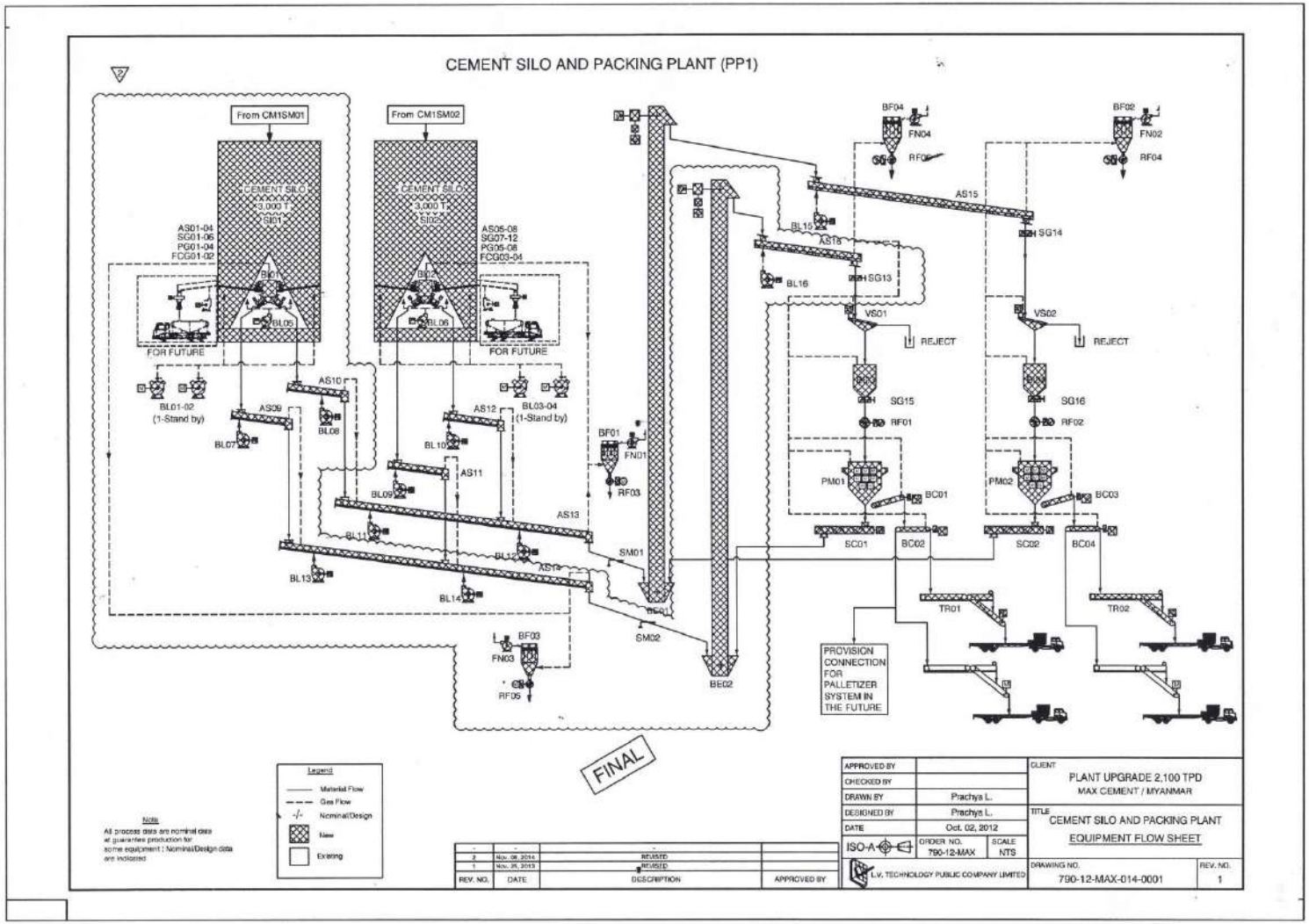

KILN FEED DEPARTMENT (KD1)
BLENDING SILO 1
3,000 Tons
SI01
BLENDING SILO 2
3,000 Tons
SI02
From RD1AS01
To Pyro process department
To KD1SI02
To KD1AS14
From PD1CHC03
FINAL
Legend
Material Flow
Gas Flow
Nominal/Design
New
Existing
Note
All process data are nominal data at guarantee production for some equipment : Nominal/Design data are indicated
APPROVED BY
CHECKED BY
DRAWN BY
Prachya L.
DESIGNED BY
Prachya L.
DATE
Oct. 02, 2012
ISO-A
ORDER
790-12-MAX
SCALE
NTS
CLIENT
PLANT UPGRADE 2,100 TPD
MAX CEMENT / MYANMAR
TITLE
KILN FEED DEPARTMENT
EQUIPMENT FLOW SHEET
L.V. TECHNOLOGY PUBLIC COMPANY LIMITED
DRAWING NO.
790-12-MAX-007-0001
REV. NO.
1
REV. NO.
DATE
DESCRIPTION
APPROVED BY
1
Nov. 25, 2015
REVISED

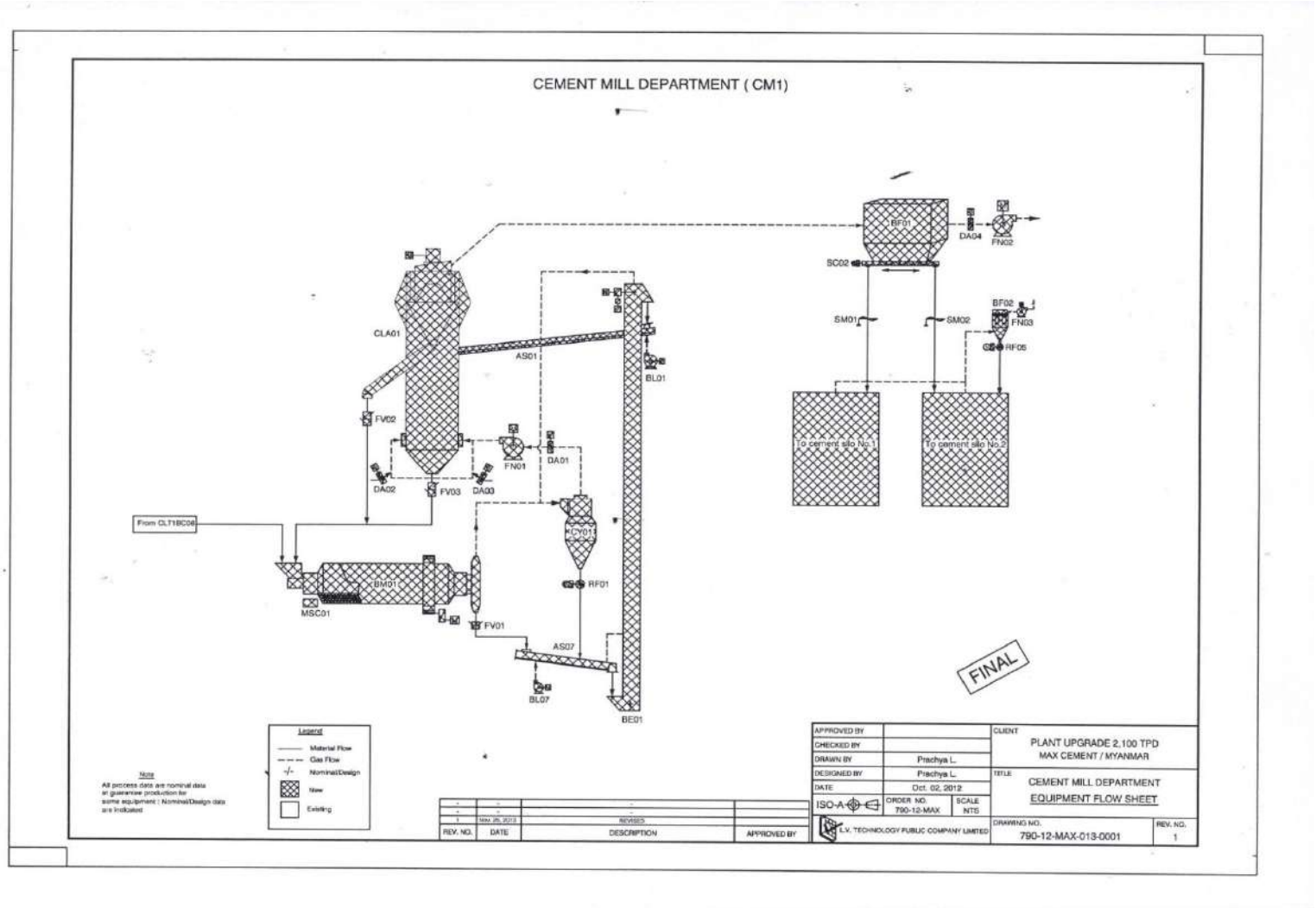

RAW MATERIAL CRUSHING AND PREPARATION (MH1)
Limestone
BF01
FN01
RF01
AP01
CR01
BC01
CR02
BC02
BC07
BC08
BC03
RE01
LIMESTONE
LIMESTONE
BC04
BC05
RE02
Clay / Laterite
HP01
CR03
BC09
BC10
BC06
Clay Bin Existing
Laterite Bin Existing
Hematite Bin Existing
Limestone Bin Existing
FINAL
Legend
Material Flow
Gas Flow
Nominal/Design
New
Existing
Note
All process data are nominal data at guarantee production for some equipment : Nominal/Design data are indicated
REV. NO. DATE DESCRIPTION APPROVED BY
1 Nov. 25, 2013 REVISED
APPROVED BY
CHECKED BY
DRAWN BY Prachya L.
DESIGNED BY Prachya L.
DATE Oct. 02, 2012
ISO-A
ORDER NO. 790-12-MAX
SCALE NTS
L.V. TECHNOLOGY PUBLIC COMPANY LIMITED
CLIENT
PLANT UPGRADE 2,100 TPD
MAX CEMENT / MYANMAR
TITLE
RAW MATERIAL HANDLING SYSTEM
EQUIPMENT FLOW SHEET
DRAWING NO. 790-12-MAX-005-0001
REV. NO. 1


PYROPROCESS DEPARTMENT (PD1)
GAA01
O_2/ CO
From KD1SG11
CY01
CY02
CY03
CY04
CY05
FV01
FV02
FV03
DG01
FV04
FV05
FV06
CAL01
Coal firing pipe
From CO1PP01
From existing coal feeder
AB01-12
DA03
TAD01
KL01
GB01-02
BU01
FN09
HE01
DA04
FN03
From Raw mill RD1SD02
To Raw mill RD1SD01
To Coal mill CO1SD01
ST01
FN02
DA02
BF01
DA05
FN01
DA01
CHC01
From CO1CHC01
RF01
CHC02
RF02
CHC03
To KD1BE01
CC01
FN04
FN05
FN06
FN07
FN08
PC01
DG02
CHC04
CLINKER No.1
CLINKER No.2 (EXISTING)
CLINKER No.3
CHC05
UNBURN CLINKER BIN
BE01
SG01
FINAL
Note
All process data are nominal data at guarantee production for some equipment : Nominal/Design data are indicated
Legend
Material Flow
Gas Flow
Nominal/Design
New
Existing
REV. NO. | DATE | DESCRIPTION | APPROVED BY
2 | Nov. 06, 2014 | REVISED
1 | Nov. 25, 2013 | REVISED
APPROVED BY
CHECKED BY
DRAWN BY | Prachya L.
DESIGNED BY | Prachya L.
DATE | Oct. 02, 2012
ISO-A1
ORDER NO. 790-12-MAX
SCALE NTS
I.V. TECHNOLOGY PUBLIC COMPANY LIMITED
CLIENT
PLANT UPGRADE 2,100 TPD MAX CEMENT / MYANMAR
TITLE
PYRO PROCESS DEPARTMENT
EQUIPMENT FLOW SHEET
DRAWING NO. 790-12-MAX-008-0001
REV. NO. 1

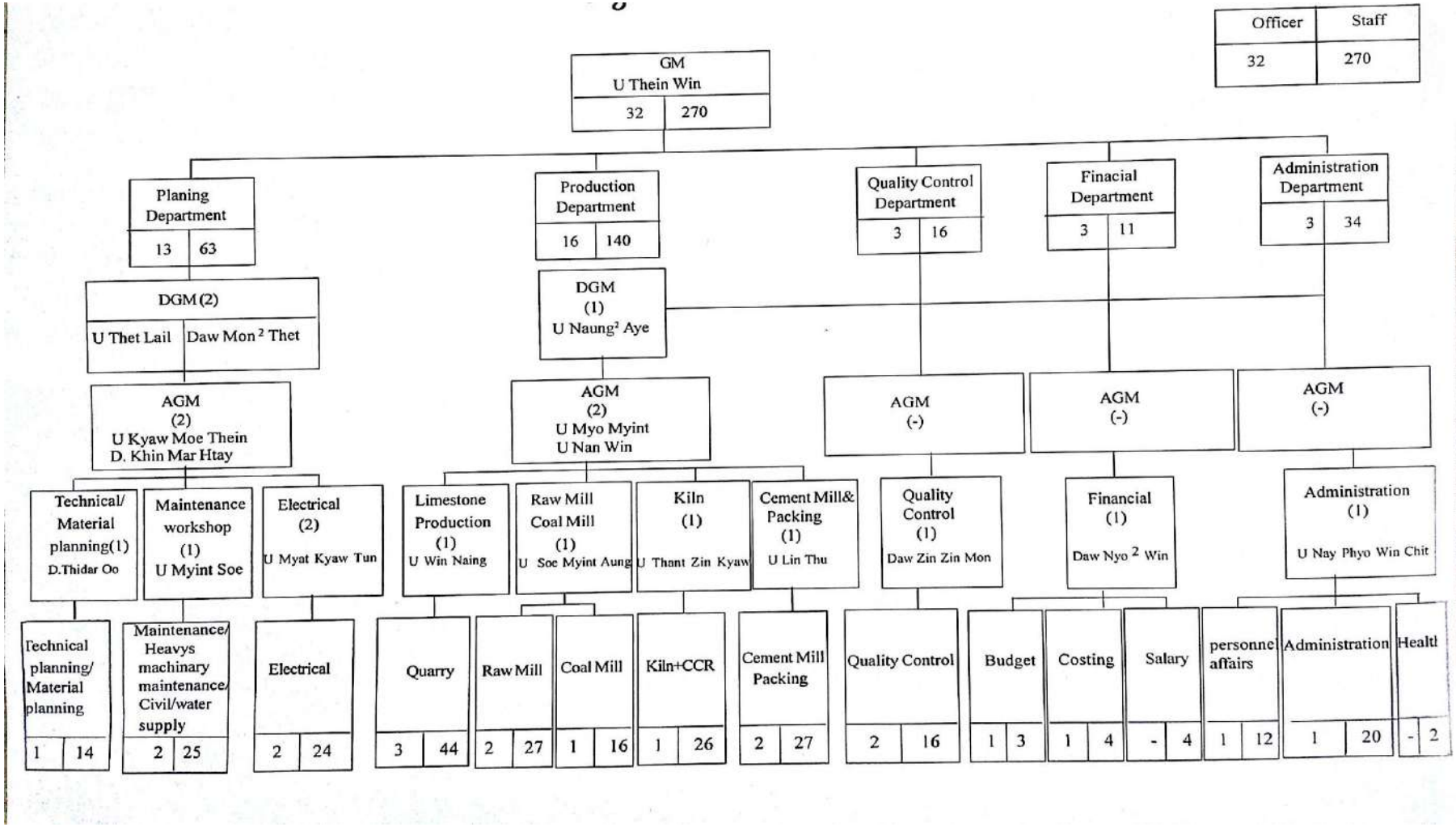

COAL MILL DEPARTMENT(CO1)
DA03
EV02
SD03
DA02
EV01
SD02
BF01
FN02
COAL
BI01
SC01
RF03
SC02
WF01
EV03
For cleaning system by water
BC01
RF02
BI02
CLA01
VRM01
AG01
SG01
SG02
SC03
RF04
BI03
SG03
To Calciner
PP01
To Kiln burner
BL01
DA01
FN01
SD01
From PD1FN01
CY01
RF01
CHC01
To PD1CHC02
(Main BF)
(BIN)
FE01
FINAL
Legend
Material Flow
Gas Flow
Nominal/Design
New
Existing
Note
All process data are nominal data at guarantee production for some equipment : Nominal Design data are indicated
REV. NO.
DATE
DESCRIPTION
APPROVED BY
1
Nov 25, 2013
REVISED
APPROVED BY
CHECKED BY
DRAWN BY
Prachya L.
DESIGNED BY
Prachya L.
DATE
Oct. 02, 2012
ISO-A
ORDER NO.
790-12-MAX
SCALE
NTS
L.V. TECHNOLOGY PUBLIC COMPANY LIMITED
CLIENT
PLANT UPGRADE 2,100 TPD
MAX CEMENT / MYANMAR
TITLE
COAL MILL DEPARTMENT
EQUIPMENT FLOW SHEET
DRAWING NO.
790-12-MAX-011-0001
REV. NO.
1


CLINKER AND ADDITIVE TRANSPORTATION (CLT1)
CLINKER
CLINKER
CLINKER
BF03
FN03
RF03
Gypsum/Additive
Gypsum/Additive
BF02
FN02
RF02
Gypsum/Additive
HP01
BC02
BC01
CR01
BI01
BI02
BE01
BF01
FN01
RF01
To existing Cement Mill
WF01
WF02
WF03
WF04
WF05
BC04
BC05
BC06
BC09
BC07
BC08
To CM1BM01
Legend
Material Flow
Gas Flow
Nominal/Design
New
Existing
Note
All process data are nominal data at guarantee production for some equipment : Nominal/Design data are indicated
FINAL
REV. NO.
DATE
DESCRIPTION
APPROVED BY
1
Nov. 25, 2013
REVISED
APPROVED BY
CHECKED BY
DRAWN BY
Prachya L.
DESIGNED BY
Prachya L.
DATE
Oct. 02, 2012
ISO-A
ORDER NO.
790-12-MAX
SCALE
NTS
I.V. TECHNOLOGY PUBLIC COMPANY LIMITED
CLIENT
PLANT UPGRADE 2,100 TPD
MAX CEMENT / MYANMAR
TITLE
CLINKER AND ADDITIVE TRANSPORTATION
EQUIPMENT FLOW SHEET
DRAWING NO.
790-12-MAX-012-0001
REV. NO.
1


CEMENT SILO AND PACKING PLANT (PP1)
From CM1SM01
From CM1SM02
CEMENT SILO 3,000 T SI01
CEMENT SILO 3,000 T SI02
FOR FUTURE
FOR FUTURE
BL01-02 (1-Stand by)
BL03-04 (1-Stand by)
AS01-04 SG01-06 PG01-04 FCG01-02
AS05-08 SG07-12 PG05-08 FCG03-04
AS09
AS10
AS11
AS12
AS13
AS14
AS15
AS16
BL07
BL08
BL09
BL10
BL11
BL12
BL13
BL14
BL15
BL16
BF01
FN01
RF03
BF02
FN02
RF04
BF03
FN03
RF05
BF04
FN04
RF06
SM01
SM02
BE02
VS01
VS02
REJECT
REJECT
SG13
SG14
SG15
SG16
RF01
RF02
PM01
PM02
BC01
BC03
SC01
SC02
BC02
BC04
TR01
TR02
PROVISION CONNECTION FOR PALLETIZER SYSTEM IN THE FUTURE
FINAL
Legend
Material Flow
Gas Flow
Nominal/Design
New
Existing
Note
All process data are nominal data at guarantee production for some equipment : Nominal/Design data are indicated
APPROVED BY
CHECKED BY
DRAWN BY Prachya L.
DESIGNED BY Prachya L.
DATE Oct. 02, 2012
ISO-A
ORDER NO. 790-12-MAX
SCALE NTS
L.V. TECHNOLOGY PUBLIC COMPANY LIMITED
CLIENT
PLANT UPGRADE 2,100 TPD
MAX CEMENT / MYANMAR
TITLE
CEMENT SILO AND PACKING PLANT
EQUIPMENT FLOW SHEET
DRAWING NO. 790-12-MAX-014-0001
REV. NO. 1
REV. NO. DATE DESCRIPTION APPROVED BY
2 Nov. 06, 2014 REVISED
1 Nov. 25, 2013 REVISED



Drawing showing steps in the manufacturing of cement



Staff organization

Golden Lion Wire Co.,Ltd

The VOICE Daily

AIR KBZ

Vol. 4 / No. 135 Established in 2004 ... September 15, 2016)

မြန်မာနိုင်ငံ ပြည်တွင်းစစ်ကို ဒေါ်အောင်ဆန်းစုကြည် အဆုံးသတ်နိုင်ပါမည်လော

စောင့်ကြည့်လေ့လာမြင်။ ရပ်မြို့အဖွဲ့...

ထုံးကျောက်တူးဖော်ရေးအတွက် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ် ရေးဆွဲမည်

ရန်ကုန်၊ စက်တင်ဘာ ၁၄

ရန်ကုန်တိုင်းဒေသကြီးအတွင်း ထုံးထုတ်လုပ်ရေးလိုအပ်ချက်ကို ထုံးကျောက်တူးဖော်ရေးအတွက် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ် ရေးဆွဲမည်ဖြစ်ကြောင်း

ဘိလပ်မြေစက်ရုံစီမံကိန်း အကောင်အထည်ဖော်ရန် ထုံးကျောက်တောင်လုပ်ကွက်အတွက် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ် (EMP) ရေးဆွဲမည်ဖြစ်ကြောင်း Myanmar Environment Sustainable Conservation Co.,Ltd.(MESC) ထံမှ သိရသည်။

နေပြည်တော် လယ်ဝေးမြို့နယ်၊ ဇလီဂက်ကြီးတောင်အုပ်စု၊ အောင်နန်းချိုကျေးရွာ၌ စက်တင်ဘာလ ၁၁ ရက်နေ့က Max Myanmar Manufacturing Co.,Ltd. ကဦးစီး၍ ဘိလပ်မြေစက်ရုံစီမံကိန်း၏ ထုံးကျောက်တောင်လုပ်ကွက်အတွက် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ် (Environmental Management Plan- EMP) ကိုရေးဆွဲရန် လူထုတွေ့ဆုံပွဲ ပြုလုပ်ခဲ့ကြောင်း MESC မှ အမှုဆောင် ဒါရိုက်တာ ဦးမြင့်ကျော်သူရက ပြောကြားသည်။

အဆိုပါစီမံကိန်း၏ ထုံးကျောက်တောင်လုပ်ကွက် ၂၃၀ ဧကနှင့် ဧက ၅၀ အတွက် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ် လုပ်ငန်းများကို ဒေသခံများအား ရှင်းလင်းတင်ပြခဲ့ပြီး ၎င်းတို့၏လိုအပ်ချက်နှင့် သဘောထားကို မေးမြန်းခဲ့ရာတွင် ယင်းဒေသ၌ လျှပ်စစ်မီးလိုအပ်ချက် ရှိနေသည့်အတွက် လျှပ်စစ်မီးအထောက်အပံ့ပေးစေလိုရာ ကုမ္ပဏီက ကျေးရွာရှိ စာသင်ကျောင်း နှင့် လမ်းမီးများကို စတင်ပေးထားကြောင်း ၎င်းကပြောဆိုသည်။

စီမံကိန်းကို နေပြည်တော်၊ လယ်ဝေးမြို့နယ်မှ မိုင် ၃၀ အကွာ ဇလီဂက်ကြီးတောင်အုပ်စု၊ အောင်နန်းချိုကျေးရွာအနီးတွင် အကောင်အထည်ဖော် ဆောင်ရွက်မည်ဖြစ်ပြီး တစ်နေ့လျှင် ဘိလပ်မြေတန်ချိန် ၂၁၀၀ ထွက်ရှိမည်ဖြစ်ကြောင်း စီမံကိန်းဆိုင်ရာ အချက်အလက်များအရ သိရသည်။ ■

The Voice Daily (15-9-2016)

ကျေးရွာအမည်-

နေ့စွဲ-

အစည်းအဝေးတက်ရောက်သူများစာရင်း

စဉ်	အမည်	လက်မှတ်	မှတ်ချက်
၁.			
၂.			
၃.			
၄.			
၅.			
၆.			
၇.			
၈.			
၉.			
၁၀.			
၁၁.			
၁၂.			
၁၃.			
၁၄.			
၁၅.			

ကျေးရွာအမည်- [illegible]

နေ့စွဲ- ၁၁ - ၉ - ၂၀၁၆

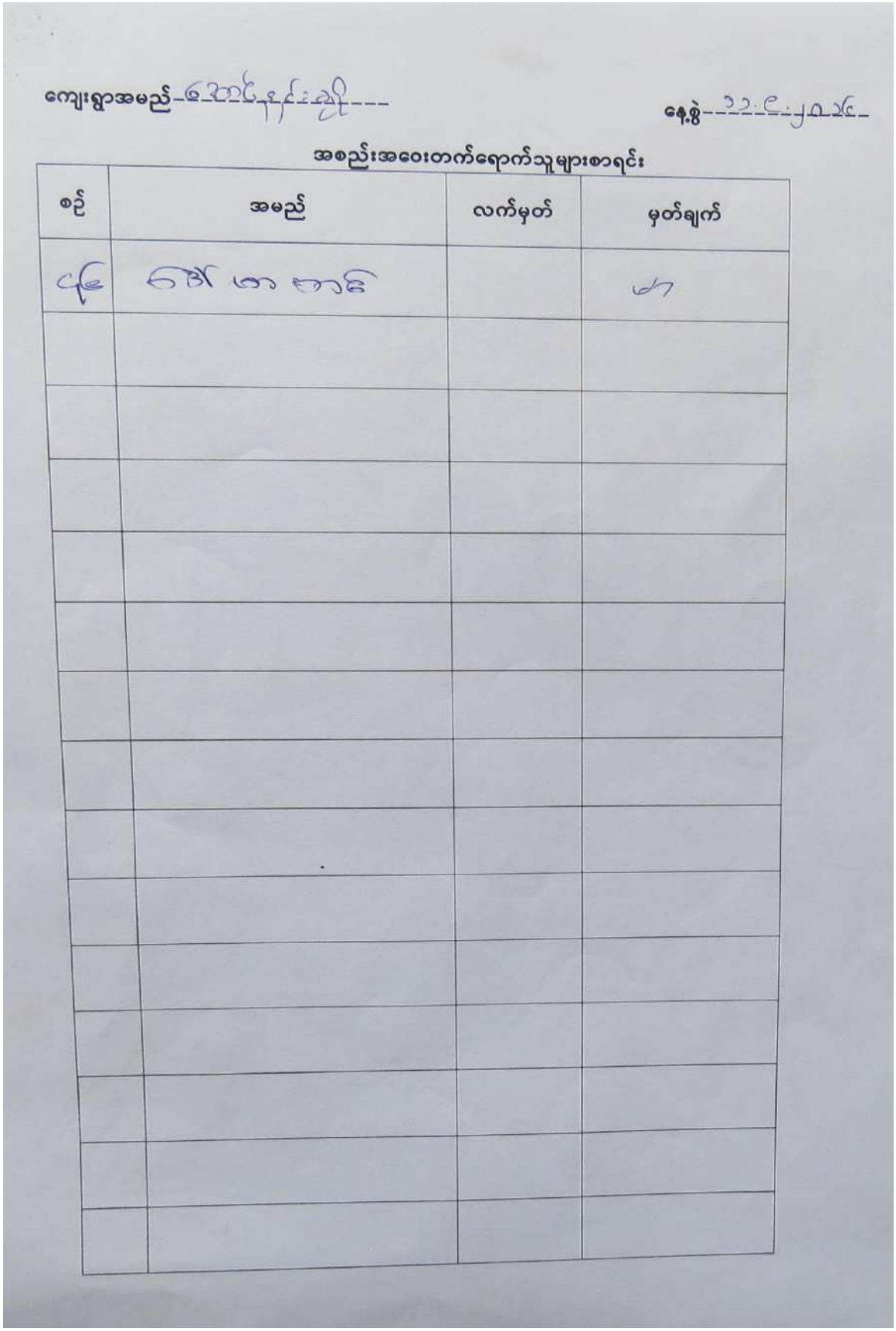
အစည်းအဝေးတက်ရောက်သူများစာရင်း

စဉ်	အမည်	လက်မှတ်	မှတ်ချက်
၁၆	ဦး အောင်ကြိုင်	[illegible]	
၁၇	ဦး ပန်းမြ	[illegible]	
၁၈	ဦး အောင်ဇော်ဝင်း	[illegible]	
၁၉	ဦး ကျော်အေး	[illegible]	
၂၀	ဦး အေးကြိုင်ထွန်း	[illegible]	
၂၁	ဦး အောင်ဖိုး	[illegible]	
၂၂	ဒေါ် [illegible]	[illegible]	
၂၃	ဦး ဦးပို	[illegible]	
၂၄	ဦး ညွန့်အောင်	[illegible]	
၂၅	ဦး [illegible] အောင်ဦး	[illegible]	
၂၆	ဦး ဦးထွန်း	[illegible]	
၂၇	ဦး ကျော်ဝင်း	ကျော်ဝင်း	
၂၈	ဦး [illegible] လေး	[illegible]	
၂၉	ဦး [illegible] တင်	[illegible]	
၃၀	ဦး [illegible]	[illegible]	

ကျေးရွာအမည် ကောင်းနှင်းကြို   နေ့စွဲ ၁၁-၉-၂၀၁၈

အစည်းအဝေးတက်ရောက်သူများစာရင်း

စဉ်	အမည်	လက်မှတ်	မှတ်ချက်
၃၁	ဦးကျော်မင်းဦး	ကျော်	ကျော်
၃၂	ဦးဗိုအောင်	ဗိုအောင်	
၃၃	ဦးအောင်မြင့်	မြင့်	
၃၄	ဦးသန်းဦး	ဦး	
၃၅	ဦးဦးဝင်း	ဝင်း	
၃၆	ဦးရဲမင်းဦး	[illegible]	
၃၇	ဒေါ်ငွေ	ငွေ	
၃၈	ဒေါ်စောရီ	ရီ	
၃၉	ဦးကျော်မင်းဦး	[illegible]	
၄၀	ဦးသံတင်	တင်	
၄၁	ဦးဝိုကာဝင်း	ဝင်	
၄၂	ဦးအောင်မြင့်	မြင့်	
၄၃	ဒေါ်ခင်သန်း	သန်း	
၄၄	ဦးကျော်လှဝင်း	Zaw	
၄၅	ဦးအောင်ငြိမ်း	ငြိမ်း	



ကျေးရွာအမည်-ဒေါင်နှင်းချိုကြီး

နေ့စွဲ-၁၁-၉-၂၀၂၄

အစည်းအဝေးတက်ရောက်သူများစာရင်း

စဉ်	အမည်	လက်မှတ်	မှတ်ချက်
၁	ဒေါ်ဟာဟာဆင်		ဟ

Lists of attendees at the public consultation meeting

MESC

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Email: myanmar.esc@gmail.com