ENVIRONMENTAL IMPACT ASSESSMENT GUIDELINES FOR CEMENT INDUSTRY

Department Of Environment
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Finally, we wish to acknowledge all stakeholders for their great contribution in the development of this Guideline.

PREFACE

This Environmental Impact Assessment Guidelines for Cement Industry is a revised version of Environmental Impact Assessment Guidelines for Industrial Projects that was published in 2007, where the Cement Industry was placed under Non-Metallic Industries category (Annex C). The Guidelines is issued in order to conform to the latest amendments specified in the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015; which is a subsidiary legislation to the Environmental Quality Act (EQA) 1974 (Act 127). Furthermore, the Department of Environment has rationalized the EIA process in order to ensure that it complies with the scope, functions and vision of the Department's Environmental Management Strategic Plan. The Plan emphasizes on the adoption of Environmental Mainstreaming and Guided Self-Regulation principles. These Guidelines are complementary to and shall be referred together with the Environmental Impact Assessment Guidelines in Malaysia (EGIM) Document 2016.

The Government of Malaysia is actively pursuing with its policy and objective of transforming the Nation's economy into a high-income country status through adoption of environmental sustainability practices. The urgency with which economic, social and political objectives must be achieved through development has greatly taxed the nation's natural resources, such as land, forests and water, whilst the discharge of wastes of various kinds has resulted in the degradation of rivers, the seas and air. In this context it is important that environmental and social safeguards are considered and incorporated in the development of Cement Industries at the planning stage

An EIA process should therefore focus on wastes management with emphasis on reducing, reusing, recycling and repurposing materials and their individual elements for as long as possible before they are ultimately discarded to the environment. This practice not only conserves and preserves scarce natural resources, prevents further degradation of ecosystems which human beings depend for survival, but also protects against air, water and land pollution and contamination. In this respect circular economic practices must be an essential ingredient for ensuring an environmentally sustainable Project. This aspect is emphasized in these Guidelines.

The EIA process is meant to be an added dimension in an overall holistic project planning process for Cement Industries; complementing technical, financial and economic planning tools. The process considers, assesses and evaluates in greater depth the potential impacts on environmental receptors and natural resources located beyond Project boundaries. These Guidelines outline the principal activities associated with the planning, construction, operations and abandonment of Cement Industries, and describes the processes, and range of tools, that can be adopted to assess and evaluate the spatial and temporal impacts on identified receptors located in the vicinity of the Project Site(s).

Cement industries are renowned for their high emissions of Green House Gases; especially carbon dioxide through high temperature decomposition of limestone and combustion of fuels to generate heat. Dust dispersions can also be problematic inducing potential health impediments amongst surrounding communities. Sourcing of raw materials, and plant operations, can induce significant noise and vibration impacts and the process can lead to scarring of landscapes. As such the EIA process should recommend proper siting of facilities; and explore the possibility of employing unconventional raw materials and renewable fuels to minimize environmental encumbrances.

These Guidelines are meant to guide Project Proponents, their Qualified Persons and other EIA practitioners in the preparation and submission of EIA reports related to the development, operations and potential abandonment of Cement Industries. They shall only be employed within the framework of the EQA 1974, including its future revisions and subsidiary legislations.

(NORLIN BINTI JAAFAR
Director General
Department of Environmental
Malaysia

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ABBREVIATIONS

AIs	Appointed Individuals
APCS	Air Pollution Control Systems
BATs	Best Available Technologies/Techniques
BMPs	Best Management Practices
BOD	Biochemical Oxygen Demand
BQ	Bill of Quantities
BPEO	Best Practical Environmental Option
C&D	Construction and Demolition
CAR	Corrective Action Report
CEO	Chief Executive Officer
CFS	Central Forest Spine
CIDB	Construction Industry Development Board/ *Lembaga Pembangunan Industri Pembinaan Malaysia*
CKD	Cement Kiln Dust
CIMAH	Occupational Safety and Health (Control of Industrial Major Accident Hazards) Regulations 1996
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CLMCG	Contaminated Land Management and Control Guidelines
CM	Compliance Monitoring
CMP	Cement Manufacturing Plant
COA	Conditions of Approval
COD	Chemical Oxygen Demand
DG	Director General
DID	Department of Irrigation and Drainage/*Jabatan Pengairan dan Saliran*
DO	Dissolved Oxygen/ Development Order
DOA	Department of Agriculture/*Jabatan Pertanian*
DOE	Department of Environment/*Jabatan Alam Sekitar*

DOF	Department of Fisheries/*Jabatan Perikanan*
DOSH	Department of Occupational Safety and Health/*Jabatan Keselamatan dan Kesihatan Pekerja*
e.g.	Example
EGIM	Environmental Impact Assessment Guideline in Malaysia
EIA	Environmental Impact Assessment
EIATRC	Environmental Impact Assessment Technical Review Committee
EM	Environmental Manager/ Effective Microorganism
EMP	Environmental Management Plan
EMT	Environmental Management Team
EO	Environmental Officer
EPD	Environment Protection Department
EPMC	Environmental Performance Monitoring Committee
EQA	Environmental Quality Act
EQR	Environmental Quality Report
ERCMC	Environmental Regulatory Compliance Monitoring Committee
ERP	Emergency Response Plan
ESAs	Environmentally Sensitive Areas
ESC	Erosion ad Sediment Control
ESCP	Erosion and Sediment Control Plan
ESI	Environmental Scoping Information
ESM	Environmental Scoping Matrix
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
etc.	*Et cetera*
FGDs	Focal Group Discussions
FOS	Factor of Safety
FRIM	Forest Research Institute of Malaysia

GAP	Good Agricultural Practices
GAs	Government Agencies
GIS	Geographic Information System
GSR	Guided Self-Regulations
GTM	Geological Terrain Mapping
HIA	Health Impact Assessment
HQ	Headquarters
HRA	Health Risk Assessment
HWC	Human-wildlife conflicts
i.e.	*id est*
IETS	Industrial Effluent Treatment Systems
ILO	International Labour Organisation
IM	Impact Monitoring
IUCN	International Union on the Conservation of Species
IWP	Industrial Wood Plantation
JAKOA	*Jabatan Kemajuan Orang Asli Malaysia*
JKPTG	Department Of Director General Of Lands And Mines/ *Jabatan Ketua Pengarah Tanah dan Galian*
JKR	Public Works Department/ *Jabatan Kerja Raya*
JKPTG	Department of Director General of Lands and Mines/ J*abatan Ketua Pengarah Tanah dan Galian*
JMG	Minerals and Geoscience Department Malaysia/*Jabatan Mineral dan Geosains*
JPBD/PLAN	Department of Town and Country Planning/ PLANMalaysia
JPSM	Forestry Department of Peninsular Malaysia/ *Jabatan Perhutanan Semenanjung Malaysia*
JPSPN	National Solid Waste Management Department/ *Jabatan Pengurusan Sisa Pepejal Negara*
KPKT	Ministry of Urban Wellbeing, Housing and Local Government/ *Kementerian Kesejahteraan Bandar, Perumahan dan Kerajaan Tempatan*

KSAS	*Kawasan Sensitif Alam Sekitar*
L10	Ten percentile level
L50	Fifty percentile level
L90	Ninety percentile level
LAC	Limit of Acceptable Change
LAeq	Equivalent A-Weighted Continuous Sound Level
LCP	*Laporan Cadangan Pemaju*
LD	Land Disturbance
LD-P2M2	Land Disturbing Pollution Prevention and Mitigation Measures
LMax	Maximum A-Weighted Continuous Sound Level
LMin	Minimum A-Weighted Continuous Sound Level
LOS	Level of Service
LTS	Leachate Treatment Systems
MAAQS	Malaysian Ambient Air Quality Standards
MESTECC	Ministry of Energy, Science, Technology, Environment and Climate Change/ *Kementerian Tenaga, Sains, Teknologi, Alam Sekitar dan Perubahan Iklim*
METMalaysia	Malaysian Meteorological Department/*Jabatan Meteorologi Malaysia*
MIDA	Malaysian Investment Development Authority/ *Lembaga Pembangunan* Pelaburan Malaysia
MOH	Ministry of Health/ *Kementerian Kesihatan*
MOM	Minutes of Meeting
MOSTI	Ministry of Science, Technology and Innovation/ *Kementerian Sains, Teknologi dan Inovasi*
MPFN	National Physical Planning Council/ *Majlis Perancang Fizikal Negara*
MRT	Mass Rapid Transit
MSL	Mean Sea Level
MSMA-2	*Manual Saliran Mesra Alam Edisi-2*
MUSLE	Modified Universal Soil Loss Equation
MWQI	Marine Water Quality Index
NGOs	Non-governmental Organizations

NPP-3	National Physical Plan-3
NPPC	National Physical Plan Council
NRE	Ministry of Natural Resources and Environment/ *Kementerian Sumber Asli dan Alam Sekitar*
NREB	Natural Resources and Environment Board
NTU	Nephelometric Turbidity Units
NWQS	National Water Quality Standards of Malaysia
O&G	Oil and Grease
OSC	One-Stop Centre
OSHA	Occupational Safety and Health Act 1994
P.E.	Population equivalent
P2M2s	Pollution Prevention and Mitigation Measures
PBT	Local Authorities/*Pihak Berkuasa Tempatan (PBT)*
PERHILITAN	Department of Wildlife and National Parks Peninsular Malaysia/*Jabatan Hidupan Liar dan Taman Negara Semenanjung Malaysia*
PM	Performance Monitoring
PM_{10}	Particulate Matter 10 micrometres or less in diameter
$PM_{2.5}$	Particulate Matter 2.5 micrometres or less in diameter
PPE	Personal Protective Equipment
PRF	Permanent reserved forest
PSD	Pipe slope drain
PTD	Land and District Office/ *Pejabat Tanah dan Daerah*
PTG	Land and Minerals Office/ *Pejabat Tanah dan Galian*
Q&A	Question and Answers
RAC	Report Adequacy Check
ROW	Right of Way
RQSAT	Report Quality Self-Assessment Tool
RUSLE	Revised Universal Soil Loss Equation
SAMM	*Skim Akreditasi Makmal Malaysia*

SAPs	Special Area Plans
SI	Soil Investigation
SIA	Social Impact Assessment
SIDRA	Signalised and Unsignalised Intersection Design and Research Aid
SMAs	Special Management Areas
SPAN	National Water Commission of Malaysia/ *Suruhanjaya Perkhidmatan Air Negara*
SPC	State Planning Committee
SS	Suspended Solids
SSA	Site Suitability Assessment
STP	Sewage Treatment Plant
STS	Sewage Treatment Systems
SWMM	Storm Water Management Model
TIA	Traffic Impact Assessment
TNB	Tenaga Nasional Berhad
TOC	Table of Content
TOR	Terms of Reference
TORAC	Terms of Reference Adequacy Check
TRC	Technical Review Committee
TSS	Total Suspended Solids
UNEP	United Nations Environment Programme
UPEN	State Economic Planning Unit/ Unit Perancang Ekonomi Negeri
WIPs	Water Intake Points
WQI	Water Quality Index
WTPs	Water Treatment Plants
WWF	World Wildlife Fund for Nature
ZOI	Zone of Impact
ZOS	Zone of Study

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The **'Environmental Impact Assessment (EIA) Guidelines for Cement Industry** (hereinafter referred to as the 'Guidelines') is newly issued in order to align with the latest amendments specified in the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015; which is a subsidiary legislation to the Environmental Quality Act (EQA) 1974 (Act 127).

The amended Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015 was enacted on 28 August 2015. It superseded the previous Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 1987. The amended Order has incorporated a revised list of Prescribed Activities, which are now segregated into two categories, i.e. a **First Schedule** (encompassing 21 Prescribed Activities) and a **Second Schedule** (encompassing 17 Prescribed Activities).

Furthermore, the Department of Environment (DOE) has rationalised the EIA process to ensure that it is in conformance with the scope, functions and visions of the Department in line with its Environmental Management Strategic Plan. The Plan emphasises on adoption of environmental mainstreaming and guided self-regulation (GSR) principles.

These new Guidelines are complementary to, and shall be referred together, with the Environmental Impact Assessment Guideline in Malaysia (EGIM) (DOE, 2016) Document.

The Project Proponent is required to comply with the requirements set out in this Guideline, as well as those prescribed in the EGIM (DOE, 2016), as mandated under Section 34A (2C) of the EQA 1974; and/ or any amendments made thereafter.

1.2 EIA FOR GUIDELINES FOR CEMENT INDUSTRY

This Guideline have been prepared to assist the Project Proponent and his/her appointed Qualified Person to identify, predict, assess and evaluate the potential impacts which greenfield, or expanding, cement manufacturing plants could potentially impose on their surrounding environment during the four major phases of project development, i.e. planning, design, pre-construction, construction and operation phases. In addition, guidelines for determining and specifying the range and scope of mitigation measures to be adopted to ameliorate potential adverse impacts to tolerable levels are elaborated.

The EIA process will entail the execution of a range of multi-disciplinary tasks to identify, predict, assess and evaluate the potential impacts which cement plants

could impose on the surrounding environment. The main objective of the EIA process is to ensure that the Project Proponent and their appointed Qualified Person takes due consideration of the consequences which cement plants could have on the continued wellbeing and safety of ecosystems and human habitats located external to the boundaries of Project sites.

The EIA report will contain important information for:

(i) The Project Proponent to adopt and implement appropriate mitigation measures in an environmentally and socially responsible manner.

(ii) The DOE and other authorities to make an informed decision on the sustainability and appropriateness of the intended project, and to guide them in outlining a Conditions of Approval (COA) for the Project.

(iii) The public to understand the nature and implications of the Project and its potential impacts on the environment.

The underpinning principles of the EIA process are detailed in the EGIM Document (DOE, 2016). Good practices for preparation of EIA reports are described in **Box 1**.

Box 1:
Good Practices for Conduct of EIA Studies

(i) Objective: The EIA process should meet its aims for assisting approving authorities to make informed decisions on project viability and acceptability; and to ensure that an adequate level of protection of environmental and natural resources, and that the human health and welfare status of surrounding communities is maintained as status quo or improved.

(ii) Focused: EIA should concentrate on identifying, assessing and evaluating significant beneficial and adverse environmental impacts, focusing on pertinent issues that are of importance.

(iii) Adaptive: The EIA should be tailored to address the realities, issues and circumstances of the Project under review.

(iv) Participative: The EIA should provide ample opportunities to inform potentially affected communities especially, and the general public which are interested in the Project, on the salient aspects of the Project and its environmental and social consequences. The intention being to solicit their opinions and inputs, and to address their concerns explicitly.

(v) Transparent: The EIA should be a clear, easily understood and open process, with early notification of its conduct, procedure, access to related documentation, and a public record of decisions taken and reasons for them.

(vi) Rigorous: The EIA should apply the 'best practicable and reliable methodologies to address the multi-disciplinary impacts and issues being investigated.

(vii) Practical: The EIA should identify measures for both impact mitigation and enhancement that are effective and which can be practically implemented.

(viii) Credible: The EIA should be carried out with a sense of professionalism, rigor, fairness, objectivity, impartiality and balance.

(ix) Efficient: The EIA should impose minimum financial burden on Project Proponents, consistent with meeting process requirements and objectives.

Source: Adapted from EIA Training Resource Manual Second Edition (UNEP, 2002).

1.3 GUIDELINE OBJECTIVES

The objectives of these Guidelines are to:

(a) Provide a clear and concise document on the preparation of an EIA report, and its findings and conclusion for the benefit of identified stakeholders, Project Proponents, Qualified Persons (i.e. DOE-registered Environmental Consultants), Government Agencies (GAs), Enforcement Officers (EO) and other EIA related practitioners.

(b) Facilitate integration of the EIA study findings into the overall project planning and development cycle, and to ensure compliance with, and adherence to, the legal requirements associated with the framework of environmental sustainability.

(c) Provide a detailed step-by-step guidance and explanation of the EIA procedures adopted and on the content of submissions made by way of the following documents:

(i) Environmental Scoping Information (ESI).
(ii) Terms of Reference (TOR).
(iii) EIA Reporting.

(d) Define the scope of the EIA with a focus on the significant environmental issues relevant to the DOE's three functional areas (water, air and wastes), whilst also taking into consideration other environmental requirements imposed by other authorities or agencies. This is to facilitate overall decision-making and project approval.

(e) Provide a succinct framework for the DOE to assess and evaluate the EIA reports.

1.4 SCOPE OF THE GUIDELINES

The scope of the Guidelines shall address impacts associated with the implementation, operation and potential abandonment of cement manufacturing plants that fall within the criteria provided in the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015 (refer to **Section 2.3**).

The coverage of these Guidelines addresses impacts induced by activities carried out within the confines of the Project site boundaries. These Guidelines do not address environmental issues associated with the procurement of raw materials for manufacture of cement products. The EIA study related to sourcing and procurement of raw materials are addressed and reported elsewhere. A holistic assessment and evaluation of environmental impacts associated with the construction and operations (and abandonment) of a Cement Manufacturing Plant (CMP) should also the relative impacts associated with sourcing of raw materials

and their transport to the CMP; as well as the transport of finished products to consumers.

1.5 OVERVIEW OF ENVIRONMENTAL ASSESSMENT PROCESS

This Section summarizes a step-by-step guide for conducting an environmental impact assessment study related to the planning, development, operations and abandonment of Cement Manufacturing Plant:

Step 1: Provide the Project Brief

When a Project Proponent intends to develop a Greenfield, or expand a Brownfield Cement Manufacturing Plant, basic information pertinent to the project will be required in order to enable the Qualified Person to understand the intent, objectives and scope of the proposed project (refer to **Section 2.2** for details).

The Project Brief should address the following aspects:

- The location of Project Site(s)
- Project's product and raw material specifications
- Project Proponent and their credentials for implementing the Cement Manufacturing Plant
- Government approvals obtained, and those pending, for project implementation
- Project land alienation and land conversion status
- The need for the Project
- Manufacturing process details including, inter-alia, sourcing of raw materials, product exports, storage provisions for raw materials and products, raw (or treated) water sourcing proposals, effluent and sludge treatment and disposal, energy consumption rates and fuel types to be employed, control mechanisms to minimise suspended particulate emissions, and waste solids management
- Scope of green technologies to be adopted
- Adoption of circular economic waste management processes including the adoption of reduce, recycle, recovery and repurposing principles
- Planning, construction and operating schedules
- Manpower requirements
- Concept engineering reports

Step 2: Identify the Legal Requirements

The Project Proponent undertaking the project has to comply with all relevant legal requirements before carrying out the EIA, and before commencement of the project (refer to **Sections 2.3, 2.4 and 3.2**).

Step 3: Check if the Project Aligns to Existing Policies and Guidelines

The Project Proponent shall clear all policy and administrative matters relating to project development and operations prior to submitting the EIA report to DOE. The environmental policies and guidelines which the Project Proponent has to meet is listed in **Section 2.6**.

Step 4: Carry Out Preliminary Stakeholder Engagement

Details of stakeholder engagements to be carried out for cement manufacturing plants are described in **Section 2.7**.

It is prudent to carry out stakeholder engagements early, before commencing with the EIA and the Project per se Constant engagement with the DOE (via the designated officer in charge), and with the relevant GAs when preparing the TOR and EIA reports.

Engagements will include public and stakeholder meetings, and focal group discussions (FGDs) in order to obtain site information, and stakeholders' perceptions and concerns regarding project implementation. Such information will be of use in conducting scoping investigations and in undertaking the EIA study.

Step 5: Preparation of the ESI and TOR

Upon determining whether the project requires either a First or Second Schedule EIA, an ESI and the TOR shall be prepared. At this point of the study, qualitative data will suffice (refer to **Chapter 3**). However, if quantitative data is available, it should be employed in preparing the ESI/ TOR report.

Information to be included in the TOR shall consist of, but not be limited nor restricted to, the ones listed in the following Sections:

(i) **Section 3.4:** Site Suitability Assessment (SSA).
(ii) **Section 3.5:** Determination of the Project and study boundaries.
(iii) **Section 3.6:** Review of baseline physical and environmental/natural resource related data, within and surrounding the project site
(iv) **Section 3.7:** Determination of key project activities during the planning, pre-construction, construction, operational and abandonment stages.
(v) **Section 3.8:** Identification of significant impacts and priority setting.
(vi) **Section 3.9:** Establishment of study requirements for EIA process.
(vii) **Section 3.10:** Outlining of mitigation measures.

Step 6: Submission of the TOR

All data and information obtained during the scoping exercise shall be reviewed for reliability and accuracy prior to preparation of the TOR report. Report preparation shall be based on DOE requirements specified in the EGIM (DOE, 2016); as well as in accordance with the precepts outlined this Guideline. The TOR shall be submitted to DOE for review and endorsement as detailed in **Section 3.11**.

Step 7: Baseline Data Collection for EIA

After endorsement of the TOR by the DOE, baseline data collection (mainly secondary) shall be carried out on areas within and surrounding the project site(s) to garner information on environment and natural resources and presence of environmentally sensitive areas.

The scope of baseline data required for the conduct of an EIA study is outlined in **Chapter 4.**

Step 8: Carry Out the EIA Studies

The major studies and components of the EIA report shall cover the following:

(i) **Chapter 5:** Impact assessment of the identified significant environmental issues.
(ii) **Chapter 6:** Identification of suitable pollution abatement and mitigation measures (P2M2s) to avoid, or to reduce potential significant environmental impacts to acceptable levels, during project implementation and operations; and to identify and ascertain the scope, intensity and prevalence of residual impacts.
(iii) **Chapter 7:** Preparation of an Environmental Management Plan (EMP) **which is a framework to monitor the actual impacts induced by the project during** its lifespan.
(iv) **Chapter 8:** Preparation of project abandonment plan. Details of the decommissioning and abandonment strategies and action plans to be implemented when a Project has to be abandoned.

Step 9: Draft EIA Report

The results of assessments and studies required by GAs, other than the DOE's core subjects, must be reviewed and approved by the respective GAs. A summarised version of such studies have to be incorporated in the EIA report. However, the entire content of GA individual reports need not be appended in the EIA report.

The structure and format of the EIA report is detailed in **Chapter 9**.

Step 10: Carry Out Public Engagement

First and Second Schedule EIA requires public engagements with the relevant stakeholders who are likely to be affected directly or indirectly by the project (e.g. communities or institutions, businesses and the general public). For First Schedule EIAs, this type of engagement is mandatory to ensure that public is aware of the proposed development within their surrounding area. A First Schedule EIA may be required to follow the procedures specified in a Second Schedule EIA for the purpose of carrying out Public Engagement. It shall be the responsibility of the Project Proponent and the EIA Consultant to organize and conduct the townhall/ public hearing, with monitoring by representatives from the DOE. Project Proponent and the EIA Consultant are also responsible to identify the most suitable phase during the EIA study period to conduct the engagement.

The main objective of these public engagements is to brief the stakeholders regarding the project, the potential environmental issues and the proposed mitigation measures; and to address their concerns and to seek any further required feedbacks with regard to Project implementation and mitigation measures to be adopted.

All findings from any public engagements shall be incorporated into the final EIA report (refer to **Sections 2.7 and 9.3** for further details).

Step 11: Submit the EIA Report and Carry out Public Display

Depending on whether the project is carried out under the First or Second Schedule, the EIA report shall, respectively, be submitted to DOE State or DOE headquarters (HQ) for review. EIA Reports for projects that straddle over two or more states; or where their waste discharges to water courses that flow through more than one state shall be submitted to DOE headquarters.

The Qualified Person shall take note of the difference in requirements for a First Schedule and Second Schedule EIA, and to follow the required DOE protocols and procedures in either case. The Second Schedule EIA requires a public display of the EIA Report to solicit public formal comments and feedbacks, to the DOE within a specified review period of one month.

Details of the submission and review process are described in **Section 9.4**.

1.6 STRUCTURE OF THE GUIDELINES

The Guidelines for development, operations and abandonment of cement manufacturing plants are structured in accordance with the step-by-step procedures described in **Section 1.5**. The substance of the Guidelines are described under nine separate Chapters, together with their respective supporting Sections, as detailed below:

Chapter	Details
Chapter 1: Introduction	• Provides an introduction to the Guidelines and explains its objectives, scope and structure.
Chapter 2: Environmental Project Planning	• Provides an overview on the approach for integrating the EIA process into project planning. • Outlines the necessary requirements for the project to undergo initial screening and assessment. • Provides a concise review of legislations, policies that are relevant to development of cement manufacturing plants, and how they are related to the EIA process. • Provides the terms and definitions associated with the cement manufacturing plant development and their interpretations. • Details out the stakeholder engagement process
Chapter 3: Terms Of Reference (TOR)	• Defines procedures for conduct of screening and scoping exercises in order to identify significant issues arising from information derived during the ESI stage for incorporation in the TOR • Presents the structure and the content for TOR reporting, including an overview of the review and approval process.
Chapter 4: Environmental Impact Assessment: Baseline Data	• Provides an outline of the relevant baseline information that needs to be incorporated in the EIA report. Information shall encompass environmental receptors which the project could impact on and vice versa
Chapter 5: Environmental Impact Assessment: Evaluation of Impacts	• Provides the methodology and tools to identify, predict, assess and evaluate the significant environmental impacts.
Chapter 6: Environmental Impact Assessment: Mitigation Measures	• Identifies appropriate P2M2s to minimise any negative impacts arising from development and operations of the project, or to enhance beneficial impacts; and to ascertain the range of measures that can be adopted to manage residual impacts adequately.
Chapter 7: Environmental Impact Assessment: Environmental Management Plan	• Provides an EMP framework for post-EIA monitoring and surveillance • Details out the GSR process for a project. • Describes the environmental monitoring and audit programmes for implementation post-EIA.

Chapter	Details
Chapter 8: Environmental Impact Assessment: Project Abandonment	• Details of the decommissioning and abandonment strategies and action plans to be implemented when a Project has to be abandoned.
Chapter 9: Environmental Impact Assessment: Reporting and Review	• Presents the structure and content for EIA reporting, including an overview of the review and approval process.

CHAPTER 2

ENVIRONMENTAL PROJECT PLANNING

2.1 INTRODUCTION

2.1.1 Environmental Impact Assessment Process

An Environmental Impact Assessment (EIA) is an integral part of project planning and development. Incorporation of the EIA process during early stages of project planning can have significant benefits and adds value to the project (see **Box 2**).

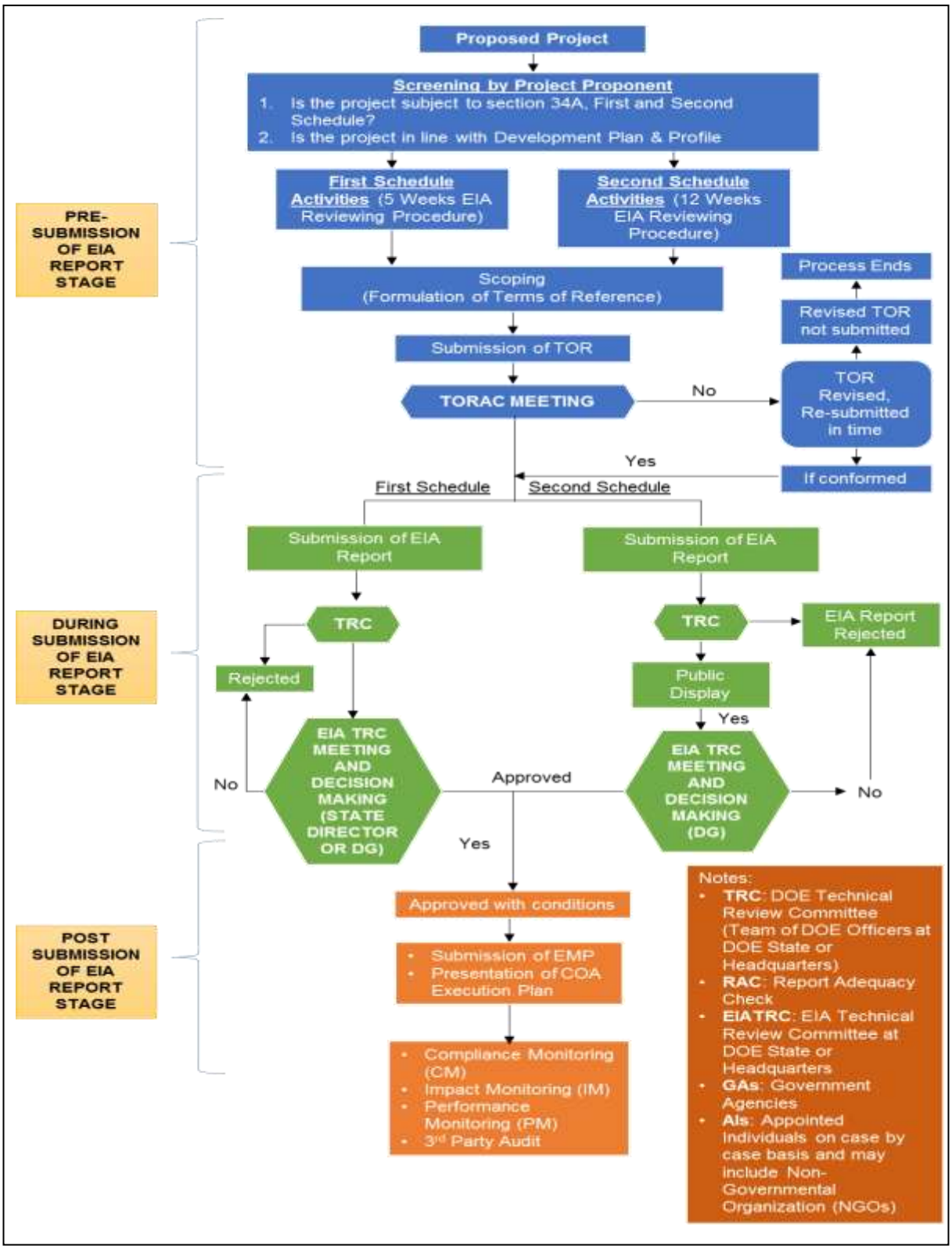
An EIA identifies key areas of environmental impact significance and provides a means for the Project Proponent and the Qualified Person to decide, at an early stage of project development, on the range and types of mitigation measures to be adopted in order to avert or minimise any adverse impacts being imposed on surrounding environmental receptors.

An EIA study is a very useful process for assessing the siting compatibility of Cement Manufacturing Plants (CMP) since it incorporates a wide range of tools to identify, assess, evaluate and mitigate any potential negative impacts that may be imposed on the physico-chemical, ecological and human components of the environment arising from project development and operations. The EIA study also provides an opportunity to enhance potential beneficial impacts which the CMP is capable of inducing on the local and regional environments, and on communities surrounding the project site.

At the same time the EIA process can also enhance, inter-alia, project viability and sustainability, and be able to protect surrounding environmental resources with the correct application of the EIA mitigation measures.

In any development, environmental impacts arise from the emission/discharge of wastes in the form of liquids, gases, solids and other inefficient operations such as noise, vibration and light emissions. These discharges/emissions induce negative impacts on environmental/social receptors depending on the intensity and duration of the induced impact. Therefore, to mitigate such adversities it is important that efforts are made to reduce to the minimum the magnitude and extent of release of these adverse perturbations from the Project boundaries. In order to identify and keep track on potential waste emissions from a specific Project, together with their properties and magnitude, it is important for the Project Proponent to develop a comprehensive Process Flow Diagram (PFD). The intention of the PFD is to portray the Project's manufacturing or development processes in terms of all of their individual pertinent individual process units, the sequence by which they function, and their interaction and relationship with each other with regard to potential waste emissions. Refer to **Appendix A** for more details on the importance of a PFD.

An overview of the EIA process is depicted in **Figure 2.1**.



Source: Environmental Impact Assessment Guideline in Malaysia (EGIM) [Department of Environment (DOE), 2016].

Figure 2.1: EIA Procedures in Malaysia

Box 2:
Benefits of Incorporating EIA into Project Planning

(i) Ensures compliance with environmental and development policies; facilitates expedient project approvals; and avoid changes to project concepts.

(ii) Assist in Site Suitability Assessments (SSA) in order to ensure that the best site is chosen by the Project Proponent by taking into consideration environmental constraints and limitations in tandem with technical and financial factors.

(iii) Complements other planning considerations by enhancing the coverage of technical and management factors deliberated by the Project Proponent.

(iv) Reduce the scope and scale of project induced adverse impacts so as to render it more environmentally and socially acceptable among the stakeholders. It can even become a positive selling point for the Project Proponent, e.g. by adoption of green technology.

(v) Facilitate adoption of best available technologies (BATs) and best management practices (BMPs) in project planning and development which would in turn improve the overall quality of the project.

2.1.2 Integration of Environmental Compliance in the Planning of Cement Manufacturing Plants

A typical project implementation cycle involves many phases that requires inputs from various technical specialists and consultants to prepare submissions to the approving authorities. Throughout the ambit of this project cycle, incorporation of environmental compliance should be advocated during three particular phases, they are being:

(a) Step 1: Project Planning Phase & Feasibility Phase

The Project Proponent is expected to have carried out an initial feasibility assessment of suitable sites for implementation of the project. Once a suitable site has been identified and selected, the Project Proponent may need to apply for land use conversion. Thereafter the Project Proponent will either apply for land alienation (in the case of state or federal land) or acquire private land for project development.

The Project Proponent shall ensure compliance with all National and State policies and regulations pertaining to Project development, as well as fulfil all relevant administrative matters pertaining to Project implementation and operations.

Environmental Screening: The Project Proponent, working closely with the Qualified Person, shall carry out a screening exercise to determine whether a CMP Project shall have to comply with a particular Schedule under the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015, or not; and which prescribed activities under this Schedule are relevant to the CMP.

Environmental Scoping: After the screening exercise, there is a need to gauge the potential significant environmental impacts which the CMP project could impose on environmental receptors located within and beyond the boundaries of the selected site; and thereafter to identify potential pollution prevention and mitigation measures (P2M2s) that can be incorporated into project designs at an early stage to avert any future serious environmental impacts on, for example, the water quality and natural flow regime of rivers, etc. These findings, collectively termed as the Environmental Scoping Information (ESI), will form the basis for developing an EIA Study Terms of Reference (TOR) for the Department of Environment (DOE) to approve/endorse.

Project Proponent must also take into consideration the implied environmental values (i.e. environmental loss and gains) resulting from project development by conducting an Environmental Cost Benefit Analysis (CBA) during the Feasibility Study Phase, and the findings to be elaborated in the ESI. CBA is a process that is used to analyse decisions, systems or projects, or to determine a value for intangibles. In an environmental study, CBA's are deliberated as environmental improvement or actions that somehow affect the natural environment as an indirect consequence. Other than CBA, the Project Proponent can also conduct Economic Valuations of Environmental Impacts (EVEI). The objective of EVEI is to quantify in monetary terms, the impacts of the proposed project on an environmental component and receptor. This study requires the monetization of potential changes (both positive and negative – if any) on environmental services arising from project implementation. The findings of CBA can be summarized in the EIA Report. The Qualified Person may also refer to the publication entitled 'Guidelines of the Economic Valuation of the Environmental Impacts for EIA Projects by DOE (2008) as guidance to prepare an EVEI.

(b) Step 2: Detailed Project Design Phase

The Project's technical details and engineering designs shall be submitted to the relevant authorities for approval, vide the One Stop Centre (OSC) system. Often, various Government Agencies (GAs) may require additional technical studies and reports to be submitted as part of the technical evaluation process. In the case of DOE, this may include the preparation of an EIA report.

Environmental Impact Assessment (EIA): If a project is categorised as a prescribed activity under the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015, it is mandatory for the Project Proponent to prepare and submit an EIA report for approval by the DOE before a project can be implemented. The Project Proponent and the Qualified Person shall carry out the EIA study based on the endorsed TOR.

The EIA report shall incorporate major findings from the relevant sectoral studies; for example wildlife relocation plans, Social Impact Assessment (SIA), Traffic Impact assessment (TIA), etc. as required by the other GAs. The scheduling of the EIA study should take into consideration the timetable for completion of sectoral studies required by other GAs, especially conduct of SIA.

Recommendations to manage identified significant environmental impacts to acceptable levels, as espoused in the EIA, shall be incorporated in the project design. For example, major structural mitigation measures such as the construction of silt traps and/or sediment basins, etc. shall be part of the engineering works to reduce the impacts of soil erosion on water courses.

(c) Step 3: Construction and Operation Phases

Construction and operation activities must comply with the EIA Conditions of Approval (COA) issued by the DOE on approval of an EIA. The COA specifies the scope of mitigation measures to be adopted in order to ameliorate negative impacts on environmental receptors and communities which activities associated with the construction, operations and abandonment of a CMP could impart. Potential negative impacts could encompass, inter-alia, Project activities associated with site access establishment, mobilisation of machineries and equipment, setting up base construction camps, land clearing, subsequent earthworks, effluent and solid waste discharges, gaseous pollutant emissions, structural works etc.

Post-EIA: The management of mitigation measures and execution of pollution controls, and their effectiveness, will be executed through an Environmental Management Plan (EMP). The EMP and the plans for environmental monitoring and auditing have to be an integrated part of all construction and operation works. These plans provide the integrative elements to ensure least degradation to the environment during work activities.

2.2 PROJECT BRIEF

At the commencement of a project, the Project Proponent shall provide a project brief, containing basic Project information for review by the appointed Qualified Person.

The types of information and components required to assist in identifying of the scope and requirements for an environmental assessment are listed in **Table 2.1**.

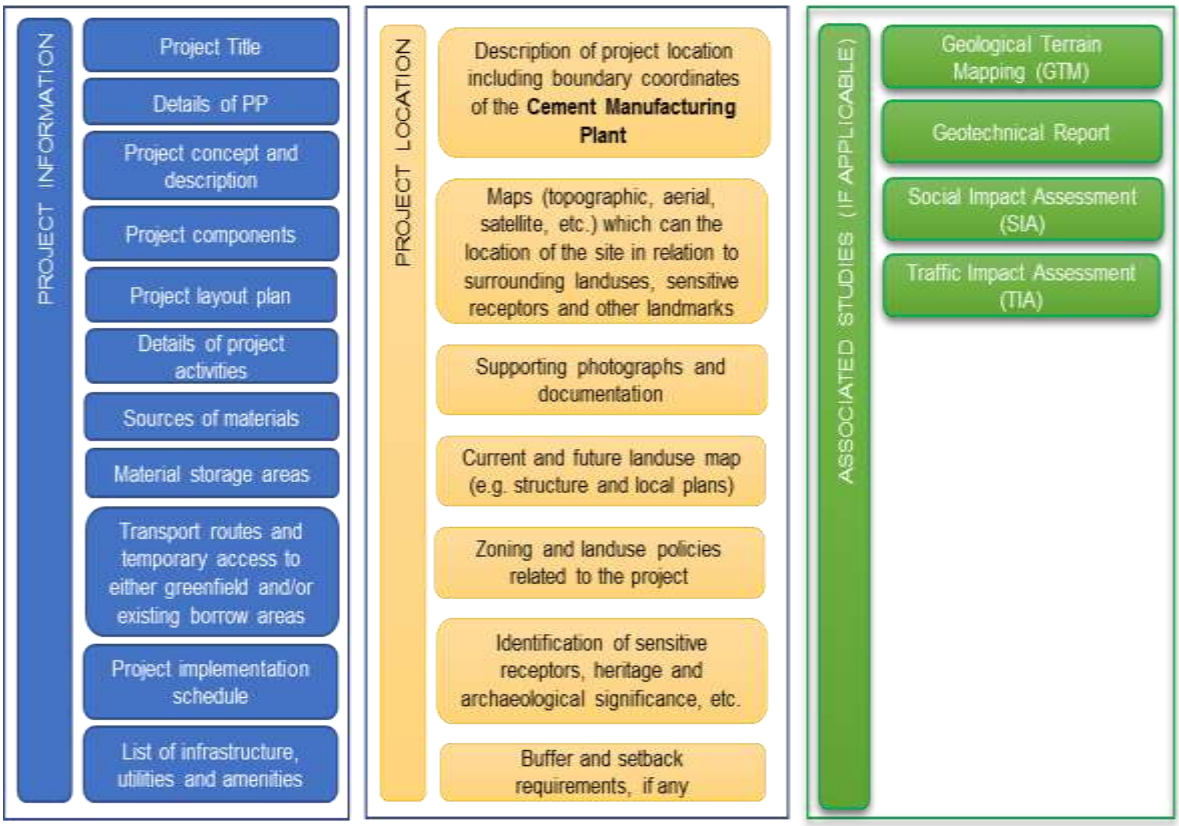
The range of raw materials that are required for manufacturing cement, and their sources of procurement, are important aspects to be deliberated in an EIA report. It has to be made clear whether the Project Proponent is also responsible for developing raw material procurement sites, or relies on an external party to supply the materials. If the former is the case, then the development and operations of the raw material source must be subjected to an EIA process. The imports of waste from abroad to be used as raw materials should be limited; and the Project

Proponent should study the possibility of recycling wastes, or by-products of other processes, as raw material to reduce environmental pollution and dependency on natural resources. The import of raw materials from abroad to manufacture cement shall be subject to relevant Authority policies. Project Proponent and EIA Consultant may also refer to 'Guidelines on the Environmentally Sound Co-Processing of Scheduled Waste in Cement Industry' by DOE as reference to use scheduled wastes as alternative raw material and/or alternative fuel and/or cement additive in the production of cement.

The cement manufacturing industry requires a significant amount of fuel for its manufacturing processes. The type of fuel to be employed must be identified, and the manner by which it will be sourced and transported to the cement plant site described in the EIA report. Use of non-fossil fuels must be justified and their impacts elaborated in detail. Efforts are required to reduce the amount of fuel used, and selection of fuels should take into consideration the potential for degradation of the air shed in the vicinity of the plant.

A significant amount of cement kiln dust (CKD) may be generated by cement manufacturing. It is therefore important to address the issue of how and where to dispose the residues and of the possibility to recycle this solid waste as an ingredient for clinker production. Best practice would be to reduce and reutilise the waste materials.

Table 2.1: Sample Project Brief by the Project Proponent



Note:
*1 Project Proponent (PP) [Company, address, contact person(s) and contact details].
*2 Includes the time limit/period of the project/plant operations.

The list is not exhaustive and not all the above may be relevant to the project. It is the responsibility of the Project Proponent and Qualified Person to determine the relevant information required for environmental assessment and compliance.

2.3 ENVIRONMENTAL AND RELEVANT LEGISLATIVE REQUIREMENTS

2.3.1 General Overview

The Environmental Quality Act (EQA) 1974 (Act 127) is the principal legislation governing environmental management in Malaysia.

Amendments to this principal legislation, and the enactment of new subsidiary legislations or regulations relevant to CMP project implementation and operations, may be enacted from time to time, due to changing circumstances. The Project Proponent and Qualified Person are required to keep abreast with, and refer to and adopt, any latest amendments for a CMP project.

The DOE is the main agency tasked to implement the EQA 1974 (Act 127). It has overall functions and responsibilities on environmental management and enforcement as prescribed under the said principle legislation and its subsidiary legislations and regulations.

The Project Proponent is responsible to comply with all prevailing and/or any new laws that have been enforced, or those that are be enforced, in Malaysia that are of relevance to the Project.

2.3.2 Environmental Quality Act 1974 (Act 127)

EIA is a mandatory requirement under the provision of Section 34A (2) of the Environmental Quality Act 1974 for activities prescribed in the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015.

Section 34A (2) stipulates "Any person intending to carry out any prescribed activities shall appoint a qualified person to conduct an environmental impact assessment and to submit a report thereof to the Director General in the manner as the Director General may prescribed, before any approval for the carrying out of such activities is granted by the relevant approving authority, submit a report to the Director General. The report shall be in accordance with the guidelines prescribed by the Director General and shall contain an assessment of the impact such activity will have or is likely to have or is likely to have on the environment and the proposed measures that shall be undertaken to prevent, reduce or control the adverse impact on the environment."

Section 34A (2A) stipulates "The Director General shall maintain a list of qualified persons who may carry out an environmental impact assessment and submit a report thereof."

Section 34A (2B): The Qualified Person who submits the report shall:-

(a) Be responsible for the environmental impact assessment and the recommendations of the environmental impact assessment;
(b) Ensure that the report and the recommendation do not contain any false or misleading information;
(c) Take a professional indemnity insurance for any liability arising from the environmental impact assessment and the recommendations of the environmental impact assessment;

Section 34A (2C): The report shall be in accordance with the guidelines as the Director General may prescribe and shall contain:-

(a) An assessment of the impact such activity will have or is likely to have on the environment; and
(b) The proposed measures that shall be undertaken to prevent, reduce or control the adverse impact on the environment.

2.3.3 Environmental Quality (Prescribed Activity) (Environmental Impact Assessment), Order 2015

The Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015 provides the legal basis for DOE to approve an EIA for specific prescribed activities under the First and/or Second Schedules.

If a project involves more than one prescribed activity and one of them falls under the Second Schedule, then the project is deemed to fall under the ambit of the Second Schedule.

For development of Cement Manufacturing Plant, the relevant prescribed activities are:

i) First Schedule

Activity 6: Cement:

(b) Cement grinding plant with cement production capacity of 200 tonnes or more per day.

ii) Second Schedule

Activity 6: Cement

(b) with clinker production capacity of 30 tonnes or more per hour

The legal adherence is based on sub-sections of the EQA 1974 (as of 5th February 2015), as follows:

(a) Section 34A (1): *The Minister, in consultation with the council, may by order prescribe any activity, which may have significant environmental impacts as prescribed activity.*

(b) Section 34A (2): *Any person intending to carry out any prescribed activity shall appoint a Qualified Person to conduct an EIA and submit a report thereof to the Director General in the manner as the Director General may prescribe.*

(c) Section 34A (2C): *The report shall be in accordance with the guidelines as the Director General may prescribe and shall contain:*

(i) An assessment of the impact such activity will have or is likely to have on the environment.

(ii) The proposed measures that shall be undertaken to prevent, reduce or control the adverse impact on the environment.

Note: The Project Proponent shall carry out screening process for all related activities that are required to be conducted in connection with project development and should be in accordance with the conditions of the stipulated order of Environmental Quality (Prescribed Activity) (Environmental Impact Assessment) Order 2015. This is to ensure that relevant EIA requirement has been fulfilled for the project activity e.g. logging/ clearance of forest area requires EIA to be conducted, based on the quantum provided in the above mentioned Order.

2.3.4 Environmental Quality (Clean Air) Regulations, 2014

The regulations in the Environmental Quality (Clean Air) Regulations 2014 are applicable for the cement industries.

A cement manufacturing industry may require furnaces, or any fuel burning equipment used for the purposes of heat generation. The gaseous emission limits from these facilities are as stipulated in the **Third Schedule of the Regulations, under Item A: Heat and Power Generation and Item F: Non-Metallic (Mineral) Industry: Cement Production (All Sizes); Manufacture of Glass Including Glass Fibre with a Melting Capacity ⩾1 Ton of Product Per Day; Manufacture of Ceramic Products by Firing, Roofing Tiles, Bricks, Refractory Bricks, Tiles, Ceramic Glass, Stoneware or Porcelain, with a Production Capacity of ⩾ 10 tons of Product Per Day.**

2.3.5 Environmental Quality (Industrial Effluents) Regulations, 2009

During operation of the cement manufacturing plant, any industrial effluent discharges from the facility shall need to comply with the Environmental Quality (Industrial Effluents) Regulations 2009.

The following regulations are to be considered during the EIA:

Design and construction of industrial effluent treatment system

5 (1) An owner or occupier of a premises shall conduct any design and construction of the industrial effluent treatment system to collect and treat the industrial effluent or mixed effluent generated within the premises in strict compliance with the specifications as specified in the Guidance Document of the Design and Operation of Industrial Effluent Treatment System issued by the Department of Environment.

Compliance with Specifications of Industrial Effluent Treatment System

6 (1) No person shall operate any industrial effluent treatment system unless it complies with the specifications as specified in sub-regulation 5 (1).

Specifically, the treated industrial effluents quality from the premise shall comply with the **Fifth, Seventh, Eighth and Ninth Schedules** of the Regulations.

2.3.6 Environmental Quality (Sewage) Regulations, 2009

This regulation applies to any premise which discharges sewage onto or into any soil, or into any inland waters or Malaysian waters; exceptions are any housing or commercial development, or both, having a population equivalent of less than one hundred and fifty.

Where applicable, the sewage from a cement manufacturing plant has to be treated to meet the **Second Schedule** of the Regulations.

2.3.7 Environmental Quality (Scheduled Wastes) Regulations, 2005

The Environmental Quality (Scheduled Wastes) Regulations 2005 regulates the handling, movement, disposal and treatment of scheduled wastes in Malaysia. The cement manufacturing industry is known to generate scheduled wastes in its processes. During the EIA preparation stage, this Regulation shall be considered, with particular reference to:

Responsibility of Waste Generator

8 (1) Every waste generator shall ensure that scheduled wastes generated by him are properly stored, treated on-site, recovered on-site for material or product from such scheduled wastes or delivered to and received at prescribed premises for treatment, disposal or recovery of material or product from scheduled wastes.

8 (2) Every waste generator shall ensure that scheduled wastes that are subjected to movement or transfer be packaged, labelled and transported in accordance with the guidelines prescribed by the Director General.

Storage of Scheduled Wastes

9 (1) Scheduled wastes shall be stored in containers which are compatible with the scheduled wastes to be stored, durable and which are able to prevent spillage or leakage of the scheduled wastes into the environment.

9 (2) Incompatible scheduled wastes shall be stored in separate containers, and such containers shall be placed in separate secondary containment areas.

9 (3) Containers containing scheduled wastes shall always be closed during storage except when it is necessary to add or remove the scheduled wastes.

9 (4) Areas for the storage of the containers shall be designed, constructed and maintained adequately in accordance with the guidelines prescribed by the Director General to prevent spillage or leakage of schedule wastes into the environment.

9 (5) Any person may store scheduled wastes generated by him for 180 days or less after its generation provided that:-

(a) The quantity of scheduled wastes accumulated on site shall not exceed 20 metric tonnes; and
(b) The Director General may at any time, direct the waste generator to send any scheduled wastes for treatment, disposal or recovery of material or product from the scheduled wastes up to such quantity as he deems necessary.

The prescribed activities mentioned above shall not apply to the States of Sabah and Sarawak. In these States natural resources management are subject to separate state legislations and requirements as summarised in **Table 2.2**.

Table 2.2: Environmental Legislation for Sabah and Sarawak

STATE	LEGISLATION	AUTHORITY
Sabah	Environmental Protection Enactment (Prescribed Activities) (Environmental Impact Assessment) Order 2005	Environment Protection Department (EPD)
Sarawak	Natural Resources and Environment (Prescribed Activities) Order 1994	Natural Resources and Environment Board (NREB)

2.3.8 Environmental Quality Act 1974 Act 127 Section 30A: Power to Control Use of Substance and Product and to State Environmental Labelling

This Act is applied to all industrial activity that stores, processes and generates hazardous substances throughout its operations. Pollution abatement measures are described under Section 30A “power of use of substance and product and to state environmental labeling”.

2.3.9 Occupational Safety and Health (Control Of Industrial Major Accident Hazards) Regulations 1996 (CIMAH)

This regulation applies to industrial activity in which there is hazardous substance involved. The objective of the regulation is to prevent major accidents and to limit consequential impacts on people and the environment.

2.3.10 Occupational Safety And Health Act 1994 (OSHA)

An Act to make further provisions for securing safety, health and welfare of persons at work, for protecting others against risks to safety or health in connection with the activities of persons at work.

2.3.11 Occupational Safety and Health (Classification, Labelling and Safety Data Sheet of Hazardous Chemicals) Regulations 2013 (CLASS)

This regulation applicable to chemicals supplied for use at a workplace. The main objective of the Regulation is to ensure chemicals supplied has provide sufficient information on hazards of chemicals; to mitigate the risk of accidents happening at the workplace.

2.4 TERMS AND DEFINITIONS

All legal definitions and interpretations shall be based on the Interpretation Acts 1948 and 1967 (Act 388). In addition, *t*erms and interpretations shall also be based on any relevant interpretation documents that have been published, or are to be published by DOE in the future.

The common terms and definitions adopted for these Guidelines are summarised in the following Section. In case of doubt and uncertainty of the terms, clarification with DOE is required.

2.4.1 Development

Under the Town and Country Planning Act 1976 (Act 172) and amendment thereof in 2006, "development" means the carrying out of any building, engineering, mining, industrial, or other similar operations in, on, over, or under land, the making of any material change in the use of any land or building or any part thereof, or the subdivision or amalgamation of lands; and "develop" shall be construed accordingly.

(a) Land Disturbing Activities

Based on the EGIM (DOE, 2016), "land disturbing activities" refer to any project development activity that is subject to Section 34A of the EQA 1974 involving clearing of trees or vegetation, excavating, raising or sloping of ground, trenching, grading and blasting.

(c) Roads/Tunnel/Bridge

As defined under the Road Transport Act 1987 (Act 333), any public road and any other road to which the public has access, includes bridges, tunnels, lay-bys, ferry facilities, interchanges, roundabouts, traffic islands, road dividers, all traffic lanes, acceleration lanes, deceleration lanes, side-tables, median strips, overpasses, underpasses, approaches, entrance and exit ramps, toll plazas, service areas, and other structures and fixtures to fully effect its use.

For the purposes of Sections 70 and 85 of the same Act, it also includes a road under construction, but shall not include any private road, bridge,

tunnel or anything connected to that road, which is maintained and kept by the private persons or private bodies.

Road classification shall be as defined by the Public Works Department (JKR) in "*A Guide on Geometric Design of Roads*" (JKR, 2015) for both urban and rural roads with specifications as shown in **Table 2.3**.

Table 2.3*:* Minimum Reserve Width for JKR Roads

Area	Road Category	Design Standard	Minimum Reserve Width (m)
Rural	Expressway	R6	60
	Highway	R5	60
	Primary Road	R5	50
		R4	40
	Secondary Road	R4	30
		R3	25
	Minor Road	R2	20
		R1	20
Urban	Expressway	U6	65
	Arterials	U5	65
		U4	40
	Collector	U4	40
		U3	40
	Local Street	U3	40
		U2	30
		U1	25

Source: A Guide on Geometric Design of Roads (JKR, 2015).

Note: Values are for road standards in flat areas and will need to be increased accordingly for areas involving deep cuts and fills.

A "Tunnel" is an artificial underground passage, especially one built through a hill or under a building, road, or river.

A "Bridge" is a structure built to span physical obstacles such as a body of water, valley, or road, for the purpose of providing passage over the obstacle.

(d) Slopes

Slope gradients are quantified in degrees (refer **Appendix A** of EIA Guideline for Development in Slope and Hill Areas for calculation method). The slope ranges are generally categorised as shown in **Table 2.4**.

Table 2.4*:* Classification of Slopes

Slope Range
< 15°
≥ 15° to < 25°
≥ 25° to < 35°
≥ 35°

Source: Adapted from the Department of Town and Country Planning (JPBD), 2009.

(e) Development Restrictions

Development restrictions and controls shall abide by the policies in the National Physical Plan-3 (NPP-3) (JPBD, 2016) and other relevant national/state policies, such as the State Structure Plan and Local Plan.

2.5 THE CEMENT INDUSTRY

General

Cement is a basic ingredient of concrete (15% content), mortar, stucco, and non-specialty grout. It is a fine powder, produced by heating limestone and clay minerals in a kiln to form clinker, grinding the clinker, and adding up to 5 percent of gypsum (Calcium Sulphate). Several types of cement are available; the most popular being Portland Cement. Portland cement is caustic, so it can cause chemical burns. The powder can cause irritation or, with severe exposure, lung cancer, and can contain some hazardous components, such as crystalline silica and hexavalent chromium. Environmental concerns are the high energy consumption required to mine, manufacture, and transport the cement; and the related air pollution associated with the release of greenhouse gases (e.g., carbon dioxide), dioxin, NO_x, SO_2, and particulates. The production of Portland cement contributes to about 10% of world carbon dioxide emission. To meet the rising global population, the International Energy Agency estimated that the cement production is set to increase between 12 to 23% by 2050. The low cost and widespread availability of the limestone, shales, and other naturally-occurring materials used in Portland cement make it one of the lowest-cost materials widely used over the last century. Concrete produced from Portland cement is one of the world's most versatile construction materials.

Manufacturing

Manufacture of Portland cement clinker requires very high energy inputs (heat and electricity). Manufacture of cement can be carried out in three ways, that is (a) dry process or (b) semi-dry or wet processes, when water is added to enhance homogenizing of the mixture of raw materials. The major raw materials for clinker production is usually limestone ($CaCO_3$) mixed with other selected secondary materials such as clay, shale, sand, iron ore, bauxite, fly ash, and slag. When a cement kiln is fired by coal to produce heat, the ash of the coal acts as a secondary raw material. More energy is required when wet processes are adopted. Cement is manufactured by heating the proportioned mixture of raw materials in a cement kiln (a large diameter, long, slowly rotating cylindrical steel structure inclined at a small angle to the horizontal) to a calcining temperature of above 600 °C and then a fusion temperature, which is in the range of 1,400 °C to 1,500 °C for modern cements, to sinter the materials into clinker.

The more common fuels used to fire kilns include pulverized coal, petroleum coke and natural gas; all fossil fuels that produce large amounts of Green House Gases (predominantly carbon dioxide). The air required for combustion is derived from the cooling air used to quench the hot clinker as it is discharged from the kiln.

To achieve the desired setting qualities in the finished product, a quantity (2–8%, but typically 5%) of calcium sulfate (is added to the clinker, and the mixture is finely ground to form the finished cement powder with a broad particle size range, in which typically 15% by mass consists of particles below 5 μm diameter, and 5% of particles above 45 μm. The cement is conveyed by belt or powder pump to a silo for storage. Cement plants normally have sufficient silo space for one to 20 weeks of production, depending upon local demand cycles. The cement is delivered to end users either in bags, or as bulk powder blown from a pressure vehicle into the customer's silo. In industrial countries, 80% or more of cement is delivered in bulk.

2.5.1 Safety Issues

Cement is highly alkaline, and the setting process releases heat. As a result, wet cement is strongly caustic, and can easily cause severe skin burns if not promptly washed off with water. Similarly, dry cement powder in contact with mucous membranes can cause severe eye or respiratory irritation. The reaction of cement dust with moisture in the sinuses and lungs can also cause a chemical burn, as well as headaches, fatigue, and lung cancer. In certain countries the raw materials contain chromium(VI), which is considered to be toxic and a major skin irritant; the level should not exceed 2 parts per million (ppm).

In the US, the Occupational Safety and Health Administration (OSHA) has set the legal limit (permissible exposure limit) for Portland cement exposure in the workplace as 50 mppcf (million particles per cubic foot) over an 8-hour workday. The National Institute for Occupational Safety and Health (NIOSH) has set a recommended exposure limit (REL) of 10 mg/m^3 total exposure and 5 mg/m^3

respiratory exposure over an 8-hour workday. At levels of 5000 mg/m^3, Portland cement is immediately dangerous to life and health.

Workers at Portland cement facilities, particularly those burning fuel containing sulfur, are susceptible to acute and chronic effects of exposure to SO_2 [sulfur dioxide], and as such peak and full-shift concentrations of SO_2 should be periodically measured.

2.5.2 Environmental Impacts

Portland cement manufacture can induce environmental impacts during all stages of the manufacturing process. These include emissions of airborne pollution in the form of dust; gases; noise and vibration when operating machinery and during blasting in quarries; consumption of large quantities of fuel mainly for heating purposes during manufacture; release of CO_2 from the raw materials during manufacture, and damage to countryside landscapes from quarrying. Pertinent gaseous emissions include greenhouse gas emissions (predominantly carbon dioxide), dioxins, NO_x, SO_2, mercury vapors and dust and particulates. Mercury emissions depends on the metals presence in the raw material and in coal used for burning. In the US dioxins and mercury emissions contributed by Cement Plants totaled seventeen (17) and nine (9) percent of total emissions within the country. The high releases of dioxins attributed to adoption of hazardous wastes as a fuel, the relatively inefficient combustion practices occurring within the kiln and the relatively short materials detention time within the kiln. These inherent properties of combustion in the Kiln influences the generation of Products of Incomplete Combustion (or Persistent Organic Pollutants) that have toxic and hazards properties.

Carbon Dioxide emissions originate from (a) decarbonation of limestone (0.5 kg/kg cement produced), (b) kiln fuel combustion (0.3 kg/kg cement produced for dry processes), and (c) from transportation vehicles (insignificant at 0.002 to 0.005 kg/kg cement produced). In addition, electricity sourced from the Grid is required to power machineries (crushers, grinders, rotating kiln and air pollution control systems. However, the carbon dioxide emissions associated with electricity use is estimated to be less than 5% of total carbon dioxide emissions induced by cement manufacture (50% by the calcining process, 40% by fuel burning and remaining 10% attributed to transportation related emissions). Globally, the contribution of cement manufacturing plants towards GHG, and specifically Carbon Dioxide emissions is estimated to be 3% and 5% respectively.

Typical electrical energy consumption is fuel specific, and is of the order of 90–150 kWh per tonne cement, equivalent to 0.09–0.15 kg CO_2 per kg finished cement if the electricity is coal-generated; however, with nuclear- or hydroelectric power, and efficient manufacturing, CO_2 generation can be reduced to 0.7 kg per kg cement.

2.5.3. Circular Economic Principles Applied To Cement Manufacture

Due to the high temperatures within operating cement kilns, combined with the oxidising (oxygen-rich) atmosphere and long residence times, cement kilns are used as a processing option for various types of waste streams; they efficiently destroy many hazardous organic compounds. The waste streams also often contain combustible materials which allow the substitution of part of the fossil fuel normally used in the process. Waste materials used in cement kilns as a fuel supplement include car and truck tires, paint sludge, waste solvents and lubricants, meat and bone meal, waste plastics, sewage sludge, rice hulls, sugarcane waste and used wooden railroad ties (railway sleepers).

Furthermore, cement manufacture also has the potential to benefit from using industrial byproducts from the waste stream from other manufacturing processes such as (a) Slag, (b) Fly ash (from power plants), (c) Silica fume (from steel mills) and (d) Synthetic gypsum (from desulfurization processes).

2.5.4 Issues to Be Addressed In Environmental Impact Assessment

Project location, or siting, is a very important aspect that needs to be addressed during the feasibility stage of Project development. In this respect the basic requirements are that the CMP should be located near to raw material procurement areas with sufficient capacity to meet the Plant's needs on a sustainable level. In addition, there should be adequate capacity of roads/highways that provide suitable linkages to raw material sources and to wholesale and retail centers, or to ports for delivery of products.

As to addressing environmental impacts induced by the Proposed CMP, the following factors should be addressed, viz:

- Landscape and land use changes resulting in incompatibility issues, visual intrusion and climate change effects.
- Soil erosion and sedimentation effects resulting from land clearing and earthworks activities to establish platforms to accommodate the CMP and its ancillary facilities, and consequent impacts on water quality affecting downstream users and economic activities, and in stream ecological resources.
- Water resource depletion through net abstraction of water for process needs and its ramifications on downstream users, downstream economic activities, and in stream biological resources.
- Energy consumption and its contribution to adverse climate change impacts.
- Solid waste (confined to CKD) disposals and their potential impacts on environmental degradation.
- Drainage impedances and consequences on inducing flooding episodes within and external to the Project site(s)
- Fire hazards induced by storage of combustible raw materials and products within the CMP premises.

- Assessing Socio-economic impacts induced by creating direct and indirect employment, business opportunities and enhancing the country's overall economic growth and reducing foreign exchange deficits.

Impact identification and assessment should follow the Guidelines on the procedural steps to be taken as described in this Document; and be cognizant of the Laws and Regulations that have implications on the establishment and operations of CMPs within Peninsular Malaysia.

In identifying mitigation measures to off-set adverse impacts to tolerable levels it is important that principles of reuse, reduce and recycling be considered where applicable and adaptable. Selected mitigation measures should adopt the best available technologies not exceeding excessive costs, and have previously demonstrated their ability to have sustainable effects on reducing environmental pollution and degradation to acceptable levels.

The Project Proponent shall identify an environmental monitoring plan to track the actual impacts that are induced on identified environmental receptors during the construction and operating phases of the Project; and whether all recommended mitigation measures are fulfilling their predicted or expected outcomes. This monitoring exercise should also be adopted if the Project is abandoned and steps taken to reinstate the Project Site(s) to their original state.

2.6 POLICY AND GUIDELINES COMPLIANCE

Any proposed development in Environmentally Sensitive Areas (ESAs) has to comply with and adhere to the requirements tabled under the national and state legislations and enactments, policies, local regulations, procedures and guidelines published by the national and state governments, agencies and local authorities.

The requirements can be either statutory or non-statutory and from one or more national or state agencies and authorities. Adherence to the policies and legislations will ensure that the development is in line with the requirements of the authorities to avoid complications in the project approval process.

2.6.1 Policy Adherence

The project must meet all legal and environmental requirements (statutory and non-statutory) and procedures of Malaysia. The project shall be in line with, and not contradict, the current national and state development policies and plans, especially for high impact projects.

Due diligence shall be undertaken with regards to policy compliance, and study requirements mandated by the relevant agencies and government departments.

The Project Proponent and his team shall be required to engage with all the relevant National and State agencies (see also **Sections 2.6 and 2.7** for details) during the project planning stage.

The Project Proponent and Qualified Person are to determine the specific compliance requirements, based on the scope and nature of the project. Examples of critical requirements that shall be addressed are summarised in **Table 2.1** (also refer to **Sections 2.6.2 and 2.6.3** for a list of relevant policies and guidelines).

Proof of compliance in the form of, but not limited to, GAs approvals, support letters and minutes of meetings (MOM), among others, shall be included as part of the TOR and EIA.

All policy and administrative matters and GA requirements at the National and State levels must be cleared before proceeding with the EIA submission.

Table 2.5: General Policy Adherence for Development and Operation of Cement Manufacturing Plant Projects prior to EIA Submission

Requirements/ Compliance	Agencies/Department	Legal Requirements	Required Outputs
• Project approvals and/or supporting documents.	1. National Physical Planning Council of Malaysia (MPFN) 2. MIDA/MITI - Regional Development Authority 3. State Planning Committee (SPC) 4. *Jawatankuasa Teknikal Pembangunan Kawasan Sensitif Alam Sekitar (KSAS)* 5. Local Authority (PBT)	• Town and Country Planning Act 1976 (Act 172)	• To ensure that the project complies with the national and state policies and requirements for the implementation of cement/ kiln manufacturing plant.
• Adherence to landuse compatibility (structure/ local/ special area plan). • Development requirements in/near ESAs. • Social Impact Assessment (SIA) requirements	1. PLANMalaysia (JPBD)	• Town and Country Planning Act 1976 (Act 172)	• To ensure that the project is in line with the Structure/ Local Plans and compatible with the surrounding landuse. • To determine need for SIA for the Project in consultation with PLANMalaysia (JPBD).

Requirements/ Compliance	Agencies/Department	Legal Requirements	Required Outputs
• Land status compliance. • Land acquisition. • Minerals release.	1. Department of Director General of Land and Mines (JKPTG) 2. Land and Mines Office (PTG) 3. District and Land Office (PTD)	• National Land Code 1965 (Act 56)	• To ensure that the Project Proponent owns the land and the status is correct with its intended development type. • To ensure there are no constraints on the land that may prohibit it from being developed.
• Geological Terrain Mapping (GTM) requirements. • Geotechnical report requirements. • Slope stability and protection requirements. • Traffic Impact Assessment (TIA) requirements).	1. Minerals and Geoscience Department (JMG) 2. Public Works Department (JKR)	• National Land Code 1965 (Act 35) • Minerals Development Act 1994 (Act 525) • Geological Survey Act 1974 (Act 129) • Road Transport Act 1987 (Act 333)	• To ensure that the topography, terrain and geological features within the site is suitable for development. • To determine the need to carry out a TIA.
• Development requirements in/near wildlife sanctuaries and other, protected areas. • Protection of flora and fauna. • Requirement for animal relocation plan, viaduct crossings, etc.	1. Department of Wildlife and National Parks (PERHILITAN)	• Wildlife Conservation Act 2010 (Act 716)	• To determine the sensitivity of the site in terms of flora and fauna species and constraints for development.

Requirements/ Compliance	Agencies/Department	Legal Requirements	Required Outputs
• Permission for river diversion. • Requirement for river reserves. • Stormwater management requirements (MSMA-2) • Erosion and Sediment Control Plan (ESCP)	2. Department of Irrigation and Drainage (DID) 3. State Water Authority	• Street, Drainage and Building Act 1974 (Act 133) • State enactments on water resources, river basins and coastal areas	• Determine the hydrological condition of the site and requirements pertaining to changes in river system and runoff management requirements.
• Development requirements within Orang Asli settlements and their roaming areas, agriculture plotsm cultural, heritage, religious and archaeological sites.	1. Jabatan Kemajuan Orang Asli (JAKOA)	• Aboriginal Peoples Act 1954 (Revision 1974) (Act 134)	• To ensure that the area is not occupied by Orang Asli community and if so, how to manage impacts.

Note: The list is not exhaustive and not all the above may be relevant to the project. It is the responsibility of the Project Proponent and Qualified Person to determine the relevant information required for environmental assessment and compliance.

2.6.2 National and State Policies and Plans

The relevant policies and plans for development of Cement Manufacturing Plants are listed in **Table 2.6**. They serve as references for the Project Proponent and the Qualified Person when undertaking the project.

Any change or amendment to existing policies and plans (i.e. updating, revision, new edition, etc.) shall be taken into account in the EIA by the Qualified Person.

Table 2.6: List of Policies and Plans Relevant to Development of Cement Manufacturing Plant

POLICIES AND PLANS	DETAILS AND SCOPE
National Physical Plan-3 (NPP-3) (JPBD, 2016)	National spatial planning guidelines: covers Siting of Industrial estates
State Structure and Local Plans (Various local authorities and publishing dates)	State and local level planning guidelines for Industrial landuse: includes development controls.
National Policy on Biological Diversity 2016 – 2025 (NRE, 2016)	Covers specifically 17 national biodiversity targets with corresponding goals and action plans to achieve within 2016 – 2025.
Central Forest Spine (CFS) I & II: Master Plan for Ecological Linkages (JPBD, 2009)	Planning requirements for development proposed in the CFS including primary and secondary linkages.
National Policy on the Environment	Specifies eight principles to harmonise economic development goals with environmental imperatives. It seeks to integrate environmental considerations into development activities and in all related decision-making processes, foster long-term economic growth and human development, and protect and enhance the environment.

Notes:

(i) The list is not exhaustive and not all the above may be relevant to the project. It is the responsibility of the Project Proponent and Qualified Person to determine the relevant information required for environmental assessment and compliance.

(ii) Industrial Master Plan by MIDA

2.6.3 Guidelines and Guidance Documents

The EIA report must also refer to the relevant guidelines and guidance documents issued by DOE and other Government Agencies (GAs) pertaining to environment-

related issues and their management; and any other documents and notices issued from time to time that are related to the EIA process and procedures.

Apart from the legislations, regulations, policies and plans mentioned above, a list of guidelines and guidance documents for EIA reporting is summarised in **Table 2.7**.

Table 2.7: List of Relevant Guidelines and Guidance Documents Related to Development Planning for Cement Manufacturing Plant

GUIDELINES/GUIDANCE DOCUMENTS	DETAILS AND SCOPE
Garis Panduan Perancangan Kawasan Sensitif Alam Sekitar (PLANMalaysia, 2017)	Provides the requirements for development in ESAs
Guidance Document for Addressing Soil Erosion and Sediment Control (ESC): Aspects in the EIA Report as per Appendix 3 of the EGIM (DOE, 2016)	EIA reporting format concerning soil erosion and sediment control.
Guidance Document for the Preparation and Submission of EMP as per Chapter 6 of the EGIM (DOE, 2016)	Guidance for the preparation of the EMP post-EIA including translating into action, the P2M2s recommended in the EIA and the COA.
Guidance Document for the Preparation of the Document on Land-Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2) as per Appendix 4 of the EGIM (DOE, 2016)	Guidance for the preparation of the LD-P2M2 document which is to be included as part of the EMP to be submitted to DOE for approval.
Technical Guidance on Scoping Preparation of EIA Report and Development on Hill and Slope Area (DOE, 2015)	Provides guidelines on scoping for development on hill and slope areas.
Manual Panduan Pemeriksaan BMPs untuk Kawalan Hakisan dan Sedimen (DOE, 2015)	A manual on inspection procedures including checklists, of the erosion and sediment control BMPs.
Guidelines for Agricultural Development in Slope Areas [Department of Agriculture (DOA), 2013]	Guidelines for agricultural development in slope areas.
Guidelines for Erosion and Sediment Control in Malaysia (DID, 2010)	Guidelines for prevention and control of soil erosion and siltation for specific projects including examples of control measures and best management practices (BMPs).

GUIDELINES/GUIDANCE DOCUMENTS	DETAILS AND SCOPE
Guidelines for Slope Design (JKR, 2010)	Covers geotechnical design criteria for slopes.
DID Manual Volume 2 – River Management (DID, 2009)	Provides methods to assess, manage and mitigate measures for river conservation, rehabilitation and restoration.
Guidelines for Prevention and Control of Soil Erosion and Siltation in Malaysia (DOE, 2008)	Guidelines for prevention and control soil erosion and siltation for specific projects including examples of control measures and best management practices (BMPs).
Stream Crossing Guidelines: An Ecological Approach (DID, 2008)	Details on Stream Crossing requirements
Best Available Techniques Guidance Document on Iron and Steel Industry	The guidance notes for selected industries in Malaysia to apply best available techniques economically achievable (BAT)

Note: The list is not exhaustive and not all the above may be relevant to the project. It is the responsibility of the Project Proponent and Qualified Person to determine the relevant information required for environmental assessment and compliance

2.7 STAKEHOLDER ENGAGEMENT

2.7.1 Introduction

Stakeholder engagement is an important process at the preliminary stage, prior to drafting the TOR. At the start of the proposed project, the Project Proponent and/or the Qualified Persons should pre-consult with DOE, the planning approval authorities and Government agencies (GAs) to confirm their study requirements and the approval process to be followed, and to obtain their feedbacks regarding the proposed project. All these will be taken into account in the TOR, EIA and by the EIA Technical Review Committee (EIATRC).

Consultations with other stakeholders, besides the GAs and approving authorities, are also needed and it is the Project Proponent and Qualified Person's responsibility to identify the key stakeholders to engage with at this early stage to assist in the preparation of the TOR and ESI.

The mechanisms for stakeholders' engagement in the EIA process can be direct, indirect and formal or informal. The EGIM (DOE, 2016) has succinctly highlighted this as follows:

…"EIA is a multi-disciplinary study on the environmental components such as water quality, air quality, waste management, environmentally sensitive areas and

natural resources. It involves the participation of government agencies, non-governmental agencies (NGOs), academicians, experts and environmental practitioners including qualified and competent persons, industries and public at large. Hence, the EIA process should provide adequate opportunities to all stakeholders including the affected public to express their concerns and provide inputs for decision making process by relevant approving authority."

Engaging with stakeholders can have general benefits to a project as shown in **Box 3**.

Box 3:
Aims of the Stakeholder Engagement

(i) To understand the GA's key requirements, especially approvals process, and guidelines to facilitate approvals for the project.
(ii) To convey the aims and scope of the development to affected stakeholders, and inform them of potential impacts induced by the development, and the mitigation measures to be put in place to address them. This builds public trust and confidence towards the project.
(iii) To obtain feedbacks from the stakeholders on their concerns so that adjustments can be made for incorporation into the project designs.
(iv) To allow early resolution of any conflicts and impasses; thus avoiding costly delays.

2.7.2 Identification of Stakeholders

The stakeholders can be grouped into three main groups from:

(i) GAs which have the powers and legal rights to administer, enforce and approve the project.
(ii) General public, organisations, properties and land owners who may be directly or indirectly be affected by the project.
(iii) Special interest groups or organisations representing their interests or influence, e.g. NGOs related to environmental conservation.

Table 2.8 presents an indicative, but non-exhaustive, list of stakeholders for engagements in connection with Cement Manufacturing Plant projects.

Table 2.8: Key Stakeholders and their Roles and Responsibilities

STAKEHOLDER	ROLES AND RESPONSIBILITIES
Department of Environment (DOE)	•Administrator of the EIA process under the EQA 1974. •Responsible for the issuance of the COA for the EIA. •Post-EIA approvals, monitoring and enforcement.
Project Proponent	•The party to carry out the development and be responsible for obtaining all necessary approvals for the industry site. •Involved in the management of the management of the project at all stages of development. •Consultation on changes in project design incorporation of P2M2s.
Relevant GAs	•GAs which have roles and functions in the project and are responsible for the issuance of approvals for studies, technical reports and engineering plans for the project. •Engagement shall assist in determining GA requirements for the project that needs to be addressed by the Project Proponent, and also to assist in obtaining information under their respective agencies relevant for the project. •List of pertinent requirements that need to be addressed is presented in Table 2.5
Affected Public and Local Population	•The public or local population that may be directly affected by the project and whose concerns and interests need to be addressed as part of the EIA. •These may include residents, business owners, farmers, Orang Asli, private land owners, etc. •Preliminary engagement may include identifying public concerns for the project that needs to be addressed, and obtain feedback on proposed mitigation measures.
NGOs	•Provide input and feedback on issues of special interest.

Note: The list is not exhaustive and not all the above may be relevant to the project. It is the responsibility of the Project Proponent and Qualified Person to identify the relevant stakeholders to engage for the project.

2.7.3 Methods of Engagement

The engagements are to be conducted in accordance with the following steps:

(i) Step 1: Identify from the relevant GAs key areas of policy, regulatory and guideline compliance.

(ii) Step 2: Obtain initial data and views from the GAs and stakeholders (communities, local leaders, etc.) to assist in preparation of the TOR.

(iii) Step 3: Document stakeholder feedbacks to identify areas of improvement that needs to be considered as per the initial project concept designs.

(iv) Step 4: Review and assess all information and feedback obtained to determine those that are relevant for incorporation into the TOR and EIA reports.

Types of stakeholder engagement are summarised in **Table 2.9**.

Table 2.9: Public Engagement Methods and Expected Outputs

STAKEHOLDER	TYPE OF CONSULTATION	INFORMATION REQUIREMENT
DOE	• Meeting and/or pre-consultations.	• Comments on TOR/ESI and EIA process and requirements.
Project Proponent and Consultants	• Meetings and/or private consultations.	• Information required for the project. • Consultation on changes in project design incorporation of P2M2s.
Relevant GAs	• Meeting and/or pre-consultations. • Official correspondence.	• Agency requirements such as key elements of policies, regulations and guidelines to adhere to, including planning approval requirements. • Methods to address those key elements and approval procedures.
Affected Public and Local Population	• Questionnaire surveys. • Interviews (formal and informal). • Focal group discussion (FGD). • Public briefing. • Project brief. • Website.	• Project briefing. • Views and concerns on the project. • Inputs for project incorporation. • Conflict resolution mechanism.
NGOs	• Meeting and/or private consultation.	• Concerns and inputs on project.

Note: The list is not exhaustive and not all the above may be relevant to the project.

2.7.4 Documentation and Reporting

Findings from stakeholder engagements shall be incorporated into the TOR, especially with regard to policy compliance and regulatory adherence.

Proof of engagement can be in the form of written reports, official response letters from the GAs, MOM, photos, etc.

CHAPTER 3
TERMS OF REFERENCE (TOR)

3.1 INTRODUCTION

The Terms of Reference (TOR) is the first major milestone in the overall Environmental Impact Assessment (EIA) process.

This Chapter, comprising 10 Sections, provides the steps in detail to prepare the TOR for submission and endorsement by the Department of Environment (DOE). These steps are as follows:

(i) **Section 3.2:** Environmental Screening Procedures.

(ii) **Section 3.3:** Environmental Scoping.

(iii) **Section 3.4:** Site Suitability Assessment (SSA).

(iv) **Section 3.5:** Study Boundaries.

(v) **Section 3.6:** Baseline Data Review (based predominantly on secondary data/information).

(vi) **Section 3.7:** Determination of Key Project Activities.

(vii) **Section 3.8:** Identification of Potential Significant Impacts and Priority Setting.

(viii) **Section 3.9**: Establishment of Study Requirements for EIA.

(ix) **Section 3.10:** Outlining of Preliminary Mitigation Measures.

(x) **Section 3.11:** Preparation and Submission of TOR/ Environmental Screening Information (ESI).

3.2 ENVIRONMENTAL SCREENING PROCEDURES

Environmental Screening is carried out to determine whether a proposed project is categorized as a prescribed activity as defined under the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015.

Two types of Cement Manufacturing Plants commonly exist in Malaysia, they are: (A) Cement Plants which produce an intermediate product termed as Clinker from select raw materials, and thereafter grinds the clinker with gypsum to produce Portland cement. Both manufacturing processes are executed within the same Site; and (B) Plants which import clinker manufactured elsewhere and grinds this material with gypsum to produce Portland cement. Type (A) Plants are more polluting in nature and are classified as a Second Schedule Prescribed Activity if the manufacture more than 30 tonnes per hour; whilst the less polluting Plant (B) is classified as a First Schedule Activity if it produces cement at a rate of over 200 tonnes per day.

If the Cement Manufacturing Plant project has properties falling within both the First and Second Schedule prescribed activities, the Second Schedule EIA shall take precedence.

Potential outline criteria for project screening is summarised in following **Box 4**:

Box 4:
Potential Outcomes from Project Screening

(i) No EIA is required: If the project does not fall within any prescribed activities listed under the First or Second Schedule, and/or has insignificant impacts on the environment.

(ii) EIA is required: If the project will have potentially significant environmental impacts, and/or falls within the prescribed activity listed under the First or Second Schedule.

(iii) Further studies and clarification from DOE: If the potential impacts from the project are uncertain, indeterminate, ambiguous or may not fall clearly within any prescribed activities, i.e. say involving new technologies, DOE shall be consulted upon on the need for an EIA.

3.3 ENVIRONMENTAL SCOPING

The main objective of environmental scoping is to identify a range of potentially significant negative as well as positive impacts which a planned Project can impart on its surrounding physio-chemical, biological and social environments; and the potential consequences such impacts can induce on receptors. This exercise shall then determine the focus, depth and spatial and temporal boundaries of an EIA Study. Scoping shall be carried out at the early stages of EIA Study project cycle. It enables the EIA to focus only on the significant, impacts and consequences imposed on sensitive receptors.

Scoping shall encompass all environmental features (physico-chemical, biological and socio-economic) in order to enable an overall preliminary evaluation of the significant impacts. At the start of the scoping exercise, no attempt shall be made to exclude, pre-empt or pre-judge any issues of concern.

The scoping exercise (also refer to **Figure 3.1**) encompasses the following steps, which are elaborated in the accompanying Sections:

(i) Site Suitability Assessment (SSA): The SSA shall consider all alternatives or options to refine and improve upon the original concept design in order to minimise consequential impacts to acceptable levels (refer to **Section 3.4**).

(ii) Determination of EIA Study Boundaries: The Qualified Person shall determine the extent of the Zone of Study (ZOS) and Zone of Impact (ZOI)

based on prevailing and projected site conditions and environmental sensitivities surrounding the Site (refer to **Section 3.5**).

(iii) Baseline Data Review: The Qualified Person shall carry out in principle qualitative assessments based on desktop studies and literature review. These may be supplemented by initial site investigations and stakeholder engagements (refer to **Section 3.6**). Quantitative assessments can be provided where necessary and when applicable.

(iv) Determination of Key Project Activities: The Project Proponent shall outline the key project activities that are executed during various phases of project implementation (i.e. during pre-construction, construction and operations) focussing on those that will induce pertinent environmental impacts on surrounding sensitive receptors (refer to **Section 3.7**).

(v) Identification of Significant Impacts and Priority Setting: This step will involve preliminary identification of significant impact consequences for further detailed assessment in the EIA. Non-significant consequences shall also be addressed accordingly in the EIA study but limited to general/qualitative impact prediction and evaluation (refer to **Section 3.8**).

(vi) Establishment of Study Requirements for EIA: Identify and detail out relevant methodologies and appropriate recognised assessment tools to be adopted in the EIA process for evaluating the spatial and temporal significance of potential impacts (refer to **Section 3.9**).

(vii) Outlining of Mitigation Measures: The Qualified Person shall identify sustainable and practical mitigation measures to abate potential significant adverse impacts (refer to **Section 3.10**).

(viii) Preparation and Submission of ESI and TOR: Findings from the scoping exercise shall be compiled, collated and analysed in order to prepare the TOR for submission to DOE (refer to **Section 3.11**).

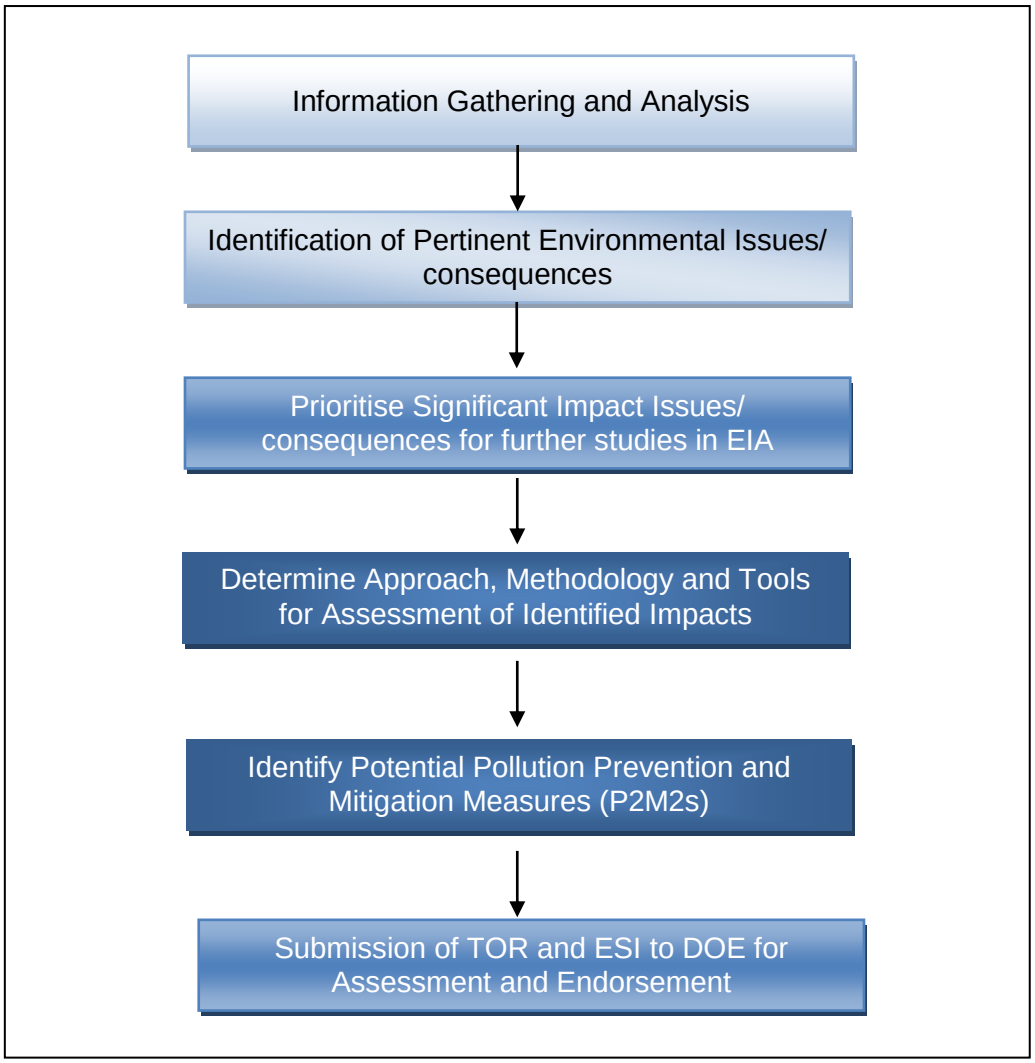


Figure 3.1: Flow Path for Environmental Scoping

3.4 SITE SUITABILITY ASSESSMENT (SSA)

The SSA processes and procedures are detailed in the EGIM (DOE, 2016). Generally, this is carried out during the project's feasibility stage. The intention is to identify potential alternatives and options to the initial concepts and layouts which can minimize potential adverse impacts, or to enhance beneficial impacts, that are likely to be imposed on environmental and natural resources. If deemed necessary the manufacturing concepts and the Plant layout can be amended and finalised; and which will form the basis for undertaking the scoping exercise (refer to **Table 3.1** for examples).

The 'Environmental Essentials for the Siting of Industries in Malaysia' (EESIM) and 'Guidelines for Siting and Zoning of Industry and Residential Area' shall be referred, to provide guidance to Project Proponent in selecting the suitable location or site to set up their industry.

The scoping exercise will add value to this SSA by recommending pragmatic mitigation measures to be adopted, such as P2M2s and best management practices (BMPs), to ameliorate potential environmental degradation that are anticipated when developing Cement Manufacturing Plants at various sites.

Table 3.1: Considerations in Project Alternatives and Options

Project Siting	• Adherence to national and state policies and guidelines. • Site constraints to the project and vice versa. • Location and proximity to sensitive receptors. • Location and proximity to raw material sources. • Availability of adequate buffers. • Any alternative sites that needs to be proposed for the project.
Terrain and Topography	• Conservational value. • Availability of land for buffers. • Slope classification and degree. • Site hydrology and drainage patterns. • Conditions and constraints of the site (hilly, steep slopes, geo-hazards, flood risk, soil conditions and soil erosion potentials). • Possibility of avoidance of unsuitable terrain. • Visual/aesthetic impacts.
Accessibility	• Availability of access. • Proximity to construction/source materials. • Strategic locational advantages. • Traffic conditions.
Technology Options	• Availability of technology to minimize impacts. • Best available technology/techniques (BAT) options. • Benchmarking with alternative technology. • Green Technology Adoption
Project Component and Design	• Adaptive design to suit terrain. • Layout consideration. • Choice of construction method and use of green construction materials. • Maintenance issues.

Social Constraints and Attributes	• Location within or close to existing communities. • Health impediments including job creation opportunities. • Inducing job creation opportunities. • Need for land acquisition and relocation of occupants/business.
Economy and Finance	• Potential employment and business opportunities. • Cost and benefit considerations. • Supply and demand scenarios. • Potential loss of income.
Operations	• Type of landuse and operational components. • Adoption of best practices and green development concepts. • Slope management considerations.

Note: The list is not exhaustive and not all the above may be relevant to the project. It is the responsibility of the Project Proponent and Qualified Person to determine the relevant information required for environmental assessment and compliance.

3.5 STUDY BOUNDARY

The delineation of boundaries within which impact assessments are to be conducted are important factors to be addressed in the TOR/ESI/EIA reports. In this respect two types of study boundaries are needed to be demarcated, they are:

(i) A study boundary, which defines the study area generally encompassing a 5-km radial zone from the project boundaries (refer to **Figure 3.2**). The Qualified Person shall define the limits of the spatial boundary based on accepted criteria.

In case of linear projects such as roads, railways and transmission lines, the ZOS shall cover a 1-km corridor (500 m on either side of the ROW) (refer to **Figure 3.3**).

(ii) An impact boundary defines the spatial area surrounding the project site(s) where environmental receptors are likely to be impacted by Project activities. This area may extend beyond the ZOS depending on land use characteristics and physical development profiles, and on terrain characteristics etc. This area zone of influence is termed the Zone of Impact (ZOI) (refer to **Figures 3.2 and 3.3**).

For material burrow sites that support the manufacturing of cement manufacturing plants, the extent of the ZOI shall be subject to the findings of an ecologist and geotechnical engineer; and on advice from the Forestry Department of Peninsular Malaysia (JPSM) and Department of Wildlife and National Parks (PERHILITAN).

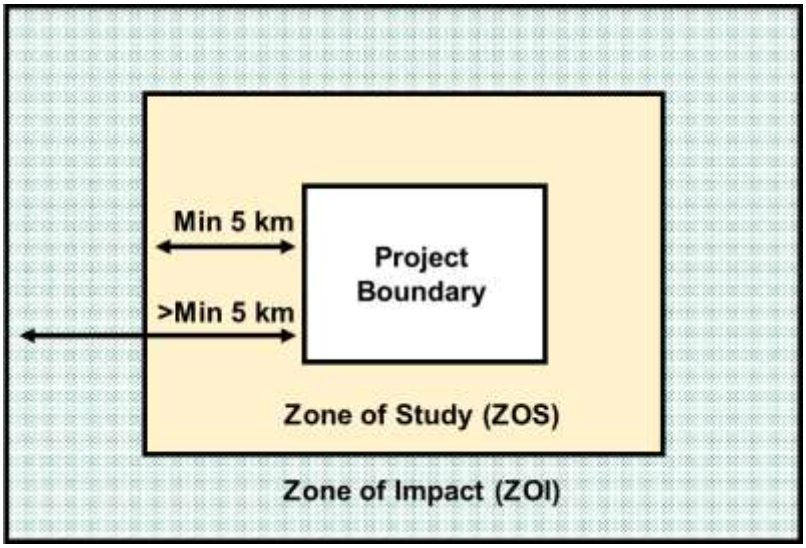


Figure 3.2: Diagram Showing the Difference between the ZOS and ZOI

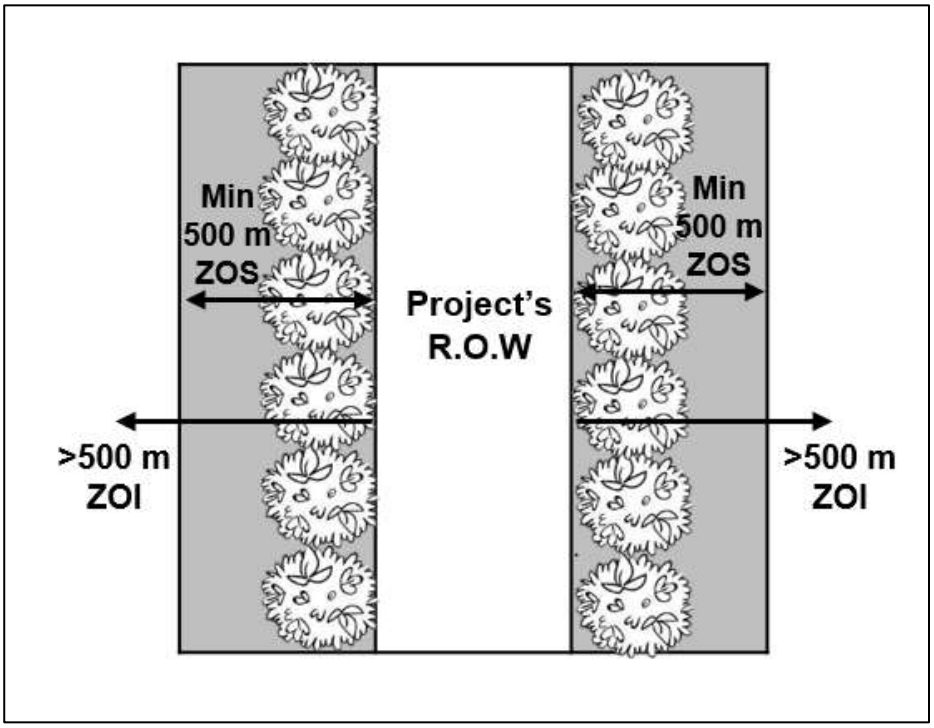


Figure 3.3: Diagram Showing the Difference between the ZOS and ZOI for Linear Project

3.6 BASELINE DATA REVIEW

The indicative requirements for reporting on the state of the environment and state of natural resources surrounding the cement manufacturing plant and is summarized in **Table 3.2.** The baseline information shall be qualitative at this stage but shall be sufficiently adequate to assess the potential impacts on the sensitive receptors. Quantitative data and findings, wherever available, shall be provided to support the assessment.

Basic information to be garnered shall include, inter-alia, project terrain and geological characteristics, surrounding land use and physical development profiles,

drainage systems, surface and ground water systems, meteorological information representative of the area, and surrounding ecological and socio-economic profiles.

If any of the items in the list are unavailable at the time of scoping, but is important to the EIA, it must be recorded as items to be addressed at the EIA stage. Items irrelevant or insignificant to the project can and shall be omitted during environmental scoping.

The criteria to decide on the priority of relevant items shall be based on their levels of significance.

Table 3.2: Baseline Requirements for Environmental Scoping

Baseline	Requirements	Data Source
Physico-chemical		
Landuse	• Landuse maps and photos. • Description of existing and future landuse (within 5-km ZOS). • Identification of ESAs.	• Topography maps. • Aerial or satellite imagery. • Structure and local plan (PLANMalaysia). • Site investigations.
Geology/ Hydrogeology	• Description of local and regional geology. • Locations of aquifer and groundwater abstraction wells.	• Geological and hydrogeological maps by JMG. • Geological Terrain Mapping (GTM) report.
Soil and Terrain	• Topography and slopes. • Soil investigation (SI). • Construction suitability map.	• Site survey. • Soil map by Department of Agriculture (DOA). • SI report. • GTM report.
Climate	• Climate data (min 5 years).	• Malaysian Meteorological Department (METMalaysia).
Hydrology	• River systems and catchment areas. • Flood prone areas.	• Topography maps. • Department of Irrigation and Drainage (DID) flood maps. • Site observations.
Water Quality	• Water Quality data (if any). • Locations of water pollution sources. • Locations of water intake points (WIPs)	• State water resource departments. • Published reports by water agencies and DOE.

Baseline	Requirements	Data Source
	and water treatment plants (WTPs). • Other downstream receptors	
Air Quality	• Air Quality data (if any) • Locations of air polluting sources.	• DOE published data. • Site observations.
Noise and Vibration Level	• General background noise levels • Locations of high noise and vibration generators.	• Site observations.
Biological		
Ecosystem	• Description of existing ecosystem and habitats, and general biodiversity level. • Identification of ESAs (forest reserve, wildlife reserves and sanctuaries, wetlands, mangroves, fisheries, etc.). • Presence of endemic, rare, threatened, endangered and near extinct flora and fauna.	• Secondary information. • Data from various relevant departments such as the Department of Wildlife and National Parks (PERHILITAN) and Forestry Department Peninsular Malaysia (JPSM). • *Buku Kawasan Sensitif Alam Sekitar (*DOE*).* • Site observations.
Social Aspects		
Demography	• Details of current and future demographics. • Economic profile of surrounding populations.	• Population census from Department of Statistics. • Structure and Local plans from PLANMalaysia. • Interviews.
Public Health	• Description of public health status of communities located in the vicinity of the cement manufacturing plant site.	• Morbidity statistics and public health data from Ministry of Health (MOH). • Published information.
Heritage, Culture and Archaeology	• Locations of historical and cultural sites, in the vicinity of the cement manufacturing plant site.	• Data from Department of Museums, National Heritage Department, Jabatan Kemajuan Orang Asli (JAKOA), etc.

Baseline	Requirements	Data Source
	• Location of Orang Asli areas and settlements, in the vicinity of the cement manufacturing plant site.	• Published information.
Traffic	• Access to project site. • Transport options.	• Road maps. • Site visits. • JKR. • Department of Highways.
Infrastructure, Utilities and Amenities.	• Potable water, electricity, sewerage, roads, telecommunication infrastructure in the vicinity of the plant site. • Waste management systems in place	• Information from utility providers. • Local plans from PLANMalaysia or Local Authority. • SPAN • JPSPN

Note: The list is not exhaustive and not all the above may be relevant to the project. It is the responsibility of the Project Proponent and Qualified Person to determine the relevant information required for environmental assessment and compliance.

3.7 DETERMINATION OF KEY PROJECT ACTIVITIES

Project activities are the basis for assessing potential impacts on surrounding environmental and natural resource receptors. **Tables 3.3** summarises the range of activities associated with the planning, construction and operations of a cement manufacturing plant. The list is not exhaustive, and the Qualified Person shall add on or delete items, and wherever necessary.

Table 3.3: List of Typical Project Activities and Related Impacts on the Environment

PROJECT ACTIVITY	POTENTIAL ENVIRONMENTAL IMPACTS	IMPACT RATING
PRE CONSTRUCTION STAGE		
Topographical Surveys	Provides information on terrain profiles that can assist in optimizing earthworks designs; mitigating excessive soil erosion incidences and balancing cut and fill volumes	Low key activity with minor adverse short term impacts. Positive long term and localized Beneficial Impacts
Geotechnical Surveys	Provides information on sub-soil properties that will aid in designing safe building foundation designs and in optimizing earthworks designs	Low key activity with minor adverse short term impacts. Positive long term and localized Beneficial Impacts
Material Surveys	Assist in quantifying raw material availability; minimum areas to be	Low key activity with minor adverse short term

PROJECT ACTIVITY	POTENTIAL ENVIRONMENTAL IMPACTS	IMPACT RATING
	mined and minimizing land disturbances	impacts. Positive long term and localized Beneficial Impacts
Environmental Impact Assessment Study	Identify at an early stage the potential adverse impacts which Project could impose on the environment; and to identify appropriate mitigation measures to be adopted in planning and design stages	Long term positive implications
Squatters Eviction and Business Relocation	Socio-economic and psychological negative impacts can materialize if appropriate solutions not identified	Potential negative long term impacts if appropriate solutions not determined
Employment Opportunities	Engagement of local surveyors an individuals to undertake the three identified surveys and EIA Study	Moderate to low positive socio-economic impacts; the latter if State, or local community business, are not engaged
CONSTRUCTION STAGE		
Earthworks Operations	Adverse landform changes; erosion and siltation occurrences and impact on water quality and ecological regimes of receiving water courses; induce flooding episodes through sedimentation of waterways; improper vegetative residue disposals can induce fires (air quality degradation) and disease vector pest breeding; air quality impacts arising from dust dispersions (vehicle movement and soil dislodgement and transport of displaced particles ex-site on public roads); noise emissions from earthworks machines	Marginal and short term impacts. no irreversible long term impacts
Transport of Construction Materials, Plant and Machineries	Noise and vibration impacts imparted on sensitive receptors located along transportation routes; accidents with other vehicles and pedestrians; causing impedances to normal traffic flows (jams) damage to road structures (e.g. culverts, bridges, road pavements, etc.); air pollution episodes (SO_x, NO_x, CO, fugitive TSP emissions)	Marginal and short term impacts on local and regional environments; irreversible long term impacts unlikely
Execution of General Construction Works	Noise and vibration impacts on workers and external receptors: soil erosion and sedimentation	Minimum tolerable impacts are indicated

PROJECT ACTIVITY	POTENTIAL ENVIRONMENTAL IMPACTS	IMPACT RATING
	effects causing water quality degradation and potential flooding episodes ex-site; public health impedances (proliferation of disease vector habitats; unsanitary conditions resulting from inadequate management of wastes); social conflicts between immigrant workers and local population	
Access Road/Rail Connection to Project Site(s)	Land acquisition, land fragmentation, relocation of people and business; fugitive dust dispersions, noise and vibration impacts on adjacent local residents; drainage impedances causing flooding; disruption to local transportation and access movements; posing danger to through flow rail movements	Negligible negative long impacts envisaged on a local scale
Extraction of Raw Materials	Vegetative and overburden clearing operations and temporary storage and final disposal that can cause flooding episodes, induce disease vector and pest proliferation; induce fire episodes; noise and vibration impacts especially if blasting practices are adopted (underground and above ground level), when crushers are operated; health impedances to workers and surrounding communities (fly rocks); security aspects related to storage and use of magazines and explosives.	Localized mainly tolerable long term impacts if mitigation measures are judicially implemented and monitored
Disposal of Waste Construction Materials	Land disturbance and degradation leading to loss in resource value; air, noise and vibration impacts on communities during transport to disposal areas; water quality impacts arising from leaching of toxic chemicals and improper disposal of toxic and hazardous spent oils and lubricants; ineffective and inefficient reuse and recirculation of latent resources in waste material discarded; traffic impedances (accidents, spillage, inducing traffic jams etc.); public health impedances(proliferation of disease vector sites)	Short term local and regional impacts that can be ameliorated with stringent application of mitigation measures

PROJECT ACTIVITY	POTENTIAL ENVIRONMENTAL IMPACTS	IMPACT RATING
Temporary Construction Camps	Social-cultural discords between immigrant workers and local populations; public health impedances (import of diseases not prevalent within the immediate Project Area(s); indiscriminate waste disposals leading to unaesthetic conditions, air and water quality degradation, disease proliferation; completion for utilities within the local area.	Potentially local and short term impacts. Nevertheless socio-cultural impacts can have long term negative impacts.
Cement Plant Start-up and Commissioning	Short term, low probability, excessive SO_x, NO_x, TSP, Dust, CO_2, CO and Dioxin and heavy Metal emissions; excessive noise and vibration emissions and water releases	No adverse short term and localized environmental impacts anticipated based on the relatively low production rates during this period, and the ability of experienced operators to curtail the advent of abnormal operations
Employment Generation and Business Development	Long term positive employment and business opportunities for construction and service companies, both primary and secondary knock-on impacts. Reduce foreign currency deficits. Enhance positive socio-economic impacts and community well-being	Potentially beneficial on a short and long term basis. Induce significant economic benefits to the Nation by off-setting imports of cement, and encouraging Nation development
OPERATIONAL STAGE		
Import of Raw Materials, Export of Finished Products and Storage of Materials at Plant Site	Noise and vibration impacts imparted on sensitive receptors located along transportation routes; air pollution episodes (SO_x, NO_x, CO, HC, fugitive TSP emissions); accidents with other vehicles and pedestrians; causing impedances to normal traffic flows (jams) damage to road structures (e.g. culverts, bridges, road pavements, etc.); fugitive and wheel related dust dispersions from vehicles and from storage facilities at Plant Site; headlight interference from transportation vehicles	Long term significant adverse impacts on a local scale could occur if identified mitigation and amelioration measures not adhered on a rigorous and consistent manner
Quarrying and Burrowing for Raw Materials	Air quality impacts, noise and vibration emissions from blasting operations and from rock crushing operations, fly rock projectiles impacting on nearby communities;	Long term significant adverse impacts on a local scale could occur if identified mitigation and amelioration measures

PROJECT ACTIVITY	POTENTIAL ENVIRONMENTAL IMPACTS	IMPACT RATING
	soil erosion and sediment impacts affecting water quality and inducing flooding episodes; security aspects related to storage and use of magazines and explosives.	not adhered on a rigorous and consistent manner
Material and Fuel Stockpiles Within Plant site	Dust dispersion within Plant area and to surrounding neighbourhoods (adverse public health impacts); erosion and sedimentation causing water quality impediments and inducing flooding episodes; auto-oxidation of coal heap resulting in fires; discharge of low pH and high turbidity drainage waters to external drainage systems and watercourses.	Potential long term impacts on a local scale if adequate mitigation measures not consistently practiced
Gaseous Discharges During Plant Operations	The principal gaseous discharges consist of CO_2 (from calcining of limestone and combustion of organic fuels), NO_x, and H_2O; subsidiary emissions which are much lower in volume include SO_x and Hg vapours (from sulphur and mercury content present in certain types of fuels used), HC, Dioxins and Persistent Organic Pollutants (arising from inefficient combustion in the Kiln and use of halogenated fuels) and TSP. Contribution to significant greenhouse gas emissions is the major concern. Other pollutants are easily dispersed within the surrounding atmosphere.	Tolerable long term impacts on a local and global perspective
Liquid By-Product Discharges	Principally treated sewage discharges contributed by Plant workers and visitors. Other less polluting effluents include cooling water discharges and storm water run-offs contaminated by oil and grease and fine dust.	Tolerable long term impacts on a local and regional perspective
Solid By-Product Discharges	Principally domestic refuse, packing material, scrap metal and schedule waste. Circular economic principals can reduce net disposals through recycling and composting practices	Negligible short and long term impacts. Can be easily mitigated
Noise and Vibration Emissions	Operation of Crushers, Grinders, Electrostatic Precipitators conveyor machines and kilns can	Tolerable long term impacts on a local scale. Noise and vibration

PROJECT ACTIVITY	POTENTIAL ENVIRONMENTAL IMPACTS	IMPACT RATING
	induce disturbance to Plant workers and surrounding premises.	emissions can be mitigated to satisfactory levels
Heat Emissions	Sources include the Kiln, Pyro-Processing module, stacks and clinker cooling chamber. Heat emissions are rapidly dispersed to the atmosphere inducing insignificant temperature increases in the surrounding atmosphere. In-plant temperature levels are easily controlled to tolerable levels	Tolerable long term impacts on a local scale.
Aesthetics	High stacks and unconventional structures can induce negative aesthetics especially if Plant is located external to an Industrial Estate. Material Burrow areas can induce significant unaesthetic landscapes but generally located at isolated areas.	Operating Burrow areas are capable of inducing adverse negative environmental impacts on a long term localized scale
Employment Opportunities and Spin-off Business	Induce significant job opportunities and prominent support to service industries	Long term positive impacts on a local and regional scale

3.8 IDENTIFICATION OF SIGNIFICANT IMPACTS AND PRIORITY SETTING

3.8.1 Selection of Scoping Method

There are many methods and tools to conduct a scoping exercise. These include checklists, matrices, or any other accepted methods, to assist in systematically organising, collating and analysing project data. At the TOR stage, qualitative assessment is adequate but quantitative data can be provided to support the assessment.

The advantages and disadvantages of the various common methods used are summarised in **Table 3.4**. The list given is not exhaustive and any other suitable methods can be used, if relevant.

A useful tool is the Environmental Scoping Matrix (ESM) where a range of points from maximum to minimum are allocated for each identified criterion according to the degree of environmental impact (both negative/positive). Finally, the scores are aggregated for a number of identified criteria (Refer to **Appendix C** for an example of the matrix used for Cement manufacturing plant).

The Qualified Person and the Project Proponent's input is vital at this stage as their knowledge and experience would ensure appropriate weightage is given to each selected criteria [i.e. those issues under assessment (see **Box 5**)].

From the scoping outputs, a priority list of environmental impacts shall be determined for in-depth studies and assessments during the EIA process.

Table 3.4: Advantages and Disadvantages of Impact Identification Methods

METHOD	ADVANTAGES	DISADVANTAGES
Checklists	• Easy to understand and use. • Good for site selection and priority setting. • Simple ranking and weightages.	• Do not distinguish between direct and indirect impacts. • Do not link action and impact. • The process of incorporation of values can be controversial.
Matrices	• Links action to impacts. • Good method for displaying EIA results.	• Difficult to distinguish direct and indirect impacts. • Have potential for double-counting of impacts.
Networks	• Links actions to impacts. • Useful in simplified to check for second order (indirect) impacts. • Handles direct and indirect impacts.	• Can be very complex if use beyond simplified version.
Overlays	• Easy to understand. • Focus and display spatial impacts. • Good siting tool.	• Can be cumbersome. • Poorly suited to address impact duration or probability.
GIS and Computer Expert Systems	• Good for impact identification and spatial analysis. • Good for experimenting.	• Heavy reliance on knowledge and data. • Often complex and expensive.

Source: EIA Training Resource Manual Second Edition (UNEP, 2002).

Note: The list is not exhaustive and not all the above may be relevant to the project. It is the responsibility of the Project Proponent and Qualified Person to determine the best method to adopt for their study.

Box 5:
Criteria for Determining Significance of Environmental Impacts

(i) Magnitude: Defined as the degree and scale of an impact (may be detrimental or beneficial) towards sensitive receptors due to a proposed activity.
(ii) Permanence: Defined as to whether the effects are temporary in nature (e.g. only during certain work activities or only during the construction stage), or may result in permanent effects (e.g. landform alteration, aesthetics, noise and vibration, water and air pollution, social etc.).
(iii) Reversibility: A measure of whether mitigation measures can be implemented to abate potential adverse environmental impacts, or to enhance positive beneficial consequences; or rehabilitating the site back to its original state or better.
(iv) Cumulative Effects: A measure of whether the effects will be accumulative singly or in combination with other effects from nearby sites/activities (that may be detrimental or beneficial) over a time period.

3.8.2 Key Issues Related to Development and Operations of Cement Manufacturing Plants

- Water Pollution: Minimal Impacts; can be easily controlled to tolerable levels.
- Water Abstraction: Minimal Impacts; can be easily calculated to tolerable levels.
- Waste Disposal: Major concern in the development of Cement Kiln Dust. There is a potential for this by-product to be recycles back to the kiln to reduce impacts.
- Fire Hazards: Natural combustion of coal stock piles. Need surveillance, and firefighting systems to be available to quell fires. In addition, ensure quick turnover of stockpile, and nitrogen blanketing of storage silos.
- Transportation of Raw Materials and Finished Products: control fugitive dust dispersions along public roads.

3.9 ESTABLISHMENT OF STUDY REQUIREMENTS FOR EIA

Once the key environmental impacts have been identified and prioritised (see **Section 3.8.2**), the subsequent step is to establish the appropriate study requirements to address these significant impacts.

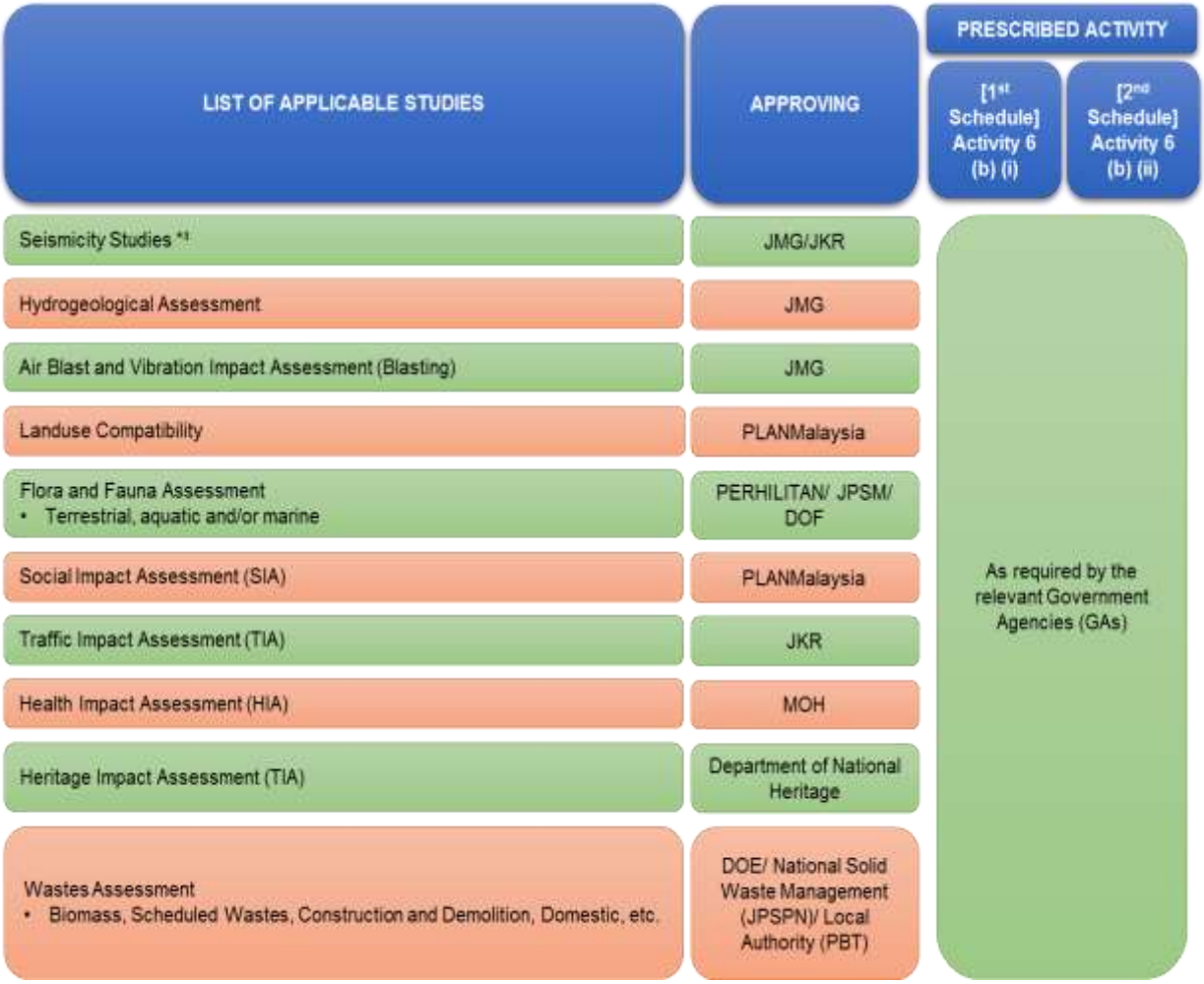
The scope of the EIA studies is dependent on the scale and extent of Project development, its relationship to adjacent land uses and physical developments and nearby sensitive receptors, the scope of planning and study approvals required by the relevant GAs and other relevant criteria. The latter will be generally determined in consultation and engagement with individual agencies (refer to **Section 2.6**).

The Qualified Person shall identify appropriate methodologies, and assessment/modelling tools, to be adopted in evaluating the scope and intensity of identified significant impacts, and to outline expected outputs from the evaluation exercise (e.g. magnitude of spatial and temporal impacts), to be addressed in the TOR. A list of applicable studies is summarised in **Table 3.5**. This list is only indicative and non-exhaustive as site conditions can vary from project to project. Hence, it is the responsibility of the Qualified Person to check and verify the applicability and extent of the relevant studies to be conducted for a specific project.

The EIA Technical Review Committee (EIATRC) shall later assess the adequacy of the proposed studies and may recommend additional studies to be incorporated into the TOR.

Table 3.5: List of Applicable Studies to be considered in the EIA

LIST OF APPLICABLE STUDIES	APPROVING	PRESCRIBED ACTIVITY	
		[1st Schedule] Activity 6 (b) (i)	[2nd Schedule] Activity 6 (b) (ii)
Slope Analysis • Terrain and slope classification	JMG/JKR	✓	✓
Geological Terrain Mapping (GTM)*1 • Erosion • Terrain Classification • Terrain Component • Construction Sustainability	JMG/JKR	✓	✓
Erosion and Sediment Control • LD-P2M2 • Erosion and Sediment Control Plan (ESCP)	DOE DID	✓	✓
Hydrology Assessment • Basin/River systems • Runoff • Flood risk	DID	✓	✓
Baseline Sampling • Water, air, noise and/or vibration	DOE	✓	✓
Water Quality Modelling • Total Suspended Solids (TSS) • Sewage and effluent loading	DOE	✓	✓
Soil Investigation (SI) *2	JMG/JKR	✓	✓
Geotechnical Report *2	JMG/JKR	✓	✓
Landslide Risk Analysis *2	JMG/JKR	✓	✓



Notes:

(i) *1 GTM shall be carried out by licensed geologist/geotechnical engineer based on JMG/JKR requirements. Report must be approved by JMG/JKR before inclusion of findings into the EIA.

(ii) *2 Required for physical development projects only, to be verified by a licensed geologist/geotechnical engineer based on JMG/JKR requirements. Reports must be approved by JMG/JKR before inclusion of findings into the EIA.

(iii) *3 Only if areas have known faults, or has experienced seismic activities previously. Reports must be approved by JMG/JKR before inclusion of findings into the EIA.

(iv) The list is not exhaustive and not all the above may be relevant to the project. It is the responsibility of the Project Proponent and Qualified Person to determine the relevant information required for environmental assessment and compliance.

3.10 OUTLINING OF MITIGATION MEASURES

The Qualified Person with the assistance of technical consultants and specialists shall assess the BATs, BMPs and options for P2M2 to address the identified key environmental issues.

At the point of the TOR/ESI, the identified measures shall be qualitative and descriptive only, to be further detailed in the EIA stage.

3.11 PREPARATION AND SUBMISSION OF TOR/ESI

Findings from the scoping exercise shall be incorporated into the ESI as information to develop the TOR. The TOR and ESI shall be submitted to DOE for review and endorsement before proceeding to the EIA stage.

3.11.1 TOR Table of Content (TOC)

The TOR shall contain, but not limited to, the following:

(a) Introduction: Include the title of the project, Project location, Agency approvals obtained and a brief introduction to project details.

(b) List of Consultants/Study Team: Include the list of Consultants and Study Team (DOE registration number, academic background, experience, area of study and declaration). The EIA consultant team shall be led by a Team/Project Leader/Manager who shall be responsible for the EIA report.

(c) Project Scope: Detail out the legal requirements to carry out the project. Provide description on the project, project activities and implementation schedule.

(d) Description of the Existing Environment: Present a succinct review of the current status of the pertinent/appropriate elements of the environment that have some association with Project development and operations. They would include land use and landscapes; geological and soil profiles; climatic conditions (encompassing temperature, humidity, rainfall and wind profiles); the quality and quantity of water resources: air quality profiles; noise and vibration profiles; socio-economic profiles; heritage profiles; archaeological profiles etc.

(e) Alternatives Consideration: Provide the assessment of the various alternatives/options considered for the project and detail out the justifications and reasons for selection of the final project siting, layout, components and/or details.

(f) Significant Environmental Impacts to be studied: Include the findings from the environmental scoping and detail out the significant impacts which will result from the project activities that are required to be included in the EIA.

(g) Study Boundary: Delineate the study boundaries and identify the environmentally sensitive areas (ESAs) within the zone of study/zone of impacts.

(h) Assessment Standards: List the standards, criteria, acceptable limits, etc. that will be used to assess the environmental impacts.

(i) Timeline of Study: Detail our all studies/investigations to be carried out, including indicative dates.

(j) Consideration of Concurrent Projects: List potential concurrent or planned projects in the vicinity of the Project site(s) that may result in cumulative impacts.

(k) Description of Modelling Tools and Assessment Methodologies: List the modelling tools and methodologies to undertake the impact assessment and evaluation of significance.

(l) Possible Mitigation Measures: Outline the mitigation measures or BMPs from similar projects that may be used to address the environmental impacts from the project.

The ESI shall be appended as part of the TOR as a supporting document. The format for the ESI is as detailed in **Appendix 8** of the EGIM (DOE, 2016).

3.11.2 TOR Adequacy Check (TORAC) Process

A review shall be carried out by the EIATRC comprising the DOE officers and appointed individuals (AIs) and/or GAs.

The TORAC requirements and procedures shall follow the requirements as detailed out in the EGIM (DOE, 2016) or any future amendments to it.

The adequacy of the scoping exercise and the TOR shall be decided in a TORAC meeting, chaired by the DOE Headquarters (HQ)/State Director (refer to **Box 6** for possible outcomes).

When the TOR Report is endorsed, the Project Proponent shall proceed to the EIA stage.

Box 6:
Outcomes from TORAC Review

At the end of the process, the TORAC meeting can decide the following:

(i) Endorse the report.
(ii) Endorse the report with revisions, where a Revised TOR shall be submitted.
(iii) Reject the report with reasons (a fresh TOR can still be submitted).

CHAPTER 4

ENVIRONMENTAL IMPACT ASSESSMENT: BASELINE DATA

4.1 INTRODUCTION

This Chapter identifies the scope and range of baseline information that is required to be sourced and collated in order to assist in the conduct of an Environmental Impact Assessment (EIA) study for a Cement Manufacturing Plant (CMP) in Cement Industry. Both primary as well as secondary data contribute towards the development of a comprehensive baseline data bank.

4.2 SECONDARY DATA SCOPE AND CONTENT

Secondary data encompasses information and statistical data retrieved from various sources; but mainly from official published reports, census, publications and research papers. They are collected and collated to develop basic information to support the assessment and evaluation of potential environmental impacts induced by a project.

All relevant information and representable statistics must be clearly referenced to their source of origin and the date of their publication; and included in the EIA report [Ref: Department of Environment (DOE) Notice 1/2012 dated 6 Jan 2012]. References with respect to all maps, photos and diagrams will also need to be included in the EIA report.

4.3 PRIMARY DATA SCOPE

Primary data is sourced in order to reinforce and update available secondary data, and to fill in information gaps that have been collated for conducting a detailed assessment of impacts. Common methodologies for primary data acquisition include site surveys, and on-site and off-site monitoring programmes, to determine real time ambient, air and water qualities, noise and vibration levels, and ecological and socio-economic profiles.

The sampling and survey areas shall in most cases be confined within the Zone of Study (ZOS) boundaries. However, if the spatial extent of impacts is deemed to occur beyond such boundaries, then the baseline sampling scope, and corresponding impact assessment, shall need to extend into the Zone of Impact (ZOI) area. This must be clearly defined in the EIA study. For example, in the case of pollution of water resources, water quality impacts could reach beyond the ZOS boundaries, and potentially extend into the ZOI. Hence, the latter Zone must be included in the impact assessment study.

Data collection covers three major environmental components:

4.3.1 Physico-Chemical Environment

In line with the DOE's environmental mainstreaming policy, the EIA study shall focus principally on the core impacts of water and air pollution, and waste disposal, when assessing the potential project related impacts on the physico-chemical environment. Within the confines of the ZOI/ZOS, baseline information on these three core subjects are needed to determine the state of the environment before, during, and after project implementation by benchmarking against relevant DOE standards and guidelines pertaining to acceptable water and air quality values, noise and vibration levels and land resource quality.

A baseline sampling plan, which delineates parameters to be sampled, methods and frequency of sampling and location of sampling sites, shall be determined based on the project site and its potential interaction with the surrounding environment. Details of the sampling plan and its execution schedule shall be prepared and be clearly stated in the EIA report; together with details on persons to be in charge, and time periods for execution of sampling runs.

The range of baseline parameters that need to be monitored and analysed is summarised in **Table 4.1**. The recommended parameters for water, air, noise and vibration monitoring, and the reference standards/ guidelines to ascertain their related significance/ implications, are provided for reference in **Appendix D to G**.

All samples must be analysed by a *Skim Akreditasi Makmal Malaysia* (SAMM) accredited laboratory or equivalent.

All test certificates and data shall be included in an Appendix to the EIA report as supporting evidence (Ref: DOE Notice 1/2012 dated 6 Jan 2012).

4.3.2 Biological Environment

The biological environment is complex in nature. Therefore, the relevant agencies such as the Forestry Department of Peninsular Malaysia (JPSM) and the Department of Wild Life and National Parks Peninsular Malaysia (PERHILITAN) must be consulted prior to executing data collection and surveys aimed at interpreting the ambient status of ecological resources in the vicinity of the Project site.

A large amount of general information already exists within the various agencies pertaining to different localities; especially in relation to Permanent Reserved Forests (PRF), wildlife sanctuaries and ecological protection areas. These can be referred to as secondary data. Similarly, other agencies such as the Forest Research Institute of Malaysia (FRIM) have documented inventories of flora and fauna in selected forest areas and conservation zones through published research.

When secondary biological related data is unavailable in and around the Project site(s), primary data will be sourced to assess the impact of land clearing and earthworks on the fauna and floral populations in the surrounding environment.

Their displacement will result in loss of biodiversity and population declines due in part to loss of habitats and lack of food sources. The survey will provide an indication of the species of fauna, especially wildlife, found in the area, their population levels and their respective habitats so that a wildlife relocation plan can be initiated especially for the large charismatic animals such as elephants, tigers, sun bears, tapirs, etc.

The scope of monitoring requirements for terrestrial and aquatic biological environments will be advised by the respective government agencies (GAs). The reported findings on floral and faunal inventories, and the potential impacts induced by project activities, are to be approved by the said GAs before incorporation in the EIA report (refer to **Table 4.2**). If the biological impact by the Project is deemed insignificant, the use of secondary data would be adequate to support the conclusions reached.

4.3.3 Human Environment

The Project Proponent shall abide by the requirements, guidelines and procedures of PLANMalaysia in carrying out a Social Impact Assessment (SIA). PLANMalaysia shall review, endorse and enforce the requirements of the SIA. For the purpose of the EIA, only the main findings from the SIA shall be incorporated.

Relevant data collection will be required to assess the socio-economic status of communities resident within the project's surrounding environment; the results of which will be included the EIA report. Secondary data will depend on the extraction of relevant information from population census reports; but for an updated real time estimation of population levels in the vicinity of the project site(s), such information is best garnered from the local authorities, district offices (PTD) and the *ketua kampung*. Primary *s*ocio-economic data may also be obtained from focal group discussions (FGDs) and from direct person-to-person interviews.

Activities related to Project development and operations could beneficially or adversely affect the health, safety and welfare of communities residing in the vicinity of the project site. These potential impacts shall be considered if they are deemed to be significant issues. These may include, but not be limited to, impacts on public health, heritage and culture, archaeology and traffic circulations (refer to **Table 4.2**). The findings of these studies must be incorporated into the EIA report.

Table 4.1: Recommended Monitoring Requirements for EIA Studies

Aspect	Recommended Parameter	Guidelines/Standards	Recommended Requirements
River Water Quality	In-situ Measurements • Dissolved Oxygen (DO) • Temperature • Conductivity • pH Ex-situ Analysis • biochemical Oxygen Demand (BOD) • Chemical Oxygen Demand (COD) • Total Suspended Solids (TSS) • Ammoniacal Nitrogen (AN) • Mercury (Hg) • Cadmium (Cd) • Chromium Trivalent (Cr^{3+}) • Chromium Hexavalent (Cr^{6+}) • Arsenic (As) • Cyanide (CN) • Lead (Pb) • Copper (Cu) • Manganese (Mn) • Nickel (Ni) • Tin (Sn) • Zinc (Zn) • Boron (B) • Iron (Fe) • Phenol • Free Chlorine (Cl_2) • Sulphide (S^{2-}) • Oil and Grease (O&G) • Total coliform • Faecal coliform	National Water Quality Standards of Malaysia (NWQS)	• One time composite sampling. • Upstream and downstream of major rivers and streams into which Project related effluents are discharged. • Minimum two sampling locations (depending on river type). • Multi-depth sampling for deep rivers (>1 m deep). • Water quality parameters shall be selected on the site conditions and the range of pollutants likely to be discharged from the Project site.
Air Quality	• $PM_{2.5}$*1 • PM_{10}*1 • Carbon Monoxide (CO)*2 • Sulphur Dioxide (SO_2)*2 • Nitrogen Dioxide (NO_2)*2 • Ozone (O_3)*2*3	Malaysian Ambient Air Quality Standards (MAAQS)	• Parameters to be sampled are dependent on site conditions. • One-time sampling at minimum two stations upwind and downwind of

Aspect	Recommended Parameter	Guidelines/Standards	Recommended Requirements
	• Hydrocarbons Source: DOE Notice 1/2015 dated Mar 2015		the Project site(s). • Project boundary and nearest receptors. Note: *[1] 24-hrs *[2] 1-hr *[3] Ozone needs to be measured for selected projects only. Justification needs to be provided for its omission.
Noise Level	• L_{Aeq} • L_{Max} • L_{Min} • L_{10} • L_{50} • L_{90}	Guidelines for Environmental Noise Limits and Control	• Parameters to be sampled are dependent on site conditions and need. • One time sampling (24-hrs for day time and night time). • Project boundary and nearest receptors.
Vibration	• Requirements as per Schedules 1 – 6 of the Planning Guidelines for Vibration Limits and Control	The Planning Guidelines for Vibration Limits and Control	• Parameters to be sampled are dependent on site conditions and need. • One time sampling (1-hr for day time and night time). • Project boundary and nearest receptors.

Note: The list above is indicative and non-exhaustive. The Project Proponent and Qualified Person shall include and provide any additional baseline sampling including parameters, as required by DOE, other GAs and/or deemed necessary for the project.

Table 4.2: Additional Sampling and Study Requirements

Aspect	Recommended Parameter	Reference	Sampling Requirements	Approving Authority
Geology and Soil	• Site topography based on land surveys. • Seismicity. • Soil profile analysis including K-value for erosion analysis. • Hazard mapping.	• JMG and JKR requirements.	• Soil Investigation (SI). • Hand auger (determine K-value). • Field survey of slope areas and hazards (as part of Geological Terrain Mapping).	• Minerals and Geoscience Department (JMG). • Public Works Department (JKR).
Hydrology	• Stream flow • Riverbed cross section	• DID requirements	• Site survey to verify river system (including river bed cross-sections) and drainage. • Stream gauging to ascertain flow profiles. • Identification of downstream sensitive receptors.	• Department of Irrigation and Drainage (DID).
Hydrogeology	• Groundwater profile • Groundwater quality	• JMG requirements • National Groundwater Quality Standard	• Groundwater table. • Hydrogeological mapping. • Groundwater quality sampling (minimum two locations depending on project size).	• JMG • DOE
Ecological Assessment	• Habitat mapping • Species inventory (including	• International Union on the	• Terrestrial: Surveys within project site and	• JPSM • PERHILITAN

Aspect	Recommended Parameter	Reference	Sampling Requirements	Approving Authority
	photographs) • Abundance and diversity assessment. **Terrestrial Flora** • Flora inventory **Terrestrial Fauna** • Mammals • Avian • Herpetofauna **Aquatic Flora and Fauna** • Fishery resources • Phytoplankton and zooplankton • Benthic organisms	Conversation of Nature (IUCN) Red List • Wildlife Conservation Act 2010 (Act 317)	adjacent land areas. • Aquatic: Within project site and nearby ESAs (fishery resources, aquaculture sites, etc.). • ESAs (within ZOI). • Identify any endemic, rare, endangered, threatened and near extinct species within the project site and surrounding ZOI. • Level of sampling and data collection shall depend on the sensitivity of the site.	• Department of Fisheries (DOF)
Landuse	• Current landuse • Future and committed landuse • Sensitive receptors • Zoning and compatibility	• Structure and local plans	• Site surveys. • Mapping to update information. • Within the ZOI.	• PLANMalaysia
Social Impact Assessment (SIA)	• Population socio-economic profile • Identification of stakeholders • Perception survey	• Manual for SIA of Project Development	• Carried out as part of the SIA. • Surveys on target groups potentially affected by the project. • Surveys shall	• PLANMalaysia

Aspect	Recommended Parameter	Reference	Sampling Requirements	Approving Authority
			represent the stakeholders in the ZOI. • Stakeholder engagement conducted.	
Public Health	• Population profile • Public health status	• Guidance Documentation Health Impact Assessment (HIA) in EIA	• Carried out as part of the HIA. • Surveys on target groups potentially affected by the project. • Surveys shall represent the stakeholders located within the ZOI. • Stakeholder engagement conducted.	• Ministry of Health (MOH)
Traffic	• Traffic count during peak traffic periods.	• JKR requirements	• Carried out as part of the Traffic Impact Assessment (TIA). • Traffic survey at major junctions leading to project sites.	• JKR
Wastes	• Estimation of biomass from site clearing. • Potential waste (domestic, construction & demolition	• DOE and local authorities (PBT) requirements.	• Site surveys to ascertain existing site conditions.	• DOE • PBT

Aspect	Recommended Parameter	Reference	Sampling Requirements	Approving Authority
	discards, scheduled wastes) generation.			
Heritage, Culture and Archaeology	• Identify and determine significance of value of such sites within or near to project site.	• National Heritage Register	• Site surveys and interviews with authorities and locals.	• National Heritage Department. • Department of Museum. • Jabatan Kemajuan Orang Asli (JAKOA).

Note: The list above is indicative, non-exhaustive and may not be relevant to the project. It is the responsibility of the Project Proponent and Qualified Person to include and provide any additional information required by the GAs from the outcome of stakeholder engagements.

CHAPTER 5

ENVIRONMENTAL IMPACT ASSESSMENT: EVALUATION OF IMPACTS

5.1 INTRODUCTION

There are many methods available to assess the nature and scope of impacts exerted on the environment arising from Project Activities. Generally, all methods of impact assessment seek to qualify and quantify the changes imposed on the ambient state of environmental resources induced by activities executed during different phases of project implementation.

While there is no one method that fits all requirements, the predictive and assessment method chosen must have at least the following attributes:

(i) Established and proven quantitative methods and models.

(ii) Adequate, accurate and up-to-date data for input into predictive models or algorithms.

(iii) Results which can be replicated, and are reproducible by independent evaluators.

(iv) Employment of cost-effective and easily accessible software, which can be readily purchased (propriety software and tools can also be used). Widely accepted freeware is also acceptable.

It is up to the Qualified Person to select the best method to carry out an assessment of the magnitude, extent and significance of impacts induced by the project based on the reliability and completeness of datasets available.

Only significant issues shall be assessed in detail in the EIA. Issues that are deemed non-significant shall be addressed qualitatively in general.

5.2 PREDICTION AND EVALUATION OF IMPACTS

The level of detail necessary for impact assessment shall be in accordance with the following factors:

(i) Scale of the project (land area occupancy, potential total disturbed areas, etc.).

(ii) Intensity of development (total land clearing required, phasing of land clearing).

(iii) Potential pollutant emissions induced by project activities.

(iv) Magnitude and complexity of impacts.

(v) Spatial extent of impacts (e.g. localised versus transboundary).

(vi) Probability of cumulative impacts (taking into consideration pollutants emitted by other projects located in adjacent areas and *vice versa*).

(vii) Sensitivity of nearby receptors [e.g. Environmentally Sensitive Areas (ESAs)].

A list of typical significant components and impacts related to associate with the development and operations of Cement Manufacturing Plant (CMP) is summarised in **Table 5.1** as a guide for the Project Proponent and Qualified Person to consider. Photo inventories will provide important supportive evidence for the assessment and evaluation of potential Impacts and should be provided (see examples in **Figure 5.3).**

Key impact assessments that is required to be conducted in the EIA for the development of a Cement Manufacturing Plant is as follows:

- Air Quality
- Noise and Vibration
- Erosion and Sedimentation
- Water Quality
- Public Health
- Drainage Impacts
- Waste Management
- Ecology
- Socio Economic
- Hydrology
- Geotechnical Hazards
- Groundwater/ Hydrogeology
- Traffic
- Safety and Health
- Risk Assessment

Other subject matter may be required to be conducted depending on the sensitivity of the receptors at the proposed project location and requirement by other Agencies.

If the existing baseline environmental quality within and external to the proposed project area is above the specified ambient standards, the project proponent needs to ensure that project operations shall not lead to further deterioration of the existing ambient quality. For existing plant/ factories that are planning to expand their operations, or increase/ upgrade their capacity, a cumulative impact assessment shall be performed to assess the degree of potential impact at the identified receptors, and the need to upgrade existing pollution control devices.

5.2.1 Air Quality

Assessment Requirements

It is important that during the construction stage of the CMP, all potential sources emitting gaseous pollutants (e.g. dust and airborne particulate and other gaseous emissions) located within and external to the project site be identified and inventorised; before assessing their current observed influence on surrounding air shed quality status, and their impacts on surrounding sensitive receptors.

During Cement Manufacturing Plant (CMP) operations, impacts from pollutant emissions by, inter-alia, plant and machinery (e.g. kiln and pyro-processing plants), by vehicles transporting raw materials and finished products in and out of the CMP, and by fuel burning equipment shall be assessed independently. The objective is ascertain the magnitude of increase in ambient pollutant concentrations in the surrounding environment induced by both CMP operational activities, and by existing sources emitting similar pollutants.

Evaluation of Impacts

Air quality models are mainly Gaussian-based, and many versions are available in the market. They are employed to determine the ambient Ground Level Concentrations (GLC) of an emitted pollutant based on their mass of discharge and long-term records of local air shed characteristics such as wind speed, direction and frequency, atmospheric stability variations over a day, temperature and humidity levels. Model predictions are useful in a wide variety of air quality decisions, including determining the air quality expected under various scenarios. It is best to adopt the most appropriate model to simulate the air pollutant dispersion patterns from a point source such as a stack, and to map the resulting spatial residual ground level pollutant concentrations to ascertain the degree of induced impacts on identified surrounding receptors. The change in GLCs of specific pollutants at sensitive receptors, pre and post-development of the CMP, shall be assessed and evaluated as to their significant impact and consequential implications (e.g. health, welfare and safety of surrounding communities and settlements).

Usually an initial air quality assessment is conducted on a qualitatively basis to ascertain whether the CMP can exert significant air quality changes on the surrounding air shed. If it is deemed possible, the air quality assessment should progress to a quantitative assessment by adopting a refined / advanced modelling system to predict with more certainty the CMP's potential to increase the ambient ground-level concentration of pollutants, and to what degree. Refined air dispersion models provide a detailed analysis of the targeted pollutant parameters of interest and caters for multiple emission sources. This approach gives a more accurate estimate of the pollutants' concentrations at receptors. However, a refined model requires more specific input data which can include topographical profiles, better receptor grid resolution, downwash or other plume adjustment, and pollutant decay or deposition algorithms. Refer to **Section 5.3** of this Guidelines for examples of prediction tools.

It is suggested that the following scenarios are considered for air quality impact assessment of a Cement Manufacturing Plant (CMP):

(i) The significant pollutants emitted from the CMP: continuous, large flow volumes with high concentration emission from point sources should be given priority.
(ii) Ambient air prediction and assessment scenarios include, inter-alia, normal operation conditions (with air pollution control system to specified guaranteed performance limits); worst case scenario (no treatment of flue gas during worst atmospheric conditions), and emergency bypass scenario (emergency shutdown due to power outage or plant upset or air pollution control system failure).
(iii) Meteorological data should be sourced from the nearest meteorological station.
(iv) Sensitivity of the receiving environment or sensitive receptors: should there be any locally specified tolerance levels, such as exposure dosage levels to plants or humans.
(v) Reference to assessment criteria such as the New Malaysian Ambient Air Quality Standard, baseline conditions or any relevant standards /guideline limits.

Some of the key information to be included in reporting modelling results are:

(i) Information about the input data and how variations may affect the results.
(ii) Discussion on the accuracy of the modelling results.
(iii) Identification of the receptors that are most highly impacted and those are the most sensitive.
(iv) Tabulate the model output in predicted pollutants concentrations at respective sensitive receptors and evaluate the significances.

The pollutants' dispersion contours should be overlaid on a land use map surrounding the project site. A sample of this contour map is illustrated in **Figure 5.1.**

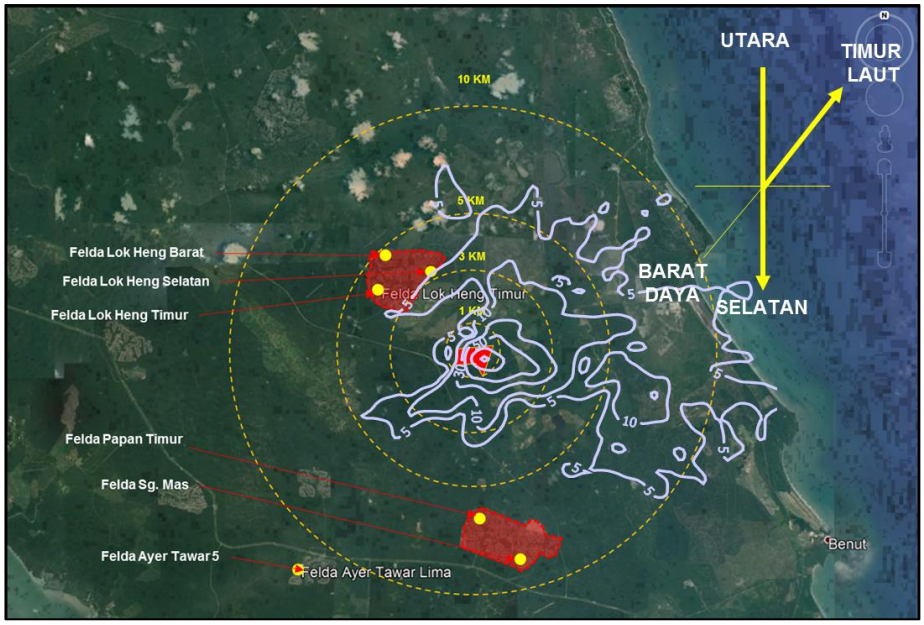


Figure 5.1: Sample of pollutants dispersion contours

Output

The objective of Air Quality model simulations is to determine the degree of potential impacts imposed on nearby sensitive receptors. Cumulative impacts, that are the sum of gaseous pollutant emissions induced by CMP operations, and by surrounding pollutant emitting premises, should also be elucidated.

Critical levels of gaseous pollutants imparted on sensitive receptors shall be identified to ensure that such levels can be mitigated to ensure that residual levels are within acceptable limits, and to ensure populations working in such areas are protected against potential induced health impediments.

5.2.2 Noise and Vibration

Assessment Requirements

During the construction stage of the CMP, the employment of machinery and equipment shall generate noise and vibrations. Typical Sound Power Levels emitted by various plant and equipment that are likely to be deployed to construct the CMP are summarised in **Table 5.2.** Likewise during the CMP's operational tenure, installed plant and equipment are capable of emitting significant noise levels at source as summarised in **Table 5.3**. Specific sound power levels, and their noise spectrum, associated with typical operating equipment can be sourced from manufacturers and suppliers for a comprehensive overview of the characteristics of potential noise emission and propagation; and measures which can be adopted to attenuate their intensity.

Table 5.2: Typical Sound Power Levels from Construction Equipment and Activities

Equipment	Operating Condition	Sound Power Level @ 15 m
Bulldozer (e.g. CAT D10)	Clearing vegetation	~84 dBA
Backhoe	Digging	78 – 80 dBA
Excavator	Operation	81 – 85 dBA
Crawler Crane	Lifting	81 – 85 dBA
Compressor	Operating	78 – 80 dBA
Concrete Batching Plant	Operation	83 dBA
Generator set	Operation	80 – 82 dBA
Impact Pile Driver	Operation	95 – 101 dBA

Table 5.3: Typical Sound Power Levels from Operating Equipment and Activities

Equipment	Sound Power Level @ 15 m
Transfer / Delivery Pump	89 - 100 dBA @ 1m
Exchanger / Exhaust Fan	90 - 100 dBA @ 5m
Air compressor	80 dBA @ 1m
Boiler	85 dBA @ 1m
Chiller	85 dBA @ 1m
Flare Combustion	85 dBA @ 1m
Burner Combustion	85 - 90 dBA
Conveyor Belt (line source)	82 – 103 dBA @ 1 m

Evaluation of Impacts

Approaches to environmental noise and vibration assessment are guided by Guidelines for Environmental Noise Limits and Control (Third edition) and The Planning Guidelines for Vibration Limits and Control, published by the DOE Malaysia.

It is suggested that the following aspects are considered for noise and vibration impact assessment for a CMP:

(i) List of significant sources from the CMP. Continuous high noise or vibration levels should be given priority.

(ii) Noise and vibration prediction and assessment scenarios. These would encompass normal operating conditions; with and without control measures.

(iii) Degree of sensitivity of the receiving environment and/or environmental receptors, gauged by any locally specified tolerance levels, such as exposure levels to residential, worship, institutions, heritage buildings etc.

(iv) Reference to assessment criteria such as the national guideline limits, baseline conditions or any relevant standards / guideline limits. Where multiple significant sources from a CMP have been identified, prediction of impacts employing modelling software normally enhances the ease by which the prediction of impacts are executed. These modelling tools could incorporate specific characteristics of noise and vibration sources, as well as attenuation features (noise, barriers, buildings, terrain etc.) to generate more accurate predictions.

Predictions of noise and vibration dispersions from the Project site can be ascertained by employing universally accepted analytical models or through manual calculations. The objective being to determine the increase in absolute noise and vibration levels in areas within and surrounding the project site. The results should be portrayed in the form of noise contours and vibration spot levels for easy comprehension of the degree and severity of impact.

Outputs

The main objective of this impact assessment is to determine the potential noise and vibration levels at the plant boundaries and whether such levels comply with DOE regulations/guidelines. Furthermore, the recommended exercise is to determine the significance of Project induced impacts at the identified receptors. The report should include:

(i) Information about the input data and how variations may affect the results.

(ii) Discussion on the accuracy of the prediction calculations and / or modelling software.

(iii) Identification of the receptors that are most highly impacted and those are the most sensitive.

The model results on predicted levels should be tabulated or portrayed as contours overlaid on suitable maps. A sample of a contour map is illustrated in **Figure 5.2.**

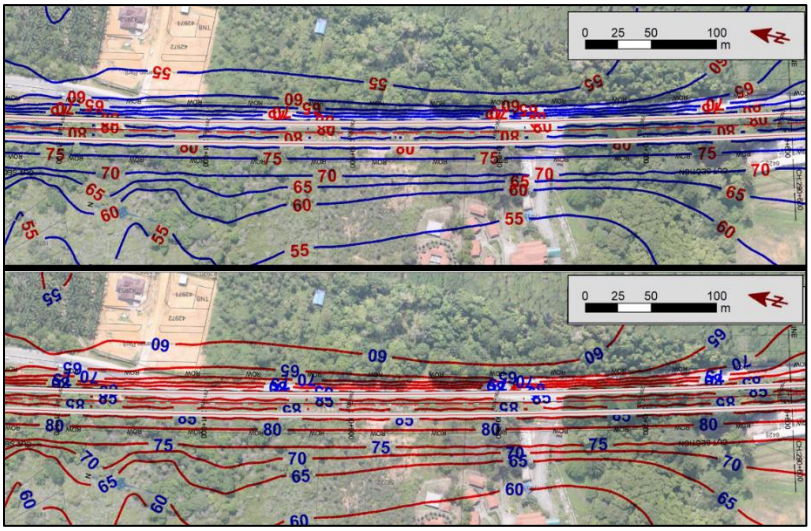


Figure 5.2: Sample of noise contour map

Noise and vibration model simulations shall determine the degree of potential impacts imposed on nearby sensitive receptors. Cumulative impacts, that are the sum of noise and vibration levels induced by CMP activities and by surrounding noise emitting premises, should also be quantified.

Critical levels of noise and vibration intensities imparted on sensitive receptors shall be identified so that mitigation measures can be identified to, inter-alia, ameliorate adverse impacts to tolerable levels, to ensure that residual levels are within acceptable limits, and to ensure those working in such areas are protected against potential induced health impediments.

5.2.3 Erosion and Sedimentation

Assessment Requirements

(i) Assessment of the scale of land clearing and removal of vegetative cover at the site to determine the rate of erosion.

(ii) Assessment of the schedules for land clearing process and rehabilitation stages

(iii) Assessment of the conditions of the hydrological and drainage systems located within and external to the CMP site; and how they may be altered if streams and rivers are diverted and/or become silted up or filled in.

(iv) Review of the type and scope of earthworks to be carried out within the project site

(v) Assessment of the extent of erosion and sedimentation that will likewise affect the aquatic ecology and water pollution downstream

(vi) Determination of suitable best management practices (BMPs) and mitigation measures to reduce the effects of erosion and sedimentation.

Evaluation of Impacts

(i) Calculate the rate of soil erosion and sediment yield using standard empirical formulae and site-specific information (surveys, soil particle analysis terrain characteristics, hydrological data, etc.), to determine the extent of erosion and sedimentation as a result from land clearing.

(ii) Provide erosion scenarios such as with or without mitigation measures in the assessment.

(iii) Run alternative simulations to determine the BMPs that shall be adopted to minimise the negative effects.

Output

(i) Adoption of precautionary principles to avoid high risk areas [identified through slope analysis and geological terrain mapping (GTM)], or in designing technical and engineering solutions to minimise erosion and geo-hazards in such areas.

(ii) Identify suitable BMPs to be incorporated in the project through the land-disturbing and pollution prevention and mitigation measures (LD-P2M2) based on the modelling results.

5.2.4 Water Quality Impacts

Assessment Requirements

(i) Assessment of the magnitude and frequency of pollutant discharge loads and their potential scope of impairment to the water quality of receiving water courses in the vicinity of, or linked to, the project site.

(ii) During the construction stage the principal pollutant loads discharged to water courses will be in the form of suspended particulates that are generated through land clearing and earthworks activities. The denuded land area stripped of its vegetative cover will increase surface run-offs during rainy periods resulting in enhanced soil erosion process and carry over of soil particles to receiving water courses. In addition, disposal of biomass, leakage of toxic and hazardous substances (oil and grease, solvents etc.) through spillage, and sewage and solid waste discharges from construction worker camps could induce significant adverse water quality impacts if not managed effectively. During the testing and commissioning stage, large amounts of water may be used for pressure testing of pipelines, vessels, pyro-processing

equipment and kilns, the discharge of which could carry with it chemical additives that could impair the water quality status of receiving waters.

(iii) During operations, improper treatment of sewage flows arising from toilets and canteens, and erosion and sedimentation of material stockpiles can also contribute to increased discharges of oxygen demand substances, nutrients and suspended particulates into waterways, leading to their degradation of water resource capability, ecological biodiversity, and economic value. As such the discharge of such pollutants and their impacts on downstream users need to be evaluated. Furthermore, stockpiling of raw materials and coal without proper protection can result in the discharge of run-offs that are acidic and contain high levels of suspended particulates. There are potentials for fire episodes to occur if coal (if employed as a fuel) is not adequately stored and consumed in a timely manner.

Evaluation of Impacts

(i) There are a variety of established quantitative models that can be applied to assess potential changes in ambient water quality status of water courses arising from the discharge of point source pollutant loadings into their system. A suitable, compatible, model must be selected to simulate the effects of pollutant loadings on downstream receptors which are dependent on the same water course for their socio-economic activities. The simulations should take into consideration the hydraulic properties of the receiving water course; particularly for the case when drought flows occur. Changes in water pollutant indicators that need to be assessed include Biochemical Oxygen Demand (BOD), Ammoniacal Nitrogen (AN) and coliforms. The magnitude of increases in these pollutant levels need to be assessed, and a determination made as to whether a water quality class shift has occurred. If in the affirmative, then mitigation measures need to be identified to ameliorate the negative impacts to tolerable levels.

It is suggested that the following procedures are considered for assessing water quality impact arising from the construction and operations of a CMP:

I. Identify the significant pollutants that are potentially emitted from the CMP. In this respect continuous, large volumes of highly contaminated water sources should be given priority. This will determine the development of BMPs for the site.

II. Water quality prediction and assessment scenarios should encompass:

(a) Normal operation conditions (with Industrial Effluent Treatment System (IETS) and Sewage Treatment systems) designed to meet the specified guaranteed performance limits), and

(b) Worst case scenario (no effluent treatment).

III. Hydrology data should be sourced from the nearest DID Monitoring Station.

IV. Sensitivity of the receiving environment or sensitive receptors, should there be any locally specified tolerance levels, such as drinking water intake, recreational requirement, agricultural or aquaculture requirement, ecological requirement, other downstream industrial needs, navigation etc.

V. Reliable estimations of the quality (concentration of pollutant) and quantity (effluent flowrate) of effluent generated should be carried out in order. This is important to ensure that the proposed treatment technology is effective and the capacity of the treated effluent is sufficient.

VI. Reference to assessment criteria such as the national river and marine water quality standards, baseline conditions or any other relevant standards / guideline limits.

Impact assessment shall rely on the concept of assimilative capacity of the receiving waterbody and water quality objectives. Quantification of the assimilative capacity of the receiving environment shall consider physical processes, as well as all chemical, biochemical and biological processes.

The prediction exercise or modelling should provide information as the basis for determining whether the aquatic resources and beneficial users are at risk, or that the assimilative capacity may be exceeded as a result of project implementation. When the prediction shows the water quality of the receiving waterbodies may have been significantly compromised due to discharges from the project, then suitable mitigation measures shall be considered to alleviate the concern so as to either remove or mitigate the impacts to acceptable levels.

Outputs

The main objective of an impact assessment is to determine the significance of the effects of pollutants being discharged from a particular source and it's Zone of Impact. Key information to be reported include:

(i) Information about the input data and how variations may affect the results.

(ii) Discussion with respect to the accuracy of the predictions.

(iii) Identification of the receptors that are most highly impacted and those are the most sensitive to the impacts imparted.

(iv) Suitable BMPs and treatment systems identified to minimise the effects of discharges to the waterways, e.g. silt traps, sewage and wastewater treatment systems, etc.

(v) Effectiveness of these BMP's can be simulated to estimate load reductions, ensuring pollutants are controlled at-site to reduce off-site impacts to meet the requirements and standards of various agencies.

5.2.5 Public Health Impact

Assessment Requirements

A health hazard may be categorized as biological, chemical or physical in nature. The recommended of general requirement for assessing health impact and existing public health status of the local community, are provide for reference in **Appendix I**.

During the CMP's Construction Stage, the common health hazards are:

(i) Respiratory effects from exposure to gaseous and particulate pollutants such as particulate matter below 10 microns (PM_{10}) in size, SO_2, and NO_2 from fuel combustion machinery on sites; and dust dispersion from unpaved surfaces and from vehicles conveying raw materials.

(ii) Vector-borne diseases (dengue fever, malaria which are caused by the unhygienic construction sites or living workers quarters).

(iii) Waterborne disease and food-borne disease like cholera, typhoid and hepatitis A due to improper sewage and solid waste disposal in the worker's camp area.

(iv) Physical injuries due to work accidents, road traffic accidents, noise induced hearing impairment from exposure to operating vehicles or machineries.

(v) Accidents and explosion hazards from handling highly flammable materials on site (pipelines, storage tanks etc.).

Evaluation of Impacts

The health risk assessment for EIA reporting is guided by the Guidance Document of Health Impact Assessment (HIA) in Environmental Impact Assessment published by DOE Malaysia (2012). Health risk is an outcome of exposure to hazardous substances. Approaches to health risk assessment can be namely qualitative or quantitative.

Qualitative health risk assessment involves listing and describing the probable change in health outcomes or endpoints that would be realised due to the proposed project. For example, inappropriate waste handling during the construction stage may lead to potential breeding of pests like rodents and disease vectors (e.g. mosquitoes and flies). However, the quantum of increase in the populations of rodents or mosquitoes; or the subsequent increase in the prevalence of diseases associated with them, are not quantified. Qualitative assessment also applies based on the comparison of the community air pollutant exposure levels with established

ambient air guideline levels. If the air pollutant exposure levels are below the guideline levels, then the potential health impact is considered as minimum or insignificant.

Quantitative health risk assessment generates a risk value on the potential adverse health effects of human exposures to environmental hazards.
The assessment should encompass the following:

- Hazard identification
- Dose-response assessment
- Exposure assessment
- Risk characterization

The application of quantitative assessment is mainly limited to assessment of chemical hazards, since biological and physical hazards do not lend themselves well to quantitative assessment. In such cases, qualitative assessment should apply.

In the case of a CMP project, the impact assessment procedure should take the following procedural steps:

- Employ acceptable risk assessment models to ascertain the level of risk from specific project activities.

- Determine the level of risk to neighbouring receptors to ascertain whether the level is within acceptable levels.

- In terms of health, surveys on existing health conditions of surrounding population/communities can assist in monitoring for sudden increase/decrease in disease outbreaks during pre- and post- project implementation.

- For workers, possible impacts on their safety and health in the line of work shall be assessed, e.g. working in high noise areas, in confined spaces, at heights, handling hazardous materials etc.

Outputs

The main objective of this health impact assessment is to determine the acceptability of these health risks.

Acceptable health risk is a societal acceptance (those who are being subjected to the risk) level of risk, which is considered tolerable or as something people can live with comfortably. The risk tolerability criteria recommended in the Guidance Document on HIA in Environmental Impact Assessment by DOE Malaysia (2012) are:

- Hazard Index is a summation of the hazard quotients for all chemicals to which an individual is exposed. For non-carcinogenic risk, a Hazard Index

value of less than or equal to 1.0 indicates that no adverse human health effects (non-cancer) are expected to occur.

- For carcinogenic risk: values of 10^{-6} to 10^{-4} (i.e. one in a million or one in a thousand) are given as a range of "generally acceptable risk"

- The qualitative/quantitative risk to receptors can assist to determine the types of BMPs necessary to reduce the risks.

- Findings from the Health Impact Assessment (HIA) can also indicate potential preventive and mitigation measures that need to be adopted to safeguard worker and community health status during the Project's construction and operation stages.

5.2.6 Drainage Impacts

Assessment Requirements

(i) Assess the scale of land clearing required, and potential alterations to the hydrological and drainage characteristics of the site.

(ii) Determine the scope and characteristics of external and internal drainage systems, especially the former, that may be impacted upon to accommodate storm flows discharged from the project site(s).

(iii) Evaluate the hydraulic conditions before and after project development, such as release of higher peak flows, and induced increases in flow velocities at critical points along external receiving drainage networks, which are located downstream of the Project site(s), for potential induced localised flooding.

(iv) Determine the potential impacts to downstream receptors, e.g. water treatment plants (WTPs), water intake points (WIPs), aquaculture areas, recreational areas; and to instream ecological resources.

Evaluation of Impacts

(i) Delineate the river basins encroached on by the development of the project; and in particular the river systems that are specifically affected.

(ii) Collect hydrological data and assess long-term rainfall trends.

(iii) Use mathematical or simulation models to ascertain the different hydraulic conditions, vis-a-vis pre- and post-project implementation, prevailing along specific receiving watercourses.

(iv) Determine the potential impacts and provide appropriate mitigation measures as part of the Land Disturbing Pollution Prevention and Mitigation

Measures (LD-P2M2), to minimise any adverse effects within and surrounding the project site.

Output

(i) Runoff hydrographs detailing pre and post-development runoff scenario and flood risk maps.

(ii) The hydrological and drainage systems of the project site and its impacts on surrounding receiving watercourses will form part of the technical and engineering works.

(iii) The types of mitigation measures needed will be proposed by the Qualified Person to be incorporated in the LD-P2M2, mainly to ensure reductions in flow velocity and volume of discharge of surface flows during the land clearing, construction and operational phases.

5.2.7 Waste Management Impacts

Assessment Requirements

(i) Identify the types of wastes generated during the project's construction and operating phases. These may include biomass generation, spent scheduled wastes (e.g. spent lubricating oil, spent hydraulic oil, etc.), construction, domestic and municipal wastes (e.g. timber, concrete, scrap material, paper, plastics food wastes green wastes, etc.); and assess their potential impacts on the local and regional environment.

(ii) Determine the range of management measures required to be carried out to curtail adverse impacts being impacted on the ambient water, air and land quality associated with the surrounding environment.

Evaluation of Impacts

(i) Identify and estimate the quantum of all waste sources with the assistance of the Project's technical and engineering consultants.

(ii) Assess the severity of impacts from improper management of such wastes on water quality, odour, air quality and public health.

(iii) Identify locations of suitable temporary storage areas within the project site.

(iv) Identify locations where the wastes will be eventually disposed off.

(v) Ascertain the potential there exists to reuse, recycle and repurpose wastes that are produced to promote a circular economic approach towards waste management.

Output

(i) Identification of proper temporary disposal sites and storage facilities for wastes generated on-site including mitigation measures against spillage, erosion, carry over of sediments to waterways, pest proliferation, and other impacts.

(ii) Mitigation measures for proper waste management to be incorporated into project site management to ensure that all wastes are properly managed and disposed off at designated and approved locations so as not to pollute the environment.

5.2.8 Ecology Impacts

Assessment Requirements

(i) Mapping of important habitats and ESAs, e.g. forest reserves, mossy forests, lakes and wetlands, etc. in the vicinity of the selected Project Site(s).

(ii) Undertake an inventory of existing flora and fauna (terrestrial, aquatic and/or marine) within the project area and its surroundings to ascertain the level of biodiversity.

(iii) Identify critical species benchmarked against the International Union for Conservation of Nature (IUCN) published red list; or other relevant references. The assessment can be based on field surveys (animal trapping, baiting, camera traps, and observations of secondary animal signs), or literature review to produce the inventory.

(iv) Recommendation of mitigation measures if there are any important flora and fauna that are in need of relocation or protection.

Evaluation of Impacts

(i) Determine the level of encroachment into ESAs such as ecologically rich habitats.

(ii) Indication of possible loss of habitat and its flora and fauna species and associated population levels, which may include endemic, rare, endangered, threatened and/or near extinct species.

(iii) Identify project activities that could disturb animal behaviour, leading to their dispersal afar, or limiting their range of movement.

(iv) Effects of increased accessibility to the project site and opening up of forested or pristine areas, e.g. to establish access roads, leading to poaching risks.

(v) Forest fragmentation and its consequences to fauna and their habitats.

(vi) Increase in roadkill and poaching of animals in the newly developed areas.

(vii) Impacts from increased human-wildlife conflicts (HWC).

Output

(i) Highlight important areas (through a habitat map) which should not be built-upon or if there is no other option, to determine suitable mitigation measures to minimise the impacts, or to replace the lost area (compensation process).

(ii) Identification of critical areas to incorporate mitigation measures such as viaducts, or culverts, to allow for safe passage of animals across linear corridors; or need to translocate important species at risk from the project, and how to execute the implementation of such measures.

(iii) Develop wildlife management plans.

5.2.9 Social Economic Impacts

Assessment Requirements

(i) Determine whether the project entails land and property acquisition and relocation of communities and businesses. These issues often cause psychological, emotional and economic impacts to those who are affected, and have to be handled with great care.

(ii) Assessment of the extent of impacts from, inter-alia, dust and other gaseous dispersions, pollution of surface and ground waters, noise and vibration, fire hazards, etc. that are imparted on nearby communities and on workers at-site. However, the project may also generate benefits such as creating increased job and business opportunities to the local population; such positive impacts should be elucidated.

(iii) An assessment of the views and perceptions voiced by potentially impacted stakeholders with regard to project development and operations should be given due consideration; and their suggestions/recommendations with regard to adoption of specific mitigation and abatement measures to address their concerns must be considered seriously in finalising the project's detail designs.

Evaluation of Impacts

(i) Identify the extent of land acquisition required and inventorise those affected stakeholders.

(ii) Demarcate the survey catchment boundaries to gather information on existing population distribution, and determine statistically the number of surveys required to ensure that information sourced is reliable and is representative of stakeholders resident in the potentially impacted area. For the EIA study, the impacts are evaluated mainly on the communities living within the Zone of Study (ZOS). If there is a need, those in the ZOI will also be assessed in terms of potential impacts that could be imposed on them.

(iii) Pertinent information can be obtained through FGDs, interviews and site questionnaire surveys. Findings shall be analysed and deductions arrived at.

(iv) The main findings from the Social Impact Assessment (SIA) shall be incorporated in the EIA.

Output

(i) Land and property acquisition and relocation of communities must be first be settled by the Project Proponent prior to undertaking an EIA study.

(ii) The findings from the social impacts, mainly from surveys and focal group discussions (FGDs) can be contentious and often skewed. Therefore, the assessments should have overall on-the-ground reviews even after the surveys are interpreted by the Qualified Person.

5.2.10 Hydrology Impacts

Assessment Requirements

(i) Assessment of the scale of land clearing and alterations to the hydrological and drainage characteristics of the site.

(ii) Determination of the scale of the drainage system that may also be altered to take in the storm flows from the project development.

(iii) Evaluation of the hydrological conditions before and after project development such as higher peak flows, increased velocities at critical points in the lowlands downstream for any localised flooding.

(iv) Determination of the impacts to downstream users, e.g. Water Treatment Plants (WTPs), Water Intake Points (WIPs), aquaculture areas, recreational areas, etc.

Evaluation of Impacts

(i) Delineate the river basins encroached on by the project and particular river systems that are affected.

(ii) Collect hydrological data and assess long-term rainfall trends.

(iii) Use mathematical or simulation models to ascertain the different hydrological conditions pre- and post-project implementation.

(iv) Determine the potential impacts and provide appropriate mitigation measures as part of the Land Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2), to minimise any adverse effects within and surrounding the project site.

Output

(i) Runoff hydrographs detailing pre and post-development runoff scenario and flood risk maps.

(ii) The hydrological and drainage systems of the project site and its impacts on surroundings will form part of the technical and engineering works.

(iii) The types of mitigation measures needed will be proposed by the Qualified Person to be incorporated in the LD-P2M2, mainly to ensure reductions in flow velocity and volume during the land clearing, construction and operational phases.

5.2.11 Geotechnical Hazards

Assessment Requirements

(i) Assessment of areas of the project site and surroundings for risk, e.g. slope failure, erosion, landslides, seismic activities, etc.

(ii) Determination of the adequacy of buffer to avoid or reduce risk of hazards to the project area.

(iii) Identification of suitable engineering and geotechnical measures required to ensure that hazards are fully addressed.

Evaluation of Impacts

(i) Develop risk map and determine factor of safety (FOS) for all engineered slopes and hazard areas.

(ii) Assess the impact and extent of damages/losses in the event of slope failure, landslide, etc. and sensitive receptors that may be affected.

(iii) Determine areas in need for mitigation measures or engineering/geotechnical solutions to reduce risk.

Output

(i) Hazard areas shall be clearly mapped out as part of the Geological Terrain Mapping (GTM) to determine construction suitability.

(ii) Areas of high risks shall be avoid being built upon or provided with adequate geotechnical and engineering measures.

(iii) Monitoring programme for slopes.

5.2.12 Groundwater/ Hydrogeology

Assessment Requirements

(i) Provide an overview of the existing hydro-geological setting of the study area, describing the aquifers, hydraulic characteristics, groundwater quality and the interaction between surface and groundwater systems.

(ii) Determination of the adequacy of buffer zones to avoid or reduce risk of exposures hazards on the project area.

(iii) Identification of suitable measures to ensure that hazards are fully addressed.

(iv) To locate and construct suitable test wells for aquifer pumping tests and groundwater quality analysis

(v) To assess the expected effects of groundwater withdrawals associated with the proposed project on any existing water wells and structures located in the surrounding environment.

Evaluation of Impacts

(i) Develop risk map and determine factor of safety (FOS) for all engineered slopes and hazard areas.

(ii) Assess the impact and extent of damages/losses in the event of slope failure, landslide, etc. and sensitive receptors that may be affected.

(iii) Determine areas in need for mitigation measures or engineering solutions to reduce risk of damage.

(iv) To determine and assess the potential impacts and mitigation measures due to project activities such as increased runoff due to the clearing of existing vegetation, and that causes changes to groundwater regime.

Output

(i) Areas of high risks shall be avoided from being developed or provided with adequate hydrogeological and engineering mitigation measures.

(ii) To recommended that an appropriate well construction and must comment on the potential for cross contamination between aquifers.

(iii) Monitoring programme for groundwater

(iv) To propose mitigation measures, including contingency plans where applicable, to address any identified water quality or quantity concerns.

5.2.13 Traffic Impacts

Assessment Requirements

(i) Describe how construction materials, workers and machinery are mobilised to, and from, the construction site and also transportation of raw material to the CMP. High vehicle volume can cause congestion on public thoroughfares, damage roads, bridges and culverts, and increased risk of road accidents. Spillage from vehicles can also occur causing traffic flow disruptions

(ii) Identification of the need for mitigation measures during construction and operational phases for traffic management.

Evaluation of Impacts

(i) Review and incorporate the main findings from the Traffic Impact Assessment (TIA) into the EIA. The TIA is carried out separately by a Traffic Consultant and endorsed by the Public Works Department (JKR).

(ii) The main impact elements to be addressed in the EIA study (e.g. risk of accidents, adverse air quality and public health impacts) are focused on communities residing alongside roads employed for transporting materials and spoils during the projects construction stage.

(iii) During the operation phase, the extra volume of traffic generated by the project will also affect communities' resident by the side of transportation routes; and the potential and magnitude of such impacts should be investigated.

Output

(i) Identify potential issues related to project induced traffic flow along public roads during construction and operational stages; and recommend

incorporation of structural and non-structural measures to address these issues as proposed by the TIA Consultants.

(ii) Identification of risk factors from various project related activities imposed on nearby communities, such as from accidents, health, etc.

5.2.14 Safety and Health

Assessment Requirements

(i) Construction activities entails higher risks to the safety and health of project workers and to surrounding communities from pollution episodes, transmission of diseases by immigrant workers, from accidents and fire hazards; these risks are to be assessed for their propensity of occurrence.

(ii) For these development projects, the risk assessment should tie in with the assessment on geotechnical hazards (see **Section 5.2.3**) as it also relates to public safety.

Evaluation of Impacts

(i) Employ acceptable risk assessment models to ascertain the level of risk from specific project activities.

(ii) Determine the level of risk to neighbouring receptors to ascertain whether the level is within acceptable levels.

(iii) In terms of health, surveys on existing health conditions of surrounding population/communities can assist in monitoring for sudden increase/decrease in disease outbreaks during pre- and post- project implementation.

(iv) For workers, possible impacts on their safety and health in the line of work shall be assessed, e.g. working in high noise areas, in confined spaces, at heights, handling hazardous materials etc.

Output

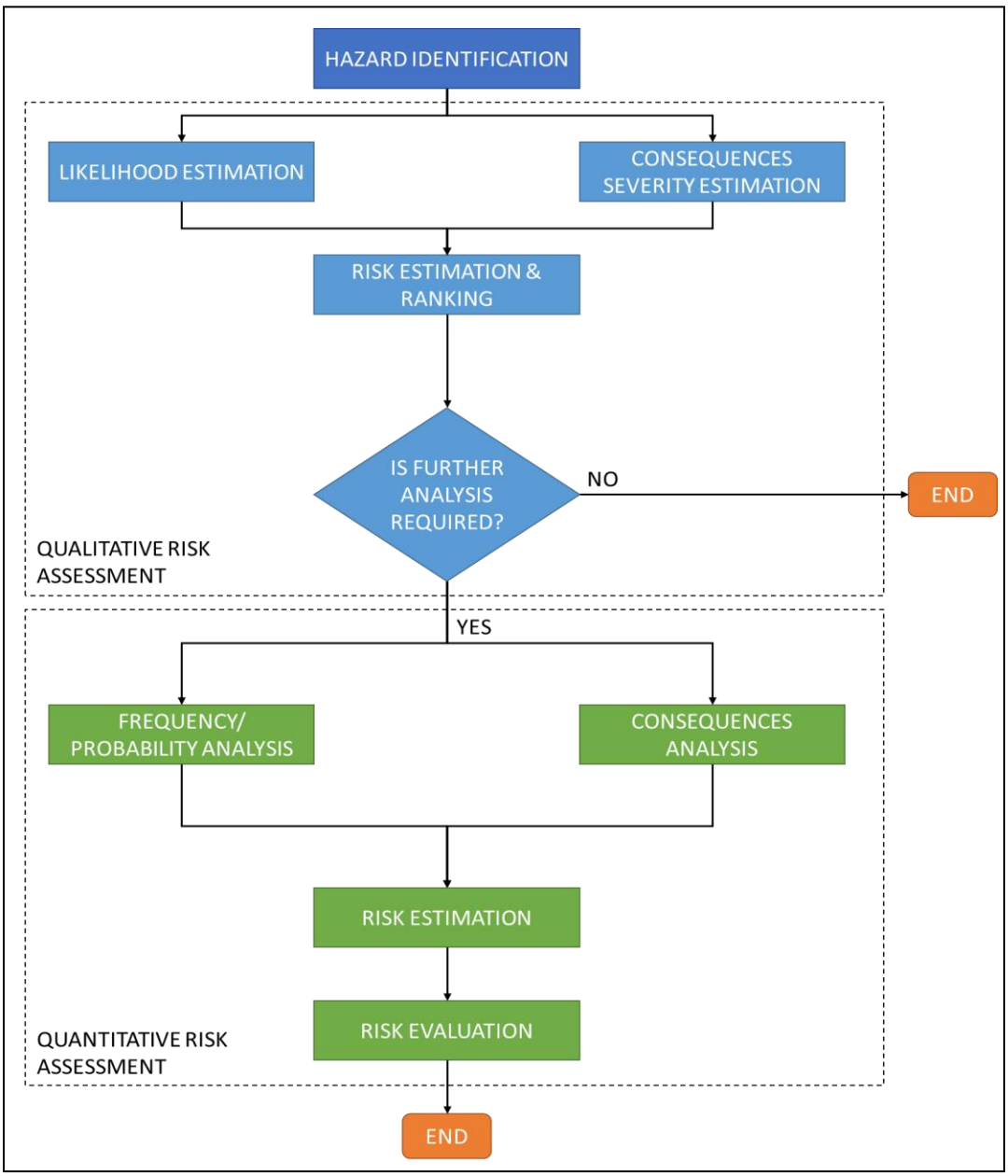
(i) The qualitative/quantitative risk to receptors can assist to determine the types of BMPs necessary to reduce the risks.

(ii) Findings from the assessment can also provide possible preventive and mitigation measures to safeguard worker and community health status during construction and operation stages.

5.2.15 Risk Assessment

Assessment Requirements

The Risk Assessment study as required by Department of Environment (DOE) is to determine quantitatively the risk posed to the population in the area where the project is to be implemented. The assessment is guided by EIA Guidelines for Risk Assessment by DOE Malaysia (2004). The process flow of the risk assessment flow is as per **Figure 5.3**.



Source: EIA Guideline for Risk Assessment (2004)

Figure 5.3: Risk Assessment Flow

Qualitative risk assessment is based upon subjective and qualitative judgment while, quantitative estimates the expected frequency and consequence of potential accidents associated with a facility or operation based on engineering evaluation and mathematical techniques.

Quantitative Risk Assessment is the application of methodology to produce a numerical representation of the frequency and extent of a specified level of exposure or harm, to specified people or the environment, due to the operation of the proposed project.

Evaluation of Impacts

The objectives of a risk assessment are to identify and quantify the probability and consequences of the possible emergency events that may escalate from the project site to the surrounding areas offsite and potentially cause undesirable outcome such as human injury, fatality or destruction of property, to calculate the risk level, and to suggest measures to reduce the level of risk if higher than the risk acceptance criteria.

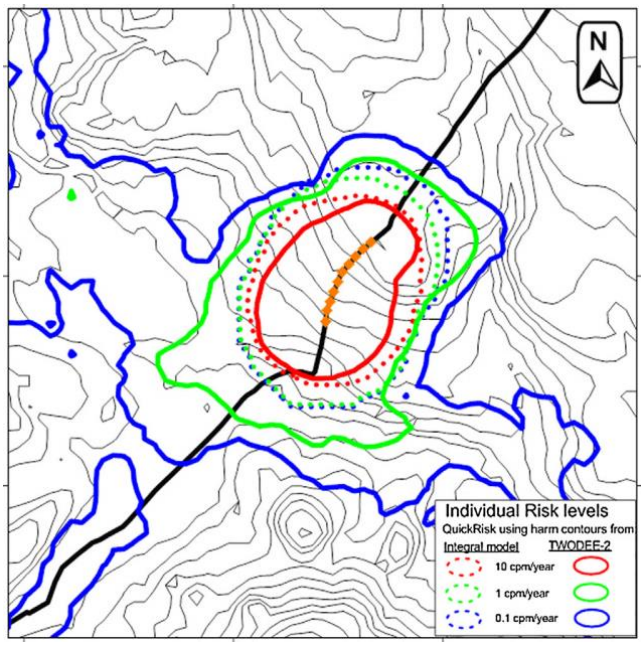
The risk assessment results will be presented in terms of individual risk in comparison against the risk criteria established by DOE.

Output

The main objective of this risk assessment is to determine the individual and societal risks values and to determine the acceptability of these risks.

(i) Individual risk

Individual risk represents the frequency or probability of an individual dying due to the occurrence of the hazardous event. The individual is assumed to be unprotected and to be present during the total exposure time. The individual risk is usually presented as a contour lines on a map as illustrated in **Figure 5.4.**



(Source: Risk assessment methodology for high-pressure CO2 pipelines incorporating topography by Diego L. et. al (2014) Process Safety and Environmental Protection p.27)

Figure 5.4: Sample of Individual Risk Contour

(ii) Societal Risk

Societal risk represents the frequency or probability of having an accident with N or more people being killed simultaneously. The people involved are assumed to have some means of protection. The societal risk is presented as an F-N curve, where N is the number of deaths and F is the cumulative frequency of accidents with N or more deaths.

(iii) Risk Tolerability

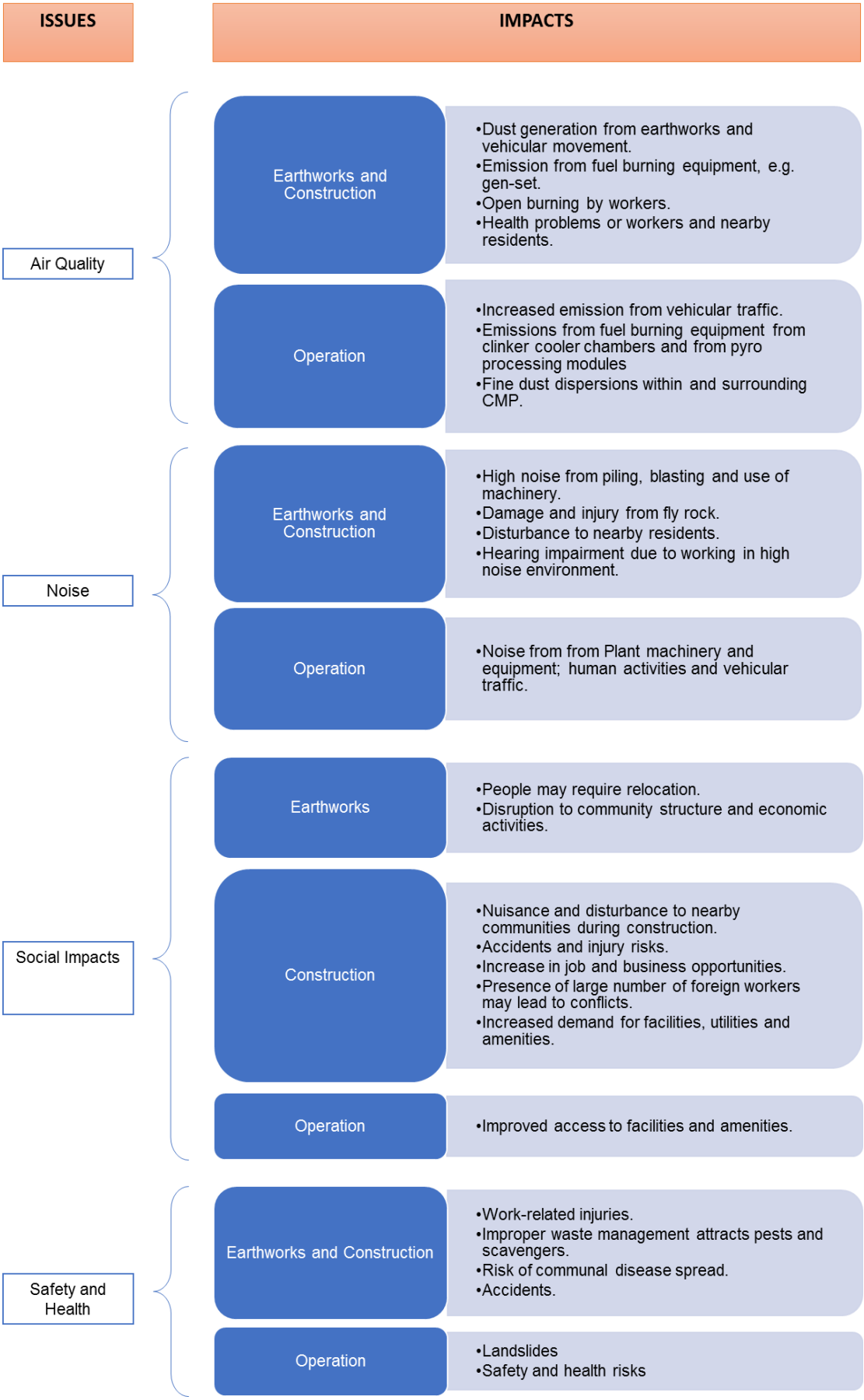
Outcome from the risk assessment is usually compared to the risk tolerability criteria so that a decision can be made whether the risk is broadly acceptable or tolerable or if it is unacceptable.

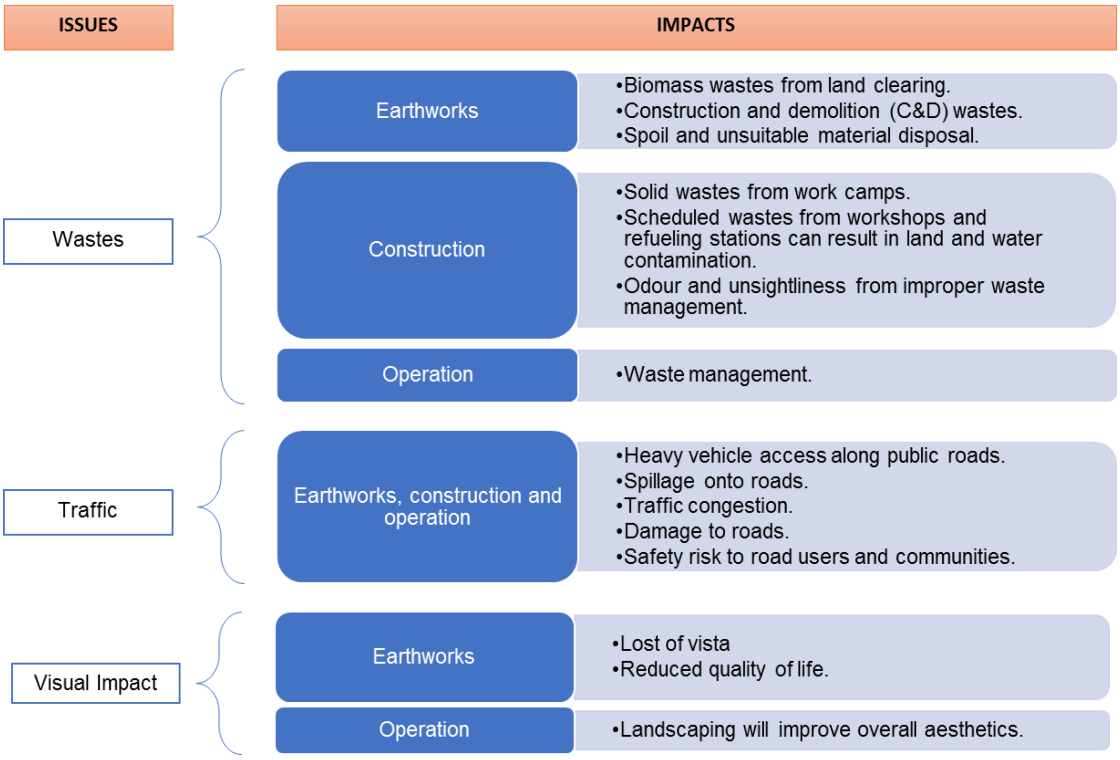
The risk tolerability criteria recommended in the EIA Guidelines for Risk Assessment by DOE Malaysia (2004) are:

- The 1 x 10^{-6} fatalities / person per year individual risk contour should not encompass involuntary recipients of industrial risks such as residential areas, schools, hospitals and places of continuous occupancy, etc.
- The 1 x 10^{-5} fatalities / person per year individual risk contour should not extend beyond industrial boundaries.

Table 5.1: Typical Issues and Impacts Associated with Cement Manufacturing Plants

ISSUES	IMPACTS	
Ecology	Earthworks and construction	•Loss of flora and fauna habitats. •Flora and fauna may be affected and may have to be relocated to adjacent sites. •Poaching.
	Operation	•Forest fragmentation. •Roadkill. •Human-wildlife conflicts (HWC).
Erosion and Sedimentation	Earthworks	•Soil erosion •Soil creep and loss. •Riverbank collapse and erosion. •Damage to constructed platforms. •Sedimentation of waterways and water bodies. •Terrestrial and aquatic ecological damage.
Geotechnical Hazards	Construction and Operation	•Seismic events. •Slope instability/failure. •Loss of life and damages to property. •Mud flows. •Sedimentation of waterways and water bodies.
Hydrology	Earthworks	•Altered watercourses and drainage systems. •Sedimentation of waterways and water bodies. •Impact on aquatic habitats and downstream water users.
	Construction	•Storm flows, peak discharges and flooding.
	Operation	•Flooding due to blocked drainage. •Flood risk due to natural disasters.
Water Quality	Earthworks	•Water pollution from soil erosion and sedimentation. •Impacts to downstream water users, e.g. WIPs, recreational areas, aquaculture farms, etc. •Ecological degradation.
	Construction	•Sewage and sullage from work camps. •Soil contamination and water pollution due to leakage of oil and chemical from equipment and machinery operations.
	Operation	•Sewage and sullen discharge from plant facilities. •Eutrophication of receiving watercourses.


ISSUES
IMPACTS
Air Quality
Earthworks and Construction
•Dust generation from earthworks and vehicular movement.
•Emission from fuel burning equipment, e.g. gen-set.
•Open burning by workers.
•Health problems or workers and nearby residents.
Operation
•Increased emission from vehicular traffic.
•Emissions from fuel burning equipment from clinker cooler chambers and from pyro processing modules
•Fine dust dispersions within and surrounding CMP.
Noise
Earthworks and Construction
•High noise from piling, blasting and use of machinery.
•Damage and injury from fly rock.
•Disturbance to nearby residents.
•Hearing impairment due to working in high noise environment.
Operation
•Noise from from Plant machinery and equipment; human activities and vehicular traffic.
Social Impacts
Earthworks
•People may require relocation.
•Disruption to community structure and economic activities.
Construction
•Nuisance and disturbance to nearby communities during construction.
•Accidents and injury risks.
•Increase in job and business opportunities.
•Presence of large number of foreign workers may lead to conflicts.
•Increased demand for facilities, utilities and amenities.
Operation
•Improved access to facilities and amenities.
Safety and Health
Earthworks and Construction
•Work-related injuries.
•Improper waste management attracts pests and scavengers.
•Risk of communal disease spread.
•Accidents.
Operation
•Landslides
•Safety and health risks



Note: The list is not exhaustive and not all the above may be relevant to the project. It is the responsibility of the Project Proponent and Qualified Person to determine the relevant information required for environmental assessment and compliance.

Soil erosion from worked slopes

Landslides and mudflows

Degraded waterways

Water pollution

Poor scheduled waste management

Improper management of spoils

Figure 5.5 (a) : Photo Inventory of Common Impacts associated with Cement Manufacturing Plant Development

Water ponding/ flooding

Dust generation

Loss of habitats

Biomass disposal

Spoil disposal

Poor worksite management

Figure 5.5 (b): Photo Inventory of Common Impacts associated with Cement Manufacturing Plant Development

5.3 PREDICTIVE METHODS AND TOOLS

There is a wide range of predictive tools and models for identifying, evaluating and assessing potential impacts. Common methods and tools are as follows:

(i) Expert opinions.

(ii) Consultations and questionnaires.

(iii) Checklists.

(iv) Spatial analysis.

(v) Network and system analysis.

(vi) Matrices.

(vii) Carrying capacity analysis.

(viii) Mathematical and computer modelling.

(ix) Case studies.

Simple methodologies are preferred, though this depends on the complex nature of the impacts. Whichever method is chosen, it must be appropriate to address the identified problems, taking into consideration local conditions at the project site.

The EIA Report must be scientifically and technically sound and whenever necessary, quantitative impact prediction on the more significant impacts should be carried out. If computer modelling is carried out, e.g. for water and air quality assessment, flooding etc., the following information is required:

(i) Name and description of method/model.

(ii) Model set-up.

(iii) Data collection and analysis.

(iv) Calibration and validation.

(v) Detail of modelling scenarios.

(vi) Presentation of results (raw data, table form, graphs).

(vii) Limitations in data collection or method chosen.

All modelling exercises that are carried out shall elucidate impacts under various scenarios, either for short, mid- to long-term for the worst-case scenario. The outputs of the modelling studies shall be presented in a concise manner and all uncertainties shall be discussed.

Technical reports, data analysis and tables and raw data, where necessary, shall be included as appendix in the EIA report to support the impact assessment methodology and findings reached.

Ultimately, the impact assessment chapter in the EIA report shall present and discuss the predictive results and outputs of studies taken; which have to be in sufficient technical detail to support the assessment. It must also be written in a manner that is easily understood by decision makers and the public.

Table 5.4 summarises examples of accepted prediction methods for impact assessment, and expected outputs. The list is not exhaustive. The Qualified Person has to propose the best methods relevant to the project under study, or may select one of the methods in the list.

Table 5.4: Examples of Prediction Methods for Environmental Impacts

Impacts	Prediction Methods	Output
Erosion and Sedimentation	• Revised Universal Soil Loss Equation (RUSLE). • Modified Universal Soil Loss Equation (MUSLE). • Computer models.	• Soil loss rates and sediment yield. • Erosion risk and potential soil loss maps.
Hydrology	• Hydrological procedures (DID). • Computer models for estimating peak flood, runoff, watershed, analysis, flood plain hydraulics, etc. examples include HEC-HMS, HEC-RAS, FLO-2D, TUFLOW, EXTRAN and Storm Water Management Model (SWMM). • Hydrological analysis in accordance with *Manual Saliran Mesra Alam Edisi-2* (MSMA-2).	• Estimation of pre-construction and post-construction runoff. • Flood risk map.
Water Quality	• Mathematical models (one, two or three-dimensional) analysis of pollution loads and dispersion in the waterways, such as QUAL2K, MIKE11, etc. • Simple mass balance models, e.g. Streeter-Phelps Model. Operational sewage and effluent discharges modelled	• Estimation of TSS (erosion) and BOD, COD and AN (sewage/ wastewater) concentration affecting a stretch of river and downstream sensitive areas. • Estimation of pollution.

Impacts	Prediction Methods	Output
	employing Qual2k or Delft3D or MIKE11.	
Air Quality	• Gaussian plume dispersion models to assess dust and gas dispersion over an area under the worst case scenario.	• Dispersion contour map indicating levels at sensitive receptions. • Comparison of computed values with the Malaysian Ambient Air Quality Standards (MAAQS). • Determination of location of maximum air pollution concentration.
Noise Level	• Mathematical models to assess noise levels for point source of linear sources. • Noise modelling software, such as SoundPlan, CadNa or Geographic Information System (GIS) acoustic models. • Traffic noise models.	• Quantitative values for noise level at sensitive receptors. • Noise contour map indicating levels at sensitive areas. • Comparison of computed values to DOE's permissible noise limits.
Ecology	• Comparative assessment of conservation status and sensitivity of habitat, flora and fauna. • Ecological models for species diversity and population change. • Limit of Acceptable Change (LAC). • Spatial models, such as GLOBIO3.	• Habitat map. • Species inventory, especially of rare, endangered, threatened and near extinct species that may require protection.
Social Impacts	• Social and economic surveys on affected population. • Perception survey to ascertain acceptance of project. • Social Impact Assessment (SIA).	• Socio-economic profiling. • Public opinion survey results. • Stakeholder feedback for EIA including possible mitigation measures.
Landuse	• Compatibility assessment based on structure plan, local plan and other guidelines. • Adherence to required setback based on national and state guidelines.	• Landuse compatibility and buffer requirements.
Public Health	• Qualitative/quantitative health risk assessment (HRA)	• Potential health impacts to nearby population.

Impacts	Prediction Methods	Output
	encompassing hazard identification exposure assessment and risk characterization.	
Biomass	• Estimation on total biomass based on vegetation types and published values.	• Predicted biomass waste generation.
Scheduled Wastes	• Identification of potential scheduled wastes generation during construction and operations based on project activities.	• Predicted scheduled waste generation.
Solid Wates	• Waste generation estimation based on population/workforce/ employees.	• Predicted waste generation.
Traffic	• Traffic impact assessment including simulation of peak traffic flows under various scenarios and junction analysis, e.g. Signalized and Unsignalized Intersection Design and Research Aid (SIDRA).	• Comparison of traffic scenario pre- and post-project and need for road improvements.
Infrastructure and Utilities	• Existing demand estimation methods by regulators, e.g. population equivalent (P.E.) calculations [National Water Services Commission (SPAN)]. • Comparison of existing supply to meet future demand to determine adequacy.	• Estimates of demand.
Aesthetics	• Visual assessment on scenic and aesthetic value of the area. • 2-D and 3-D Viewshed Analysis.	• Before and after scenario.

Note: The list is not exhaustive and not all the above may be relevant to the project. It is the responsibility of the Project Proponent and Qualified Person to determine the relevant method required for environmental assessment and compliance

5.4 CRITERIA AND STANDARD

The method to determine the degree of significant impact is to benchmark the findings against the stipulated current criteria and standard limits imposed by DOE and/or various Government Agencies (GAs) (refer to **Appendix D to G**).

In situations where there are no local standards or limits, similar regional and international limits and adherence levels can be adopted based on the expert opinion of the Qualified Person. However, the chosen criteria and standards must be suitable and relevant to local conditions.

Table 5.5 provides a list of the evaluation criteria for various environmental components to be used as a guide.

Based on the prediction methods and tools, the outcomes shall be derived (see **Box 7**).

Table 5.5: Examples of Criteria and Standards for Environmental Parameters

Impacts	Evaluation Criteria
Erosion and Sedimentation	**Guidelines Documents** (a) Guidelines Document for Addressing Soil Erosion and Sediment Control Aspects in the EIA Report (DOE, 2016). (b) Guidance Document for the Preparation of the Document on LD-P2M2 (DOE, 2016). (c) Guidelines for Erosion and Sediment Control in Malaysia (DID, 2010). (d) *Manual Saliran Mesra Alam Edisi-2* (MSMA-2) (DID, 2012). **Sediment Basin/Silt Trap Discharge** (a) TSS: 50 mg/L or 100 mg/L, depending on locality. (b) Turbidity: 250 NTU.
Water Quality and Pollution Control	(a) Ambient water quality: National Water Quality Standards (NWQS). (b) Sewage discharges: Environmental Quality (Sewage) Regulations 2009. (c) Effluent discharges: Environmental Quality (Industrial Effluent) Regulations. (d) Toilets and septic tanks: SPAN approved design and requirements.
Flood/Runoff Management	(a) MSMA-2 (DID, 2012) requirements.
Air Quality	(a) Environmental Quality (Clean Air) Regulations 2015. (b) Malaysian Ambient Air Quality Standards (MAAQS).
Noise Level	(a) Guidelines for Environmental Noise Limits and Control 3rd Edition (DOE, 2019). (b) Occupational Safety and Health (Noise Exposure) Regulation 2019.
Vibration	(a) The Planning Guidelines for Environmental Vibration Limits and Control 2nd Edition (DOE, 2007) (b) JMG requirements for blasting operations.

Impacts	Evaluation Criteria
Ecology	(a) International Union on the Conservation of Nature (IUCN) and Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) listing. (b) Wildlife Conservation Act 2010. (c) Feedback from PERHILITAN and Forestry Department Peninsular Malaysia (JPSM).
Landuse	(a) Structure Plans, Local Plans, Special Area Plans (SAP), Special Management Areas (SMAs) Guidelines. (b) Environmental Sensitive Area (ESA) Listing under the National Physical Plan-3 (NPP-3) (JPBD, 2016). (c) Guidelines for Hillside and Highland Development (National and State). (d) Guidelines for Siting and Zoning of Industry and Residential Areas (DOE, 2012). (e) Local Authority requirements.
Land Traffic	(a) Acceptance level of service (LOS) for traffic flows. (b) Local authority/Public Works Department (JKR) requirement.
Safety and Health	(a) Occupational Safety and Health Act 1994. (b) Factory and Machinery Act 1967. (c) Department of Occupational Safety and Health (DOSH) Requirements. (d) International Labour Organisation (ILO) and other guidelines. (e) Guidance Document on HIA in EIA (DOE, 2004). (f) EIA Guidelines for Risk Assessment (DOE, 2004).
Social Impacts/ Heritage, Culture and Archaeology	(a) Public perception on acceptability. (b) National Heritage Register (National Heritage Department). (c) Preservation of cultural, heritage, historical and archaeological items and sites of significance. (d) Social Impact Assessment (SIA) requirements in the context of the Town and Country Planning Act (Amendment) 2017 (Act A1522) for three categories: (i) SIA 1: Development projects under subsection 20B(1) and (2) of act A 1522 for coastal reclamation projects and major national infrastructure. (ii) SIA 2: Development projects under subsection 22(2A) Act 172 for new township development for population over 10,000 people or covering area over 100 ha or both, major national infrastructure and development in slope and hill areas. (iii) SIA 3: Any other development projects with significant social impacts as ordered by the National Physical Planning Council (NPCC) from time to time.

Impacts	Evaluation Criteria
Wastes	**Scheduled wastes** Environmental Quality (Scheduled Wastes) Regulations 2005. **Other wastes** (a) Solid Waste and Public Cleaning Management Act 2007. (b) Local authority requirements.
Treatment Systems	(a) Technical Guidance Document on the Design and Operation of Industrial Effluent Treatment Systems (DOE, 2015). (b) Technical Guidance Document on Performance Monitoring of Industrial Effluent Treatment Systems (DOE, 2015). (c) Technical Guidance Document on Performance Monitoring of Air Pollution Control Systems (DOE, 2005).
Visual Aesthetics	Public perception on acceptability.

Notes:

(i) Refer to Appendix D - G for details on specific standards and limits.

(ii) The list is not exhaustive and not all the above may be relevant to the project. The Project Proponent and Qualified Person shall make reference to the latest standards and requirements by the authorities.

Box 7:
Outcomes from Impact Assessment

(i) No Impact: This scenario occurs when there are very low to no sensitive receptors in the vicinity of the project to be subjected to impacts. Examples are communities living very far away, where they are only indirectly affected such as through traffic along the main roads. Another scenario is when there are terrain constraints such as steep slopes, but the Project Proponent has decided to redesign the layout without affecting these areas.

(ii) Significant Impact: This scenario is based on the predictive results. In the assessment, if the results showed that the project will generate detrimental impacts, then mitigation measures will have to be provided to address the issues. Any residual impacts shall also be clearly stated in the EIA.

(iii) Non-significant Impact: Impacts will inevitably occur in project development but it may not result in significant exceedance of the accepted criteria or standards. An example is TSS from erosion and sedimentation. The TSS emanating from land clearance that abides by Class II waters of the NWQS is acceptable. Under this scenario, the impact is classified as non-significant, with the level of impact abiding with the stipulated criteria and standards.

CHAPTER 6

ENVIRONMENTAL IMPACT ASSESSMENT: MITIGATION MEASURES

6.1 INTRODUCTION

This Chapter focuses on the pollution prevention and mitigation measures (P2M2) which can be considered for implementation in order to quell potentially adverse environmental impacts, which are capable of being induced by activities associated with the construction and operations of a Cement Manufacturing Plant (CMP) in cement industry, to tolerable or acceptable levels so as to safeguard and maintain the pre-development status of the local environment, as well as to sustain the integrity of the Project. This objective can be attained through adoption of the following steps:

(i) Avoidance of negative impacts through selection of best options/alternatives in terms of manufacturing processes.
(ii) Where adverse impacts cannot be avoided, then appropriate preventive measures and best management practices (BMPs) should be adopted to reduce and minimise the adverse impacts.
(iii) Ensure residual impacts are kept within acceptable levels.
(iv) Adopt circular economic waste management principles by application of reduce, reuse, recycle and repurposing practices

6.2 POLLUTION PREVENTION AND MITIGATION MEASURES (P2M2)

6.2.1 P2M2 Principles

Recommendations for adopting P2M2s is an important outcome of an EIA study. It evolves from the findings of multi-faceted impact assessments carried out with respect to CMP construction and operational activities and their interaction with the local and regional environments.

P2M2s are required if there are Project activities which can impact negatively on surrounding air and water qualities, on ambient noise and vibration levels, on the integrity of existing ecological systems, and on the health, safety and wellbeing of surrounding communities.

In most, if not all, Project developments, land disturbance (LD) activities occur in order to clear the Project Site of vegetation (denudation process) and thereafter to carry out earthworks operations in order to establish suitable platforms to support Project facilities. These activities can induce significant negative water and air quality impacts leading to public health impairments, flooding episodes and induce diminishing of the economic and social resource capability of watercourses. P2M2s are required to quell impacts to tolerable levels and are referred to as LD-

P2M2. Guidelines for preparation of LD-P2M2 documents are described under **Appendix 4** contained in the publication entitled "Environmental Impact Assessment Guidelines in Malaysia (EGIM) (DOE 2016)". In this respect a LD-P2M2 checklist must be submitted together with relevant sectional drawings and maps. The version of a typical checklist is presented herewith:

Table 6.1: Standard Requirements for the LD-P2M2 Submission

Requirement	Information to be Included
Project Activity and Implementation	• Phasing plan. • Project implementation schedule. • Description of constriction activities. • Construction schedule complete with timeline or charts for P2M2s installation. • Construction method statements.
Information and Analysis on Project Development	• Selected weather and rainfall data. • Site runoff velocity and flow rates (pre- and post-development). • Description of soil and geological characteristics (type, erodibility, hydrologic group, percentage dispersible material, excavation depth, etc.). • Description of adjacent areas that may be affected by land disturbance. • List of drainage, streams and river systems located onsite as well as receiving streams and rivers. • Lists of P2M2s proposed. • Access roads and project components located outside of project boundary. • Earthworks cut and fill volume. • Availability of rocks materials. • Biomass management. • Solid (construction waste) and domestic waste management. • Spill prevention and control plan. • Hazardous waste management. • Soil loss prediction (pre, during and post-development) for with and without LD-P2M2 implementation scenarios. • Calculation for sediment traps/basins and projected runoff flows.
Map of Site Plan with Existing Conditions	• Topographic survey map. • Geological Terrain Map. • Erosion risk map. • Landuse map. • Site development plan map.

Source: Guidance Document for the Preparation of the Document on LD-P2M2, DOE 2016.

The Department of Environment (DOE) has made it a mandatory requirement to recommend P2M2 for all development projects; and to mainstream the environmental agenda towards a culture of guided self-regulation (GSR) by placing the onus of environmental protection and management clearly on the Project Proponent to comply.

6.2.2 Application of P2M2

The underpinning principles of P2M2s are to reduce environmental degradation and pollution through application of pollution control and abatement measures that take into consideration prevailing site conditions, and the state of the environment surrounding the project site. The main objective is to preserve the integrity of the Project site, and to ensure public health, safety and wellbeing. The general approach is to adopt the following principles:

(i) The extent of the P2M2s to be adopted shall correspond to the degree of significance of the predicted impact. Once an impact is identified as significant, P2M2s shall be recommended in the EIA report for application when the Project is implemented (e.g. as part of the engineering designs for slope reinforcement works, sediment control, etc.). For minor issues, simple management actions will suffice, e.g. water browsing for dust control at site, and installation of hoardings for noise attenuation and visual screening.

(ii) Priority shall be given to controlling pollution at source (e.g. reducing erosion and surface runoff within Project site), rather than to permit its translocation to adjacent areas (e.g. maintenance of silt traps and removal of accumulated silt from the drainage system).

(iii) Mitigation measures need to be site and project-specific. The P2M2s need not be complex and costly, but shall instead be practical, easy to implement and be effective.

(iv) The P2M2s shall be adequately described based on its design intent and functional attributes. The proposed measures shall be supported by diagrams, illustrations, photos and maps. The technical reports and specifications relating to the P2M2s shall be included as an Appendix in the EIA report.

(v) The application of innovative state-of-the-art technologies is encouraged if it can be proven to be effective in ameliorating the impacts to acceptable levels.

(vi) P2M2s require regular inspection, maintenance and rehabilitation. These shall be incorporated as part of the environmental management requirements of the project, including the allocation of sufficient budget and personnel to carry out such tasks.

(vii) Effectiveness of P2M2s shall be recorded and documented as part of the monitoring and audit programmes (refer to **Chapter 7**).

(viii) The Qualified Person shall propose best management practices (BMPs), if deemed necessary.

(ix) The P2M2s and BMPs shall be incorporated early into the overall project design and as part of the LD-P2M2 document.

The submission of the EIA, and the pledges given by the Project Proponent to adopt measures that will protect the integrity of the surrounding environment and resident communities shall reflect a commitment towards ensuring that the recommended P2M2s are implemented during all stages of work activities. These efforts shall include, but not be limited, to executing measures, actions or due diligence principles in accomplishing the overarching goal of protecting the environment during project implementation and operations.

6.3 POLLUTION CONTROL SYSTEMS

6.3.1 General Considerations.

Prior to the commencement of a Project's land clearing and earthworks operation, it is recommended that a Plan be formulated for adopting effective and efficient pollution control systems as part of an overall LD-P2M2 strategy. This is to ensure that adverse impacts imposed on the surrounding environment be avoided during this short-term phase of Project development. One of the main features in the LD-P2M2 is the use of pollution control systems.

During a Cement Manufacturing Plant's operational phase, the conduct of various activities will generate and release different types of pollutants, mainly in the form of sullage and sewage discharges, toxic, hazardous and particulate gaseous emissions, and discharges of surface flows containing suspended solids, oil and grease, etc. Depending on the scale and volume of discharge of such pollutants, a pollution control system plan incorporating appropriate P2M2s needs to be evolved, together with specifications relating to control equipment and maintenance works. The most common facilities a CMP will adopt will include for the Sewage Treatment Plant Systems (STS), Air Pollution Control Systems (APCS), Oil and Grease removal basins and suspended particulate removal facilities.

The Project Proponent shall engage a Qualified Consultant to prepare the detailed designs of any Pollution Control Systems for the EIA study. The Qualified Consultant must be a professional engineer who holds a current registration certificate issued by the Board of Engineers, and also be a certified Competent Person under Section 49A of the Environmental Quality Act (EQA) 1974.

Detailed requirements for specific pollution control systems and their applicability can be referred to in the Announcement by DOE dated March 2017.

Consultant shall refer to the Best Available Technique Guidance Documents published by DOE as guidance. If the proposed technology is new and has not been previously employed in the country, the Project Proponent shall provide detailed information on the new technology, especially with regards to its performance.

6.3.2 Erosion and Sediment Management

(a) Site Clearing and Earthworks

Objective: To arrest or mitigate soil erosion and sediment translocation at source (i.e. within the Project area) in order to reduce adverse impacts being imposed on communities and environmental sensitive areas located downstream of the Project site

Implementation Steps

(i) Establish proper scheduling and implementation of P2M2s in accordance with the project's overall implementation schedule.

(ii) Retain much of the natural vegetation by reducing the extent and duration of denuded and earthworks areas. Demarcate site buffer areas.

(iii) Reduce periods of exposure to the elements with respect to slopes and cleared areas.

(iv) Stabilise bare slopes, and apply protective covers, when they are not subject to construction activities.

(v) Protect stockpile areas from being eroded by air flows and rainfalls

(vi) Implement P2M2s to curtail soil losses within the Project site due to erosion processes and install sediment control measures to reduce translocation of loose sediments to external drainage systems.

(b) Runoff and Stormwater Management

Objective: To effectively manage the rate of surface runoffs discharged from the project site in order to prevent localised flooding, as well as to reduce or eliminate the risk of inducing potential flooding episodes at downstream locations, especially during rainy seasons.

Implementation Steps

The EIA shall assess the impacts imposed on external drainage systems by storm water discharges from the project site, and as a consequence to identify flow retardation measures as specified in the *Manual Saliran Mesra Alam Edisi-2* (MSMA-2) which can be implemented for intercepting the rapid stormwater flows in

an adequate manner. These measures include, but are not limited to, the following:

(i) Installation of temporary drains to minimise concentrated water flows during construction. In sites with limited areas, pipe slope drains (PSD) can be used to convey runoff into sediment containment system.

(ii) Channelling discharges via a series of check dams to a sediment pond to reduce run-off velocities and peak flows. Temporary energy dissipation structures are often used to reduce flow velocity.

(iii) The size and capacity of the drains must be sufficient to accommodate at least a 10-year ARI storm event (see also MSMA-2).

(iv) All drainage and waterway banks shall be stabilised, e.g. by rock cover, turf reinforcement mats, etc.

(v) Proper stream crossing and culverts are required along waterways to prevent blockages that can restrict storm water flows.

(c) Sediment Control

Objective: To ensure effective control of sediments at-site, employing both structural and non-structural measures in order to reduce water pollution episodes and sedimentation of watercourses.

Implementation Steps

(i) Installation of sediment control devices and structures such as silt fences, silt traps, sediment basins, barriers and use of active treatment systems where space is a constraint.

(ii) Retardation/capture structures and devices are to be designed to retain the calculated runoff volume for a sufficient period of time to allow for suspended sediments to settle.

(iii) Use of active treatment systems (ATS) such as flocculants, anionic polymers, etc. in space constraint locations to accelerate entrapment and settlement of fine sediments.

(iv) Regular inspection and maintenance of the structures to ensure their performance efficiency, especially after heavy storm events.

(v) Sediment control also extends to spillage of materials and mud trekking from vehicles and measures to address these must be put in place, including tyre washing facilities, road cleaning and dust control.

Box 8:
P2M2 Checklist for Erosion and Sediment Management

Site Clearing and Earthworks

Erosion and sedimentation management during land clearing and earthworks include:

(i) Development of phased clearing and subsequent earthworks operation plan.
(ii) Adoption of erosion, sediment and drainage control measures as outlined in the prepared LD-P2M2 strategy document.
(iii) Stabilised entrance and access roads.
(iv) Adequate turfing of slopes.
Temporary cover for exposed areas, e.g. erosion control mats, mulching, etc.

Runoff and Stormwater Management

Flooding and drainage issues can be prevalent during the land clearing and earthworks phase. Measures to minimise such occurrences include:

(i) Implementation of temporary drainage systems based on MSMA-2 criteria and concepts.
(ii) Cascading and pipe slope drains (PSD) along berms and steep slopes.
(iii) Inlet and outlet protection.
(iv) Provision and maintenance of riparian reserves alongside watercourses.
(v) Stream crossings to be adequately designed to pass through flows.
(vi) River alterations to have approval from the DID.

Sediment Control

Entrap and retain sediments prior to discharge out of the project site. Examples include:

(i) Sediment basin/silt trap.
(ii) Active Treatment System (Anionic).
(iii) Wash trough/wheel washing at main entrance/exit.
(iv) Road cleaning.
(v) BMP inspection and maintenance.

Operation

Erosion and sedimentation will not be major impacts and no mitigation measures are necessary except for periodic slope maintenance and rehabilitation in the case of erosion and failure during heavy rainfalls.

Permanent drainage network and retention systems (e.g. detention ponds, dry ponds, rain harvesting system, etc.) to be installed at-site to attenuate peak runoffs

6.3.3 Air Pollution Control

Objective: To minimise emission of fine dust and gaseous pollutants arising from construction and operation activities, and including transport of materials to and from the Project site.

Implementation Steps

(i) Clean up all spillage along transportation routes and maintain entrances/exits in a clean condition.

(ii) Any potential emission sources such as fuel burning equipment must comply with the relevant agencies' requirements and limits. The project proponent shall ensure that the proposed flue gas treatment system is able to handle the estimated flow rates and are treated based on the type of fuel used. Project Proponent shall also provide description and verification on the flue gas treatment used, especially with regards of materials imported from other countries.

(iii) Regular housekeeping to remove mud trekking along roads.

(iv) All emissions shall conform with DOE emission standards and compliance limit as per Environmental Quality (Clean Air) Regulations 2014; whilst open burning shall be prohibited at all times.

Box 9:
P2M2 Checklist for Air Pollution Control

Earthworks and Construction

The measures to include dust suppression methods, especially if dust pollution affects sensitive receptors. Some examples include:

(i) Wet suppression along main transportation routes and on earth stockpiles.
(ii) Measures to reduce equipment and vehicular emissions by enforcing periodic maintenance of vehicles and machineries.
(iii) Measures during blasting operations should include supervisions and adherence to safety measures, among others, to prevent injuries and safety concerns, e.g. from fly rock, vibration and noise.

Operation

Most emissions will be from vehicles and fuel burning equipment. All emissions must abide by the emission standards of DOE and install Air Pollution Control Systems (APCS) as needed.

Application of appropriate Best Available Techniques (BAT) by referring to the Guidance Document pertaining to Fuel Burning Equipment and Air Pollution Control Systems.

Control of fugitive dust emissions from exposed coal and raw material stockpiles

Control over natural oxidation processes within coal stockpiles so as to prevent fires.

Application of suitable fugitive emission controls by making reference to the Guidance Document pertaining to Fugitive Emission Control.

Carry out periodic performance monitoring schedules with respect to process controls

Carry out performance monitoring of of air pollution control systems making reference to the Technical Guidance Document on Performance Monitoring of Air Pollution Control Systems (DOE-APCS-5 First Edition 2006).

Conduct continuous and/or periodic emission monitoring in compliance with THE environmental Quality (Clean Air) Regulation requirements; and to DOE's requirement on Predictive Emission monitoring System (PEMS) and Continuous Emission Monitoring System (CEMS)

6.3.4 Noise and Vibration Control

Objective: To minimise noise and vibration disturbance to nearby receptors as well as to protect workers operating in a high noise environment.

Implementation Steps

(i) Noise and vibration impacts can be addressed through measures such as phasing construction work; erecting perimeter hoardings around the worksites, provision of acoustic silencers on noisy machines and equipment and use of physical barriers; or maintaining natural ones.

(ii) Protection of workers using personal protection equipment (PPE) is important within a work environment.

(iii) Periodic maintenance of vehicles and machinery to control the intensity of noise and vibration emissions to tolerable levels

(iv) Schedule piling and blasting works during day time and week days. Employ delayed firing blasting techniques.

(v) Besides DOE's guideline on the environmental noise limits and also vibration limits, the project should also adhere to relevant guideline and regulations from DOSH such as OSHA, Industry Code of Practice (ICOP) for Management of Occupational Noise Exposure and Hearing Conservation 2019 and Occupational Safety and Health (Noise Exposure) Regulations 2019 [P.U. (A) 60/2019].

Operation Stage

Landscaping and natural buffers can help reduce noise impacts from human activities. In the case of noisy machinery, such as gen-sets, compressors, fans etc. they can be acoustically enclosed to reduce noise impacts.

Box 10:
P2M2 Checklist for Noise and Vibration Control

Earthworks and Construction

Examples of measures include:

(i) Perimeter hoarding.

(ii) Regular machinery and vehicle servicing.

(iii) PPE for workers.

(iv) Scheduling of piling and blasting work.

Operation

Landscaping and natural buffers can help soften the noise from human activities. For noisy machineries such as gen-sets, these can be enclosed to reduce noise.

6.3.5 Water Quality

Objective: To prevent water pollution of rivers and other watercourses located within and in the surrounding areas of the project site during the Project's construction and operation phases. Where possible, to maintain water quality at baseline conditions or better, and be within DOE prescribed limits for specific uses of the waterways.

Implementation Steps

(i) Potential water pollutants include suspended solids, sewage, sullage, machinery discharges, oil and grease (O&G), etc. Silt traps and sedimentation basins/ponds will be able to trap most of the physical constituents such as silt and sediments, but not dissolved materials and O&G, before final discharge.

(ii) Proper storage areas including adequate bunding are to be provided for scheduled wastes, concrete batching plants, chemicals, spoils, fuel tanks and temporary waste disposal areas. Containment facilities to be designed to retain 110% of the largest inventory of liquid wastes. Containment facilities shall be made from impermeable

(iii) Suitable treatment systems especially for sewage and sullage effluents (from on-site toilets and construction labour camps) shall be adopted to ensure that the discharge quality meets the agencies and local authority's standards during the construction and operational phases of the project.

(iv) In case of spillage and accidental release of toxic and hazardous wastes, measures are to be in place to contain, remediate and remove the contaminants from entering watercourses.

Box 11:
P2M2 Checklist for Water Pollution Control

Earthworks and Construction

Measures to prevent TSS, organic pollutants and O&G from entering into the downstream rivers and drainage systems during the construction phase must be proposed such as:

(i) Implement appropriate LD-P2M2s.
(ii) Discharges from wastewater treatment plants and toilet facilities at site and at base camps to follow the National Water Services Commission (SPAN) requirements.
(iii) Establish proper workshop areas.
(iv) Bunded storage for scheduled wastes, concrete batching plants, chemical storage and fuel tank areas.
(v) For batching plants, to include measures to prevent releases of concrete wastes and washouts outside of the project boundary.
(vi) Include a proper closure plan on plant shut-down.

Operation

During the operational period, high loadings of sewage and sullage, surface run-offs and process effluents to be treated to conform with stipulated standards on effluent discharges to inland waters as promulgated by DOE.

A proper STS and effluent treatment system shall be required if there are any sewage generated. O&G traps are required to be installed to intercept discharges from canteens and kitchens and be regularly maintained to ensure their functional reliability.

Operation Stage

(i) Install separate drainage systems for stormwater flows and effluent discharges.

(ii) Provision of first flush pit at process areas.

(iii) Apply suitable Best available Techniques (BAT) to control discharge of sewage and process effluents; e.g. by referring to the Guidance Document on the Design and Operation of Industrial Effluent Treatment System (DOE-IETS-9)

(iv) Carry out Performance Monitoring with respect to process controls (e.g. Kiln operations).

(v) Carry out Performance Monitoring with respect to sewage and industrial effluent treatment systems by referring to the Technical Guidance Document on Performance Monitoring of Industrial Effluent Treatment systems (DOE-IETS-1).

(vi) Carry out continuous and/or periodic effluent quality monitoring in compliance with Environmental Quality (Sewage) Regulation, and/or Environmental Quality (Industrial Effluent) regulation requirements.

(vii) The effluent from a plant's treatment system shall be discharged into a "check pond" before being released to the environment. The check pond shall function as an important biomarker for assessing the quality of effluent and to be discharged to the environment.

6.3.6 Waste Management

Objective: To minimise the amount of waste generated from the site and to ensure proper collection, storage and disposal of the different types of wastes generated during construction, operations and abandonment stages.

Implementation Steps

(i) Wastes comprising biomass, municipal, construction and demolition (C&D) and scheduled wastes require specific management strategies.

(ii) The key approach is to ensure proper regular collection and disposal of wastes generated and to dispose them at well managed temporary/permanent repositories located within the Project site, or to temporarily store them at site prior to disposal off-site at approved facilities.

(iii) General housekeeping of the construction site is also important. No open burning of wastes should be permitted.

(iv) The processes in the industry must be designed to be in-line with DOE's "cradle-to cradle" policy wherever possible in order to minimize generation of waste.

Box 12:
P2M2 Checklist for Waste Management
Earthworks and Construction

Solid Wastes

The measures for proper solid waste management include:

(i) Temporary disposal area to be provided and well managed.
(ii) Waste bins to be provided at active work areas.
(iii) Regular housekeeping practices to be carried out
(iv) Disposal of wastes at a local authority licensed landfill.
(v) Practice circular economic principals in the management of wastes by encouraging reduce, recycle, repurposing activities.

Scheduled Wastes

The measures include proper scheduled waste management controls in adherence to the Environmental Quality (Scheduled Wastes) Regulations 2005. Some examples include:

(i) Scheduled waste storage area with bunding.
(ii) Maintaining scheduled waste inventory.
(iii) Proper scheduled waste notification, labelling, inventory and consignment to track and control movement of scheduled wastes.
(iv) Provision of Chemical or Oil Spill kits
(v) Scheduled waste management and disposal at licensed facilities employing licensed transporters.
(vi) Competent person trained in scheduled waste management.

Operation

Adequate bins and disposal sites need to be provided to collect and store wastes.
Regular disposal services shall be required.

6.3.7 Safety and Health

Objective: To ensure that the general public and worker safety and health are not compromised with ongoing construction works.

Implementation Steps

(i) Safety and health measures are intended to address issues such as work place conditions and worker's health. These include preventive checks on any communicable diseases among the workers, provision of personal protective equipment (PPE), provision of firefighting equipment, safety trainings and having an Emergency Response Plan (ERP) in place.

(ii) Proper work procedures are designated at-site and off-site to prevent unauthorised entry from the public into the active work site to reduce the risks of accidents and injuries.

(iii) Project Proponent shall also refer to relevant guidelines such as OSHA and Guidelines on Occupational Safety and Health in Construction Industry (Management) (OSHCIM) from DOSH that provides practical guidance to the client, designer and contractor on the management of safety, health and welfare when carrying out construction projects.

Box 13:
P2M2 Checklist for Safety and Health

Earthworks and Construction

The measures for safety and health are:

(i) Develop and maintain an Emergency Response Plan (ERP).
(ii) Safety officer to be employed.
(iii) Instil PPE requirements.
(iv) Workers to have CIDB green card.
(v) Health checks on workers to prevent spread of communicable diseases.
(vi) Periodic Staff Training to be conducted especially with regard to safety and health

6.3.8 Visual

Objective: To reduce the impact of visual intrusion during and after construction.

Implementation Steps

(i) Wherever possible, preserve natural areas not affected by construction activities. This includes all river courses and associated riparian areas.

(ii) Use of hoardings or barriers can also reduce the direct visual impacts.

(iii) Rehabilitation of the site through landscaping and replanting will help to soften and even reverse some of the impacts during construction.

6.4 RESIDUAL IMPACTS

Residual impacts are those that persist even after all mitigation measures are judiciously implemented. The extent of residual impacts shall be clearly detailed in the EIA report; and associated impact monitoring shall be recommended.

CHAPTER 7

ENVIRONMENTAL IMPACT ASSESSMENT: ENVIRONMENTAL MANAGEMENT PLAN

7.1 INTRODUCTION

The Environmental Management Plan (EMP) is a legal document prepared by the Project Proponent that incorporates pollution prevention and mitigation measures (P2M2s), and best management practices (BMPs) that are specified in the Project's Conditions of Approval (COA) issued by the Department of Environment (DOE).

Other than mitigation measures, the EMP includes, inter-alia, self-regulation requirements; an environmental monitoring plan and audit programmes to assess the effectiveness of the P2M2 implementation.

The EMP is a living document and must be updated whenever there are major changes to project designs and layouts, or when construction methods change, factors that may result in specific impacts not originally addressed in the EMP.

Application of 5S principles in order to keep track with latest environmental requirements, and in improving a project's environmental management strategy. An explanation of the principal content of a 5S strategies is presented in **Box 14.**

7.2 EMP FRAMEWORK

Insufficient information concerning the Project's work plan may not be available during the EIA stage to formulate a comprehensive EMP. The EMP chapter in the EIA should only be an EMP framework for eventual morphing into a full EMP during the post EIA approval stage

The Project Proponent can submit a detailed EMP concurrently with the EIA Report if there is sufficient information to formulate an effective EMP. The EMP be updated at a later stage to incorporate the requirements of the COAs.

The format for the EMP shall be based on requirements stated within the EGIM Document (DOE, 2016); and shall contain pertinent details abstracted from the principal LD-P2M2 Documents. The proposed monitoring and audit programmes should also be a part of the EMP.

BOX 14:
Application of 5S in Up keeping Environmental Compliances

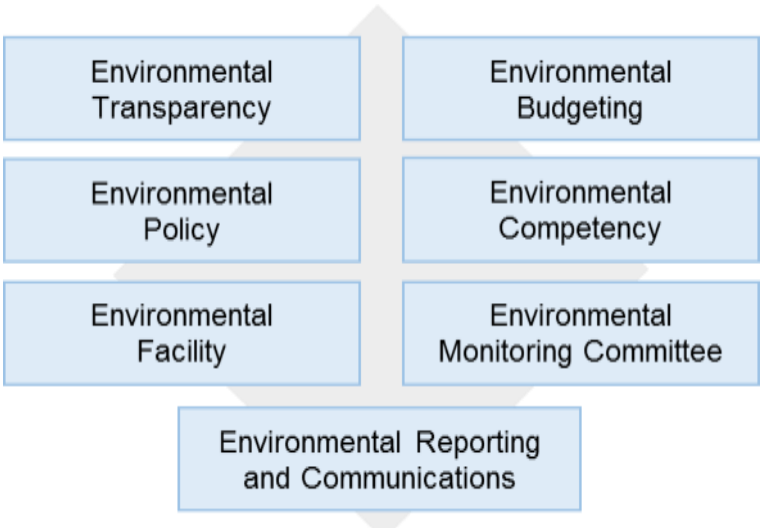
Seiri	Organise, Sort and Eliminate things that are obsolete and not in use and store them away
Seiton	Set in Order, and promote Neatness i.e. arrange items or information used regularly so that they can be easily accessible and quickly stored
Seiso	Clean, Shine in order to ensure everything is checked and functioning properly.
Seiketsu	Standardise - develop routine programmes to organise work areas and processes.
Shitsuke	Discipline, Sustain - create a culture that follows the steps of 5S on a daily basis.

Note: 5S was developed in Japan by Hiroyuki Hirano

7.3 SELF-REGULATION

DOE has initiated a Guided Self-Regulation (GSR) requirement that must be adopted by Projects that are categorised as prescribed activities, during all of its implementation stages. In this respect, the EMP shall incorporate the required Environmental Mainstreaming Tools.

There are seven environmental mainstreaming tools, the being:



7.3.1 Environmental Policy

This refers to the Project Proponent's high level Environmental Policy that needs to be followed throughout the organisation.

7.3.2 Environmental Budgeting

The Project Proponent has to provide for an environmental budget to cover environmental-related commitments, e.g. recruitment of environmental working level and supervisory personnel, implementing P2M2s, undertaking monitoring and auditing of impacts, executing remedial and rehabilitation works, and training of staff on environmental related matters.

If a budget has not been firmed up during the EIA study stage, the Project Proponent shall commit to a pledge to allocate an adequate budget to cover for expenses to be incurred to execute and comply with activities outlined in the EMP during the post-EIA stage to ensure compliance.

The budget requirements shall also be reflected in the Project's construction Contract Documents, as part of the Bills-of-Quantities, for contractors to price for execution of specified environmental related works.

7.3.3 Environmental Monitoring Committee

The Project Proponent is required to establish an Environmental Regulatory Compliance Monitoring Committee (ERCMC) to be headed by the Chief Executive Officer (CEO), or organisation chairman. This is to ensure that there is a high-level commitment towards environmental protection and conservation during Project implementation and operations.

An Environmental Performance Monitoring Committee (EPMC), chaired by a senior officer of the organisation, shall oversee the execution of day-to-day environmental management activities at the working level.

For large-scale projects involving multiple contractual work packages executed by many contractors, the respective main contractors are required to form their respective Environmental Management Teams (EMTs), comprising of at least an Environmental Manager (EM) and an Environmental Officer (EO), and supported by several technical assistants.

An organisation chart shall be developed to portray all parties involved in the environmental management of the Project, together with a listing of all participating personnel and their respective roles and responsibilities. This organisation chart shall be included in the EMP framework.

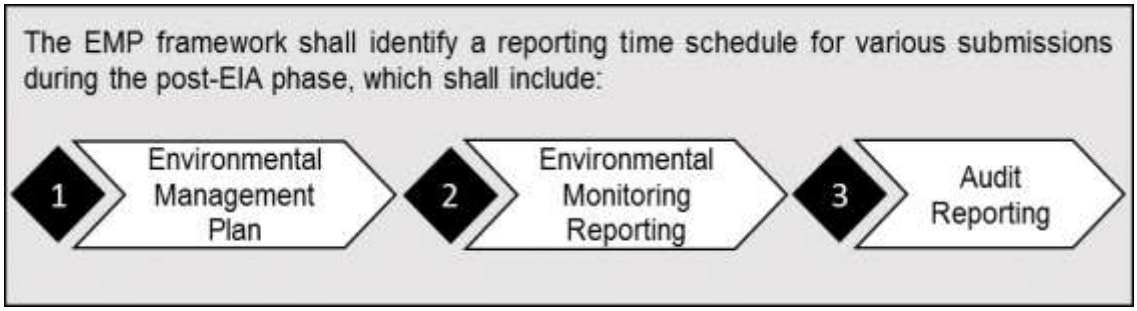
7.3.4 Environmental Facility

The EMP shall specify the range of environmental facilities to be incorporated in the Project. Such facilities would encompass Industrial Effluent Treatment Systems (IETS), Sewage Treatment Systems (STS), Air Pollution Control Systems (APCS), BMPs, P2M2 structures, and associated supporting utilities and facilities, all of which would require operational and maintenance support.

7.3.5 Environmental Competency

Personnel training requirements are required for all relevant site personnel in order to ensure environmental management competency. The proposed training requirements and execution programmes shall be described in the EMP document.

7.3.6 Environmental Reporting and Communication



The mode of communication between the ERCMC, EPMC and the respective EMTs must be clearly defined in the EMP document.

Lines of communication between the Project Proponent, the EPMC and the relevant stakeholders, must be clearly defined. This is not only limited to project site management activity, but also to cover engagements with affected communities, and the general public, so as to manage adequately any potential grievances and expectations related to Project development and operations.

7.3.7 Environmental Transparency

This refers to the Project Proponent's initiative to be transparent on its implementation and performance of environmental management. Such sharing may be in the form of environmental sustainability report, website, billboard or fliers.

7.4 MONITORING AND AUDIT PROGRAMMES

The environmental monitoring and audit programmes are important components of the EMP. Monitoring and audits shall be implemented during the post-EIA stage.

7.4.1 Monitoring Category

Environmental monitoring can be categorised into three main categories:

(a) Performance Monitoring (PM)

(i) Relates to monitoring the performance of treatment systems such as IETS, STS and APCS.

(ii) This shall be undertaken by a Competent Persons with knowledge and expertise in the relevant treatment systems.

(b) Compliance Monitoring (CM)

(i) Relates to the monitoring of P2M2s within the site to ascertain their performances. This is carried out by representative sampling of waste discharges at specific points within the site, and at its boundaries. The level of pollutants measured, and their comparison with established limits of discharge, are performed to gauge the level of performance of P2M2s. Sampling of waste emissions are usually taken either at points of release (in the case of noise, air and vibration), or at discharge points from treatment plants (in the case of sewage, process effluents, sediment basin discharges).

(ii) The sampling and testing of waste discharges/emissions shall be carried out by a Competent Person engaged by an accredited laboratory.

(c) Impact Monitoring (IM)

(i) Impact monitoring may only be required in cases where there is a possibility that residual waste discharges may still induce adverse impacts on receptors located external to the Project site boundaries despite having been subjected to P2M2s. In these cases, monitoring of ambient air and water quality, and noise and vibration levels, at the identified receptors shall be carried out and compared with similar levels monitored prior to commencement of Project construction activities. Samplings and measurements may also be carried out at other sensitive receptors such as flora and fauna habitats

(ii) This shall be carried out by Competent Person employed by an accredited laboratory.

7.4.2 Monitoring Programme

The scope of a monitoring programme shall be dependent on the scale of the project and in relation to the nature of predicted impacts. Monitoring will

encompasses areas within the project site, and at sensitive receptors located external to the project area that are likely to be impacted by Project induced waste emissions .

Details of the monitoring programmes are outlined and specified by the Qualified Person; and have to be approved by DOE before they are implemented. Details such as monitoring locations, frequencies, monitoring parameters, recommended limits, instrumentation and personnel requirements have to be presented and discussed in the EMP.
The monitoring programme shall take into consideration the range and scope of potential waste emissions generated and released by Project activities, and the state of existing environmental resources and receptors and physical development profiles surrounding the Project site. A typical monitoring for a cement manufacturing plant projects is summarised in **Table 7.1.**

DOE has the right to mandate any monitoring programme changes, or seek additional information and data to support the proposed programmes.

Table 7.1 Sample of a Monitoring Programme for a Cement Manufacturing Plant

Types of monitoring/ Test Parameters	Sampling Point	Compliance Requirement	Monitoring Frequency
Compliance Monitoring			
Stack Emission PM_{10}, $PM_{2.5}$, NOx, SOx, Total Suspended Particulates, Mercury, Cadmium, Dioxins	Sampling port of kiln and clinker cooler stacks	Environmental Quality (Clean Air) Regulation 2014	Quarterly
Effluent pH, Temperature, BOD, COD, Total Suspended Solids, Mercury, Cadmium, Chromium Hexavalent, Chromium Trivalent, Arsenic, Cyanide, Lead, Copper, Manganese, Nickel, Tin, Zinc, Boron, Iron, Silver, Aluminium, Selenium, Barium, Fluoride, Formaldehyde, Phenol, Free Chlorine, Sulphide,	Effluent discharge from IETS	Environmental Quality (Industrial Effluent) Regulations 2009	Monthly

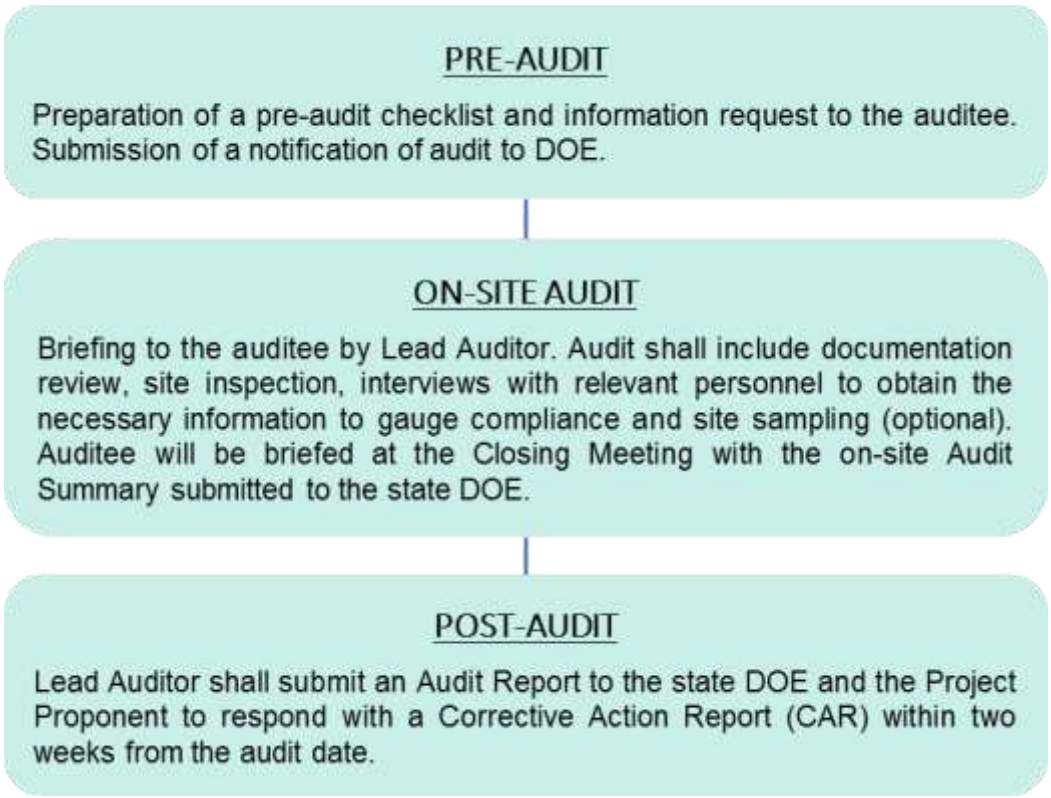
Types of monitoring/ Test Parameters	Sampling Point		Compliance Requirement	Monitoring Frequency
Oil and Grease, Ammoniacal Nitrogen, Colour				
Noise L_{eq}, L_{max}, L_{10}, L_{90}	NB1	North Plant Boundary	Guidelines for Environmental Noise Limits and Control	Quarterly
	NB2	East Plant Boundary		
	NB3	South Plant Boundary		
	NB4	West Plant Boundary		
Impact Monitoring				
Ambient Air PM_{10}, $PM_{2.5}$, Mercury, Cadmium	A1	Within Project Site	Ambient Air Quality Guidelines	Quarterly
	A2	Residential areas located external to Project Site		
Surface Water Temperature, pH, DO, Turbidity, BOD, COD, Total Suspended Solids, Ammoniacal Nitrogen, Oil and Grease, Total Coliform Count, Faecal Coliform Count	W1	Upstream of waste discharge point	Class IIB and Class III of the NWQSM	Quarterly
	W2	Downstream of waste discharge point		
Groundwater pH, Temperature, Salinity, DO, Conductivity, As, Cd, Cr, Cu, Fe, Hg, Mn, Ni,Pb, Se, Sn, V, Zn, VOC, TPH	G1	Upstream of Project Site	National Groundwater Quality Standard National Drinking Water Quality Standard	Baseline to be conducted before commencement of operation As per DOE requirement
	G2	Downstream of Project Site		

7.4.3 Environmental Audit

Environmental auditing is a post-EIA evaluation process to determine the effectiveness and performance of the mitigation measures adopted by the Project Proponent to comply with the COAs.

Audit requirements are guided by the Environmental Audit Guidance Manual published by DOE in 2011. The audit must be undertaken by an independent third party who is certified as a DOE registered environmental auditor.

The typical audit process involves:



CHAPTER 8

ENVIRONMENTAL IMPACT ASSESSMENT: ABANDONMENT PLAN

8.1 INTRODUCTION

An Abandonment Plan is a document prepared by the Project Proponent detailing the decommissioning and abandonment strategies and action plans to be implemented when a Project has to be abandoned.

Box 15:
Scenarios associated with Project Abandonment

(i) Change of project development stages and / or phases.
(ii) Major maintenance or turnaround events occurring during operation stage.
(iii) Temporary curtailment of activities due to change in project ownership or change in project contractor.
(iv) Temporary or permanent curtailment of activities due to changes in government policies
(v) Temporary or permanent curtailment of activities during construction stage due to challenges in project funding
(vi) Temporary or permanent suspension of activities during operation stage due to shortfalls in company financing.
(vii) Decommissioning and closure of a Plant upon reaching its design life, or at the end of its useful life
(viii) Decommissioning and closure of facilities due to expiry of concession

The Abandonment Plan shall also incorporate P2M2s and BMPs that should be implemented when carrying out abandonment procedures and associated activities.

8.2 ABANDONMENT PLAN

8.2.1 Pre-Abandonment Activities

In order to determine the best decommissioning / abandonment strategy, a Best Practical Environmental Option (BPEO) assessment should be performed. The resulting findings and conclusions shall be outlined and described, and the

principal conclusions presented in the Abandonment Plan. **Figure 8.1** illustrates a potential BPEO Concept.

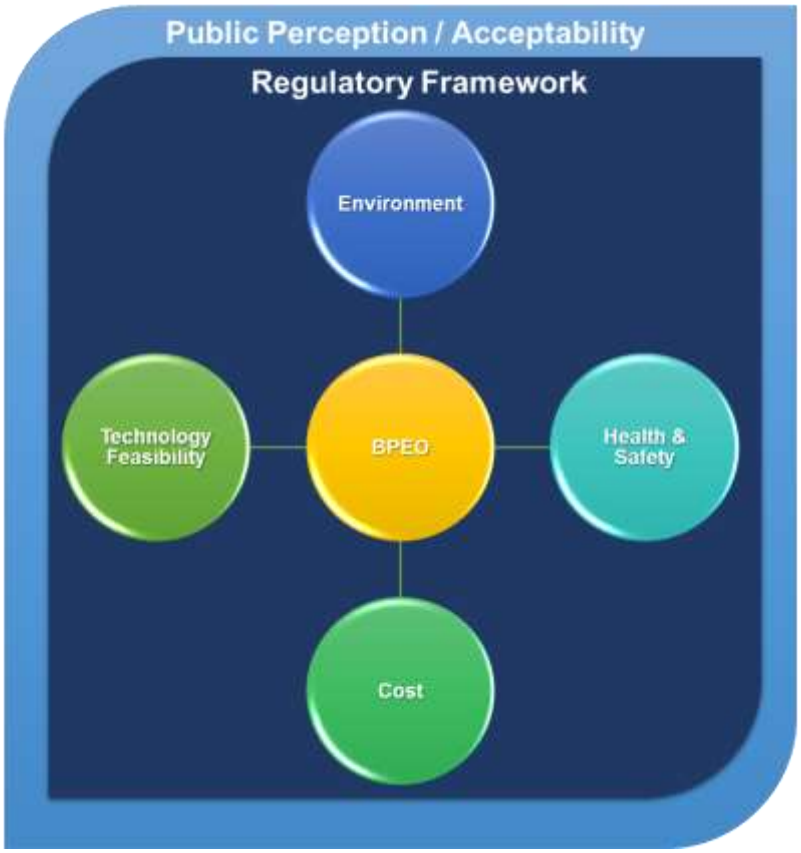


Figure 8.1: Best Practical Environmental Option Concept

The process of decommissioning an industrial Plant can raise complex issues. It is widely accepted that in selecting the "best" decommissioning plan, it is essential that due consideration be given to the critical and inter-related requirements of human health and safety, environmental protection, technological feasibility and economic stewardship, all within the broader context of public perception / stakeholder acceptability. A BPEO assessment provides a means of determining which decommissioning strategy is the most suitable for a particular Plant or facility.

The strategy for decommissioning and abandonment of the industrial Plant shall also be assessed using criteria and framework as set out in the **Contaminated Land Management and Control Guidelines (CLMCG)**. The guidelines among others provide the guiding principles and contaminated land management frameworks for different type of land use that would be of subsurface contamination concerns.

The framework is defined through a series of three (3) specific guideline namely:

- Contaminated Land Management and Control Guidelines No. 1: Malaysian Recommended Site Screening Levels for Contaminated Land

- Contaminated Land Management and Control Guidelines No. 2: Assessing and Reporting Contaminated Sites
- Contaminated Land Management and Control Guidelines No. 3: Remediation of Contaminated Sites

All three (3) guidelines need to be read in sequence as each one describes requirement that is part of the overall framework to determine required remediation works in the Abandonment Plan which is explained in the CLMCG No. 3.

8.2.2 Abandonment Activities

During the abandonment phase of a project, the following activities are normally carried out,via:

(i) Identifying work packages and outlining pertinent specifications for undertaking the identified tasks.

(ii) Tendering process and awarding of contract for decommissioning and demolition work;

(iii) Removal and disposal of scheduled waste, demolition materials and refuse;

(iv) Disassembling of equipment and plant;

(v) Removal of plant piping, cabling, storage facilities and segregation of reusable/ recyclable and repurposing components;

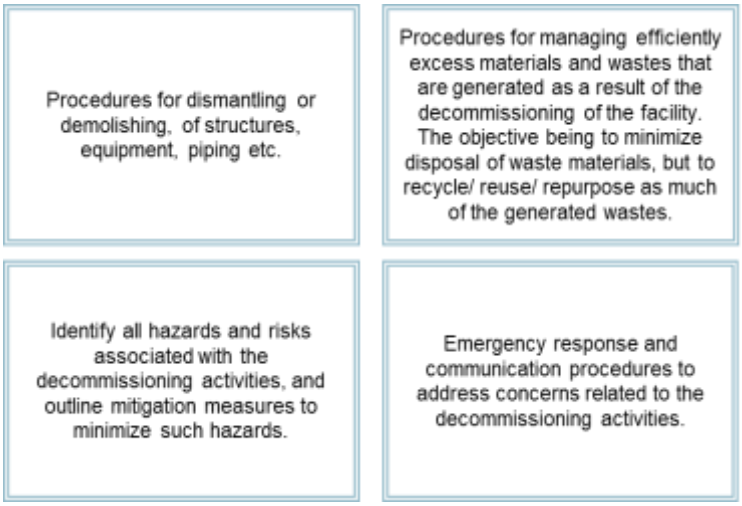
(vi) Demolition of a building, and separating those components that can be reutilised and recycled prior to disposing the residual materials to approved repositories.

(vii) Site levelling and filling and revegetation; and

(viii) Site stabilisation / Rehabilitation.

Details of the selected or preferred decommissioning strategies/options shall be described in the Abandonment Plan.

As a minimum, the following aspects, and associated management plans, shall be described in the Abandonment Plan:



Potential environmental impacts associated with a project Abandonment stage are summarized in **Table 8.1**.

Table 8.1: Example of Impacts Associated With Abandonment of a Project

Environmental Indicator	Potential Impact During Project Abandonment
Air Quality	Emission of dust due to demolition works, site levelling and filling activities Emissions from transportation of construction materials and wastes.
Erosion and sedimentation	Dismantling and demolition works may result in soil disturbance causing increase of erosion risks.
Water Quality	Demolition and removal of fuel storage tanks and associated pipe work and dismantling of effluent treatment plant which may lead to water contamination if the residues are not properly contained and treated. Leaching from demolition works and mishandling of wastes and chemicals.
Noise	Noise from hacking, demolition and transportation works.
Wastes	A variety of wastes can be generated during decommissioning and demolition works. These wastes may include unused machinery, metals wastes, concrete wastes, plastics and other solid wastes. Hazardous materials may include unused chemicals, oil or fuel, and scheduled wastes. Improper handling and disposal may lead to land contamination as well as contamination of water resources.

Environmental Indicator	Potential Impact During Project Abandonment
Socio economic	Decommissioning and abandonment of a project may bring an end to the direct and indirect employment opportunity afforded to local and regiona lcommunities.

The abandonment plan shall also describe the implementation of an environmental management plan to gauge the impact which abandonment activities can impart on the surrounding ambient air and water qualities, noise and vibration levels, drainage impedances due to siltation effects, siltation of other watercourses, etc. A description is also warranted with respect to the adoption of a waste management plan based on circular economic principles that gives credence to enforcing recycling/ reuse/ repurpose strategies.

8.2.3 Post Abandonment Activities

Appropriate site remediation and restoration activities shall be described if residual site contamination (e.g. hydrocarbons in soil from past leaks and spills) is detected.

A post decommissioning monitoring programme should be conducted to assess environmental changes and implications of the selected decommissioning strategy/options and to monitor any potential residual impacts imposed on the local environment. Depending on the sensitivity of the site, additional surveys may be conducted to monitor and trace the recovery of the site to acceptable levels.

8.3 REPORTING

The detailed Abandonment Plan shall be submitted to DOE for review and acceptance at least three (3) months prior to its implementation.

The format of Abandonment Plan shall comply with the associated guidance document to be issued by DOE.

An Environmental Sustainability Report, which shall include a post abandonment environmental monitoring scheme, BMP inspections and wastes inventories, shall be submitted to the state DOE office during the post project abandonment stage.

CHAPTER 9

ENVIRONMENTAL IMPACT ASSESSMENT: REPORTING AND REVIEW

9.1 INTRODUCTION

This Chapter describes the format and procedures for preparation of an Environmental Impact Assessment (EIA) for submission to the Department of Environment (DOE) for approval. The submission can be performed only after the completion of all other necessary studies and requirements.

9.2 EIA REPORT

9.2.1 EIA Report Format

The EGIM (DOE, 2016) Document, specifically **Section 4.6** and **Appendix 9**, describes the content and format for EIA reporting.

The EIA Report shall typically include the following contents:

(i) A declaration from the Project Proponent and Qualified Person in the format detailed in Appendix 9 of the EGIM Document (DOE, 2016). The declaration must be printed in the Project Proponent's company letterhead and attached to the EIA Report.

(ii) Executive Summary of the EIA Report shall be prepared in Bahasa Malaysia and English.

(iii) Brief Introduction to the project, providing salient information, on inter-alia, the Project Proponent (address, key person and contact information); the Environmental Firm engaged to carry out the EIA Study (address, key person and contact information); and the composition of the EIA Team Members (name, academic, qualifications, areas of study, signature).

(iv) Review of the basic policies, and regulatory and legal requirements, for implementing the project (refer to **Chapter 2** of this EIA Guideline for details).

(v) Terms of Reference (TOR) for the EIA Study as endorsed by the DOE (refer to **Chapter 3** of this EIA Guideline for further details). An endorsement letter from DOE approving and endorsing the TOR has to be attached as an Appendix to the EIA Report.

(vi) Statement of Need for project implementation. This narrative shall include supporting statements to justify the need and necessity to implement the

Project. This Statement shall form part of the EIA report. Key points to be addressed are summarised in **Box 16**.

Box 16:
Key Points to be Addressed in Need Statement

Key justifications for supporting the implementation of a project may include, but are not limited, to the following, points:

(i) Meet increasing market demands for the manufactured products.
(ii) Fulfilment of, or adherence to, the goals of National and State policies and plans
(iii) Enhancing social and economic benefits to communities.
(iv) Application of new green and sustainable technologies that will benefit both the community and the country.

(vii) Deliberation on Project alternatives and options (refer to **Section 3.4** of this EIA Guideline).

(viii) Detailed description of the project including site information, manufacturing concepts, breakdown of major process streams, material and manpower requirements, and project activities and their execution time schedules (refer **Table 9.1**).

(ix) Description of the baseline conditions (physical-chemical, biological and human environment) prevailing within the ZOS prior to Project implementation that may be impacted upon by project activities (see **Chapter 4** of this EIA Guideline).

(x) Assessment of the significant impacts (positive and negative), that can be imparted on nearby sensitive receptors; predicting the spatial and temporal extent and intensity of identified impacts; describing and recommending P2M2s to be adopted to minimise or enhance each type of impact, and to identify any potential residual impacts that need to be addressed in further depth (see **Chapters 4** and **5** of this EIA Guideline).

(xi) Details of public consultations and engagements carried out as part of EIA Study.

(xii) Environmental Management Plan (EMP) incorporating both general P2M2s and LD-P2M2, monitoring and audit programmes (see **Chapter 7** of this EIA Guideline).

(xiii) Appendices detailing the technical studies carried out as part of the EIA study together with supporting documentation, result of analysis, list of references, etc.

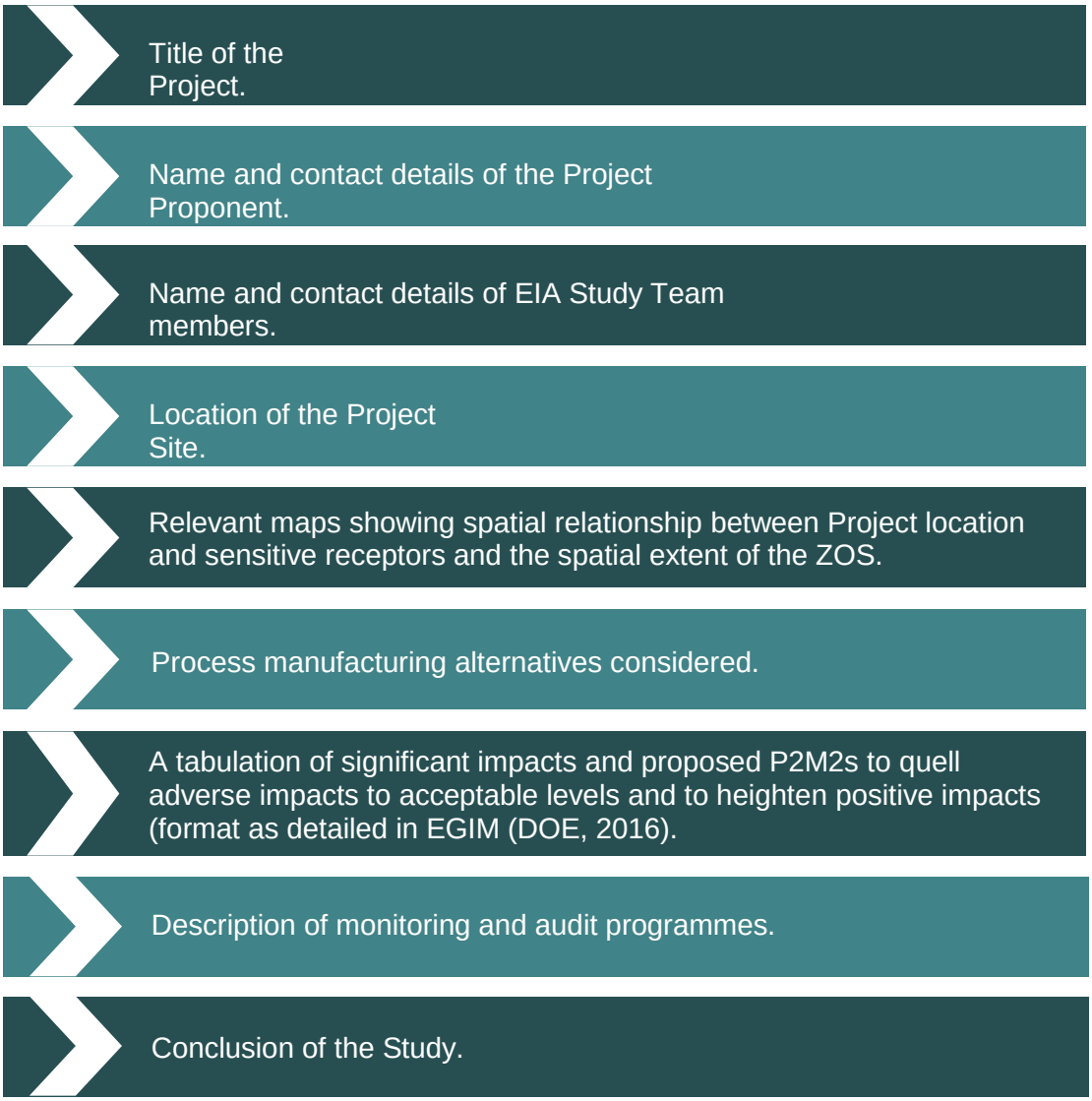
Table 9.1: Recommended Project Description Scope and Content

Project Details	Project title. Name and contact details of the Project Proponent. Name and contact details of EIA Team. Location of project (coordinates, lot no, district, etc.) Relevant map of project location and accessibility.
Location	General site plan including ZOS (5-km radius) Project boundary and layout (with coordinates). Description of location in relation to identifiable landmarks (e.g. city centres, main roads, towns, etc.).
Project Component and Design Details	Project details (land area, buffer, lots and land status). Project concept, layout and component. Technology use. Examples of similar project type and scale. Supported with drawings, illustration and diagrams.
Project Activities	Method statement for major project activities during pre-construction, construction and operational stages. Manpower requirements. Resource requirements (e.g. soil and aggregate sources, spoil disposal area, etc.).
Infrastructure, Utilities and Amenities Requirement	Details of the estimated demand for: Water supply Electricity/ Fuels Sewerage Telecommunications. Transport system. Waste management.
Project Implementation Schedule	Estimated timeline for phases implementation from planning, to construction and operational phases. Details of each stages of implementation.

Note: The list is not exhaustive and not all the above may be relevant to the project. It is the responsibility of the Project Proponent and Qualified Person to determine the relevant information required for environmental assessment and compliance.

9.2.2 Executive Summary

The executive summary provides a concise brief of the findings and recommendations arising from the EIA Study. It shall be written in non-technical language, both in Bahasa Malaysia and English, presenting the following information:



Soft copy of the Executive Summary (PDF format) shall be submitted to DOE along with soft copy of the full EIA Report.

9.2.3 Data Deliverables

The Project Proponent shall include all available relevant data sourced and collated during the EIA study (in raw or processed format) along with the EIA Report, when requested by DOE.

Examples of such data include sampling results (certificates and raw data), modelling databases, baseline data (surveys, hydrographic data and climate data), metadata files, etc. This data shall also be provided to the relevant government agencies (GAs) upon request.

9.2.4 Conclusion to the EIA Report

The Qualified Person shall provide a pledge that the EIA study is carried out professionally and that the recommendations for P2M2 to be implemented will be

able to mitigate against the identified negative environmental impacts to an acceptable level to ensure minimal degradation of the environment.

The Project Proponent shall also provide a pledge that he has understood the content and findings of the EIA study that has been carried out; and are conversant with proposed recommendations for P2M2s to be implemented, and shall implement all of the P2M2s that are recommended in the EIA Report.

9.3 PUBLIC DISPLAY

A second schedule EIA will have mandatory requirements prior to the approval of the EIA Report. These include:

Public Engagement: Public engagement is a mandatory requirement for a Second Schedule EIA. This can take many forms, but the common approach is through conduct of focus group discussions or through public briefings with identified stakeholders resident or having connection with the ZOI. In the briefing sessions, the Project Proponent and EIA Team members shall present the project brief. This will be followed by a question and answer session. All discussions will be recorded and reported in the EIA Report.

Public display and review of EIA Report: *The* EIA Report will be displayed after it is submitted to the DOE Office. The display shall be for a period of a month, during which time the public will have an opportunity to review and officially submit their responses and comments in writing to the DOE. Notification of the public display of the EIA Report shall be advertised in two local newspapers, and / or any other media as approved by DOE.

Display locations: The EIA Report will be displayed at selected locations (DOE offices, public libraries and local authority offices) where the public can access and view the documents easily. The Project Proponent and Qualified Person can propose other suitable locations for display to DOE.

Online display: The Executive Summary (now the whole report can be downloaded at the website) of EIA Reports will be uploaded to the DOE website for the duration of the review period

9.4 EIA REPORT SUBMISSION AND REVIEW PROCESS

The EIA Report submission shall be in accordance with the procedural steps outlined in the EGIM document (DOE, 2016).

A TOR/ ESI Checklist and EIA Checklist as appended in **Appendix H** can be used by the Project Proponent and the Qualified Person to assist in conducting a self-check of the content of the EIA Report prior to submission to DOE.

When the EIA is approved, DOE will issue an approval letter with Conditions of Approval addressed to the Project Proponent. Potential outcomes from an EIA review are presented in **Box 17**. If the EIA Report is rejected on the grounds that the EIA Report is lacking in key information and / or detailed impact assessments; or the revised EIA Report cannot be submitted within the EIA review timeline period, the revised or updated EIA Report can be submitted later when it is ready and the EIA review timeline will commence again.

Box 17:
Outcomes from EIA Review Process

The possible outcomes of the EIATRC meetings are:

(i) Approval of the EIA Report, provided that the report meets with the requirements of Section 34A (3) of the Environmental Quality Act (EQA) 1974.

(ii) Rejection of the EIA Report, where the report does not meet with the requirements of Section 34A (3) of the Environmental Quality Act (EQA) 1974.

The decision on the EIA Report as issued by DOE marks the end of the EIA process.

REFERENCES

REFERENCES

American Public Health Association, American Water Works Association, Water Environment Federation (APHA) (2017). Standard Methods for the Examination of Water and Wastewater 23rd Edition

Atomic Energy Licensing Act 1984 (Act 304)

Department of Environment (1993) Buku Panduan Kawasan Sensitif Alam Sekitar.

Department of Environment (2004) Environmental Impact Assessment Guidelines for Risk Assessment

Department of Environment (2006) Technical Guidance on Performance Monitoring of Air Pollution Control Systems.

Department of Environment (2007) Noise Labelling and Emission Limits of Outdoor Sources

Department of Environment (2019) Guidelines for Environmental Noise Limits and Control (Third Edition)

Department of Environment (2007) The Planning Guidelines for Vibration Limits and Control

Department of Environment (2008) Guidelines for Prevention and Control of Soil Erosion and Siltation in Malaysia

Department of Environment (2011) Environmental Audit Guidance Manual

Department of Environment (2012) Guidance Document of Health Impact Assessment (HIA) in Environmental Impact Assessment (EIA)

Department of Environment (2012). Guidelines for Siting and Zoning of Industry and Residential Areas

Department of Environment (2015) Contaminated Land Management and Control Guidelines No. 1: Malaysian Recommended Site Screening Levels for Contaminated Land

Department of Environment (2015) Contaminated Land Management and Control Guidelines No. 2: Malaysian Recommended Site Screening Levels for Contaminated Land

Department of Environment (2015) Contaminated Land Management and Control Guidelines No. 3: Malaysian Recommended Site Screening Levels for Contaminated Land

Department of Environment (2015) Technical Guidance Document on the Design and Operation of Industrial Effluent Treatment Systems.

Department of Environment (2015) Technical Guidance Document on Performance Monitoring of Industrial Effluent Treatment Systems.

Department of Environment (2016) Environmental Impact Assessment Guidance in Malaysia.

Department of Environment (2016) Guidance Document on Implementation of Self-Regulation Initiative in Industrial Manufacturing Premises – Environmental Mainstreaming Tools

Department of Environment (2017) Guidelines on Land Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2)

Department of Environment (2017) Environmental Essentials for Siting of Industries in Malaysia.

Department of Irrigation and Drainage (2010) Guidelines for Erosion and Sediment Control in Malaysia.

Department of Irrigation and Drainage (August 2012) Urban Stormwater Management Manual for Malaysia 2nd Edition (MSMA-2)

Department of Town and Country Planning of Peninsular Malaysia (2016) National Physical Plan-3 (NPP-3).

Department of Town and Country Planning of Peninsular Malaysia (2012) National Physical Coastal Zone Plan (NPCZP).

Department of Town and Country Planning of Peninsular Malaysia (2017) Manual Penilaian Impak Sosial Bagi Projek Pembangunan Edisi Ke-2

Department of Town and Country Planning of Peninsular Malaysia (2012) National Physical Coastal Zone Plan (NPCZP)

Diego, L., Alison, M., Ju Lynne, S., Simon, G., Mike, B., Mike, W. (2014) , Risk assessment methodology for high-pressure CO_2 pipelines incorporating topography, Process Safety and Environmental Protection 9 2 p 27-35

Dr Zimwara et al (2012) Air pollution Control Techniques for Cement Manufacturing Industry: A Case Study for Zimbabwe CIE42 Proceedings 2012

Environmental Quality Act 1974 (Act 127)

Factories and Machinery Act 1974 (Act 139)

Fisheries Act 1985 (Act 317)

Jane Harley (2007) The impact of Cement Kilns on the Environment

Malaysian Investment Development Authority (Incorporation) Act 1965 (Act 397)

Malaysian Sewerage Industry Guidelines Vol 4: Sewage Treatment Plants.

Ministry of Health Malaysia (2009) National Standard for Drinking Water Quality

Ministry of Natural Resources and Environment (2016) National Policy on Biological Diversity 2016 – 2025.

Ministry of Science, Technology and Innovation (2002) National Policy on the Environment.

MS 1228:1991 Code of Practice For Design and Installation of Sewerage Systems

National Heritage Act 2005 (Act 645)

National Land Code 1965 (Act 56)

Nisa Zainudeen Cement and its effect to the environment: A case study in Sri Lanka

Occupational Safety and Health (Control of Industrial Major Accident Hazards) Regulations 1996

Occupational Safety and Health Act 1994 (Act 514)

Road Transport Act 1987 (Act 333)

Roman Jaques (1998) Environmental Impacts Associated with New Zealand Cement Manufacture

Solid Waste and Public Cleansing Management Act 2007 (Act 672)

Street, Drainage and Building Act 1974 (Act 133)

Town and Country Planning Act 1976 (Act 172)

United Nations Environment Programme (UNEP) (2002) EIA Training Resource Manual 2nd Edition

USEPA: Portland Cement Manufacturing

Wildlife Conservation Act 2010 (Act 716)

Wikipedia: Cement Industries
(https://en.wikipedia.org/wiki/Cement#Cement_industry_in_the_world)

GLOSSARY

GLOSSARY

Air Pollution Control Systems (APCS)	Equipment or machinery used in the capture and treatment of emissions from fuel burning equipment, incinerators and other types of engines to ensure it meets with the standards of the Malaysian Ambient Air Quality Standards (MAAQS).
Appointed Individuals (AIs)	Persons appointed to be part of the TRC with expertise and specialist knowledge on specific fields/subjects to contribute to the technical review of a report.
Approving Authority/ Agencies	Any government ministry, agencies or department with the authority to approve a project and/or activity under their jurisdiction by law.
Auditing	Evaluation process carried out by an independent auditor to determine effectiveness and performance of P2M2 and to ensure compliance of a project with the COA.
Baseline Data	Site specific data pertaining to the existing environment (physical, chemical, biological and human). It establishes the ambient situation, usually before some drastic change occurs, e.g. a major project.
Best Available Technology/ Techniques (BAT)	The most current and advanced technologies and methods available for pollution prevention and management.
Best Management Practices (BMPs)	Using the best controlling measures to prevent or mitigate pollution of other sources of environmental impact.
Bill of Quantities (BQ)	Itemized list of construction works and management requirements for a project issued to a contractor to quote.
Biological Diversity/ Biodiversity	The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.
Buffer Zone	An area designated around the boundary of a project and/or adjacent to environmentally sensitive areas where no or limited development is allowed for the purpose of mitigating against any environmental impact from the site to the surrounding areas or vice versa.
Catchment	The area determined by landform within which falling rain will contribute to runoff at a particular point such as a stream or river.

	Often, it is used synonymously with basin or watershed.
Central Forest Spine (CFS)	The backbone of Peninsular Malaysia's ESA network which comprises of four major forest complexes [i] Banjaran Titiwangsa-Banjaran Bintang-Banjaran Nakawan, [ii] Taman Negara-Banjaran Timur, [iii] South East Pahang, Chini and Bera Wetlands, and [iv] Endau Rompin Park-Kluang Wildlife Reserves.
Competent Person	A person with the necessary skills and knowledge to carry out the specific technical task, usually gained through certification, work experience or training.
Compliance Monitoring (CM)	Monitoring of P2M2 installed within the project site to ensure they are functional and effective in treating pollutants.
Conditions of Approval (COA)	A set of legally binding instructions and requirements prepared by DOE after the end of EIA process for the Project Proponent to abide by for all phases of the development.
Cumulative Impact	The total sum from combination of various activities or sources resulting in accumulation and aggregation of multiple impacts which would be significantly expanded as compared to a single event.
Cut and Fill	Procedure in which the elevation of a landform surface is modified by the removal or addition of surface material.
Development Order (DO)	A legal approval for a Project Proponent to proceed with the construction of a project once they have satisfied the requirements of the approving authority, i.e. One Stop Centre (OSC).
Digital Elevation Model (DEM)	Digital model or 3D representation of a terrain's surface created from terrain elevation data.
Disaster Risk Factor	The level of risk and susceptibility of an area towards natural or man-made disasters, such as tsunamis, wildfires, landslides, flood, drought, etc.
Disposal Area	A designated or gazette area specifically for the storage of wastes or excess materials generated from construction.
Drainage	Natural or artificial removal of surface and sub-surface water from an area.
Earthworks	Excavation and relocation of large quantities of soil and earth to form slopes, platforms, embankments, etc.
Ecology	The study of the habits and modes of life-living organisms (such as plants and animals), and their relationships to each other and their

	environment.
Ecosystem	A dynamic complex of plant, animal and microorganism communities and their non-living environment that interact as a functional unit.
EIA Adequacy Check	Initial review of the EIA by a technical committee comprising of DOE HQ/state officers to determine compliance with the TOR.
Emergency Response Plan (ERP)	A manual incorporating all measures, actions, roles and responsibilities for the project team to take action during emergencies and crisis, covers various scenarios that may occur during construction and operations.
Endemic Species	Native to, and restricted to, a particular geographical region. Highly endemic species, those with very restricted natural ranges, are especially vulnerable to extinction if their natural habitat is eliminated or significantly disturbed.
Environment	The area (specific zone to be affected by the project), and all natural resources (physical, biological and human resources), people, economic development and quality-of-life values.
Environmental Impact Assessment (EIA)	A study to identify, predict, evaluate and communicate information about the impacts (both beneficial and adverse) on the environment of a proposed development activity and to detail out the mitigating measures prior to project approval and implementation.
Environmental Management Plan (EMP)	A legally binding document which spells out in concise details the environmental requirements and P2M2 as detailed in the EIA and LD-P2M2 as well at other information, e.g. environmental budget, monitoring and audit programmes and roles and responsibilities of the EMT.
Environmental Management Team (EMT)	Specialist team comprising of relevant personnel of a project with specific roles and responsibilities in the management of environmental matters at-site.
Environmental Manager (EM)	A person mandated to oversee all aspects of managing environmental compliance for a project, usually heads the EMT.
Environmental Officer (EO)	The site personnel directly in charge of supervising a site to ensure that all P2M2 are in place, maintained and repaired and that all requirements within the COA are adhered by the contractors. Other tasks include training of staff, taking samples for reporting and attending site walkabouts and meetings.
Environmental	Organizational setup within the Project Proponent which shall

Performance Monitoring Committee (EPMC)	management environmental compliance at the working level during construction and operational phases of a project.
Environmental Pledge/Declaration	Statement by the Project Proponent and/or Qualified Person preparing the EIA that they have carried out the study in the proper manner and all facts and figures are to their knowledge true and correct and that they will carry out the recommendations and P2M2 for the project as described in the EIA.
Environmental Regulatory Compliance Monitoring Committee (RMCMC)	Organizational setup within the Project Proponent which shall management environmental compliance at the policy level during construction and operational phases of a project.
Environmental Quality Act 1974 (EQA)	The main legislation governing environmental management in Malaysia, contains provisions on setting up of an environmental management body; rules and regulations for specific activities within its jurisdiction; powers for enforcement and licensing; etc.
Environmental Scoping Information (ESI)	A report detailing the findings of the environmental scoping carried out for a site to allow for decision making through identification of significant impacts, proposals for mitigation measures and required studies. Forms and important part of the EIA process.
Environmental Scoping Matrix	Technique to integrated large amounts of information for a rapid assessment in identifying significant impacts based on project activities and their impacts on different aspects of the environment.
Environmentally Sensitive Areas (ESAs)	Areas of critical importance which has characteristics of significant biodiversity value; natural heritage; scenic beauty; provision of important ecosystem services; and/or is easily degraded due to natural and anthropogenic impacts, warranting its protection and conservation.
Erosion	The detachment or wearing away of the earth's surface, particularly soil or loose materials, by flowing water, wind or other geological agents.
Erosion and Sediment Control Plan (ESCP)	Document incorporating all erosion and sediment control measures as required by the Department of Irrigation and Drainage (DID) for a site. Usually prepared by a professional engineer (PE) to be endorsed by DID.

Gazette	The official publication of a government organization institution, or protected area.
Geological Terrain Mapping (GTM)	Report prepared by a licensed Geologist required by the Minerals and Geoscience Department (JMG) to be submitted for DO approval, contains information on the terrain, geological makeup, soils and slope classification to allow for assessment of site suitability for construction.
Geology	The science which has for its object the investigation of the earth's crust, of the strata which enter into its composition with their mutual relations, and of the successive changes to which their present condition and position are due.
Government Agencies (GAs)	Personal from government ministries, agencies and/or department with a role in specific committees, approving authorities or decision making bodies.
Guided Self-Regulation (GSR)	An initiative by DOE to cultivate environmental ownership and excellence in environmental commitment from the sectors regulated by DOE especially in regard to performance monitoring of pollution control measures, scheduled reporting, record keeping, competent persons and involvement of environmental professionals with specific roles.
Habitat	The normal abode or locality of an animal or plant; the physical environment of a community; the place where a person or thing can usually be found.
Health Impact Assessment (HIA)	A report which assesses the health impacts of policies, plans and project using quantitative, qualitative and participatory techniques for decision making. Usually required by the Ministry of Health (MOH) or Department of Health (DOH) for projects with health implications to nearby populations.
Hill/Highlands	Areas above elevations of 300 m from MSL characterized by undulating and mountainous hills and ridges.
Hill-Station	Town or village located in the low mountains or highland areas.
Hydrology	The study of the rainfall and runoff process and relates to the derivation of hydrographs for given floods, droughts and seasonal pattern of inundation.
Impact Monitoring (IM)	Monitoring of impacts outside of the project site to ascertain its origin and magnitude.
Industrial Effluent	Any waste in the form of liquid or wastewater generated from manufacturing process including the treatment of water for water supply or any activity occurring at any industrial premises

Industrial Effluent Treatment System (IETS)	Systems used in the treatment of industrial effluent to ensure that the discharges meet the quality specified under Standard A/B of the Environmental Quality (Industrial Effluent) Regulations 2009.
Land Acquisition/ Alienation	The act of obtaining, either voluntarily or by law, the necessary land from existing landowners. May involve relocation of existing population on the said piece of land.
Land-Disturbing Activities	Activities such as clearing of trees or vegetation, excavating, raising or sloping of ground, trenching, grading and blasting.
Land Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2)	Document incorporating construction methods, processes, materials and practices intended to prevent, reduce or eliminate the generation of pollutants at the source (development area) during any land-disturbing activity through the protection of natural resources through incorporation of BMPs.
Limit Value	Quantity of the substances expressed in terms of certain specific parameters, concentration, or levels which shall not be exceeded during normal operation.
Method Statement	A detailed scope and account of proposed construction techniques, equipment and machinery usage and structural and non-structural measures applied in carrying out construction, usually prepared by the contractors.
Mixed effluent	Any waste in the form of liquid or wastewater containing both industrial effluent and sewage
Modeling	To simulate a particular feature of the world using mathematical and computer aids to better understand, define, quantify and visualize the process.
Monitoring	To measure, systematically and repeatedly, the continuing conditions to track change(s).
Noise	A sound, especially one that is loud or unpleasant or that causes disturbance.
Orang Asli	Collective term for ethnic groups who are widely regarded as comprising Peninsular Malaysia's original inhabitants.
Performance Monitoring (PM)	Monitoring of performance systems, e.g. IETS, STS and APCS.

Permanent Reserved Forest (PRF)	The total area of forest land that has been legally designated for retention for forestry as defined under the Forestry Act 1985.
Personal Protective Equipment (PPE)	Equipment designed to safeguard a user against harm when working in risk and hazard areas.
Pollution Prevention and Mitigation Measures (P2M2)	The various methods (structural and non-structural) required to ensure that pollution does not occur or at least minimized as a result of a project.
Prescribed Activity	Any activity specified by the Director General of Environment under the Environmental Quality (Prescribed Activity) (Environmental Impact Assessment) Order 2015, as requiring to undergo an EIA.
Project Activities	Specific tasks undertaken throughout the course of a project (earthworks, construction or operational) which serves to meet certain objectives.
Project Brief	Information pertaining to a project or development, including the details of the project, layout, method statement, location, etc. which can assist in assessment of the project.
Project Proponent	The main person, organization or body which is proposing to undertake a project or activity. He/she shall bear responsibility to ensure that the project meets all environmental requirements mandated by DOE and other GAs or is liable to be held accountable under the law.
Public Display	Mandatory viewing of a Second Schedule EIA for a fixed period of time whereby the public can forward recommendations and objections to the report for consideration by DOE in the EIA approval process.
Public Participation/ Engagement	The process whereby the public and related stakeholders are allowed the opportunity to participate in the planning, decision making, objection, idea sharing and/or approval of a project which may affect them. Can be mandated or voluntary.
Qualified Person	A person appointed by the Director General of Environment or is certified by/registered with DOE under Section 34A (2B) to carry out an EIA study, e.g. Environmental Consultant.
Recreation	Activity of leisure, leisure being discretionary time.
Residual Impacts	Impacts that still persists despite P2M2 and BMPs put in place.

Revised TOR	Final version of the TOR after incorporation of comments from the TRC and additional information.
Right of Way (ROW)	A type of easement granted or reserved over the land for transportation purposes.
Riparian Area	Pertaining to the banks of streams, wetlands, lakes or tidewater. A relatively narrow strip of land that borders a stream or river, which often coincides with the maximum water surface elevation of the 100-year storm.
Risk	A combination of the likelihood of an occurrence of a hazardous event with specified period or in specified circumstances and the severity of injury or damage to the health of people, property, environment or any combination of these caused by the event.
Runoff	The portion of precipitation that runs off the surface as opposed to soaking in.
Sampling Station	Locations identified and designated for collection of Environmental data (air, water, noise, vibration, ecology, etc.). Schedule Categorization of Prescribed Activities divided into the First Schedule (EIA without need for public display and will be processed by DOE State) and Second Schedule (EIA requiring public display and will be processed by DOE HQ).
Schedule	Categorization of Prescribed Activities divided into the First Schedule (EIA without need for public display and will be processed by DOE State) and Second Schedule (EIA requiring public display and will be processed by DOE HQ).
Scheduled Wastes	Any form of toxic and hazardous wastes listed under the First Schedule of the Environmental Quality (Scheduled Wastes) Regulations 2005 (Amendment 2007).
Scoping	Initial phase in an EIA to identify the key environmental issues and the study spatial and temporal boundaries. The scoping will identify the required investigations and assessment of significant impacts during the subsequent phases of the EIA process.
Screening	Process by which a proposed development project is identified as being subjected to a regulatory provision requiring an EIA.
Sedimentation	The deposition of sediment from suspension in water.
Seismicity	The occurrence or frequency of ground vibrations or earthquakes in a region.

Self-regulation	The adoption and implementation of measures and practices by a Project Proponent on their own initiative without requiring intervention of the authorities to safeguard the environment and meet all regulatory requirements of the country.
Setback	Distance which a building or other structure is set back from a street or road a river, a shore or any other place which is deemed to need protection.
Sewage	Any liquid waste or wastewater discharge containing human, animal, domestic or putrescible matter in suspension or solution, and includes liquids containing chemicals in solution either in the raw, treated or partially treated form.
Sewage Treatment System (STS)/ Plant (STP)	Any facility designed and constructed for the purpose of reducing the potential of the sewage to cause pollution.
Siltation	The deposition or accumulation of silt that is suspended in a body of water.
Site Suitability Assessment (SSA)	A study on the suitability of various sites and the determination based on specific criteria on the best possible site for a project.
Slope	A ratio of run (horizontal) to rise (vertical).
Social Impact Assessment (SIA)	A process to identify, predict, evaluate and communicate information about the social impacts of a proposed project, policy, programme or plan on a community and their activities, and to choose the best development option and subsequently propose mitigation measures.
Soil Investigation (SI)	Technical study on the soil and sub-surface strata of a project site to determine the sub-surface conditions and engineering requirements needed prior to a development.
Spoil	Rock and debris produced by tunneling, dredging and other excavations.
Statement of Need	A brief on the justifications for a project, including supporting arguments and evidence on the necessity of the project and benefits that will be generated.
Stormwater	Water that originates during precipitation events e.g. rainfall.
Suspended Sediment	Sediment suspended in a fluid by its (fluid) turbulent flow.
Technical Review Committee (TRC)	A panel of decision makers comprising DOE officers, AIs and GAs that are selected to review the TOR and/or EIA to provide approval based on the reports submitted by the Project Proponent and Qualified Person(s).

Terms of Reference (TOR)	Product from scoping process which sets the objectives, defines the scope, and establishes the strategy and schedule for EIA process to address identified significant issues.
Terrain	Pertaining to the physical features of a land or area.
Threshold Value	Minimum capacity of a facility or process
Topography	The configuration of the surface of the earth, including its relief, the position of its streams, roads, cities, etc. The earth's natural and physical features collectively.
TOR Adequacy Check (TORAC)	A review by a selected panel of DOE officers, IAs and/or GAs on whether a TOR has been prepared in accordance with DOE requirements and contains all necessary information for decision making to be made.
Tourism	Activity of traveling to a place for pleasure and/or the business of providing hotels, restaurants, entertainment, etc. to cater to the needs of travelers.
Traffic Impact Assessment (TIA)	A study/report on the condition of the roads and traffic in an area and if there is adequate capacity to meet the increasing demand from a project or to identify measures required to ensure that traffic will be smooth and uninterrupted.
Visual/Aesthetics	Pleasing scenery, vistas and view to an audience.
Wastes	Any substance which is discarded after primary us. Comprises of various types of wastes, such as municipal wastes, scheduled wastes, biomass wastes, etc.
Water Quality	A term to describe the chemical, physical and biological characteristics of water, usually with respect to its suitability for a particular purpose.
Water Quality Index (WQI)	An index integrating six water quality parameters to provide a general categorization to determine the condition of the water source.
Zone of Impact (ZOI)	The maximum area which will receive the impacts from the project.
Zone of Study (ZOS)	Boundary identified for the EIA Study which would be the main spatial area to carry out baseline data gathering, determine extent of modelling and assessment and other supporting studies.

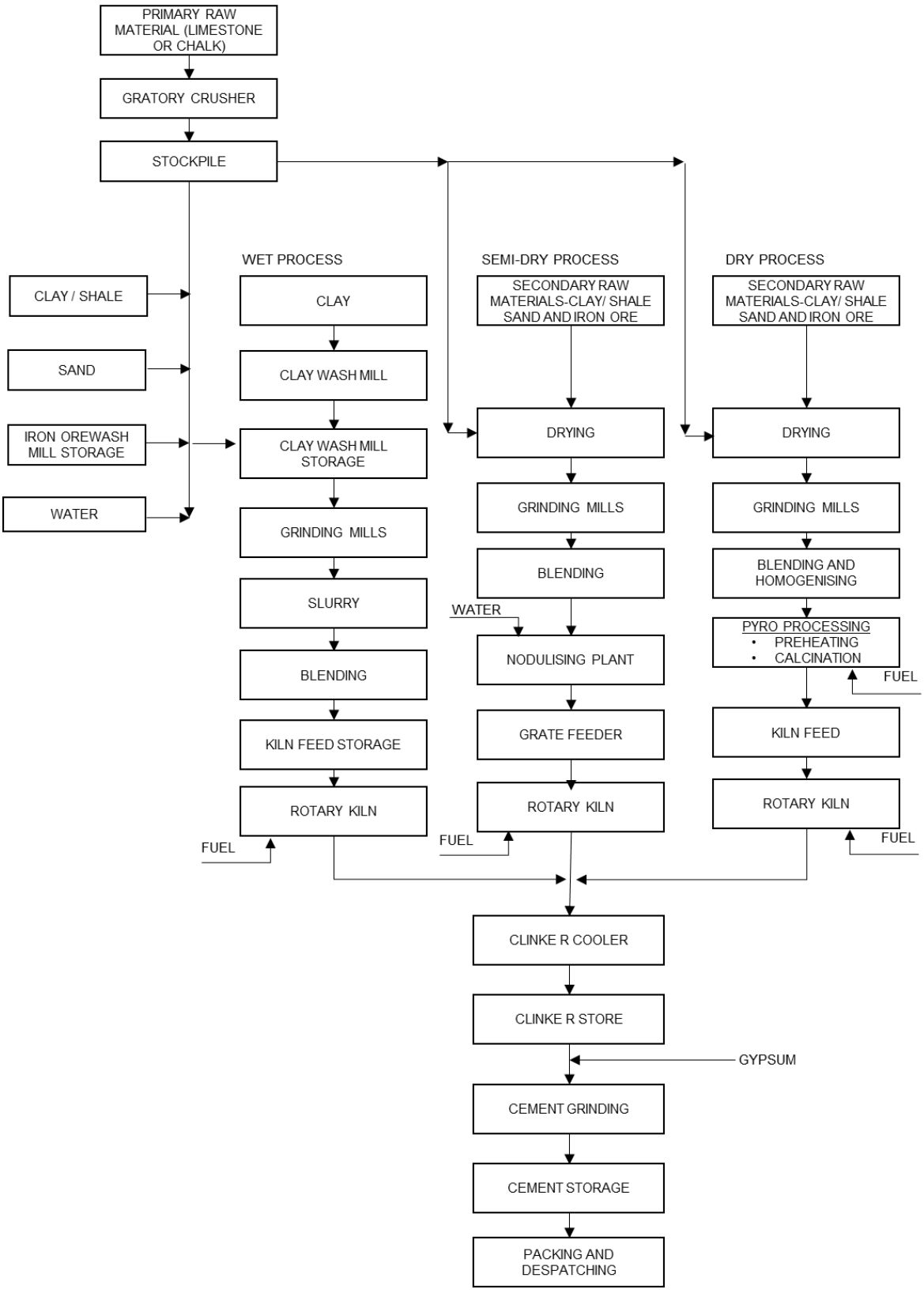
APPENDICES

APPENDIX A

SAMPLE OF PROCESS FLOW DIAGRAM (PFD)

APPENDIX A

SAMPLE OF PROCESS FLOW DIAGRAM (PFD)



APPENDIX B

LIST OF GUIDELINES AND GUIDANCE DOCUMENTS

APPENDIX B

LIST OF GUIDELINES AND GUIDANCE DOCUMENTS

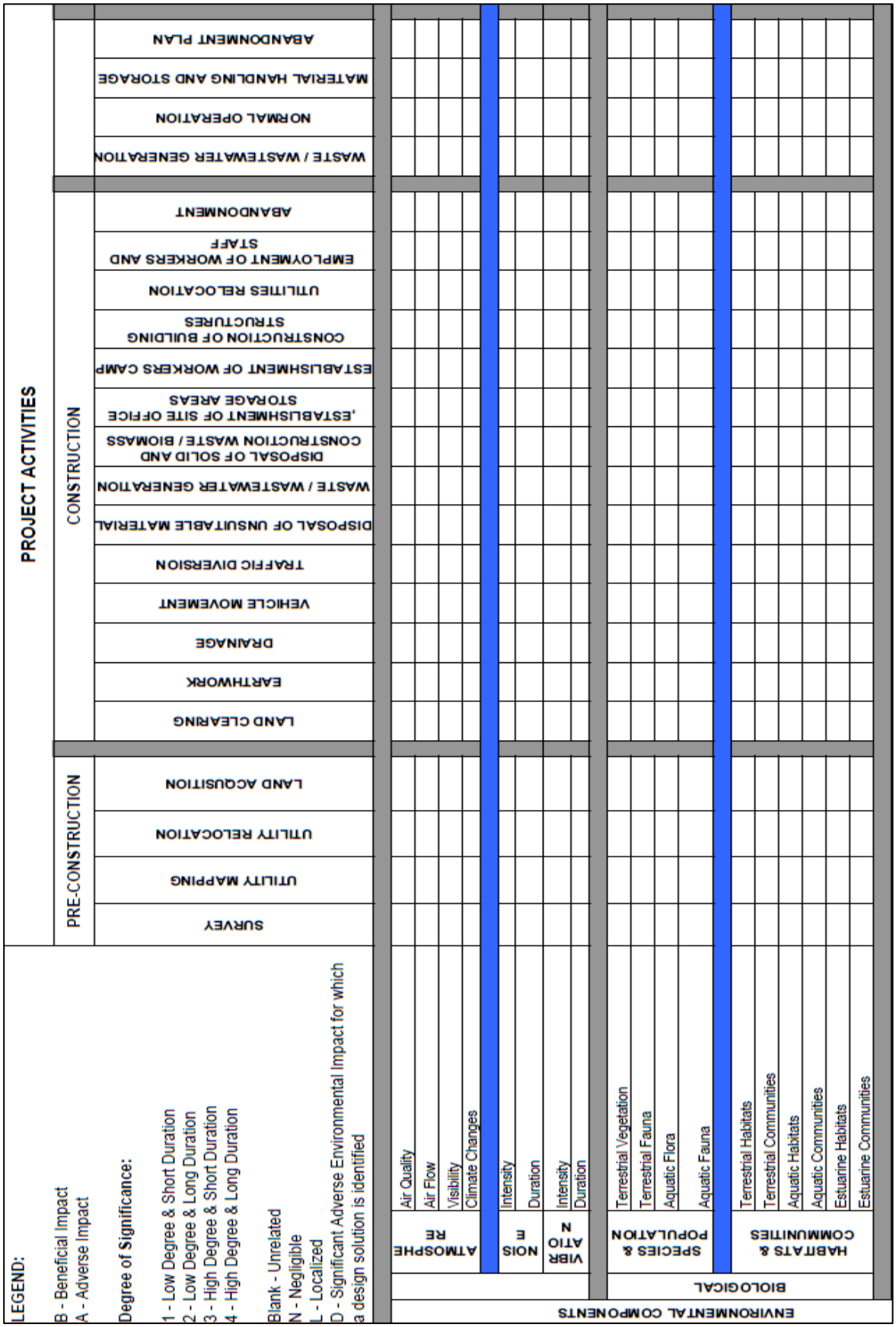
No	Title of Guidelines and Guidance Documents	Source
1.	Best Available Techniques Guidance Document on Productions of Petrochemicals	www.doe.gov.my
2.	Contaminated Land Management and Control Guidelines No. 1: Malaysian Recommended Site Screening Levels for Contaminated Land, 2015	www.doe.gov.my
3.	Contaminated Land Management and Control Guidelines No. 2: Malaysian Recommended Site Screening Levels for Contaminated Land, 2015	www.doe.gov.my
4.	Contaminated Land Management and Control Guidelines No. 3: Malaysian Recommended Site Screening Levels for Contaminated Land, 2015	www.doe.gov.my
5.	Environmental Essentials for Siting of Industries in Malaysia, 2017	www.doe.gov.my
6.	Environmental Impact Assessment Guidance in Malaysia, 2016	www.doe.gov.my
7.	Environmental Impact Assessment Guidelines for Risk Assessment, 2004	DOE Office
8.	Guidance Document of Health Impact Assessment (HIA) in Environmental Impact Assessment (EIA), 2012	DOE Office
9.	Guidance Document on Implementation of Self-Regulation Initiative in Industrial Manufacturing Premises – Environmental Mainstreaming Tools, 2016	www.doe.gov.my
10.	Guidelines on Land Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2), 2017	www.doe.gov.my
11.	Technical Guidance Document for on the Design and Operation of Industrial Effluent Treatment System (DOE-IETS-9 Sixth Edition 2015)	www.doe.gov.my/ DOE Office
12.	Technical Guidance Document on Performance Monitoring of Industrial Effluent Treatment Systems (DOE-IETS-1 Seventh Edition 2015)	www.doe.gov.my/ DOE Office
13.	Technical Guidance on Performance Monitoring of Air Pollution Control Systems (DOE-APCS-5 First Edition 2006)	www.doe.gov.my/ DOE Office
14.	Guidelines for Environmental Noise Limits and Control (Third Edition, 2019)	www.doe.gov.my/
15.	The Planning Guidelines for Vibration Limits and Control 2007	www.doe.gov.my/
16.	Guidelines For Siting And Zoning Of Industry And Residential Areas (2012)	www.doe.gov.my/

APPENDIX C

SAMPLE OF ENVIRONMENTAL IMPACTS ASSESSMENT SCOPING MATRIX

APPENDIX C

SAMPLE OF ENVIRONMENTAL IMPACTS ASSESSMENT SCOPING MATRIX



LEGEND:

B - Beneficial Impact
A - Adverse Impact

Degree of Significance:

1 - Low Degree & Short Duration
2 - Low Degree & Long Duration
3 - High Degree & Short Duration
4 - High Degree & Long Duration

Blank - Unrelated
N - Negligible
L - Localized
D - Significant Adverse Environmental Impact for which a design solution is identified

		PROJECT ACTIVITIES																					
		PRE-CONSTRUCTION				CONSTRUCTION																	
		SURVEY	UTILITY MAPPING	UTILITY RELOCATION	LAND ACQUSITION	LAND CLEARING	EARTHWORK	DRAINAGE	VEHICLE MOVEMENT	TRAFFIC DIVERSION	DISPOSAL OF UNSUITABLE MATERIAL	WASTE / WASTEWATER GENERATION	DISPOSAL OF SOLID AND CONSTRUCTION WASTE / BIOMASS	,ESTABLISHMENT OF SITE OFFICE STORAGE AREAS	ESTABLISHMENT OF WORKERS CAMP	CONSTRUCTION OF BUILDING STRUCTURES	UTILITIES RELOCATION	EMPLOYMENT OF WORKERS AND STAFF	ABANDONMENT	WASTE / WASTEWATER GENERATION	NORMAL OPERATION	MATERIAL HANDLING AND STORAGE	ABANDONMENT PLAN
	Surrounding Population																						
	Employees																						
	Parasitic Disease																						
	Communicable Disease																						
	Physiological Disease																						
SOCIAL & ECONOMIC	Employment																						
	Housing																						
	Education																						
	Utilities																						
	Amenities																						
	Property & Settlement																						
AESTHETIC & CULTURAL	Landforms																						
	Biota																						
	Wilderness																						
	Water Quality																						
	Atmospheric Quality																						
	Climate																						
	Tranquility																						
	Sense of Community																						
	Community Structure																						
	Man Made Objects																						

LEGEND:

B - Beneficial Impact
A - Adverse Impact

Degree of Significance:

1 - Low Degree & Short Duration
2 - Low Degree & Long Duration
3 - High Degree & Short Duration
4 - High Degree & Long Duration

Blank - Unrelated
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L - Localized
D - Significant Adverse Environmental Impact for which a design solution is identified

	PROJECT ACTIVITIES																					
	PRE-CONSTRUCTION				CONSTRUCTION																	
	SURVEY	UTILITY MAPPING	UTILITY RELOCATION	LAND ACQUSITION	LAND CLEARING	EARTHWORK	DRAINAGE	VEHICLE MOVEMENT	TRAFFIC DIVERSION	DISPOSAL OF UNSUITABLE MATERIAL	WASTE / WASTEWATER GENERATION	DISPOSAL OF SOLID AND CONSTRUCTION WASTE / BIOMASS	,ESTABLISHMENT OF SITE OFFICE STORAGE AREAS	ESTABLISHMENT OF WORKERS CAMP	CONSTRUCTION OF BUILDING STRUCTURES	UTILITIES RELOCATION	EMPLOYMENT OF WORKERS AND STAFF	ABANDONMENT	WASTE / WASTEWATER GENERATION	NORMAL OPERATION	MATERIAL HANDLING AND STORAGE	ABANDONMENT PLAN
Historic Places or Structure																						
Religious Places or Structure																						
Landscape																						

APPENDIX D

MALAYSIA AMBIENT AIR QUALITY STANDARD

APPENDIX D

MALAYSIA AMBIENT AIR QUALITY STANDARD

Pollutants	Averaging Time	Ambient Air Quality Standard (μg/m^3)		
		IT-1 (2015)	IT-2 (2018)	IT-3 (2020)
Particulate matter with the size less than 10 micron (PM_{10})	1 year	50	45	40
	24 hour	150	120	100
Particulate matter with the size less than 2.5 micron ($PM_{2.5}$)	1 year	35	25	15
	24 hour	75	50	35
Sulphur Dioxide (SO_2)	1 year	350	300	250
	24 hour	105	90	80
Nitrogen Dioxide (NO_2)	1 year	320	300	280
	24 hour	75	75	70
Ground level ozone (O_3)	1 hour	200	200	180
	8 hour	120	120	100
*Carbon Monoxide (CO)	1 hour	35	35	30
	8 hour	10	10	10

Note:

*measurement in mg/m^3

There are 3 interim targets set which include interim target 1 (IT-1) in 2015, interim target 2 (IT-2) in 2018 and the full implementation of the standard in 2020. All projects should strive to achieve the interim target 3.

APPENDIX E

MALAYSIA NATIONAL WATER QUALITY STANDARD

APPENDIX E

MALAYSIA NATIONAL WATER QUALITY STANDARD

Parameter	Unit	River Class					
		I	IIA	IIB	III	IV	V
Ammoniacal Nitrogen	mg/L	0.1	0.3	0.3	0.9	2.7	>2.7
Biochemical Oxygen Demand	mg/L	1	3	3	6	12	>12
Chemical Oxygen Demand	mg/L	10	25	25	50	100	>100
Dissolved Oxygen	mg/L	7	5 – 7	5 – 7	3 – 5	<3	<1
pH	-	6.5 – 8.5	6 – 9	6 – 9	5 – 9	5 – 9	-
Colour	TCU	15	150	150	-	-	-
Electrical Conductivity*	µS/cm	1,000	1,000	-	-	6,000	-
Floatables	-	N	N	N	-	-	-
Odour	-	N	N	N	-	-	-
Salinity	%	0.5	1	-	-	2	-
Taste	-	N	N	N	-	-	-
Total Dissolved Solid	mg/L	500	1,000	-	-	4,000	-
Total Suspended Solid	mg/L	25	50	50	150	300	300
Temperature	°C	-	Normal + 2°C	-	Normal + 2°C	-	-
Turbidity	NTU	5	50	50	-	-	-
Faecal Coliform**	Count/ 100 ml	10	100	400	5,000 (20,000)[a]	5,000 (20,000)[a]	-
Total Coliform	Count/ 100 ml	100	5,000	5,000	50,000	50,000	>50,000

Notes:

N = No visible floatable materials or debris, no objectional odour or no objectional taste
* = Related parameters, only one recommended for use
** = Geometric mean
a = Maximum not to be exceeded

Parameter	Unit	Class				
		I	IIA/IIB	III#	IV	V
Al	mg/L	Natura Levels or Absent	-	(0.06)	0.5	Levels above IV
As	mg/L		0.05	0.4 (0.05)	0.1	
Ba	mg/L		1	-	-	
Cd	mg/L		0.01	0.01* (0.001)	0.01	
Cr(IV)	mg/L		0.05	1.4 (0.05)	0.1	
Cr(III)	mg/L		-	2.5	-	
Cu	mg/L		0.02	-	0.2	
Hardness	mg/L		250	-	-	
Ca	mg/L		-	-	-	
Mg	mg/L		-	-	-	
Na	mg/L		-	-	3 SAR	
K	mg/L		-	-	-	
Fe	mg/L		1	1	1 (Leaf) 5 (Others)	
Pb	mg/L		0.05	0.02* (0.01)	5	
Mn	mg/L		0.1	0.1	0.2	
Hg	mg/L		0.001	0.004 (0.0001)	0.002	
Ni	mg/L		0.05	0.9*	0.2	
Se	mg/L		0.01	0.25 (0.04)	0.02	
Ag	mg/L		0.05	0.0002	-	
Sn	mg/L		-	0.004	-	
U	mg/L		-	-	-	
Zn	mg/L		5	0.4*	2	
B	mg/L		1	(3.4)	0.8	
Cl	mg/L		200	-	80	
Cl_2	mg/L		-	(0.02)	-	
CN	mg/L		0.02	0.06 (0.02)	-	
F	mg/L		1.5	10	1	
NO^2	mg/L		0.4	0.4 (0.03)	-	
NO^3	mg/L		7	-	5	
P	mg/L		0.2	0.1	-	
Silica	mg/L		50	-	-	
SO^4	mg/L		250	-	-	
S	mg/L		0.05	(0.001)	-	
CO^2	mg/L		-	-	-	
Gross-α	Bq/L		0.1	-	-	
Gross-β	Bq/L		1	-	-	
Ra-226	Bq/L		<0.1	-	-	
Sr-90	Bq/L		<1	-	-	
CCE	µg/L		500	-	-	
MBAS/ BAS	µg/L		500	5000 (200)	-	
O& G (Mineral)	µg/L		40: N	N	-	
O & G (Emulsified Edible)	µg/L		7000: N	N	-	
PCB	µg/L		0.1	6 (0.05)	-	
Phenol	µg/L		10	-	-	-
Aldrin/ Dieldrin	µg/L		0.02	0.2 (0.01)	-	-
BHC	µg/L		2	9(0.1)	-	-

Parameter	Unit	Class				
		I	IIA/IIB	III#	IV	V
Chlordane	µg/L		0.08	2 (0.02)	-	-
t-DDT	µg/L		0.1	(1)	-	-
Endosulfan	µg/L		10	-	-	-
Heptachlor/ Epoxide	µg/L		0.05	0.9 (0.06)	-	-
Lindane	µg/L		2	3 (0.4)	-	-
2,4-D	µg/L		70	450	-	-
2,4,5-T	µg/L		10	160	-	-
2,4,5-TP	µg/L		4	850	-	-
Paraquat	µg/L		10	1800	-	-

Notes: * = At hardness 50 mg/L $CaCO_3$.
# = Maximum (unbracketed) and 24-hour average (bracketed) concentrations.
N = Free from visible film sheen, discolouration and deposits.

Water Classes and Uses

CLASS	USES
Class I	• Conservation of natural environment • Water supply I – Practically no treatment necessary • Fishery I- very sensitive aquatic species
Class IIA	• Water Supply II – Conventional treatment required • Fishery II – Sensitive aquatic species
Class IIB	• Recreational use with body contact
Class III	• Water Supply III – Extensive treatment required • Fishery III – Common, of economic value and tolerant species, • livestock drinking
Class IV	• Irrigation
Class V	• None of the above

National Groundwater Quality Standard for Industry

PARAMETER	THRESHOLD (mg/L)
Alkalinity	300
COD	30
Chloride	100
Fe	0.3
Mn	0.2
pH	6.5 – 8.0
Silica	20.0
Sulphate	200
TDS/ Cond (mS/m)	450/70
SS	5
Total Hardness	250

Source: Malaysia Index and Standard for Groundwater Quality (DOE, 2019)

NATIONAL DRINKING WATER QUALITY STANDARD

Recommended Raw Water Quality Criteria and Frequency of Monitoring

Group	Parameters	Column I	Column II			Column III
		Acceptable Value (mg/L unless otherwise stated)	Frequency to be monitored			Source of reference
			Surface	Ground	Direct impounding	
1	Total coliform	5,000 MPN/100 ml or cfu/100 ml	W	M	M	WHO1
	Turbidity	1,000 NTU	W	M	M	WHO2
	Colour	300 TCU	W	M	M	WHO1
	pH	5.5 - 9.0	W	M	M	MAL
2	Total dissolved solids	1,500	M	Y/4	Y/4	WHO1
	BOD	6	M	Y/4	Y/4	WHO1
	COD	10	M	Y/4	Y/4	WHO1
	Chloride	250	M	Y/4	Y/4	MAL
	Anionic detergent MBAS	1.0	M	Y/4	Y/4	WHO1
	Ammonia (As N)	1.5	M	Y/4	Y/4	WHO1
	Nitrate (As N)	10	M	Y/4	Y/4	MAL
	Iron (As Fe)	1.0	M	Y/4	Y/4	MAL
	Fluoride	1.5	M	Y/4	Y/4	WHO1
	Hardness	500	M	Y/4	Y/4	MAL
	Manganese	0.2	M	Y/4	Y/4	WHO1
3	Mercury	0.001	Y/4	Y/4	Y/4	MAL
	Cadmium	0.003	Y/4	Y/4	Y/4	MAL
	Selenium	0.01	Y/4	Y/4	Y/4	WHO1
	Arsenic	0.01	Y/4	Y/4	Y/4	MAL
	Cyanide	0.07	Y/4	Y/4	Y/4	MAL
	Lead	0.05	Y/4	Y/4	Y/4	MAL
	Chromium	0.05	Y/4	Y/4	Y/4	WHO1
	Silver	0.05	Y/4	Y/4	Y/4	MAL
	Copper	1.0	Y/4	Y/4	Y/4	MAL
	Magnesium	150	Y/4	Y/4	Y/4	MAL
	Sodium	200	Y/4	Y/4	Y/4	MAL

Group	Parameters	Column I	Column II			Column III
		Acceptable Value (mg/L unless otherwise stated)	Frequency to be monitored			Source of reference
			Surface	Ground	Direct impounding	
	Zinc	3	Y/4	Y/4	Y/4	MAL
	Sulphate	250	Y/4	Y/4	Y/4	MAL
	Mineral oil	0.3	Y/4	Y/4	Y/4	MAL
	Phenol	0.002	Y/4	Y/4	Y/4	WHO1
4	Aldrin/ Dieldrin	0.00003	Y/4	Y/4	Y/4	MAL
	DDT	0.002	Y/4	Y/4	Y/4	MAL
	Heptachlor & Heptachlor epoxide	0.00003	Y/4	Y/4	Y/4	MAL
	Methoxychlor	0.02	Y/4	Y/4	Y/4	MAL
	Hexachlorobenzene	0.001	Y/4	Y/4	Y/4	MAL
	Lindane	0.002	Y/4	Y/4	Y/4	MAL
	Chlordane	0.0002	Y/4	Y/4	Y/4	MAL
	2,4-D (Dichlorophenoxyacetic acid)	0.03	WN	Y/4	Y/4	MAL
5	Gross α	0.1Bq/L	WN	WN	WN	MAL
	Gross β	1.0Bq/L	WN	WN	WN	MAL

Note:
Collection of samples of both raw and treated water for examination for toxic substances should be carried out more frequently if values above the acceptable values are known to be present in the source of supply, or where such potential pollution exists.

W : Indicates parameters to be monitored at least once a week
M : Indicates parameters to be monitored at least once a month
Y/4 : Indicates parameters to be monitored at least once in 3 months
Y : Indicates parameters to be monitored at least once a year
WHO1 : Refers to WHO International Standards for Drinking Water 1963
WHO2 : Refers to WHO Guidelines for Drinking Water Quality Vol. 1 & 2 1984
MAL : Refers to values adapted for Malaysian conditions

Source: Engineering Service Division, Ministry of Health

Drinking Water Quality Standards and Frequency of Monitoring

Group	Parameters	Column I	Column II				Column III
		Acceptable Value (mg/L unless otherwise stated)	Frequency to be monitored				Source of reference
			Water treatment plant outlet	Service reservoir outlet	Distribution system	Well/ spring	
1	Microbiological:						
	Total Coliform	MPN method/membrane filtration method: Must not be detected at any 100 ml sample	W	W	M	2Y	MAL
	E. Coli or Thermotolerant Coliform bacteria	Absent in 100 ml sample	W	W	M	2Y	WHO2
	Faecal Streptococci	Membrane filter method: Absent in 100 ml sample MPN Method: <1 in 100 ml sample	WN	WN	WN	WN	EEC
	Clostridium perfringens	Absent	WN	WN	WN	WN	MAK 1990
	Viruses	Absent in 100 ml	WN	WN	WN	WN	NZ
	Protozoa	Absent in 100 ml	WN	WN	WN	WN	NZ
	Helminths	Absent in 100 ml	WN	WN	WN	WN	NZ
	Physical:						
	Turbidity	5 NTU	W	W	M	2Y	WHO2
	Colour	15 TCU	W	W	M	2Y	WHO2
	pH	6.5 – 9.0	W	W	M	2Y	MAL
	Free residual chlorine	0.2 – 5.0	W	W	M	2Y	WHO1
	Combined residual chlorine	Not less than 1.0	W	W	M	2Y	MAL 1990
	Monochloramine	3	WN	WN	WN	WN	WHO2
2	Inorganic:						

Group	Parameters	Column I	Column II				Column III
		Acceptable Value (mg/L unless otherwise stated)	Frequency to be monitored				Source of reference
			Water treatment plant outlet	Service reservoir outlet	Distribution system	Well/ spring	
	Total dissolved solids	1000	M	M	Y/2	2Y	WHO2
	Chloride	250	M	M	Y/2	2Y	WHO2
	Ammonia (As N)	1.5	M	M	Y/2	2Y	WHO2
	Nitrate (As N)	10	M	M	Y/2	2Y	WHO1
	Iron	0.3	M	M	Y/2	2Y	WHO2
	Fluoride	0.4 – 0.6	M	M	Y/2	2Y	MAL
	Hardness	500	M	M	Y/2	2Y	WHO1
	Aluminium	0.2	M	M	Y/2	2Y	WHO2
	Manganese	0.1	M	M	Y/2	2Y	WHO2
3	Mercury (Total)	0.001	Y/4	Y/2	Y	2Y	WHO2
	Cadmium	0.003	Y/4	Y/2	Y	2Y	WHO2
	Arsenic	0.01	Y/4	Y/2	Y	2Y	WHO2
	Cyanide	0.07	Y/4	Y/2	Y	2Y	WHO2
	Lead	0.01	Y/4	Y/2	Y	2Y	WHO2
	Chromium	0.05	Y/4	Y/2	Y	2Y	WHO2
	Copper	1	Y/4	Y/2	Y	2Y	WHO1
	Zinc	3	Y/4	Y/2	Y	2Y	WHO2
	Sodium	200	Y/4	Y/2	Y	2Y	WHO2
	Sulphate	250	Y/4	Y/2	Y	2Y	WHO2
	Trihalomethane: The sum of the ratio of the concentration to each of guideline value should not exceed 1.						
	Chloroform	0.2	Y/4	Y/2	Y	2Y	WHO3
	Bromoform	0.1	Y/4	Y/2	Y	2Y	WHO2

Group	Parameters	Column I	Column II				Column III
		Acceptable Value (mg/L unless otherwise stated)	Frequency to be monitored				Source of reference
			Water treatment plant outlet	Service reservoir outlet	Distribution system	Well/ spring	
	Dibromochloromethane	0.1	Y/4	Y/2	Y	2Y	WHO2
	Bromodichloromethane	0.06	Y/4	Y/2	Y	2Y	WHO2
	Selenium	0.01	Y/4	WN	WN	WN	WHO2
	Silver	0.05	Y/4	WN	WN	WN	MAL 1990
	Magnesium	150	Y/4	WN	WN	WN	MAL 1990
	Antimony	0.005	WN	WN	WN	WN	WHO2
	Barium	0.7	WN	WN	WN	WN	WHO2
	Boron	0.5	WN	WN	WN	WN	WHO3
	Molybdenum	0.07	WN	WN	WN	WN	WHO2
	Nickel	0.02	WN	WN	WN	WN	WHO2
	Uranium	0.002	WN	WN	WN	WN	WHO3
	Hydrogen sulfide	0.05	WN	WN	WN	WN	WHO2
	Mineral oil	0.3	WN	WN	WN	WN	MAL 1990
	Phenol	0.002	WN	WN	WN	WN	WHO1
	Bromate	0.025	WN	WN	WN	WN	WHO2
	Chlorite	0.2	WN	WN	WN	WN	WHO2
	2-Chlorophenol	0.0001	WN	WN	WN	WN	WHO2
	2,4-Dichlorophenol	0.0003	WN	WN	WN	WN	WHO2
	2,4,6-Trichlorophenol	0.2	WN	WN	WN	WN	WHO2
	Formaldehyde	0.9	WN	WN	WN	WN	WHO2
	Dichloroacetic Acid	0.05	WN	WN	WN	WN	WHO2
	Trichloroacetic Acid	0.1	WN	WN	WN	WN	WHO2
	Chloral Hydrate (Trichloroacetaldehyde)	0.01	WN	WN	WN	WN	WHO2
	Dichloroaceto-nitrile	0.09	WN	WN	WN	WN	WHO2
	Dibromoaceto-nitrile	0.1	WN	WN	WN	WN	WHO2
	Trichloroaceto-nitrile	0.001	WN	WN	WN	WN	WHO2

Group	Parameters	Column I	Column II				Column III
		Acceptable Value (mg/L unless otherwise stated)	Frequency to be monitored				Source of reference
			Water treatment plant outlet	Service reservoir outlet	Distribution system	Well/ spring	
	Cyanogen Chloride (As CN)	0.07	WN	WN	WN	WN	WHO2
4	Aldrin/Dieldrin	0.00003	Y/4	WN	WN	WN	WHO2
	DDT	0.002	Y/4	WN	WN	WN	WHO2
	Heptachlor& Heptachlor Epoxide	0.00003	Y/4	WN	WN	WN	WHO2
	Methoxychlor	0.02	Y/4	WN	WN	WN	WHO2
	Lindane (BHC)	0.002	Y/4	WN	WN	WN	WHO2
	Endosulfan	0.03	Y/4	WN	WN	WN	AUS
	Chlordane	0.0002	WN	WN	WN	WN	WHO2
	1,2-Dichloropropane	0.04	WN	WN	WN	WN	WHO3
	1,3-Dichloroporpene	0.02	WN	WN	WN	WN	WHO2
	Hexachlorobenzene	0.001	WN	WN	WN	WN	WHO2
	Pentachlorophenol	0.009	WN	WN	WN	WN	WHO3
	Alachlor	0.02	WN	WN	WN	WN	WHO2
	Aldicarb	0.01	WN	WN	WN	WN	WHO2
	Ametryn	0.05	WN	WN	WN	WN	AUS
	Atrazine	0.002	WN	WN	WN	WN	WHO2
	Bentazone	0.3	WN	WN	WN	WN	WHO3
	Carbofuran	0.007	WN	WN	WN	WN	WHO3
	Chlorotoluron	0.03	WN	WN	WN	WN	WHO2
	Cyanazine	0.0006	WN	WN	WN	WN	WHO3
	2,4-Dichlorophenoxyacetic acid (2,4D)	0.03	WN	WN	WN	WN	WHO3
	Diquat	0.01	WN	WN	WN	WN	WHO3
	1,2-Dibromo-3-chloropropane	0.001	WN	WN	WN	WN	WHO2
	1,2-Dibromoethane	0.0004	WN	WN	WN	WN	WHO3
	Isoproturon	0.009	WN	WN	WN	WN	WHO2
	MCPA	0.002	WN	WN	WN	WN	WHO2

Group	Parameters	Column I	Column II				Column III
			Frequency to be monitored				
		Acceptable Value (mg/L unless otherwise stated)	Water treatment plant outlet	Service reservoir outlet	Distribution system	Well/ spring	Source of reference
	Metolachlor	0.01	WN	WN	WN	WN	WHO2
	Molinate	0.006	WN	WN	WN	WN	WHO2
	Pendimethalin	0.02	WN	WN	WN	WN	WHO2
	Permethrin	0.02	WN	WN	WN	WN	WHO2
	Propanil	0.02	WN	WN	WN	WN	WHO2
	Pyridate	0.1	WN	WN	WN	WN	WHO2
	Simazine	0.002	WN	WN	WN	WN	WHO2
	Trifuralin	0.02	WN	WN	WN	WN	WHO2
	2,4 DB	0.09	WN	WN	WN	WN	WHO2
	Dichlorprop	0.1	WN	WN	WN	WN	WHO2
	Fenoprop	0.009	WN	WN	WN	WN	WHO2
	Mecoprop	0.01	WN	WN	WN	WN	WHO2
	2,4,5-T	0.009	WN	WN	WN	WN	WHO2
	Terbuthylazine	0.007	WN	WN	WN	WN	WHO3
	Organic substances:						
	Carbon tetrachloride	0.002	WN	WN	WN	WN	WHO2
	Dichloromethane	0.02	WN	WN	WN	WN	WHO2
	1,2-Dichloroethane	0.03	WN	WN	WN	WN	WHO2
	1,1,1-Trichloroethane	2	WN	WN	WN	WN	WHO2
	Vinyl chloride	0.005	WN	WN	WN	WN	WHO2
	1,1-Dichloroethene	0.03	WN	WN	WN	WN	WHO2
	1,2-Dichloroethene	0.05	WN	WN	WN	WN	WHO2
	Trichloroethene	0.07	WN	WN	WN	WN	WHO2
	Tetrachloroethene	0.04	WN	WN	WN	WN	WHO2
	Benzene	0.01	WN	WN	WN	WN	WHO2
	Toulene	0.7	WN	WN	WN	WN	WHO2
	Xylene	0.5	WN	WN	WN	WN	WHO2
	Ethylbenzene	0.3	WN	WN	WN	WN	WHO2

Group	Parameters	Column I	Column II				Column III
			Frequency to be monitored				
		Acceptable Value (mg/L unless otherwise stated)	Water treatment plant outlet	Service reservoir outlet	Distribution system	Well/ spring	Source of reference
	Styrene	0.02	WN	WN	WN	WN	WHO2
	Benzo (A) Pyrene	0.0007	WN	WN	WN	WN	WHO2
	Monochlorobenzene	0.3	WN	WN	WN	WN	WHO2
	1,2-Dichlorobenzene	1	WN	WN	WN	WN	WHO2
	1,4-Dichlorobenzene	0.3	WN	WN	WN	WN	WHO2
	Trichlorobenzene (Total)	0.02	WN	WN	WN	WN	WHO2
	Di (2-ethylhexyl) Adipate	0.08	WN	WN	WN	WN	WHO2
	Di (2-ethylhexyl) Phthalate	0.008	WN	WN	WN	WN	WHO2
	Edetic Acid (EDTA)	0.6	WN	WN	WN	WN	WHO3
	Acrylamide	0.0005	WN	WN	WN	WN	WHO2
	Epichlorohydrin	0.0004	WN	WN	WN	WN	WHO2
	Hexachlorobutadiene	0.0006	WN	WN	WN	WN	WHO2
	Microcystin-LR	0.001	WN	WN	WN	WN	WHO3
	Nitrilotriacetic acid (NTA)	0.2	WN	WN	WN	WN	WHO2
	Tributylin oxide	0.002	WN	WN	WN	WN	WHO2
5	Radiocativity:		WN	WN	WN	WN	WHO2
	Gross α	0.1Bq/L	WN	WN	WN	WN	WHO2
	Gross β	1.0Bq/L	WN	WN	WN	WN	WHO2

Notes: Any toxic substances not listed shall be deemed as not allowable in drinking water

W : Indicates parameters to be monitored at least once a week.
M : Indicates parameters to be monitored at least once a month.
Y/2 : Indicates parameters to be monitored at least once in 6 months.
Y/4 : Indicates parameters to be monitored at least once in 3 months.
Y : Indicates parameters to be monitored at least once a year.
2Y : Indicates parameters to be monitored at least once in 2 years.
WN : Indicates parameters to be monitored when necessary.
WHO1 : Refers to WHO Guidelines for Drinking Water Quality 1984.

WHO2	:	Refers to WHO Guidelines for Drinking Water Quality 1993/96.
WHO2	:	Refers to WHO Guidelines for Drinking Water Quality (Addendum to Vol. 1) 1998.
MAL	:	Refers to values adapted for Malaysian conditions.
AUS	:	Indicates Australian Drinking Water Quality Guidelines, 1996.
EEC	:	Indicates EEC Standard Council Directive (80/778/EEC).
NZ	:	Indicates Drinking Water Standards for New Zealand 1995.

Source: Engineering Service Division, Ministry of Health

APPENDIX F

MALAYSIA MARINE WATER QUALITY STANDARD

APPENDIX F

Malaysia Marine National Water Quality Standard

Parameter	Class I	Class 2	Class 3	Class E
Beneficial uses	Preservation, Marine Protected areas, Marine Parks	Marine Life, Fisheries, Coral Reefs, Recreational and Mariculture	Ports, Oil and Gas Fields	Mangroves, Estuarine and River-mouth Water
Temperature	≤ 2°C Increase over max ambient	≤ 2°C Increase over max ambient	≤ 2°C Increase over max ambient	≤ 2°C Increase over max ambient
Dissolved Oxygen	>80% Saturation	5	3	4
Total Suspended Solid	25 mg/L or ≤ 10% increase in seasonal avg, whichever is lower	50 mg/L (25 mg/L) or ≤10% increase in seasonal avg, whichever is lower	100 mg/L or ≤10% increase in seasonal avg, whichever is lower	100 mg/L or ≤30% increase in seasonal avg, whichever is lower
Oil and Grease (mg/L)	0.01	0.14	5	0.14
Mercury* (µg/L)	0.04	0.16 (0.04)	50	0.5
Cadmium* (µg/L)	0.5	2 (3)	10	2
Chromium (VI) (µg/L)	5	10	48	10
Copper (µg/L)	1.3	2.9	10	2.9
Arsenic (III)* (µg/L)	3	20 (3)	50	20 (3)
Lead (µg/L)	4.4	8.5	50	8.5
Zinc (µg/L)	15	50	100	50
Cyanide (µg/L)	2	7	20	7
Ammonia (unionized) (µg/L)	35	70	320	70
Nitrite (NO_2) (µg/L)	10	55	1,000	55
Nitrate (NO_3) (µg/L)	10	60	1,000	60
Phosphate (µg/L)	5	75	670	75
Phenol (µg/L)	1	10	100	10
Tributyltin (TBT) (µg/L)	0.001	0.01	0.05	0.01
Faecal coliform	70 faecal coliform count/100ml	100 faecal coliform count/100ml & (70 faecal coliform count/100ml)	200 faecal coliform count/100ml	100 faecal coliform count/100ml & (70 faecal coliform count/100ml)

Parameter	Class I	Class 2	Class 3	Class E
Polycyclic Aromatic Hydrocarbon (PAHs) (µg/L)	100	200	1000	1000

Note: * MWQCS in parentheses are for coastal and marine water areas where seafood for human consumption is applicable

APPENDIX G

NOISE & VIBRATION GUIDELINE STANDARDS

APPENDIX G

NOISE & VIBRATION GUIDELINE STANDARDS

Noise - Schedule of Permissible Sound Levels

FIRST SCHEDULE – RECOMMENDED PERMISSIBLE SOUND LEVEL (L_{Aeq}) BY RECEIVING LAND USE FOR NEW DEVELOPMENT

Receiving Land Use Category	L_{Aeq} Day 7.00 am – 10.00 pm	L_{Aeq} Night 10.00 pm – 7.00 am
Low Density Residential, Noise Sensitive Receptors, Institutional (School, Hospital, Worship)	55 dBA	50 dBA
Suburban Residential (Medium Density), Recreational	60 dBA	55 dBA
Urban Residential (High Density), Mixed Development	65 dBA	60 dBA
Commercial Business Zones.	65 dBA	60 dBA
Industrial Zones	70 dBA	65 dBA

SECOND SCHEDULE – RECOMMENDED PERMISSIBLE SOUND LEVEL (L_{Aeq}) BY RECEIVING LAND USE FOR EXISTING BUILT UP AREAS

Receiving Land Use Category	L_{Aeq} Day 7.00 am – 10.00 pm	L_{Aeq} Night 10.00 pm – 7.00 am
Low Density Residential, Noise Sensitive Receptors, Institutional (School, Hospital, Worship)	60 dBA	55 dBA
Suburban and Urban Residential, Mixed Development.	65 dBA	60 dBA
Commercial Business Zones.	70 dBA	65 dBA
Industrial Zones	75 dBA	75 dBA

Note: The above prescribed L_{Aeq} limits are representative noise levels consistent with developed areas without noise disturbance generally deemed acceptable to majority of receptors occupying in premises at the respective land category.

THIRD SCHEDULE – RECOMMENDED PERMISSIBLE SOUND LEVEL (L_{Aeq}) TO BE MAINTAINED AT THE EXISTING NOISE CLIMATE

Existing Levels	Recommended Permissible Sound Levels*
L_{Aeq}	Existing L_{Aeq}

Notes:

1. Existing L_{Aeq} is determined from baseline measurements of the prevailing noise in the absence of the new noise sources(s); typically undertaken just prior to the operations of the new road, railway line or industrial premises operations, or alternatively with the noise source(s) being assessed to be temporarily disabled.
2. Due to uncertainty in measurements, noise levels within + 1.5 dBA of the Existing L_{Aeq} is acceptable and deemed maintained at the existing noise climate.

SIXTH SCHEDULE –MAXIMUM PERMISSIBLE SOUND LEVEL (L_{10} AND L_{max}) OF CONSTRUCTION, MAINTENANCE AND DEMOLITION WORK BY RECEIVING LAND USE

Receiving Land Use Category	Noise Parameter	Day 7.00 am – 10.00 pm	Evening 7.00 pm – 10.00 pm	Night 10.00 pm – 7.00 am
Residential, Sensitive Areas (Note 2 **)	**L_{10}**	75 dBA	70 dBA	70 dBA*
	L_{max}	90 dBA	85 dBA	85 dBA*
	L_{Aeq}	-	-	*Note 1
Commercial, Mixed Development	**L_{10}**	80 dBA	80 dBA	75 dBA
Industrial	**L_{10}**	80 dBA	80 dBA	80 dBA

Note

*1. At night time, the maximum permissible levels as stipulated in Schedule 3 for respective residential density type shall apply.

**2. Limits for daytime L_{Aeq} or reduction of L_{10} levels in vicinity of sensitive premises (such as schools and hospitals) may be exercised by the Local Authority or Department of Environment. In such situations, limits for daytime L_{Aeq} +3 dBA based on Schedule 3 may apply.

3. There are no prescribed limits for L_{max} and L_{Aeq} levels for construction noise for commercial and industrial land use. Assessment of L_{Aeq} levels if required shall be based on comparison against prevailing ambient noise (Schedule 3).

For the full guideline, please refer to ‘Guidelines for Environmental Noise Limits and Control (Third Edition) by DOE, 2019’.

Vibration – Schedule Of Recommended Vibration Limits

SCHEDULE 2 – RECOMMENDED LIMITD FOR DAMAGE RISK IN BUILDINGS FROM SHORT TERM VIBRATION

Type of Structure	Vibration Velocity Vi (mm/s) at Foundation (as Defined by the Respective Rating Curves of Figure 1)	Vibration Velocity Vi (mm/s) at plane of floor of uppermost full storey (all frequencies)
Industrial buildings and buildings of similar design	Curve C	40
Commercial building, dwelling and buildings of similar design and/or use	Curve B	15
Structures that, because of their particular sensitivity to vibration, do not correspond to those listed above, or of great intrinsic value (e.g. residential houses, or buildings that are under preservation order)	Curve A	8

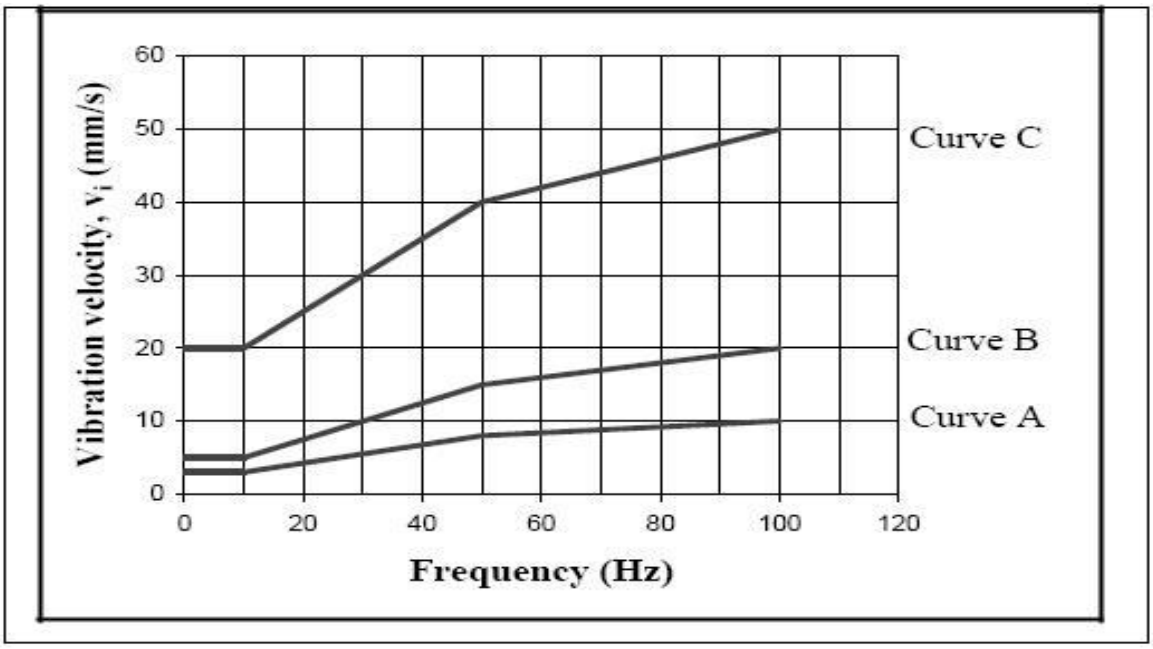

Figure 1: Foundation Vibration Velocity Limiting Values for Vectoral Sum of Vibration Levels in Three Orthogonal Axes

For the full guideline, please refer to 'The Planning Guidelines for Vibration Limits and Control in the Environment, 2nd Edition, DOE, 2007'.

APPENDIX H

CHECKLIST FOR TOR/ESI

CHECKLIST FOR EIA REPORT

APPENDIX H

CHECKLIST FOR TERMS OF REFERENCE (TOR) / ENVIRONMENTAL SCOPING INFORMATION (ESI)

Item		Adequacy Check		Remarks
		Yes	No	
1.0	**Is the project a NEW development?**			
2.0	**Is the project an AMENDMENT to an existing development? If so,**			
	(a) Was there an EIA for the existing development?			
	(b) Does the addition involve new area development? If so how much and where?			
3.0	**Has policies compliance been met by the Project Proponent?**			
	(a) Federal/ State approvals			
	(b) Land status/ acquisition			
	(c) Land use compatibility			
	(d) Environmentally Sensitive Areas			
	(e) Others (Forest, fisheries etc.)			
4.0	Who were involved in the scoping task?			
	(a) Project Proponent			
	(b) Town planner/Architect			
	(c) Engineering consultants			
	(d) Environmental consultant			
	(e) Affected public/stakeholders			
	(f) Government agencies			
	(g) Others			
5.0	**Does the project involve the following activities?**			
	(a) Establish accessibility			
	(b) Base camp and site facilities			
	(c) Mobilisation of workers, equipment and materials			
	(d) Site clearing and biomass removal			
	(e) Earthworks			
	(f) Drainage works			
	(g) Civil and structural works			
	(h) Electrical and mechanical works			
	(i) Testing and commissioning works			
	(j) Materials/products handling and storage			
	(k) Process controls			
	(l) Air pollution control system			
	(m) Industrial / Sewage effluent treatment system			
	(n) Noise / vibration controls			
	(o) Safety controls			
	(p) Waste generations			
	(q) Others			
6.0	**Land use on site and surrounding areas**			

Item		Adequacy Check		Remarks
		Yes	No	
	(a) Are the following features intersected by the Project?			
	i) Rivers and/or lakes			
	ii) Coastal areas			
	iii) Wetlands/Mangroves			
	iv) Coral reefs/Seagrass beds			
	v) Forest reserves			
	vi) Built-up areas			
	vii) Tourism/recreational areas			
	(b) Are the environmental issues with each feature identified?			
7.0	**Timeline**			
	(a) Project implementation schedule (by phase, in chronological order of occurrence)			
8.0	**Project information provided**			
	(a) Project concept and layout			
	(b) Project activities			
	(c) Material sources and storage			
	(d) Infrastructure, utilities and			
9.0	**Site Suitability Assessment**			
	(a) Siting constraints / suitability addressed?			
	(b) Have the affected public be informed/consulted?			
	(c) Alternative project layout provided?			
	(d) Best available technology (BAT) considered?			
	(e) Carrying capacity considered?			
	(f) No Project Option?			
	Significant impacts scoped and prioritized?			
	(a) Identified Impacts			
	(i) Water quality			
	(ii) Air quality			
	(iii) Noise and vibration			
	(iv) Safety impact			
	(v) Health impact			
	(vi) Waste generation			
	(vii) Others			
	(b) For each significant impact, were the methods and scope sufficient for impact assessment?			
	(c) Were mitigation measures proposed to address the significant impact?			

CHECKLIST FOR ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT

Items	Mark	Page No.	Remarks
CHAPTER 1: INTRODUCTION			
1.1 Project Title This Chapter has provided contain as a minimum the following information: i. Name / Title of project ii. Name and contact details of the Project Proponent (i.e. Contact person, address, telephone number, e-mail address) iii. Name of the registered EIA Consulting firm (i.e. EIA team leader, address, telephone number, e-mail address) iv. Location of the project (including where applicable, coordinates, lot numbers, sub-district and district names) v. Relevant maps illustrate ng project location and surrounding sensitive receptors			
1.2 Project Proponent and Qualified Person Details have been provided on (a) the identity of the Project Proponent (i.e. public or private organization); the details of the EIA consulting firm; and including consultants engaged to participate on the EIA study. All the members of the EIA consulting team, including team leader and subject matter consultants (SMCs), are currently registered with DOE under the EIA Consultant Registration Scheme (www.doe.gov.my)			
1.3 Legal Aspects The project is designated as a Prescribed activity is subject to section 34A, Environmental Quality Act, 1974 Project conforms to government's development plans			

Items	Mark	Page No.	Remarks
CHAPTER 2: TERMS OF REFERENCE OF EIA STUDY			
TOR of the EIA study which has been endorsed by the DOE has been included in the EIA Report together with the relevant endorsement.			
CHAPTER 3: STATEMENT OF NEED			
The Statement of Need has described the outline and the background of the project; and has stated the reasons for its implementation. Social, economic and other reasons to support the project implementation has been established. A definitive statement on the need for the project has been provided in the EIA Report.			
CHAPTER 4: PROJECT OPTIONS			
Project options has been described in the EIA Report on technical, economic, social, and environmental aspects advantages and disadvantages. The following alternatives (wherever applicable), have been described. (i) Site Options (ii) Project Options (including "no project option", and "scaled-down project option") (iii) Technology Options (iv) Raw Materials Procurement Options (v) Construction Method Options (vi) Layout Options (vii) Alignment Options (viii) Operation Options			
CHAPTER 5: PROJECT DESCRIPTION			
This chapter has provided salient information on the following topics: (i) Description of the project concept including information pertaining to: size and capacity of plant, land requirements, nature and quantity of raw materials, energy source and consumption rates, water source and consumption rates, wastewater amount and treatment system, labour requirements,			

Items	Mark	Page No.	Remarks
transportation of raw material and products, supporting or ancillary facilities, and special infrastructural requirements			
(ii) Basic process flow and mass energy balance diagram value depicting project operations			
(iii) A summary description of the technical, economic, and environmental aspects of the project has been included.			
(iv) Proposed project implementation schedule and project lifespan (wherever applicable) (v) Comparison with the existing plant/project in Malaysia or elsewhere (vi) Operation and maintenance activities			
CHAPTER 6: EXISTING ENVIRONMENT			
A description of the existing environment within and the surrounding the Project site encompasses the following information has been provided, viz.: i. The Zone of Study in actual terms. The Zone of Impact study in Project site ii. Existing physico-chemical, biological, social, and economic profiles have been described in qualitative and quantitative terms encompassing the following parameters: • Physico-chemical ➢ Topography ➢ Site soil properties ➢ Geological terrain mapping ➢ Geotechnical report ➢ Seismic activity in spatial terms ➢ Landuse (5-km radius) ➢ Hydrology/drainage characteristics ➢ Climate conditions ➢ Water quality ➢ Ambient air quality ➢ Ambient noise and vibration levels			

Items	Mark	Page No.	Remarks
• Biological ➢ Terrestrial profile (Flora and fauna) ➢ Aquatic/Marine profile (Flora and fauna) ➢ Biodiversity status • Socio-economy ➢ Demography ➢ Historical, cultural and archaeological information ➢ Environmental sensitive areas, and areas of special or unique scientific, socio- economic or cultural values ➢ Traffic circulation around Project site • Health status of surrounding communities. • Socio-economic status of surrounding communities			
CHAPTER 7: EVALUATION OF IMPACTS			
1.1 Assessment and Evaluation of Impacts i. Assessment matrix ii. Discussion on the impact identification covers the following aspects and conform the following requirement: • The nature of the environmental effect • The source of the impact • The nature of impact			
1.2 Detailed Examination of Impacts (i) The scope and nature of impacts, linear spatial range, linear deviation, and linear implications (e.g. negligence, moderate or severe) have been elaborated with respect the surrounding places of proposed development, viz.: ➢ Pre-construction phase - Temporary site access - Site surveys, soil and geotechnical studies			

Items	Mark	Page No.	Remarks
- Environmental assessment - Land acquisition - Extent of eviction of residents, demolition works for build-up, relocation of buildings etc. ➢ Construction phase - Permanent access road construction - Establishment and operations of base construction camps and office, other site facilities - Site clearing and biomass removal - Earthworks - Blasting - Drainage works - Waste disposal - Landscaping - Transportation of construction materials and plant and equipment ➢ Operational phase - Procurement and transportation of raw material - Transportation of products - Slope maintenance - Infrastructure, utility and amenities maintenance - Operation of project - Air quality impacts - Noise and vibration impacts - Water quality impacts - Socio economic impacts - Ecology impacts - Soil erosion and sedimentation impacts ➢ Abandonment phase - Noise and vibration - Waste management - Earthworks operation (ii) Description of the methodology used for impact prediction and evaluation (iii) Pictorial description of potential impacts.			

Items	Mark	Page No.	Remarks
1.3 Project Evaluation Quantification of the environmental (through assessment matrix and Cost Benefit Analysis) and development trade-offs anticipated from the proposed project			
CHAPTER 8: MITIGATION MEASURES			
Identification of appropriate P2M2s applicable to all phases of project implementation including construction and implementation phases **8.1 Adherence to DOE Guidelines** (a) Guidance Document for addressing soil erosion and sediment control aspect in EIA Report as per Appendix 3 of EGIM. (b) Guidance Document for the preparation of Land Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2) as per Appendix 4 of EGIM. (c) Other relevant guidelines and guidance documents issued by the DOE pertaining to environmental-related system and management as per Appendix 5 of EGIM.			
8.2 Proposed Mitigation Measures (a) Description of the scope and purpose of mitigation measures to be adopted and incorporated into the design of the project to effectively eliminate, prevent, and minimize predicted adverse impacts, provided. (b) Evidence from Project Proponent showing commitment to implement the proposed P2M2s described in EIA Report.			
CHAPTER 9: ENVIRONMENTAL MANAGEMENT PLAN (EMP)			
9.1 Land Disturbing Pollution Prevention and Mitigation Measures Guided Self-regulation is detailed out in the report.			

Items	Mark	Page No.	Remarks
Preparation and compliance of LD-P2M2 based on the Guidance Document for the Preparation of Document on Land Disturbing and Pollution Prevention Mitigation Measures (LD-P2M2)			
9.2 Proposed Monitoring Programme The following descriptions have been provided: (i) Performance monitoring (PM) (ii) Compliance monitoring (CM) (iii) Impact monitoring (IM) (iv) Environmental auditing			
CHAPTER 10: STUDY FINDINGS			
Conclusion of study findings based on the outcome of evaluation of impacts induced by the project activities as the effects of proposed mitigation measures described.			
REFERENCES			
APPENDICES			
(i) Input data and results of modelling studies (ii) Supporting documents e.g. COA (iii) Other relevant documents e.g. photographs, supporting letter from GAs etc.			

APPENDIX I

GENERAL REQUIREMENT FOR ASSESSING HEALTH IMPACT

EXISTING PUBLIC HEALTH STATUS OF LOCAL COMMUNITY

APPENDIX I

GENERAL REQUIREMENT FOR ASSESSING HEALTH IMPACT

1. Health Impact Assessment (HIA) subject specialist must be a qualified person, registered with the Department of Environment.

2. Methodology of Health Impact Assessment (HIA) should be in accordance to the published guideline, the Guidance Document of Health Impact Assessment (HIA) in Environmental Impact Assessment published by DOE Malaysia (2012) or equivalent guidelines.

3. Approaches to health risk assessment can be qualitative or quantitative depending on the type of health hazard identified. Qualitative health risk assessment involves listing and describing the possible changes in health outcomes or endpoints resulting from the proposed project. For example, inappropriate waste handling during the construction stage may lead to potential breeding site of pests like rodents and disease vectors like mosquitoes and flies. However, the quantum of increase in the populations of rodents or mosquitoes or the subsequent increase in the prevalence of diseases associated with them, are difficult to be quantified.

4. Quantitative health risk assessment generates a risk value on the potential adverse health effects of human exposures to environmental hazards. Quantitative methodology of HRA should be in accordance to the Guidance Document of Health Impact Assessment (HIA) in Environmental Impact Assessment published by DOE Malaysia (2012) or equivalent guidelines.

5. Assessment of health impact should include acute and chronic health effects as well as lifetime cancer risk when applicable.

6. Assessment of health impact should be conducted for construction stage and operational phase of the project. During the construction stage, the common health hazards are (not exhaustive):
   i. Respiratory effects from exposure to gaseous and particulate pollutants such as particulate matters below 10 microns (PM10), SO2, and NO2 from fuel combustion machinery on sites.
   ii. Vector-borne diseases (dengue fever, malaria which is caused by the unhygienic construction sites or living workers quarters).
   iii. Waterborne diseases and food-borne diseases like cholera, typhoid and hepatitis A due to improper sewage and solid waste disposal in the worker's camp area.
   iv. Physical injuries due to work accidents, road traffic accidents, noise induced hearing impairment from exposure to vehicle or machinery noises.
   v. Accidents and explosion hazards from handling highly flammable materials on site (pipelines, storage tanks etc.).

7. Assessment of health impact needs to consider worst case scenario.

8. For relevant hazards identified, their abilities to cause cancer should be clearly stated in the report. The weight of evidence for cancer and their mode of action should be reported.

9. For carcinogen Group 1, Group 2A and 2B or equivalent, lifetime cancer risk assessment must be conducted for all receptors with completed or potential exposure pathways.

10. For carcinogen with mutagenic mode of action, lifetime cancer assessment must consider early life exposure. Aged adjustment factor (ADAF) need to be applied for assessing cancer risk from carcinogen with mutagenic mode of action. ~~For~~ Details information on methodology for assessing early life exposure to carcinogen is available/stated/explained in the guideline produced by the U.S Environmental Protection Agency [EPA/630R-03/003F (2005) entitled “supplemental guidance for assessing susceptibility from early-life exposure to carcinogens].

11. The location of highly vulnerable receptors such as schools, health care facilities, aged care facilities and source of water intake must be identified and the distance from the project site must be clearly stated.

12. Multiple chemical exposure: cumulative and aggregate health risk assessment should be conducted for both cancer and non-cancer risk assessment. Aggregate health risk assessment is a combined exposure to a single stressor across multiple routes and multiple pathways. Cumulative health risk assessment evaluates combined exposure to multiple stressors via multiple exposure pathways that affect a single biological target.

13. The sources for toxicological information, health reference values, standards or guideline used in HIA must be written in the report for evaluation purpose.

14. Formula used in health risk assessment [HRA] should be reported for the purpose of evaluation.

15. It is the responsibility of the consultants/subject specialist to check and refer to the latest requirement by Ministry of Health (if any).

EXISTING PUBLIC HEALTH STATUS OF THE LOCAL COMMUNITY

Profiling of existing community health status is an integral part of HIA in EIA framework. To profile the existing health status of the local community, the consultant can obtain health data through:

1. Primary data collection – Obtained through local population survey. The survey should cover all potential impacted community and survey sample should be representative of the community. The primary data will provide prevalence of the relevant health outcome as the baseline data.

2. Secondary data on relevant diseases from local health clinics/hospitals can be requested from State Health Department.

3. In case of primary data collection, the questionnaire used for data collection must be attached in the appendices.