

EIA GUIDELINES

POWER GENERATION AND TRANSMISSION PROJECTS



Department of Environment
Ministry of Environment and Water, Malaysia



EIA GUIDELINES FOR POWER GENERATION AND TRANSMISSION

2021

Department of Environment, Malaysia

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Section 5, Pusat Bandar Wangsa Maju
53300 Kuala Lumpur
Tel: +603-4145 8888 Fax: +603-4145 8877
Email: dnasbenviroment@gmail.com

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The Department of Environment (DOE) would like to express our gratitude to all Government Agencies (GAs), both at the Federal and State level, the Local Authorities, Consultants, stakeholders and Non-Governmental Organisations (NGOs) in providing their inputs and incomparable assistance in developing the content of the Guidelines.

The Department is also grateful to all DOE staff for their efforts and passion in steering the Guidelines into reality for the benefits of streamlining and improving EIA reports preparation in the country.

Last but not least, DOE also hopes that the Guidelines will be used in the context of EQA 1974 for the betterment of Environmental Management in the country.

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PREFACE

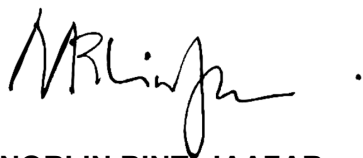


This document (referred as **the Guideline**) represents the revised version of the *Environmental Impact Assessment Guidelines for Power Generation and Transmission Projects* developed by the Department of Environment (DOE) in 1995. It is prepared following the latest requirements in the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015, of the Environmental Quality Act (EQA) 1974 (Act 127).

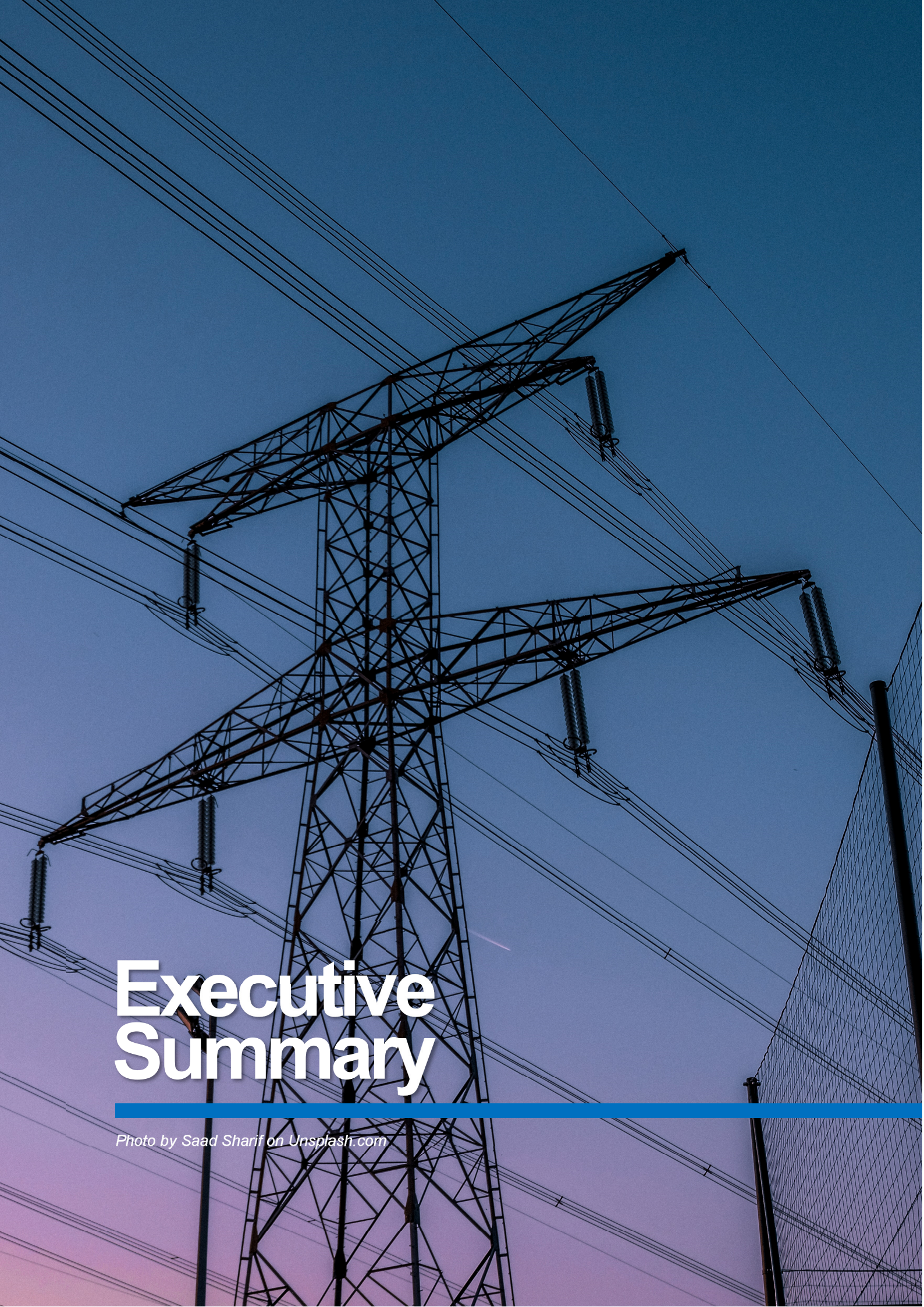
This Guideline is meant to assist various stakeholders that are involved with the construction of a power station and transmission line. This includes the Project Proponent, project team, environmental consultant, government agencies, and also non-profit organisations (NGOs).

This document provides in depth guidance on the requirements to conduct an Environmental Impact Assessment (EIA) study including step-by-step approaches to ensure it is carried out in accordance to all related guidelines and standards. Apart from that, this Guideline highlights the EIA pre-requisites to be considered by the Project Proponent and states the roles and responsibilities of each stakeholders involved. This takes into account the task of each government agencies within the EIA domain.

As the project spans over various aspects and legal jurisdictions, it is recommended that this document is read together with other relevant guidance documents to ensure all environmental issues and requirements are addressed appropriately.



NORLIN BINTI JAAFAR
Director General,
Department of Environment



Executive Summary

Photo by Saad Sharif on Unsplash.com

SCOPE OF THE GUIDELINE

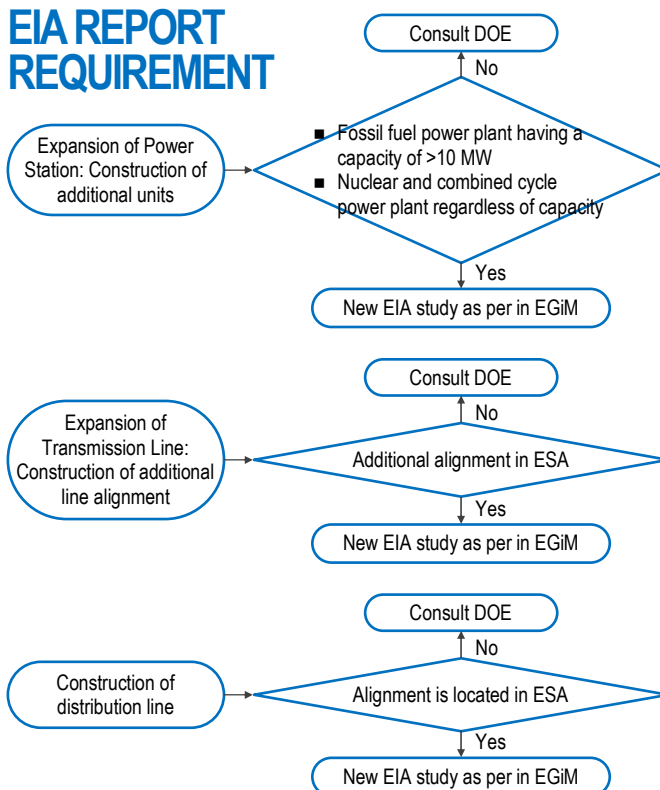
FIRST SCHEDULE: PRESCRIBED ACTIVITY 11

- Construction of steam generated power station using fossil fuels (other than coal) and having capacity of 10 MW or more, with or without transmission line.
- Construction of combined cycle power station, with or without transmission line.
- Construction of transmission line in environmentally sensitive area.

SECOND SCHEDULE: PRESCRIBED ACTIVITY 11

- Construction of coal fired power station and having the capacity of 10 MW or more with or without transmission line.
- Construction of nuclear-fuel power station with or without transmission line.

EIA REPORT REQUIREMENT



TERMS AND DEFINITIONS

POWER GENERATION – Defined as the process of generating electricity from various sources of primary energy. The production of power is carried out in power stations.

POWER TRANSMISSION – Process of transmitting electricity using transmission lines.

STEAM GENERATED POWER STATION – A steam generated power station is designed to convert heat from the combustion of a fuel into mechanical energy using steam. The mechanical energy is then transformed by electric generators into electric power.

FOSSIL FUELS – Fossil fuels power stations typically burn the hydrocarbon fuels in boilers to generate steam that drives large turbines that produce electricity.

MEGAWATT – Megawatt (MW) is a unit to measure electric power with 1 MW is equivalent to 1,000,000 watts.

COMBINED CYCLE POWER STATION – A combined-cycle power plant uses both a gas and a steam turbine together to produce up to 50% more electricity from the same fuel than a traditional simple-cycle plant.

TRANSMISSION LINE - The overhead transmission line which consists of tower, conductor and insulator whereby the conductor is designed to carry electric power (132 kV and above) from generation stations to substations.

ENVIRONMENTALLY SENSITIVE AREA (ESA)

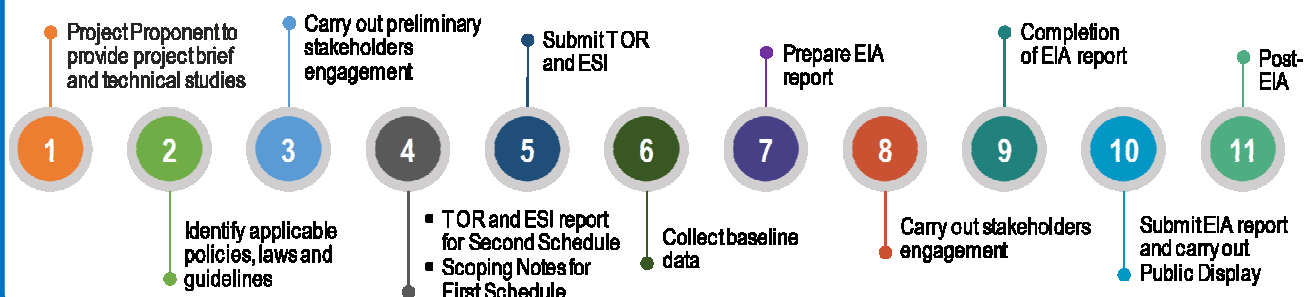
– A particular area that is sensitive to any forms of alteration to its ecosystem due to natural processes or activities within or around it, either directly or indirectly. ESA is categorised into three ranks i.e. Rank 1, Rank 2 and Rank 3.

COAL FIRED POWER STATION – Coal fired power station makes use of coal combustion energy to produce steam that finally generate electricity.

COAL – It is a flammable black or brown organic sedimentary rock which is mostly carbon and typically found as layers (coal beds) or veins (coal seams).

NUCLEAR-FUEL POWER STATION – The nuclear-fuel power station uses a nuclear reactor to produce and control the release of energy from splitting of the atoms (a process called fission) of certain elements (e.g. uranium, plutonium).

OVERVIEW OF EIA PROCESS



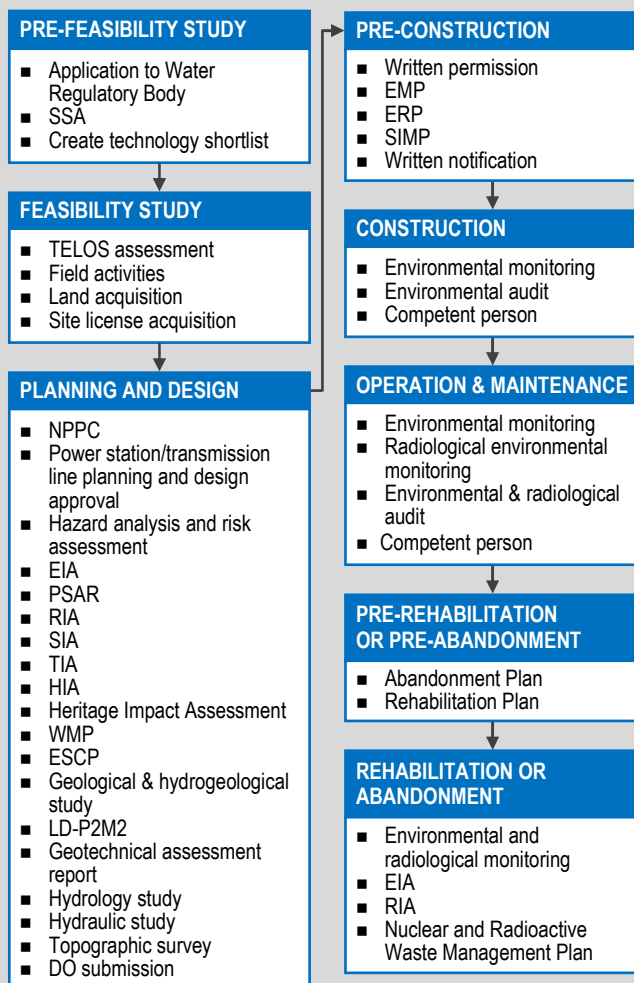
ENVIRONMENTAL PROJECT PLANNING

RELEVANT LEGISLATIONS

Since power generation and transmission is subjected to the EIA Order 2015 of the EQA 1974, the following provisions are directly applied:

- i) **SECTION 34A (6)** - Any person intending to carry out a prescribed activity shall not carry out such activity until the report required under this section to be submitted to the Director General has been submitted and approved.
- ii) **SECTION 34A (7)** - If the Director General approves the report, the person carrying out the prescribed activity, in the course of carrying out such activity, shall provide sufficient proof that the conditions attached to the report (if any) are being complied with and that the proposed measures to be taken to prevent, reduce or control the adverse impact on the environment are being incorporated into the design, construction and operation of the prescribed activity.

RELEVANT REQUIREMENTS AT VARIOUS PROJECT IMPLEMENTATION STAGE



RELEVANT POLICIES

- Sustainable Development Goals
- Five Year Malaysia Plan
- Third National Physical Plan (NPP)
- Central Forest Spine Ecological Network Master Plan
- National Policy on Biological Diversity 2016 – 2025
- National Policy on Climate Change
- National Water Resources Policy
- National Policy on the Environment
- Green Technology Master Plan Malaysia 2017 – 2030
- Malaysia National Forestry Policy 1978 (Revised 1993)
- Rancangan Fizikal Zon Persisiran Pantai Negara

RELEVANT GUIDELINES

- Guideline for Site Selection for Nuclear Power Plant
- GPP Pembangunan dan Pengurusan di Kawasan Berisiko Bencana Gempa Bumi
- GPP Pemuliharaan dan Pembangunan Kawasan Sensitif Alam Sekitar (KSAS)
- GPP Pembangunan di Kawasan Bukit dan Tanah Tinggi
- EIA Guideline in Malaysia
- Guidelines for Erosion and Sediment Control in Malaysia
- Guidelines for Slope Design
- Urban Stormwater Management Manual for Malaysia (MSMA 2nd Edition)
- Garis Panduan Pembangunan Melibatkan Sungai dan Rizab Sungai
- Garis Panduan Jalan Hutan 2010 (Pindaan 2013)
- Integrated Approaches under the National Water Resources Policy

STAKEHOLDER ENGAGEMENT

Relevant Stakeholders

- DOE
- Project Proponent
- Government Agencies
- Approving Authorities
- Affected Groups
- Interest Groups

Engagement Methods

- Direct interview
- Workshop
- Public Dialogue
- Focus Group Discussion (FGD)
- Exhibitions and road show
- Round table discussion

Documentation and Reporting

- Engagement details (date, venue, itinerary)
- List of attendance
- Copies of survey form
- Report on summary of the engagement (minutes of meeting, photos, analysis)
- Video or voice recordings

TERMS OF REFERENCE

ENVIRONMENTAL SCOPING

- Information gathering and analysis
- Identification of significant environmental issues
- Prioritise significant issues for further studies in EIA
- Determine approach, methodology and tools for assessment
- Identify potential pollution prevention and mitigation measures (P2M2)
- Submission of TOR and ESI for DOE assessment and endorsement for Second Schedule only

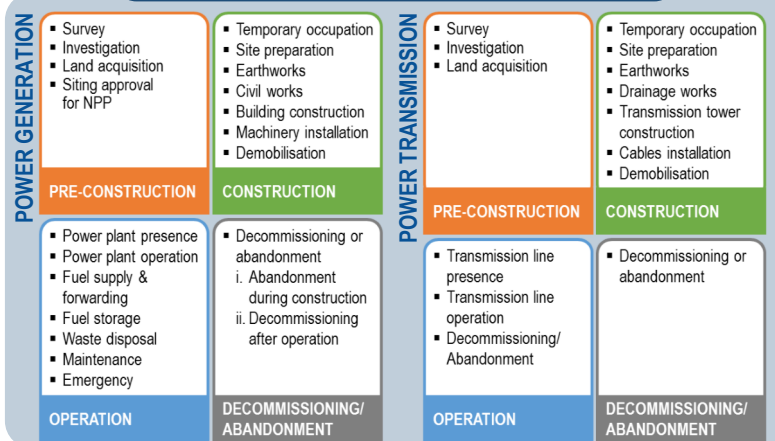
SITE SUITABILITY ASSESSMENT (SSA)

- Consideration of project alternatives and options:
- Project siting
 - Terrain and topography
 - Hydrology
 - Social aspect
 - Accessibility
 - Nuclear power plant must refer to AELB Guidelines

EIA STUDY BOUNDARY

- Zone of Study (ZOS): 5 km radial zone from project boundary
- Zone of Impact (ZOI): Not limited to a specific distance and will be determined by modeling and impact-causing project activities
- Project buffer zones: must refer to approved development plans, relevant guidelines, policies and regulations
- Emergency planning zone: For nuclear power plants

DETERMINATION OF KEY PROJECT ACTIVITIES



BASELINE DATA REVIEW

- Must be adequate to assess potential impacts on the ESAs which includes:
- Physical: Land use, geology and hydrogeology, soil characteristics, terrain, climate, hydrology, water quality, air quality, noise and vibration level
 - Biological: Ecosystem, terrestrial flora and fauna, aquatic flora and fauna
 - Social: Demography, stakeholders, public health status, heritage, culture and archaeology, ecotourism
 - Land traffic
 - Environmentally sensitive areas (ESAs)
 - Existing site constraints

IDENTIFICATION OF SIGNIFICANT IMPACTS AND PRIORITY SETTING

- Various techniques to analyse and prioritise issues and impacts: Network method, comparison with other similar projects, questionnaire and matrix
- Criteria for determining significance of impacts: Magnitude, permanence, reversibility and cumulative effects

RELATED KEY ISSUES

- Location of power station and transmission line
- Discharge to air
- Discharge to water
- Fuel forwarding and/or storage
- Radiological waste management
- Slope stability
- Hydrology and drainage
- Logging issues

SELECTION OF MITIGATION MEASURES

- To be assessed and identified based on best available techniques (BATs), best management practices (BMPs) and options available
- To be qualitative and descriptive only and to be detailed out in the EIA stage

PREPARATION OF TOR AND ESI REPORT

Preparation of the document to follow as per EGiM and to be submitted to DOE HQ for endorsement (for Second Schedule only)

EIA STUDY TEAM

- Study team can be formed once issues and possible impacts are identified
- Qualified Person must be registered with DOE
- All team members are to perform the tasks required for the EIA study (studies, modeling, public engagements)
- Assess the impacts, proposed P2M2, EMP and monitoring framework

ESTABLISHMENT OF STUDY REQUIREMENT

- Scope of EIA study is dependent of the scale and magnitude of the project
- Qualified Person to provide methodologies, assessment/modeling tools, baseline data, potential impact and proposed mitigation measures

BASELINE DATA COLLECTION

Purpose

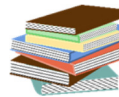
- Identify existing environmental conditions which may influence project design decisions;
- Identify sensitive issues or areas requiring mitigation or compensation;
- Provide input data to numerical models for prediction of impacts; and
- Provide baseline reference for compensation during project implementation stage.

PRIMARY DATA

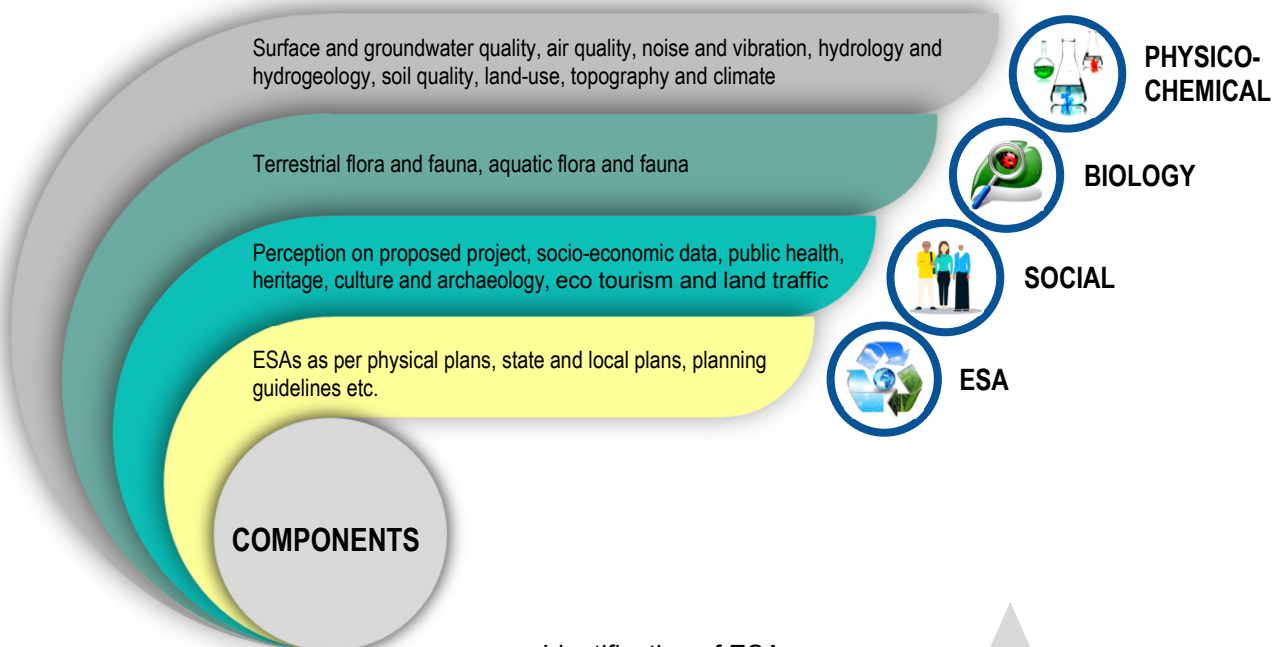


First-hand data collected e.g. field survey and sampling exercise

SECONDARY DATA



Information from various sources e.g. published reports and research papers



*Note: All samples must be analysed by a laboratory accredited by the Skim Akreditasi Makmal Malaysia (SAMM). All test certificates and data shall be included in the appendix of the EIA as supporting evidence.

Identification of ESAs:

01.
ESA rank

02.
Category

03.
Location

04.
The nearest distance from project boundary

05.
Source

EVALUATION OF IMPACTS

WASTE MANAGEMENT

■ Assessment requirements

- i) Types of waste generated during construction and operations
- ii) Impacts from these wastes and management measures

■ Prediction method

- i) Potential scheduled waste generation based on project activities
- ii) Waste generation estimation based on population
- iii) Total biomass based on vegetation types and published studies values
- iv) Potential radiological waste/spent fuel generation

■ Evaluation of impacts

- i) Identify and estimate the quantum of all waste sources
- ii) Severity of impacts from improper management
- iii) Locations of temporary storage within the site
- iv) Locations for disposal site

■ Output

- i) Proper temporary disposal sites and storage facilities
- ii) Mitigation measures against spillage and other impacts
- iii) Mitigation measures to be incorporated into project site management
- iv) Management of radiological waste and spent fuel (requires separate EIA)

HYDROLOGY

■ Assessment requirements

- i) Land clearing scale and alterations to hydrological and drainage characteristics of the site
- ii) Scale of drainage system that may be altered
- iii) Hydrological condition before and after project implementation
- iv) Impacts to the downstream and its surrounding area

■ Prediction method

- i) Hydrological procedures (DID)
- ii) Computer models for estimating peak flood, runoff, watershed analysis, flood plain hydraulics, etc.
- iii) Hydrological analysis

■ Evaluation of impacts

- i) Delineate river basins are affected
- ii) Hydrological data and long-term rainfall trends
- iii) Hydrological condition: Pre- and post-project implementation

■ Output

- i) Hydrological and drainage systems of the project and its impact on the surrounding

WATER QUALITY

■ Assessment requirements

- i) Types and scale of impairment to water quality
- ii) Potential sources of pollutants

■ Prediction method

- i) Mathematical models analysis of pollution loads and dispersion in the waterways
- ii) Simple mass balance models

■ Evaluation of impacts

- i) Pollutant loading (magnitude and extent of impacts further downstream)
- ii) Potential water polluting sources
- iii) Users and sensitive habitat located downstream

■ Output

- i) Identify suitable BMP and treatment system
- ii) Discharge limit
- iii) Dose received by public and environment

NOISE

■ Assessment requirements

Ambient noise environment and activities that pose impairment hazards

■ Prediction method

- i) Mathematical models
- ii) Noise modeling software
- iii) Traffic noise models

■ Evaluation of impacts

Model or calculate the increase in noise level, mapped as noise contours

■ Output

- i) Extent of potential impacts to nearby sensitive receptors
- ii) Critical levels for pollutant at sensitive receptors

GROUNDWATER QUALITY / SOIL CONTAMINATION

■ Assessment requirements

Contaminant concentration in groundwater/soil

■ Prediction method

Mathematical models analysis of pollutant pathway in groundwater

■ Evaluation of impacts

Extent and concentration of contaminants travelling in groundwater/soil

■ Output

- i) Determine the sufficiency of buffer from the project to the sensitive receptors
- ii) Planning of buffer and Emergency Planning Zone for nuclear power station
- iii) Short- and long-term food and agriculture restrictions in case of accident

AIR QUALITY

■ Assessment requirements

Identify potential air pollution generating sources

■ Prediction method

- i) Gaussian plume dispersion model
- ii) Dispersion and dose modelling
- iii) Radioactive decay products
- iv) Radioecology

■ Evaluation of impacts

Assess the level of pollutants pre and post development for major sensitive receptors. If necessary, air quality models shall be used

■ Output

- i) Extent of potential impacts to nearby sensitive receptors
- ii) Critical levels for pollutant at sensitive receptors shall be identified and mitigated
- iii) Dose received by the public during normal and abnormal nuclear power station operation
- iv) Planning of buffer and Emergency Planning Zone for nuclear power station
- v) Short- and long-term food and agriculture restrictions in case of accident

LAND USE AND AESTHETICS

■ Assessment requirements

- i) Compatibility of the project towards the surrounding land use
- ii) Adequacy of buffer as per structure plan, local plan or any other guidelines

■ Prediction method

- i) Compatibility based on structure plan, local plan and other guidelines
- ii) Setback based on national and state guidelines
- iii) Visual assessment
- iv) Viewshed Analysis

■ Evaluation of impacts

- i) Designated land use of the project site as per the spatial plan
- ii) Suitability of the project on the surrounding development

■ Output

- i) Suitability of the project on the designated site
- ii) Land use conflict that may arise

ECOLOGY**■ Assessment requirements**

- i) Mapping of important habitats and ESA
- ii) Inventory of existing flora and fauna
- iii) Identification of critical species

■ Prediction method

- i) Assessment of conservation status and sensitivity of habitat, flora and fauna
- ii) Ecological models for species diversity and population change
- iii) Limit of Acceptable Change (LAC)
- iv) Spatial models
- v) Integrated exposure/dose/effect assessment with risk characterisation
- vi) Radioecology

■ Evaluation of impacts

- i) Level of encroachment into ESA
- ii) possible loss of habitat and its flora and fauna
- iii) Project activities that could disturb animal behaviour
- iv) Forest fragmentation and its consequences
- v) Increase in poaching and roadkill
- vi) Impacts from increased human-wildlife conflict

■ Output

- i) Highlight important area to be protected
- ii) Identification of critical areas for mitigation measures
- iii) Develop WMP
- iv) Threshold limit
- v) flora and fauna as radiation monitoring indicator

GEOTECHNICAL HAZARDS**■ Assessment requirements**

- i) Areas of the project site and its surroundings for risk
- ii) Adequacy of buffer to avoid or reduce risk of hazards
- iii) Suitable engineering and geotechnical measures

■ Prediction method

- i) SI study
- ii) GTM
- iii) Site assessment
- iv) Risk analysis
- v) Engineering design and estimation of FOS

■ Evaluation of impacts

- i) Risk map and determine FOS
- ii) Impact and extent of damages/losses in the event of slope failure and sensitive receptors that may be affected
- iii) Areas in need of mitigation measures

■ Output

- i) Hazard areas
- ii) Areas of high
- iii) Monitoring programme for slopes

EROSION AND SEDIMENTATION**■ Assessment requirements**

- i) Land clearing scale
- ii) Conditions of the hydrological and drainage system
- iii) Extent of erosion and sedimentation
- iv) Suitable BMP

■ Prediction method

- i) RUSLE
- ii) MUSLE
- iii) Computer models

■ Evaluation of impacts

- i) Rate of erosion and sediment yield
- ii) Erosion scenarios i.e. with and without mitigation measures
- iii) Simulation to determine the BMPs that shall be adopted

■ Output

- i) Adoption of avoidance principles
- ii) Identify suitable BMP to incorporate in the LD-P2M2

SOCIAL**■ Assessment requirements**

- i) Land and property acquisition and relocation of communities
- ii) Extent of impacts, both negative views and perception of the affected stakeholders

■ Prediction Method

- i) Social and economic surveys on affected population
- ii) Perception survey to ascertain acceptance of project
- iii) SIA

■ Evaluation of impacts

- i) Extent of land acquisition and affected stakeholders
- ii) Delineate the survey catchment and determine statistically the number of surveys required
- iii) Focus on communities within the ZOS
- iv) Main findings from SIA shall be incorporated

■ Output

- i) Land and property acquisition and relocation of communities must first be settled prior to EIA commissioning and submission
- ii) Possible public acceptance or rejection of the nuclear power station project

SAFETY, SECURITY, SAFEGUARD AND HEALTH**■ Assessment requirements**

Safety and health towards workers and nearby population

■ Prediction method

- i) Qualitative/Quantitative Health Risk Assessment (HRA)
- ii) Qualitative/Quantitative risk assessment (QRA)

■ Evaluation of impacts

- i) Level of risk to neighbouring receptors
- ii) Existing health conditions of receptors
- iii) Possible impacts on workers' safety and health during construction stage
- iv) Ascertain the level of risk
- v) Aspects of radiation safety from the nuclear power station construction, operation and decommissioning
- vi) Aspect of security and safeguard for the nuclear power station

■ Output

- i) Determine the qualitative/ quantitative risk to receptors to identify appropriate BMP
- ii) Findings from HIA can also provide mitigation measures
- iii) Health and safety protection
- iv) Recovery plan and execution
- v) Nuclear security and safeguard system

TRAFFIC**■ Assessment requirements**

- i) Traffic arrangement during construction
- ii) Identification of the need for mitigation measures

■ Prediction Method

- i) TIA
- ii) Simulation

■ Evaluation of impacts

- i) Review and incorporate main findings from TIA into the EIA
- ii) Main impact elements are communities living along the logistic road during construction

■ Output

- i) Potential issues during construction and incorporation of structural and non-structural measures
- ii) Identification of risk factors
- iii) Traffic control system to accommodate nuclear and radioactive material transport

CHAPTER 6

MITIGATION MEASURES

PURPOSE

- Avoidance of negative impacts through selection of alternatives to implement the preventive measures
- Adopt relevant mitigation measures to minimise the impacts
- Enhance and amplify the beneficial impacts
- Ensure that residual impacts are kept within acceptable levels



P2M2

Key P2M2s based on environmental components/aspects:

- Air quality
- Land disturbance
- Slope stabilisation
- Waste management
- Surface water pollution
- Noise and vibration
- Ecological management
- Runoff and stormwater management
- Land traffic

LD-P2M2

- BMPs comprising activities, facilities, measures, planning or procedures used to minimise accelerated erosion and sedimentation
- Site specific
- Must have Work Breakdown Structure (WBS) of project activities
- Main components of LD-P2M2: Project activity and implementation, information and analysis on project site and development, map of site plan with existing condition

GENERAL APPROACHES



Need and extend of P2M2s correspond to significance of impact



Priority on control at source and rectifying the impacts



Project-specific



Practical, easy to implement and effective



Use of new technology is encouraged



Explanation on the design and function of P2M2s shall be supported by diagrams, illustrations, photos and maps



P2M2s shall require regular inspection, maintenance and rehabilitation



Enhance and amplify the beneficial impacts



Effectiveness of the P2M2s shall be documented via monitoring programme

NOTE:

1. The Qualified Person shall identify and propose BMPs based on the findings of the EIA.
2. The submission of the EIA and the pledge by the Project Proponent shall reflect the agreement and commitment towards ensuring implementation of the P2M2s and BMPs on-site during all stages of work.

PROJECT ACTIVITY & IMPLEMENTATION



- Phasing plan
- Project implementation schedule
- Description of construction activities
- Construction timeline, including BMP installation
- Construction method statement

INFORMATION AND ANALYSIS ON PROJECT SITE AND DEVELOPMENT



- Selected weather and rainfall data
- Site runoff velocity and flow rates (pre and post development)
- Description of soil and geological characteristics
- Description of adjacent areas that may be affected by land disturbance
- List of drainage, streams and river onsite, including receiving water bodies
- List of BMP proposed
- Access roads and project components located outside of project boundary
- Earthworks cut and fill volume
- Availability of materials
- Biomass management
- Construction and domestic waste management
- Spill prevention and control plan
- Soil loss prediction (pre, during and post development as well as with and without BMP scenarios)
- Projected runoff flows
- Calculation for BMP (sediment traps/basins, check dams, etc.)

MAP OF SITE PLAN WITH EXISTING CONDITION



- Topographic survey map
- Geological terrain map
- Erosion risk map
- Land use map
- Site development plan

ENVIRONMENTAL MAINSTREAMING AGENDA AND SELF-REGULATION CULTURE

- Full responsibility and accountability of the Project Proponent
- Regulatory compliance to the COA and other environmental requirements
- Embracing the environmental mainstreaming and self-regulation aspirations
- Portray positive image of good governance and corporate social responsibility to the public

ROLES AND RESPONSIBILITIES DURING POST-EIA STAGE

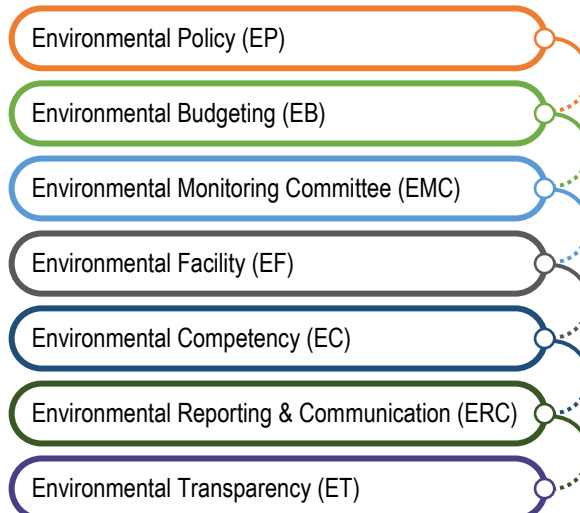
Implementation of EIA Conditions of Approval (COA) and P2M2 requires the involvement of several parties:

- | | |
|--------------------------------------|-------------------------|
| ■ DOE | ■ Project Proponent |
| ■ AELB (nuclear power projects) | ■ Environmental |
| ■ Environmental Officer/Radiological | Consultant |
| Environmental Protection Officer | ■ Environmental Auditor |

ENVIRONMENTAL MANAGEMENT PLAN

- A living document that states explicitly on:
 - actions to be taken;
 - measures to be instituted; and
 - structures to be built
- Needs to be revised and updated
- Includes LD-P2M2 document

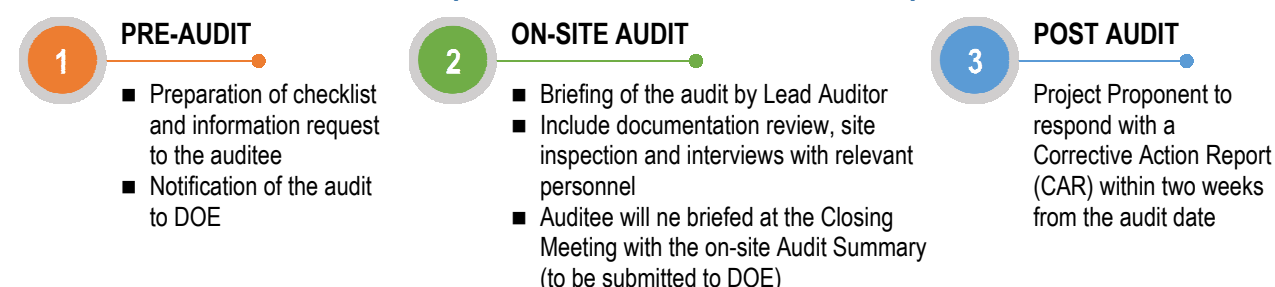
ENVIRONMENTAL MAINSTREAMING TOOLS



ENVIRONMENTAL MONITORING

- Conducted after the EMP document has been approved and the physical work of the project is about to commence
- Can be grouped into three different aspects; Impact Monitoring (IM), Performance Monitoring (PM) and Compliance Monitoring (CM)
- Monitoring programme: Physical environment, biological environment

ENVIRONMENTAL AUDIT (TYPICAL AUDIT PROCESS)



ENVIRONMENTAL SUSTAINABILITY REPORT

- An organisational report that gives information about environmental performance, compliance and monitoring
- Can be made up of several reports, e.g. environmental reports (Compliance Report and Monitoring Report)

ENVIRONMENTAL DATABASE

- Recommended to be established to assist the Project Proponent in managing issues in an effective way
- Benefits: Environmental scanning, A Fact Library, financial viability

Chapter 8

TOR AND EIA CHECKLIST

- Checklists to assist the Qualified Person in preparing:
 - TOR/ESI; and
 - EIA.
- Both checklists must be filled in and incorporated at the front of the respective reports.
- Can also be used by the EIATRC as a reference.

- Specific format for the EIA report, as detailed in Appendix 9 of EGIM.
- Consist of cover page, preliminary pages, chapters arrangement and appendices

FIRST / SECOND SCHEDULE
ENVIRONMENTAL IMPACT ASSESSMENT REPORT
NAME OF PROJECT PROPONENT
PROJECT TITLE VOLUME XY
PROPOSED PROJECT GRAPHIC (ILLUSTRATION)
MONTH/YEAR

EIA report cover

PROJECT PROPONENT'S LETTERHEAD
ENVIRONMENTAL PLEDGE FROM PROJECT PROPONENT
Environmental Impact Assessment (First Schedule) for
I hereby declare that the entire EIA Report is the product of the EIA Consultant engaged by my company and all the facts stated in the Report and the accompanying information are to the best of my knowledge and belief true and correct, and that I have not withheld or distorted any material facts. I agree and I undertake the responsibility to implement all the pollution prevention and mitigating measures (P2M2) described in the EIA Report, in the Environmental Management Plan (EMP) and in the Land Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2) as proposed by the EIA Consultant. I have allocated sufficient funds for the above purpose.
Name : NRIC Number : Designation : Signature : Date : Company's Stamp :

Environmental Pledge by the Project Proponent

EIA STUDY TEAM LEADER'S LETTERHEAD
DECLARATION FROM EIA STUDY TEAM LEADER
Environmental Impact Assessment (First Schedule) for
I declare that the entire EIA Report is the product of my own and the work of my team members (i.e. other consultants who are also Qualified Persons) who worked under my supervision and all the facts stated in the Report and the accompanying information are to the best of my knowledge and belief true and correct, and that I have not withheld or distorted any material facts. I have briefed the Project Proponent on the content of the Report and highlighted to him all the pollution prevention and mitigating measures (P2M2) described in it, and in the Environmental Management Plan (EMP), and in the Land Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2), and the Project Proponent has agreed to implement them (i.e. P2M2).
Name of EIA Consultant Team Leader : NRIC Number : Designation : Signature : Date : Company's Stamp :

Declaration by the Qualified Person

Chapter 9

EIA REPORT FORMAT

MAIN TEXT OF THE EIA REPORT



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ABBREVIATIONS

$\mu\text{g}/\text{m}^3$	micrograms per cubic metre	ERC	Environmental Reporting and Communication
$\mu\text{S}/\text{cm}$	microsiemens per centimetre	ERCMC	Environmental Regulatory Compliance Monitoring Committee
AGC	Attorney General Chambers	ERP	Emergency Response Plan
AI	Appointed Individual	ESA	Environmentally Sensitive Area
APCS	air pollution control system	ESC	Erosion and Sediment Control
ASEAN	Association of Southeast Asian Nations	ESI	Environmental Scoping Information
BAT	Best Available Technology	ESCP	Erosion and Sediment Control Plan
BKSA	Water Regulatory Body	ESR	Environmental Sustainability Report
BMP	Best Management Practice	ET	Environmental Transparency
BOD	Biochemical oxygen demand	FGD	Focus Group Discussion
CePEOEIA	Certified Professional Environmental Officer in EIA Project Development and Operation	FIA	Fisheries Impact Assessment
CESSWI	Certified Erosion, Sediment and Storm Water Inspector	FOS	Factor of Safety
CFS	Central Forest Spine	FRIM	Forest Research Institute of Malaysia
cfu	colony-forming unit	GA	Government Agencies
CH_4	Methane	GCD	gabion check dams
CIDB	Construction Industry Development Board	GIS	Geographic Information System
CISEC	Certified Inspection of Sediment and Erosion Control	GPPPP	Garis Panduan Perancangan Pemuliharaan dan Pembangunan
CITES	Convention on International Trade in Endangered Species	GPS	Global Positioning System
CM	compliance monitoring	GTM	Geological Terrain Mapping
CO	Carbon monoxide	H_2S	Hydrogen sulphide
COA	Conditions of Approval	HIA	Health Impact Assessment
dB	decibels	HQ	headquarters
dba	A-weighted decibels	HRA	Health Risk Assessment
DID	Department of Irrigation and Drainage	HSE	Health, Safety and Environment
DO	Development Order	HWC	Human-Wildlife Conflict
DO	Dissolved oxygen	Hz	hertz
DOE	Department of Environment	IACRR	International Association for Coastal Reservoir Research
DOF	Department of Fisheries	ICZM	Integrated Coastal Zone Management
DOSH	Department of Occupations Safety and Health	IETS	Industrial Effluent Treatment System
EAP	Emergency Action Plan	IFM	Integrated Flood Management
EB	Environmental Budget	IKRAM	Malaysian Institute of Labour
EC	Environmental Competency	ILM	Integrated Lake Management
EERE	Office of Energy Efficiency and Renewable Energy	IM	impact monitoring
EESIM	Environmental Essentials for Siting of Industries in Malaysia	IRBM	Integrated River Basin Management
EF	Environmental Facility	IRDA	Iskandar Regional Development Authority
EGiM	Environmental Impact Assessment Guidelines in Malaysia	ISMP	Integrated Shoreline Management Plan
EIA	Environmental Impact Assessment	IUCN	International Union for Conservation of Nature
EIATRC	EIA Technical Review Committee	IWK	Indah Water Konsortium
EMC	Environmental Monitoring Committee	IWRM	Integrated Water Resources Management
EMP	Environmental Management Plan	JAKOA	Department of Orang Asli Development
EMR	Environmental Monitoring Report	JKPTG	Department of Director General of Lands and Mines Federal
EMT	Environmental Mainstreaming Tools	JKR	Public Works Department
EO	Environmental Officer	JMG	Department of Mineral and Geoscience Malaysia
EP	Environmental Policy	JPSM	Forestry Department Peninsular Malaysia
EPMC	Environmental Performance Monitoring Committee	JUPEM	Department of Survey and Mapping Malaysia
EPMD	Environmental Performance Monitoring Document	km	kilometre
EQA	Environmental Quality Act	KM	Planning Permission
		LAC	Limit of Acceptable Change

ABBREVIATIONS

LCP	Development Proposal Report	PSAR	Preliminary Safety Analysis Report
LD-P2M2	land disturbing pollution prevention and mitigation measures	QRA	Qualitative/Quantitative risk assessment
LLM	Malaysian Highway Authority	RCC	roller compacted concrete
LoS	Level of Safety	REMP	Radiological Environmental Management Plan
m	metres	RFZPPN	National Physical Plan for Coastal Zone
MAAQS	Malaysian Ambient Air Quality Standards	RIA	Radiological Impact Assessment
MarDep	Marine Department	RKK	Special Area Plans
MARPOL	The International Convention for the Prevention of Pollution from Ships 1973/1978	RUSLE	Revised Universal Soil Loss Equation
MESTECC	Ministry of Energy, Science, Technology, Environment and Climate Change	SAINS	Syarikat Air Negeri Sembilan
METMalaysia	Malaysian Meteorological Department	SAMM	Laboratory Accreditation Scheme of Malaysia
mg/l	milligrams per litre	SAR	Safety Analysis Report
ml	millilitre	SATU	Syarikat Air Terengganu
mm/s	millimetre per second	SDG	Sustainable Development Goals
MMWQS	Malaysian Marine Water Quality Standards	SI	Soil Investigation
MOH	Ministry of Health	SIA	Social Impact Assessment
MOTAC	Ministry of Tourism, Arts and Culture Malaysia	SIMP	Social Impact Management Plan
MRA	Marine Risk Assessment	SO ₂	Sulphur dioxide
MSMA	Urban Stormwater Management Manual	SPAN	National Water Resources Commission
MUSLE	Modified Universal Soil Loss Equation	SSA	Site Suitability Assessment
NCIA	Northern Corridor Implementation Authority	STP	sewage treatment plant
NGO	non-governmental organization	STS	Sewage Treatment System
NO ₂	Nitrogen dioxide	SZIRA	Guidelines for Siting and Zoning of Industry and Residential Areas
NPP	National Physical Plan	TBT	tributyltin
NPPC	National Physical Plan Council	TCU	true colour units
NRE	Ministry of Natural Resources and Environment	TIA	Traffic Impact Assessment
NTU	Nephelometric turbidity unit	TNB	Tenaga Nasional Berhad
NWRP	National Water Resources Plan	TOR	Terms of Reference
NWQS	National Water Quality Standards for Malaysia	TORAC	TOR Adequacy Check
O ₃	Ozone	UNDP	United Nations Development Programme
P2M2	pollution prevention and mitigation measures	UPEN	State Economic Planning Unit
PAH	polycyclic aromatic hydrocarbons	US	United States
PE	Professional Engineer	WBS	work breakdown structure
PERHILITAN	Department of Wildlife and National Parks Peninsular Malaysia	WMP	Wildlife Management Plan
PLANMalaysia	Federal Department of Town and Country Planning	WQI	National Water Quality Index
PTD	Land Registry Offices	ZOI	Zone of Impact
PTG	State Land and Mines Office	ZOS	Zone of Study
PM	performance monitoring		
PMR	Performance Monitoring Report		
PPE	personal protection equipment		

GLOSSARY

Active Treatment System (ATS) Treatment of runoffs using a mechanical system with the application of coagulants and flocculants to promote the settling of suspended solids out of the aqueous phase. Only coagulants and flocculants which have been approved for use by environmental agencies such as USEPA or similar authorities are allowed to be used.

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 from DOE and other agencies.

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 (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.

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).

Disposal Area A designated or gazetted area specifically for the storage of wastes or excess materials generated from construction and during operation.

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.

GLOSSARY

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 Action Plan (EAP) A document prepared by Dam Owner which contains predetermined plan of action to be taken to reduce the potential for loss of life, environmental damages and economic losses affect by dam breach. It is a continually updated set of instructions and maps, with reference to the dam break study, that deal with possible emergency situations or unusual occurrences at or related to a dam or reservoir.

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 Performance Monitoring Committee (EPMC) Organisational setup within the Project Proponent which shall 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) Organisational 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) A special area that is very sensitive to any changes in the ecosystem as a result of natural processes or activities in or around the area, either directly or indirectly

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 organisation 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) Personnel 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 regards to performance monitoring of pollution control measures, scheduled reporting, record keeping, competent persons and involvement of environmental professionals with specific roles.

Health Impact Assessment (HIA) A report which assesses the health impacts of policies, plans and projects 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.

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 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) A legal pledge document by the Project Proponent to prevent, mitigate and control the discharge from the development area containing the major pollutant (suspended solids) resulting from land disturbing activities through the protection of natural resources by preservation and conservation, reduction of waste generation and releases or discharges of pollutants to land, air and water and incorporation of BMPs and techniques to attain compliance with the EIA COA.

L₁₀ Level exceeded for 10% of the time and takes account of any annoying peaks in noise.

L₅₀ Level exceeded for 50% of the time and takes account of any annoying peaks in noise.

L₉₀ Level exceeded for 90% of the time and takes account of any annoying peaks in noise.

L_{Aeq} A-weighted, equivalent continuous sound level in decibels measured over a stated period of time.

L_{max} Highest sound level measured during a single noise event.

L_{min} Lowest sound level measured during a single noise event.

Marine Risk Assessment (MRA) Technical document which studies the existing marine traffic of the project area, identifying constraints for navigation and risk of potential collision or mishaps during vessel operations.

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.

Modeling To simulate a particular feature of the world using mathematical and computer aids to better understand, define, quantify and visualise 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.

GLOSSARY

Orang Asli Collective term for ethnic groups who are widely regarded as comprising Peninsular Malaysia's original inhabitants as defined under Aboriginal Peoples Act 1954 (Act 134).

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.

PM_{2.5} Atmospheric particulate matter (PM) that have a diameter of less than 2.5 micrometers.

PM₁₀ Atmospheric particulate matter (PM) that have a diameter of less than 10 micrometers.

Pollution Prevention and Mitigation Measures (P2M2) The various methods (structural and non-structural) required to ensure that pollution does not occur or at least minimised 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 prepare 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, organisation 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) under EQA 1974 to carry out an EIA study, e.g. Environmental Consultant.

Revised TOR Final version of the TOR after incorporation of comments from the TRC and additional information.

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 Categorisation of Prescribed Activities divided into the First Schedule (EIA without need for public display and public comments and will be processed by DOE State) and Second Schedule (EIA requiring public display and public comments 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 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.

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, IAs 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 of the scoping process which sets the objectives, defines the scope, and establishes the strategy and schedule for EIA process to address identified significant issues. Typically, the TOR is complemented by an ESI.

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.

Traffic Impact Assessment (TIA) A study on the condition of the roads and traffic (level of service) 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 use. Comprises of various types of wastes, such as municipal wastes, scheduled wastes, biomass wastes, etc.

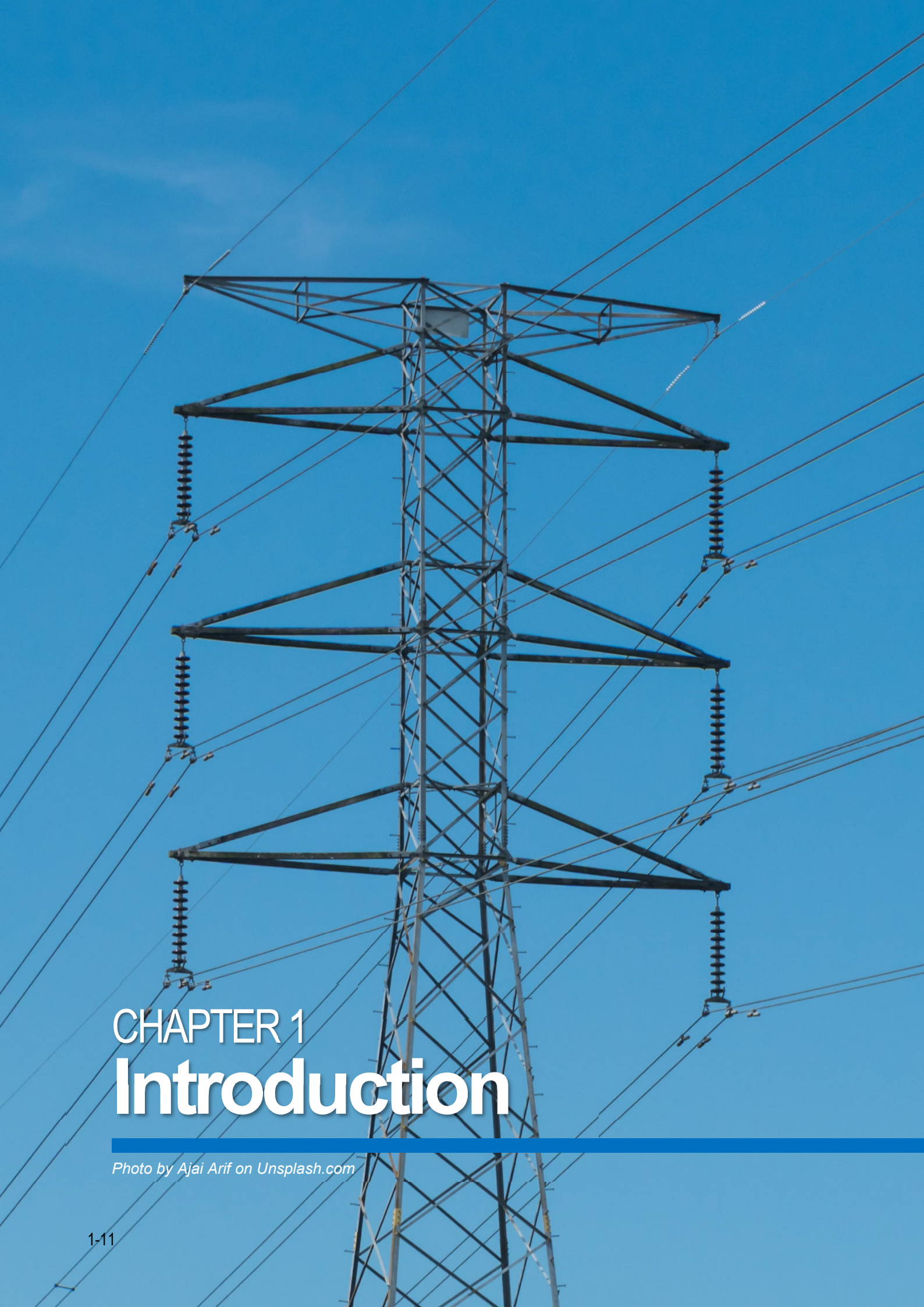
Water Quality A term to describe the chemical, physical and biological characteristics of water, usually with respect to its suitability for a particular purpose.

Water Quality Index (WQI) An index integrating six water quality parameters to provide a general categorisation to determine the condition of the water source.

Wildlife Management Plan (WMP) A technical report that outlines implementation steps to increase, preserve and manage wildlife impacted from a project, both during construction and operation project. The management plan usually contains maps, descriptive documents, and records of progress and change.

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.



CHAPTER 1 Introduction

Photo by Ajai Arif on Unsplash.com

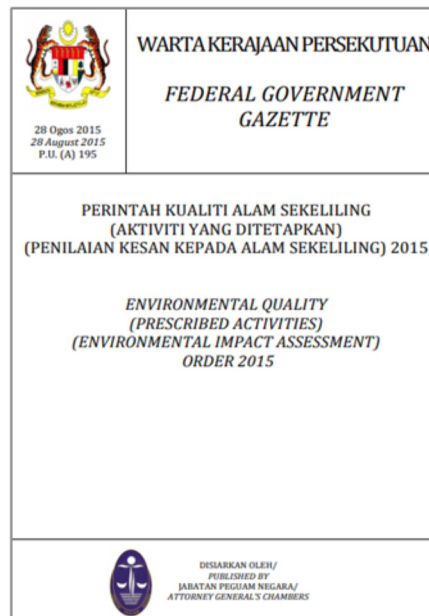
1.1 INTRODUCTION

This document is entitled:

'Environmental Impact Assessment (EIA) Guidelines for Power Generation and Transmission

This document shall be as **"the Guideline"** hereinafter. It supersedes the '*EIA Guidelines for Power Generation and/or Transmission Projects*' published in 2009.

The Guideline adopts the latest amendments in the Environmental Quality Act 1974 (EQA 1974) (Act 127), mainly the Environmental Quality (Prescribed Activities) (EIA) Order 2015 (hereinafter to be referred to as "the EIA Order 2015"). The EIA Order 2015 replaced EIA Order 1987 that had been referred to in the previous guideline.



EIA Order 2015

1 INTRODUCTION

The Guideline also incorporates all new elements that have been introduced by the Department of Environment (DOE) with regards to EIA through its other recent guidelines, directives and notifications such as:

- i) Environmental Impact Assessment Guidelines in Malaysia (EGiM);
- ii) Guidelines on Land Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2), 2017;
- iii) Environmental Mainstreaming Directive, 2017; and
- iv) announcement on the requirement to engage qualified consultants to prepare detailed design of pollution control systems at the EIA study stage.

Additionally, this document also considers current practices in terms of policy, technology, design, mitigating measures and environmental management.

This includes relevant information and description that enable the stakeholders to understand the overall concept of EIA and the possible environmental issues that may arise from the proposed project.

This Guideline complements EGiM and thus should be read together with other guidelines relevant to the prescribed activity. Compliance with the requirements as set out in this Guideline and EGiM will thereby fulfil the obligations of the Project Proponent as specified in the Section 34A (2C) of the EQA 1974, and/or any amendments thereafter.

1.2 OBJECTIVES OF THE GUIDELINE

The Guideline is structured to supplement the general guidelines specified in the EGiM and to improve the effectiveness of the current EIA procedures by:

- i) providing a clear and concise guidance document on EIA preparation to the Project Proponent, DOE officers, qualified person (s), stakeholders, government agencies (GAs), appointed individuals (AIs), non-governmental organisations (NGOs) and other EIA-related practitioners;
- ii) facilitate integration of the EIA into the overall project planning and development cycle;
- iii) ensuring compliance with and adherence to the legal requirements within the framework of environmental sustainability;
- iv) providing a detailed step-by-step guidance with explanations of the EIA procedures and submissions, comprising Environmental Scoping Information (ESI), Terms of Reference (TOR), EIA reporting and post-EIA;
- v) defining 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 applicable requirements by other authorities or agencies, to facilitate overall decision-making and EIA approval; and
- vi) providing an integrated framework for decision making for the DOE to assess the EIA report.

1.3 SCOPE OF THE GUIDELINE

The scope of this guideline covers five prescribed activities under Activity 11 – Power Generation and Transmission of the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015. There are three prescribed activities under the First Schedule and two prescribed activities under the Second Schedule.

The relationship or summary between each prescribe activity is shown in *Figure 1.1*.

PREScribed ACTIVITY NO. 11: POWER GENERATION AND TRANSMISSION

FIRST SCHEDULE

- Construction of steam generated power station using fossil fuels (other than coal) and having capacity of 10 megawatts (MW) or more, with or without transmission line.
- Construction of combined cycle power station, with or without transmission line.
- Construction of transmission line in environmentally sensitive area.

SECOND SCHEDULE

- Construction of coal fired power station and having the capacity of 10 megawatts or more with or without transmission line.
- Construction of nuclear-fuel power station with or without transmission line.

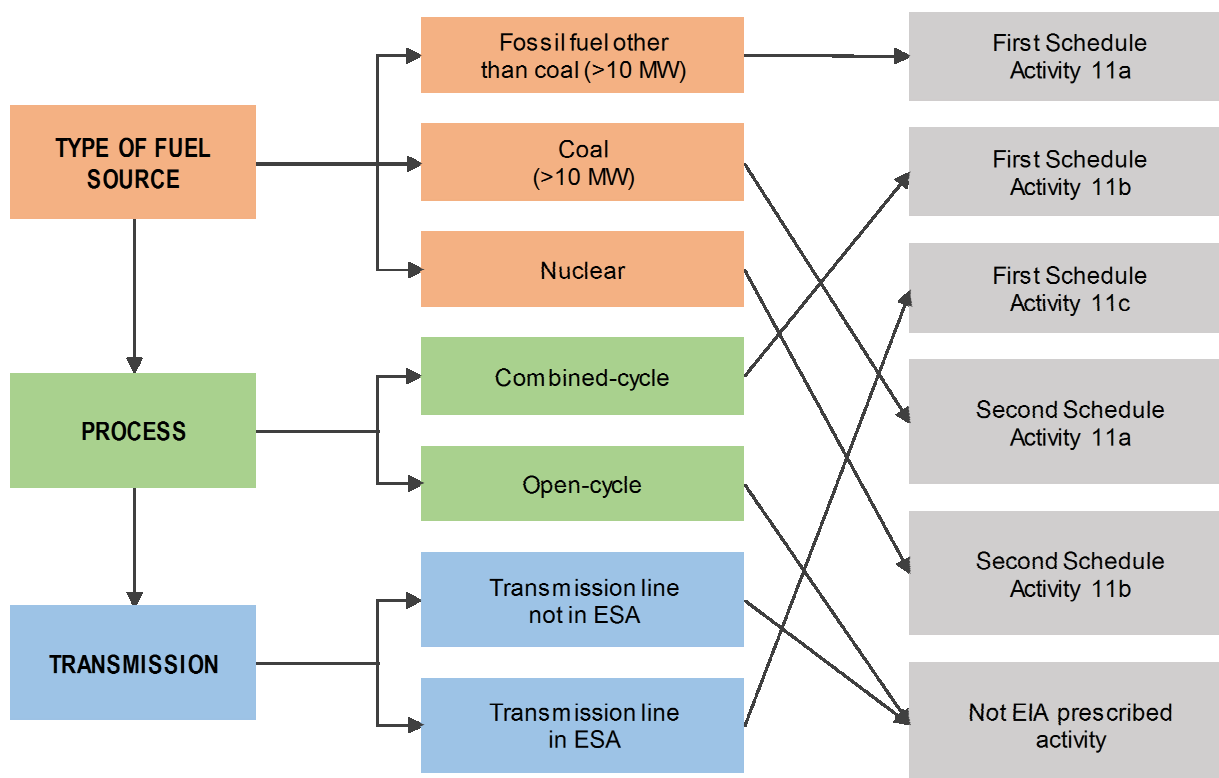


FIGURE 1.1 Relationship between each prescribed activity under Power Generation and Transmission

1.4 TERMS AND DEFINITIONS

As specified in the EIA Order 2015, power generation and transmission falls under Prescribed Activity 11 of the EIA for both First Schedule and Second Schedule. The definition for Power Generation and Power Transmission are shown in *Figure 1.1*. *Table 1.1* and *Table 1.2* describe the relevant terms and definitions for each activity.

POWER GENERATION	POWER TRANSMISSION
Defined as the process of generating electricity from various sources of primary energy. The production of power is carried out in power stations.	Process of transmitting electricity using transmission lines.

Source:

1. Energy Commission (ST)
2. Tenaga Nasional Berhad (TNB)

FIGURE 1.1 Definition of power generation and power transmission

TABLE 1.1 Terms and definition for Activity 11 of the EIA (First Schedule)

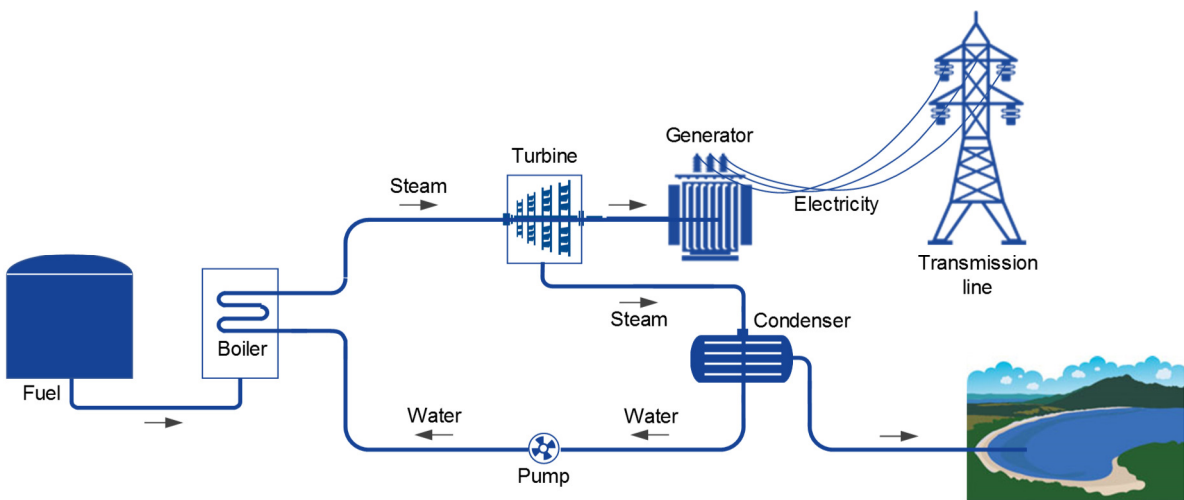
FIRST SCHEDULE: ACTIVITY 11a
Construction of steam generated power station using fossil fuels (other than coal) and having capacity of 10 MW or more, with or without transmission line.
Steam generated power station A steam generated power station is designed to convert heat from the combustion of a fuel into mechanical energy using steam. The mechanical energy is then transformed by electric generators into electric power. 

TABLE 1.1 (cont'd)

Terms and definition for Activity 11 of the EIA (First Schedule)

FIRST SCHEDULE: ACTIVITY 11a	
Construction of steam generated power station using fossil fuels (other than coal) and having capacity of 10 MW or more, with or without transmission line.	
Fossil fuels (coal is fossil fuel but excluded following the First Schedule above) Fossil fuels power stations typically burn the hydrocarbon fuels in boilers to generate steam that drives large turbines that produce electricity. Three main types of fossil fuels: ■ Natural Gas Natural gas is one of the petroleum products, produced from a combustible mix of hydrocarbon gases. It is colourless and consists mainly of methane (CH₄). Natural gas is popular as fuel in power station. ■ Oil Oil fuels commonly used are the derivatives of crude oils including distillate oil (such as diesel) and residual fuel oil (such as medium fuel oil). ■ LPG LPG is heavier than natural gas and stored under modest pressures in its liquid form, thus making it easier to be transported and stored. LPG is rarely used in power station due to higher cost. Megawatt Megawatt (MW) is a unit to measure electric power with 1 MW is equivalent to 1,000,000 watts. For example, 1 MW of a coal power station's capacity can supply around 400 to 900 average homes (US NRC).	



Natural gas burning in Burgan oil field, Kuwait

Source:

1. Energy Commission (ST)
2. Tenaga Nasional Berhad (TNB)
3. Britannica Encyclopedia
4. U.S. Energy Information Administration
5. National Geographic

TABLE 1.1 (cont'd) Terms and definition for Activity 11 of the EIA (First Schedule)**FIRST SCHEDULE: ACTIVITY 11b**

Construction of combined cycle power station, with or without transmission line.

Combined cycle power station

A combined-cycle power plant uses both a gas and a steam turbine together to produce up to 50 percent more electricity from the same fuel than a traditional simple-cycle plant. The waste heat from the gas turbine is routed to the nearby steam turbine, which generates extra power.

- **Typical Plant Function**

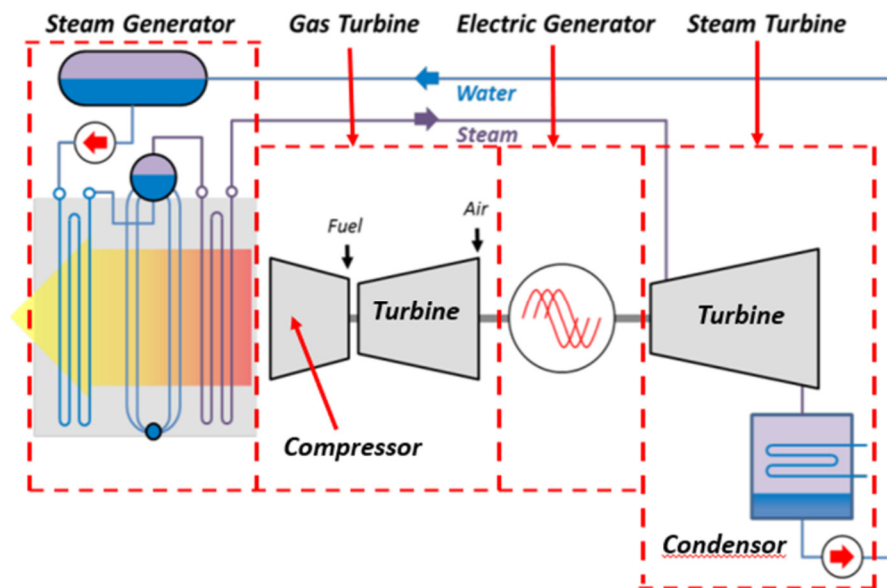
The air and fuel are combusted at high pressure and thus producing high pressure and temperature flue gas that entered a gas turbine. The fast-spinning turbine drives a generator that converts into a portion of the spinning energy into electricity.

- **Heat recovery system captures exhaust**

A Heat Recovery Steam Generator (HRSG) captures exhaust heat from the gas turbine that would otherwise escape through the exhaust stack, generate steam and delivers it to the steam turbine.

- **Steam turbine delivers additional electricity**

The steam turbine sends its energy to the generator drive shaft, where it is converted into additional electricity.



Source: Flowserve Corporation, 2019

TABLE 1.1 (cont'd)

Terms and definition for Activity 11 of the EIA (First Schedule)

FIRST SCHEDULE: ACTIVITY 11c

Construction of transmission line in environmentally sensitive area.

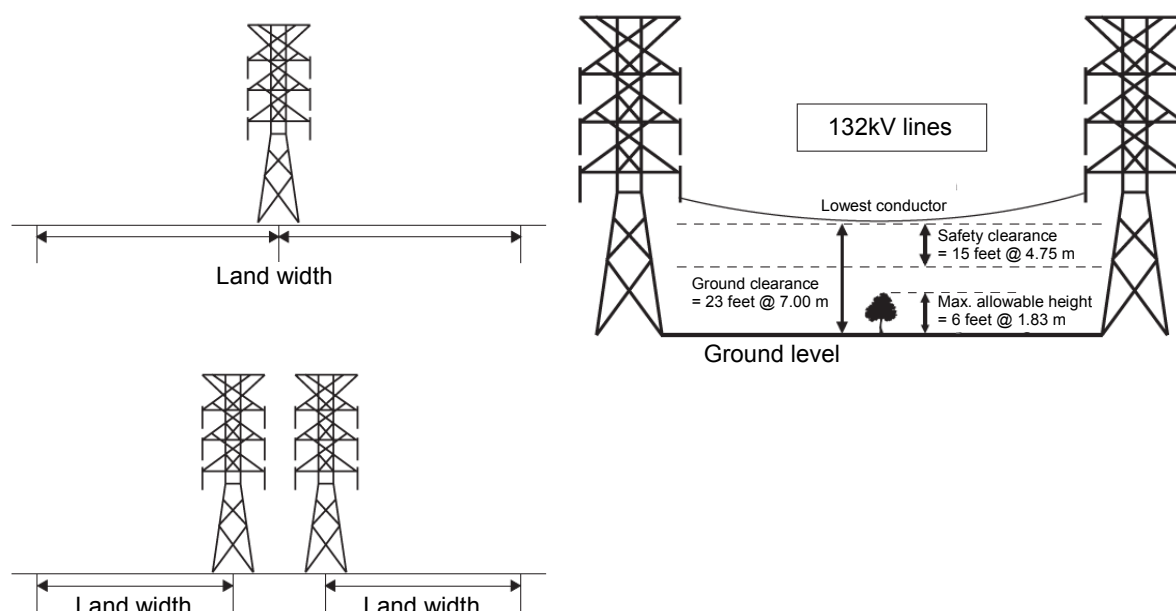
Transmission line

The overhead transmission line which consists of tower, conductor and insulator whereby the conductor is designed to carry electric power (132 kV and above) from generation stations to substations. Transmission lines may also be laid underground or submerged in water (the sea or river). The substation shall distribute the power via underground cables or aerial bundle cable to residents or other. (Source: TNB and ST)

Table 1: Width of Land for Lattice Tower in Accordance to Transmission Corridor Area and Voltage Level

Type of Transmission Corridor Area	Voltage Level		
	132kV	275kV	500kV
Width of transmission corridor in forest area	30 m	30 m	35 m
Width of transmission corridor in other than forest area	20 m	20 m	25 m

For monopole transmission towers which involve voltage level of 132kV, the width of land which has been practiced by the utility is 5.5 metres.



1 INTRODUCTION

TABLE 1.1 (cont'd) Terms and definition for Activity 11 of the EIA (First Schedule)

FIRST SCHEDULE: ACTIVITY 11c	
Construction of transmission line in environmentally sensitive area.	
Environmentally sensitive area (ESA) A particular area that is sensitive to any forms of alteration to its ecosystem due to natural processes or activities within or around it, either directly or indirectly. ESA is categorised into three ranks i.e. Rank 1, Rank 2 and Rank 3. Source: NPP-3 (PLANMalaysia, 2016)	

TABLE 1.2 Terms and definition for Activity 11 of the EIA (Second Schedule)

SECOND SCHEDULE: ACTIVITY 11a	
Construction of coal fired power station and having the capacity of 10 MW or more with or without transmission line.	
Coal fired power station Coal fired power station makes use of coal combustion energy to produce steam that finally generate electricity. A typical process involves coal handling and preparation which include coal pulverising into a fine powder by a large grinder. Pulverised coal is then fired into a boiler where combustion occurs in suspension. The heat of combustion is transferred to boiler tubes and converted into high pressure steam that turns steam turbine and subsequently turn an electric generator to produce electricity. The schematic diagram is shown in section 1.5 Scope of Prescribed	Coal It is a flammable black or brown organic sedimentary rock which is mostly carbon and typically found as layers (coal beds) or veins (coal seams). It is a common fuel used in power stations. Emission from the type of coal to be used must adhere to Clean Air Regulation 2014 requirements. Appropriate technologies shall be applied to address emission issues should coal sulphur and ash content are high  Coal Source: https://www.nationalgeographic.org/encyclopedia/fossil-fuels/
	

TABLE 1.2 (cont'd)

Terms and definition for Activity 11 of the EIA (Second Schedule)

SECOND SCHEDULE: ACTIVITY 11b

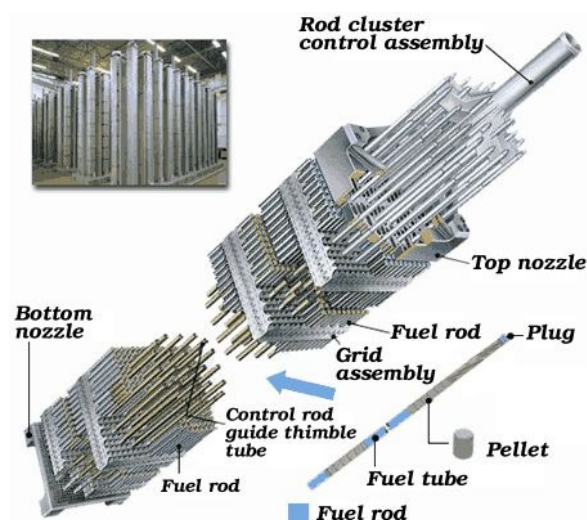
Construction of nuclear-fuel power station with or without transmission line.

Nuclear-fuel power station

The nuclear-fuel power station uses a nuclear reactor to produce and control the release of energy from splitting of the atoms (a process called fission) of certain elements (e.g. uranium, plutonium). The energy released from continuous fission of the atoms of the fuel is harnessed as heat in either a gas or water and is used to produce steam. The steam is used to drive the turbines which produce electricity (as in most fossil fuel plants).

There are many types of nuclear power reactors, but most common one are:

- Pressurized Water Reactor (PWR);
- Boiling Water Reactor (BWR);
- Pressurized Heavy Water Reactor; and
- Other types of reactors such as Advanced Gas Cooled Reactors Light Water Graphite Reactor.



PWR Nuclear Fuel Assembly
Source: World Nuclear Association

1.5 SCOPE OF PRESCRIBED ACTIVITIES

The scope of the prescribed activities under Activity 11 of the EIA for First Schedule and Second Schedule cover the fuel used, the type of process involved and the transmission line. Brief descriptions of the scope for each prescribed activity are listed in *Table 1.3* and *Table 1.4*.

TABLE 1.3 General description of the scope for Activity 11 of the EIA (First Schedule)

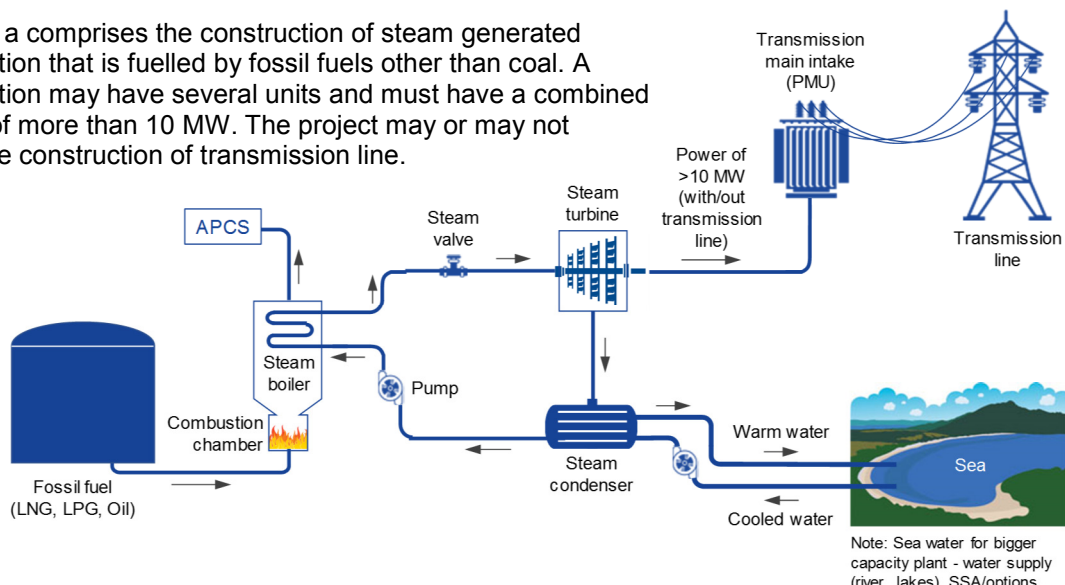
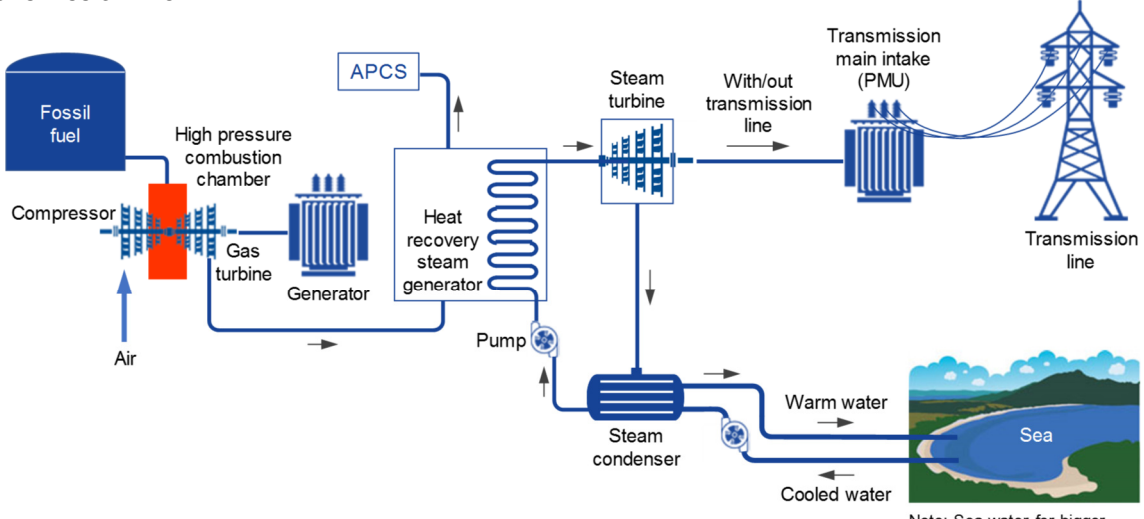
FIRST SCHEDULE: ACTIVITY 11a
Construction of steam generated power station using fossil fuels (other than coal) and having capacity of 10 MW or more, with or without transmission line.
Activity 11a comprises the construction of steam generated power station that is fuelled by fossil fuels other than coal. A power station may have several units and must have a combined capacity of more than 10 MW. The project may or may not include the construction of transmission line.  Note: Sea water for bigger capacity plant - water supply (river, lakes). SSA/options.
FIRST SCHEDULE: ACTIVITY 11b
Construction of combined cycle power station, with or without transmission line.
Activity 11b comprises the construction of a combined cycle power station regardless of the type of fuel used including renewable energy. A combined cycle power station uses both gas and steam turbine together to produce higher efficiency in electricity conversion from the same fuel compared to a normal simple open-cycle station. A combined cycle power station normally has a bigger combined capacity than a open-cycle station. The project may or may not include the construction of transmission line.  Note: Sea water for bigger capacity plant - water supply (river, lakes). SSA/options.

TABLE 1.3 (cont'd) General description of the scope for Activity 11 of the EIA (First Schedule)

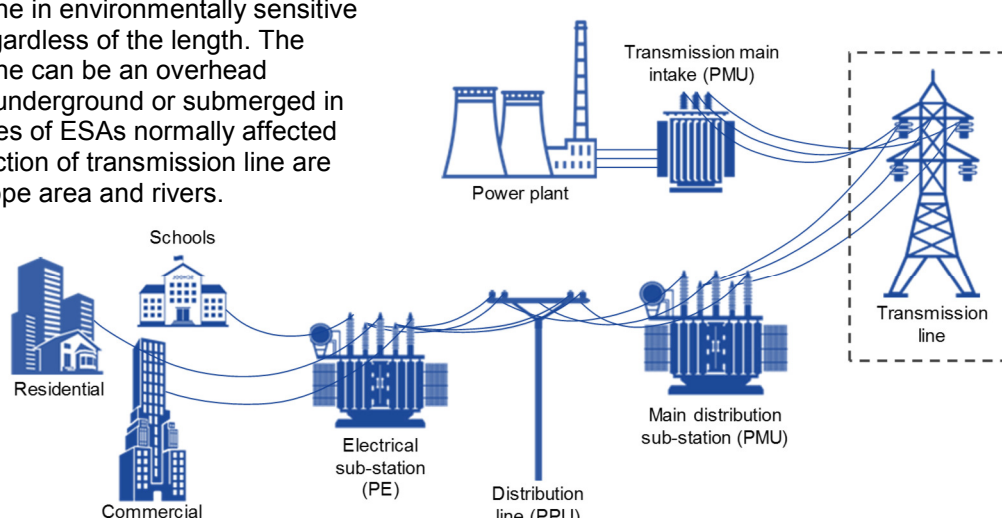
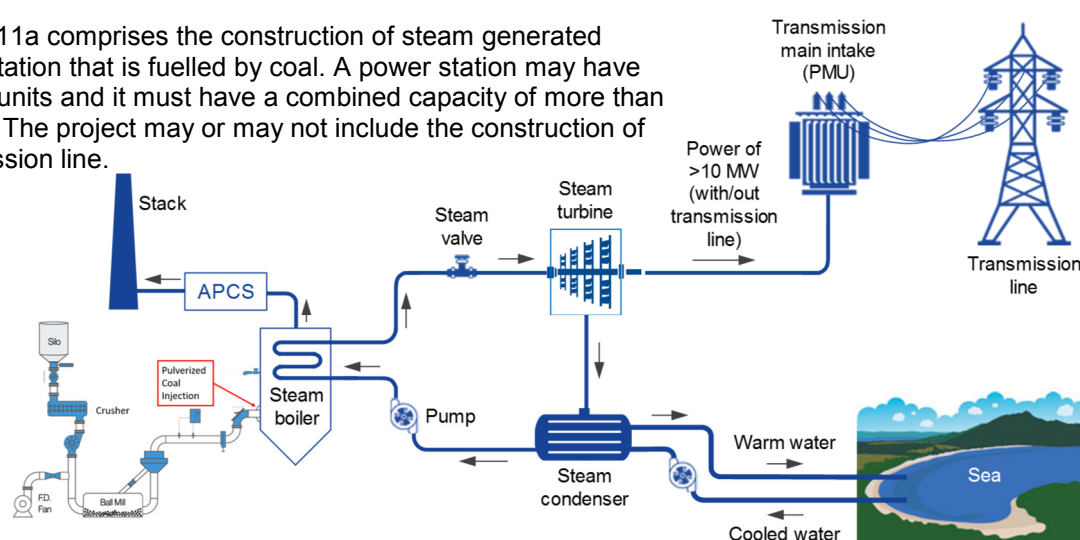
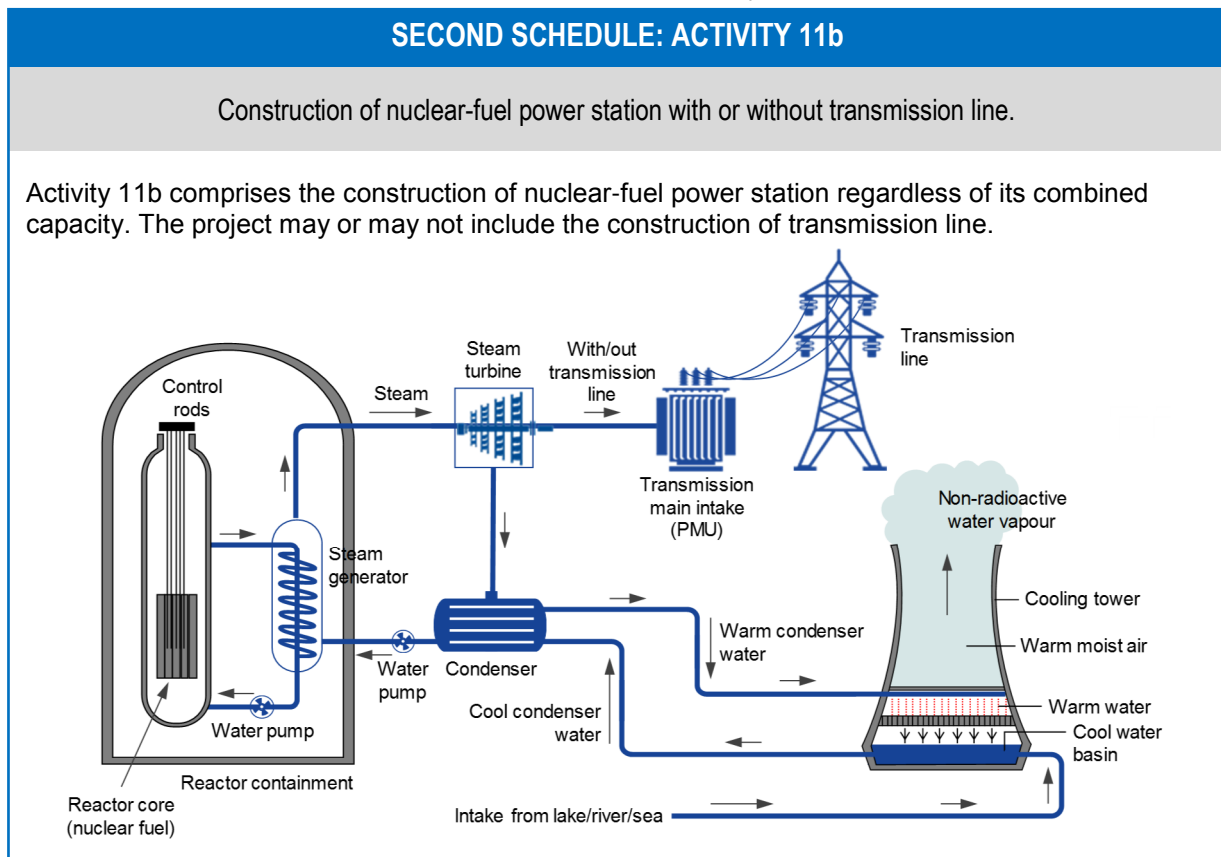
FIRST SCHEDULE: ACTIVITY 11c	
Construction of transmission line in environmentally sensitive area.	
Activity 11c comprises the construction of transmission line in environmentally sensitive area (ESA) regardless of the length. The transmission line can be an overhead structure, laid underground or submerged in water. Examples of ESAs normally affected by the construction of transmission line are forest area, slope area and rivers.	 Note: 1. PPU is under distribution line. 2. Distribution line in ESA may be subjected to EIA as well. Source: <i>Panduan Piawai Rekabentuk Pencawang Elektrik</i>

TABLE 1.4 General description of the scope for Activity 11 of the EIA (Second Schedule)

SECOND SCHEDULE: ACTIVITY 11a	
Construction of coal fired power station and having the capacity of 10 MW or more with or without transmission line.	
Activity 11a comprises the construction of steam generated power station that is fuelled by coal. A power station may have several units and it must have a combined capacity of more than 10 MW. The project may or may not include the construction of transmission line.	 Note: Sea water for bigger capacity plant - water supply (river, lakes). SSA/options.

1 INTRODUCTION

TABLE 1.4 (cont'd) General description of the scope for Activity 11 of the EIA (Second Schedule)



1.6 EIA REPORT REQUIREMENT

EIA report is required for the prescribed activities specified in the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015 including Activity 11 for both First Schedule and Second Schedule as stipulated in Section 34A of the Environmental Quality Act (EQA) 1974. It is also applicable to both Sarawak and Sabah except for 11(c): Construction of transmission line in environmentally sensitive area. Any person intending to carry out any prescribed activity shall appoint a qualified person to conduct an EIA and to submit a report thereof to the Director General in the manner as the Director General may prescribe.

[Note: The Project Proponent or the Qualified Person must always consult with the DOE for the final decision whether or not the EIA report is required. The conditions stated below are of the typical case but may change depending on a case-by-case basis.]

1.6.1 Scenarios that Require EIA

EIA report requirements for the case of expansion of power station and transmission line depends on several conditions as described below.

1.6.1.1 Expansion of Power Station: Construction of Additional Units

The expansion of power station may involve increase of the capacity by the addition of units along with its respective terminal and fuel handling facility. A typical power station unit comprises of a boiler or a reactor, air pollution control system (APCS), turbine and the generator which generates a certain capacity in MW. If the new unit(s) have a capacity of more than 10 MW, an EIA is required to address the impacts from the construction and operation of the additional units and facilities due to additional potential emission to the environment or new areas to be cleared. For nuclear power station, an EIA is required regardless of its capacity. The expansion is subjected to First Schedule Activity 11a and 11b as well as Second Schedule Activity 11a.

1.6.1.2 Expansion of Transmission Line: Construction of Additional Line Alignment

If the construction of additional transmission line alignment is conducted in ESAs, the activity shall fall under Activity 11c of the First Schedule. However, this is not applicable to construction of transmission line in Sabah and Sarawak as mentioned above.

1.6.1.3 Construction of Distribution Line in ESAs

Should the distribution line is to be constructed in an ESA such as rivers, forests, slope areas, etc.; the activity is subject to EIA and falls under the relevant prescribed activities such as:

- i) First Schedule - Activity 5: Forestry Activity; 13: Development in Slope Area; and
- ii) Second Schedule - Activity 5: Forestry; Activity 12: Development in Coastal Area, National Park and State Park; Activity 13: Development in Slope Area.

1.6.1.4 Power Generation Using Renewable Energy Source

With the emergence of new technologies in Malaysia, there are many renewable energy sources that are being used and explored as a more environmentally friendly and sustainable alternative. Renewable energy power generation does not fall under the scope of this guideline, however, it may fall under other prescribed activities in the EIA Order 2015 such as:

- i) First Schedule - Activity 5: Forestry Activity; 13: Development in Slope Area; and
- ii) Second Schedule - Activity 5: Forestry; Activity 12: Development in Coastal Area, National Park and State Park; Activity 13: Development in Slope Area; Activity 14: Waste Treatment and Disposal; Activity 15: Construction of Dam.

1.7 OVERVIEW OF THE EIA PROCESS

This section provides an overview of the step-by-step guide to the preparation of an EIA study for power generation and transmission. Each step is briefly described and reference made to each chapter is listed in *Table 1.5*.

TABLE 1.5 Step-by-step guide for the EIA process

STEP	DESCRIPTION	REFERENCE IN THE GUIDELINE
1. Project Proponent to provide project brief and technical studies	■ The Project Proponent must provide basic information about the proposed project in order for the Qualified Person to understand the intent, objectives and scope of the proposed project. ■ The basic information includes: i) project location with coordinates; ii) project boundary; iii) project acreage; and iv) project layout plan and components. ■ This is to assist the Qualified Person to determine whether the proposed project falls under the Prescribed Activity 11 of the EIA for First Schedule and Second Schedule of the EIA Order 2015.	Chapter 1
2. Identify applicable policies, laws and guidelines	The Project Proponent is required to identify and comply with the relevant legal requirements before submitting the EIA report to the DOE State and HQ for approval.	Chapter 2
3. Carry out preliminary stakeholders' engagement	■ It is important for the Project Proponent to carry out stakeholders engagement prior to preparing the Terms of Reference (TOR) and Environmental Scoping Information (ESI) reports. ■ Constant engagement with DOE is advisable (via the designated officer in charge), as well as with the relevant government agencies (GAs). This is to ensure the scoping is comprehensively covered in the EIA report.	Chapter 2
4. Prepare TOR and ESI report	■ TOR and ESI must be submitted for endorsement before submission of EIA report. ■ Qualitative data will suffice. However, quantitative data can also be included if available. ■ These reports must cover the followings: i) Site Suitability Assessment (SSA); ii) determine project and study boundaries iii) overview baseline data iv) identify current issues and constraints within the project site; v) identify existing site conditions and ESAs; vi) predict potential impacts; and vii) propose appropriate mitigation measures.	Chapter 3
5. Submit TOR and ESI	■ The TOR and ESI prepared by the Qualified Person must follow the format as documented in the EGIM and this Guideline. ■ The TOR and ESI must be submitted to DOE HQ for review and endorsement.	Chapter 3

TABLE 1.5 (cont'd) Step-by-step guide for the EIA process

STEP	DESCRIPTION	REFERENCE IN THE GUIDELINE
6. Collect baseline data	■ After the TOR endorsement, data collection must be carried out to obtain information of the existing environment and surroundings of the project site. ■ Two approaches will be used for the data collection which are primary data and secondary data. i) Primary data: - Site survey, ground-truthing and sampling programmes. ii) Secondary data: - Relevant reports and literatures from various government departments and agencies; and - Studies performed for other projects within the project's vicinity.	Chapter 4
7. Prepare EIA report	■ The EIA study must covers the following main components: i) assess impacts of the project against baseline by comparing scenarios 'before project' and 'after project'; ii) predict impacts qualitatively and measure quantitatively; iii) identify and predict the environmental issues during pre-construction, during construction and operation stages of the project; iv) propose applicable pollution prevention and mitigation measures (P2M2s) during pre-construction, during construction and operation stages of the project; and v) provide post-EIA framework including Environmental Management Plan (EMP) and Environment Mainstreaming Tools (EMTs) programmes.	Chapters 5, 6 and 7
8. Carry out stakeholders' engagement	■ Upon completion of the draft EIA report, a stakeholder engagement must be carried out by the Project Proponent and assisted by the Qualified Person. ■ The potential stakeholders are local communities, business operators etc., who are likely to be directly or indirectly affected by the project. ■ The main objectives of these engagements are: i) to brief the stakeholders about the project, the potential environmental impacts and the proposed P2M2s; and ii) to seek stakeholders concern and feedback regarding the project. ■ All findings from the public engagements shall be incorporated into the final EIA report.	Chapter 2
9. Completion of EIA report	■ Key findings from all the relevant technical studies must be incorporated into the EIA report. ■ The EIA report prepared by the Qualified Person must follow the format as documented in the EGIM and this Guideline.	Chapter 8
10. Submit EIA report and carry out Public Display	■ Hard copy and soft copy (in PDF format) of the EIA report must be submitted to DOE HQ for approval. ■ Concurrently, the Project Proponent must engage major newspaper companies to advertise and announce the availability of the EIA report for public review. ■ The proposed locations for the EIA report to be displayed must obtain prior approval from the DOE HQ. ■ The public can vet through the EIA report and give their comments to the DOE HQ throughout the public display period.	Chapter 8

TABLE 1.5 (cont'd) Step-by-step guide for the EIA process

STEP	DESCRIPTION	REFERENCE IN THE GUIDELINE
11. Post-EIA	■ Once the EIA is approved, the Project Proponent must appoint a Qualified Person to prepare an EMP report for submission and approval from the relevant State DOE. ■ The Project Proponent must also implement the EMTs to ensure the project is regulatory-compliant and the environmental agendas are achieved.	Chapter 9

1.8 STRUCTURE OF THE GUIDELINE

The structure of the Guideline is as following:

Chapter 1 INTRODUCTION	Provides the terms and definition of the prescribed activities, scope, overview of EIA study and structure of the Guideline.
Chapter 2 ENVIRONMENTAL PROJECT PLANNING	Outlines relevant legal requirements and policies throughout the life cycle of a power generation and transmission project.
Chapter 3 TERMS OF REFERENCE (TOR)	■ Provides the procedures to conduct environmental scoping in order to prepare TOR and ESI documents. ■ Presents the structure and content of TOR document, including an overview of the TOR review and endorsement process.
Chapter 4 ENVIRONMENTAL	Outlines the relevant baseline data information to be incorporated in the EIA report.
Chapter 5 EVALUATION OF IMPACTS	■ Provides the methodology and tools to identify, predict, evaluate and assess the potential significant environmental impacts. ■ Details the requirement of LD-P2M2 and its procedure.
Chapter 6 MITIGATION MEASURES	Identifies applicable P2M2s to minimise negative impacts from the project.

Chapter 7 POST-EIA	■ Outlines the EMP and EMT frameworks. ■ Provides roles and responsibilities during post-EIA stage. ■ Details out the environmental monitoring, audit, sustainability report and database.
Chapter 8 TOR AND EIA CHECKLIST	Provides the checklist for environmental review criteria for TOR and EIA approval. The checklist is prepared to assist projects proponents, consultant, and DOE.
Chapter 9 EIA REPORT FORMAT	Outlined the format of an EIA Report.

An aerial night photograph of Kuala Lumpur, Malaysia. The city is densely packed with buildings, many of which are brightly lit. In the foreground, a large, well-lit football field is visible, surrounded by trees and smaller buildings. The city extends to the horizon under a dark night sky.

CHAPTER 2

Environmental Project Planning

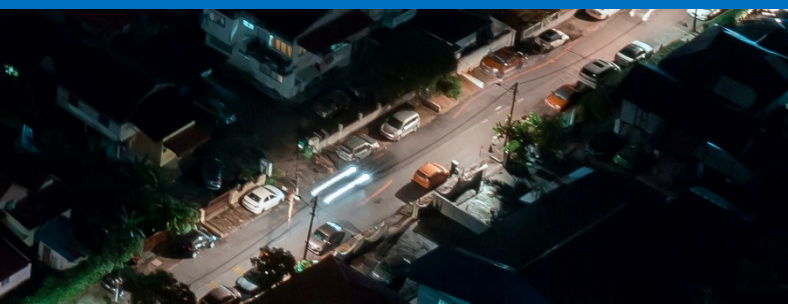
Kuala Lumpur
Photo by Wengang Zhai on Unsplash.com



2.1 INTRODUCTION

EIA is an integral part of the overall integrated project planning, which can provide benefits and value to any project. It is a tool to evaluate the potential impacts arising from a proposed project based on the physical, biological and human components of the environment. It identifies the key areas of environmental concerns for consideration during the project planning stage and provides a means to decide on the types of mitigation measures to avert or minimise the adverse impacts at an early stage.

The relevance of this understanding is important to ensure that environmental considerations are taken into account at the earliest possible stage of project planning, and not as an afterthought. Project delays are more often than not due to lateness in undertaking an EIA. Clear roles and responsibilities of each party in an EIA study is to establish the scope of the consultants involved in a Project. It is also to establish the scope or limit of the assessors to comment and ensure continuity of input during EIA report assessment.



2.2 POWER GENERATION AND TRANSMISSION CONCEPT

The main electricity company in Peninsular Malaysia is Tenaga Nasional Berhad (TNB), which covers both the generation and transmission. TNB is also the biggest shareholder for the electrical company Sabah Electricity Sdn. Bhd. (SESB) in Sabah. Meanwhile, Sarawak Energy Berhad (SEB) is the energy company responsible for the generation, transmission and distribution of electricity for Sarawak state.

There are a number of Independent Power Producer (IPP) companies that only generate electricity but channel the transmission to TNB. In Malaysia, the use of hydro, coal and other fossil fuel are most popular in supplying power throughout the country.

Malaysia is also looking at the usage of new power sources such as nuclear power, as well as the various emerging renewable energy power sources including solar, wind, geothermal and biogas just to name a few.

The energy sources can be split into two namely non-renewable and renewable sources.

NON-RENEWABLE ENERGY SOURCE

- Coal
- Oil
- Natural gas
- Liquefied Petroleum Gas (LPG)
- Nuclear

RENEWABLE ENERGY SOURCE

- Hydro
- Solar
- Wind
- Geothermal
- Biomass
- Hydrogen
- Ocean

The following sections show the components for each type of power stations and transmission line.

2.2.1 Power Generation Project Components

The components for power generation stations involve the machineries or processes within the respective type of power stations. Fuel preparations, firing methods, engineering safety and integrity and environmental considerations are different, depending on types of fuel.

The other major difference is the subsequent waste generation, with nuclear having the most difficult and challenging waste management, followed by coal and almost no waste for oil and gas fuels.

2.2.1.1 Non-renewable Energy Source

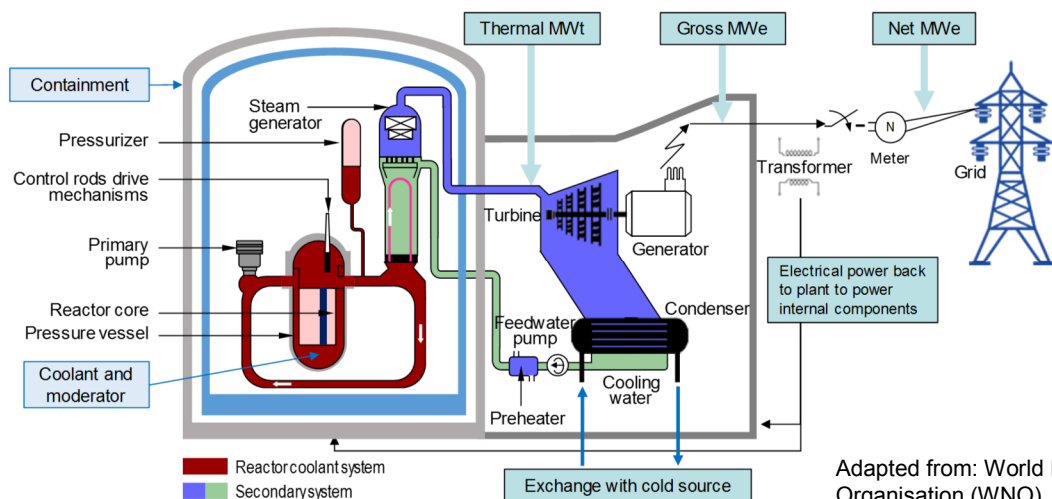
Non-renewable sources are energy sources that will eventually run out or will not be replenished. Most power generation in Malaysia uses non-renewable sources.

■ Fossil Fuel

Generally, a thermal power station using fossil fuel as its power source has major components that include fuel preparation system, boiler, air pollution control system (APCS), turbine, condenser and a flue-gas stack.

- i) **Fuel preparation system:** This system prepares the fossil fuel prior to going inside the combustion chamber. Examples of fuel preparation system include fuel gas dehumidifier/driers, carbon filters and fuel gas boosters.
- ii) **Boiler:** A boiler produces steam of the specified quality of the desired production rate. It also contains the combustion process to facilitate heat transfer from the flames and hot gases to the water and steam tubes. (Source: ST)

- iii) **APCS:** APCS is a system, device or equipment designed and installed primarily for the purpose of reducing or eliminating the emission of air contaminants to the atmosphere. (Source: EPA)
 - iv) **Turbine:** A turbine is a combustion engine that can convert natural gas or other liquid fuels or steam to mechanical energy which then drives a generator that produces electrical energy.
 - v) **Condenser:** A condenser in a power plant is to condense the steam from the turbine to be reused in the cycle and maximise turbine efficiency.
 - vi) **Flue-gas stack:** A flue-gas stack is a type of chimney, a vertical pipe, channel or similar structure through which combustion product gases called flue gases are exhausted to the outside air.
- **Nuclear**
- Major components of nuclear power station are almost identical to thermal power station except for the presence of a nuclear reactor in place of the boiler. There are several components common to most types of reactors:
- i) **Fuel:** Uranium is the basic fuel. Usually pellets of uranium oxide (UO_2) are arranged in tubes to form fuel rods. The rods are arranged into fuel assemblies in the reactor core.
 - ii) **Containment:** The structure around the reactor and associated steam generators which is designed to protect it from outside intrusion and to protect those outside from the effects of radiation in case of any serious malfunction inside. It is typically a metre-thick concrete and steel structure.
 - iii) **Steam generator:** Part of the cooling system of pressurised water reactors (PWR) where the high-pressure primary coolant bringing heat from the reactor is used to make steam for the turbine, in a secondary circuit. Essentially a heat exchanger is like a motor car radiator.
 - iv) **Moderator:** Material in the core which slows down the neutrons released from fission so that they cause more fission. It is usually water but may be heavy water or graphite.
 - v) **Control rods or blades:** These are made with neutron-absorbing material such as cadmium, hafnium or boron, and are inserted or withdrawn from the core to control the rate of reaction, or to halt it.
 - vi) **Coolant:** A fluid circulating through the core so as to transfer the heat from it. In light water (i.e. normal water) reactors the water moderator functions also as primary coolant.
 - vii) **Pressure vessel or pressure tubes:** Usually a robust steel vessel containing the reactor core and moderator/coolant, but it may be a series of tubes holding the fuel and conveying the coolant through the surrounding moderator.



2.2.1.2 Renewable Energy Source

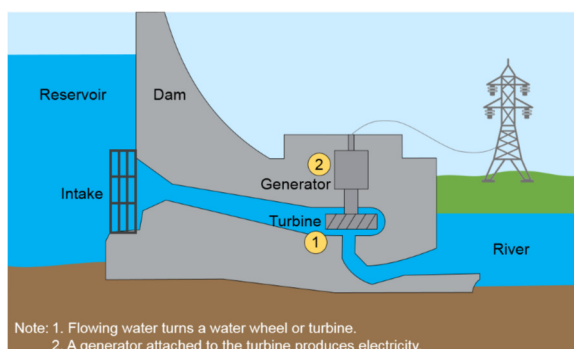
According to US Energy Information Administration, renewable energy is energy from sources that are naturally replenishing but flow-limited; which means it comes from renewable resources that are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time.

■ Hydro

Hydro is a widely used and considered as renewable energy in Malaysia. Several existing power stations have used hydro as the energy source such as the Ulu Jelai Power Station, Sungai Perak Power Station, Sultan Ismail Hydroelectric Power Station and many more. This activity falls under *Second Schedule Item 15: Construction of Dam* which is detailed in the EIA Guideline for the Construction of Dam.



Bakun Dam, Sarawak



Adapted from: US EPA

■ Solar

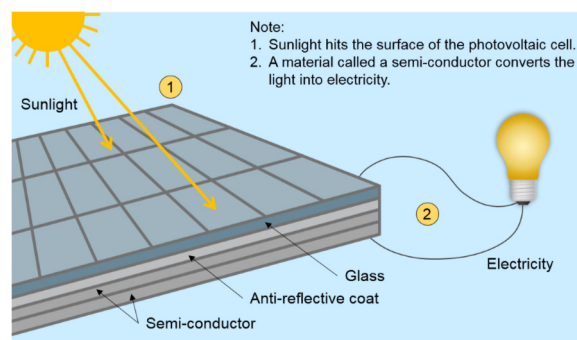
Solar energy technology is rapidly developing in Malaysia. Malaysia has an abundant source of solar power which encourages its implementation. This activity is not covered under this guideline but it can be covered under any other prescribed activities in the EIA Order 2015.

There are three ways to harness solar energy:

- i) Photovoltaic cells – most common in Malaysia;
- ii) Solar thermal technology; and
- iii) Passive solar heating.



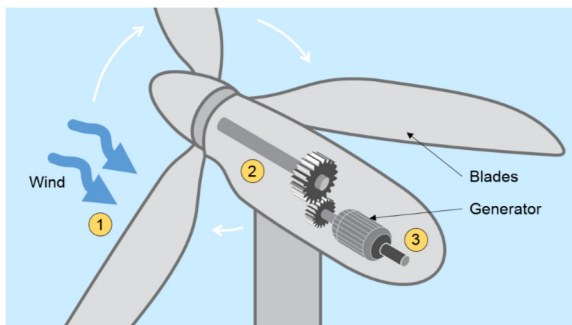
Rows of solar panels on the roof top of the United World College Southeast Asia in Singapore. (AFP Photo)
Source: <https://theaseanpost.com/article/malaysias-solar-sector-rise>



Adapted from: US EPA

■ Wind

Wind power is the fastest-growing energy source in the world, but in Malaysia, not all areas are suitable for wind power due to low wind speed. Wind energy is uncontrollable and requires special motors or controllers that drive the turbine blades when wind is not strong enough. This activity is not covered under this guideline but it can be covered under any other prescribed activities in the EIA Order 2015.



Note:

1. As the wind blows over the blades of a wind turbine, it causes the blades to lift and rotate.
2. The rotating blades turn a shaft that is connected to a generator.
3. The generator creates electricity as it turns.

Adapted from: US EPA



Solar panel installations and a wind turbine at the Phu Lac wind farm in southern Vietnam's Binh Thuan province. (Manan Vatsyayana / AFP Photo)

Source: <https://theaseanpost.com/article/malaysia-aseans-biggest-solar-employer>

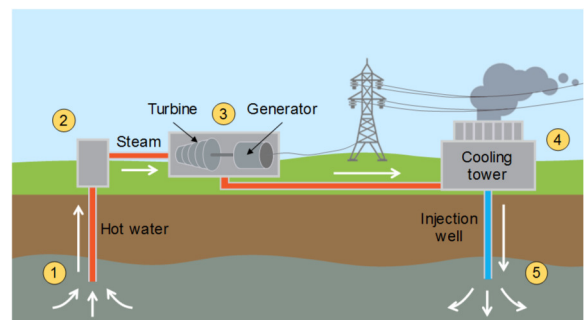
■ Geothermal

Geothermal energy is the heat that comes from the sub-surface of the earth. It is contained in the rocks and fluids beneath the earth's crust and can be found as far down to the earth's hot molten rock, magma. It requires digging of wells deep into underground reservoirs to access the steam and hot water which then used to drive the turbines connected to electricity generators. A geothermal power station may generate power using a combined-cycle power system, thus making it fall within the scope of this guideline under Activity 11b: Construction of combined cycle power station, with or without transmission line.



The Nesjavellir Geothermal Power Station in Iceland
Credit: Greta Ivarsson

Source: <https://www.power-technology.com/features/what-is-geothermal-energy/>



Note:

1. Hot water is pumped from deep underground through a well under high pressure.
2. When the water reaches the surface, the pressure is dropped, which causes the water to turn into steam.
3. The steam spins a turbine, which is connected to a generator that produces electricity.
4. The steam cools off in a cooling tower and condenses back to water.
5. The cooled water is pumped back into the Earth to begin the process again.

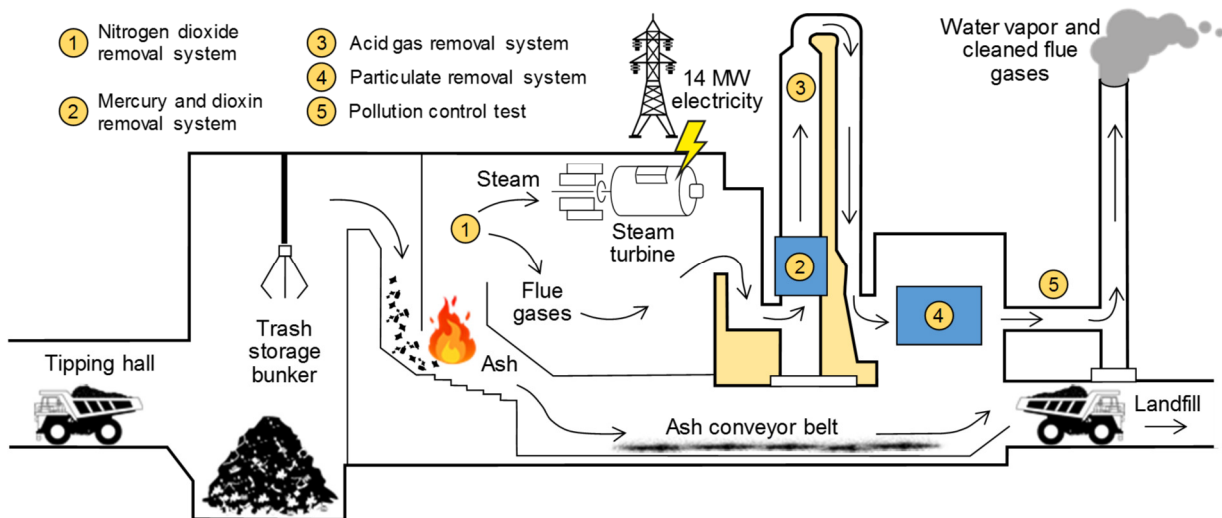
Adapted from: US EPA

■ Biomass/Waste to Energy

Biomass is organic material that comes from plants and animals which contains stored energy from the sun. Solid biomass, such as wood and garbage, can be burned directly to produce heat.

Municipal solid waste (MSW) which contains biomass is usually burned at special Waste-to-Energy (WtE) stations that use heat from the fire to make steam for generating electricity.

This activity may fall under *Second Schedule Item 14(b)(i): Solid Waste: Construction of Thermal Treatment Plant.*

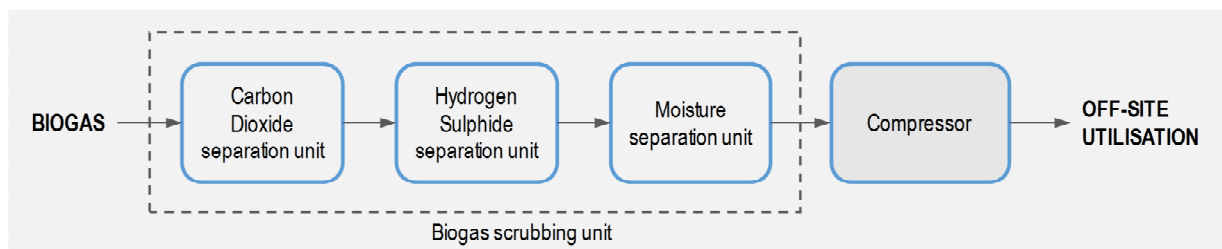


Waste to energy plant diagram
Adapted from: Ecomaine

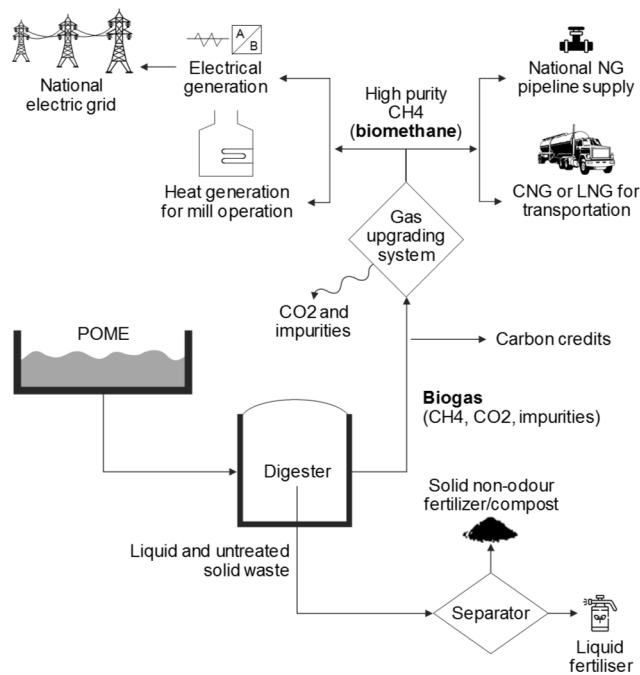
■ Biogas

In Malaysia, biogas can be sourced from palm oil mill effluent (POME) which produces methane gas via anaerobic digestion. However, the location of POME biogas stations are located in rural area which is far away from point of demand. Thus, POME biogas is transported for offsite usage. The biogas must be treated first before it is being transported.

This activity does not require an EIA.



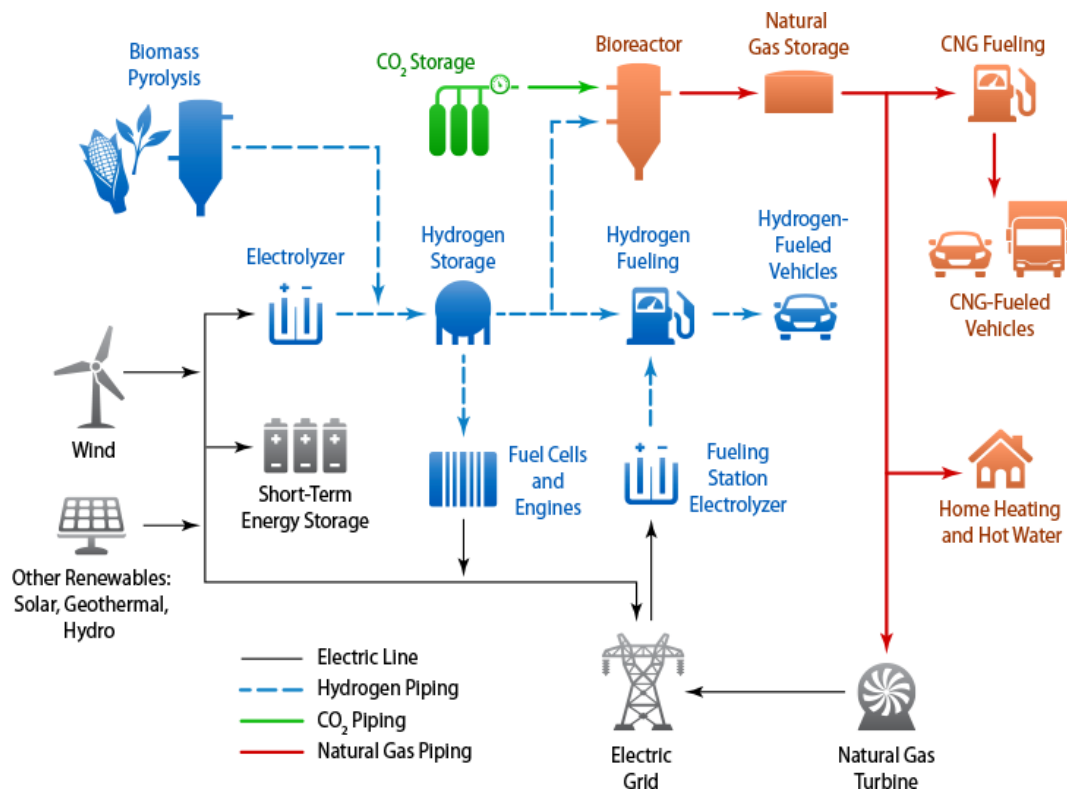
Typical gas upgrading system



Note: CNG - Compressed Natural Gas
Adapted from: M. Junaidi *et. al.* (2016)

■ Hydrogen

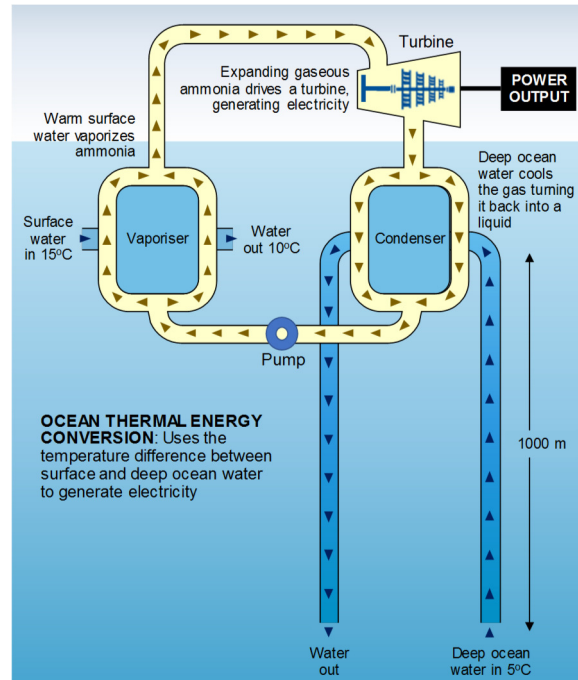
Hydrogen burns to produce only emit water, thus no pollutants. Thus, it is increasingly being used to fuel passenger cars and buses. Due to its light weight but high energy density, it is used as rocket fuel and air balloons. Through fuel cell technology, it is increasingly being used as power source. It is the lightest and the most abundant element in the universe. However, hydrogen is locked up in enormous quantities in water, hydrocarbons and other organic matter, which requires substantial energy to unlock it. As such, it requires external energy like renewable energy source such as wind, solar, hydro and geothermal, fossil fuel as well as nuclear to liberate it from the primary source. The success of hydrogen economy relies very much on the primary energy price which is required in cracking the hydrogen out from its primary source. This activity may fall within the scope of this guideline (Activity 11 under First and Second Schedule) depending on the type of primary source used.



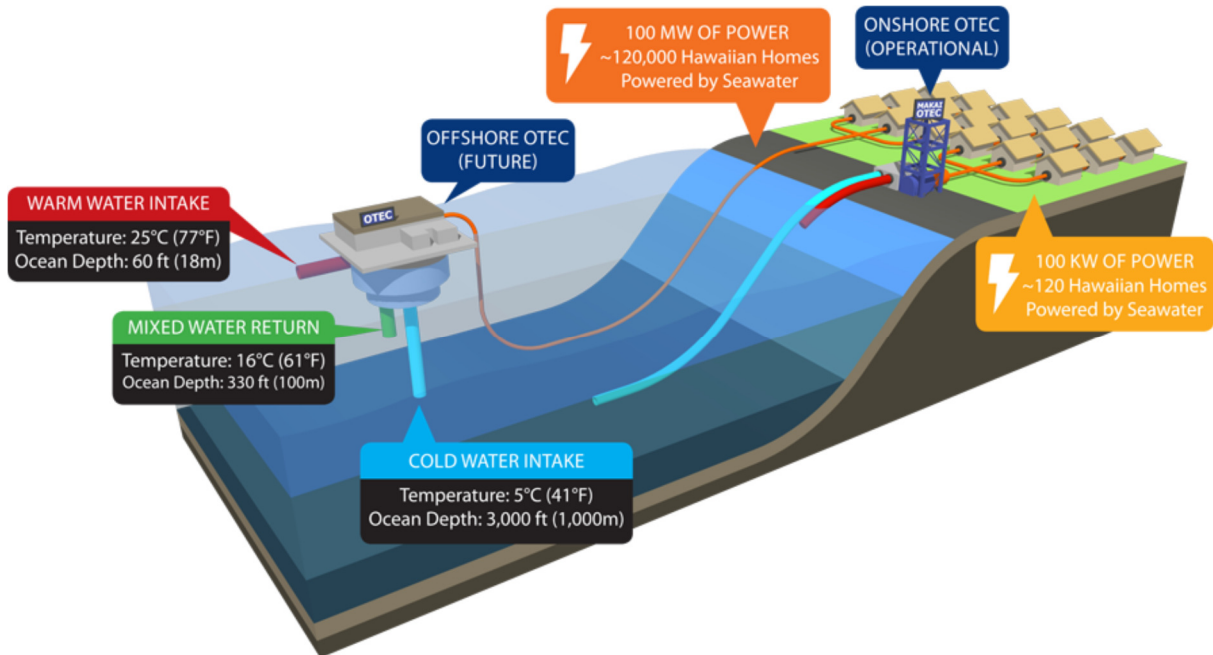
Note: CNG – Compressed Natural Gas
Example of hydrogen generated from renewable energy
Source: National Renewable Energy Laboratory (NREL)

■ Ocean Thermal Energy Conversion Power Station

Ocean Thermal Energy Conversion (OTEC) is a process that can produce electricity by using temperature difference between deep cold ocean water and warm surface waters. It uses the thermal gradient to drive turbines for electricity generation. Warm seawater helps to vaporise the working liquid (ammonia), i.e. a phase change, which becomes gaseous ammonia that spins the turbine to generate electricity. The gaseous ammonia then passes through the extracted cold seawater, making it in liquid form again allowing it to be recycled. This activity is not covered under this guideline but it can be covered under any other prescribed activities in the EIA Order 2015.



Source: Patrick Brown, 2013



Source: Makai Ocean Engineering

2.3 GOVERNANCE STRUCTURE OF POWER GENERATION AND TRANSMISSION

In Malaysia, the authority to make decision on planning development is a shared responsibility of the Federal and State Government. According to the Town and Country Planning Act 1976 (Act 172):

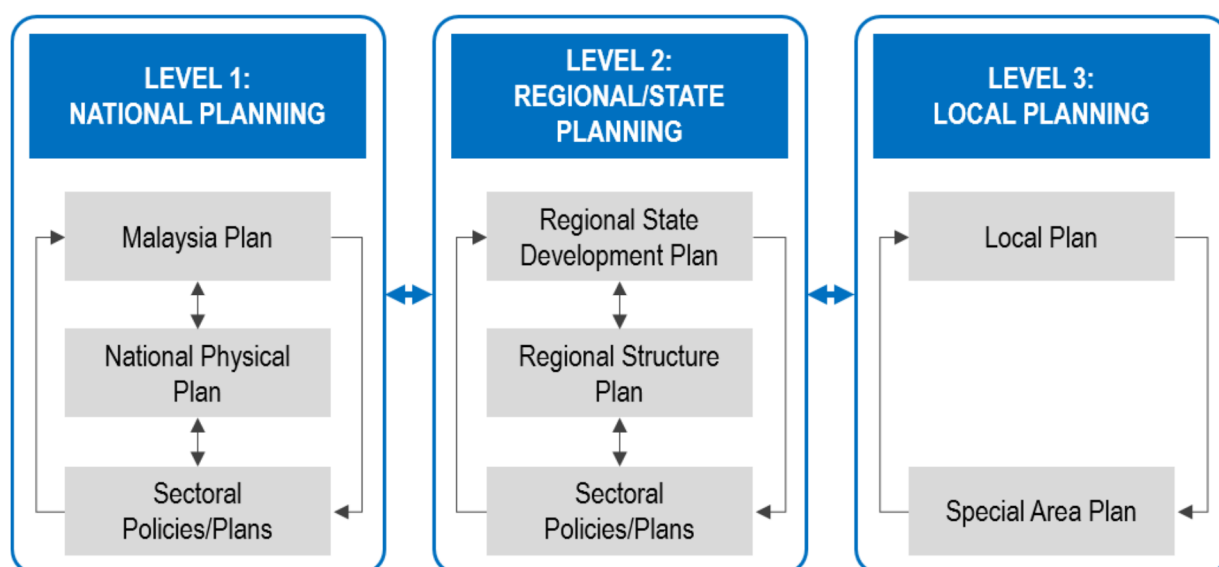
“Section 20B. (1) Without prejudice to section 20A, it shall be the duty of every Federal Government and State Government department or agency to seek advice from the Council on a development proposal relating to-

b) any construction of a major national infrastructure including –

*(i) airports, seaports, inland ports, railway transportation networks, highways, **power stations**, dams and toxic waste disposal sites;*

Thus, any power generation/power station projects must seek advice from the National Physical Planning Council (NPPC) prior to its implementation. The development process in Malaysia is governed through a 3-tiered process, known as the National Development Planning Framework. The essence of this framework is embodied through the enactment of the Town and Country Planning Act 1976 (Act 172). This Act provides the legal framework of which the functions of the federal, state and local governments are stipulated, as illustrated in Figure 2.1. This applies to all power station projects in Malaysia.

However, nuclear power station implementation specifically require a comprehensive and integrated planning as well as strong commitment from the government at national level in order to ensure long-term sustainability.



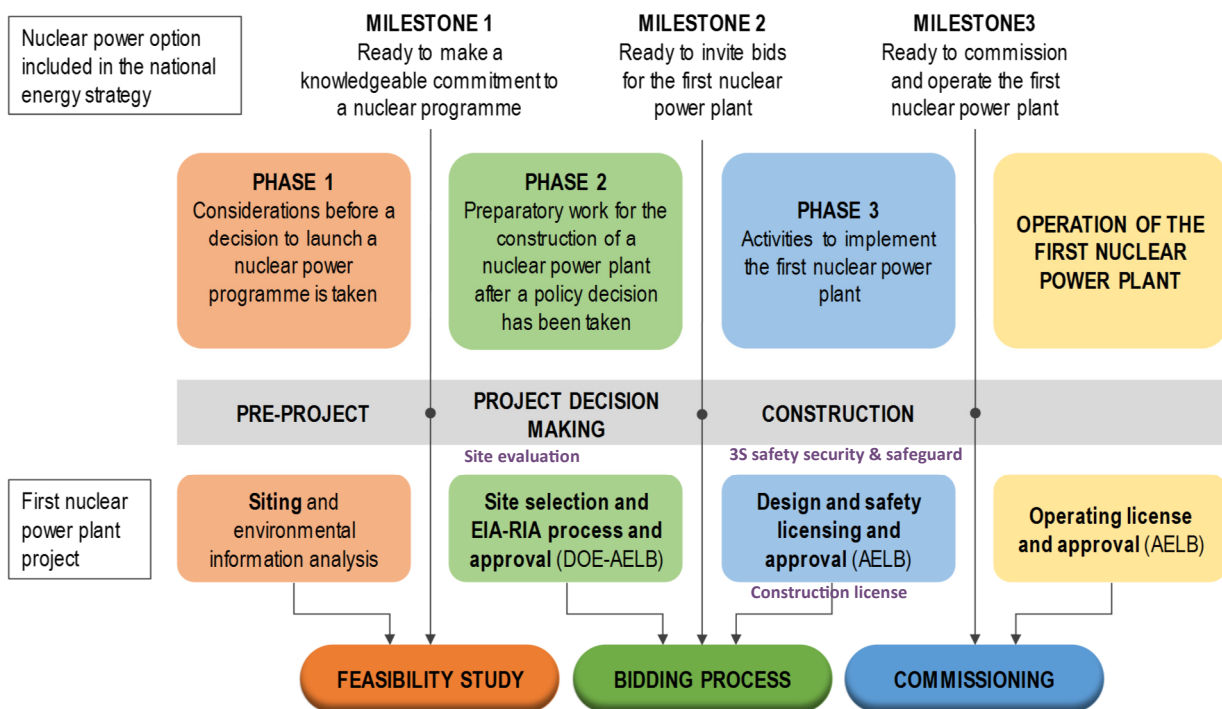
Source: National Physical Plan-2, Federal Department of Town and Country Planning, Ministry of Housing and Local Government, Malaysia

FIGURE 2.1 National Development Planning Framework

2 ENVIRONMENTAL PROJECT PLANNING

The planning and assessment must cover the overall phases as shown in *Figure 2.2*.

The Pre-Project stage (Phase 1) in *Figure 2.2* involves the formulation of national policy and masterplan for nuclear power station projects. A Nuclear Energy Project Implementation Organisation (NEPIO) shall be in charge of formulating the national masterplan in Malaysia and shall coordinate across relevant stakeholders including AELB, Malaysian Nuclear Agency and DOE (*Figure 2.3*).



Source: Managing Environmental Impact Assessment for Construction and Operation in New Nuclear Power Programmes (IAEA, 2014)

FIGURE 2.2 Pre-EIA, site selection and EIA process requirement sequence roadmap in a nuclear power project

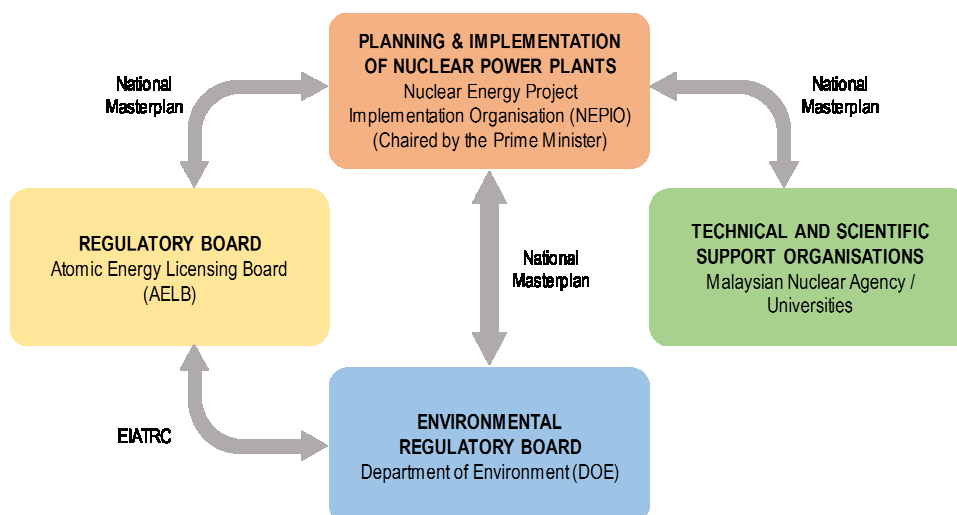
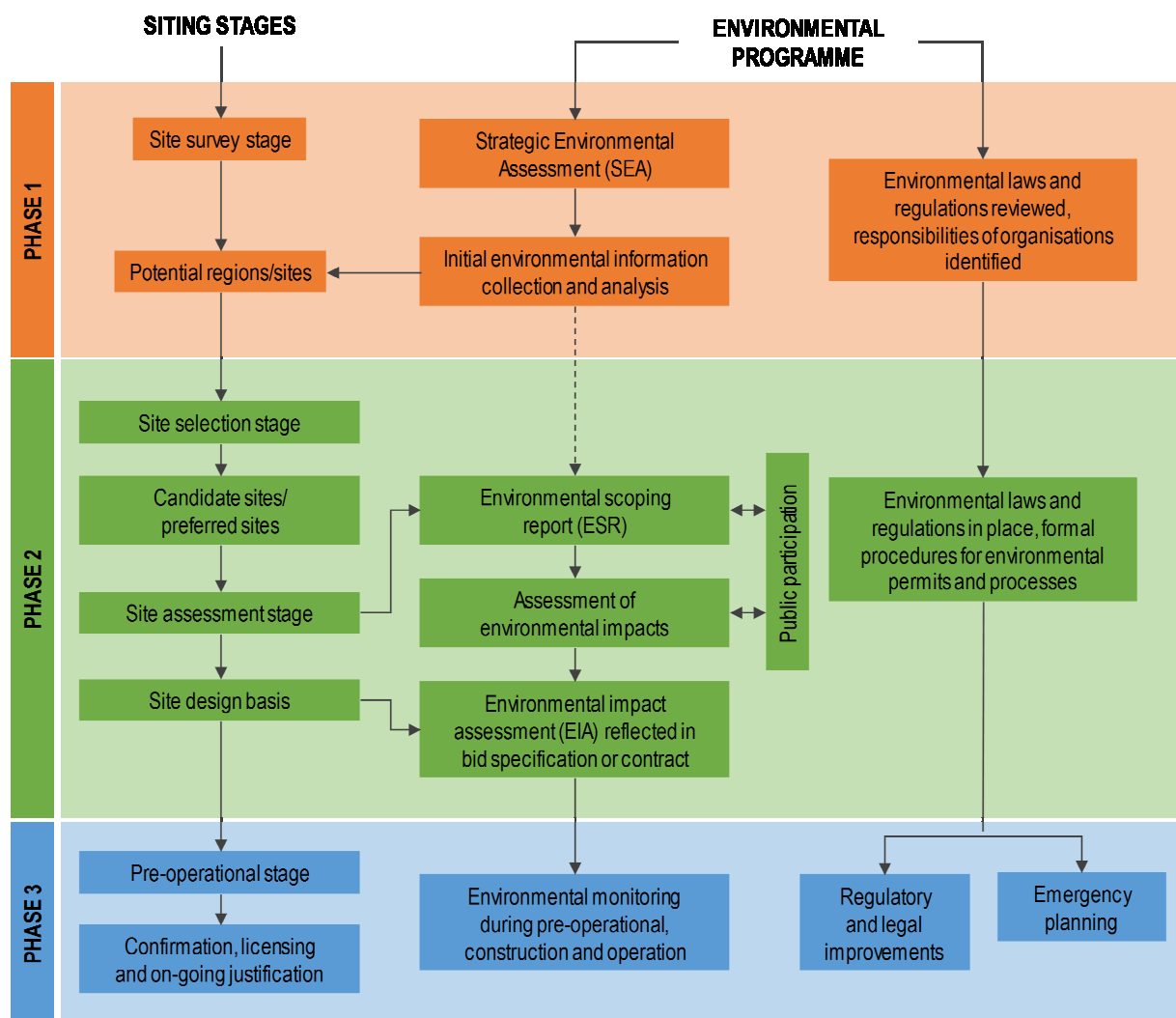


FIGURE 2.3 Nuclear Power Station Implementation Level

Once the national masterplan is completed and policy decision is made, the individual nuclear power station project shall be subjected to EIA. The EIA stage comes in during the Project Decision Making (Phase 2) together with the RIA study. This is where Atomic Energy Licensing Board (AELB) becomes part of the EIATRC in commenting on the EIA report. The overall process should be in compliance with both EQA 1974 (Act 127) and Atomic Energy Licensing Act 1984 (Act 304).

Site licensing shall be obtained first prior to EIA, or at least concurrent, so that, EIA studies can be done on the approved safe site. *Figure 2.4* shows the milestones and phases in nuclear power project showing the position of EIA.



Source: Managing Environmental Impact Assessment for Construction and Operation in New Nuclear Power Programmes (IAEA, 2014)

FIGURE 2.4 Phased approach addressing the environmental issues in nuclear power project

2.4 RELEVANT LEGISLATIONS

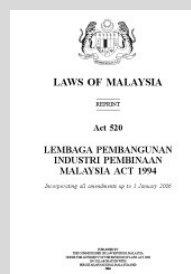
This chapter presents all relevant policies, laws and guidelines that must be referred to in an EIA study for Power Generation and Transmission projects. Nuclear power projects in particular requires multiple reviews of environmental laws and regulations throughout the process of environmental assessment during pre-feasibility, feasibility, design, construction and operational stages to suit nuclear-fuel power requirements.

2.4.1 Environmental Quality Act 1974 (EQA 1974)

Section 34A of the EQA 1974 provides powers to the Minister to prescribe, by order, any activity which may have significant environmental impacts as a prescribed activity, for which a report on an assessment of the impact(s) such an activity will have on the environment, be submitted to the Director General of Environmental Quality for approval. The submission of an EIA report for approval by the Director General is a requirement prior to the approval by the relevant project approving authorities. Enforcement of the provisions of Section 34A of the EQA was made possible from 1st April, 1988.

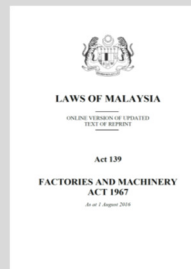
2.4.2 Relevant Federal Laws

Other than the EQA 1974, other relevant federal laws shall also be referred to prior to any commencement of power generation and transmission projects. The laws include but not limited to:



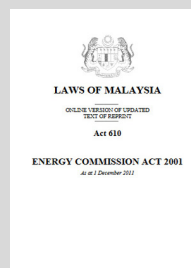
CONSTRUCTION INDUSTRY DEVELOPMENT BOARD (CIDB) ACT 1994

This Act defines the construction of power station and transmission line including on site clearance, soil investigation and improvement, earth-moving, excavation, laying of foundation, site restoration and landscaping; and procurement of construction materials, equipment or workers.



FACTORIES AND MACHINERY ACT 1967

This Act concerns matters relating to the safety, health and welfare of person therein, the registration and inspection of machinery and on matters connected therewith during construction, structural alteration, repair or maintenance of power station and transmission line.

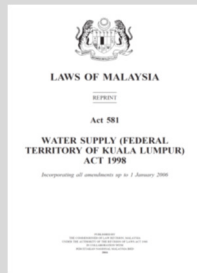


ENERGY COMMISSION ACT 2001

This Act is to provide for the establishment of the Energy Commission with powers to regulate the energy supply activities in Malaysia; and to enforce the energy supply laws and other related matters.

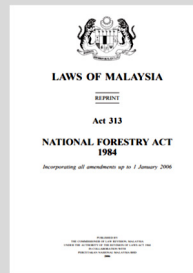
 LAWS OF MALAYSIA ONLINE VERSION OF UPDATED TEXT OF REPRINT Act 304 ATOMIC ENERGY LICENSING ACT 1984 <i>As at 1 December 2017</i>	ATOMIC ENERGY LICENSING ACT 1984 This Act is to provide for the regulation and control of atomic energy, for the establishment of standards on liability for nuclear damage and for other related matters.
 LAWS OF MALAYSIA Act 726 SUSTAINABLE ENERGY DEVELOPMENT AUTHORITY ACT 2011	SUSTAINABLE ENERGY DEVELOPMENT AUTHORITY ACT 2011 This Act is for the establishment of the Sustainable Energy Development Authority Malaysia and to provide for its functions and powers.
 LAWS OF MALAYSIA Act 725 RENEWABLE ENERGY ACT 2011	RENEWABLE ENERGY ACT 2011 The Act is to provide for the establishment and implementation of a special tariff system to catalyse the generation of renewable energy and to provide for related matters.
 LAWS OF MALAYSIA ONLINE VERSION OF UPDATED TEXT OF REPRINT Act 317 FISHERIES ACT 1985 <i>As at 1 November 2017</i>	FISHERIES ACT 1985 This Act concerns the conserving, managing and developing any maritime and estuarine fishing and fisheries matters.
 LAWS OF MALAYSIA Act A1516 NATIONAL LAND CODE (AMENDMENT) ACT 2014	NATIONAL LAND CODE 1965 This Act is to amend and consolidate the laws relating to land and land tenure, the registration of title to land and of dealings therewith.
 LAWS OF MALAYSIA ONLINE VERSION OF UPDATED TEXT OF REPRINT Act 226 NATIONAL PARKS ACT 1980 <i>As at 1 January 2017</i>	NATIONAL PARKS ACT 1980 This Act preserves and protects flora and fauna within the National Park boundary.
 LAWS OF MALAYSIA REPRINT Act 133 STREET, DRAINAGE AND BUILDING ACT 1974 <i>Incorporating all amendments up to 1 January 2006</i>	STREET, DRAINAGE AND BUILDING ACT 1974 This Act is to amend and consolidate the laws relating to street, drainage and building in local authority areas in Peninsular Malaysia, and for purposes connected therewith.
 LAWS OF MALAYSIA Act 654 SURUHANJAYA PERKHIDMATAN AIR NEGARA (SPAN) ACT 2006	SURUHANJAYA PERKHIDMATAN AIR NEGARA (SPAN) ACT 2006 This Act provides the establishment of SPAN with powers to supervise, regulate and enforce water supply and sewerage services laws.
 LAWS OF MALAYSIA REPRINT Act 514 OCCUPATIONAL SAFETY AND HEALTH ACT 1994 <i>Incorporating all amendments up to 1 January 2006</i>	OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA) 1994 This Act secures the safety, health and welfare of persons at work, and for protecting others against risks to safety or health in connection with the activities of persons at work.
 LAWS OF MALAYSIA REPRINT Act 298 PROTECTED AREAS AND PROTECTED PLACES ACT 1959 <i>Incorporating all amendments up to 1 January 2006</i>	PROTECTED AREAS AND PROTECTED PLACES ACT 1959 This Act is to provide for protected areas and places.

2 ENVIRONMENTAL PROJECT PLANNING



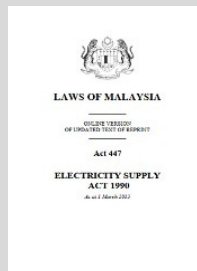
WATERS ACT 1920

This Act controls and licenses any disruption or diversion of water from rivers and streams.



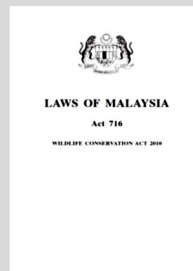
NATIONAL FORESTRY ACT 1984

This Act is to provide the administration, management and conservation of forests and forestry development within the States of Malaysia and for connected purposes.



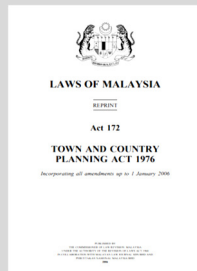
ELECTRICITY SUPPLY ACT 1990

This Act provides the regulation of the electricity supply industry and the licensing of any electrical installation.



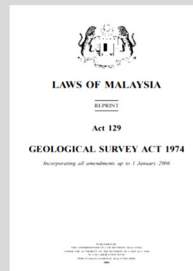
WILDLIFE CONSERVATION ACT 2010

This Act is to provide for the protection and conservation of wildlife and for matters connected therewith.



TOWN AND COUNTRY PLANNING (AMENDMENT) ACT 2017

All applications for planning permission for any construction of a major national infrastructure must seek advice from the National Physical Planning Council (NPPC). Prior to that, an SIA report must be submitted to PLANMalaysia for approval.



GEOLOGICAL SURVEY ACT 1974

This Act regulates and controls geological surveys, to establish geological archives and to provide for matters incidental thereto.

2.4.3 Relevant State Laws

Below are the relevant laws in each state related to power generation and transmission line construction (not limited to). Most of the state laws are related to water supply and water management; which is indirectly related to power generation and transmission projects due to it being potentially located near rivers or coastal areas.



MELAKA

- Malacca River and Coastal Development Corporation Enactment 2005
- Melaka Water Resources Enactment 2014



PULAU PINANG

- Water Supply Enactment 2004
- Water Supply (Catchment Area) Order 2004



KEDAH

- Water Supply Enactment (1990)
- Muda Agricultural Development Authority Act, 1972



SABAH

- Environment Protection Enactment 2002
- Forest Enactment 1968
- Land Ordinance
- Parks Enactment 1984
- Town and Country Planning Ordinance
- Water Resources Enactment 2003



PAHANG

Pahang Water Resources Enactment 2007



PERLIS

Water Supply Enactment



NEGERI SEMBILAN

Water Act 1920 (Revised - 2007) (Act 418)



PERAK

- Perak Water Act 1920
- Perak Water Board Enactment 1988



KELANTAN

Water Supply Enactment 1995



JOHOR

- Water Supply Enactment (No. 119)
- Water Supply Rules



SELANGOR

Selangor Waters Management Authority



SARAWAK

- Buildings Ordinance, 1994
- Electricity Ordinance, 2007
- Forests Ordinance, 2015
- National Parks and Nature Reserves Ordinance, 1998
- Natural Resources and Environment Ordinance, 1993
- Sarawak Electricity Supply Corporation (Successor Company) Ordinance 2004
- Sarawak Land Code 1958
- Sarawak Rivers Ordinance, 1993
- Water Ordinance, 1994



TERENGGANU

Terengganu Water Resources Enactment (2020)



KUALA LUMPUR

Water Supply (Federal Territory of Kuala Lumpur) Act 1998

2.5 RELEVANT POLICIES

National planning policies facilitate decision-making for development planning so as to control the type, location and quantum of the proposed development. Taking into account the sensitivity of an area, the planning policies also identify the locations of Environmentally Sensitive Areas (ESAs) and the type of developments that are permitted in these areas. The national planning policies will be the guidance to formulate and prepare the local and regional planning policies. Below is the list of the relevant policies relevant to power generation and transmission projects that can be referred to for EIA study purposes. (not limited to).



THE UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS (SDG)

A blueprint under the United Nations to achieve a better and more sustainable future for all. They address the global challenges we face, including poverty, inequality, climate change, environmental degradation, peace and justice. SDGs that are related to Power Generation and Transmission projects are:

- SDG 7 – Affordable and clean energy
- SDG 9 – Industry, Innovation and Infrastructure
- SDG 11 – Sustainable Cities and Communities
- SDG 12 – Responsible Consumption and Production
- SDG 14 – Life below Water
- SDG 15 – Life on Land



FIVE YEAR MALAYSIA PLAN

Outlines the Malaysia's five-year development policies and strategies plan.



THIRD NATIONAL PHYSICAL PLAN (NPP-3) (PLANMalaysia, 2015)

Provides physical planning plans for the implementation of sustainable development strategies.



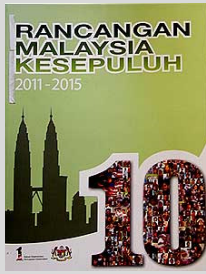
NATIONAL GREEN TECHNOLOGY POLICY (KeTTHA, 2009)

One of the pillars is on energy which aims to attain energy independence and promote efficient utilisation.



GREEN TECHNOLOGY MASTER PLAN MALAYSIA 2017 – 2030 (MESTECC, 2017)

The master plan includes planning in the adoption and use of green technology in harnessing energy, water resources and managing wastes.



TENTH MALAYSIA PLAN (RMK-10)

The RMK-10 has included the 5 pillar of new energy policy comprising of the followings under initiatives for energy source:

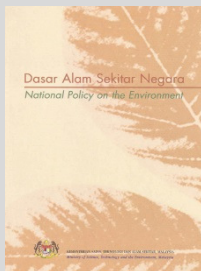
- To import LNG and coal
- To focus on renewable energy
- Nuclear power as an option to generate electricity

NATIONAL RENEWABLE ENERGY POLICY

The vision of the policy is to achieve 20% renewable energy capacity mix by year 2025. Its objectives include:

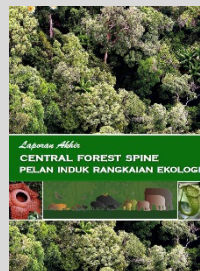
- To increase renewable energy contribution in the national power generation mix;
- To facilitate the growth of the renewable energy industry;
- To ensure reasonable renewable energy generation costs;
- To conserve the environment for future generations; and
- To enhance awareness on the role and importance of renewable energy.

Source: www.seda.gov.my



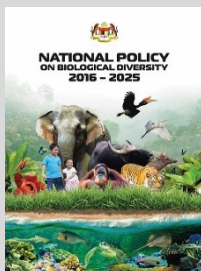
NATIONAL POLICY ON THE ENVIRONMENT (MINISTRY OF SCIENCE, TECHNOLOGY AND THE ENVIRONMENT, 2002)

Provides principles and strategies to ensure the environment remains productive, both ecologically and economically.



CENTRAL FOREST SPINE (CFS) ECOLOGICAL NETWORK MASTER PLAN (PLANMALAYSIA, 2010)

Provides a general framework for development planning within and near to any identified ecological networks.



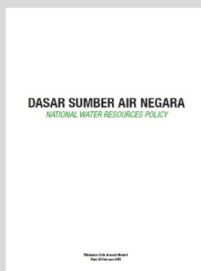
NATIONAL POLICY ON BIOLOGICAL DIVERSITY 2016 – 2025 (NRE, 2016)

Provides direction and framework to conserve biodiversity.



NATIONAL POLICY ON CLIMATE CHANGE (NRE, 2010)

Provides framework to mitigate climate change in an integrated and balance manner.



NATIONAL WATER RESOURCES POLICY (NRE, 2012)

Sets out strategies that will guide water resources stakeholders to structure actions for effective conservation and management of water resources.



MALAYSIA NATIONAL FORESTRY POLICY 1978 (REVISED 1993) (JPSM, 1993)

Conserve and manage the forest through sustainable management and maintain its important roles in the national economy and preservation of environmental stability.

2.6 RELEVANT GUIDELINES AND GUIDANCE DOCUMENTS

Guidelines pertaining to environment-related system, management and safety of power generation and transmission projects must be cross-referenced and incorporated in the EIA report. Any other relevant guidance documents such as notices or circulars issued by DOE or any other Government Agencies must also be incorporated in the EIA report. *Table 2.1* lists the guidelines and guidance documents relevant to power generation and transmission projects that can be referred to for EIA study purposes.

TABLE 2.1 List of guidelines and guidance documents relevant to power generation and transmission projects

GUIDELINES / GUIDANCE DOCUMENTS	RELEVANCY TO POWER GENERATION AND TRANSMISSION PROJECTS
Garis Panduan Perancangan Pemuliharaan dan Pembangunan (GPPPP) Kawasan Sensitif Alam Sekitar (KSAS) (PLANMalaysia, 2017)	Provides the requirements for development in ESA
Central Forest Spine (CFS) Ecological Network Master Plan (PLANMalaysia, 2010)	Aims to rebuild, maintain and enhance relationships between the remaining forest areas in Peninsular Malaysia
Contaminated Land Management and Control Guidelines (DOE, 2009)	Provides a framework on how to manage contaminated land for construction of power infrastructure and abandonment/decommissioning plan
Best Available Techniques Guidance Document on Power Generation (DOE, 2014)	Provides notes in implementing the Best Available Techniques (BAT) in minimising emission from power generation
Guideline for Site Selection for Nuclear Power Station (AELB, 2011)	Provides the criteria for a suitable site to construct a nuclear power station; including matters related to public health, safety and environmental issues
Guideline for Site Evaluation for Nuclear Power Station (AELB, 2011)	Assists Project Proponent as applicants in evaluating a potential site following regulatory requirements in terms of nuclear safety to the public and environment
Guidelines for Decommissioning of Facilities Contaminated with Radioactive Materials (Atomic Energy Licencing Board, 2008)	For when the operation of a contaminated facility comes to the end of its operation life and/or is no longer useful to the licensee
Nuclear Energy Series No. Ng-T-3.11 (2014): Managing Environmental Impact Assessment for Construction and Operation In New Nuclear Power Programmes (International Atomic Energy Agency (IAEA) Vienna, 2014)	Describes the EIA process, the subsequent utilisation of the EIA, and the necessary infrastructure for such processes
Guidance Document Addressing Soil Erosion and Sediment Control (ESC): Aspects in the EIA Report as per Appendix 3 of the EGIM (DOE, 2016)	Guidance to address aspects of soil erosion and sediment control (ESC)
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
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.

TABLE 2.1 (cont'd) List of guidelines and guidance documents relevant to power generation and transmission projects

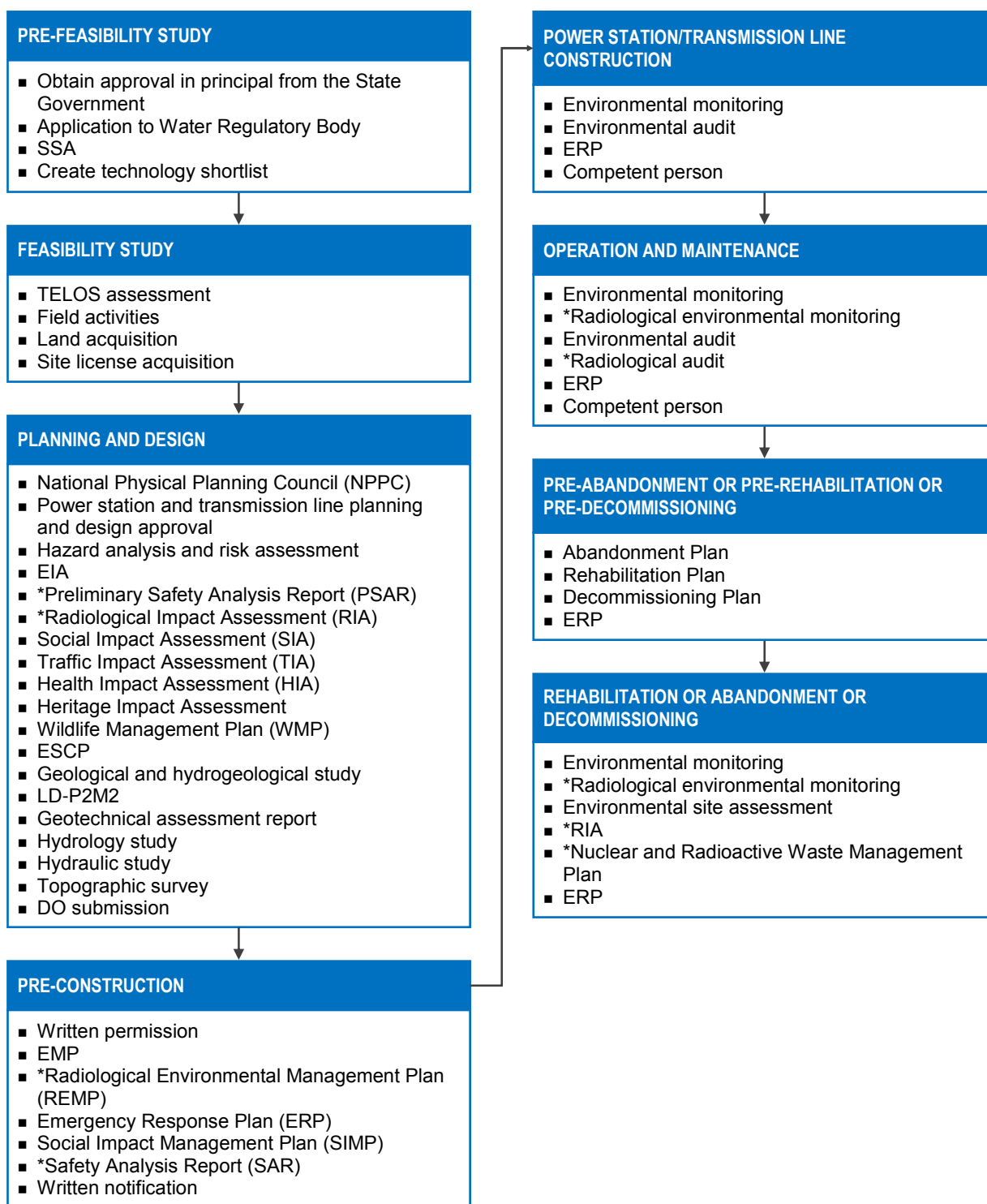
GUIDELINES / GUIDANCE DOCUMENTS	RELEVANCY TO POWER GENERATION AND TRANSMISSION PROJECTS
Garis Panduan Jalan Hutan 2010 (Pindaan 2013) (DIDM, 2014)	Guidance for forest road management includes phases of planning, construction, maintenance and closure of forest roads.
Guidelines for Slope Design (JKR, 2010)	Provides geotechnical design criteria for slopes.
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 document for approval from DOE State.
Garis Panduan Pembangunan Melibatkan Sungai dan Rizab Sungai (DID, 2000)	Provides proper planning and sustainable development involve the river and its reserve area.
Urban Stormwater Management Manual for Malaysia (MSMA 2nd Edition) (DID, 2012)	Provides planning and design guidance to manage stormwater.
Guidelines for Siting and Zoning of Industry and Residential Areas (SZIRA) (DOE, 2012)	Provides guidance with regards to buffer distances according to a list of industries.
Environmental Essentials for Siting of Industries in Malaysia (EESIM) (DOE, 2017)	Provides guidance in selecting a suitable site for the setting up of an industrial facility.
Integrated Approaches under the National Water Resources Policy: ■ Water Resources Management (IWRM) ■ Integrated River Basin Management (IRBM) ■ Integrated Lake Management (ILM) ■ Integrated Coastal Zone Management (ICZM) ■ Integrated Shoreline Management Plan (ISMP) ■ Integrated Flood Management (IFM)	Assist in structuring current practices towards better water resources governance, taking into consideration their unique application ranging from facilitating allocation to addressing hazards.

2.7 INTEGRATION OF ENVIRONMENTAL COMPLIANCE INTO PROJECT PLANNING

The Project Proponent is responsible of all legal requirements on environment begins from the planning stage up until the rehabilitation or abandonment stage. As such, an effective project planning requires involvement from many parties or stakeholders to ensure that it covers all relevant sectors. This includes a technical Project Team from the Project Proponent side in providing input and from various technical government agencies (GA).

A transparent and smooth integration between sectors must be established first in a Project Team in order to fulfil DOE's and GA's requirements. The EIA Consultant must be able to cross-refer various sectors in order to come up with a good environment findings that not only focusing during the EIA study but also during the post-EIA stage. A typical life cycle of a power generation and transmission projects and relevant requirements in each stage is shown in *Figure 2.5* and the details are listed in *Table 2.2*.

2 ENVIRONMENTAL PROJECT PLANNING



*Only for nuclear power project

Note: PSAR, SAR, RIA, REMP, RMA are for AELB jurisdiction or approval, however are referenced for EIA overall project safety evaluation.

FIGURE 2.5 Summary of relevant requirements throughout the life cycle of a power generation and transmission project

TABLE 2.2 List of relevant requirement at various project implementation stage

REQUIREMENT	DETAILS	AGENCIES	LEGAL PROVISION
PRE-FEASIBILITY STUDY			
Obtain approval in Principle by the State Government	■ Permission to develop the project ■ Gazettement of the project in the State Structure Plan	State Government	Town and Country Planning Act 1976 (Act 172)
Application to Water Regulatory Body	■ Application to obtain license for usage of water ■ Application to obtain approval to drill borehole	State Water Regulatory Body	State Water Enactment
Site suitability assessment (SSA)	Land compatibility	■ Department of General of Lands and Mine (JKPTG) ■ State Land and Mines Office (PTG) ■ JMG ■ DOE	-
Create technology shortlist	Technology availability and suitability	-	NA
FEASIBILITY STUDY			
TELOS assessment at the opted site	TELOS framework to assess five key areas: Technical, Economic, Legal, Organisational and Scheduling	-	NA
Field activities	■ Geological mapping ■ Drilling ■ Geophysical investigation	JMG	Geological Survey Act 1974 (Act 129)
Land acquisition	Acquiring land chosen for the project	■ JKPTG ■ PTG	National Land Code 1965 (Act 56)
Site license acquisition	Acquiring license for the project site	■ Energy Commission (ST) ■ AELB	■ Radiation Protection (Licensing) Regulations 1986 ■ Electrical Supply Act 1990 (Act 447)
PLANNING AND DESIGN			
National Physical Planning Council (NPPC)	■ All applications for planning permission for any construction of a major national infrastructure including power station must seek advice from the NPPC ■ Technical studies	PLANMalaysia	Town and Country Planning Act 1976 (Act 172)
Power station and transmission line planning and design approval	Produce masterplan of the project including location, alignment and design	■ PLANMalaysia ■ Local council ■ DID ■ JKR ■ AELB ■ ST	■ Town and Country Planning Act 1976 (Act 172) ■ Street, Drainage and Building Act 1974 (Act 133) ■ Atomic Energy Licensing Board Act 1984 (Act 304) ■ Electrical Supply Act 1990 (Act 447)

2 ENVIRONMENTAL PROJECT PLANNING

TABLE 2.2 (cont'd) List of relevant requirement at various project implementation stage

REQUIREMENT	DETAILS	AGENCIES	LEGAL PROVISION
PLANNING AND DESIGN (cont'd)			
Hazard analysis and risk assessment	Assess the potential hazard and the risk present with the project	■ AELB ■ DOSH ■ DOE	■ Atomic Energy Licensing Board Act 1984 (Act 304) ■ EQA 1974 (Act 127) ■ Occupational Safety and Health Act 1994 (Act 514)
Environmental Impact Assessment (EIA)	■ TOR and ESI ■ Statement of need ■ Project options ■ Project description ■ Existing environment ■ Evaluation of impacts ■ Mitigation measures ■ Post-EIA	DOE	EQA 1974 (Act 127)
Preliminary Safety Analysis Report (PSAR)	■ Supports the application for authorisation for siting and/or construction ■ Demonstrate readiness of the nuclear power project to start trial testing operations of the plant before commercial operation	AELB	Atomic Energy Licensing Board Act 1984 (Act 304)
Radiological Impact Assessment (RIA)	■ Determine source of the elevated naturally occurring radioactive materials (NORM) present ■ Refer radiological criteria set by AELB ■ Establish site characteristics ■ Identify critical group ■ Identify critical pathways ■ Establish dosimetric models (mathematical models)	■ AELB ■ DOE	Atomic Energy Licensing Board Act 1984 (Act 304)
Social Impact Assessment (SIA)	Analyse, monitor and manage both positive and negative social impacts.	PLANMalaysia	Town and Country Planning Act 1976 (Act 172)
Traffic Impact Assessment (TIA)	■ Project description ■ Road and junction characteristics ■ Traffic count survey ■ Existing traffic condition evaluation ■ Traffic forecast ■ Evaluation of traffic impacts ■ Mitigation measures ■ Post-TIA	■ JKR ■ Local Council	■ Local Government Act 1976 (Act 171) ■ Town and Country Planning Act 1976 (Act 172)
Health Impact Assessment (HIA)	■ Project description ■ Existing public health status ■ Evaluation of health impacts ■ Mitigation measures ■ Post-HIA	Ministry of Health (MOH)	EQA 1974 (Act 127)
Heritage Impact Assessment	■ Project description ■ Land use assessment ■ Existing heritage component ■ Evaluation of heritage impacts ■ Mitigation measures	Department of National Heritage	National Heritage Act 2005 (Act 645)

TABLE 2.2 (cont'd) List of relevant requirement at various project implementation stage

REQUIREMENT	DETAILS	AGENCIES	LEGAL PROVISION
PLANNING AND DESIGN (cont'd)			
Wildlife Management Plan (WMP)	■ Project description ■ Existing wildlife status ■ Evaluation of wildlife impacts ■ Mitigation measures ■ Post-WMP	PERHILITAN	Wildlife Conservation Act 2010 (Act 716)
Erosion and Sediment Control Plan (ESCP)	■ Annual soil erosion rate ■ Sediment yield ■ Mitigation measures (erosion and sedimentation control measures) ■ Inspection and maintenance	DID	NA
Geological and hydrogeological study	■ Project description ■ Geological profile ■ Permeability test ■ Construction materials ■ Groundwater regime ■ Evaluation of impact ■ Mitigation measures	JMG	Geological Survey Act 1974 (Act 129)
LD-P2M2	■ Description of adjacent areas that may be affected by land disturbance ■ List of BMP proposed ■ Earthworks cut and fill volume ■ Availability of materials ■ Biomass management ■ Spill prevention and control plan ■ Soil loss prediction (pre, during and post development as well as with and without BMP scenarios) ■ Projected runoff flows ■ Calculation for BMP (sediment traps/ basins, check dams, etc.)	DOE	EQA 1974 (Act 127)
Geotechnical assessment report	■ Determine the type of earth that exists below ground ■ Determine the best foundation for the structure	■ JMG ■ JKR Geotechnical Branch ■ IKRAM	Geological Survey Act 1974 (Act 129)
Hydrology study	■ Project description ■ Existing hydrology conditions ■ Evaluation of impact (including potential coastal erosion) ■ Mitigation measures	DID	NA
Hydraulic study	■ Project description ■ Site and meteo-marine conditions ■ Existing condition hydrodynamic, waves, water quality, littoral transport) ■ Evaluation of impact including potential coastal erosion (hydrodynamic, waves, water quality, sediment transport, littoral transport, sediment spill dispersion) ■ Assessment on river geomorphology ■ Mitigation measures	DID	NA

2 ENVIRONMENTAL PROJECT PLANNING

TABLE 2.2 (cont'd) List of relevant requirement at various project implementation stage

REQUIREMENT	DETAILS	AGENCIES	LEGAL PROVISION
PLANNING AND DESIGN (cont'd)			
Topographic survey	Topographical map of the project area	NA	Geological Survey Act 1974 (Act 129)
Development Order (DO)	Approval of various submission to the technical agencies: ■ EIA report – DOE ■ SIA report – PLANMalaysia ■ TIA report – JKR ■ HIA report – MOH ■ Heritage Impact Assessment report – Department of National Heritage ■ ESCP report – DID ■ Geotechnical report (if required) ■ Other relevant technical studies	Local authority	Town and Country Planning Act 1976 (Act 172)
PRE-CONSTRUCTION			
Written permission	Installation of machineries, equipment and reactor at site	DOE	EQA 1974 (Act 127)
Environmental Management Plan (EMP)	■ Project Proponent/Contractor's Environmental Policy ■ Organisational chart (EPMC and ERCMC) ■ Training requirements ■ Environmental requirements (COAs, LD-P2M2 document) ■ Environmental Mainstreaming Tools (EMTs) ■ Written notification to DOE prior starts of work. To provide at least the followings: ■ Name of Environmental Officer (EO) ■ Detailed design drawings ■ Name of contractors ■ Name of Resident Engineer ■ Name of consultants	DOE	EQA 1974 (Act 127)
Radiological Environmental Monitoring Programme (REMP)	■ Determine effect of plant operations on people ■ Determine trends of radioactivity in the environment ■ Provide assurance to the general public ■ Meet regulatory requirements ■ Provide for monitoring during emergencies	AELB	Atomic Energy Licensing Act 1984 (Act 304)
Social Impact Management Plan (SIMP)	■ Project description ■ Existing human environment ■ Social impact ■ Enhancement/Mitigation measures ■ Monitoring programme	■ PLANMalaysia ■ PLANMalaysia @Negeri	Town And Country Planning Act 1976 (Act 172)
Safety Analysis Report (SAR)	Revisions of the SAR prior to the plant entering first routine operation	AELB	Atomic Energy Licensing Act 1984 (Act 304)

TABLE 2.2 (cont'd) List of relevant requirement at various project implementation stage

REQUIREMENT	DETAILS	AGENCIES	LEGAL PROVISION
POWER STATION/TRANSMISSION LINE CONSTRUCTION			
Environmental monitoring	Performance, compliance and impact monitoring: - Water quality monitoring - Air quality monitoring	- DOE - AELB	- EQA 1974 (Act 127) - Atomic Energy Licensing Board Act 1984 (Act 304)
Environmental audit	- Audit site administrative details - Regulatory compliance summary - Audit findings - Recommendations	DOE	EQA 1974 (Act 127)
Environmental Reporting	- Form EIA 1-18—EIA (EIA Project Information status) - Form EIA 2-18—EIA Approval Conditions Compliance Report	DOE	EQA 1974 (Act 127)
Competent person	- Environmental Officer (EO) - Certified Erosion, Sediment and Storm Water Inspector (CESSWI) - Certified Inspection of Sediment and Erosion Control (CISEC) - Certified Professional Environmental Officer in EIA Project Development and Operation (CePEOEIA) - Radiation Protection Officer (RPO)	- DOE - AELB	- EQA 1974 (Act 127) - Atomic Energy Licensing Board Act 1984 (Act 304)
OPERATION AND MAINTENANCE			
Environmental monitoring	Performance, compliance and monitoring: - Water quality monitoring - Air quality monitoring	DOE	EQA 1974 (Act 127)
Radiological environmental monitoring	Radiological monitoring	AELB	Atomic Energy Licensing Board Act 1984 (Act 304)
Environmental and radiological audit	- Audit site administrative details - Regulatory compliance summary - Audit findings - Recommendations	- DOE - AELB	- EQA 1974 (Act 127) - Atomic Energy Licensing Board Act 1984 (Act 304)
Environmental Reporting	- Form EIA 1-18—EIA (EIA Project Information status) - Form EIA 2-18—EIA Approval Conditions Compliance Report	DOE	EQA 1974 (Act 127)
Competent person	- Environmental Officer (EO) - Certified Erosion, Sediment and Storm Water Inspector (CESSWI) - Certified Inspection of Sediment and Erosion Control (CISEC) - Certified Professional Environmental Officer in EIA Project Development and Operation (CePEOEIA) - Radiation Protection Officer (RPO)	- DOE - AELB	- EQA 1974 (Act 127) - Atomic Energy Licensing Board Act 1984 (Act 304)

2 ENVIRONMENTAL PROJECT PLANNING

TABLE 2.2 (cont'd) List of relevant requirement at various project implementation stage

REQUIREMENT	DETAILS	AGENCIES	LEGAL PROVISION
PRE-REHABILITATION OR PRE-ABANDONMENT OR PRE-DECOMMISSIONING			
Abandonment plan	Overall abandonment strategy	DOE	EQA 1974 (Act 127)
Rehabilitation plan	■ Survey of the current status of the facilities ■ Focus of rehabilitation ■ Measures to improve efficiency ■ Environmental and social impacts ■ Measures to mitigate impacts	■ DOE ■ ST ■ AELB	EQA 1974 (Act 127)
Decommissioning plan	■ Safe dismantling of facility ■ Ensure radiation protection of workers and public ■ Management of radioactive and non-radioactive materials ■ Termination of regulatory authorisation	■ ST ■ AELB	Atomic Energy Licensing Board Act 1984 (Act 304)
REHABILITATION OR ABANDONMENT OR DECOMMISSIONING			
Environmental monitoring	Performance, compliance and monitoring: ■ Water quality monitoring ■ Air quality monitoring	DOE	EQA 1974 (Act 127)
Environmental and radiological monitoring	Radiological monitoring	AELB	Atomic Energy Licensing Board Act 1984 (Act 304)
Environmental Reporting	■ Form EIA 1-18—EIA (EIA Project Information status) ■ Form EIA 2-18—EIA Approval Conditions Compliance Report	DOE	EQA 1974 (Act 127)
Environmental site assessment	■ Initial assessment involving desktop study, site reconnaissance, conceptual site model (if applicable) ■ Detailed assessment involving data collection and analysis ■ Risk assessment including hazard identification, toxicity assessment, exposure assessment and risk characterisation	DOE	EQA 1974 (Act 127)
Radiological Impact Assessment (RIA)	■ Determine source of the elevated naturally occurring radioactive materials (NORM) present ■ Refer radiological criteria set by AELB ■ Establish site characteristics ■ Identify critical group ■ Identify critical pathways ■ Establish dosimetric models (mathematical models)	■ DOE ■ AELB	Atomic Energy Licensing Board Act 1984 (Act 304)
Nuclear and Radioactive Waste Management Plan	■ Determine type of radioactive waste: - Low-level waste (LLW) accounts for 1% of total radioactivity produced - Intermediate-level waste (ILW) accounts for 4% of total radioactivity produced - High-level waste (HLW) accounts for 95% of total radioactivity produced - Treatment and conditioning of waste ■ Storage and disposal	AELB	Atomic Energy Licensing Board Act 1984 (Act 304)

2.7.1 Project Team

In order to ensure that all relevant requirements listed in *Table 2.1* are fulfilled, the Project Proponent is advised to form a Project Team. The Project Team members comprise the EIA Study Team and other technical or engineering consultants responsible for other components of the project. This can be illustrated as per *Figure 2.6*.

The **Project Team** members must:

- provide sufficient input in ensuring that a comprehensive of the relevant technical studies are prepared; and
- advise the Project Proponent with accurate information so that the Project Proponent can make informed holistic decisions.

Table 2.3 shows the studies typically required in a project and each Project Team member's roles.

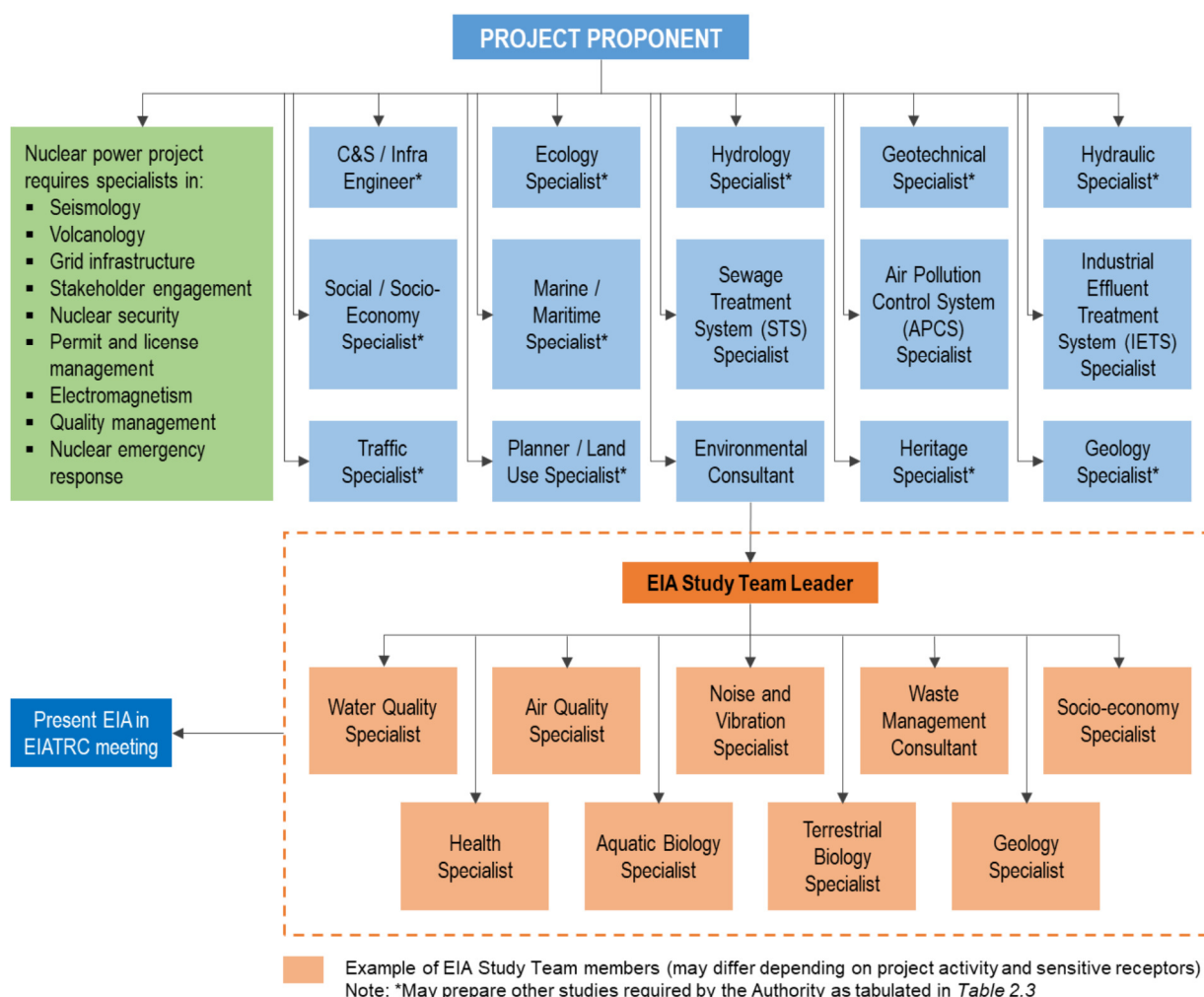


FIGURE 2.6 Organisation chart of Project Proponent, project team and EIA study team

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TABLE 2.3 Typical project team members' roles and relevant studies

PROJECT TEAM MEMBER	STUDY / SECTOR	ROLE	ASSESSMENT AUTHORITY
Project Proponent		■ Fully responsible for the project starting from planning stage until rehabilitation or abandonment stages ■ Provide project information: i) Project title ii) Project location iii) Land title iv) Statement of need v) Project options vi) Project concept and description vii) Project layout plan and components viii) Method statement ix) Sources of construction materials x) Spoil disposal areas xi) Biomass disposal areas xii) Transport route and temporary access xiii) Project implementation schedule and phasing	NA
EIA Consultant	Environmental Impact Assessment	■ Identify ESAs ■ Assess impacts on the environment ■ Propose P2M2 ■ Propose EMP framework	DOE
Combustion Specialist	Fuel Combustion Process and Technology	■ Identify types and characteristics of fuel used/ selected and the possible environmental impact (e.g. low quality coal, MSW, etc.) ■ Prepare general mass and heat balance for the combustion process and the entire station including the APCS ■ Review combustion technology used and the associated environmental impact (e.g. Fluidized bed for low quality coal and MSW and low NO_x burner for NO_x emission controls, FGD, etc.)	DOE
Planner/Land Use Specialist	Land Use Study	■ Identify ESAs / buffer zone ■ Prepare Development Proposal Report (LCP) ■ Conduct viewscape assessment ■ Prepare Planning Permission (KM) submission	PLANMalaysia
STS Specialist	Sewage Treatment System (STS) Design	■ Design the sewage treatment system for the project ■ Provide flowchart showing the entire STS components proposed and mass balance of the major parameters	■ Indah Water Konsortium (IWK) ■ SPAN ■ Local Council
IETS Specialist	Industrial Effluent Treatment System (IETS) Design	■ Design the industrial effluent system for the project ■ Provide flowchart showing the entire IETS components proposed and mass balance of the major parameters	■ DOE ■ DOSH ■ Local Council

TABLE 2.3 (cont'd) Typical project team members' roles and relevant studies

PROJECT TEAM MEMBER	STUDY / SECTOR	ROLE	ASSESSMENT AUTHORITY
APCS Specialist	Air Pollution Control System (APCS) Design	■ Design the APCS based on the estimated emission flowrate and characteristics ■ Describe the APCS technology used. ■ Provide the process flowchart showing the entire APCS treatment components proposed with mass balance	■ DOE ■ DOSH ■ Local Council
Geology Specialist	Geological/ Geohydrological Study	■ Determine geological characteristics of the project area ■ Identify potential groundwater locations present within or near the project area ■ Assess impact to the geology/ hydrogeology of the surrounding area	JMG
Geotechnical Specialist	Geotechnical/ Foundation Study	■ Conduct geotechnical assessment ■ Design structure's foundation	■ JMG ■ JKR Geotechnical Branch ■ IKRAM
Hydrology Specialist	River Hydraulics and Hydrology Study	■ Assess the river's hydraulics and hydrology ■ Design drainage masterplan	DID
Coastal Engineer/ Hydraulic Specialist	Coastal Hydraulics	■ Assess the coastal hydraulics ■ Design coastal structures	DID
Ecology Specialist	Ecology study	■ Conduct impact assessment on aquatic ecology and fishermen ■ Propose mitigating measures	DOF
Social/Socio-economic Specialist (registered with MSIA)	Social Impact Assessment (SIA)	■ Conduct impact assessment on social ■ Propose Social Impact Management Plan (SIMP)	■ PLANMalaysia ■ Local Council
Traffic Specialist	Traffic Impact Assessment (TIA)	■ Conduct impact assessment on present traffic conditions ■ Predict traffic conditions in the future ■ Propose upgrading or new roads if necessary	■ JKR ■ Local Council
Marine / Maritime Specialist	Marine Risk Assessment (MRA)	■ Conduct risk assessment from marine navigation ■ Propose marine Emergency Response Plan (ERP)	MarDep
Civil and Structure / Infrastructure Engineer	Earthwork Plan	■ Design the platform level ■ Calculate cut and fill volume ■ Determine project phasing	■ DID ■ Local Council
Civil and Structure Engineer	Erosion and Sediment Control Plan (ESCP)	■ Prepare ESCP layout ■ Design BMPs	■ DID ■ Local Council
Oceanographic Specialist	Oceanographic Assessment	Assessment of thermal environmental impact of water cooling discharge into the ocean, etc.	■ DOE ■ AELB

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TABLE 2.3 (cont'd) Typical project team members' roles and relevant studies

PROJECT TEAM MEMBER	STUDY / SECTOR	ROLE	ASSESSMENT AUTHORITY
EIA-RIA Consultant	Radiological Impact Assessment (RIA)	■ Identify RIA and ESAs ■ Assess radiological impacts on the workers, public and environment ■ Propose P2M2 ■ Propose Radiological Protection Programme framework	■ DOE ■ AELB
Quality Assurance Management Specialist	Quality Management	■ Assess the Quality Management System for the EIA ■ Forming part of and able to be integrated with the overall nuclear power project	■ DOE ■ AELB
Emergency Response Specialist	Emergency Response	■ To assess the site conditions in the ability to respond to nuclear and radiological emergency ■ Prepare Emergency Response Plan for nuclear power project	■ DOE ■ AELB
Environmental Consultant	Environmental Management Plan*	■ Prepare EMP based on EIA COAs ■ Prepare LD-P2M2 document ■ Propose monitoring programme and audit framework	DOE
Environmental Consultant	Environmental Monitoring Report*	■ Conduct environmental monitoring as required in the approved EMP ■ Prepare monitoring report	DOE

Note: *Post-EIA (described in **Chapter 7** of this guideline)

For a nuclear power project, the following is a list of project team comprising of the Project Proponent, consultants and specialists that is over and above the conventional EIA, as recommended by AELB and IAEA:

- i) *Orang bertanggungjawab terhadap lesen* (OBTL) (e.g. Chief Executive Officer of Project Proponent);
- ii) Radiation Protection Officer (RPO) recognised by AELB;
- iii) Nuclear Energy Project Implementation Organisation (NEPIO);
- iv) Operating Organisation / Facility Owner (Operator/Project Proponent); and
- v) Consultants and specialists:
 - Nuclear Environmental Scientist and Engineer;
 - Nuclear Biologist and Health Physicist;
 - Nuclear Related Geologist and Hydrologist;
 - Seismologist and Volcanologist (if applicable);
 - Visual Engineering Engineer;
 - Acoustic Engineer;
 - Grid Infrastructure Specialist;
 - Electromagnetism Specialist;
 - External Human Induced Event Specialist;
 - Nuclear Law Specialist;
 - Nuclear Emergency Planning Specialist;
 - Nuclear Security Specialist;
 - Nuclear Quality Management Specialist;
 - Public Information and Public Acceptance (PIPA) Specialist; and
 - Nuclear Permitting and Licencing Specialist.

2.8 STAKEHOLDERS ENGAGEMENT

Stakeholders engagement is an important factor in an EIA study. The stakeholders engagement must be conducted under the socio-economic study in the EIA. The stakeholders engagement is also another platform for the general public to voice their concerns on top of being able to review and comment the EIA report.

Stakeholders engagement for nuclear power project is very challenging, thus, Project Proponent as well as approval authorities have to take extra vigilant and profound understanding of the subject matter. Public in general are not well educated in nuclear and radiological matters, mostly are driven by perceptions. Many vested parties would take advantage by influencing the public to push for their agendas. A comprehensive public information and education programs are required well in advance, and specialist PIPA shall be engaged by the Project Proponent and approval authorities.

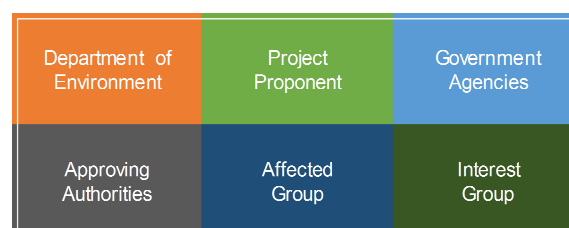
It is also noted that, stakeholders engagement for nuclear power project has to take place twice, once during siting process followed by the EIA public review process, the later as per normal.

There are two categories of stakeholders:

- i) Statutory stakeholders – the various authorities and government bodies
- ii) Non-statutory stakeholders – Local communities, specialist group, NGOs, public, neighbouring country public affected directly by the project (if any).

2.8.1 Identification of Stakeholder

The potential stakeholders engagement for power generation and transmission projects can be categorised into six main categories as shown in *Figure 2.7*. Each category plays an important roles and shoulder different responsibilities in the EIA process. It is imperative that the stakeholders engagement must cover the extent of the Zone of Impact (ZOI). If the forecasted ZOI spreads into a neighbouring State, the engagement shall also include stakeholders from the affected area.



Note: May include agencies from other States if the predicted impact crosses State boundary

FIGURE 2.7 Relevant stakeholders to be engaged during the EIA process

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For EIA purposes, there will be at least three stages of stakeholder engagements:

i) **Stage 1 - Preliminary Stakeholders Engagement**

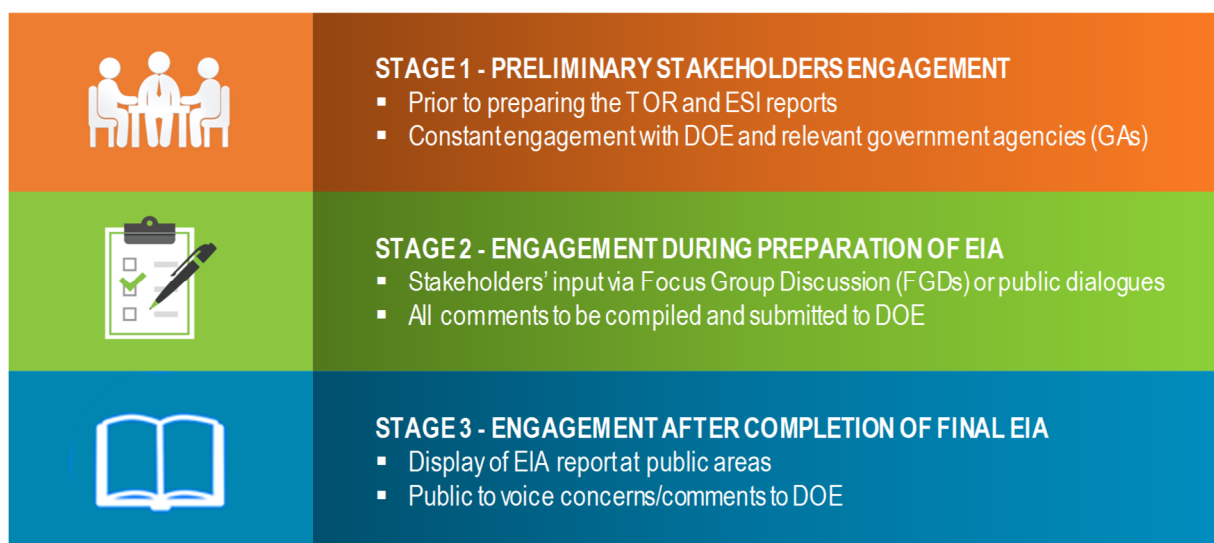
It is important for the Project Proponent to carry out stakeholders engagement prior to preparing the TOR and ESI reports. Constant engagement with DOE is advisable (via the designated officer in charge), including relevant government agencies (GAs). This is to ensure that the scoping is comprehensively covered in the EIA report.

ii) **Stage 2 - Engagement during the preparation of EIA**

Stakeholders' input is also an important factor in an EIA study. The stakeholders' engagements in the form of Focus Group Discussions (FGDs) or public dialogues must be conducted under the socio-economic study in the EIA. All comments both positive and negative and the responses must be compiled in the EIA report and submitted to DOE for department's record.

iii) **Stage 3: Engagement after the final EIA report is complete**

During the EIA review process by the EIATRC, public display of the EIA report at public areas approved by DOE must be carried out. At this stage, the public is able voice their concerns via written comments to the DOE. Separate engagement with the Project Proponent and stakeholders can be also be done at this stage.



2.8.2 Roles and Responsibilities

Table 2.4 lists the potential stakeholders to be considered for the stakeholders engagement. Representatives from government agencies (GAs) and Non-Governmental Organisations (NGOs) will also be engaged to seek for their opinion or feedback on the power generation and transmission project. It is important for these representatives to highlight the relevant issues and give feedback of the project to be incorporated in the TOR and EIA. The representatives sent for these engagements should be the same representatives to attend the TORAC and EIATRC meetings (if not, handed over to the replacement) to guarantee continuity of the input provided.

TABLE 2.4 Roles and responsibilities of potential stakeholders

POTENTIAL STAKEHOLDER	ISSUE/IMPACT OF INTEREST	ROLES AND RESPONSIBILITIES
Department of Environment (DOE)	- Water quality degradation - Air quality degradation - Waste management	Assess and approve/reject the EIA report based on the EIA guideline
Local Council	- Area management - Development order	- Ensure local plan and special management area are considered - Ensure EIA has addressed all relevant sectors adeptly - Highlight any licensing issues related to the development - Approve Development Order
JKPTG / PTG / PTD	- Land status compliance - Land acquisition - Minerals release	- Ensure that the Project Proponent owns the land and the status is correct with its intended development type - Ensure there are no constraints on the land that may prohibit it from being developed
Department of Irrigation and Drainage (DID)	- Flooding - Coastal/River bank erosion and sedimentation	- Ensure DID Guidelines are adhered to (e.g.: MSMA, ISMP, ICZM, IWRM, ILM, IFM, IRBM) - Ensure any flow regimes are not affected - Ensure no major erosion and sedimentation - Endorse Hydrology and Hydraulic Report
Fisheries Development Authority of Malaysia (LKIM)	Fishermen livelihood	Adhere to Fisheries Development Authority of Malaysia Act 1971 (Act 49)
Department of Wildlife and National Parks Peninsular Malaysia (PERHILITAN)	- Wildlife - Terrestrial fauna - Wildlife Management Plan (WMP)	- Ensure adherence to the Wildlife Conservation Act 2010 (Act 716) - To determine the sensitivity of site in terms of flora and fauna species and constraints for development
JKR Geotechnical Division	- Slope design specification - Geotechnical	Ensure compliance to all JKR Guidelines and Manuals
Malaysian Public Works (JKR) / Malaysian Highway Authority (LLM)	- Level of Service (LoS) of nearby JKR road - Building code and standard - Road design specification	- Ensure compliance to all JKR / LLM Guidelines and Manuals - Approve TIA

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

2 ENVIRONMENTAL PROJECT PLANNING

TABLE 2.4 (cont'd) Roles and responsibilities of potential stakeholders

POTENTIAL STAKEHOLDER	ISSUE/IMPACT OF INTEREST	ROLES AND RESPONSIBILITIES
Marine Department (MarDep)	■ Marine risk ■ Marine traffic and navigation	Ensure compliance to all acts and laws under the control of Marine Department such as State Ports Rules, Boat Rules 1953, and Merchant Shipping Act (Oil Pollution) 1994 (Act 515)
Forestry Department of Peninsular Malaysia (JPSM)	■ Logging/Forest clearing ■ Logging Management Plan	■ Ensure adherence to the National Forestry Act 1984 (Act 313) and CFS ■ To determine the status of the forest, ensuring it can be developed and is not within PRF, water catchment, etc. ■ Facilitate and coordinate with DOE on LD-P2M2 implementation particularly on management of <i>matau</i>, skid trails and access roads (<i>jalan hutan</i>)
Department of Mineral and Geoscience Malaysia (JMG)	■ Slope stability and protection requirements ■ Geological conditions ■ Soil conditions and suitability ■ Geological Terrain Mapping (GTM) requirements	■ Ensure topography, terrain and geological features within the site is suitable for development ■ Ensure compliance to Mineral Development Act 1994 (Act 525) and Geological Survey Act 1974 (Act 129) ■ Ensure adherence to all JMG Guidelines
Department of Orang Asli Development (JAKOA)	Development requirements within Orang Asli settlements and their roaming areas, agriculture plots, cultural, heritage, religious and archaeological sites	■ Ensure adherence to the Aboriginal Peoples Act 1954 (Revision 1974 (Act 134) ■ Ensure that the area is not occupied by Orang Asli community and if so, how to manage impacts
Water Regulatory Body (BKSA)	Water resources	■ Ensure conservation of water resources, river basin, coastal waters and the surrounding environment ■ Ensure compliance to State's BKSA laws ■ Work together with water operators
Department of Fisheries (DOF)	■ Loss of marine/aquatic habitat ■ Encroachment of marine parks ■ Aquaculture production ■ Fishermen livelihood ■ Fisheries Management Plan	■ Ensure compliance to Fisheries Act 1985 (Act 317) and its regulations ■ Assess impacts on fisheries are minimised or none ■ Ensure offset programmes or fisheries plan are undertaken and monitored to mitigate any loss of habitat
Federal Department of Town and Country Planning (PLANMalaysia)	■ ESAs within the project area ■ Land use conflict ■ Planning guidelines ■ Buffer zone ■ Social Impact Assessment (SIA) requirements	■ Ensure that the National Physical Plan (NPP), State Structure Plan and Local Plan are complied with ■ Ensure other planning policies are adhered to (e.g.: CFS, NWRP, National Forestry Policy, National Policy on the Environment, National Action Plan for Peatland) ■ Ensure ESAs are not significantly impacted ■ To determine the need of SIA

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

TABLE 2.4 (cont'd) Roles and responsibilities of potential stakeholders

POTENTIAL STAKEHOLDER	ISSUE/IMPACT OF INTEREST	ROLES AND RESPONSIBILITIES
Atomic Energy Licensing Board (AELB)	Nuclear and radiological impacts	Ensure compliance with the prevailing nuclear laws and regulations including Atomic Energy Licensing Act 1984 (Act 304)
Ministry of Health (MOH)	- Health impact - Type of diseases	Ensure adherence to all MOH Guidelines in establishing workers' camp/quarters
Economic Planning Unit (EPU)	Economic benefits	Ensure alignment with relevant national economic policies
State water operators (Air Selangor, SATU, SAINS, etc.)	Water supply service	- Ensure no impact on water supply - Work together with BKSA
National Water Resources Commission Malaysia (SPAN)	- Water supply system - Sewerage system	Ensure compliance to National Water Services Commission Act 2006 (Act 654), Water Service Industry Act 2006 (Act 655) and their regulations
Department of Survey and Mapping Malaysia (JUPEM)	Topography	- Confirm the project boundary - Ensure that the latest reference map from JUPEM is referred to
Energy Commission (ST)	- Power generation and transmission licensing - Other electricity supply regulatory issues	Ensure compliance with the prevailing electricity supply acts including Electricity Supply Act 1990, License Supply Regulation 1990 and Electricity Regulation 1994
Nuclear technical support organisation (e.g. Malaysian Nuclear Agency, universities having nuclear or related expertise)	Nuclear and radiological impacts	- Assessing the technical adequacy of the EIA and RIA studies conducted by the project proponent and their consultants - Advising DOE and AELB on the matter
Regional development authorities (IRDA, NCIA, etc.)	Regional matters	Ensure the EIA has addressed all relevant sectors adeptly
Attorney General Chambers (AGC)	- National and international laws - Legal compliance	Check that all relevant laws and legislations are complied with
Port authorities (Penang Port Commission, Johor Port Authority, etc.)	- Port limit - Port requirements	Ensure compliance to State Port Rules
Affected groups: - Local community including <i>Orang Asli</i> - Business owner - Land owner		- Give relevant inputs for protection of local interest - Give feedback to the impact findings
Interest groups: - NGOs relevant to the environment sector - Specialists - Environmental practitioners		Provide inputs based on their technical knowledge and expertise

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

2.8.3 Method of Engagement

The stakeholders engagements can be focused by having direct interview, focus group discussion (FGD), public dialogue, workshop, exhibition and road show, and round table discussion. Details of these methods are as follows:



DIRECT INTERVIEW

- Useful in obtaining specific information and attitudes from wider range of stakeholders in the early stages. Also useful in exploring more complex issues among key stakeholders later during the project design stage.
- Typical questionnaire method to gather socio-economic data, with questions typically covering:
 - i) information on head of the household;
 - ii) information on household numbers;
 - iii) education of household;
 - iv) house and housing condition;
 - v) transport and vehicle ownership;
 - vi) land ownership (or occupation);
 - vii) livestock;
 - viii) income and expenditure;
 - ix) perceptions regarding the project;
 - x) perceptions regarding constraints to agricultural development;
 - xi) attitude to resettlement (readiness to move); and
 - xii) preferred areas for resettlement and income-producing activities.



FOCUS GROUP DISCUSSION (FGD)

- Involves specific groups that may be affected such as fishermen, hoteliers, etc. (small groups: recommended 6 to 12 people).
- Allows facilitator to probe emerging issues.
- It is resource intensive and may be more appropriately used later in the process.



PUBLIC DIALOGUE

- Enables presentation of project information to the general public.
- Allows large numbers of people to be involved in some limited discussion.
- Need to be carefully managed to ensure all views are heard.



WORKSHOP

- Structured group discussions designed to solve problems and identify the ways forward.
- Useful in bringing different groups of experts together. Requires experienced facilitators as well as in providing careful explanation to the attendees.



EXHIBITIONS AND ROADSHOW

- Useful way of presenting project information and options to the public, especially local communities.
- Able to reach large numbers of people if well-advertised.
- Allows face-to-face feedback of information.



ROUNDTABLE DISCUSSION

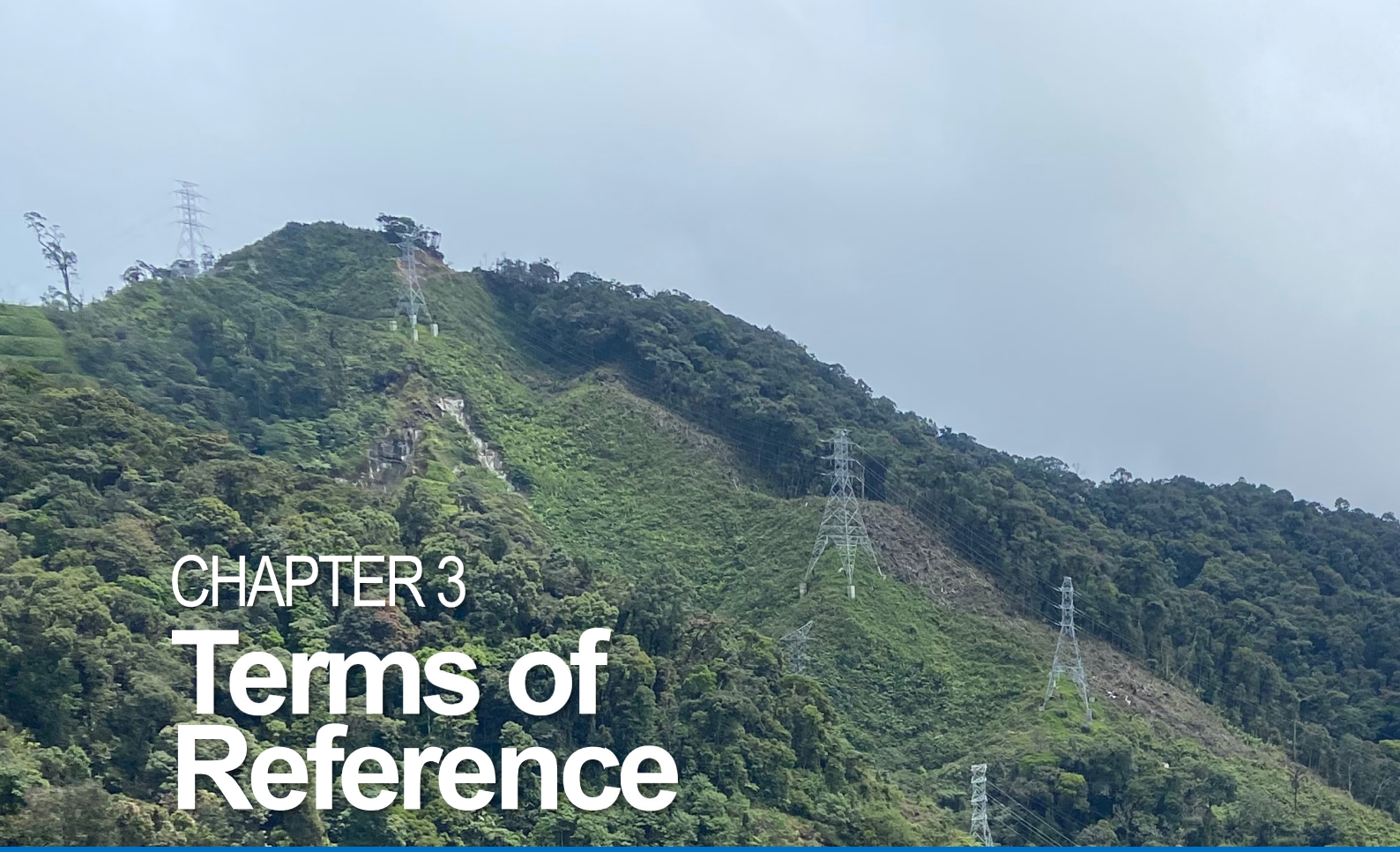
- Facilitated debates between groups with different views with the aim of reaching consensus.
- Useful for engaging specialist interest and single-issue groups.

2.8.4 Documentation and Reporting

The overall process of the stakeholder engagement must be adequately documented and reported in the EIA report. The report must include, but not limited to the followings:

- i) engagement details (date, venue, itinerary);
- ii) list of attendance;
- iii) copies of survey form;
- iv) report on summary of the engagement (minutes of meeting, photos, analysis); and
- v) video or voice recordings.

All comments both positive and negative and its responses must be compiled in the EIA and submitted to DOE for their record.



CHAPTER 3

Terms of Reference

Bentong, Pahang
Photo by Ryan Chu on Unsplash .com



3.1 INTRODUCTION

Undertaking the Terms of Reference (TOR) is the first major procedure in the overall EIA process. However, for First Schedule EIA, the TOR document submission is no longer required. Nonetheless, the scoping process main component of the TOR is still an essential exercise that needs to be carried out at the early stage of the EIA study. The key objectives in conducting the scoping process are:

- i) To assess suitability of the project site;
- ii) To refine the project boundary according to the environmental sensitivity of the surrounding area;
- iii) To determine the zone of study (ZOS) and zone of impact (ZOI);
- iv) To identify baseline data required to be assessed for the project;
- v) To outline the key project activities during the various stages of the project implementation namely pre-construction, construction and post construction;
- vi) To identify existing environmental issues within the EIA study boundary which cover physical, biological and social components;
- vii) To identify significant impacts and non-significant impacts of the project which are also to be categorised accordingly. All impacts during the various stages of the project implementation namely pre-construction, construction and post construction must be identified;
- viii) To identify and detail out the methodologies and assessment tools to be used in the EIA for the identified significant impacts; and
- ix) To propose applicable P2M2 to reduce the significant impacts.

As such, the Qualified Person must carry out environmental scoping to identify the potential adverse environmental issues of concern in order to determine the focus scope and content of the First Schedule EIA while the Second Schedule EIA, it is done to produce a comprehensive TOR document for submission to DOE.

The TOR document will be complemented by an ESI which provides further elaboration and serves as evidence on how the TOR of an EIA project is formulated. An ESI must focus mainly on the important issues and significant impacts to be addressed or covered by the Project Proponent in the EIA. Resources must not be expended on matters that are trivial. Fundamentally, a TOR document can be considered as the “executive summary” of an ESI.

3.2 ENVIRONMENTAL SCREENING

A preamble of the environmental scoping and TOR preparation is conducting environmental screening whereby it determines whether a proposed project is subject to a regulatory provision requiring an EIA as defined in *Section*

3.3 ENVIRONMENTAL SCOPING

Environmental scoping is essential to identify the environmental attributes and issues associated with the project. This is to determine the focus, depth, spatial and temporal boundaries of the EIA study that are significant and require assessment. The scoping must cover all aspects of physical, biological and socio-economic.

For nuclear power stations, they differ significantly with conventional power stations as the EIA process should meet international practice to alleviate international concerns with nuclear power stations. Thus, the scoping process must consider radiological releases, radioactive waste and spent fuel management and decommissioning process.

This is to ensure that the EIA is at an appropriate level of detail, corresponding with the scale and significance of the proposed activity. If done well, scoping will ensure that the relevant issues and information are focused on. It will also ensure that important issues are not forgotten. In overall, *Figure 3.1* illustrates the flow path for environmental scoping.

3.4 SITE SUITABILITY ASSESSMENT

The identification of a suitable site is normally undertaken during pre-feasibility stage and based on general criteria such as technical constraints, availability of land, and costs in respect of land, utilities and infrastructure facilities required. Environmental issues and impacts form additional matters which need to be taken into account in site selection. In order to achieve this, Site Suitability Assessment (SSA) is introduced as a method for site selection.

It is imperative that the nature of the proposed project must be in line with what was gazetted in the planning policies in order to avoid land use incompatibility issues. The project must conform to all hierarchy levels of the planning policies namely:

- i) National: NPP-3, RFZPPN, CFS, KSAS, etc.;
- ii) State: State Structure Plan;
- iii) Regional: Regional Development Planning Policy; and
- iv) Local: Local Plan.

Comments on SSA shall be incorporated in the EIA report. There may be a situation where the proposed project site or location may not contradict with the approved development plans or any other guidelines but the site exhibits certain critical characteristics (e.g. geomorphological features) that may present a particularly formidable constraint to the project. In such situation, the Consultant shall thoroughly examine the suitability of the site and state its conditions in the EIA report.

Table 3.1 shows some of the considerations that shall be made in assessing the suitability of the project site.

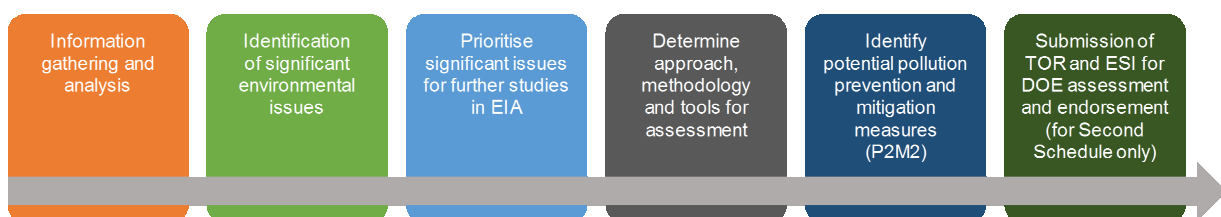


FIGURE 3.1 Environmental scoping flow path

TABLE 3.1 Considerations for SSA

PROJECT ASPECT	CONSIDERATION
Project siting	■ Adherence to national, state and local policies and guidelines ■ Site constraints to the project and vice versa ■ Location and proximity to sensitive receptors ■ Availability of adequate buffers ■ Any alternative sites proposed for the project
Terrain and topography	■ Conservational value ■ Availability of land for buffers ■ Slope classification and degree ■ Site hydrology and drainage patterns ■ Conditions of the site (soil conditions, flood risk, geohazards, etc.) ■ Visual/Aesthetic impacts
Accessibility	■ Availability of access ■ Proximity to construction/source materials ■ Strategic locational advantages ■ Traffic conditions
Pollution prevention and mitigation measures (P2M2) technology options	■ Availability of technology to minimise impacts ■ Best available control technology (BACT) options ■ Benchmarking with alternative technology ■ Green technology adoption
Project component and design	■ Layout consideration ■ Choice of method statement
Social	■ Need for land acquisition or relocation ■ Location for workers camp ■ Location within or close to sensitive area and historical sites, cemeteries, places of worship, <i>Orang Asli</i> settlements and their roaming areas ■ Location within or close to populated areas and scenic areas

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 and to engage with relevant agencies.

A 'No Project' option shall also be assessed and its implications discussed comparatively with the 'With Project' option.

An integral part of EIA is the review of project options from the environmental, economic and social standpoints. A deliberate assessment of project options during project planning encourages the Project Proponent to search for the best preference in terms of location, technology, construction methods, environmental protection measures, etc. The overall result will enhance the quality of the project, minimise adverse impacts and maximise benefit to the society.

For nuclear power projects, the alternative option is no-build option (i.e. without nuclear power). With no-build option, there will be no environmental disadvantages normally associated with nuclear power such as particulates, sulphur dioxide and nitrogen dioxide emissions.

3.4.1 Nuclear Power Station Site Selection

Site selection for a nuclear power station shall follow the Guideline for Site Selection for Nuclear Power Plant (AELB, 2011) and Guideline for Site Evaluation for Nuclear Power Plant (AELB, 2011) which are under the purview of AELB.

The AELB Guideline documents are the main reference and supported by regulation documents from IAEA. Four safety parameters are used for the siting assessment, namely, geology and hydro-geological characteristic, air dispersion (meteorological) analysis, population data and safety characteristics. The safety characteristics consist of determination of safety zones and emergency infrastructure for nuclear

power station from estimated radioactive dispersion in a postulated nuclear accident. Also, the waste generated, both nuclear as well as radioactive waste, are to be stored at site for a designated time frame until a permanent waste disposal site is found, licensed and operational.

Note that, a nuclear-fuel power project site is required to be licensed by AELB, as a mandatory safety standard. The waste disposal site on the other hand shall require a different EIA approval and siting licensing.

The general site selection criteria for nuclear power projects are listed in *Table 3.2*.

TABLE 3.2 General site selection criteria for nuclear power station project

CRITERIA	DESCRIPTION
Geology/Seismology	■ Avoid areas with active (and dormant) volcanic activity ■ Avoid subsidence areas caused by withdrawal of sub-surface fluids ■ Avoid unstable slope areas ■ Avoid areas of potential collapse (e.g.: karstic areas in limestone, salt or other soluble formations) ■ Avoid mined areas ■ Avoid areas subject to seismic and other induced water waves and floods
Atmospheric dispersion	■ Identify any areas of the project boundary where short-term dispersion characteristics do not satisfy the standard nuclear power station design value
Population consideration	■ Determine population distribution and density within project area and potential sites based on available census data ■ Consideration should be given to sites located away from very densely populated areas ■ Areas of low population density are generally preferred
Emergency planning	■ Consideration to the significant impediments to the implementation of emergency planning such as: i) traffic capacity; ii) number of egress alternatives; iii) network type (e.g.: freeway or expressway, urban streets or rural roads); iv) on ramp capacities for freeways; v) number of traffic control points per network segment; vi) terrain characteristics; and vii) climatic conditions.
Security plan	■ Site characteristics should be such that adequate security plans and measures can be established and implemented

Source: AELB, 2011

TABLE 3.2 (cont'd)

General site selection criteria for nuclear power station project

CRITERIA	DESCRIPTION
Hydrology	■ Identify and exclude major flood-prone area within project area ■ Identify and compare site supply characteristics associated with low-flow conditions ■ The following factor should be taken into account in assessing the impacts on water quality: i) baseline thermal loadings (from upstream facilities); ii) baseline ambient water temperature; iii) baseline chemical properties; iv) stream flow rate and width; v) the sensitivity of the species present; and vi) baseline concentrations of dissolved oxygen, dissolved solids and nutrients.
Industrial, military and transportation facilities	■ Identify and avoid an area within 16 km from major airports ■ Consideration to existing and projected of the following facility within 8 km from project area: i) military bases, ammunition storage areas and ordinance test ranges, missile bases, firing or bombing ranges; ii) oil pipelines; iii) oil or gas wells; iv) oil and gas storage areas; v) significant manufacturing facilities; vi) chemical facilities; vii) refineries; viii) mining and quarrying operations; ix) dams; x) land and water transportation routes for hazardous materials; and xi) docks and anchorages for hazardous materials
Ecological system and biota	■ Identify and exclude all areas categorised as ESA Rank 1 ■ Avoid any area with likely presence of threatened or endangered species
Land use and aesthetics	■ Identify and exclude all protected areas, particularly those areas gazetted within definition of Convention on Biological Diversity and International Union for the Conservation of Nature ■ Identify, avoid and give special considerations to the following nearby facilities: i) hospitals; ii) schools; iii) prime agricultural lands; iv) historic, cultural and archaeological sites; v) commercially exploitable mineral resources; vi) transportation and utility corridors; and vii) recreational areas. ■ Considerations should be given to designated amenity areas, land use compatibility and consistency with NPP, Structure Plan, Local Plan and Special Area Plan.
Socioeconomics	■ Conduct SIA study as required by Act 172.

Source: AELB, 2011

3.5 EIA STUDY BOUNDARY

It is essential to determine the coverage and boundary of the EIA study to ensure significant environmental issues are comprehensively assessed and reported. There are two types of study boundaries as per below. These boundaries are illustrated in *Figure 3.2* and *Figure 3.3*.

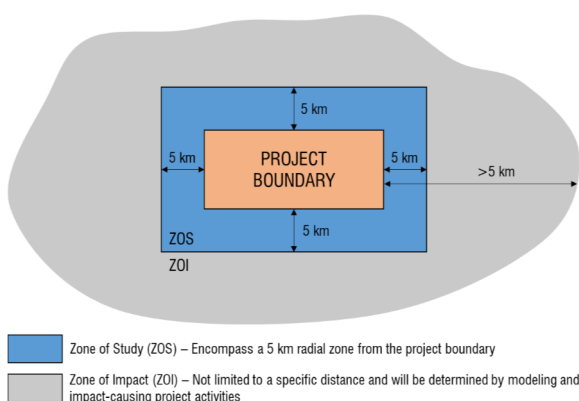


FIGURE 3.2 Types of study boundaries

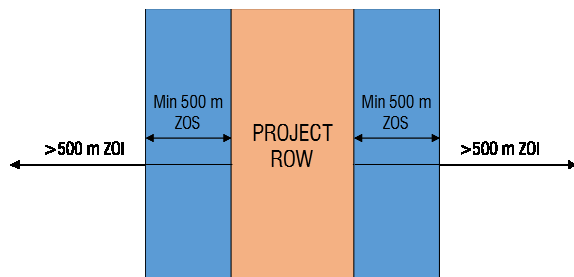


FIGURE 3.3 Extent of ZOS and ZOI for linear projects

3.5.1 Project Buffer Zones

The Qualified Person must refer to approved development plans, relevant guidelines, policies and regulations in order to determine the required buffer zones for the groundwater project. Buffer zones must be established in order to:

- protect any ESA or sensitive receptors that might be affected by the project implementation; and
- protect the project area from being contaminated by any surrounding pollution.

3.5.2 Emergency Planning Zone

Nuclear power stations require a larger buffer zone and study boundary, called an Emergency Planning Zone. Its concept is as shown below in *Figure 3.4*, in which, IAEA designate a maximum of 30 km radius from the project while the United States of America (USA) authority regulated an 80 km (50 miles) radius. If there is food source areas such as paddy fields present within the 80 km, the Emergency Planning Zone shall extend to 80 km. The width of the Emergency Planning Zone dictates the environmental sampling scope of the project. It is recommended for the user to abide to the latest AELB guidelines in the designation of the Emergency Planning Zone for nuclear power stations.

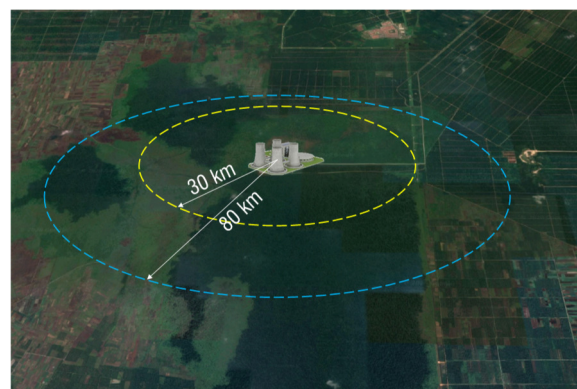


FIGURE 3.4 Nuclear power station emergency planning zone

3.6 BASELINE DATA REVIEW

The baseline information can be qualitative but must be adequate to assess the potential impacts on the ESA. Quantitative data and findings wherever available, must be furnished to support the assessment. *Table 3.3* provides the indicative requirements for baseline description in the environmental scoping exercise.

If any of the baseline data are unavailable at the time of scoping, the Qualified Person must state in the TOR that the data will be made available in the EIA report. Irrelevant and insignificant baseline data requirement can be omitted and justified in the TOR.

TABLE 3.3 Baseline data requirements for environmental scoping

ENVIRONMENTAL COMPONENT		TYPE OF DATA	DATA SOURCE
Physical	Topography	■ Contour ■ Elevation ■ Terrain - slope ■ Description of existing morphology of the project area e.g. hilly, undulating, etc. ■ Construction suitability map	■ Topography maps (JUPEM) ■ Topographic survey
	Land use	■ Land use maps ■ Photos ■ Description of existing and future land use (5, 30 or 80 km ZOS)	■ Aerial or satellite imagery ■ Structure and local plans (PLANMalaysia) ■ Ground truthing
	Geology/ Hydrogeology	■ Description of local and regional geology/hydrogeology ■ Aquifers	■ Geological and hydrogeological maps (JMG) ■ Geological Terrain Mapping (GTM) report
	Soil characteristics	■ Soil profile ■ Particle size distribution ■ Construction suitability map	■ Soil investigation (SI) report ■ Soil map (Department of Agriculture – DOA)
	Climate	Climate data (min 5 years):	Malaysian Meteorological Department (METMalaysia)
	Hydrology	■ River systems ■ Catchment areas ■ Flood prone areas	■ Hydraulic and hydrology report ■ Topography map ■ Flood map (DID)
	Water quality	■ Historical water quality data ■ Water intake points ■ Water treatment plants	■ Published reports by water agencies and DOE ■ State water resources departments ■ Field data collection
	Air quality	Historical air quality data	■ Published reports by DOE ■ Ground-truthing
	Noise and vibration level	Location of noise polluting sources	Field data collection

*Other baseline data e.g. contour areas, biological ecosystems, heritage areas etc. are also considered as ESAs. This section highlights specific ESAs that may need to be considered for the project.

3 TERMS OF REFERENCE

TABLE 3.3 (cont'd) Baseline data requirements for environmental scoping

ENVIRONMENTAL COMPONENT		TYPE OF DATA	DATA SOURCE
Biological	Ecosystem (terrestrial, flora and fauna, fisheries, marine flora and fauna)	- Existing ecology and habitats - Presence of endemic, rare, threatened, endangered and near extinct flora and fauna	- Published reports by PERHILITAN and DIDM - Ground truthing and field data collection
Social	Demography	- Demographics data - Stakeholders	- Population census (Department of Statistics) - Local Plans (PLANMalaysia)
	Public health	Public health status	Morbidity statistics and public health data (MOH)
	Heritage, culture and archaeology	- Locations of historical and cultural sites - Location and numbers of <i>Orang Asli</i> areas and settlements	Data from JAKOA
	Ecotourism	Locations of ecotourism sites	Data from Ministry of Tourism, Arts and Culture Malaysia (MOTAC)
Others	Land traffic	Road network	- Aerial or satellite imagery - Ground-truthing
	Marine traffic	Marine traffic Navigation channel Port limit	- Bathymetry - Data from Marine Department - Ground-truthing
Environmentally Sensitive Areas (ESAs)	- Central Forest Spine (CFS) - Water intakes (downstream of project area) - Water intake catchment areas - Groundwater recharge zones - Sensitive receptors		- NPP-3 - GPPPP - Aerial or satellite imagery - Structure and local plans (RTD) - Ground-truthing

*Other baseline data e.g. contour areas, biological ecosystems, heritage areas etc. are also considered as ESAs. This section highlights specific ESAs that may need to be considered for the project.

3.6.1 Identification of Existing Environmental Site Constraints

Subsequent to the reviewing of available baseline data, a list of existing site constraints can be generated based on the data in hand. Examples of environmental site constraints are:

- flood-prone areas;
- slope areas;
- central forest spine; and
- Orang Asli* settlement or roaming area.

The identification of these constraints must be done as early as possible to ensure that the proposed project can be designed and implemented smoothly. This includes any mitigation to alleviate the anticipated impacts.

3.7 DETERMINATION OF KEY PROJECT ACTIVITIES

In order to successfully undertake an EIA, it is necessary to conduct the following:

- describe the project activities which could potentially adversely affect the environment.
- clearly identify just what the issues are.
- predict who or what could be affected and how.
- evaluate the significance of the effects.

The identification of key project activities should be done as early as the scoping stage. Although the activities may be different, in many instances their impacts on the environment are similar.

When evaluating and describing the existing environment and the impact on this environment from the project, it is **the issues** which need to be highlighted with the focus on the components of the environment.

When it comes to determining practical mitigating measures, however, such as specifying clauses within contract documentation, the focus changes back to **the activities** (including siting), for it is by controlling activities that environmental effects can be most cost-effectively mitigated.

The Project Proponent must provide key project activities to the Qualified Person during the scoping stage. The project activities are the basis for assessing the potential impacts. A summary of the typical dam project activities at each project stage is presented in *Figure 3.5*.

Project activities associated with power generation and transmission projects are outlined in *Table 3.4*. The list includes most of the major activities related to power generation and transmission projects but may be modified if specific activities, not already mentioned, form part of the overall development. It should be noted that even though the disposal of radiological waste and spent fuel activities require a separate EIA submission to DOE for approval, they still need to be addressed in the EIA for power generation and transmission project.

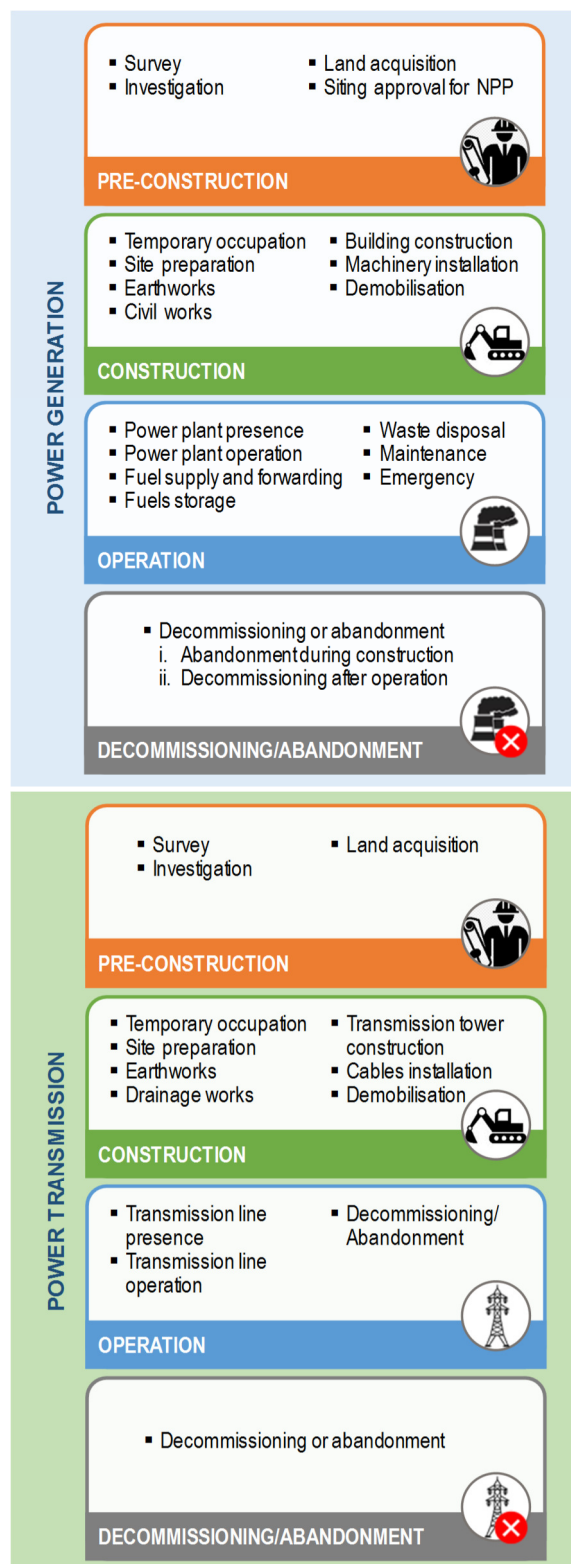


FIGURE 3.5 Typical power generation and transmission project key activities

3 TERMS OF REFERENCE

TABLE 3.4 Activities associated with power generation and transmission projects

ACTIVITY		ISSUE OF CONCERN
POWER GENERATION	1. PRE-CONSTRUCTION SURVEY	
	■ Survey i) Putting surveyors into new areas ii) Cutting sight lines through vegetation iii) Establishing base camps	■ Soil erosion ■ Water pollution ■ Wildlife disturbance ■ Waste management ■ Public opposition
	■ Investigation i) Siting investigation ii) Introduction of workforce in new areas iii) Establishing base camps iv) Putting in access tracks v) Drilling holes and/or digging pits vi) Baseline environmental and radiological sampling	
	■ Land acquisition i) Acquire land ii) Resettlement of affected occupants	■ Socio-economy (resettlement and rehabilitation) ■ Public opposition ■ Land use change ■ Demolition waste
	2. CONSTRUCTION ACTIVITIES	
	■ Temporary occupation i) Construction of temporary buildings, storage facilities and working areas ii) Water supply iii) Solid waste disposal iv) Sewage disposal v) Workforce vi) Pest control vii) Machine servicing and maintenance	■ Soil erosion ■ Loss of biodiversity and wildlife disturbance ■ Water pollution (sewage and sillage) ■ Air and noise pollution ■ Waste management ■ Safety and health
	■ Site preparation i) Demolition and removal of structures ii) Removal and disposal of vegetation (including trees) iii) Construction of access roads iv) Construction of temporary drainage v) Operation of equipment (chainsaw, bulldozers)	■ Soil erosion ■ Water pollution (silt) ■ Loss of biodiversity ■ Waste (biomass disposal) ■ Hydrology and drainage ■ Air and noise ■ Land/Marine traffic safety
	■ Earthwork i) Operation of equipment (bulldozers, diggers, trucks, scrapers) ii) Construction of haul roads iii) Cutting (may include drilling/blasting) iv) Transportation of soil and waste v) Filling vi) Building ground retention structures	
	■ Civil works i) Operation of equipment ii) Diversion of surface waters iii) Transportation of aggregates iv) Laying of pavement for permanent roads	■ Soil erosion ■ Water pollution (silt) ■ Slope erosion ■ Slope stability ■ Land/marine traffic safety

TABLE 3.4 (cont'd) Activities associated with power generation and transmission projects

ACTIVITY	ISSUE OF CONCERN
2. CONSTRUCTION ACTIVITIES (cont'd)	
■ Building construction i) Operation of equipment ii) Piling/Foundation works iii) Transportation of structure, station and materials iv) Pouring of concrete	■ Water pollution (concrete) ■ Construction waste ■ Hydrology and drainage ■ Slope erosion ■ Slope stability ■ Land/marine traffic safety
■ Machinery installation i) Boilers/Turbines/Nuclear reactor and components installation	■ Water quality ■ Land use change ■ Aesthetic/visual ■ Public opposition
3. OPERATION ACTIVITIES	
■ Power station presence i) Chimneys/Stacks ii) Radiation emission iii) Buildings and infrastructure iv) Water intakes and outlets v) Amenities	■ Water quality ■ Air quality ■ Hydrology and drainage ■ Soil condition ■ Land use change ■ Safety and health (including radiatological) ■ Socio-economy (perception) ■ Aesthetic/visual ■ Nuclear security
■ Power station operation i) Station (turbines, boilers, radiators/transformers, nuclear reactors) ii) Air discharge (NO₂, CO₂, CO, SO₂, Particulates, dioxin and furans, heavy metals, radionuclides for nuclear power station) iii) Water discharge iv) Spills and leaks v) Radiation and radiological emission	■ Water quality ■ Air quality ■ Hydrology and drainage ■ Soil condition ■ Safety and health (including radiatological) ■ Socio-economy (perception) ■ Nuclear security and safeguard ■ Marine life for large power station including nuclear power station
■ Fuel supply and forwarding i) Road or marine tankers ii) Oil and/or gas pipelines iii) Conveyors	■ Land traffic safety ■ Marine traffic safety ■ Water quality ■ Air quality ■ Socio-economy ■ Nuclear security and safeguard
■ Fuels storage i) Oil storage ii) Coal storage iii) Uranium storage	■ Water quality ■ Nuclear security and safeguard ■ Safety and health
■ Waste disposal i) Wastewater (sewage and cooling water) ii) Ash iii) Spent fuel iv) Radioactive waste v) Solid waste vi) Scheduled waste	■ Water quality ■ Air quality ■ Safety and health (including radiatological) ■ Soil and groundwater contamination ■ Public opposition
■ Maintenance i) Routine shutdown ii) General maintenance	■ Scheduled waste ■ Solid waste

3 TERMS OF REFERENCE

TABLE 3.4 (cont'd) Activities associated with power generation and transmission projects

ACTIVITY		ISSUE OF CONCERN
POWER GENERATION	3. OPERATION ACTIVITIES (cont'd)	
	■ Emergency i) Power station fire or explosion ii) Nuclear accident	■ Public and residence evacuation ■ Health and safety protection including admission of protective tablets ■ Food consumption restrictions ■ Socio-economy ■ Clinical emergency ■ Recovery plan and execution
	4. ABANDONMENT AND DECOMMISSIONING	
	■ Abandonment during construction i) Demobilisation and removal of temporary buildings ii) Waste removal/disposal (rubbish, equipment and liquid wastes) iii) Rehabilitation of occupied or contaminated site ■ Decommissioning after operation i) Asbestos removal and disposal ii) Transformer oil disposal iii) Landfill closure iv) Ash pond (secured landfill) v) Rehabilitation of contaminated land vi) Contaminated building materials	■ Soil erosion ■ Water pollution ■ Air and noise pollution ■ Safety and health ■ Unmanaged wastes
TRANSMISSION LINE	1. PRE-CONSTRUCTION ACTIVITIES	
	■ Survey i) Putting surveyors into new areas ii) Cutting sights lines through vegetation iii) Establishing base camps ■ Investigation i) Introduction of workforce in new areas ii) Establishing base camps iii) Putting in access tracks iv) Drilling holes and/or digging pits	■ Soil erosion ■ Water pollution ■ Wildlife disturbance ■ Waste management
	■ Land acquisition i) Acquire land ii) Resettlement of affected occupants	■ Socio-economy (resettlement and rehabilitation) ■ Land use change ■ Demolition waste
	2. CONSTRUCTION ACTIVITIES	
	■ Temporary occupation i) Construction of temporary buildings, storage facilities and working areas ii) Water supply iii) Solid waste disposal iv) Sewage disposal v) Workforce vi) Pest control vii) Machine servicing and maintenance	■ Soil erosion ■ Loss of biodiversity and wildlife disturbance ■ Water pollution (sewage and sullage) ■ Air and noise pollution ■ Waste management ■ Safety and health
	■ Cables installation i) Transportation of cables ii) Laying and stringing of cables	■ Safety and health (workers and public for stringing across public roads) ■ Water quality ■ Land use change ■ Aesthetic/Visual

TABLE 3.4 (cont'd) Activities associated with power generation and transmission projects

ACTIVITY	ISSUE OF CONCERN
2. CONSTRUCTION ACTIVITIES (cont'd)	
■ Site preparation i) Demolition and removal of structures ii) Removal and disposal of vegetation (including trees) iii) Construction of access roads iv) Construction of temporary drainage v) Operation of equipment (chainsaw, bulldozers)	■ Soil erosion ■ Water pollution (silt) ■ Loss of biodiversity ■ Waste (biomass disposal) ■ Hydrology and drainage ■ Air and noise ■ Land traffic safety
■ Earthwork i) Operation of equipment (bulldozers, diggers, trucks, scrapers) ii) Construction of haul roads iii) Cutting (may include drilling/blasting) iv) Transportation of soil and waste v) Filling vi) Building ground retention structures	
■ Drainage works i) Operation of equipment ii) Diversion of surface waters	■ Soil erosion ■ Water pollution (silt) ■ Slope erosion ■ Slope stability ■ Land traffic safety
■ Transmission tower construction i) Operation of equipment ii) Piling/Foundation works iii) Transportation of structure, station and materials iv) Concreting	■ Water pollution (concrete washout/silt) ■ Construction waste ■ Hydrology and drainage ■ Slope erosion ■ Slope stability ■ Land traffic safety
3. OPERATION ACTIVITIES	
■ Transmission line presence i) Towers ii) Aerial cables iii) Cleared swathe iv) Consequential activities (including horticulture)	■ Land use change ■ Socio-economy ■ Aesthetic/visual
■ Transmission line operation i) Electromagnetic radiation emission ii) Interference iii) Cable breaks	■ Safety and health ■ Socio-economy ■ Aesthetic/visual
4. ABANDONMENT AND DECOMMISSIONING	
■ Abandonment i) Borrow areas ii) Unsuitable or surplus spoil dumps iii) Camp sites iv) Rubbish dumps v) Equipment vi) Liquid wastes	■ Soil erosion ■ Water pollution ■ Air and noise pollution ■ Safety and health ■ Unmanaged wastes
■ Decommissioning i) Removal of cables and towers ii) Replanting	■ Water pollution ■ Air and noise pollution ■ Safety and health ■ Wastes (demolition wastes)

3.8 IDENTIFICATION OF SIGNIFICANT IMPACTS AND PRIORITY SETTING

This section discusses the technique to prioritise impacts as well as the linkage between activities issues and impacts.

3.8.1 Technique to Prioritise Environmental Impacts

There are various techniques that can be used to conduct environmental scoping, such as:

- i) networks method;
- ii) comparison with other similar projects;
- iii) questionnaire checklists; and
- iv) matrix.

The recommended technique to analyse and prioritise important issues in an EIA study is by using a matrix table (*Table 3.5*). The matrix table provides a means to assess the cause-effect relationship between the project activities and their impacts on the environment. The Qualified Person is required to determine the significance of an impact. It is recommended that the matrix table is incorporated in the ESI document.

How to develop an impact matrix table:

1. X-axis – activities (subdivides to three phases i.e. pre-construction, construction, operation, abandonment or decommissioning)
2. Y-axis – components of the environment
3. Contents of the matrix table are not fixed and may vary based on the project activities and location.
4. Label the components that are potentially impacted from each activity (X, T, I, S, R or P)

In addition to the impact matrix established, there are also several criteria that need to be considered in prioritising significant impacts to be studies in the EIA which are as follow:

- i) **Magnitude:**
The degree and scale of an impact (positive/negative) towards sensitive receptors due to the proposed activity
- ii) **Permanence:**
Nature of the effects whether they are temporary or permanent
- iii) **Reversibility:**
A measure of whether mitigation measures can be implemented in rehabilitating the site back to its original state or better
- iv) **Cumulative impacts:**
A measure of whether the effects will be accumulative singly or in combination with other effects from nearby sites/activities (positive/ negative) over a period of time

TABLE 3.5 Specific EIA matrix for power generation and transmission projects

PROJECT ACTIVITIES	PHYSICO-CHEMICAL													
	LAND COMPATIBILITY									SURFACE WATER				
	Landforms	Soil Profile	Soil Composition	Slope Stability	Subsidence and Compaction	Seismicity	Flood Plains / Swamps	Land Use	Engineering and Mineral Resources	Buffer Zones	Shore Line	Bottom Interface	Flow Variation	Water Quality
PRE-CONSTRUCTION														
■ Survey														
■ Investigation														
■ Land acquisition														
CONSTRUCTION														
■ Temporary occupation														
■ Site preparation														
■ Earthwork														
■ Civil works														
■ Drainage works														
■ Building construction														
■ Transmission tower construction														
■ Cables installation														
■ Machinery installation														
■ Abandonment/Demobilisation														
POST-CONSTRUCTION														
■ Power station presence														
■ Transmission line presence														
■ Power station operation														
■ Transmission line operation														
■ Fuel supply and forwarding														
■ Waste disposal														
■ Maintenance														
■ Emergency														
■ Abandonment/Decommissioning														

X Insignificant and excluded from EIA study.

T Environmental impact that is potentially significant but on a temporary basis and will assume equilibrium after certain period of time.

I Environmental impact that is potentially significant but about which there is insufficient data to make a reliable prediction. Close monitoring and control is recommended.

S Potentially significant adverse environmental impact for which a design solution has been identified.

R Residual and significant adverse environmental impact.

P Significant positive environmental impact.

3 TERMS OF REFERENCE

TABLE 3.5 (cont'd) Specific EIA matrix for power generation and transmission projects

PROJECT ACTIVITIES	PHYSICO-CHEMICAL												
	GROUND WATER				ATMOSPHERE					NOISE			
	Water Table	Flow Regime	Water Quality	Recharge	Aquifer Characteristics	Existing Use	Air Quality	Air Flow	Climate Change	Visibility	Intensity	Duration	Frequency
PRE-CONSTRUCTION													
■ Survey													
■ Investigation													
■ Land acquisition													
CONSTRUCTION													
■ Temporary occupation													
■ Site preparation													
■ Earthwork													
■ Civil works													
■ Drainage works													
■ Building construction													
■ Transmission tower construction													
■ Cables installation													
■ Machinery installation													
■ Abandonment/Demobilisation													
POST-CONSTRUCTION													
■ Power station presence													
■ Transmission line presence													
■ Power station operation													
■ Transmission line operation													
■ Fuel supply and forwarding													
■ Waste disposal													
■ Maintenance													
■ Emergency													
■ Abandonment/Decommissioning													

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R Residual and significant adverse environmental impact.

P Significant positive environmental impact.

TABLE 3.5 (cont'd) Specific EIA matrix for power generation and transmission projects

PROJECT ACTIVITIES	BIOLOGICAL												
	SPECIES AND POPULATIONS						HABITATS AND COMMUNITIES						
	Terrestrial Vegetation	Terrestrial Wildlife	Other Terrestrial Fauna	Aquatic / Marine Flora	Fish	Other Aquatic / Marine Fauna	Terrestrial Habitat	Terrestrial Communities	Aquatic Habitats	Aquatic Communities	Estuarine Habitats	Estuarine Communities	Marine Habitats
PRE-CONSTRUCTION													
■ Survey													
■ Investigation													
■ Land acquisition													
CONSTRUCTION													
■ Temporary occupation													
■ Site preparation													
■ Earthwork													
■ Civil works													
■ Drainage works													
■ Building construction													
■ Transmission tower construction													
■ Cables installation													
■ Machinery installation													
■ Abandonment/Demobilisation													
POST-CONSTRUCTION													
■ Power station presence													
■ Transmission line presence													
■ Power station operation													
■ Transmission line operation													
■ Fuel supply and forwarding													
■ Waste disposal													
■ Maintenance													
■ Emergency													
■ Abandonment/Decommissioning													

X Insignificant and excluded from EIA study.

T Environmental impact that is potentially significant but on a temporary basis and will assume equilibrium after certain period of time.

I Environmental impact that is potentially significant but about which there is insufficient data to make a reliable prediction. Close monitoring and control is recommended.

S Potentially significant adverse environmental impact for which a design solution has been identified.

R Residual and significant adverse environmental impact.

P Significant positive environmental impact.

3 TERMS OF REFERENCE

TABLE 3.5 (cont'd) Specific EIA matrix for power generation and transmission projects

PROJECT ACTIVITIES	HUMAN										
	HEALTH AND SAFETY							SOCIAL			
	Physical Safety	Physiological Well-being	Parasitic Safety	Communicate Disease	Physiological Disease	Radiation Exposure	Nuclear Safety and Safeguard	Employment	Housing	Education	Utilities
PRE-CONSTRUCTION											
■ Survey											
■ Investigation											
■ Land acquisition											
CONSTRUCTION											
■ Temporary occupation											
■ Site preparation											
■ Earthwork											
■ Civil works											
■ Drainage works											
■ Building construction											
■ Transmission tower construction											
■ Cables installation											
■ Machinery installation											
■ Abandonment/Demobilisation											
POST-CONSTRUCTION											
■ Power station presence											
■ Transmission line presence											
■ Power station operation											
■ Transmission line operation											
■ Fuel supply and forwarding											
■ Waste disposal											
■ Maintenance											
■ Emergency											
■ Abandonment/Decommissioning											

X Insignificant and excluded from EIA study.

T Environmental impact that is potentially significant but on a temporary basis and will assume equilibrium after certain period of time.

I Environmental impact that is potentially significant but about which there is insufficient data to make a reliable prediction. Close monitoring and control is recommended.

S Potentially significant adverse environmental impact for which a design solution has been identified.

R Residual and significant adverse environmental impact.

P Significant positive environmental impact.

TABLE 3.5 (cont'd) Specific EIA matrix for power generation and transmission projects

PROJECT ACTIVITIES	HUMAN												
	AESTHETIC AND CULTURAL												
	Landforms	Biota	Wilderness	Water Quality	Atmospheric Quality	Climate	Tranquility	Sense of Community	Community Structure	Man-made Objects	Historic Places or Structure	Religious Places or Structure	Landscape
PRE-CONSTRUCTION													
■ Survey													
■ Investigation													
■ Land acquisition													
CONSTRUCTION													
■ Temporary occupation													
■ Site preparation													
■ Earthwork													
■ Civil works													
■ Drainage works													
■ Building construction													
■ Transmission tower construction													
■ Cables installation													
■ Machinery installation													
■ Abandonment/Demobilisation													
POST-CONSTRUCTION													
■ Power station presence													
■ Transmission line presence													
■ Power station operation													
■ Transmission line operation													
■ Fuel supply and forwarding													
■ Waste disposal													
■ Maintenance													
■ Emergency													
■ Abandonment/Decommissioning													

X Insignificant and excluded from EIA study.

T Environmental impact that is potentially significant but on a temporary basis and will assume equilibrium after certain period of time.

I Environmental impact that is potentially significant but about which there is insufficient data to make a reliable prediction. Close monitoring and control is recommended.

S Potentially significant adverse environmental impact for which a design solution has been identified.

R Residual and significant adverse environmental impact.

P Significant positive environmental impact.

3.8.2 Linkage between Activities, Issues and Impacts

Environmental impacts result from actions, or activities, associated with planning, constructing, operating and closing of groundwater projects.

Activities which result in environmental changes that are potentially significant are **issues**. The **amount and degree of environmental change** is the **impact**. **Impacts** can be grouped under **issues** and can be broken down into primary and secondary impacts. **Impacts** can also be grouped under broad **environmental components** which are subject to change.

Environmental issues or problems, basically arise when the project activities:

1. Have the **potential to cause pollution or other physical effects**.
2. Result in **resource depletion** (i.e. not sustainable).
3. **Threaten biodiversity**.
4. Are not **acceptable to the host community or wider public** (possibly as a result of all points above among other matters).

3.8.3 Issues and Impacts

Issues and impacts can be formulated from the project activities mentioned in *Section 3.6*. A brief discussion on the environmental issues throughout the project period i.e. pre-construction, construction and operation is presented in the following sub-sections.

PRE-CONSTRUCTION OR SITING: Majority of pre-construction impacts include the site selection of highly sensitive power stations such as coal (both for low quality and good quality coal), WtE and nuclear power stations. The related perceived emission and safety of the station to be sited at a locality/region can affect both the environment as well as socio-economy of the surrounding.

CONSTRUCTION: Negative construction impacts are caused primarily by the following site preparation activities: clearing, excavation, earth moving, dewatering, dredging and/or impounding streams and other water bodies, establishing lay-down areas, and developing borrow and fill areas. The large number of workers employed in construction power stations can have significant socio-cultural impacts on local communities.

OPERATION: For a nuclear power station, the most significant impact is during abnormal operation when accident occurs. Nuclear power station accidents are classified into various levels (e.g.: the radioactive release may be significant but does not warrant national level emergency or vice versa). National level emergency may result in very serious environmental and socio-economic impact affecting either within or beyond national borders.

ABANDONMENT OR DECOMMISSIONING: Abandonment of power generation projects may occur during construction stage due to economic crisis or lack of resources. On the other hand, decommissioning of power generation projects happen once its operation is deemed completed or not needed anymore. The impacts include improper disposal of waste and potential contamination of land. Nuclear power plants in particular requires complex processes including the preparation of separate EIA report, treatment or disposal of contaminated construction materials and monitoring of the situation until release from regulatory control.

3.8.3.1 Key Issues: Power Generation

The major components of power generation projects include the power system (i.e. energy conversion, turbine and generator) and associated facilities, which may include the cooling system, stack gas cleaning equipment, fuel storage areas, waste management, safety, security and safeguard systems, worker colonies and electrical substations. The type of facility and size of power generation projects, as well as location, will determine the type and size of these associated facilities and their impacts. Most power stations in Malaysia are located

along the coast to ease the receiving of raw materials via sea, as well as sea water used for cooling purposes. They are also sometimes built on reclaimed land (exclude nuclear power station).

Negative impacts can occur during pre-construction or siting, construction, operation and abandoning or decommissioning of power generation. Effects from operations are fully covered in *Table 3.6*.

TABLE 3.6 Key issues for power generation

ISSUES	IMPACTS
Location of power station	■ Effects on geology and soils May sterilise any mineral resources beneath it depending on the value placed on the geological and soil resources
	■ Effect on climate and meteorology i) Fog or smog, especially in basins or valleys which do not have adequate flushing of ambient air ii) Nuclear power has positive impacts on climate change
	■ Effects on land use i) Change from forests or wetlands to industrial area ii) Conflict with <i>Orang Asli</i> settlement iii) Conflict with fishermen community
	■ Loss of habitat i) Loss of habitat mostly aquatic ii) Avoid building power stations near sensitive habitats like coral reefs and seagrass
	■ Effect on the visual landscape (aesthetic) i) Visual obstruction by structures ii) Visual intrusion relies upon the opinion of the particular viewer as to whether the impact on the landscape is negative or positive, and its degree of significance
	■ Effects on population and communities i) Misplaced or resettlement of individual households ii) Influx of workers iii) Affect sites of cultural significance such as burial grounds or other sacred sites iv) May affect the safety, environment and socio-economy of nearby population in case of nuclear power accident
Discharge to air (air emission)	■ Reduced air quality (localised) i) Emission of sulphur oxide (SOX), nitrogen oxide (NOX), carbon monoxide (CO), carbon dioxide (CO₂) and particulates (which may contain trace metals and dioxin) ii) Radionuclide emission may cause safety and environmental hazards during nuclear power station accident (Krypton, Xenon, Argon, Iodine, Bromine, Cobalt, Cesium, Chromium, Manganese, Niobium and Hydrogen)

3 TERMS OF REFERENCE

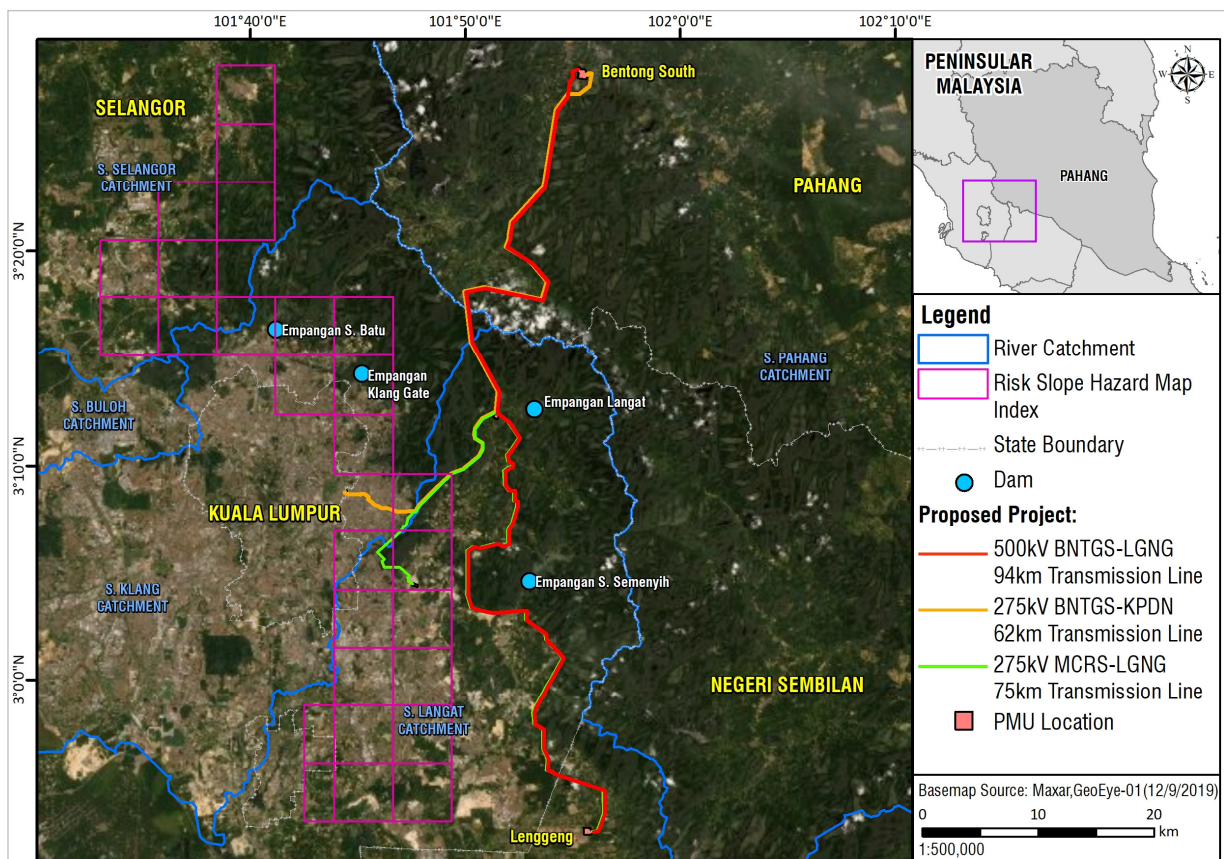
TABLE 3.6 (cont'd) Key issues for power generation

ISSUES	IMPACTS
Discharge to air (air emission) (cont'd)	■ Causes acid rain Act as precursors of acid rain, particularly when coal with its high sulphur content is the fuel
	■ Thermal plume effects on aircraft i) Aircraft safety from buoyant emissions from chimneys (e.g. from power stations and other industrial sources). ii) Threshold limit on temperatures and velocities from the approved funnels
	■ Reduced visibility High particulate levels in stack emissions can also reduce visibility, effecting aircraft operations
	■ Radiation i) Radiation emission from radionuclides from coal and nuclear power station: The list of radionuclides are shown in <i>Attachment 1</i>. ii) Health hazards may exist
Discharge to water	■ Improper radioactive waste/spent fuel management Radiation emission from radionuclides from coal and nuclear power station: The list of radionuclides are shown in <i>Attachment 1</i>.
	■ Malfunction of wastewater or effluent treatment system Wastewater or effluent that are not sufficiently treated may enter the waterways around the project area.
	■ Effect to water resources in catchment Thermal effect to receiving water Impact of radioactive contamination to groundwater Extent of impact of release to surrounding receiving water
Fuel forwarding and/or storage	■ Public perception i) Low risk is associated with fuel forwarding / storage of gas, oil and nuclear fuel but public perception thinks otherwise ii) Risk assessment required by DOE iii) Preparation of Emergency Response Plan (ERP) as part of Environmental Management Plan (EMP)
	■ Threat to human safety i) Potential threat to human life from fires and explosions; and water quality from spills ii) Risk assessment required by DOE
	■ Security and safeguards of nuclear fuel Risk of nuclear fuel abuse for proliferation purposes
Radiological waste management	■ Radiation dose assessment Improper disposal may cause radiation exposure to humans and environment
	■ Spent fuel management i) May be processed for recycling or disposed of ii) Follow IAEA Guidelines in managing / disposing iii) May create negative public perception iv) Risk of proliferation (safety, security and safeguard)
	■ Accidents or spillage Radionuclides and nuclear waste may spread by air or water into land, underground water, in the populated or sensitive areas.

3.8.3.2 Key Issues: Power Transmission

Electric power transmission systems include the transmission line, its right-of-way (ROW), switchyards, substation, and access or maintenance roads. The principal structures of the transmission line include the line itself, conductors, towers, and supports (e.g. wires). The voltage and capacity of the transmission line affects the sizes required for these principal structures.

Transmission line can range from several kilometres to hundreds of kilometres in length. The ROW in which the transmission line is constructed can range in width from 20 to 500 m or greater depending upon the size of the line and the number of transmission lines located within the ROW. Transmission lines are primarily overland systems and can be constructed to span or cross wetlands, streams, rivers, hills and near-shore areas. Underground transmission lines are technically feasible but are very costly.



Transmission line alignment crossing four different states
Source: DNASB

3 TERMS OF REFERENCE

Like highways and roads, electric power transmission lines are linear facilities that will affect natural and socio-cultural resources. The effects of short transmission lines can be localised; however, long transmission lines can have regional effects.

Environmental impacts to natural, social, and cultural resources increase with increasing line length. As linear facilities, the impacts of transmission lines occur primarily within or in the immediate vicinity of the ROW.

The magnitude and significance of the impacts increase as the voltage of the line increases, requiring larger supporting structures and ROWs. Operational impacts also increase. For example, electromagnetic field (EMF) effects are significantly greater for larger power transmitted.

Negative environmental impacts of transmission lines are caused by construction and operation/maintenance of transmission lines. The key issues for power transmission projects can be summarised as detailed in *Table 3.7*.

CONSTRUCTION: Clearing of vegetation from sites and ROWs and construction of access roads, tower pads, and substation are the primary sources of construction-related impacts. Loggers who are not under the Project Proponent's control may log outside of the ROWs which subsequently cause adverse impacts to the environment.

OPERATION: Operation and maintenance of the transmission line involves chemical or mechanical control of vegetation in the ROW and occasional line repair and maintenance. These plus the physical presence of the line itself with Electromagnetic Field (EMF) radiation, can be a source of environmental impact.

ABANDONMENT OR DECOMMISSIONING: Abandonment or decommissioning of transmission line projects may cause large areas of land to be exposed. This may cause severe surface run-off, especially if the project is located within slope areas.

TABLE 3.7 Key issues for power transmission

ISSUES	IMPACTS
Location of transmission lines	■ Effects on geology and soils Removal or lateral support or loading resulting in major land slippage
	■ Loss of habitat (terrestrial) i) Loss and fragmentation of habitat ii) Wildlife-human conflict iii) Avoid crossing forest reserves or other sensitive areas
	■ Effect on the visual landscape (aesthetic) i) Visual obstruction is the blocking view by structures ii) Visual intrusion relies upon the opinion of the particular viewer as to whether the impact on the landscape is negative or positive, and its degree of significance
	■ Effects on population and communities i) Misplaced or resettlement of individual households ii) Influx of workers iii) Affect sites of cultural significance such as burial grounds or other sacred sites
Discharge to air (air emission)	■ Radiation Transmission lines create EMFs
Discharge to water	■ Surface runoff i) Uncontrolled forest clearing and earthwork for transmission line/power station including access roads will cause soil erosion and sedimentation of river. ii) Follow <i>Garispenduan Jalan Hutan</i> 2010
Slope stability	■ Alignments near slope area Access road and transmission line alignments may cause slope failure if not designed properly

TABLE 3.7 (cont'd) Key issues for power transmission

ISSUES	IMPACTS
Hydrology and drainage	■ Sedimentation of rivers i) Uncontrolled earthworks may cause river sedimentation which may lead to flooding ii) River buffer zone must be maintained
	■ River diversion/blocked river flow i) Uncontrolled filling of earth may block the natural flow of the river ii) Rivers may be diverted with no proper study and design
Logging issues	■ Uncontrolled logging i) Loggers may log areas outside of the project area causing erosion and sedimentation issues ii) Logging contractor must comply to DOE and JPSM requirements

POSITIVE IMPACTS: On the positive side, power line ROWs, when properly managed can be beneficial to wildlife. Cleared areas can provide feeding and nesting sites for birds and mammals. The “edge” effects is well-documented in biological literature; it described the increased habitat diversity resulting at the contact between the ROW and the existing vegetation. Power lines and structures can serve as nesting sites and perches for many birds, especially raptors (bird of prey).

3.9 SELECTION OF MITIGATION MEASURES

The Qualified Person with assistance from the technical consultants and specialists must assess the BATs, BMPs and options for P2M2. The proposed P2M2 must be able to address and mitigate the identified key environmental issues.

At the point of the TOR and ESI stages, the proposed P2M2 are qualitative and descriptive only and shall be detailed out later in the EIA report. *Table 3.8* lists the example of brief descriptions of potential mitigation measures to be implemented.

TABLE 3.8 Brief description for mitigation measures

ENVIRONMENTAL IMPACT	BRIEF DESCRIPTION FOR MITIGATION MEASURES
Ecological	Confine land clearing and construction activities within the designated working area only
Erosion	Incorporate the slope designs into the measures in the LD-P2M2 shall to ensure slope stability
Solid waste and scheduled waste	Implement best management practices to handle wastes comprise biomass, municipal, construction and demolition and scheduled wastes
Water quality	Install sediment control structure to trap physical constituents such as silt and sediments except for dissolved materials and oil and grease before final discharge
Air quality	Minimise and control fine dust dispersion and emissions
Noise and vibration	Minimise and control noise and vibration disturbance
Safety and health	Ensure workers and public's safety and health are not compromised with on-going construction activities
Land traffic	Identify and manage traffic along logistic roads during construction stage

3.10 ESTABLISHMENT OF STUDY REQUIREMENT

The scope of an EIA study is dependent on the scale and magnitude of a proposed dam development. This includes compatibility with adjacent land uses and ESAs and the type of planning and study approvals as required by other relevant GAs.

The Qualified Person must extract and incorporate the methodologies, assessment/modeling tools, baseline data, potential impacts and proposed mitigation measures from these studies as part of the TOR.

The relevant studies are listed in *Table 3.9*. However, it should be noted that the list provided is **only indicative as site conditions and locations can vary between projects**. As such, it is the responsibility of the Qualified Person to assess and verify the applicability and extent of these studies to be conducted for a specific project.

The EIATRC later will assess the suitability of the required studies and may recommend these studies to be incorporated in the TOR during TORAC meeting.

TABLE 3.9 List of relevant studies to be incorporated in EIA

STUDY REFERENCE	APPROVING AUTHORITY
Social Impact Assessment (SIA)	PLANMalaysia
Slope analysis ■ Terrain and slope classification	■ JMG ■ JKR Cerun
Geological Terrain Mapping (GTM) ■ Erosion ■ Terrain classification ■ Terrain component ■ Construction suitability	
Geology and Geotechnics ■ Rocks ■ Mineral potential	JMG
Erosion and Sediment Control Plan (ESCP)	DID
Hydraulic and Hydrology study ■ Basin/River systems ■ Runoff ■ Flood risk	
Traffic Impact Assessment (TIA)	JKR
Health Impact Assessment (HIA)	MOH
Heritage Impact Assessment ■ Archaeological ■ Heritage	Department of National Heritage
Radiological Impact Assessment (RIA)	AELB
Wildlife Management Plan (WMP) ■ Wildlife Evacuation Plan ■ Wildlife Monitoring Plan	PERHILITAN
Topographic survey	JUPEM
Soil Investigation (SI) Study	JMG
Hydrological Assessment	
Emergency Action Plan	BOMBA
Quantitative Risk Assessment	■ DOE ■ DOSH ■ AELB

Note: For nuclear power station project, the approving authorities for emergency preparedness plan and response shall be subjected to the leadership and coordination of Majlis Keselamatan Negara (MKN)/NADMA. AELB is the lead technical agency.

3.11 STUDY TEAM

The EIA study team can be formed upon identifying the environmental issues and impacts of a dam project.

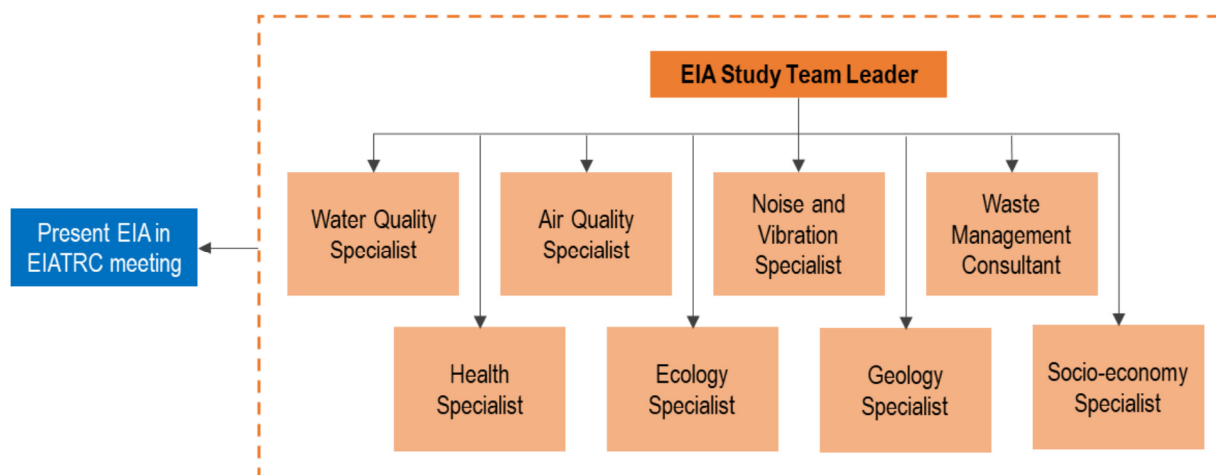
The Qualified Person who is part of an EIA study team must be registered with the DOE either as an EIA Consultant, Subject Consultant or Assistant Consultant. He/She has to ensure that his/her EIA registration is valid throughout the EIA study period.

Subsequently, in order to ensure that all environmental issues and impacts are captured comprehensively in the EIA study, the EIA team members are encouraged to further refine the environmental issues and impacts outlined in *Section 3.8.3*.

The organisation chart of the EIA study team is shown in *Figure 3.6*.

Roles and responsibilities of an EIA study team member:

1. Identify and map Environmentally Sensitive Areas (ESA);
2. Identify all important tasks to be performed in the EIA study (e.g.: studies, modelling, public engagements, etc.);
3. Ensure all TOR components are covered;
4. Ensure data and information are factually correct, can be verified and technically defensible;
5. Assess impacts holistically and comprehensively;
6. Propose P2M2 with consideration of Best Available Technology (BAT) or Best Management Practices (BMPs) using suitable modeling tools; and
7. Propose EMP and monitoring framework.



Note:

1. The EIA Study Team members may differ depending on project activity and sensitive receptors.
2. Where applicable, the specialists shall be accredited by the relevant bodies e.g. Board of Geologist

FIGURE 3.6 Organisation chart of project team and EIA study team

3.12 PREPARATION OF SCOPING NOTES, TOR AND ESI REPORT

The outcomes of the environmental scoping are termed as ESI which will form the basis to develop the TOR for DOE endorsement. The TOR must be submitted to DOE for review and endorsement before proceeding to the EIA stage.

3.12.1 TOR Table of Content

The TOR shall contain but not limited to the following:

Chapter 1 INTRODUCTION	This TOR is for the preparation of an EIA Study for "Project Title".
Chapter 2 LIST OF CONSULTANTS/ STUDY TEAM	Details of each individuals (must be registered with DOE) who will carry out the EIA study, which include: ■ DOE registration number; ■ academic background; ■ experience; ■ area of study; and ■ declaration (signatures). The EIA consultant team is to be led by a Team/Project Leader/ Manager who is responsible for the EIA report. Include contact details (complete address, phone and fax numbers) of the appropriate and responsible person(s) to whom enquiries regarding the EIA should be directed to.
Chapter 3 SCOPE OF PROJECT	List out those components of the Project which fall under the Prescribed Activities under the EIA Order, and describe with enough details for the reader to understand the scope of the significant project work components, without the technical details, including a well described engineering implementation programme of the project.
Chapter 4 ALTERNATIVES CONSIDERATION	Outline alternative solutions (project site, technologies, etc.) that will be studied or described to justify that the Project will result in the least environmental impacts.

Source: Adapted from EGIM (DOE)

Chapter 5 SIGNIFICANT ENVIRONMENTAL IMPACTS TO BE STUDIED	List and describe those significant environmental impacts which will potentially be affected by the project works or components which will need to be covered in detail in the EIA.
Chapter 6 STUDY BOUNDARIES	Delineate study boundaries for each of the above significant environmental elements to be investigated and identifying the critical groups of sensitive receptors and how the impacts on the sensitive receptors will be studied.
Chapter 7 ASSESSMENT STANDARDS	List out standards, criteria, acceptable limits, etc. that will be used to assess the environmental impacts to be investigated.
Chapter 8 TIMELINE OF STUDIES	Details of all studies/investigations to be carried out; who, where, when, how, etc. with indicative dates.
Chapter 9 CONSIDERATION OF CONCURRENT PROJECTS	List out potential concurrent or planned project that may result in cumulative impacts.
Chapter 10 DESCRIPTION OF MODELING TOOLS AND ASSESSMENT METHODOLOGIES	List out modelling tools, methodologies etc. for undertaking impact assessment and evaluation of significance. The extent of accuracy of these tools will also need to be provided, including name of models, applicability of models and tools, verifiability of results, how results are verified, grid size (for water modelling).
Chapter 11 POSSIBLE MITIGATION MEASURES	Outline possible mitigation measures or best management practices from similar projects that may be used to address the environmental impacts on this project.

Source: Adapted from EGIM (DOE)

3.12.2 ESI Table of Content

The ESI must be included with the TOR submission as an annex or appendix. The following is an indicative list of information which must be included in the ESI:

Chapter 1 INTRODUCTION TO ESI	■ Introduction: Provide a short introduction to the ESI. ■ Preparer: Provide the name, designation, contact number and affiliation company of the ESI preparer. ■ The need for EIA: Describe the need for an EIA for the project.
Chapter 2 BASIC INFORMATION OF PROJECT	■ Project Title: Provide name of project. ■ Purpose and Nature of Project: Provide brief description on the project's background, previous studies, statement of need, and project concept, size, components and outline of process technologies, and project development phases including future phases. ■ Identification of Project Proponent: Provide Project Proponent's name and address. If the Proponent is a Joint Venture partnership, the Joint Venture partners shall be identified, together with the Project Manager for the Joint Venture. ■ Location and Scale of Project: Provide coordinates of project, extent of project coverage and maps at appropriate scales. ■ History of Site: Describe brief history of the site where project is to be sited. ■ Project Justification: Describe any alternatives evaluated during early proposal (e.g. location, siting, technology, process) and summarize the criteria used to compare options and select the preferred project proposal. ■ Number and Types of Prescribed Projects: Describe which category the project falls under the EQA, and state the criteria that made the activity fall under the Prescribed Activity. ■ Previously Approved EIA Reports or Studies: List out any previous EIAs or studies that were conducted for other projects around the proposed project site. ■ Regional Setting of Project: Describe how the project is placed in the regional biophysical and social context. ■ Name and Telephone Number of Contact Person: Provide contacts of key personnel of Project Proponent. Normally no more than two persons.
Chapter 3 ALTERNATIVE CONSIDERATION	Outline alternative solutions (project option, project site, technologies etc.) that will be studied or described to justify that the project will result in the least environmental impacts.

Note: The items listed above are not exhaustive. Other items shall be included whenever relevant. The ESI shall be included with the TOR submission as an annex or appendix.

Source: Adapted from EGIM (DOE)

Chapter 4

MAJOR ELEMENTS OF THE ENVIRONMENT IN VICINITY OF PROJECT SITE AND STUDY BPUNDARIES

A relatively comprehensive list of elements of the environment is mentioned in this paragraph. Attention shall be given only to the more significant elements associated with the proposed project.

- **Air Quality:** Briefly describe the prevailing air streams and wind directions at the project site and identify the list of air sensitive receivers within a study boundary of 500 metres.
- **Noise and Vibration:** Briefly describe the existing noise contributors at and around the project site and identify the list of sensitive noise receptors within a study boundary of 500 metres.
- **Water Quality:** Briefly describe the existing waterbodies and rivers at and around the project site and identify the list of water sensitive receivers within a study boundary of 500 metres.
- **Hydrology and Hydrogeology:** Briefly describe the hydrology and hydrogeology at and around the project site within a study boundary of 1,000 metres.
- **Flood Risk:** Briefly describe the existing risk of flooding and flood defense infrastructure at and around the project site within a study boundary of 500 metres.
- **Erosion Risk:** Briefly describe the existing risk of erosion and erosion mitigation infrastructure at and around the project site within a study boundary of 500 metres.
- **Waste Management:** Briefly describe the existing sources of solid and hazardous waste arising at and around the project site.
- **Ecology:** Briefly describe the existing habitats (land and marine including bathymetric characteristics for marine projects) at and around the project site within a study boundary of 500 metres.
- **Cultural Heritage:** Briefly describe any historical evidence of cultural importance at and around the Project site within a study boundary of 500 metres.
- **Land Contamination:** Briefly describe the existing and previous land uses at and around the project site that may have caused any land contamination within a study boundary of 500 metres.
- **Groundwater:** Briefly describe the existing uses of groundwater at and around the project site and the existing and previous land uses that may have caused any groundwater contamination within a study boundary of 1,000 metres.
- **Land Use, Landscape and Visual:** Briefly describe the existing land use and landscape at and around the project site within a study boundary of 500 metres and identify a list of visually sensitive receptors.
- **Traffic:** Briefly describe the existing traffic conditions at and around the project site within a study boundary of 3,000 metres.
- **Hazards and Risk Assessment:** Briefly describe any existing hazardous installations at and around the project site or risks associated with the project itself within a study boundary of 500 metres (including possibilities such as seismic and geological events).

Note: The items listed above are not exhaustive. Other items shall be included whenever relevant. The ESI shall be included with the TOR submission as an annex or appendix.

Source: Adapted from EGIM (DOE)

Chapter 4 (cont'd) MAJOR ELEMENTS OF THE ENVIRONMENT IN VICINITY OF PROJECT SITE AND STUDY BPUNDARIES	■ Socio-economy: Briefly describe the socio-economic conditions at and around the project site within a study boundary of 500 metres. ■ Geology: Briefly describe the topographical and geological features at and around the project site within a study boundary of 500 metres and may include information on mineral deposits and soil characteristic.																
Chapter 5 OUTLINE OF PLANNING AND IMPLEMENTATION PROGRAMME	■ Relevant Policies: Briefly describe government policies (federal, state or local) which are relevant to the project. ■ Project Implementation: Briefly describe who will implement and construct the project works, and who will undertake the detailed EIA studies. ■ Project Timetable: Provide indicative dates when the project will commence and end. ■ Interactions with Other Projects: List out all concurrent or planned projects in the vicinity of this project. The purpose of this list is to enable DOE to assess the significance of cumulative impacts from all the projects. ■ Project Assessment Timeline: Provide a proposed target timeline for the whole assessment process. The time table for proposed studies and investigations shall be included, and as a minimum, shall include:- TOR submission; TOR public review (if relevant); environmental studies; consultation programme; EIA report submission; EIA report public display; Project Proponent's response to public comments. ■ Proposed Studies: Describe scope of works of studies/ investigations/surveys that will be undertaken to obtain the baseline information on the major elements of the environment.																
Chapter 6 POSSIBLE IMPACTS ON THE ENVIRONMENT	Outline the methodologies used in the impact analysis/ assessment and provide a brief qualitative description of the potential impacts during construction and operational phases of project implementation on the following: <table border="0"> <tr> <td>■ Air quality</td><td>■ Cultural heritage</td></tr> <tr> <td>■ Noise and vibration</td><td>■ Land contamination</td></tr> <tr> <td>■ Water quality</td><td>■ Groundwater</td></tr> <tr> <td>■ Hydrology and hydrogeology</td><td>■ Land use, landscape and visual</td></tr> <tr> <td>■ Flood risk</td><td>■ Traffic</td></tr> <tr> <td>■ Erosion risk</td><td>■ Hazards/Risk assessment</td></tr> <tr> <td>■ Waste management</td><td>■ Socio-economy</td></tr> <tr> <td>■ Ecology</td><td>■ Geology</td></tr> </table> Note: A relatively comprehensive list of impacts is mentioned in this paragraph. Attention shall be given only to the more significant impacts associated with the proposed project.	■ Air quality	■ Cultural heritage	■ Noise and vibration	■ Land contamination	■ Water quality	■ Groundwater	■ Hydrology and hydrogeology	■ Land use, landscape and visual	■ Flood risk	■ Traffic	■ Erosion risk	■ Hazards/Risk assessment	■ Waste management	■ Socio-economy	■ Ecology	■ Geology
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■ Flood risk	■ Traffic																
■ Erosion risk	■ Hazards/Risk assessment																
■ Waste management	■ Socio-economy																
■ Ecology	■ Geology																

Note: The items listed above are not exhaustive. Other items shall be included whenever relevant. The ESI shall be included with the TOR submission as an annex or appendix.

Source: Adapted from EGIM (DOE)

Chapter 7 MITIGATION MEASURES TO BE INCORPORATED IN THE DESIGN	Qualitatively describe the proposed pollution prevention and mitigation measures (P2M2) or generally referred to as best management practices that will be implemented to address the impacts from pre-construction (including feasibility studies and design), construction and operational phases of the project implementation as described in “Possible Impacts on the Environment” section of the ESI.
Chapter 8 USE OF PREVIOUSLY APPROVED EIA REPORTS OR STUDIES	Outline and describe any relevant information that is referenced from the previous EIAs or studies that were identified in Section 3(ii) above and briefly discuss how this information is suitable to be used for this project.
Chapter 9 LIST OF DRAWINGS, FLOWCHARTS, DIAGRAMS AND PHOTOGRAPHS	Provide the following: ■ Clear, coloured and readable maps, diagrams and photographs to illustrate the nature of the project and its general layouts indicating the location of the project and all its components and project boundaries. ■ Macro scale maps (1:50,000 and 1:25,000), plans, photographs or satellite images, clearly identifying the location of the proposed project location. ■ An updated satellite image to indicate the recent existing environment may be used. The coverage of the land use map must be at least within 5 km radius (intervals of 250 metres). For large scale projects such as the construction of dams or impounding reservoirs, the coverage of the land use map may be beyond 5 km radius depending on the catchment area. ■ Clear, coloured and readable maps, diagrams and photographs to illustrate the nature of the project and its general layouts indicating the location of the project and all its components and project boundaries. ■ Macro scale maps (1:50,000 and 1:25,000), plans, photographs or satellite images, clearly identifying the location of the proposed project location. ■ An updated satellite image to indicate the recent existing environment may be used. The coverage of the land use map must be at least within 5 km radius (intervals of 250 metres). For large scale projects such as the construction of dams or impounding reservoirs, the coverage of the land use map may be beyond 5 km radius depending on the catchment area. ■ Other types of map that may be relevant to the key and critical issues of the proposed project. They may include cadastral map, topography and geological map, bathymetry map, hydrological map, coral population map etc. ■ For industrial-based projects, clear and readable flowchart of the production processes and explanation on the processes and the project's maximum capacity.
REFERENCES	Provide a list of documents and studies used to prepare the Environmental Scoping Information (ESI).

Note: The items listed above are not exhaustive. Other items shall be included whenever relevant. The ESI shall be included with the TOR submission as an annex or appendix.

Source: Adapted from EGIM (DOE)



CHAPTER 4 Baseline Data

Genting Highlands, Pahang
Photo by Aaron Lee on Unsplash.com



4.1 INTRODUCTION

An EIA shall contain a description of the existing environment before the project commences (termed as 'baseline condition') that may or may not be affected directly or indirectly from the project.

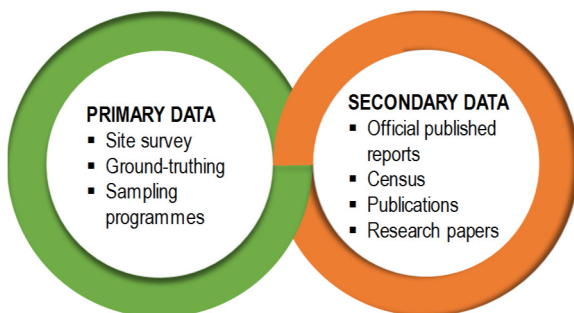
Objectives for the description on baseline conditions include:

- identify existing environmental conditions which may influence project design and safety decisions (project layout, project components);
- identify sensitive issues or areas requiring mitigation or compensation;
- provide input data to numerical models for prediction of impacts; and
- provide baseline reference for compensation during project implementation stage.

The approach and methodology in obtaining detailed baseline data and technical studies will be identified in the TOR and ESI documents. The detailed baseline data sampling will be carried out once the DOE endorsed the TOR. However, in some cases, the Qualified Person can do a pre-consultation with the DOE, to obtain a consensus to carry out the baseline sampling, while waiting for the TOR and ESI endorsement.

4.2 BASELINE DATA COLLECTION

There are two types of baseline data namely primary and secondary data which comprise of physico-chemical, biological and human environment. Identifications of ESAs are also defined in this chapter.



PRIMARY DATA is collected to obtain first-hand data for detailed assessment. Primary data can also be collected to fill in the gaps in information gathered through secondary data collection. Typically, the sampling and assessment area shall be bounded by the zone of study (ZOS). However, if assessment shows that the impact may extend much farther away, the zone of impact (ZOI) shall be included as part of the sampling and assessment area. The Qualified Person has to clearly define this in the EIA study.

SECONDARY DATA includes information and statistical data from various sources which are collected to form the basic information brief for the Project. All sources of information and statistics must be clearly referenced and acknowledged alongside the date of publications. References for all maps, photos and diagrams will also need to be included in the EIA.

4.3 COMPONENTS OF ENVIRONMENTAL BASELINE DATA

Environmental baseline data collection covers three major environmental components namely physico-chemical, biological and human environment.

4.3.1 Physico-chemical Environment

The physico-chemical baseline data collection must focus on the core aspects of pollution which are water, air and wastes.

Baseline data on these three core aspects are needed to determine the status of the environment. The status of the environment which includes before, during and after the project's implementation must be benchmarked against the DOE standards.

A baseline sampling plan, which includes coordinates of sampling stations, methodology, frequency and parameters to be sampled must

be determined based on the project location and the project activities. Details of the baseline sampling plan must be clearly stated in the EIA report by the Qualified Person.

Table 4.1 lists a range of baseline data requirements which include water, air, noise and vibration. All samples must be analysed by a laboratory accredited under the Laboratory Accreditation Scheme of Malaysia (SAMM) or equivalent. All test certificates and data shall be included in the appendix of the EIA report as supporting evidence.

TABLE 4.1 Recommended baseline data requirements for physico-chemical environment

COMPONENT	RECOMMENDED PARAMETER	REFERENCE GUIDELINES/ STANDARDS	RECOMMENDED REQUIREMENTS
River water quality	■ As stated in National Water Quality Standards of Malaysia (NWQS) ■ *Radionuclides (e.g.: Cobalt, Cesium, Iodine, Hydrogen, Krypton and Xenon) ■ Selected parameters must be based on site location	■ NWQS ■ Atomic Energy Licensing (Radioactive Waste Management) Regulations 2011 ■ Atomic Energy Licensing (Low Activity Radioactive Material) (Exemption) Order 2020 ■ AEL (Basic Safety Radiation Protection) Regulations 2010	■ One time sampling ■ Upstream and downstream of major rivers within the ZOI ■ Multi-depth sampling for deep rivers (>1 m deep) ■ Pesticides testing required for project located near agriculture sites
Estuarine and marine water quality	■ As stated in Malaysian Marine Water Quality Standards (MMWQS) ■ *Radionuclides (e.g.: Cobalt, Cesium, Iodine, Hydrogen, Krypton and Xenon) ■ Selected parameters must be based on project location	■ MMWQS ■ Atomic Energy Licensing (Radioactive Waste Management) Regulations 2011 ■ Atomic Energy Licensing (Low Activity Radioactive Material) (Exemption) Order 2020 ■ AEL (Basic Safety Radiation Protection) Regulations 2010	■ Sampling once during tide range (spring and neap tides) and tide stage (flooding and ebbing tides) conditions ■ Multi-depth sampling (top, middle and bottom)
Lake water quality	■ As stated in National Water Quality Standards of Malaysia (NWQS) ■ *Radionuclides (e.g.: Cobalt, Cesium, Iodine, Hydrogen, Krypton and Xenon) ■ Selected parameters must be based on project location	■ National Lake Water Quality Criteria and Standard (NLWQS) (NAHRIM, 2015) ■ Atomic Energy Licensing (Radioactive Waste Management) Regulations 2011 ■ Atomic Energy Licensing (Low Activity Radioactive Material) (Exemption) Order 2020 ■ AEL (Basic Safety Radiation Protection) Regulations 2010	■ One time sampling ■ Inlet, middle and outlet of lake ■ Multi-depth sampling for deep lakes (>1 m deep) ■ Pesticides testing required for project located near agriculture sites
Air quality	■ PM_{2.5} ■ PM₁₀ ■ Carbon monoxide (CO) ■ Sulphur dioxide (SO₂) ■ Nitrogen dioxide (NO₂) ■ Ozone (O₃) ■ *Radionuclides (e.g.: Krypton, Xenon, Argon, Iodine, Bromine, Cesium and Hydrogen)	■ Malaysian Ambient Air Quality Standards (MAAQS) ■ Atomic Energy Licensing (Low Activity Radioactive Material) (Exemption) Order 2020 ■ AEL (Basic Safety Radiation Protection) Regulations 2010	■ One time sampling ■ Parameters to be sampled are dependent on project location ■ Minimum two sampling locations (upwind and downwind) ■ Sampling at project boundary and nearest receptors

Note: *for nuclear power station projects

4 BASELINE DATA

TABLE 4.1 (cont'd) Recommended baseline data requirements for physico-chemical environment

COMPONENT	RECOMMENDED PARAMETER	REFERENCE GUIDELINES/ STANDARDS	RECOMMENDED REQUIREMENTS
Noise	■ L_{Aeq} ■ L_{max} ■ L_{min} ■ L_{10} ■ L_{50} ■ L_{90}	Guidelines for Environmental Noise Limits and Control	■ One time sampling ■ Parameters to be sampled are dependent on project location ■ Sampling at project boundary and nearest receptors
Vibration	Requirements as per Schedule 1-6 of the Planning Guidelines for Vibration Limits and Control	The Planning Guidelines for Vibration Limits and Control	■ One time sampling ■ Parameters to be sampled are dependent on project location ■ Sampling at project boundary and nearest receptors
Terrestrial radiation	Background radiation of the project area	IAEA Safety Standards Series No. GSG-8, Radiation Protection of the Public and the Environment	IAEA Safety Standards Series No. GSG-10, Prospective Radiological Environmental Impact Assessment for Facilities and Activities

For nuclear power projects, the baseline data establishment and management shall follow the relevant Quality Assurance Programme adopted by authorities such as AELB or following the prevailing IAEA Guidelines.

Other baseline data requirement are listed in *Table 3.2* in **Chapter 3**.

All samples must be analysed by a laboratory accredited under the Laboratory Accreditation Scheme of Malaysia (SAMM) or equivalent. All test certificates and data shall be included in the appendix of the EIA report as supporting evidence.

The proposed procedures for sampling practices for water, air, soil, noise and vibration are appended in *Attachment 2*.

4.3.2 Biological Environment

The relevant agencies such as the Forestry Department and the PERHILITAN must be consulted prior to carrying out data collection, surveys and assessment of the results.

Secondary data regarding the location of permanent reserved forests, wildlife sanctuaries and protected areas from various agencies and published journals can be used to strengthen the baseline data information in the EIA study. Similarly, other agencies such as the Forest Research Institute of Malaysia (FRIM) have published research and inventories of flora and fauna in selected forest areas and conservation zones.

The biological environment is divided into two, namely terrestrial and aquatic. Each of these consist of flora and fauna. The scope and requirement for terrestrial and aquatic samplings are determined by the magnitude of the potential impacts. *Table 4.2* lists the recommended baseline sampling requirements for biological environment.

TABLE 4.2 Recommended baseline data requirements for biological environment

COMPONENT	RECOMMENDED PARAMETER	REFERENCE GUIDELINES/ STANDARDS	RECOMMENDED REQUIREMENTS
Terrestrial flora	■ Tree species inventory (photograph) – family, species, local name ■ Species distribution ■ Conservation status ■ Legal status ■ Diameter (for saplings and trees) ■ Tree quality ■ Non-timber species, climbers, ferns and orchids ■ Rattan, bamboo and palms	■ International Union for Conservation of Nature (IUCN) Red List of Threatened Species ■ Biological radiation indicator	■ Surveys within project site and adjacent ■ Approaches: i) stratification ii) ground samples ■ Survey methods: i) transect line or transect survey ii) interviews and local knowledge iii) other relevant methods
Terrestrial fauna	■ Groups: i) avifauna ii) volant mammals iii) non-volant mammals iv) insects v) herpetofauna ■ Fauna species inventory (photograph) - local name, scientific name, English name ■ Habitat preference ■ Species distribution ■ Conservation status ■ Legal status	■ IUCN Red List of Threatened Species ■ Wildlife Conservation Act 2010 (Act 716) ■ Biological radiation indicator	■ Surveys within project site and adjacent ■ Approaches: i) habitat mapping ii) fauna diversity surveys ■ Survey methods: i) transect line or transect survey ii) live-trapping iii) mist netting iv) camera trapping v) harp trap vi) night-spotting vii) sweeping net viii) interviews and local knowledge ix) other relevant methods
Aquatic (flora and fauna)	■ Groups i) fish survey ii) plankton (zooplankton and phytoplankton) iii) macro invertebrates iv) aquatic plants v) periphyton ■ Species inventory (photograph) - local name, scientific name, English name ■ Species distribution ■ Conservation status ■ Legal status	■ IUCN Red List of Threatened Species ■ Fisheries Act 1985 (Act 317) ■ Biological radiation indicator	■ Surveys within project site and adjacent ■ Approaches: i) aquatic sampling ii) ground truthing (aquaculture operators) ■ Survey methods: i) dip nets ii) surber samplers iii) grab samplers iv) suction samplers v) colonisation samplers vi) interviews and local knowledge vii) other relevant methods

4.3.3 Human Environment

Relevant data collection will be required for the section on socio-economic assessment in the EIA.

For **primary data**, a series of engagement with stakeholders can be arranged to convey information about the proposed project in order to receive perception and feedback from the stakeholders.

The stakeholders engagements can be further focused by having direct interview, focus group discussion (FGD), public dialogue, workshop, exhibition and road show, and round table discussion. Details of these methods are listed in *Section 2.8.3* in **Chapter 2**.

For **secondary data**, it includes the population census. However, for accurate population statistics, the data is best collected from the local authorities and district offices.

If SIA is required, the study shall follow the requirements, guidelines and procedures of PLANMalaysia. This department must review, endorse and enforce the requirements of the SIA. For the purpose of the EIA, only the main findings from the SIA are to be incorporated.

Other components that may affect communities within the vicinity of the project site must be considered if they are deemed as significant issues. These include, but are not limited to public health, heritage, culture and archaeology, ecotourism; and land traffic as listed in *Table 4.3*. Similar with SIA, only the main findings from these studies are to be incorporated in the EIA.

TABLE 4.3 Recommended baseline data requirements for human environment

COMPONENT	RECOMMENDED PARAMETER	REFERENCE GUIDELINES/ STANDARDS	RECOMMENDED REQUIREMENTS
Socio-economic	■ Settlement pattern ■ Population distribution ■ Demography and population dynamics ■ Population socio-economic profile ■ Existing infrastructure, utilities and amenities	SIA Manual (PLANMalaysia)	■ Surveys on target stakeholders potentially affected by the project ■ Surveys must represent the stakeholders in the ZOI ■ Conduct stakeholder engagement
Public health	■ Population profile ■ Public health status	Guidance Document on Health Impact Assessment (HIA) in EIA (DOE Malaysia)	■ Surveys on target stakeholders potentially affected by the project ■ Surveys must represent the stakeholders in the ZOI ■ Conduct stakeholder engagement
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 ■ As specified in local plan, special area plan
Ecotourism	Identify and determine significance of value of such sites within or near to project site	-	■ Surveys on target stakeholders potentially affected by the project ■ Conduct stakeholder engagement ■ As specified in local plan, special area plan

4.3.4 Other Relevant Baseline Studies

There may be other relevant baseline studies required that are specific to the project nature which are listed in *Table 4.4*.

TABLE 4.4 Other recommended baseline studies

COMPONENT	RECOMMENDED PARAMETER	REFERENCE GUIDELINES/ STANDARDS	RECOMMENDED REQUIREMENTS
Land traffic	Traffic count during peak periods	JKR/Local council requirements	- Carried out as part of the TIA - Traffic surveys at major junctions near to project site
Marine traffic and navigation	- Marine features, characteristics and conditions e.g. port and harbour limits, marine operations, anchorage areas, etc. - Regulatory setting of the project area concerning marine traffic	Marine Department (MarDep) requirements	- Data is obtained from (but not limited to) LKIM, DOF and MarDep - Can be carried out as part of the Marine Risk Assessment (MRA)

4.4 BASELINE DATA COLLECTION FOR NUCLEAR POWER STATION PROJECT

For nuclear power station projects, the actions related to the baseline study of a new nuclear facility's environment shall be divided into three stages:

- i) **A preliminary survey performed in the environment**, during which the Project Proponent shall survey sampling targets (in terms of, for example, the incidence of flora and fauna) that are suitable for radiation monitoring in the environment of the nuclear facility. The information received from the preliminary survey during RIA preparation can be used to develop the programme for the nuclear facility's baseline study.
- ii) **An analysis performed before the construction activities of the nuclear facility**, during which the Project Proponent shall determine the concentrations of radioactive substances in the environment before the construction of the nuclear facility has affected them.
- iii) **An analysis performed before the operation of the nuclear facility**, during which the Project Proponent shall determine the level of background radiation and concentrations of radioactive substances in the environment after the construction of the nuclear facility has affected them.

The above actions are required in the EIA and Safety Analysis Report (SAR) prior to the operational license is obtained and to be realised by the Project Proponent. The recommended radiological baseline data requirements are tabulated in *Table 4.5*.

An example of a measurement programme for baseline study of radioactivity before the operation of the nuclear power plant as recommended by Radiation and Nuclear Safety Authority (STUK) is as shown in the *Attachment 3*.

4 BASELINE DATA

TABLE 4.5 Radiological baseline data requirements

COMPONENT	RECOMMENDED PARAMETER	REFERENCE GUIDELINES/STANDARDS
Radiological baseline	■ Radionuclide source such as characteristic, discharge routes, transfer mechanism ■ Existing onsite background radiation level and variability before construction according to EPZ ■ Identification of flora and fauna to be used for radiobiological monitoring or radiation exposures indicator ■ Radionuclides activity levels and variability in land (topsoil, sub-topsoil, etc.); in rivers (riverbed and sediments, fishes and water living animals); underground water; ambient air; vegetation, food and agriculture products, livestock, etc. ■ Human environment, population density, age, critical groups/recipient ■ Physical and chemical pollutants that may affect the radionuclide transfer, re-concentration, etc. ■ Offsite dose calculation	■ Prevailing AELB Guidelines ■ IAEA Guidelines ■ Study areas ranging from 30 to 80 km radius from source/nuclear power project designated for emergency response zone (radius depends on prevailing guideline by AELB)



RECOMMENDED REQUIREMENTS

- AELB requirements following prevailing Acts and Guidelines
- Conducted as part of site licensing, station operating licensing, and radiation monitoring programme
- Most probably the first primary data established in IEI report
- New data for the project

The need for the baseline study in nuclear power project is better understood upon examining the radiation exposure pathways from the project source as shown in *Figure 4.1*. This diagram shows how a radiation source emitted from the nuclear power station can be transmitted into the environment through air, water, soil, food chain, etc and finally reaches human being. The sources and receptors are the basic subjects of the baseline data and information required before constructing a nuclear power station.

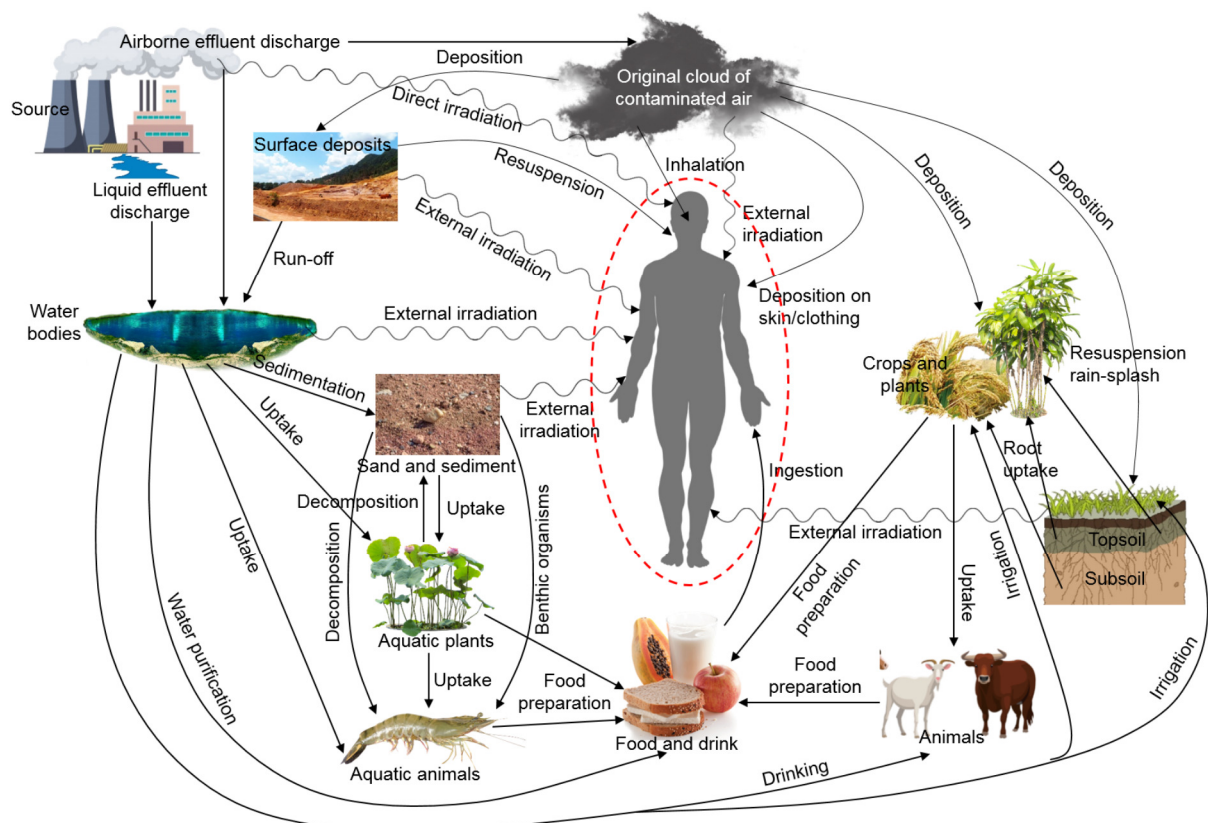


FIGURE 4.1 Nuclear power station radiation exposure pathways

4.5 IDENTIFICATION OF ENVIRONMENTALLY SENSITIVE AREAS (ESAs)

As specified in the NPP-3, an ESA is defined as:

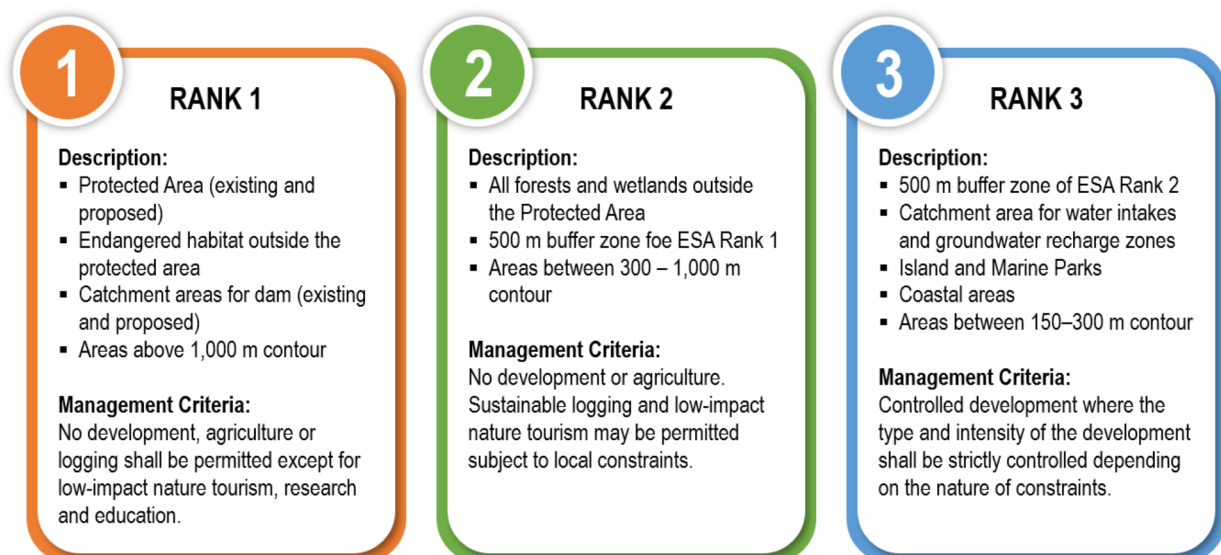
“a special area that is very sensitive to any changes in the ecosystem as a result of natural processes or activities in or around the area, either directly or indirectly”

Identification of ESA is central in carrying out the EIA study. The ESA identification shall be based on nine main sources namely:

- i) Physical plans/policies (NPP/RFZPPN);
- ii) State plans;
- iii) Local plans;
- iv) Planning guidelines e.g. GPPPP;
- v) *Buku Panduan Kawasan Sensitif Alam Sekitar Malaysia* (DOE, 1993)
- vi) Environmental Quality Act 1974 (water intake point);
- vii) EESIM (water intake point);
- viii) SZIRA (natural system, human system); and
- ix) Ground-truthing.

It is recommended that ESAs are to be integrated into the planning and management of land use and natural resources. The rank of ESAs and their respective management criteria are illustrated in *Figure 4.2*.

All identified ESAs within the ZOS must be presented in a satellite image, and each of the ESAs must be listed in a table which consist of ESA rank, category, location, the nearest distance from project boundary and source. However, important and sensitive ESAs outside of the ZOS must still be identified and shown in the satellite image (*Figure 4.3*). An example of the table is shown in *Table 4.6*. In addition, a brief description of each of the categories must be provided to determine their existing condition.



Source: NPP-3 (2016)

FIGURE 4.2 ESA rank and management criteria

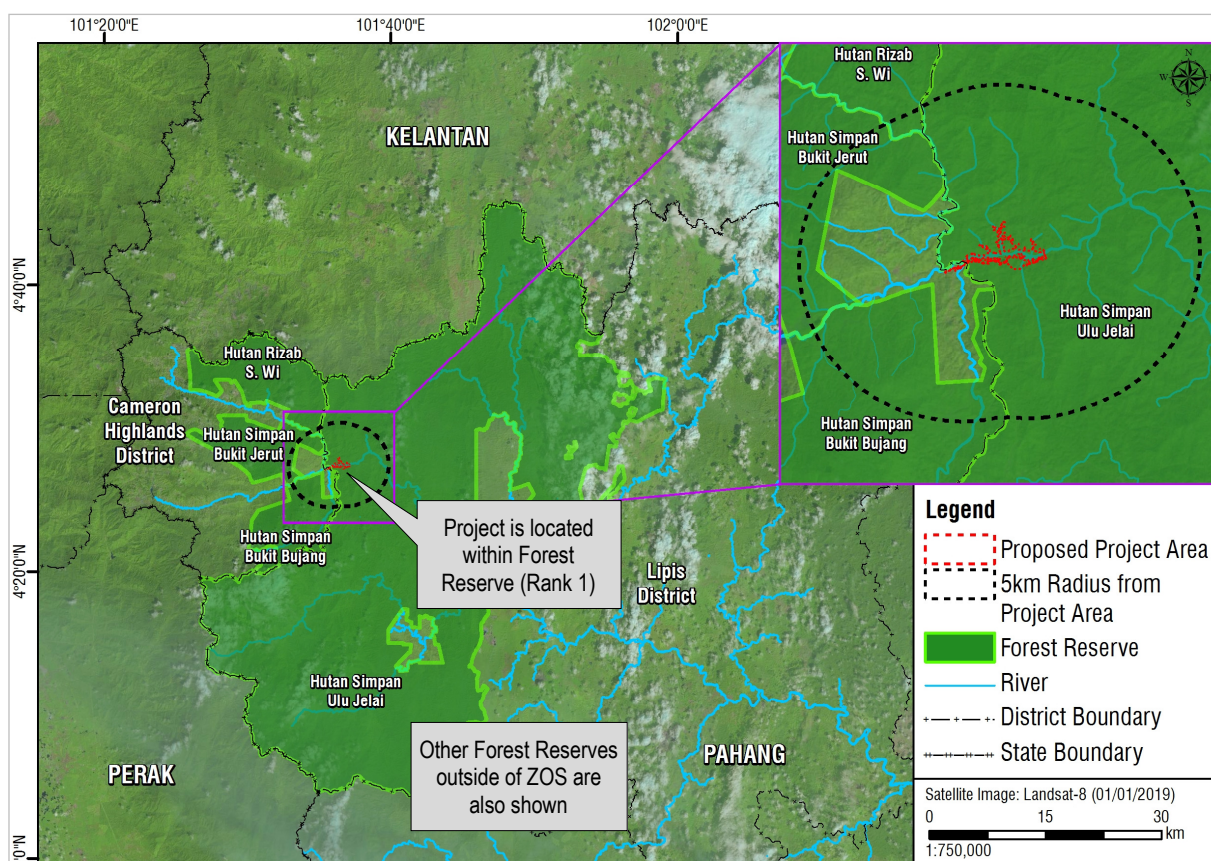
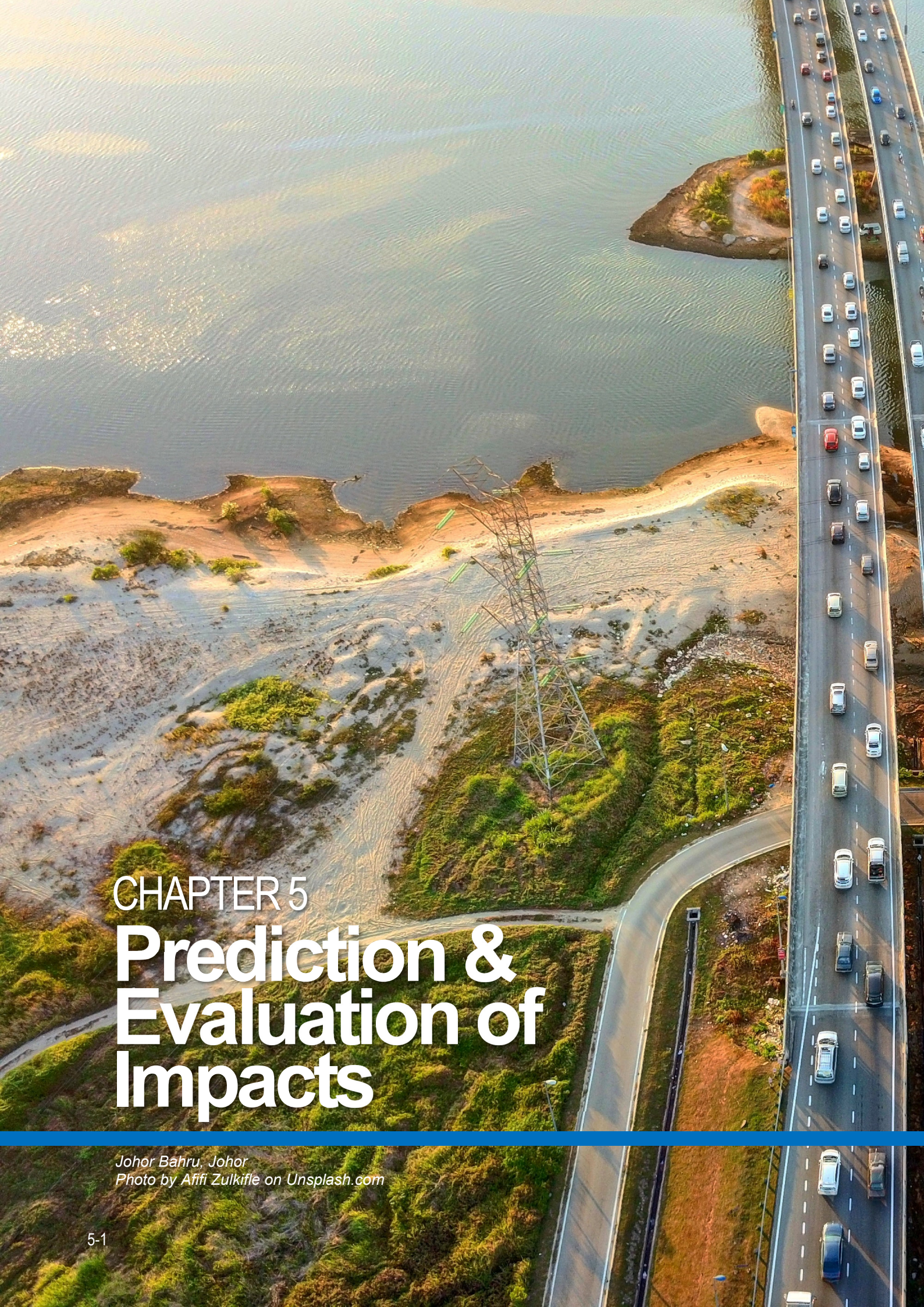


FIGURE 4.3 Example of ESAs identified at a project site

TABLE 4.6 Example of ESAs and its details

ESA RANK	CATEGORY	LOCATION	NEAREST DISTANCE FROM PROJECT BOUNDARY (KM)	SOURCE
1	Forest Reserve	Hutan Rizab/ Hutan Simpan Kekal Ulu Jelai	Within the Forest Reserve	■ Topographic Map No. 3762 (JUPEM, 1993) ■ NPP-3 (PLANMalaysia, 2016) ■ <i>Katalog Metadata Geospasial</i> (DIDM, 2011)
		Hutan Rizab/ Hutan Simpan Kekal Bukit Jerut	2.0	■ NPP-3 (PLANMalaysia, 2016) ■ <i>Katalog Metadata Geospasial</i> (DIDM, 2011)
		Hutan Simpan Kekal Bukit Bujang	1.0	■ NPP-2 (PLANMalaysia, 2010) ■ <i>Katalog Metadata Geospasial</i> (DIDM, 2011)

An aerial photograph showing a coastal landscape. On the right, a multi-lane highway runs vertically, filled with cars. To the left of the highway is a green embankment. Further left is a large, flat, muddy area that appears to be flooded or recently dried up, with some sparse vegetation. A tall, metal lattice power line tower stands in the middle of this muddy area. The top half of the image shows a body of water, likely the sea, with a sandy beach area visible between the water and the muddy field. The lighting suggests it might be late afternoon or early morning, with long shadows and a warm glow.

CHAPTER 5

Prediction & Evaluation of Impacts

Johor Bahru, Johor
Photo by Afifi Zulkifle on Unsplash.com



5.1 INTRODUCTION

There are many methods to predict and evaluate environmental impacts. Generally, all of these methods will assess the impacts of the project against the existing environment (status quo). These impacts are predicted to be caused by project activities during different stages of the project's implementation.

The predictions and evaluations are made through quantitative or qualitative or even both methods.

QUANTITATIVE METHOD is based on the measurement of quantity or amount via numerical tools such as modelling. The result of this method is usually a number or a set of numbers.

QUALITATIVE METHOD involves quality where the results are expressed in words; for example, significant, insignificant, temporary, permanent, high, medium or low.

QUALITATIVE METHODS can be used to understand the meaning of the numbers obtained from **QUANTITATIVE METHODS**.

5 PREDICTION & EVALUATION OF IMPACTS

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 methods and models;
- ii) adequate, accurate and up-to-date data for assessment;
- iii) results can be replicated and are reproducible by independent evaluators; and
- iv) cost-effective and, for any software, can be easily purchased (proprietary software and tools can also be used). Widely accepted freeware is acceptable.

5.2 PREDICTION OF ENVIRONMENTAL IMPACTS

There are various methodologies that can be used for prediction, evaluation and assessment of impacts. Simple methodology is preferred, though this depends on the complexity of the impacts. Whichever method is chosen, it must be appropriate to address the problem, taking into consideration the local conditions of the site.

It is up to the Qualified Person to select the best method to conduct the assessments and/or generate practical scenarios from reliable datasets to ascertain the magnitude, extent and significance of impacts from the project. **Only significant issues shall be addressed in detail in the EIA study. Issues that are not significant shall only be addressed qualitatively.**

Methods and tools that can be employed:

1. Expert opinion
2. Consultation and questionnaires
3. Checklists
4. Spatial analysis
5. Network and system analysis
6. Matrices
7. Carrying capacity analysis
8. Mathematical and computer modeling
9. Case studies



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 modeling is carried out (water quality, 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) details of scenarios for modelling;
- vi) presentation of results (raw data, table form, graphs); and
- vii) limitations in data collection or method chosen.

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

Necessary technical report, data analysis, tables and raw data shall be included as appendix in the EIA to support the impact assessment methodology.

Ultimately, the main text for impact assessment in the EIA shall be the predictive results and outputs of studies, which have to be written in a manner that is easily understood by decision makers and the public.

5.3 EVALUATION OF ENVIRONMENTAL IMPACTS

Evaluation is the stage of an EIA where predicted adverse impacts are judged as to their significance. The latter determines the level of mitigation necessary to bring the impacts to acceptable levels.

The judgement of significance can be based on one or more of the following, depending on the environmental component being evaluated:

- i) Pollution emission limits - Comparison with laws, regulations or accepted national or international standards;
- ii) Nature conservation - Reference to pre-set criteria (such as conservation or protected status of a site, features or species);
- iii) Sustainability - Consistence with pre-set policy objectives (such as for agriculture, national, forestry, economic development, land use and others); and
- iv) Social acceptability - Consultation and acceptability by the relevant decision makers, local community or the general public.

The level of details in the impact identification shall commensurate with the following factors:

- i) scale of the project (land area, total disturbed areas, etc.);
- ii) intensity of development (total land clearing, phasing of land clearing);
- iii) potential pollution sources from the project (land clearing works, construction and operation activities);
- iv) magnitude and complexity of impacts (quantitative or qualitative assessment, longevity of impact (residual impact));
- v) area of impacts (localised versus transboundary);
- vi) probability of cumulative impacts (effects of project on adjacent land areas and *vice versa*); and
- vii) sensitivity of nearby receptors e.g. ESA.

Table 5.1 summarises the major evaluation of impacts and the expected output based on the typical significant components of a power generation and transmission project.



Sultan Iskandar Power Station, Johor
Source: <http://chimneysfmalaysia.blogspot.com/>

5 PREDICTION & EVALUATION OF IMPACTS

TABLE 5.1 Key impact evaluation and its expected output

ENVIRONMENTAL COMPONENT	SOURCE OF POLLUTION	ASSESSMENT REQUIREMENTS
Ecology	Construction Stage Land disturbing activities e.g. site clearing, construction of access road	■ Mapping of important habitats and ESA ■ Inventory of existing flora and fauna ■ Identification of critical species ■ Recommendation of mitigation measures for flora and fauna that need relocation or protection
	Operation Stage Potential radiation emission during abnormal operation or accidents and spillage	
Water quality	Construction Stage ■ Land disturbing activities (parameters of concern; TSS and turbidity) ■ Sewage discharge from on-site workers quarters (parameters of concern; DO, BOD, ammoniacal nitrogen)	■ Assessment of types and scale of impairment to water quality ■ Determination of potential sources of pollutants
	Operation Stage ■ Untreated effluent from power station ■ Potential radiation emission during abnormal operation or accidents and spillage.	

Note: The list is not exhaustive and not all of 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.

PREDICTION METHOD	EVALUATION OF IMPACTS	OUTPUT
■ 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 Output ■ Habitat map ■ Species inventory, especially of rare, endangered, threatened and near extinct species that may require protection ■ Dose rates ■ Risk quotients	■ Determine the level of encroachment into ESA ■ Indication of possible loss of habitat and its flora and fauna ■ Identify project activities that could disturb animal behaviour ■ Forest fragmentation and its consequences ■ Increase in poaching and roadkill ■ Impacts from increased human-wildlife conflict (HWC)	■ Highlight important area to be protected ■ Identification of critical areas for mitigation measures ■ Develop wildlife management plan
■ Integrated exposure/dose/effect assessment with risk characterisation ■ Radioecology Output ■ Dose rates ■ Risk quotients		■ Threshold limit for impacted flora and fauna ■ The use of flora and fauna as radiation monitoring indicator
1. Water quality ■ Mathematical models (one, two or three -dimensional) analysis of pollution loads and dispersion in the waterways e.g. QUAL2K, MIKE11, PLOAD, TSI, etc. ■ Simple mass balance models e.g. Streeter-Phelps Model Output ■ Estimation of pollutant concentration affecting a stretch of river and downstream sensitive areas ■ Estimation of pollutant load and extent of effect on sensitive receptors 2. Thermal (once-through cooling system) Mathematical dispersion modeling Output Predicted impacts on water temperatures and thermal stratification	■ Determine pollutant loading via variety of models and determine the magnitude and extent of impacts further downstream ■ Identify potential water polluting sources ■ Identify and determine users and sensitive habitat located downstream	Identify suitable BMP and treatment system
	■ Estimation of pollutant concentration (including thermal plume) affecting a stretch of river and downstream sensitive areas ■ Estimation of pollutant load and extent of effect on sensitive receptors ■ Assess the potential effluent or radioactive water emission into sea bodies	■ Discharge limit from effluent treatment system ■ Dose received by the public and the environment from water emission of nuclear power station

Source:

1. INTERNATIONAL ATOMIC ENERGY AGENCY, Generic Models for Use in Assessing the Impact of Discharges of Radioactive Substances to the Environment, Safety Reports Series No. 19, IAEA, Vienna (2001).
2. INTERNATIONAL ATOMIC ENERGY AGENCY, Environmental Modelling for Radiation Safety (EMRAS), A Summary Report of the Results of the EMRAS Programme (2003–2007), IAEA-TECDOC-1678, I.

5 PREDICTION & EVALUATION OF IMPACTS

TABLE 5.1 Key impact evaluation and its expected output

ENVIRONMENTAL COMPONENT	SOURCE OF POLLUTION	ASSESSMENT REQUIREMENTS
Air quality	<u>Construction Stage</u> Vehicles movement and machineries operation	Identify potential air pollution generating sources
	<u>Operation Stage</u> Air emission from power station	
Noise	<u>Construction Stage</u> ■ Piling activities ■ Vehicles movement and machineries operation	Assessment of ambient noise environment and activities that pose impairment hazards to the workers and nearby sensitive receptors
Groundwater quality/soil contamination	<u>Operation Stage</u> Emission from power plant	Assessment of contaminant concentration in groundwater/soil from project implementation

Note: The list is not exhaustive and not all of 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.

PREDICTION METHOD	EVALUATION OF IMPACTS	OUTPUT
1. Air quality Gaussian plume dispersion model to assess dust generation over an area under the worst-case scenario Output ■ Dispersion contour map indicating levels at sensitive receptors ■ Comparison of computed values with the New Malaysia Ambient Air Quality Standard ■ Determination of location of maximum air pollution concentration 2. Radiation dispersion ■ Dispersion and dose modelling ■ Radioactive decay products ■ Radioecology Output ■ Radioactive releases and nuclide types ■ Dispersion ■ Concentrations and doses caused	Assess the level of pollutants pre and post development for major sensitive receptors. If necessary, air quality models shall be used	■ Identify the extent of potential impacts to nearby sensitive receptors ■ Critical levels for pollutant at sensitive receptors shall be identified and mitigated ■ Dose received by the public during normal and abnormal nuclear power station operation ■ Planning of buffer and Emergency Planning Zone for nuclear power station as well as short- and long-term food and agriculture restrictions in case of accident
■ Mathematical models to assess noise levels for point source or linear sources ■ Noise modeling software, e.g. SoundPlan, CadNa or Geographic Information System (GIS) acoustic models ■ Traffic noise models Output ■ 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	Model or calculate the increase in noise level, mapped as noise contours	■ Identify the extent of potential impacts to nearby sensitive receptors ■ Critical levels for pollutant at sensitive receptors shall be identified and mitigated
Mathematical models analysis of pollutant pathway in groundwater (e.g.: MODFLOW, MIKE SHE, MODPATH, etc.) Output Estimation of pollution concentration and its path in groundwater/soil	Identify the extent and concentration of contaminants travelling in groundwater/soil with respect to the nearest sensitive receptor (e.g.: well or water intake point)	■ Determine the sufficiency of buffer from the project to the sensitive receptors especially if there is any well or water intake points ■ Planning of buffer and Emergency Planning Zone for nuclear power station as well as short- and long-term food and agriculture restrictions in case of accident

Source:

1. INTERNATIONAL ATOMIC ENERGY AGENCY, Generic Models for Use in Assessing the Impact of Discharges of Radioactive Substances to the Environment, Safety Reports Series No. 19, IAEA, Vienna (2001).
2. INTERNATIONAL ATOMIC ENERGY AGENCY, Environmental Modelling for Radiation Safety (EMRAS), A Summary Report of the Results of the EMRAS Programme (2003–2007), IAEA-TECDOC-1678, I.

5 PREDICTION & EVALUATION OF IMPACTS

TABLE 5.1 (cont'd) Key impact evaluation and its expected output

ENVIRONMENTAL COMPONENT	SOURCE OF POLLUTION	ASSESSMENT REQUIREMENTS
Hydrology and hydraulic	<u>Construction Stage</u> Land disturbing activities e.g. site clearing, cut and fill	■ Assessment of land clearing scale and alterations to hydrological and drainage characteristics of the site ■ Determine the scale of drainage system that may be altered ■ Evaluation of hydrological condition before and after project implementation ■ Determination of impacts to the downstream
Waste management	<u>Construction Stage</u> ■ Land disturbing activities e.g. site clearing ■ Construction activities <u>Operation Stage</u> ■ Domestic waste from workers ■ Radiological waste from nuclear power station	■ Identify types of waste generated during construction and operations and the impacts ■ Assessment of the impacts from these wastes and the required management measures

Note: The list is not exhaustive and not all of 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.

PREDICTION METHOD	EVALUATION OF IMPACTS	OUTPUT
■ 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 <i>Manual Saliran Mesra Alam 2</i> (MSMA 2) and approved by DID ■ Hydrological analysis taking into account weather extremity due to climate change (rainfall pattern) Output ■ Estimation of pre-construction and post-construction runoff ■ Flood risk map ■ Environmental flow analysis (upstream and downstream)	■ Delineate the river basins or systems that are affected ■ Collect hydrological data and assess long-term rainfall trends ■ Use mathematical or simulation models to ascertain the different hydrological condition pre- and post-project implementation	Hydrological and drainage systems of the project and the impact on the surrounding as input to the technical and engineering works
1. Scheduled Waste Identification of potential scheduled waste generation during construction and operations based on project activities Output Predicted scheduled waste generation 2. Radiological waste/spent fuel Identification of potential radiological waste/spent fuel generation during operation, decommissioning and undesirable incidences/emergency Output Predicted radiological waste generation/spent fuel 3. Solid waste Waste generation estimation based on population Output Predicted waste generation 4. Biomass Estimation on total biomass based on vegetation types and published studies values Output Predicted biomass waste generation	■ Identify and estimate the quantum of all waste sources ■ Assess the severity of impacts from improper management ■ Identify locations of temporary storage within the site and assess the safety, security and safeguard ■ Identify locations for disposal site	■ Identification of proper temporary disposal sites and storage facilities ■ Develop mitigation measures against spillage and other impacts ■ Mitigation measures to be incorporated into project site management ■ Management of radiological waste, including decommissioning debris, and spent fuel (disposal activity requires separate EIA)

Source:

1. INTERNATIONAL ATOMIC ENERGY AGENCY, Generic Models for Use in Assessing the Impact of Discharges of Radioactive Substances to the Environment, Safety Reports Series No. 19, IAEA, Vienna (2001).
2. INTERNATIONAL ATOMIC ENERGY AGENCY, Environmental Modelling for Radiation Safety (EMRAS), A Summary Report of the Results of the EMRAS Programme (2003–2007), IAEA-TECDOC-1678, I.

5 PREDICTION & EVALUATION OF IMPACTS

TABLE 5.2 (cont'd) Key impact evaluation and its expected output

ENVIRONMENTAL COMPONENT	SOURCE OF POLLUTION	ASSESSMENT REQUIREMENTS
Erosion and sedimentation	Construction Stage ■ Land disturbing activities ■ Pollutants of concern: TSS and turbidity	■ Assessment of land clearing scale to determine rate of erosion ■ Assessment of the conditions of the hydrological and drainage system ■ Assessment of the extent of erosion and sedimentation ■ Determination of suitable BMP
Geotechnical hazards	Construction Stage ■ Slope cutting ■ Piling activities	■ Assessment of areas of the project site and its surroundings for risk. For example, slope failure, erosion, landslides, seismic activities, etc. ■ Determination of the adequacy of buffer to avoid or reduce risk of hazards to the project area ■ Identification of suitable engineering and geotechnical measures required to ensure that hazards are fully addressed
Safety, security, safeguard and health	Operation Stage ■ Potential radiation emission during abnormal operation or accidents and spillage	Assessment of safety and health towards workers and nearby population

Note: The list is not exhaustive and not all of 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.

PREDICTION METHOD	EVALUATION OF IMPACTS	OUTPUT
■ Revised Universal Soil Loss Equation (RUSLE) ■ Modified Universal Soil Loss Equation (MUSLE) ■ Computer models Output ■ Soil loss rates and sediment yields ■ Erosion risk and potential soil loss maps	■ Calculate the rate of erosion and Calculate the rate of erosion and sediment yield using standard formulae and site-specific information ■ Provide erosion scenarios i.e. with and without mitigation measures ■ Run simulation to determine the BMPs that shall be adopted to minimise negative impacts	■ Adoption of avoidance principles ■ Identify suitable BMP to be incorporated in the land-disturbing pollution prevention and mitigation measures (LD-P2M2)
■ Soil investigations (SI) ■ Geological Terrain Mapping (GTM) ■ Site assessment by qualified geotechnical engineer and/or geologist ■ Risk analysis ■ Engineering design and estimation of Factor of Safety (FOS) Output Identification and mapping of high risk areas to avoid or to apply mitigation measures	■ Develop risk map and determine factor of safety (FOS) for all engineered slopes and hazard areas ■ Assess the impact and extent of damages/losses in the event of slope failure and sensitive receptors that may be affected. ■ Determine areas in need of mitigation measures or engineering solutions to reduce risk	■ Hazard areas shall be clearly mapped out as part of the GTM to determine construction suitability ■ Areas of high risks shall be avoided being built upon or with adequate geotechnical and engineering measures being proposed ■ Monitoring programme for slopes
1. Health Qualitative/Quantitative Health Risk Assessment (HRA) encompassing hazard identification, exposure assessment and risk characterisation Output Potential health impacts to nearby population (including radiological / toxicology) 2. Risk and Hazard Qualitative/Quantitative risk assessment (QRA) encompassing hazard identification, exposure assessment and risk characterisation Output ■ Potential risk and hazard during construction and operation stages to construction workers and nearby population ■ Nuclear hazard and risk should there be incidences or emergency occurrences	■ Determine the level of risk to neighbouring receptors ■ Identify the existing health conditions of receptors ■ Assess the possible impacts on workers' safety and health during construction stage ■ If necessary, use risk assessment models to ascertain the level of risk ■ Evaluate all aspects of radiation safety from the nuclear power station construction, operation and decommissioning ■ Evaluate all aspect of Security and Safeguard for the nuclear power station	■ Determine the qualitative/ quantitative risk to receptors to identify appropriate BMP ■ Findings from HIA can also provide possible preventive and mitigation measures ■ Health and safety protection ■ Recovery plan and execution ■ Nuclear security and safeguard system

Source:

1. INTERNATIONAL ATOMIC ENERGY AGENCY, Generic Models for Use in Assessing the Impact of Discharges of Radioactive Substances to the Environment, Safety Reports Series No. 19, IAEA, Vienna (2001).
2. INTERNATIONAL ATOMIC ENERGY AGENCY, Environmental Modelling for Radiation Safety (EMRAS), A Summary Report of the Results of the EMRAS Programme (2003–2007), IAEA-TECDOC-1678, I.

5 PREDICTION & EVALUATION OF IMPACTS

TABLE 5.2 (cont'd) Key impact evaluation and its expected output

ENVIRONMENTAL COMPONENT	SOURCE OF POLLUTION	ASSESSMENT REQUIREMENTS
Climate	Operation Stage ■ Site clearing, removing vegetation in impounded areas, access road, etc. ■ Presence of water body	■ Loss of carbon sink due to forest clearance ■ Changes of micro climate due to the presence of impounded water body
Land use and aesthetic	Construction Stage ■ Land disturbing activities e.g. site clearing ■ Construction of buildings	■ Assessment of the compatibility of the project towards the surrounding land use ■ Determination of the adequacy of buffer as per structure plan, local plan or any other guidelines (including AELB and IAEA Guidelines)
Social	Planning Stage ■ Relocation of settlements Construction Stage ■ Employment opportunities ■ Social conflict between foreigners and locals ■ Nuisance from construction activities; noise and dust Operation Stage ■ Potential radiation emission during abnormal operation or accidents and spillage	■ Determine whether there is land and property acquisition and relocation of communities ■ Assessment of extent of impacts, both negative (dust, noise, pollution, hazards, etc.) and positive (job and business opportunities) ■ Assessment of the views and perception of the affected stakeholders
Traffic	Construction Stage Movement of trucks carrying construction materials	■ Description on traffic arrangement during construction ■ Identification of the need for mitigation measures

Note: The list is not exhaustive and not all of 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.

PREDICTION METHOD	EVALUATION OF IMPACTS	OUTPUT
■ The Greenhouse Gas Protocol (GHG Protocol) of the World Resources Institute (WRI) ■ The technical report and methodology guidelines of the Inter-governmental Panel on Climate Change (IPCC) Output Estimation of pre-construction and post-construction carbon sink	■ Determine loss of carbon sink due to vegetation clearance ■ Determine potential carbon sink of aquatic vegetation (microphyte) in the water body	Identify potential measures to offset the loss of carbon sink
1. Land use ■ Compatibility assessment based on structure plan, local plan and other guidelines including AELB and IAEA for nuclear power projects ■ Adherence to required setback based on national and state guidelines Output Land use compatibility and buffer requirements 2. Aesthetic ■ Visual assessment on scenic and aesthetic value of the area ■ 2-D and 3-D Viewshed Analysis Output Before and after project	■ Identify the designated land use of the project site as per the spatial plan ■ Evaluate the suitability of the project on the surrounding development	■ Determine the suitability of the project on the designated site ■ Highlight possible land use conflict that may arise
1. Social ■ Social and economic surveys on affected population ■ Perception survey to ascertain acceptance of project ■ Social Impact Assessment (SIA) Output ■ Socio-economic profiling ■ Public opinion survey results ■ Stakeholder feedback for EIA including possible mitigation measures	■ Identify the extent of land acquisition and affected stakeholders ■ Delineate the survey catchment and determine statistically the number of surveys required ■ Evaluation to focus on communities within the ZOS. If there is a need, those in ZOI shall also be assessed ■ Main findings from SIA shall be incorporated	Land and property acquisition and relocation of communities must first be settled prior to EIA commissioning and submission
■ Traffic impact assessment, e.g. peak traffic flow, junction analysis ■ Simulation using SIDRA Output Comparison of traffic scenarios pre, during and post project and need for road improvement	■ Review and incorporate main findings from TIA into the EIA ■ Main impact elements are communities living along the logistic road during construction	■ Identification of potential issues during construction and incorporation of structural and non-structural measures ■ Identification of risk factors

Source:

1. INTERNATIONAL ATOMIC ENERGY AGENCY, Generic Models for Use in Assessing the Impact of Discharges of Radioactive Substances to the Environment, Safety Reports Series No. 19, IAEA, Vienna (2001).
2. INTERNATIONAL ATOMIC ENERGY AGENCY, Environmental Modelling for Radiation Safety (EMRAS), A Summary Report of the Results of the EMRAS Programme (2003–2007), IAEA-TECDOC-1678, I.

5.4 ENVIRONMENTAL CRITERIA AND STANDARDS

The method to determine the level of significant impact is to compare the results against the stipulated current criteria and standard limits imposed by the DOE and/or various GAs. The environmental criteria and standards are provided in *Attachment 4* to *Attachment 10*.

In cases where there are no local standards or limits, regional and international limits and adherence levels can be adopted based on expert opinion of the Qualified Person. However, the chosen criteria and standards must be relevant and applicable to local conditions. *Table 5.2* lists the evaluation of criteria and standards for environmental parameters.

TABLE 5.2 Examples of criteria and standards for environmental parameters

IMPACTS	EVALUATION CRITERIA
Erosion and sedimentation	■ Guidance documents i) Guidance Document for Addressing Soil Erosion and Sediment Control Aspects in the EIA Report (DOE, 2016) ii) Guidance Document for the Preparation of the Document on LD-P2M2 (DOE, 2016) iii) Guidelines for Erosion and Sediment Control in Malaysia (DID, 2010) iv) Manual Saliran Mesra Alam Edisi-2 (MSMA-2) (DID, 2012) ■ Sediment basin/silt trap discharge i) TSS: 50 mg/L or depending on locality ii) Turbidity: 250 NTU or depending on locality ■ Silt curtain i) TSS: Shall be based on limit stated in Malaysian Marine Water Quality Standards (MMWQS) ii) Turbidity: 250 NTU or depending on locality
Water quality and pollution control	■ Ambient water quality: National Water Quality Standards for Malaysia (NWQS) ■ Ambient marine/brackish water quality: MMWQS ■ Sewage discharge: Environmental Quality (Sewage) Regulations 2009 ■ Toilet and septic tanks: Design and requirements approved by SPAN ■ Vessels: The International Convention for the Prevention of Pollution from Ships 1973/1978 (MARPOL 73/78) and Marine Department of Peninsular Malaysia requirements ■ Drinking Water Quality Standard by Ministry of Health (MOH) ■ AELB and IAEA Guidelines
Flood/run-off management	MSMA-2 requirements
Air quality	■ Environmental Quality (Clean Air) Regulations 2014 ■ New Malaysia Ambient Air Quality Standard (DOE, 2013) ■ MARPOL ■ AELB and IAEA Guidelines
Noise level	■ The Planning Guidelines for Environmental Noise Limit and Control (DOE, 2019) ■ Factories and Machinery (Noise Exposure) Regulations 1989

Note: The list is not exhaustive and not all of 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.

TABLE 5.3 (cont'd) Examples of criteria and standards for environmental parameters

IMPACTS	EVALUATION CRITERIA
Vibration	■ The Planning Guidelines for Environmental Vibration Limits and Control 3rd Edition (DOE, 2007) ■ JMG requirements for blasting operations
Ecology	■ International Union on the Conservation of Nature (IUCN) and Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) listing ■ Wildlife Conservation Act 2010 ■ Feedback from DOF, PERHILITAN and DIDM ■ AELB and IAEA Guidelines
Land use	■ Structure Plans, Local Plans, Special Area Plans (RKK) ■ ESAs ■ Environmental Essentials for Siting of Industries in Malaysia (EESIM) (DOE, 2017) ■ Guidelines for Siting and Zoning of Industry and Residential Areas (SZIRA) (DOE, 2012) ■ Local authority requirements ■ AELB and IAEA Guidelines
Land traffic	■ Acceptable level of service (LOS) for traffic flows ■ Local authority/JKR requirements
Safety and health	■ Occupational Safety and Health Act 1994 ■ Factory and Machinery Act 1967 ■ Department of Occupational Safety and Health (DOSH) ■ Guidance Document on Health Impact Assessment (HIA) in EIA (DOE, 2009) ■ EIA Guidelines for Risk Assessment (DOE, 2009) ■ AELB and IAEA Guidelines
Socio-economic	■ Public perception on acceptability ■ National Heritage Register (National Heritage Department) ■ Preservation of cultural, heritage, historical and archaeological items and sites of significance ■ SIA requirements in the context of the Town and Country Planning Act (Amendment) 2017 (Act A1522)
Waste	■ Scheduled wastes i) Environmental Quality (Scheduled Wastes) Regulations 2005 ■ Other wastes i) Solid Waste and Public Cleansing Management Act 2007 ii) Local authority requirements iii) Atomic Energy Licensing (Radioactive Waste Management) Regulations 2011 iv) IAEA Guidelines ■ Solid and Scheduled Wastes from vessels i) The International Convention for the Prevention of Pollution from Ships 1973/1978 (MARPOL 73/78) ii) MarDep requirements
Visual aesthetics	Public perception on acceptability

Note: The list is not exhaustive and not all of 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.

5.5 ECONOMIC VALUATION OF ENVIRONMENTAL IMPACTS (EVEI)

Due to the substantial capital investment, the proposed project is expected to provide substantial economic and business opportunities to market participants. However, the construction and operation of the proposed project are also likely to cause some negative environmental impacts that must be mitigated as required by law, besides going through the EIA approval process.

The objective of the EVEI is to quantify and monetize the impacts of the proposed project on the flow of environmental services. This requires valuation in monetary terms of the changes (both negative and positive if any) in environmental services arising from project implementation over an assessment period of 50 years.

A critical step in the valuation process revolves around the need to ensure valid attribution of impacts on environmental services to the proposed project. In order to satisfy this requirement, physical environmental impacts that can reasonably be attributable to the proposed project must first be demonstrated. In other words, the approach requires the establishment of a clear link between project impacts on the physical functions of the environment and the alteration of the quality and quantity of streams of environmental goods and services. The Guidelines on the Economic Valuation of the Environmental Impacts for EIA Projects (DOE,2008) is very clear in this regards where it specifies that:

“... a key issue is to identify and quantify the changes in the flow of goods and services produced by the environment which are impacted by a development project, and then to monetize these changes into costs or benefits”

The valuation process can be divided into nine distinct steps, as follows:

- **Step 1: Identify the project stakeholders**
The stakeholders are determined by establishing clear links between the degradation in environmental services to the impacted parties.

- **Step 2: Define the “with project” and “without project” scenario**

A contrast is considered under the “with” and “without” project scenarios, as opposed to “before” and “after” scenarios. It involves the conceptualization of the “with” and “without” project scenarios. For the current project under evaluation, the “with Project” scenario is defined as the situation where the project is implemented. The “without Project” scenario is depicted as the situation in which the proposed project is not implemented i.e. maintenance of the status quo.

- **Step 3: Describe the physical impacts**

A listing of potential physical impacts of the project that can be reliably attributed to the project is prepared and described by focusing on the physical extent of the impact and the link between the project and its impact on the flow of environmental services.

- **Step 4: Quantify the impacts on the environment over the duration of the project**

The physical impacts of the project on the environment is explained and quantified via scientific assessments of the study team that include among others marine biologists, air and water quality specialists, hydraulic specialist and etc.

- **Step 5: Monetize the impacts**

The quantified impacts produced in Step 4 are monetized using market and non-market valuation techniques. Value parameters of similar environmental services obtained in other studies are used as reference points for evaluation.

- **Step 6: Discounting**

Costs and benefits over time (25 years) are discounted to present values using several discount rates (4, 6 and 8%). Twenty-five years is typically used as the standard period of evaluation since the present value of future benefits/costs beyond 50 years tend to become quantitatively insignificant.

- **Step 7: Determine the Net Present Value**
The net present value is computed in this step by adding up the discounted values of the losses and gains in environmental services.
- **Step 8: Perform sensitivity analysis**
Sensitivity test is conducted for different discount rates to demonstrate the impact of variation in rates on the net present value of the environmental costs and benefits.
- **Step 9: Make a recommendation**
An overall assessment is made based on the magnitude of Net Present Values at different levels of discount rates.

this reaction will have both positive and negative impacts on the social components. It is imperative for the Project Proponent to carefully deliberate the interweaving of these components so that the environmental trade-off can be strongly justified and appropriately managed, and the proposed new development will be beneficial in terms of socio-economy as well as spurring the progress of the county.

Acknowledging that most EIA projects will cause some sort of environmental trade-off does not mean there are no alternative ways in mitigating the impacts. One of the tangible ways in addressing environmental trade-offs is by conducting environmental offset, which shall be discussed in **Chapter 6**.

5.6 ENVIRONMENTAL TRADE-OFFS

Trade-off can be defined when components of a system are competing with or exclusive of each other. In short, trade-offs can be said as a win-lose situation. It implies a decision to be made with full comprehension of both the upside and downside of a particular choice. In environmental terms, trade-offs occur when the provision of services from a particular ecosystem or environmental component is reduced as a consequence of development. In short, any environmental impacts that cannot be sufficiently mitigated are considered as trade-offs.

Managing environmental trade-offs is important in achieving the goal of sustainable development. Sustainability can only be attained by providing equal emphasis on the relation between three major components as illustrated in *Figure 5.1*.

New developments are normally related to the advancement of economic components and customarily thought to impede on the environmental components. The outcome from

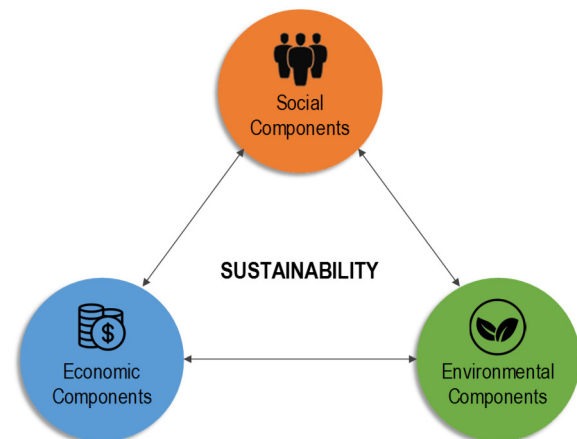


FIGURE 5.1 Major sustainability components



CHAPTER 6

Mitigation Measures

Selangor
Photo by Timothy Tan on Unsplash.com

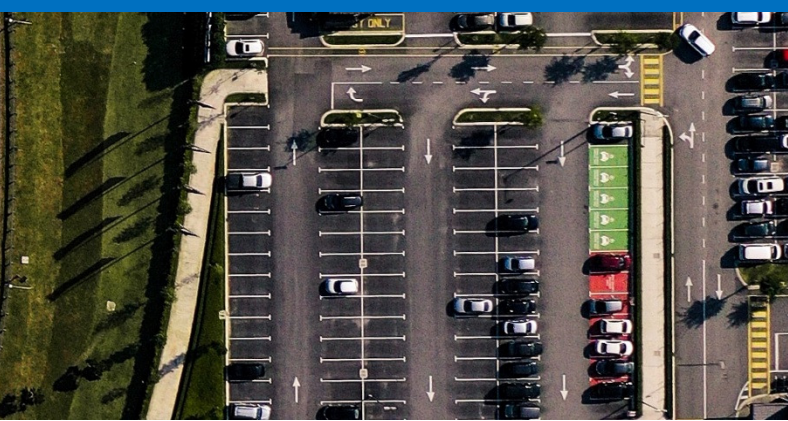


6.1 INTRODUCTION

Pollution prevention and mitigation measure (P2M2) is the stage to determine applicable preventive, remedial or compensatory measures for each of the adverse impacts that have been evaluated as being significant. The mitigation measures provided in this chapter shall serve as a guide only.

The objectives of P2M2:

1. Avoidance of negative impacts through selection of alternatives to implement the preventive measures.
2. When an impact cannot be avoided to adopt relevant mitigation measures to minimise the impacts.
3. Enhance and amplify the beneficial impacts.
4. Ensure that residual impact are kept within acceptable levels.



6.1.1 General Approaches

The key objectives of implementing P2M2s are to reduce environmental degradation and pollution through management measures that best suited to the site conditions. The P2M2s implementation include:

- i) The need and extend of P2M2s required shall correspond to the significance of the predicted impact:
 - a) for significant issue, P2M2s must be identified and elaborated in the EIA. Example: for and from engineering design and calculations for slope reinforcement works on cut slopes; and
 - b) for minor issue, management actions and simple measures need only be highlighted. Example: need for water browsing for dust control at site during construction.
- ii) Priority shall be on control at source and rectifying the impacts;
- iii) Solutions shall be project-specific and designed for the site conditions;
- iv) The P2M2s shall not be complex and costly, but instead be practical, easy to implement and effective;
- v) The explanation on the design and function of P2M2s shall be supported by diagrams, illustrations, photos and maps. The technical reports and specifications shall be attached in the EIA as appendix;
- vi) The use of new technology is encouraged if it can be proved to be effective. The Project Proponent or the Qualified Person is responsible to provide supporting document that the proposed technology is tried and tested and able to mitigate the impacts;
- vii) The proposed P2M2s require regular inspection, maintenance and rehabilitation and shall be incorporated as part of the management requirements of the project as addressed in *Section 7.5.2 of Chapter 7*; and
- viii) Effectiveness of the P2M2s shall be documented and this is through implementation of a monitoring programme.

The Qualified Person shall also identify and propose Best Management Practices (BMPs) based on the findings of the EIA. The P2M2s and BMPs shall be incorporated into the overall design of the project. It is recommended that alternative measures and/or introduce newer technology which have been proven effective.

The submission of the EIA and the pledge agreed by the Project Proponent shall reflect the agreement and commitment towards ensuring implementation of the P2M2s and BMPs on-site during all stages of work.

6.2 POLLUTION PREVENTION AND MITIGATION MEASURES

The applicable P2M2s for power generation and transmission project are listed in *Table 6.1*.

TABLE 6.1 P2M2 for construction of power generation and transmission projects

ACTIVITIES	ENVIRONMENTAL ASPECT	SIGNIFICANT POTENTIAL IMPACTS	P2M2
Earthwork activities	Air pollution	■ Suspension of dust and particulate matter ■ Exhaust emission	■ Water-bowsing at exposed surface area ■ Minimise the exposed area by phasing ■ Maintain and regularly check the equipment and machineries ■ Prohibition of open burning ■ Blasting activities should include supervisions and adherence to safety measures ■ Any emissions from genset, machineries and equipment must comply with relevant agencies requirements and limits
	Water pollution (land disturbance)	■ Erosion and sedimentation ■ Increase in flooding risk (localised or downstream)	■ Establish proper scheduling and phasing of P2M2 implementation in accordance to the project phasing and project implementation schedule ■ Retain much of the natural vegetation by reducing the total working area ■ Install temporary perimeter drain to manage runoff water during rain ■ Install series of check dams to reduce velocity and peak flows ■ The size and capacity of the drains must be sufficient to cater at least a storm of 10-year ARI event (refer MSMA-2) ■ Install sediment control devices and structures ■ Design retardation/capture structures to accommodate the calculated runoff volume to allow adequate time for suspended sediments to settle
	Slope stabilisation	Occurrence of slope failures, erosion or landslide/mudslide	■ Adequate buffer zone/setback ■ Slope benching with appropriate protection measures (runoff and erosion control) ■ Geotechnical measures for identified hazard areas ■ Periodical monitoring and maintenance of the slopes
Construction works	Ecological management	■ Destruction to sensitive habitat ■ Impact to local flora and fauna	■ Ban on poaching and illegal hunting ■ Delineate work area to ensure no accidental encroachment ■ Wildlife Management Plan ■ Reforestation Plan ■ Monitor displaced and stranded wildlife ■ Provide sufficient environmental flow to maintain biological function of waterbodies ■ Notify the relevant authorities (JPSM or PERHILITAN) of any sighting of rare, endangered, threatened and near extinct wildlife for further actions

TABLE 6.1 (cont'd) P2M2 for construction of power generation and transmission projects

ACTIVITIES	ENVIRONMENTAL ASPECT	SIGNIFICANT POTENTIAL IMPACTS	P2M2
Construction works (cont'd)	Water pollution	■ Pollutant carried by surface runoff to nearby water bodies ■ Domestic wastewater discharge ■ Inappropriate waste storage and disposal	■ Erosion and sedimentation Prepare and implement LD-P2M2. Further details is provided in Section 6.3 ■ Wastewater discharge i) Septic tank and toilet facility at base camp as per National Water Services Commission (SPAN) requirements ii) Sewage discharge to meets the limit of Environmental Quality (Sewage) Regulations 2009 iii) Proper desludging and other maintenance works on the sewage treatment system iv) Installation of oil and grease trap v) For batching plant, to include measures on concrete wastes and washouts vi) Proper closure plan on plant shut down ■ Material and waste storage i) Proper workshop area ii) Bunded storage for scheduled waste, chemical and fuel tank area iii) All scheduled wastes shall be handled, stored and disposed of in accordance with the Environmental Quality (Scheduled Wastes) Regulations 2005
	Safety and health	■ Accident risk at construction site ■ Health risk to workers and locals from prolonged exposure to air emission pollutants and dust ■ Transmission of communicable diseases and vector-borne diseases	■ Health i) Implementation of P2M2 on air pollution ii) Clean water supply and proper solid waste disposal iii) Housekeeping to prevent mosquito breeding iv) Periodical health checks on workers ■ Safety i) To employ a Health, Safety and Environment (HSE) Officer ii) PPE requirement iii) Workers to have CIDB green card iv) Preparation of Emergency Response Plan (ERP) v) Provision of sufficient training ■ Nuclear power accident i) Nuclear power station design shall be licensed by AELB with all safety, security and safeguard measures approved with SAR in place ii) Technical measures, design and station selection in such that the probability of a severity accident is minimal iii) The risk of radioactive releases minimised by design conforming to defense-in-depth safety principle and highest safety standards iv) Facilities will contain systems for the safe handling and transportation of waste

TABLE 6.1 (cont'd) P2M2 for construction of power generation and transmission projects

ACTIVITIES	ENVIRONMENTAL ASPECT	SIGNIFICANT POTENTIAL IMPACTS	P2M2
Construction works (cont'd)	Waste management	■ Generation of solid waste ■ Generation of scheduled waste	■ Wastes comprise biomass, municipal, construction and demolition and scheduled wastes, all of which require specific management strategies: i) Solid waste - Temporary disposal area - Waste bins in active working areas - Regular housekeeping - Disposal at landfill (licensed by local authority) i) Scheduled waste - Management of scheduled waste according to Environmental Quality (Scheduled Wastes) Regulations 2005, that includes: - Storage area with bunding - Provide inventory - Proper labelling - Spill kit - Competent person (CePSWaM) i) Biomass waste - Proper biomass management controls - Selection of disposal areas i) Radioactive and nuclear waste - Nuclear power station design must include the handling and safety of radioactive and nuclear waste in compliance with AELB and IAEA standards ■ To ensure proper storage facilities or disposal sites are provided on-site
	Noise and vibration	■ Noise and vibration generated from machineries and equipment ■ Noise and vibration induced by vehicle movements	■ Perimeter hoarding to reduce noise propagation ■ Regular maintenance for vehicle and machinery ■ PPE for workers ■ Scheduling of certain activities (piling, transportation via heavy vehicles, etc.) outside to be within working hour only ■ Establish grievance mechanisms for disturbance complaints
	Land and marine traffic	■ Increase in accident risk ■ Reduction in level of service of local road network	■ Identify logistic routes and prepare traffic management plan ■ Schedule transportation plan especially for heavy vehicle traffic ■ Impose speed limits ■ Road signage ■ To install zebra crossing, yellow lines, traffic lights and bumpers ■ To install clear demarcation and lighted buoys for marine traffic navigation

TABLE 6.1 (cont'd) P2M2 for construction of power generation and transmission projects

ACTIVITIES	ENVIRONMENTAL ASPECT	SIGNIFICANT POTENTIAL IMPACTS	P2M2
Operation stage	Water pollution	■ Discharge of pollutants ■ Pollutants carried by surface runoff	■ Regular maintenance of operating equipment and machineries ■ Regular maintenance of IETS/STS to ensure compliance to discharge limit at all times ■ Best available technology will be used to minimise emissions when handling radioactive liquid ■ Emissions must always be kept as low as reasonably achievable and in compliance with AELB and IAEA Guidelines
	Air pollution	Fine dust dispersion and emission	■ Stockpile of energy source material and by products (e.g. coal, fly ash) must be covered ■ Wet suppression on the stockpiles ■ Regular maintenance of APCS ■ Monitoring ■ Best available technology will be used to minimise emissions when handling radioactive liquid ■ Emissions must always be kept as low as reasonably achievable and in compliance with AELB and IAEA Guidelines
	Noise and vibration	Noise and vibration disturbance	■ Monitoring of seismic activity ■ Landscaping and natural buffers ■ Contain station within noise baffling buildings
	Slope stabilisation	Occurrence of slope failures	Slopes are required to be periodically monitored and maintained
	Ecological management	Loss of habitat and biodiversity of important flora and fauna	■ Viaduct/animal crossings ■ Signage to warn road users ■ Human-Wildlife Conflict (HWC) resolution mechanism ■ Proper handling during transportation and installation of nuclear energy source (uranium and plutonium) ■ Regular maintenance of effluent/water treatment system ■ Periodic monitoring of effluent discharge
	Runoff and stormwater management	■ Erosion and sedimentation ■ Increase in flooding risk (localised or downstream)	■ Permanent drainage network and drainage systems to be installed at site to capture runoff from the site ■ Slope maintenance and rehabilitation in the case of erosion and failure
	Waste/Wastewater management	■ Generation of solid waste ■ Discharge of wastewater	■ Adequate bins and disposal sites ■ Regular disposal services ■ Management of radiological waste and spent fuel to comply with AELB and IAEA Guidelines ■ Treat discharges and emissions to meet required standard(s)

TABLE 6.1 (cont'd) P2M2 for construction of power generation and transmission projects

ACTIVITIES	ENVIRONMENTAL ASPECT	SIGNIFICANT POTENTIAL IMPACTS	P2M2
Operation stage (cont'd)	Safety and health	Nuclear accident resulting in environmental pollution and safety of public	■ Emergency Response Plan (ERP) ■ Nuclear security and safeguard plan ■ Health and safety protection plan for both operation and emergency ■ Recovery plan and execution ■ Nuclear power station operation shall be licensed by AELB with all continual safety, security and safeguard measures approved with SAR in place ■ Ensure safe handling and transportation of waste and the monitoring of the amount and type of radioactive substances ■ Spent nuclear fuel will be handled safely at all stages of the waste management process ■ Minimise the risk of accidents and abnormal situations by applying strict quality and safety requirements, and by applying the continuous improvement principle ■ Civil protection measures ■ Protection measures influencing the food industry and restrictions on the use of food products can reduce the radiation dose due to food ingestion
Abandonment/Decommissioning	Safety and health	■ Dismantling and removal of construction material from the site ■ Radioactive wastes and spent fuel ■ Contaminated land	■ An abandonment plan shall be submitted to DOE at least three months prior to project abandonment. In the event of abandonment, this plan shall be followed closely to allow for a systematic and proper abandonment. ■ All scheduled wastes shall be properly disposed of at a licensed disposal facility upon project abandonment ■ Ample time should be allowed for the demolishing and removal of on-site equipment, machinery and building structure ■ Appropriate cover vegetation to be established on cleared area to ensure no severe soil erosion ■ All construction waste should be properly disposed by the Proponent such that it will not be a burden to the local council ■ Radioactive waste and spent fuel management must be implemented ■ A final decommissioning plan must be submitted to AELB for license application

6.3 LAND-DISTURBING POLLUTION PREVENTION AND MITIGATION MEASURES (LD-P2M2)

The LD-P2M2 document addresses on how to prevent, reduce and eliminate pollutants from land-disturbing activities including but not limited to **SITE CLEARING/LOGGING AND EARTHWORK**.

The formulation of LD-P2M2 must be conducted based on the following guidelines produced by the Department of Environment (DOE):

- i) Guidance Document for Addressing Soil Erosion And Sediment Control Aspects in the EIA (DOE); and
- ii) Guidelines on Land Disturbing Pollution Prevention and Mitigation Measures (DOE).

6.3.1 Work Breakdown Structure

A work breakdown structure (WBS) for the project activities must be produced to list all activities or work packages that must be performed in the project (although each work package may have several activities within it). An example of a WBS is shown in *Figure 6.1*. If any of the project activity involves land disturbance including sub-components under WBS, LD-P2M2 must be submitted and approved by the DOE.

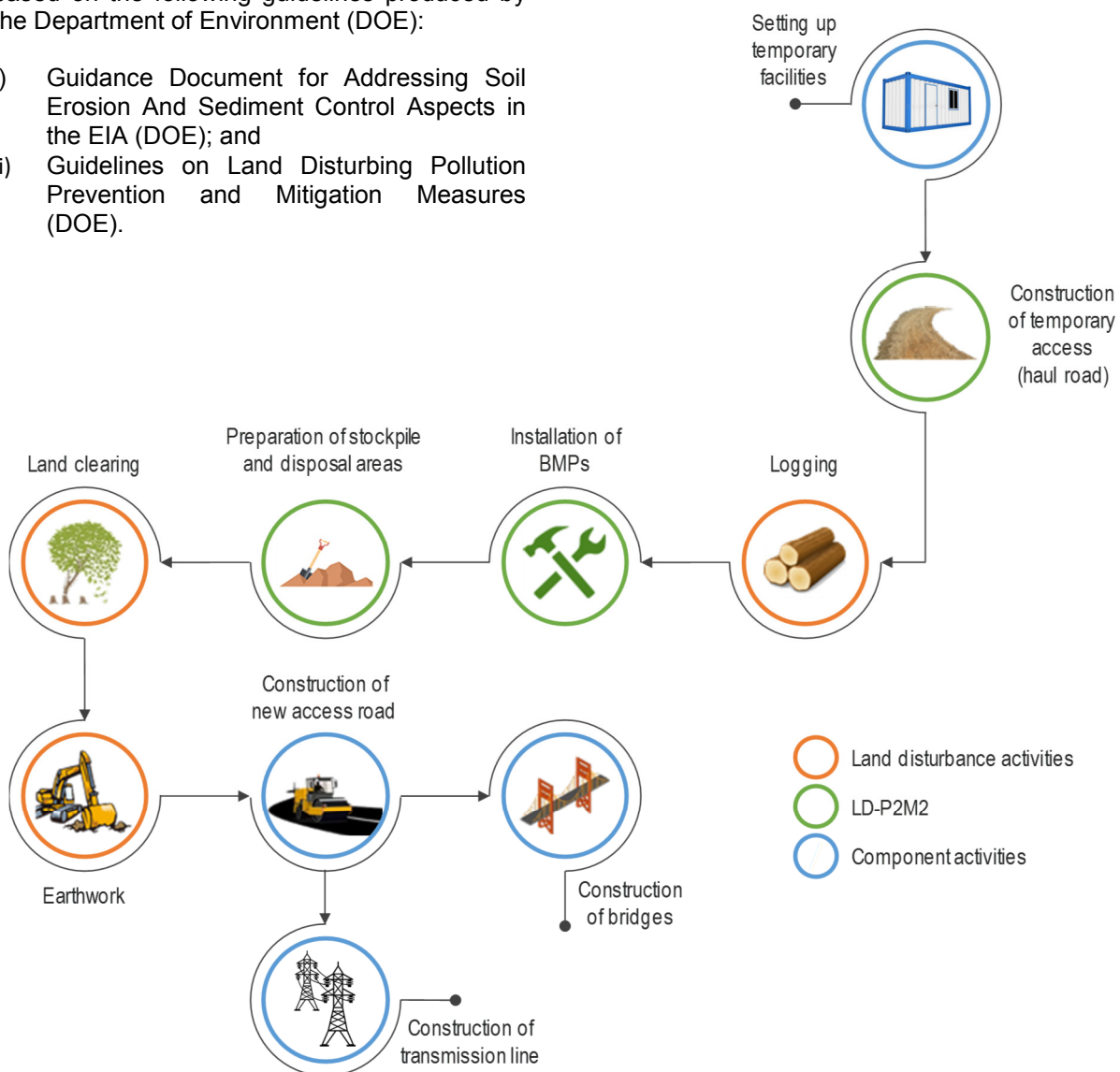


FIGURE 6.1 Example of a WBS

6.3.2 LD-P2M2 Checklist

The LD-P2M2 document should cover all the basic information required as specified in the Guidance Document. For ease of reference, a submission checklist is shown in *Table 6.2* which was adapted from EGIM. It important to note that all submissions must be accompanied by the relevant technical drawings and maps.

TABLE 6.2 LD-P2M2 checklist for EIA report submission

COMPONENT	INFORMATION REQUIRED	PAGE IN EIA REPORT
Project activity and implementation	■ Phasing plan ■ Project implementation schedule ■ Description of construction activities ■ Construction timeline, including BMP installation ■ Construction method statement	
Information and analysis on project site and development	■ Selected weather and rainfall data ■ Site runoff velocity and flow rates (pre- and post-development) ■ Description of soil and geological characteristics ■ Description of adjacent areas that may be affected by land disturbance ■ List of drainage, streams and river onsite, including receiving water bodies ■ List of BMP proposed ■ Access roads and project components located outside of project boundary ■ Earthworks cut and fill volume ■ Availability of materials ■ Biomass management ■ Construction and domestic waste management ■ Spill prevention and control plan ■ Soil loss prediction (pre, during and post development as well as with and without BMP scenarios) ■ Projected runoff flows ■ Calculation for BMP (sediment traps/basins, check dams, etc.)	
Map of site plan with existing condition	■ Topographic survey map ■ Geological terrain map ■ Erosion risk map ■ Land use map ■ Site development plan	

Source: EGIM (DOE)

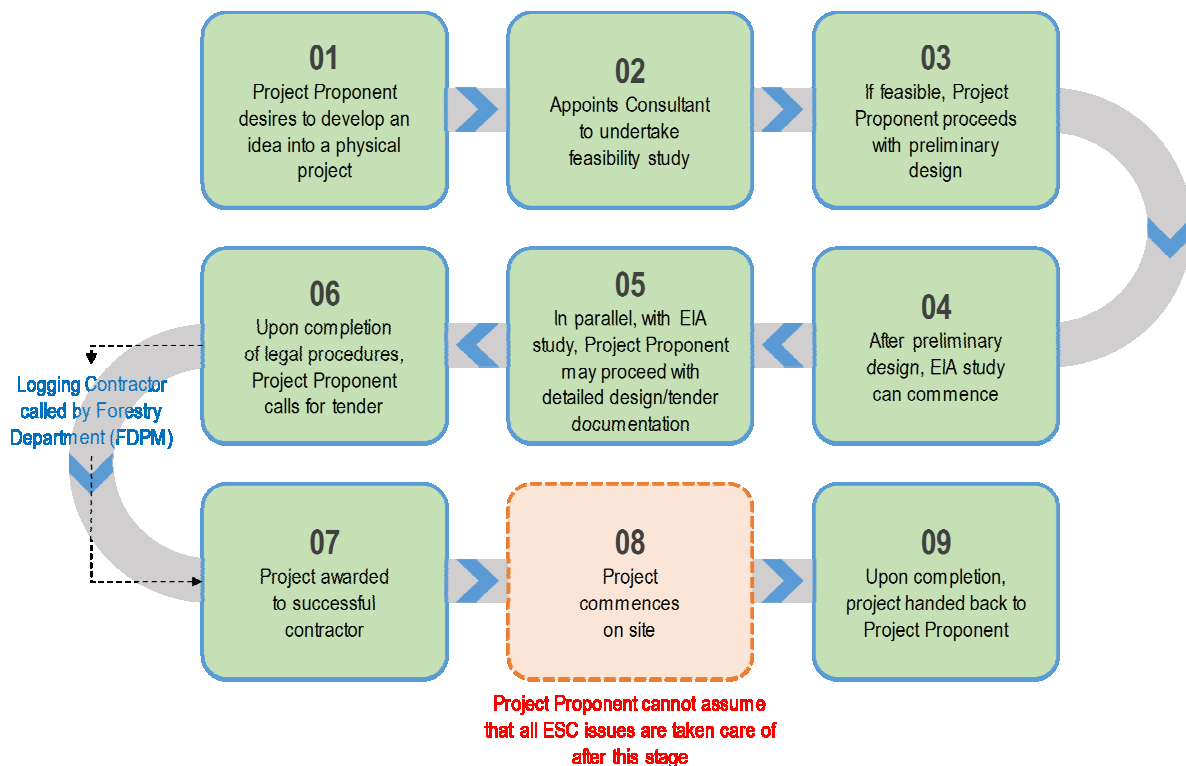
6.3.3 Best Management Practices

Best management practice (BMP) for LD-P2M2 must be proposed in accordance to the Guidelines on LD-P2M2 (DOE, 2017). There are two types of BMPs which are structural BMPs and non-structural BMPs.

STRUCTURAL BMPs	NON-STRUCTURAL BMPs
Structural BMPs such as sediment trap, silt fence and Active Treatment System (ATS) can be calculated and engineered. Thus, it can be assumed that all design of structural BMPs will be in accordance to both DOE and DID guidelines.	Despite the fact that structural BMPs can be designed appropriately, problems may arise from the actual implementation of the BMPs on site, in which the non-structural BMPs must be executed.

Non-structural BMPs involve management of people and monitoring of the effectiveness of BMPs. The cooperation and integration of different parties are crucial in ensuring the success of an LD-P2M2 plan.

A coordination committee headed by State Administration, consist of State DOE, State DIDM, Project Proponent and logging contractor must be established. This can be illustrated in *Figure 6.2* and *Figure 6.3*.



* Erosion and sediment control (ESC) issues will occur after Step 8, thus a functional and practical Environmental Management Committee (EMC) must be established

FIGURE 6.2 Obstacle in managing logging contractor under DIDM

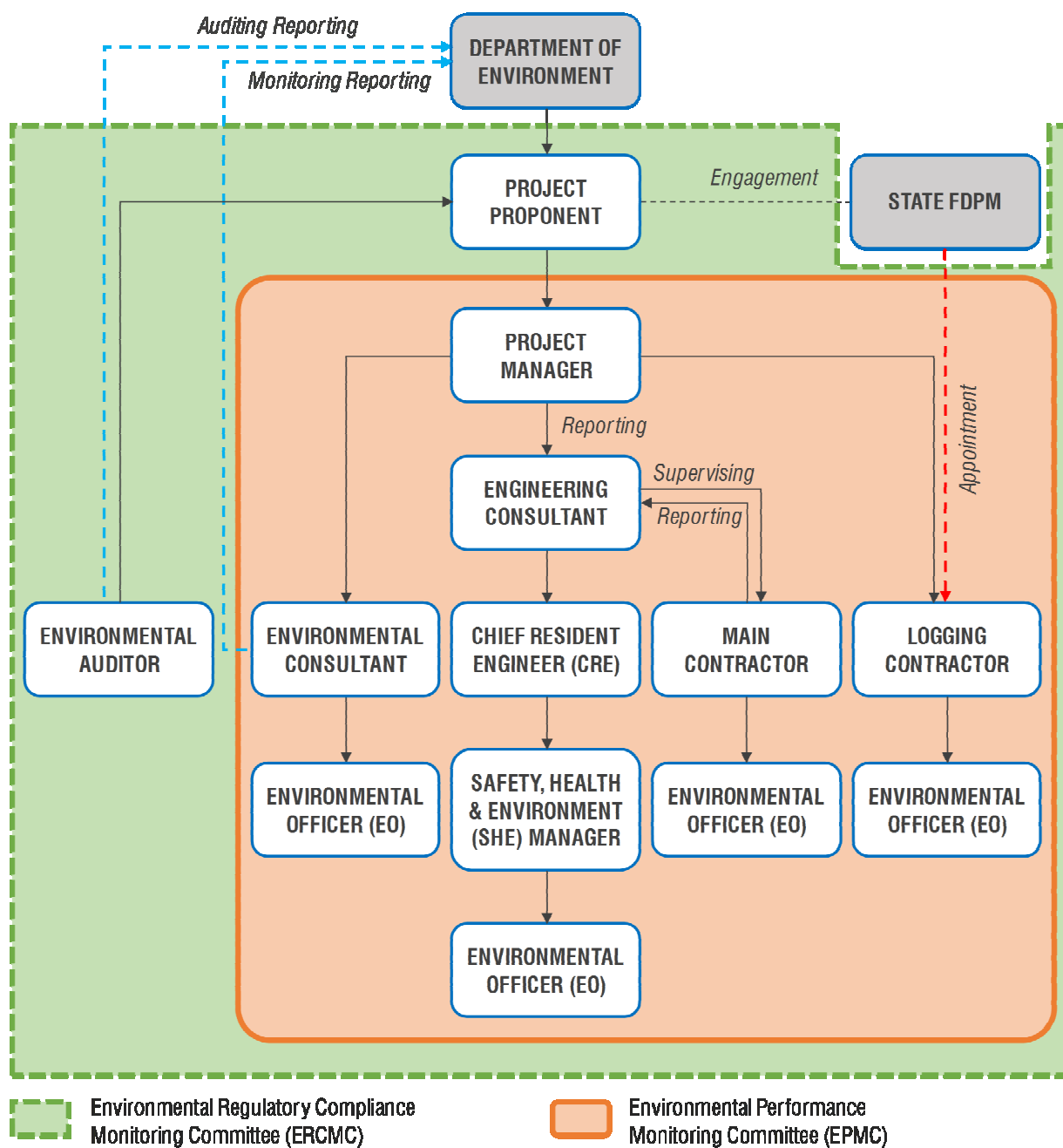


FIGURE 6.3 Example of an organisation chart of an EMC for projects involving logging activity

6.4 ENVIRONMENTAL OFFSET

According to *Australian Environmental Offsets Act 2014* an **environmental offset** is defined as an activity undertaken to counterbalance a **significant residual impact** of a prescribed activity on a prescribed environmental matter.

An environmental offset compensates for unavoidable impacts on significant environmental matters, (e.g. valuable species and ecosystems) on one site, by securing land at another site, and managing that land over a period of time, to offset those significant environmental matters which were lost.

Source: State of Queensland. (2020). Environmental Offsets Act 2014

Figure 6.4 provides a simple illustration of the basic concept of providing an environmental offset. It illustrates land containing environmental values at one site being cleared for development. Those environmental values are then 'replaced' by providing an environmental offset at another site, which contains those same environmental values which were impacted as a result of the development.

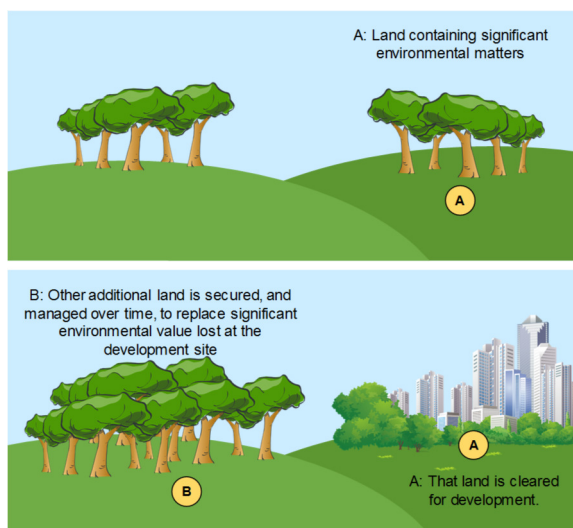


FIGURE 6.4 Concept of environmental offset

WHEN IS AN ENVIRONMENTAL OFFSET REQUIRED?

An environmental offset may be required as a condition of approval, following consideration of avoidance and mitigation measures when prescribed activity is likely to result in a significant residual impact on a prescribed environmental matter(s). Where appropriate, offsets are considered during the assessment phase of an environmental impact assessment.

Environmental offset is a method in mitigating the environmental impacts that still occur even after appropriate mitigation measures were put in place. In short, environmental offset can be defined as measures that compensate for:

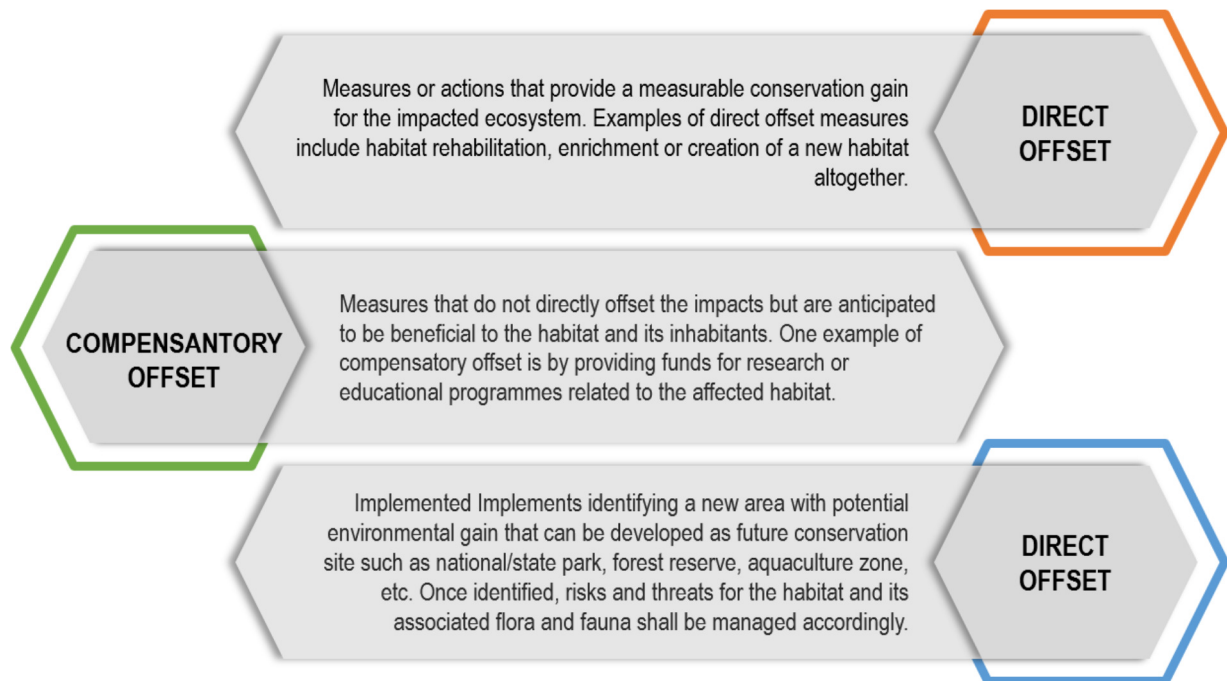
- i) residual impacts of the development; and
- ii) impacts that lead to environmental trade-off (total loss of habitat).

Environmental Protection Agency (2006) defines environmental offsets as “environmentally beneficial activities undertaken to counterbalance an adverse environmental impact, aspiring to achieve ‘no net environmental loss’ or a ‘net environmental benefit’ outcome”.

Certain habitats or ecosystems, once affected, cannot be replaced or have the capacity or resilience to return to their original state. As such, environmental offset can be undertaken to:

- i) create new habitat elsewhere;
- ii) enhance existing habitat elsewhere that have similar characteristics; and
- iii) enhance the growth and population of its associated organisms at the impacted area.

6.4.1 Types of Environmental Offset



6.4.2 Selection for Environmental Offset

There are several factors that need to be considered in selecting the most appropriate offset measures to be implemented. They include:

- i) Time to achieve conservation gain – The conservation gain is required in short, medium or long-term;
- ii) Level of certainties to success – The probability of the offset programme to provide the desired effect;
- iii) Site suitability – The availability of site that is able to provide a good chance of success within the stipulated timeframe using viable budget and expertise;
- iv) Consultation with government/private agencies – Support from government/private agencies is needed in formulating a holistic approach to the offset implementation; and
- v) Appropriate and transparent governance – A thorough and transparent supervision is needed during the implementation of the offset programme.

CHAPTER 7

Post-EIA

Tanjung Kling, Melaka
<http://en.wikipedia.org>



7.1 INTRODUCTION

Post-EIA refers to the stage where the EIA has been approved, normally with accompanying COA, and the Project Proponent has decided to commence on the construction and operation of the project. It is perhaps the most important stage in the EIA cycle whereby findings from the impact assessment, as well as the proposed pollution and mitigation measures, shall be translated into actionable plan to ensure compliance to the environmental requirements. This is when the EIA study will show its worth by being a planning tool for minimising negative environmental impacts and avoiding costly mistakes in project implementation.

In general, post-EIA can be divided into three main stages, namely:

- pre-construction;
- construction;
- operation; and
- abandonment or decommissioning.

Various means and initiatives can be applied and each stakeholder has a specific role to play in achieving environmental compliance and protection objectives.

7.2 ENVIRONMENTAL MAINSTREAMING AGENDA AND SELF-REGULATION CULTURE

Environmental mainstreaming agenda is adopted in the EIA procedure to enhance its effectiveness in alleviating the negative impacts on the environment arising from the project development.

ENVIRONMENTAL MAINSTREAMING AGENDA AND SELF-REGULATION CULTURE

1. Full responsibility and accountability in implementing appropriate P2M2 falls under the purview of the Project Proponent.
2. The Project Proponent must also demonstrate regulatory compliance to the COA and other environmental requirements throughout the project implementation stages.
3. The Project Proponent stands to reap benefits by embracing the environmental mainstreaming and self-regulation aspirations.
4. A potent business strategic tool where positive image of good governance and corporate social responsibility could be portrayed to the public, enhancing public's acceptance of the project.

7.3 ENVIRONMENTAL MAINSTREAMING TOOLS

DOE has formulated a set of Environmental Mainstreaming (EM) tools in order to assist the Project Proponent in achieving the state of self-regulation. The EM tools to be implemented in the organisations are as illustrated in *Figure 7.1*.

Rigorous implementation of the EM tools is expected to result in the Project Proponent achieving environmental excellence (EE). EE is exhibited in the intrinsic values of being:

- i) environment conscious (where environmental agenda is factored into management and decision-making process);
- ii) achievement of sustained environmental regulatory compliance;
- iii) high degree of environmental transparency and accountability; and
- iv) strong commitment to continuous environmental improvement.



FIGURE 7.1 Environmental mainstreaming tools

ENVIRONMENTAL POLICY (EP)

The EP of the Project Proponent must use strong and unequivocal statements to convey their environmental commitment to their employees, clients, stakeholders and the public. It must be disseminated to all relevant parties and translated into action in the:

- work procedures;
- materials purchasing policy;
- business decision-making process; and
- cascades down to the supply chain.

ENVIRONMENTAL BUDGETING (EB)

Sufficient budget must be set aside solely for the purpose of taking measures to comply with the environmental regulatory requirements and other environmental-related efforts. The EB must also include the cost for:

- setting up of laboratory facilities;
- provision of personnel; and
- purchase of performance monitoring equipment.

ENVIRONMENTAL MONITORING COMMITTEE (EMC)

The EMC consists of:

- Environmental Regulatory Compliance Monitoring Committee (ERCMC)
The committee is set up at the policy level and shall be chaired by the Project Proponent's Chief Executive Officer or the Chairman. It meets on a minimum once a year.
- Environmental Performance Monitoring Committee (EPMC)
The committee is set up at the working level and shall be chaired by a senior official of the Project Proponent. It meets on a monthly basis, or at a minimum, once in a quarter year.

ENVIRONMENTAL FACILITY (EF)

The primary components of the EF include:

- effluent treatment system;
- air pollution control system;
- Best Management Practices (BMPs); and
- support facilities such as laboratory, performance monitoring (PM) equipment, on-line instrumentation system and waste management infrastructure.

ENVIRONMENTAL COMPETENCY (EC)

The relevant personnel involved in discharging various environmental responsibilities within an organisation need to possess the required competencies. The personnel include those who have been assigned the task to perform DOE-regulated functions such as:

- supervising BMP;
- waste management;
- air pollution control; and
- effluent treatment systems.

The Project Proponent must draw up a comprehensive training programme to produce competent persons and trained support staff to ensure full compliance with DOE requirements in the regulated activities.

ENVIRONMENTAL REPORTING & COMMUNICATION (ERC)

A formal communication channel must be established for reporting environmental concerns and system upsets which warrant prompt actions to be instituted. Internal reporting can be initiated to report on a regular basis the regulatory compliance status of the organisation to the Chief Executive Officer and various heads of the department within the organisation.

Updates of new environmental requirements and their implications can be disseminated to the relevant project personnel. Environmental reporting and communication (ERC) requires systematic analysis of PM data, which must be summarised in appropriate format for easy understanding and communication and shall be maintained for management review purposes.

ENVIRONMENTAL TRANSPARENCY (ET)

In order to foster rapport with immediate neighbours (residential, industrial, etc.), promote green image and improve public confidence, the Project Proponent is encouraged to be more transparent in their environmental compliance and achievement.

Example of transparency approach are:

- display or communicate compliance status via website, pamphlet, etc.;
- notice board at project site; and
- preparation of Environmental Sustainability Report (ESR).

7.4 ROLES AND RESPONSIBILITIES DURING POST-EIA STAGE

During the post-EIA stage, implementation of COA and P2M2 described in the EIA report require the involvement of several parties on both DOE and the Project Proponent side.

Fundamentally, there are six different parties involved, namely:

- DOE
- AELB (only for nuclear power projects);
- Project Proponent;
- Environmental Officer;
- Environmental Consultant; and
- Environmental Auditor.

ROLES AND RESPONSIBILITIES

Department of Environment (DOE)	DOE acts as the enforcer of EQA 1974. The major roles and responsibilities of DOE in the post-EIA stage include the following: i) Reviewing and approving LD-P2M2 plan and EMP; ii) Facilitate the Project Proponent in matters related to the implementation of EMP and compliance to environmental regulations; iii) Ensuring appropriate implementation of COA and other related environmental regulations through periodical enforcement checks/visits; and iv) Taking appropriate legal action for occurrence of non-compliances via Notice, Prohibition or Stop Work Order, Compound and Prosecution.
Atomic Energy Licensing Board (AELB) (for nuclear power projects)	AELB acts as the enforcer of Atomic Energy Licensing Act 1984. The major roles and responsibilities of AELB in the post-EIA stage include the following: i) Collaborate with DOE on EMP for Non-Radiological and Radiological Integration in the Radiological Environmental Monitoring Programme (REMP); ii) Facilitate/Advise Project Proponent in EMP implementation and environmental compliance; and iii) Conduct enforcement checks to ensure appropriate COA implementation.
Project Proponent	The major roles and responsibilities of the Project Proponent include the following: i) Formulating an EP of the organisation with respect to the EIA project, which shall be communicated to the stakeholders, consultants, contractors and other parties involved in the project planning and implementation; ii) Establishing an organisational structure which clearly shows the emplacement of an EO; iii) Allocation of sufficient funds with itemised budget required for water quality monitoring, air quality and noise monitoring, for implementation of EMP including P2M2. P2M2 shall be those which can be described as: ■ state-of-the-art technologies; ■ BAT; or ■ industry best practices. iv) Appointing an EO at the stage of post-EIA to be charged with responsibilities to execute environmental quality control and performance monitoring functions during the construction and operation phases of the project implementation. Service of an EO can also be obtained from an Environmental Service Provider. However, this is allowed during the construction phase only. The Project Proponent shall employ their own EO at the operational stage; v) Establishing a project EPMC to monitor: ■ environmental performance; ■ effectiveness of P2M2; and ■ status of regulatory compliance of the project. The EPMC shall be represented by all relevant parties involved in project implementation and chaired by a senior member representing the Project Proponent. The EPMC shall meet at a minimum of once in every three months and the minutes of the meeting shall be recorded;

ROLES AND RESPONSIBILITIES	
Project Proponent (cont'd)	vi) For nuclear, establish the REMP both for normal and emergency operation; vii) Setting up a mini laboratory, wherever appropriate, to facilitate the implementation of an environmental performance monitoring programme. This mini laboratory shall be adequately equipped with relevant resources including staff and portable analytical testing equipment; and vii) Ensuring the EMP/REMP including temporary and permanent P2M2 are implemented and maintained according to industry's best practices (BAT and BMP).
Environmental Officer / Radiological Environmental Protection Officer (nuclear power projects)	The EO is the main project personnel responsible for ensuring regulatory compliance at the project implementation stage. The roles and core duties of the EO include the following: i) Implementing the EMP/REMP and installing temporary and permanent P2M2. ii) Preparing Environmental Performance Monitoring Document (EPMD). EPMD describes in detail how EIA approval conditions are going to be complied and how performance monitoring of the various P2M2 will be conducted to ensure the optimal functionality of the P2M2 is maintained. The details shall include, among others: ■ performance monitoring equipment/instruments; ■ sampling protocols; and ■ analysis. iii) Performing or supervising the conduct of performance monitoring (PM) programme as specified in the EPMD. iv) Preparing Performance Monitoring Report (PMR): ■ PMR discusses the results of the performance monitoring conducted as described in the EPMD; ■ PMR shall also make some definitive conclusions on the overall performance of the P2M2 and suggest improvement measures to be taken if necessary; and ■ PMR shall be submitted to the EPMC and maintained for the inspection of the DOE officers. v) Communicating the status of environmental regulatory compliance of the project during the construction and operation phases to the Project Proponent. vi) Maintaining a detailed record of major upset conditions encountered, if any, for the duration of the project construction and operation stages. The date of occurrences, nature and causes of upset conditions, and the corrective actions taken shall be recorded. vii) Acting as an environmental advisor to the Project Proponent in advising him to undertake additional efforts, if any, to further ensure effective implementation of EMP including temporary P2M2 on a sustained basis.
Environmental Consultant	The duties of the Environmental Consultant are: i) ensure the Project Proponent is briefed on the requirements of the COA and other related environmental requirements; ii) prepare the LD-P2M2 and EMP/REMP documents; iii) inform the Project Proponent on the environmental protection commitment that they shall take in implementing the project; and iii) define the necessary environmental monitoring programmes in accordance with the objectives and requirements of the EMP/REMP.
Environmental Auditor	An EIA project will necessitate the appointment of a third-party environmental auditor during the post-EIA stage. The audit team should be independent from the Project Proponent to ensure the objectivity of the audit as well as its findings and conclusions. The roles and responsibilities of the environmental auditor are: i) plan the audit procedures according to the Environmental Audit Guidance Manual; ii) notify the audit visit dates to DOE (and AELB for nuclear power projects) and the Project Proponent; iii) ensure the efficient and effective conduct and completion of the audit within the audit scope and plan; and iv) prepare and submit the audit report to DOE (and AELB for nuclear power projects).

7.5 ENVIRONMENTAL MANAGEMENT PLAN

An EMP translates the P2M2 recommended in the EIA report and the COA into action. The EMP is a concrete plan of action which is explicit, illustrative, action-oriented, time-bound and definitive.

EMP is by nature a living document which needs to be revised and updated. Among the situations that require the EMP to be revised are:

- i) variations in project concept, activities and its execution method*;
- ii) changes in project phasing*;
- iii) modifications to P2M2*;
- iv) replacement of important personnel e.g. EO, auditor, etc.

For power generation and transmission projects, the EMP may be submitted separately according to the work stages i.e. EMP for construction, EMP for operation and EMP for decommissioning (closure plan).

*Note: *Several aspects of the changes may relate to specific COA imposed by DOE, thus any changes to that aspects must be approved by DOE beforehand.*

The EMP document states the following in explicit terms:

- i) What **ACTIONS** will be taken:
 - project concepts.
 - project details.
- ii) What **MEASURES** will be instituted:
 - P2M2.
 - Safety measures.
- iii) What **STRUCTURES** will be built:
 - Project components.
 - construction method statement.
- iv) **WHEN** the actions will be executed:
 - project phasing.
 - project work programme.

7.5.1 Preparation of EMP

The Project Proponent and the Consultant (must be a Qualified Person) who has been tasked to prepare the EMP shall study and understand the P2M2 recommended in the EIA report and the COA. The typical steps to carry out the EMP are outlined in Figure 7.2.

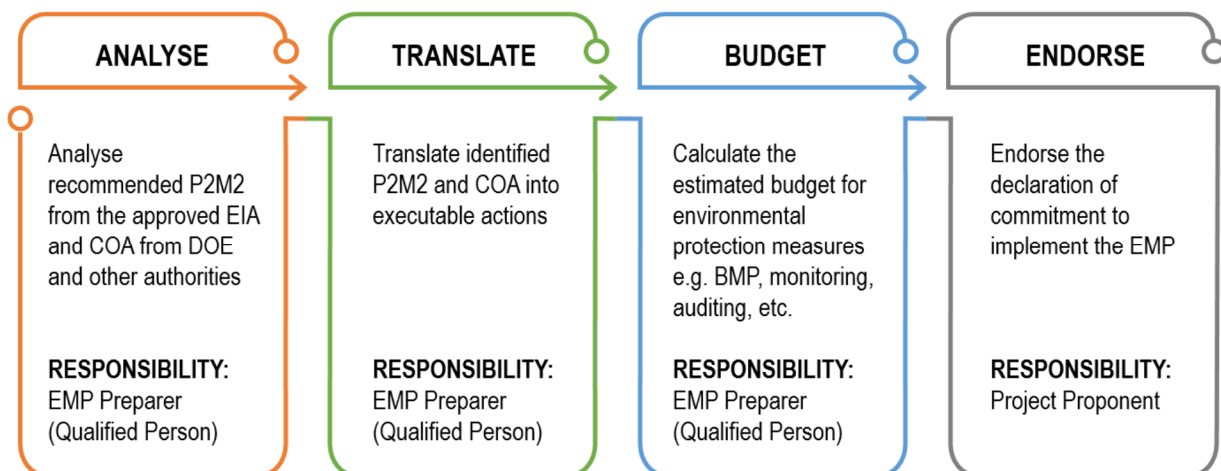


FIGURE 7.2 Typical steps in EMP preparation

7.5.2 Preparation of Land-Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2)

The LD-P2M2 document is a legal pledge made by the Project Proponent to take efforts, measures, actions or due diligence in accomplishing the overarching goal of protecting the environment and in mitigating the environmental impact during the implementation of the proposed development project.

The LD-P2M2 document gives guidance to the Project Proponent's personnel especially the EO in supervising the implementation of the LD-P2M2 that includes the installation, inspection and maintenance of the BMP as well as in preparing the required documentation and reports.

Focus of the LD-P2M2 is on the prevention, mitigation and control of discharge from the development area containing the major pollutant (suspended solids) resulting from land disturbing activities. The LD-P2M2 document is to be attached or inserted into the EMP as part of the EMP submission requirement.

■ Content of LD-P2M2 Document

Generally, the following shall be prepared and provided in the LD-P2M2 document:

i) Narrative Description

The narrative describing the:

- a) project description;
- b) existing site conditions;
- c) conditions after development;
- d) major land disturbing activities;
- e) total site area;
- f) total disturbed area;
- g) soil types;
- h) design criteria for P2M2;
- i) expected rainfall;
- j) runoff velocities and peak flows; and
- k) illustration of how, what, where, why and when P2M2 is to be installed, inspected and maintained.

ii) Schedule of Construction (Land Disturbing) Activities

Schedule of construction activities detailing the project phasing, construction of stages

and sequences that progress with the implementation of each of the LD-P2M2 in a timely manner. It is imperative that the implementation of BMP should be prioritised first before any land-disturbing activity is allowed to commence.

Holding a pre-construction meeting to be attended by the Project Proponent, EO, project contractors and subcontractors is an example of an initial construction sequence conducted prior to any land-disturbing activities.

iii) LD-P2M2 Plan and Construction Notes

A plan consisting of maps and/or site plans showing the existing geomorphology and land use of the site, to be overlaid with the site development map that depict the proposed land disturbing activities or earthworks, inclusive of proposed area alterations and the locations of all P2M2 facilities. Construction notes which refer to general instruction of P2M2 applications shall be included in the LD-P2M2 plan or written on a separate sheet.

iv) Method Statement

Method Statement refers to Environmental Method Statement that details how, what, where, why and when the elements of environmental protection will be integrated and implemented into each of the land-disturbing activity. The typical land disturbing activities include but are not limited to:

- a) site land clearing;
- b) excavation of cuttings;
- c) forming of embankments and fills;
- d) excavation of foundation pits, trenches and tunnels or viaduct;
- e) stream or river diversion;
- f) stream or river crossing;
- g) in-stream works; and
- h) drilling of boreholes.

Further details on formulating an effective LD-P2M2 can be referred to in the Guidelines on LD-P2M2 (DOE).

7.5.3 EMP Report Format

The EMP shall follow the general specifications and format, and shall contain five chapters as explained below:

Chapter 1 INTRODUCTION	Provide information on: ■ Project layout as approved in the Development Order by Local Authority; ■ Project implementation schedule; and ■ Name of the EMP prepare and the consulting firm.
Chapter 2 POLICY	Provide information on: ■ Company's corporate policy statement on environmental management and protection; and ■ Commitment by the top management on the mainstreaming of environmental agenda and instilling of self-regulation in the development project and on ensuring continuous compliance with the environmental regulatory requirements.
Chapter 3 ORGANISATIONAL STRUCTURE	Provide information on: ■ Organisation chart of the company's top management with responsibilities on environmental management and protection (provide names, positions, mobile phone contact numbers and e-mail addresses); ■ Name, mobile phone contact number and e-mail address of environmental manager, EO, engineering consultant, contractor, site supervisor and competent person* (wherever relevant and available); (*Note: Competent person is a person certified by DOE through the certification program administered by EiMAS); and ■ Name of environmental consultant and accredited laboratory conducting environmental monitoring, analysis of environmental samples and submitting reports to DOE.
Chapter 4 TRAINING REQUIREMENT	Provide information on: ■ Plan for staff training in order to develop competency to discharge responsibilities on environmental requirements and compliance. The training areas shall include maintenance and performance monitoring of all P2M2, wherever relevant.
Chapter 5 ENVIRONMENTAL REQUIREMENT	Provide information on: ■ EIA Approval Condition (COA); ■ Environmentally-related COA from other authorities e.g. DID, AELB, DIDM, etc.; ■ LD-P2M2 document; ■ P2M2 to be implemented as in <i>Table 7.1</i>. ■ Water pollution control: i) Water pollution control monitoring; ii) Effluent treatment; iii) Temporary sullage and sewage treatment; iv) Permanent sullage and sewage treatment; and v) Control of oil and grease, concrete wash, etc. ■ Control of air pollution and noise: i) Air pollution control monitoring; and ii) Air pollution control. ■ Materials and waste management: i) Solid waste; ii) Biomass; iii) Housekeeping; iii) Raw materials and stockpiles; iv) Spoils/dredge materials/construction waste; and v) Open burning avoidance.

Chapter 5
**ENVIRONMENTAL
REQUIREMENT**
(cont'd)

- Scheduled waste management: Management of scheduled waste to comply with the Environmental Quality (Scheduled Waste) Regulations 2005, AELB Guidelines and IAEA Guidelines.
- Radiological waste management: Management of radiological waste to comply with AELB and IAEA Guidelines
- Emergency Response Plan (ERP): Name and contact details of the professional who has been tasked to prepare the ERP.
- Abandonment/Decommissioning and closure plan: In a particular case where the Project Proponent intends to abandon a project whether it is in the construction stage or after it has started operation, an abandonment/decommissioning and closure plan shall be prepared. Disposal of radiological waste and spent fuel from decommissioning must be addressed in the EIA for nuclear power project even though it requires an EIA on its own.
- Declaration and Checklist:
 - i) **Declaration** - The Project Proponent is required to make a declaration that all actions/measures/plans outlined in the EMP will be implemented as in *Figure 7.3*. The form is required to be filled out and submitted to DOE together with the EMP document.
 - ii) **Checklist** - A checklist to assist the Consultant in the EMP preparation and to summarise the EMP actionable items is given in *Figure 7.4*.

TABLE 7.1 Pollution Prevention and Mitigation Measures (P2M2) to be implemented

PROJECT ACTIVITIES AND ENVIRONMENTAL ISSUES CONCERNED	IMPACT	P2M2 RECOMMENDED IN EIA REPORT	P2M2 TO BE IMPLEMENTED

Note: The contents of the above table are to be derived from “Summary of Impacts and Pollution Prevention and Mitigation Measures” recommended in the EIA Report and additional requirements stipulated in the EIA Approval Condition (COA). P2M2 shall be those which can be described as “state of the art technologies” or “industry best practices”.

DECLARATION BY PROJECT PROPONENT/AUTHORISED PERSON	
I certify that the Environmental Management Plan (EMP) has been prepared with my knowledge and I shall undertake the responsibility to ensure the actions, plans and pollution prevention and mitigation measures (P2M2) stated in the EMP will be implemented. I have provided sufficient allocation for the implementation of the EMP and P2M2.	
Project Title:	
Project Address/Location:	
Name of Project Proponent/Authorised Person	
Signature :	
Date :	

Source: EGiM (DOE)

FIGURE 7.3 Declaration by Project Proponent/ Authorised Person

ENVIRONMENTAL MANAGEMENT PLAN PREPARATION CHECKLIST		
Project Title:		
Name of Project Proponent:		
Name of Consultant:		
RECOMMENDED POLLUTION PREVENTION AND MITIGATION MEASURES (P2M2) AND EIA APPROVAL CONDITIONS (COA) COMPLIANCE CHECKLIST		
P2M2 Recommended or COA Number	Actionable Item in EMP on Page	Notes
Name of Project Proponent/Authorised Person		
Signature :		
Date :		

Source: EGiM (DOE)

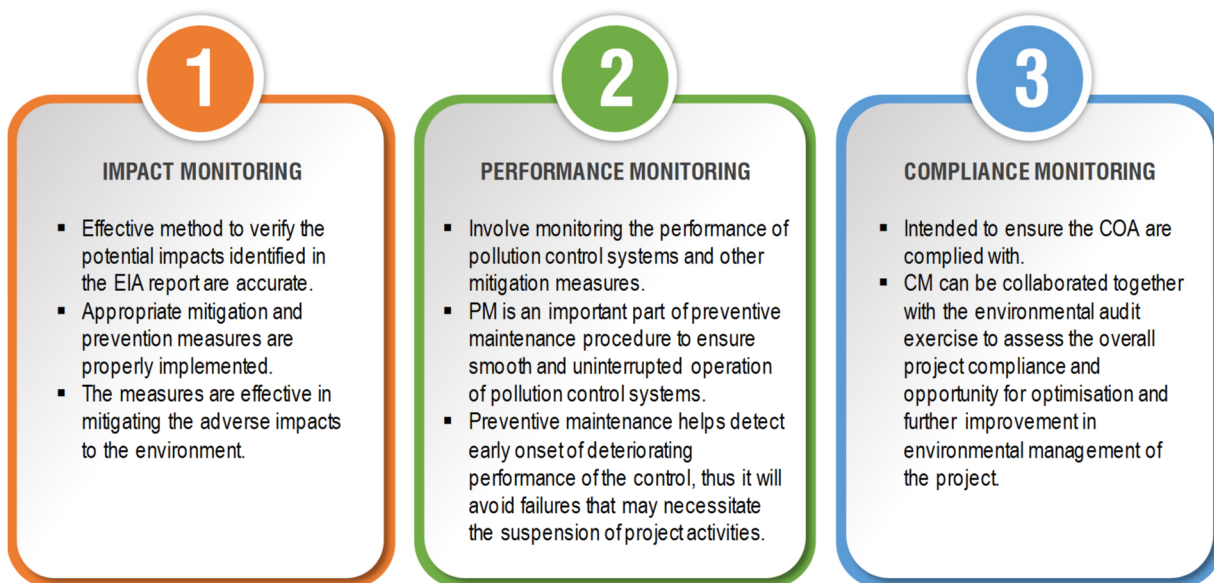
FIGURE 7.4 Environmental Management Plan preparation checklist

7.6 ENVIRONMENTAL MONITORING

Environmental monitoring is an imperative process during the post-EIA stage. Specifically, environmental monitoring shall be conducted after the EMP document has been approved and the physical work of the project is about to commence.

In general, monitoring activities can be grouped into three different aspect, namely:

1. Impact Monitoring (IM);
2. Performance Monitoring (PM); and
3. Compliance Monitoring (CM).



7.6.1 Monitoring Programme

The purpose of a monitoring programme is to provide information that the predicted impacts from a project are within the environmental acceptable limits, and to provide early warning information of unacceptable environmental condition.

Monitoring for key sectors should begin before construction to determine the baseline conditions. Subsequently, monitoring conducted during construction and operation will determine the degree and significance of impacts that will occur during these phases of the project.

The monitoring programme should be designed to do the following:

- i) provide scientifically sound information useful for determining the status of the environment;
- ii) provide information to predict future effects; and
- iii) provide information for management decisions on possible mitigation.

The minimum requirement for a nuclear power project is shown in *Attachment 9*.

■ Monitoring of Physical Environment

Monitoring of physical environment is generally designed for the purpose of observing the impact to the environment as well as ensuring compliance to a set of standards or level. In general, the monitoring of physical environment covers the following components:

- i) surface water quality;
- ii) Underground water quality (for nuclear power);
- iii) air quality; and
- iv) noise and vibration.

Monitoring of surface water quality should focus on the impacts that may materialise from the effect of sediment, pesticide and fertilizer discharge into the water bodies. Monitoring should be conducted upstream of the point of discharge and downstream from the discharge in any receiving water body considered environmentally significant (e.g. rivers, lakes, water intakes). Expected pollutants (e.g. suspended sediments, nutrients) should be measured together with important parameters for environmental preservation and human health.

Meanwhile, air quality monitoring of dust (particulate matter), noise and vibration are central in measuring the level of nuisance generated during the construction stage to the sensitive receptors. These also related to the safety and well-being of the personnel working for the project as well as the properties and its inhabitant in the surrounding area.

The operation of power generation and transmission project will cause changes to the hydrology and morphology of the adjacent environment. Diversion of surface water will also cause reduction in downstream flows. As such, direct and/or indirect monitoring of water quality and downstream flow regime should be conducted.

■ Monitoring of Biological Environment

The advantage of biological monitoring over physical parameters of the environment is that it measures the actual effect of a pollutant on living organisms in their natural habitat. Generally, biological monitoring is far more time consuming and expensive than physical monitoring. Therefore, the biological monitoring programme has to be considered thoroughly and devised in a way that the feedback can be significant.

Biological monitoring methods and subjects vary greatly and are likely to be site specific. In order to establish a good and rigorous monitoring procedure, it is imperative that the objective and purpose of the biological monitoring are clear.

For power generation and transmission project that is located within an area of significant inland fishing/aquaculture activities, monitoring of heavy metals or radiation bioaccumulation in the tissue of fish and/or shellfish can be done to ensure the produce is safe for human consumption.

■ Radiological Environmental Monitoring Programme

Nuclear power station specifically requires an operational radiological environmental monitoring programme (REMP). The baseline environmental data collection programme to support the REMP must include the same elements and sampling points, but it may start after the EIA report has been completed and prior to commencement of operations. Therefore, the baseline radiological sampling programme may not be as extensive as that required to support the REMP. The environmental monitoring programme should include a definition of required data reliability, the frequency of data collection, monitoring and sampling locations (along the exposure pathways) and the density of these locations. Monitoring points will be on-site as well as off-site. Additionally, the monitoring programme may expand and include different activities during the life cycle of the nuclear power plant.

TABLE 7.2 Suggested environmental monitoring programme of power generation and transmission project

CATEGORY	PROJECT STAGE	PARAMETER	PLACE OF MEASUREMENT	FREQUENCY
Ambient water quality	During construction	As stated in National Water Quality Standards of Malaysia (NWQS) or Malaysian Marine Water Quality Standards (MMWQS)	Surrounding water bodies e.g. river, lake estuarine and marine	Monthly
		■ Suspended solids ■ Turbidity	Outlet of silt traps	■ Daily ■ Within period of 24 hours after rain is recorded to be equal to or exceed 12.5 mm
	During operation	■ As stated in NWQS or MMWQS ■ Radionuclides	■ Upstream ■ Downstream ■ Near ESAs	Monthly
	During abandonment or decommissioning			Periodically
Ambient air quality	During construction	Particulate matter	Boundary of project area	Monthly
	During operation	■ Particulate matter ■ SO_x ■ NO_x ■ Ozone ■ CO ■ Radionuclides	Boundary of project area	Quarterly
	During abandonment or decommissioning			Periodically
Noise	During construction	L _{eq}	Boundary of project area	Monthly
	During operation	L _{eq}		Quarterly
Vibration	During construction	Peak particle velocity	Boundary of project area	Monthly
	During operation	Peak particle velocity		Quarterly
Hydrology	During construction	Flowrate	Downstream of project area	Continuous
	During operation	Flowrate		Continuous
Wildlife (with PERHILITAN)	Before construction	Target species	Wildlife trails	Continuous
	During construction	Target species	Wildlife crossing structures	Monthly
	During operation	Target species		Quarterly
Soil contamination	During operation	Heavy metals	Within project area	Yearly
Aquatic life	During operation	Bioaccumulation of heavy metals and radiation	Surrounding water bodies	Yearly

TABLE 7.2 (cont'd) Suggested environmental monitoring programme of power generation and transmission project

CATEGORY	PROJECT STAGE	PARAMETER	PLACE OF MEASUREMENT	FREQUENCY
Radiological Environment Monitoring Programme	Throughout during construction and operation	Target radionuclides in selected environmental samples	■ Surrounding project area ■ Downstream and upstream of project ■ Near facilities	Periodically

7.7 ENVIRONMENTAL AUDIT

Third-party environmental audit provides a systematic accumulation of evidence about the project's compliance status to the regulatory requirements relevant to the project. The environmental audit can also be viewed as a performance improvement tool where the Proponent gains a better understanding on their current standard of environmental management. Ideally, the audit process shall start after the EMP has been approved but before the commencement of physical work at site.

The environmental audit generally has the following objectives:

- as a tool to assess compliance with environmental legislation;
- to improve environmental performance through monitoring the effectiveness of P2M2; and
- to increase the Project Proponent's knowledge of itself and its activities thus, increasing its ability to continually improve and minimise future potential liabilities.

Audit requirements are guided by the Environmental Audit Guidance Manual (2011) published by DOE. The audit must be undertaken by an independent, third party, DOE-registered auditor.

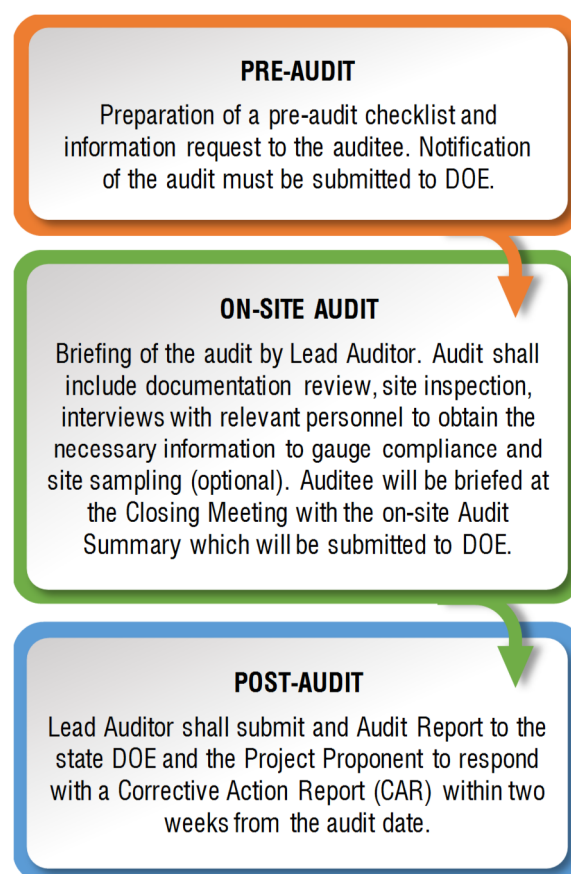


FIGURE 7.5 Typical audit process

In EQA 1974 (Act 127):

"Section 33(A). *Environmental Audit*

- (1) *The Director General may require the owner or occupier of any vehicle, ship or premises, irrespective of whether the vehicle, ship or premises are prescribed under section 18 or otherwise, to carry out an environmental audit and to submit an audit report in the manner as may be prescribed by the Minister by regulations made under this Act."*

7.8 ENVIRONMENTAL SUSTAINABILITY REPORT

Environmental Sustainability Report (ESR) is an organisational report that gives information about environmental performance, compliance and monitoring.

This report can be taken as part of the self-regulation approach whereby it is for the internal use of the organisation, rather than for submission to DOE. ESR can be made up of several different report that relates to three important stages of project cycle management, namely evaluation, monitoring and audit.

In general, there are two main types of environmental report:

- i) Compliance Report:
 - Form EIA 2-18;
 - EMP and LD-P2M2;
 - Audit reports; and
 - Minutes of meeting (ERCMC and EPMC).
- ii) Monitoring Report:
 - Environmental Monitoring Report (EMR);
 - BMP Check Reporting (ESC Online Reporting);
 - *In-situ* measurement data;
 - Inventory of scheduled wastes; and
 - Implementation of EMT.

Pertinent findings from the environmental reports mentioned above shall be collated, digested, summarised and presented in an executive summary form that is the ESR. The environmental reports are mainly prepared by the EO and the Environmental Consultant. These two shall ensure that information from the ground is compiled and presented in an easy to understand format covering the essential aspects on environmental performance of the project. Subsequently, the ESR report shall be made available to the EMC for their purview.

It is important that a good record-keeping practice is established as all type of records as well as correspondence related to environmental management shall be retained throughout the duration of the project. Among the importance of good record keeping practice are:

- i) the record serves as evidence/proof of actions taken;
- ii) provide evaluation results;
- iii) allow for communication between the committees (ERCMC and EPMC);
- iv) help in decision-making process based on administrative and technical findings;
- v) evidence of compliances and non-compliances;
- vi) create sense of accountability; and
- vii) provide summary of analysis and interpretation.

Section 1

PROJECT STATUS AND PROGRESS

- Physical progress of the project/operation
- Financial progress of the project/operation
- List of achieved and future requirement/milestone
- Status of P2M2 implementation
- Status of environmental budgeting
- Update of environmental reports submitted/to be submitted

Section 2

ENVIRONMENTAL MONITORING DATA

- Summary of recent compliance monitoring data
- Summary of recent performance monitoring data
- Summary of recent impact performance monitoring data
- Overview of P2M2 effectiveness
- Highlights of upset conditions and/or non-compliances
- Proposed mitigation and/or non-compliances

Section 3

MATERIAL AND/OR WASTE MANAGEMENT

- Summary of material storage and waste generation
- Summary of SW inventory
- Capacity status for material and waste storage
- Overview of waste disposed and/or recycled

Section 4 AUDIT AND INSPECTION

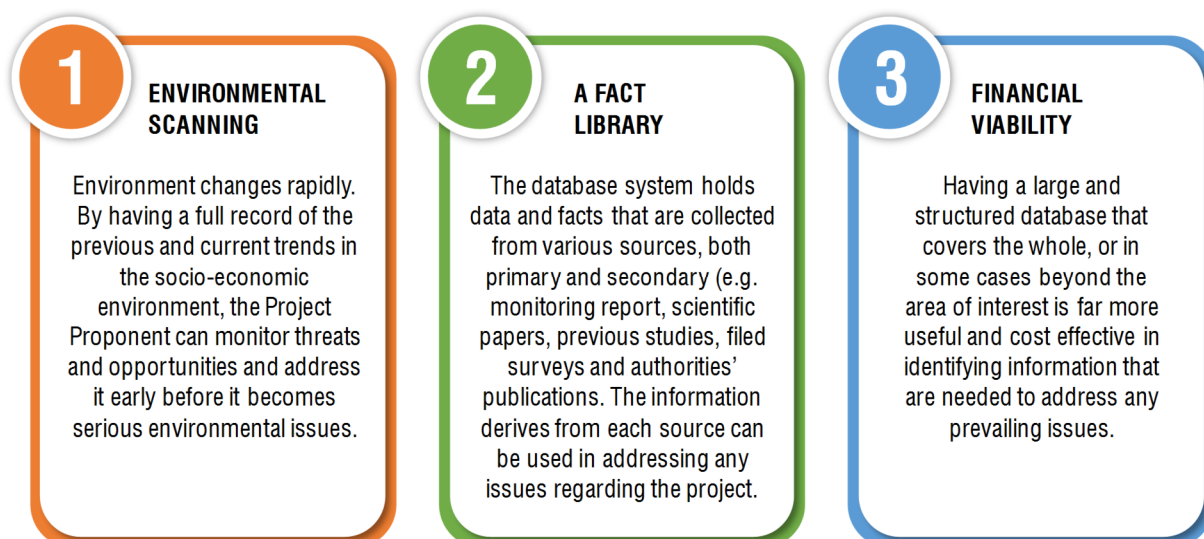
- Summary of findings from:
 - i) daily site inspection;
 - ii) third-party audit; and
 - iii) authorities enforcement visit.

Section 5 OVERALL COMPLIANCE STATUS

- Status of overall compliance
- Highlights of pertinent issues regarding non-compliances
- Compliance matter needing higher management attention

7.9 ENVIRONMENTAL DATABASE

The implementation of EIA projects may encounter possible issues from various sources such as authorities, stakeholders and the public. Thus, it is recommended that an environmental database is established in order to assist the Project Proponent in managing those issues in an effective way. There are three main importance in setting up an environmental database, as illustrated below.



7.9.1 Approach and Methodologies

It is advisable that various data and documents related to the project is kept in digital form so that they can be easily retrieved when needed. Common methodologies that can be used in setting up the environmental database are as below:

- i) **Data definition** – Creation and modification that defines the arrangement of the data;
- ii) **Update** – Insertion, modification and deletion of the actual data;
- iii) **Retrieval** – Providing information in a form directly usable or for further processing by other applications. The retrieved data may be made available in a form basically the same as it is stored in the database or in a new form obtained by altering or combining existing data from the database; and
- iv) **Administration** – Registering and monitoring users, enforcing data security, monitoring performance, maintaining data integrity, dealing with concurrency control and recovering information that had been corrupted by unexpected event such as system failure.

The background of the entire page is a photograph of several strings of warm-white LED string lights hanging against a pale, overcast sky. The lights are arranged in a series of parallel lines that slope downwards from left to right. The overall mood is calm and atmospheric.

CHAPTER 8

Checklist

Sungai Buloh, Selangor
Photo by Anis Azhar on Unsplash.com



8.1 INTRODUCTION

This chapter provides checklists to assist the Qualified Person in preparing the:

- i) Terms of Reference (TOR) / Environmental Scoping Information (ESI); and
- ii) Environmental Impact Assessment (EIA).

Both checklists must be filled in and incorporated at the front of the respective reports. Besides the Qualified Person, these checklists can also be used by the EIATRC as a reference.

The checklists are:

- i) Checklist for TOR/ESI as per in *Table 8.1*; and
- ii) Checklist for EIA as per in *Table 8.2*.

8 CHECKLIST

TABLE 8.1 Checklist for TOR/ESI

ITEM		ADEQUACY CHECK		PAGE IN TOR/ESI	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?				
	<i>*amendment such as increase in reservoir storage capacity, additional water intake point, add-on weir and other relevant components that may impact the surrounding environment</i>				
3.0	Has policies compliance been met by the Project Proponent?				
	a) Federal approval				
	■ NPPC				
	■ Others				
	b) State approval				
	c) Land status/acquisition				
	d) Land use compatibility				
	e) ESAs				
	f) Others				
	■ DIDM				
	■ PERHILITAN				
	■ DID				
	■ AELB				
	■ PLANMalaysia				
	■ JAKOA				
	■ PTG				
4.0	Who were involved in the scoping tasks?				
	a) Project Proponent				
	b) Engineering/Specialist consultants				
	c) Environmental consultant				
	d) Affected public/stakeholders				
	e) Government agencies				
	f) Others				
5.0	Does the project involve the following activities?				
	a) Survey				
	b) Establish accessibility				
	c) Base camp and site facilities				
	d) Logging activity				
	e) Quarrying activity				
	f) Earthworks and haul roads				
	g) Mobilisation of workers, equipment and materials				
	h) Site clearing and biomass removal				
	i) Construction of intakes and spillway				

TABLE 8.1 (cont'd) Checklist for TOR/ESI

ITEM	ADEQUACY CHECK		PAGE IN TOR/ESI	REMARKS
	YES	NO		
5.0	j) Diversion			
	k) Drainage works			
	l) Civil and structural works			
	m) Electrical and mechanical works			
	n) Testing and commissioning works			
	o) Construction materials handling and storage			
	p) Process controls			
	q) Air pollution control system			
	r) Industrial effluent treatment system			
	s) Sewage effluent treatment system			
	t) Noise/vibration controls			
	u) Safety controls			
	v) Waste generations			
	w) Others			
6.0	Land use on site and surrounding areas			
	a) Are the following features intersected by the Project?			
	■ Rivers and/or lakes			
	■ Coastal areas			
	■ Wetlands/Mangroves			
	■ Coral reefs/Seagrass beds			
	■ Forest reserve			
	■ Agriculture			
	■ Aquaculture			
	■ Built-up areas			
	■ Tourism/recreational areas			
	■ Orang Asli settlements			
	■ Orang Asli roaming area/ <i>kawasan rayau</i>			
	■ Wildlife roaming area			
	■ Archaeology area			
	b) Are the environmental issues with each feature identified?			
7.0	Timeline			
	a) Project implementation schedule (by phase)			
8.0	Project information provided			
	a) Project concept and layout			
	b) Project activities			
	c) Project components			
	d) Material sources and storage			
	e) Infrastructure, utilities and amenities requirement			

8 CHECKLIST

TABLE 8.1 (cont'd) Checklist for TOR/ESI

ITEM		ADEQUACY CHECK		PAGE IN TOR/ESI	REMARKS
		YES	NO		
9.0	Site Suitability Assessment				
	a) Siting constraints/suitability addressed?				
	b) Have the affected public been informed/consulted?				
	c) Alternative project layout provided?				
	d) Best available technology (BAT) considered?				
	e) No-project option considered?				
10.0	Significant impacts scoped and prioritised?				
	a) Identified impacts				
	■ Water quality				
	■ Air quality				
	■ Noise and vibration				
	■ Safety impact				
	■ Health impact				
	■ Geology				
	■ Hydrology				
	■ Flood risk				
	■ Soil erosion				
	■ Terrestrial flora				
	■ Terrestrial fauna				
	■ Ecology				
	■ Waste generation				
	■ 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?				

TABLE 8.2 Checklist for EIA

ITEM		ADEQUACY CHECK		PAGE IN EIA	REMARKS
		YES	NO		
1.0	Executive Summary (brief and concise)				
	a) In Bahasa Malaysia				
	b) In English				
2.0	Introduction				
2.1	a) Title of the project				
	b) Project Proponent details				
	c) EIA Consultant details				
	d) Project location (boundary coordinates) in A3 size				
	e) Relevant maps showing project location and ESAs				
2.2	Legal requirements				
3.0	Terms of Reference				
4.0	Statement of Need				
	a) Principal reasons for proposed project (include relevant supporting documents)				
	b) Aim of project				
5.0	Project Options				
	a) Alternatives considered?				
	b) Project optimisation done?				
6.0	Project Description				
6.1	a) Project Concept:				
	b) Layout plan				
	c) Size and land requirement				
	d) Project component				
	e) Method statement				
	f) Labour requirement				
	g) Raw material requirement				
	h) Infrastructure/Utilities/Amenities				
6.2	Project activities: Construction				
6.3	Project activities: Operational				
6.4	Project Implementation schedule (chart)				
7.0	Description of Existing Environment				
7.1	a) Physico-chemical				
	■ Land use, land use zoning and compatibility				
	■ Topography/Bathymetry				
	■ Geology and soil				
	■ Hydrology				
	■ Hydrogeology				
	■ Soil erosion				
	■ Climate				

8 CHECKLIST

TABLE 8.2 (cont'd) Checklist for EIA

ITEM	ADEQUACY CHECK		PAGE IN EIA	REMARKS
	YES	NO		
7.1	■ Water quality			
	■ Ambient air quality			
	■ Ambient noise			
	■ Vibration			
	b) Biological (where applicable)			
	■ Terrestrial flora			
	■ Terrestrial fauna			
	■ Marine ecology			
	■ Freshwater ecology			
	c) Socio-economy			
	■ Anthropology			
	■ Public Health			
	■ Historical, cultural and archaeological aspects			
	■ Ecotourism			
	■ Stakeholders' Engagements			
	d) Environmentally Sensitive Areas			
7.2	Technical Studies (where applicable):			
	a) Social Impact Assessment (SIA)			
	b) Traffic Impact Assessment (TIA)			
	c) Health Impact Assessment (HIA)			
	d) Heritage Impact Assessment			
	e) Wildlife Impact Assessment (WIA)			
	f) Topographic survey			
	g) Soil Investigation (SI) study			
	h) Hydraulic and Hydrology study			
	i) Geotechnical study			
	j) Geological Terrain Mapping			
	k) Erosion and Sediment Control Plan (ESCP)			
8.0	Evaluation of Impacts: Power Generation			
8.1	Detailed assessment of impacts during:			
	a) Pre-construction phase			
	i) Survey			
	■ Sending surveyors into new areas			
	■ Cutting sight lines through vegetation			
	■ Establish accessibility			
	ii) Investigation			
	■ Siting investigation			
	■ Establishing base camps			
	■ Putting in access tracks			
	■ Drilling holes and/or digging pits			
	■ Baseline environmental and radiological sampling			

TABLE 8.2 (cont'd) Checklist for EIA

ITEM		ADEQUACY CHECK		PAGE IN EIA	REMARKS
		YES	NO		
8.1	iii) Land acquisition				
	■ Acquire land				
	■ Resettlement of affected occupants				
	b) Construction phase				
	i) Temporary occupation				
	■ Construction of temporary buildings, storage facilities and working areas				
	■ Water supply				
	■ Solid waste disposal				
	■ Sewage disposal				
	■ Workforce				
	■ Pest control				
	■ Machine servicing & maintenance				
	ii) Site preparation				
	■ Demolition and removal of structures				
	■ Removal and disposal of vegetation				
	■ Constructing access roads				
	■ Constructing temporary drainage				
	■ Operating equipment (chainsaw, bulldozers)				
	iii) Earthwork				
	■ Drainage works				
	■ Operation of equipment				
	■ Diversion of surface water				
	iv) Dam construction				
	■ Operation of equipment (bulldozers, diggers, trucks, scrapers)				
	■ Construction of haul roads				
	■ Cutting/quarrying/ blasting, borrow areas				
	■ Transportation of construction materials				
	■ Filling				
	■ Building ground retention structures				
	v) Civil works				
	■ Operation of equipment				
	■ Alteration of surface water hydrology				
	vi) Reservoir filling				
	■ Raising groundwater levels				
	■ Inundation of land				
	■ Vegetation decomposition				
	■ Alteration of surface water hydrology				

8 CHECKLIST

TABLE 8.2 (cont'd) Checklist for EIA

ITEM	ADEQUACY CHECK		PAGE IN EIA	REMARKS
	YES	NO		
8.1				
vii) Demobilisation				
■ Demobilisation and removal of temporary buildings				
■ Waste removal/ disposal (including rubbish, equipment and liquid wastes)				
■ Rehabilitation of occupied or contaminated site				
c) Post-construction phase				
i) Power station presence				
■ Chimneys/Stacks				
■ Radiation emission				
■ Buildings and infrastructure				
■ Water intakes and outlets				
■ Amenities				
ii) Power station operation				
■ Station (turbines, boiler, radiators/ transformers, nuclear reactors)				
■ Air discharge (NO ₂ , CO ₂ , CO, SO ₂ , Particulates, dioxin and furans, heavy metals, radionuclides for nuclear power station)				
■ Water discharge				
■ Spills and leaks				
■ Radiation and radiological emission				
iii) Fuel supply and forwarding				
■ Road or marine tankers				
■ Oil and/or gas pipelines				
■ Conveyor				
iv) Fuel storage				
■ Oils storage				
■ Coal storage				
■ Uranium storage				
v) Waste disposal				
■ Wastewater (sewage and cooling water)				
■ Ash				
■ Spent fuel				
■ Radioactive waste				
■ Solid waste				
■ Scheduled waste				
vi) Maintenance				
■ Route shutdown				
■ General maintenance				

TABLE 8.2 (cont'd) Checklist for EIA

ITEM		ADEQUACY CHECK		PAGE IN EIA	REMARKS
		YES	NO		
8.1	vi) Emergency				
	■ Power station fire or explosion				
	■ Nuclear accident				
	vi) Decommissioning and abandonment				
	■ Asbestos removal and disposal				
	■ Transformer oil disposal				
	■ Landfill closure				
	■ Ash pond rehabilitation				
	■ Rehabilitation of contaminated land				
	■ Contaminated building materials				
9.0	Evaluation of Impacts: Power Transmission				
9.1	a) Pre-construction phase				
	i) Survey				
	■ Putting surveyors into new areas				
	■ Cutting sight lines through vegetation				
	■ Establish base camps				
	ii) Investigation				
	■ Establishing base camps				
	■ Putting in access tracks				
	■ Drilling holes and/or digging pits				
	iii) Land acquisition				
	■ Resettlement of affected occupant				
	b) Construction phase				
	i) Temporary occupation				
	■ Construction of temporary buildings, storage facilities and working areas				
	■ Water supply				
	■ Solid waste disposal				
	■ Workforce				
	■ Pest control				
	■ Machine servicing and maintenance				
	ii) Site preparation				
	■ Demolition and removal of structures				
	■ Removal and disposal of vegetation (including trees)				
	■ Construction of access roads				
	■ Construction of temporary drainage				
	■ Operation of equipment (chainsaw, bulldozers)				

8 CHECKLIST

TABLE 8.2 (cont'd) Checklist for EIA

ITEM		ADEQUACY CHECK		PAGE IN EIA	REMARKS
		YES	NO		
9.1	iii) Earthwork				
	■ Operation of equipment (bulldozers, diggers, trucks, scrapers)				
	■ Construction of haul roads				
	■ Cutting (may include drilling/blasting)				
	■ Transportation of soil and waste				
	■ Filling				
	■ Building ground retention structures				
	iv) Drainage works				
	■ Operation of equipment				
	■ Diversion of surface waters				
	v) Transmission tower construction				
	■ Operation of equipment				
	■ Piling/Foundation works				
	■ Transportation of structure, station and materials				
	■ Concreting				
	vi) Cables installation				
	■ Transportation of cables				
	■ Laying and stringing of cables				
	vii) Abandonment				
	■ Burrow area				
	■ Unsuitable or surplus spoil dumps				
	■ Camp sites				
	■ Rubbish dumps				
	■ Equipment				
	■ Liquid waste				
	c) Operational phase				
	i) Transmission line presence				
	■ Towers				
	■ Aerial cables				
	■ Cleared swathe				
	■ Consequential activities (including horticulture)				
	ii) Transmission line operation				
	■ Electromagnetic radiation emission				
	■ Interference				
	■ Cable breaks				
	iii) Decommissioning/Abandonment				
	■ Removal of cables and towers				
	■ Replanting				

TABLE 8.2 (cont'd) Checklist for EIA

ITEM		ADEQUACY CHECK		PAGE IN EIA	REMARKS
		YES	NO		
10.0	Pollution Prevention and Mitigation Measures (P2M2)				
10.1	Environmental Aspects				
	a) Water pollution				
	b) Air pollution				
	c) Noise and vibration				
	d) Waste management				
	e) Socio economy				
	f) Land traffic				
	g) Others				
11.0	Environmental Management Plan (EMP)				
11.1	Environmental Mainstreaming Tools:				
	a) Environmental policy (EP)				
	b) Environmental budgeting (EB)				
	c) Environmental monitoring committee (EMC)				
	d) Environmental facility (EF)				
	e) Environmental competency (EC)				
	f) Environmental reporting and communication (ERC)				
	g) Environmental transparency (ET)				
11.2	LD-P2M2				
11.3	Environmental Monitoring Programme:				
	a) Impact monitoring (IM)				
	b) Performance monitoring (PM)				
	c) Compliance monitoring (CM)				
	■ Location of monitoring points				
	■ Frequency of monitoring				
	■ Parameters to be measured				
	■ Environmental quality criteria				
	■ Procedures for reporting				
11.4	Environmental Audit Programme				
11.5	Environmental Sustainability Report				
11.6	Environmental Database				
12.0	Study Findings				
13.0	Reference				
14.0	Appendices				

CHAPTER 9

EIA Report Format

Genting Highlands, Pahang
Photo by Adib Pouzi on Unsplash.com





9.1 INTRODUCTION

DOE has stipulated a specific format for the EIA report, as detailed in Appendix 9 of EGIM. The standard EIA report format encompasses the cover page, preliminary pages, chapters' arrangement and appendices. It is important that format is followed to ensure the final EIA report able to meet the required standard set by DOE. Various means and initiatives can be applied and each stakeholder has a specific role to play in achieving environmental compliance and protection objectives.

9.2 REPORT COVER

The EIA report cover shall follow the arrangement as shown in *Figure 9.1*.

FIRST / SECOND SCHEDULE

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

NAME OF PROJECT PROPONENT

PROJECT TITLE
VOLUME X/Y

PROPOSED PROJECT GRAPHIC (ILLUSTRATION)

MONTH/YEAR

FIGURE 9.1 Format for EIA report cover

9.3 PRELIMINARY PAGES

The preliminary pages are an important part of the EIA report that shall not be overlooked. Items that must be provided here are:

- i) Environmental Pledge by the Project Proponent;
- ii) Declaration by the Qualified Person; and
- iii) Executive Summary.

■ Environmental Pledge by the Project Proponent

The environmental pledge is a document that state the Project Proponent is fully aware on the environmental protection required and affirm their commitment in undertaking the pollution control measures specified in the EIA report. The pledge shall be written on the official letterhead of the Project Proponent's company, as illustrated in *Figure 9.2*.

PROJECT PROPONENT'S LETTERHEAD

ENVIRONMENTAL PLEDGE FROM
PROJECT PROPONENT

Environmental Impact Assessment (First Schedule) for
.....
.....
.....

I hereby declare that the entire EIA Report is the product of the EIA Consultant engaged by my company and all the facts stated in the Report and the accompanying information are to the best of my knowledge and belief true and correct, and that I have not withheld or distorted any material facts. I agree and I undertake the responsibility to implement all the pollution prevention and mitigating measures (P2M2) described in the EIA Report, in the Environmental Management Plan (EMP) and in the Land Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2) as proposed by the EIA Consultant. I have allocated sufficient funds for the above purpose.

Name :

NRIC Number :

Designation :

Signature :

Date :

Company's Stamp :

FIGURE 9.2 Environmental pledge by the Project Proponent

■ Declaration by the Qualified Person

EIA Team Leader, as the Qualified Person, shall make a declaration that the EIA report was prepared truthfully, and the Project Proponent was briefed on the environmental protection requirement stated in the EIA report. The declaration must be written on the official letterhead of the Qualified Person's company, as shown in *Figure 9.3*.

EIA STUDY TEAM LEADER'S LETTERHEAD

**DECLARATION FROM
EIA STUDY TEAM LEADER**

Environmental Impact Assessment (First Schedule) for
.....
.....
.....

I declare that the entire EIA Report is the product of my own and the work of my team members (i.e. other consultants who are also Qualified Persons) who worked under my supervision and all the facts stated in the Report and the accompanying information are to the best of my knowledge and belief true and correct, and that I have not withheld or distorted any material facts. I have briefed the Project Proponent on the content of the Report and highlighted to him all the pollution prevention and mitigating measures (P2M2) described in it, and in the Environmental Management Plan (EMP), and in the Land Disturbing Pollution Prevention and Mitigation Measures (LD-P2M2), and the Project Proponent has agreed to implement them (i.e. P2M2).

Name of EIA Consultant Team Leader :
NRIC Number :
Designation :
Signature :
Date :
Company's Stamp :

FIGURE 9.3 Declaration by the Qualified Person

■ Executive Summary

Executive Summary is a gateway to the main EIA. Thus, it shall succinctly summarise the details of the proposed project, its main issues as well as the proposed P2M2 to be implemented. The Executive Summary is intended not only to be reviewed by DOE and other agencies, but also to be read by the public. As such, it must be written in non-technical language.

The Executive Summary must be prepared in English and Bahasa Malaysia, whereby both versions must be presented in infographic and similar format. Information that needs to be included in the Executive Summary are:

- i) name/title of the Project;
- ii) name and contact details of the Project Proponent and the Qualified Person (contact person, address, telephone number and e-mail);
- iii) location of the project (coordinates, lot number, district name);
- iv) description of the project and the surrounding existing environment;
- v) relevant maps showing project location and sensitive receptors;
- vi) tabulation of potential impacts, their magnitude and the proposed P2M2, as shown in *Table 9.1*; and
- vii) description of relevant monitoring programmes (performance monitoring, compliance monitoring, and impact monitoring).

TABLE 9.1 Summary of potential impacts, their magnitude and proposed P2M2

SIGNIFICANT POTENTIAL IMPACTS	MAGNITUDE OF SIGNIFICANT POTENTIAL IMPACTS	PROPOSED P2M2	REFERENCE PAGE IN EIA REPORT

9.4 MAIN TEXT OF THE EIA REPORT

The main text or body of the EIA report shall contain at least the following chapters as summarised below:

Chapter 1 INTRODUCTION	■ The type of project and its specific location shall be specified in the project title. ■ Relevant maps showing project location and sensitive receptors. ■ Identify the Project Proponent by providing details on: i) company's name; ii) authorised person/contact person; and iii) contact details (address, telephone number and email). ■ Provide the details of the EIA consulting firm, which are: i) company's name; ii) EIA Team Leader and the registration number; iii) Subject Matter Consultants and the registration number; and iv) contact details (address, telephone number and e-mail). ■ State the relevant prescribed activity related to the project. ■ Provide definitive statement on the conformance of the project to the: i) NPP; ii) Structure Plan; iii) Local Plan; iv) Regional Plan (inter-state planning); v) SZIRA; and vi) EESIM.
Chapter 2 TERMS OF REFERENCE	■ First Schedule EIA i) Provide Scoping Notes ■ Second Schedule EIA i) Provide the TOR of the EIA study which has been endorsed by DOE; and ii) Cite reference of the endorsement.
Chapter 3 STATEMENT OF NEED	■ Outline the background of the project and the reasons for it being proposed; ■ Establish social, economic or other needs for the project; ■ Conclude with definitive statement on the aim and purpose of the project; and ■ Substantiate the statement with accurate facts and figures.
Chapter 4 PROJECT OPTION	■ Discuss the advantages and disadvantages from the technical, economic, social and environmental perspective; and ■ Project options that can be deliberated are: i) site options; ii) layout options; iii) alignment options; iv) technology options; v) raw materials options; vi) construction method options; vii) operation options; and viii) no project/scaled-down project options.

Chapter 5 PROJECT DESCRIPTION	■ Describe the project according to: i) size and capacity; ii) land requirements; iii) raw materials required; iv) energy and water source and consumption; v) labour requirement; vi) transportation; vii) ancillary facilities; and viii) special infrastructural requirements. ■ Provide related maps and diagrams; ■ Summarise the technical, economic and environmental features that are essential to the project; ■ State the project implementation schedule and the project lifespan; and ■ Describe the operation and maintenance activities.
Chapter 6 EXISTING ENVIRONMENT	■ Define the zone of study; ■ Describe in qualitative and quantitative terms the baseline conditions for: i) physico-chemical; ii) biological; iii) social; and iv) economic setting. ■ Outline in great details the ESAs and areas of special or unique scientific, socio-economic or cultural values; and ■ Sources of information must be explained. Uncertainties of the information must be discussed.
Chapter 7 EVALUATION OF IMPACTS	■ Present analysis of the predicted impacts in quantitative and qualitative terms; ■ The impacts shall be characterised according to: i) magnitude; ii) extent; iii) duration; and iv) significance. ■ Discussion on impact identification and prediction shall cover the following aspects: i) zone of impact shall be based on the complexity of the project and supported by appropriate modelling exercise; ii) the nature of environmental effect; and iii) the source and nature of impact. ■ Describe the methodologies used for predicting impacts; ■ Indicate general impacts of pollutant emission in the study area based on the output of modelling exercise (if applicable). Contours of pollution shall be presented on maps; ■ All modelling exercise shall undergo the completed stages of modelling which area: i) model verification; ii) calibration; and iii) validation. ■ Quantify the environmental and development trade-offs anticipated from the proposed project using cost-benefit evaluation technique.

Chapter 8 MITIGATION MEASURES	■ Discuss all the mitigation measures which have been incorporated into the design and implementation of the project; ■ The mitigation measures shall be identified for each potential adverse impact at each stage of the project implementation; ■ Mitigation measures can be structural, non-structural, procedural or administrative; ■ The proposed mitigation measures must adhere to: i) Guidance Document for addressing soil erosion and sediment control; ii) Guidance Document for the preparation of LD-P2M2; and iii) Other relevant guidelines and guidance document issued by DOE. ■ Selected mitigation measures must be considered as the “state-of-the-art”, or “BAT” or “industry best practices”.
Chapter 9 ENVIRONMENTAL MANAGEMENT PLAN	■ Outline the detailed framework for the EMP document to be prepared after the EIA is approved; ■ Proposed the appropriate monitoring programme that covers performance monitoring, compliance monitoring and impact monitoring; and ■ Discuss the proposal for environmental audit programme.
Chapter 10 STUDY FINDINGS	Draw appropriate conclusions of the study findings from the perspective of the impacts of the proposed project.
REFERENCES	Provide full citation of all the references used.

9.5 APPENDICES

Relevant data, information or analysis that was not incorporated in the main text of the EIA report shall be compiled in the Appendices. These includes the following:

- i) certificate of analysis of laboratory tests from data collection activities;
- ii) input data and results of modelling studies;
- iii) field work report during existing environment study;
- iv) supporting documents such as SSA, ESI, etc.; and
- v) relevant public engagement documents such as list of attendance, meeting minutes, photographs, etc.

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ATTACHMENT 1

List of Air and Water Emission
from NPP



LIST OF AIR AND WATER EMISSION FROM NPP

In general, approximately 300 different nuclides are formed in the nuclear power reactor under normal operation condition. Most of these nuclides are radioactive. Although there is a large quantity of fission products formed, many have little impact on the radioactive releases to the environment because of their extremely short half-lives (<1 day), small quantities, or biological insignificance.

Gaseous fission products important to these releases include:

- Tritium (^3H);
- Noble gases (^{85}Kr , and ^{133}Xe); and
- Iodine (^{131}I , ^{133}I , and ^{135}I).

Relevant gaseous activation products include:

- Nitrogen (^{13}N), (^{16}N);
- Carbon (^{14}C); and
- Argon (^{41}Ar).

Important liquid and solid waste activation products arising from interaction of neutrons with corrosion and erosion elements include:

- Chromium (^{51}Cr);
- Cobalt (^{58}Co , ^{60}Co); and
- Ferrous (^{59}Fe).

Note:

1. Iodine, solid at room temperature, is a fission product resulting from nuclear fission, released as a gaseous effluent due to vaporization.
2. Other decay daughters of produced fission products may also appear in the gaseous effluents as particulate matter.
3. Activation products are formed by neutron interactions with oxygen in water and air, with nitrogen and argon in air, and with impurity corrosion elements. Like fission products, many of the neutron activation products produced are insignificant in reactor effluents due to their short half-lives (<1 day) or small quantities.

(Ref: <https://www.intechopen.com/books/nuclear-power-operation-safety-and-environment/radiological-releases-and-environmental-monitoring-at-commercial-nuclear-power-plants>).

ATTACHMENT 1

There are no specific radionuclides mentioned in the Atomic Energy Act 304 (1985) on the nuclear power plant emission to air or water. However, for the purpose of this guideline, an example from USNRC (US Nuclear Regulatory Commission) may be also referred. Table...below listed the various radionuclides emitted by nuclear power plants, to air or water, by USNRC, and included as well as the corresponding clearance limit as stipulated in Atomic Energy Act 304, 1985.

Table...: Radioactive Effluents from Nuclear Power Plants
(Ref: Annual Report 2007. Washington, DC: USNRC, Office of Nuclear Reactor Regulation; 2007)

CATEGORY	COMMONLY REPORTED RADIONUCLIDES (AIR)	CLEARANCE LEVEL (P.U.(A) 274, Act 304, 1985), Bq/g
Fission and activation gases	Krypton (85, 85m, 87, 88) Xenon (131, 131m, 133, 133m, 135, 135m, 138) Argon (41)	1×10^5 , 1×10^3 , 1×10^2 , 1×10^2 NIL, 1×10^4 , 1×10^3 , NIL, 1×10^3 , NIL, NIL 1×10^2
Iodines/Halogens	Iodine (131, 132, 133, 134, 135) Bromine (82)	1×10^2 , 1×10^1 , 1×10^1 , 1×10^1 , 1×10^1 1×10^1
Particulates	Cobalt (58, 60) Cesium (134, 137) Chromium (51) Manganese (54) Niobium (95)	1×10^1 , 1×10^1 1×10^1 , 1×10^1 1×10^3 1×10^1 1×10^1
Tritium	Hydrogen (3)	1×10^6
Mixed Fission and Activation Products	Iron (55) Cobalt (58, 60) Cesium (134, 137) Chromium (51) Manganese (54) Zirconium (95) Niobium (95) Iodine (131, 133, 135)	1×10^4 1×10^1 , 1×10^1 1×10^1 , 1×10^1 1×10^3 1×10^1 1×10^1 1×10^1 1×10^2 , 1×10^1 , 1×10^1
Tritium	Hydrogen (3)	1×10^6
Dissolved and Entrained Noble Gases	Krypton (85, 85m, 87, 88) Xenon (131, 133, 133m, 135, 135m)	1×10^5 , 1×10^3 , 1×10^2 , 1×10^2 NIL, 1×10^3 , NIL, 1×10^3 , NIL

It is important to note, during nuclear accident, the following radionuclides becomes very important to deal with (Ref...below):

RADIONUCLIDES	SYMBOLS	RADIONUCLIDES	SYMBOLS
Tritium	^3H	Strontium	^{90}Sr
Iodine	^{131}I , ^{133}I , and ^{135}I	Cesium	^{137}Cs
Xenon	^{133}Xe	Uranium	^{235}U , ^{238}U
Cobalt	^{58}Co , ^{60}Co	Plutonium	^{239}Pu

Ref: Dr. Faraj Ghanbari, "Baseline and Routine Environmental Radiological Monitoring around Nuclear Power Reactors (Nuclear Facility)", Sixth RMCC Workshop Amman, Jordan, June 2011.

ATTACHMENT 2

Proposed Procedures for Sampling Practices for
Water, Air, Noise and Vibration



ATTACHMENT 2

ENVIRONMENTAL COMPONENT	SAMPLING STATION SELECTION
1. WATER QUALITY	
a) Surface water:	
i) Lake	■ Avoid areas near structures to avoid point sources of contamination), unless these structures are targeted for the study ■ Use <i>in situ</i> field measurements to determine the vertical and lateral distribution of water quality. This is because the water is stagnant and commonly become stratified and water quality can vary greatly among the stratified sectors.
ii) River or stream	■ Identify stream where constituents are well mixed along the cross section. ■ Far enough above and below confluences of streamflow or point sources of contamination to avoid sampling at a cross section where flows are poorly mixed or not unidirectional. ■ At a stream reach where representative samples can be collected safely during all flow regimes.
iii) Marine	■ Sampling shall be done during low tide which represent worst water quality condition ■ Sampling sites should form a gradient away from the source (e.g., STP outfall) towards the ecosystem of concern (coral reefs, aquaculture, etc.)

GOOD PRACTICES	QUALITY CONTROL	REFERENCE																
<u>In-situ water quality sampling:</u> ■ Before taking an instrument into the field, field personnel must be familiar with the contents of the operating manual for that specific instrument, and ensure that it is stored, calibrated, maintained and used as per manufacturer's instructions. ■ Detailed records of calibration and maintenance must be kept. Calibration must be undertaken as per the instrument manufacturer's instructions. ■ Sensors on sondes should be kept moist or wet at all times, and not be allowed to dry out. ■ Do not allow the sonde to touch the substrate as there is a risk of damage to the sensors from sticks, rocks, debris and anoxic sediments. Thoroughly clean the sonde if it has accidentally made contact with the substrate before taking any further readings. ■ Depth can be determined in a boat by using the depth sounder. ■ Stratification with the water column can occur for a number of parameters, therefore depth profiling is necessary in waterbodies deeper than 5 m. ■ Follow the manufacturer's direction for taking the readings. Allow the readings to stabilise. Typical readings for dissolved oxygen, electrical conductivity and pH in potable (drinking), fresh and marine water are presented in Table 1. Table 1: Typical ranges for dissolved oxygen, conductivity and pH in different water types <table><tr><th>PARAMETER</th><th>POTABLE WATER</th><th>FRESH WATER</th><th>MARINE WATER</th></tr><tr><td>Dissolved oxygen (DO)</td><td></td><td colspan="2">Typical concentrations under ambient conditions 6–10 mg/L. Values may be higher if algal blooms are present, or lower if anoxic conditions are present.</td></tr><tr><td>Electrical conductivity (EC)</td><td>50–500 µS/cm</td><td><1,500 µS/cm</td><td>~52,000 µS/cm</td></tr><tr><td>pH</td><td></td><td colspan="2">6–8.5. These may be lower if acid rock drainage or acid sulfate soils/ sediments are present. The total</td></tr></table> Source: Department of Environment and Science, Queensland (2018)	PARAMETER	POTABLE WATER	FRESH WATER	MARINE WATER	Dissolved oxygen (DO)		Typical concentrations under ambient conditions 6–10 mg/L. Values may be higher if algal blooms are present, or lower if anoxic conditions are present.		Electrical conductivity (EC)	50–500 µS/cm	<1,500 µS/cm	~52,000 µS/cm	pH		6–8.5. These may be lower if acid rock drainage or acid sulfate soils/ sediments are present. The total		The collection of quality control samples is essential in order to provide confidence in the results of a sampling program, and is part of the overall quality assurance program. The following methods are advisable to be conducted in order to quality control the sample. ■ Blanks A blank sample is a sample named so that it is indistinguishable from the other samples. This means the source and chemical composition of the samples are not known to the analyst. Blind samples can determine variability within a laboratory or bias and variability between two or more laboratories. ■ Replicates Replicate samples are obtained by collecting two or more samples across a site at the same time. Replicate samples provide estimates of the sample variability, including experimental sampling error and analytical error.	■ ASEAN Marine Water Quality Management Guidelines and Monitoring Manual ■ Monitoring and Sampling Manual Environmental Protection (Water) Policy 2009 - State of Queensland, Australia ■ National Field Manual for the Collection of Water-Quality Data - US Geological Survey, 2018
PARAMETER	POTABLE WATER	FRESH WATER	MARINE WATER															
Dissolved oxygen (DO)		Typical concentrations under ambient conditions 6–10 mg/L. Values may be higher if algal blooms are present, or lower if anoxic conditions are present.																
Electrical conductivity (EC)	50–500 µS/cm	<1,500 µS/cm	~52,000 µS/cm															
pH		6–8.5. These may be lower if acid rock drainage or acid sulfate soils/ sediments are present. The total																

ENVIRONMENTAL COMPONENT	SAMPLING STATION SELECTION
1. WATER QUALITY (cont'd)	
a) Surface water (cont'd):	

GOOD PRACTICES	QUALITY CONTROL	REFERENCE
■ Record the measured values in a notebook, and save the reading if a memory function is available. Record the following details: i) site details (e.g. site code, site name, waterway, GPS co-ordinates); ii) date and time of measurement; and iii) any factor that may have affected the measurement (e.g. presence of an algal bloom, recent rainfall, etc.). <u>Ex-situ water quality sampling:</u> ■ Prior to leaving for the field, inspect all equipment and ensure it is in good working order and has been cleaned appropriately. Make sure if you are using an intermediate container that is appropriate for the analytes/s being sampled for. ■ Samples should be collected directly into the laboratory supplied containers when sampling waters where possible, as this will reduce the risk of contamination. Direct sample collection is the preferred procedure if the environment is safe (e.g. during low flow conditions), and sample bottles do not contain preservative. ■ On reaching the sampling site, prepare a clean work area and ensure all equipment that you will require is unpacked and easily accessible. ■ Pre-label all sample containers if possible. ■ For surface water sampling, water is collected at the surface of the water with hand. A small air space should be left to allow the sample to be mixed before analysis; ■ For station that is deeper than 5 m, deploy the water sampler and lower into a representative area of water and to the required depth (surface: 0.2d, middle: 0.5d, bottom: 0.8d). Ensure the bottom of the sampler is at least 1 m above the riverbed/seabed; ■ Refill by deploying the water sampler, lowering the sampler to the required depth and triggering the sampler. ■ Remove the sampler from the water and fill the labelled sampler containers. Do this quickly to avoid sediment particles from settling to the bottom of the water sampler. Recap the sample containers. ■ Complete a final check that details on the sample container are correct. ■ Place the sample container in a cooler box (with ice or ice bricks) or refrigerator and chill. Double bag samples if using ice. ■ Thoroughly rinse discrete depth sampler three times with high quality deionised water, allow to dry and store in a clean location prior to reuse at further sampling sites. ■ Fill out the chain of custody form.		

ENVIRONMENTAL COMPONENT	SAMPLING STATION SELECTION
1. WATER QUALITY (cont'd)	
b) Groundwater	■ Implement safety precautions and site preparations before the commencement of the groundwater sampling ■ The total depth and depth to the water level should be measured within the bore before any purging and sampling. ■ Using a pump for purging and sampling a bore ensures that representative sample of water residing in the aquifer will be obtained. ■ Make sure the pumping technique is consistent and every sample is obtained following the same procedure. ■ Purge the well and monitor field measurements. Purging the well of standing water is generally required to ensure that the sample water will be withdrawn directly from the aquifer. ■ During sample collection, make sure that the pump discharge line or the bailer does not contact the sample container. ■ All samples requiring preservation must be preserved immediately at the time of sample collection.
2. AIR	■ The site should be representative of the area selected that reflect concentrations and fluctuations of air pollution of air pollutant within the area. ■ The stations should be away from: i) nearby sources of air pollution at least 25 m away from domestic chimneys. ii) absorbing surfaces at least 1m away from absorbing building material. iii) area where considerable building or land use changes are foreseen in the near future. ■ The site where the station is located should fulfil one or more of the following requirements depending on the types of instruments used: i) it should be available for a long period. ii) it should preferably be accessible any time throughout the year. iii) electrical power of sufficient rating should be available. iv) it should be vandal-proof. v) it may need to be protected for extreme of temperatures.
3. VIBRATION	■ The vibration assessment should normally be at the nearest building. ■ The best position for the monitoring point would often be on the floor slab or foundation. ■ Monitoring points should be accessible to all parties concerned.

GOOD PRACTICES	QUALITY CONTROL	REFERENCE
<u>In-situ water quality sampling:</u> (Refer to surface water column) <u>Ex-situ water quality sampling:</u> ■ Confirm that the location conforms to the network design of the study, with respect to areal and depth distribution. ■ Document land-use/land-cover characteristics of the watershed with respect to study objectives and potential effects on groundwater. Consider the effects of features such as landfills, waste-disposal or industrial sites, etc. ■ Review subsurface geology and verify that the existing or newly developed well is within the desired geologic units. ■ Evaluate the site for accessibility with respect to equipment needed for well installation and sample collection. ■ Measure and record the water level in existing wells by using steel or electrical tape. If the well does not have an access point for measuring water levels, note this fact in the station folder. ■ Review seasonal water-level declines that could make the well unsuitable for use as a sampling site. ■ Check that the yield of water is adequate for sampling; typically, a minimum of 0.25 gallons (approximately 1 litre) per minute is adequate.		
■ Identifying type of pollutants to be monitor and use the established standard or guideline as the priority. ■ Determine the size and location of the monitoring stations to ensure that the measurements taken are adequate and representative of the air quality conditions of the area. ■ Determine the time and duration of the sampling aligns with the monitoring objective. ■ Determine the type of monitoring equipment or system to be use. ■ Determine the appropriate sampling frequency to ensure that the data collected is sufficient for statistical analysis.	All air measuring equipment shall be properly calibrated in accordance with current standards and thereafter, or recommendations governing the calibration of such equipment in accordance to the equipment manufacturer's instructions.	Methods for Measurement of Air Pollution, Part 14: Guidelines for Planning the Sampling of Atmosphere. IS 5182 (Part 14): 2000
■ Vibration measurements shall usually include: i) background (ambient) vibration levels at a receiver location or at the real property boundary of a source; ii) these may be undertaken at locations prior to a project development; and iii) it could also be undertaken in the absence of the source operating (for example with a plant not operating, or without construction activities). ■ Vibration measured indoors may be undertaken outdoors or indoors on building floor slabs or foundation as the case may be.	All vibration measuring equipment shall be properly calibrated in accordance with current standards and thereafter, or recommendations governing the calibration of such equipment in accordance to the equipment manufacturer's instructions.	The Planning Guidelines for Vibration Limits and Control in the Environment - Department of Environment (DOE), Malaysia

ATTACHMENT 2

ENVIRONMENTAL COMPONENT	SAMPLING STATION SELECTION
3. VIBRATION (cont'd)	
4. NOISE	■ Site selection depends on the purpose for which the measurement is made and is typically at locations that may be affected by noise or for which a noise severity assessment is to be undertaken. ■ The site can be residential and other noise sensitive premises, commercial or industrial premises. ■ The measurement shall be at the receptors' property boundary.

GOOD PRACTICES	QUALITY CONTROL	REFERENCE
■ Vibration could be assessed against an absolute numerical vibration limit and/or assessed based on the increase of the vibration levels with respect to the ambient level without the offending source. ■ Assessment of vibration levels against an acceptance limit is fairly straight forward, as it merely requires comparison of the measured level against the permissible levels.		
■ Baseline noise measurements shall require noise levels to be measured continuously over a day night time period that are divided into the following periods: i) day: 7.00 am to 10.00 pm; and ii) night: 10.00 pm to 7.00 am the following day. ■ Microphone positions shall be mounted at least above 1.2 m above the ground and at least 3.5 m away from any reflecting surfaces other than the ground. ■ The microphone shall be orientated so that it is most uniformly sensitive to the incident sound from prevailing noise source. ■ Any non-representative or temporary noisy sources, such as roadworks, construction works (unless the construction work is the subject of assessment) shall be avoided where feasible. ■ The noise parameters to be measured shall be L_{Aeq} and the L_{max} over the nominated measurement interval. ■ The measurements may include other statistical parameters such as the L_{90}, L_{50} and L_{10}, or a full statistical distribution of the sound pressure levels recorded over the measurement interval. ■ Results to be reported shall be L_{Aeq} Day, L_{Aeq} Night and L_{Aeq} 24 hours. ■ Other statistical parameter s such as the L_{90}, L_{50}, L_{10} and L_{max} levels should also be reported in situations when noise levels are fluctuating in nature.	■ Calibration of sound level meters and noise monitoring units should be conducted by a calibration laboratory or original equipment manufacturer at intervals not exceeding two years or other frequency determined by DG or recommended by manufacturer. ■ It is recommended that calibrated reference sound sources used to check calibration in the field (sound level calibrators) should also be calibrated at two years interval. ■ A field check of instrument calibration shall be made before and after each set of measurements, using a calibrated reference sound source to ensure accuracy of ± 1 dB. ■ Notwithstanding the above, where instrumentation used for long term permanent monitoring to be checked at regular intervals (once every 6 months) to ascertain reliability and stability of the monitoring system. ■ If during a field check of instrument calibration, the sound level meter reading differs from the calibrated reference level, the difference must be noted. Any measurements taken in the interval since calibration was last checked should be adjusted accordingly. In all cases, where a difference in field calibration of more than 1 dB is noted between consecutive checks, measurement data obtained during the previous interval should be discarded.	Guidelines for Environmental Noise Limits and Control (Third Edition) - Department of Environment (DOE), Malaysia

ATTACHMENT 3

Radioactivity Baseline Study



RADIOACTIVITY BASELINE STUDY

The project proponent shall present the results of the radiation and activity measurements made during these analyses in the baseline study. The presentation of the results shall be illustrative and such that the results from the environmental radiation monitoring of the new nuclear power plant can be reliably compared with the results from the baseline study.

An example of a measurement programme for baseline study of radioactivity before the operation of the nuclear power plant as recommended by STUK is as shown in the Table below:

Example of radioactivity measurement for the baseline study

MEASUREMENT TARGET	NUMBER OF MONITORING INSTRUMENTS OR SAMPLES AND MEASUREMENT OR SAMPLING SITES	COLLECTION FREQUENCY (NUMBER/PERIOD)	ANALYSIS AND FREQUENCY
A01. External radiation	External radiation dose rate measuring stations in the site area (or its vicinity) and outside of it at a distance of approx. 5 km from the plant site	Continuous measurement for 3 years	Continuous measurement and recording
A02. External radiation	10–20 environmental dosimeters evenly spread in the key directions at 1–10 km from the plant site	4 times a year	Gamma dose 4 times a year
A03. Radioactive substances in the form of airborne particles and iodine in the air	4–5 air sample collectors 1–10 km from the plant site	Continuous collection, filters are replaced twice per month for 3 years	Gamma emitters twice a month
A04. Deposition	3–5 rainwater collectors 1–10 km from the plant site	Continuous collection, change from the closest collector once a month and from the others four times a year for 3 years	Gamma emitters and ^3H from the closest collector once a month; other gamma emitters and ^3H four times a year. ^{89}Sr and ^{90}Sr , four times a year, normally only from the closest collector
A05. Soil	Sampling from the estimated main atmospheric deposition area, 0–5 km from the plant site (a minimum of 6 places, distribution of depth)	once during 3 years	Gamma emitters and ^{90}Sr
A06. Indicator organisms in the terrestrial environment	A minimum of 4 indicator species that enrich radionuclides or are species that are radiation- sensitive	1–2 times per year for 3 years	Gamma emitters 1–2 times a year and ^{89}Sr and ^{90}Sr once a year. Occasionally also ^{14}C
A07. Terrestrial wild plants and game	0–10 km from the plant site, approx. 10 samples depending on local crops and animals caught	Once per year for 3 years	Gamma emitters once per year
A08. Grazing grass	0–10 km from the plant site	Once per year for 3 years	Gamma emitters once in the growing season and ^{14}C once a year

ATTACHMENT 3

Example of radioactivity measurement for the baseline study

MEASUREMENT TARGET	NUMBER OF MONITORING INSTRUMENTS OR SAMPLES AND MEASUREMENT OR SAMPLING SITES	COLLECTION FREQUENCY (NUMBER/PERIOD)	ANALYSIS AND FREQUENCY
A09. Milk	Sample representing farms at a distance of 0–10 km from the plant site. Sample of milk production from a local dairy (less than 40 km away).	4 times per year for 3 years	¹³¹ I at least once per 3 months, gamma emitters once per 3 months and ⁸⁹ Sr and ⁹⁰ Sr once a year. Iodine analysis normally only of milk in the immediate area, Sr analysis only of samples 0–40 km away.
A10. Garden products	1–10 km from the plant site; a minimum of 5 species	Once per year for 3 years	Gamma emitters once per year
A11. Crops	A minimum of 3 species (depending on number of species produced) less than 20 km away from the plant site	Once per year for 3 years	Gamma emitters, ⁸⁹ Sr and ⁹⁰ Sr, once a year
A12. Meat	A minimum of 2 species (depending on number of species produced and the main economy of the region) less than 40 km away from the plant site	Once per year for 3 years	Gamma emitters once per year
A13. Groundwater	From the plant site, from a nearby groundwater monitoring point	Once per year for 3 years	Gamma emitters once per year
A14. Domestic water	From the plant site, from a nearby large population centre	4 times per year for 3 years	Gamma emitters and ³ H 4 times a year, ⁸⁹ Sr and ⁹⁰ Sr once a year
A15. Seawater or lake water depending on plant site	From a minimum of 6 sites (depending on the number of reactors and receiving bodies of water in the site area)	4 times per year for 3 years	Gamma emitters and ³ H from the closest point 4 times a year and from further 2 times a year. ⁸⁹ Sr and ⁹⁰ Sr from the closest point and the so-called reference point twice a year
A16. Indicator organisms in the marine environment and benthic fauna	A minimum of 5 indicator species from 7 locations, 2 species of benthic fauna from 2 locations	2 times per year for 3 years	Gamma emitters 2 times a year, ⁸⁹ Sr and ⁹⁰ Sr, ²³⁸ Pu and ^{239,240} Pu only from the closest and so-called reference point
A17. Fish	A minimum of 5 economically significant species that are different in their habits from the receiving body of water and reference area	Once per year for 3 years	Gamma emitters once a year, ⁸⁹ Sr and ⁹⁰ Sr for 2 species once a year
A18. Sinking matter	From a minimum of 6 locations, if possible	Continuous collection, collection tubes are replaced 4 times per year for 3 years	Gamma emitters 4 times a year, ²³⁸ Pu and ^{239,240} Pu only from the closest and so-called reference point once a year
A19. Bottom sediment	The surface sediment (0–10 cm) is collected annually from 4 points	Once per year for 3 years	Gamma emitters

Example of radioactivity measurement for the baseline study

MEASUREMENT TARGET	NUMBER OF MONITORING INSTRUMENTS OR SAMPLES AND MEASUREMENT OR SAMPLING SITES	COLLECTION FREQUENCY (NUMBER/ PERIOD)	ANALYSIS AND FREQUENCY
A20. Bottom sediment	Sampling from areas of sediment located in the main dispersion directions from a minimum of 8 points (distribution of depth)	once during 3 years	Gamma emitters, ⁹⁰ Sr and ^{239,240} Pu distributions of depth
A21. Humans	Whole body counting, local population from the environment of the nuclear power plant	Once per year for 3 years	Gamma emitters once per year
A22. Special areas	If necessary, special areas in the environment of the nuclear power plant that may be significant in terms of radiation exposure to the environment, living populations or humans may be selected as control targets. Special areas may include, for example, landfill runoff from the site area, water from the wastewater treatment plant and products grown or farmed near the nuclear facility (such as when residual heat from a power plant is utilized in the production of foodstuffs).	If necessary, special areas in the environment of the nuclear power plant that may be significant in terms of radiation exposure to the environment, living populations or humans may be selected as control targets. Special areas may include, for example, landfill runoff from the site area, water from the wastewater treatment plant and products grown or farmed near the nuclear facility (such as when residual heat from a power plant is utilized in the production of foodstuffs).	If necessary, special areas in the environment of the nuclear power plant that may be significant in terms of radiation exposure to the environment, living populations or humans may be selected as control targets. Special areas may include, for example, landfill runoff from the site area, water from the wastewater treatment plant and products grown or farmed near the nuclear facility (such as when residual heat from a power plant is utilized in the production of foodstuffs).

ATTACHMENT 4

National Water Quality Standards for
Malaysia (NWQSM)



NATIONAL WATER QUALITY STANDARDS FOR MALAYSIA (NWQSM)

PARAMETER	UNIT	CLASS				
		I	IIA/IIB	III#	IV	V
Al	mg/l	NL	-	(0.06)	0.5	>0.5
As	mg/l	NL	0.05	0.4(0.05)	0.1	>0.1
Ba	mg/l	NL	1	-	-	-
Cd	mg/l	NL	0.01	0.01* (0.001)	0.01	>0.01
Cr (IV)	mg/l	NL	0.05	1.4 (0.05)	0.1	>0.1
Cr (III)	mg/l	NL	-	2.5	-	-
Cu	mg/l	NL	0.02	-	0.2	>0.2
Hardness	mg/l	NL	250	-	-	-
Ca	mg/l	NL	-	-	-	-
Mg	mg/l	NL	-	-	-	-
Na	mg/l	NL	-	-	3 SAR	
K	mg/l	NL	-	-	-	-
Fe	mg/l	NL	1	1	1(Leaf) 5 (Others)	
Pb	mg/l	NL	0.05	0.02* (0.01)	5	>5
Mn	mg/l	NL	0.1	0.1	0.2	>0.2
Hg	mg/l	NL	0.001	0.004 (0.0001)	0.002	>0.002
Ni	mg/l	NL	0.05	0.9*	0.2	>0.2
Se	mg/l	NL	0.01	0.25 (0.04)	0.02	>0.2
Ag	mg/l	NL	0.05	0.0002	-	-
Sn	mg/l	NL	-	0.004	-	-
U	mg/l	NL	-	-	-	-
Zn	mg/l	NL	5	0.4*	2	>2
B	mg/l	NL	1	3.4	0.8	>0.8
Cl	mg/l	NL	200	-	80	>80
Cl ₂	mg/l	NL	-	(0.02)	-	-
CN	mg/l	NL	0.02	0.06 (0.02)	-	-
F	mg/l	NL	1.5	10	1	>1
NO ₂	mg/l	NL	0.4	0.4 (0.03)	-	-
NO ₃	mg/l	NL	7	-	5	>5
P	mg/l	NL	0.2	0.1	-	-

Notes:

1. NL : Natural levels or absent
2. * : At hardness 50 mg/l CaCO₃
3. # : Maximum (unbracketed) and 24-hour average (bracketed) concentrations
4. N : Free from visible film sheen, discolouration and deposits

ATTACHMENT 4

PARAMETER	UNIT	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	1000	1000	-	-	6000	-
Floatables	-	N	N	N	-	-	-
Odour	-	N	N	N	-	-	-
Salinity	%	0.5	1	-	-	2	-
Taste	-	N	N	N	-	-	-
Total Dissolved Solid	mg/l	500	1000	-	-	4000	-
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/ 100ml	10	100	400	5000 (20000)a	5000 (20000)a	-
Total Coliform	count/ 100ml	100	5000	5000	50000	50000	>50000

Notes:

1. N : No visible floatable materials or debris, no objectional odour or no objectional taste
2. * : Related parameters, only one recommended for use
3. ** : Geometric mean
4. a : Maximum not to be exceeded

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 IV	Irrigation.
Class V	None of the above.

ATTACHMENT 5

Malaysia Marine Water Quality Standards
(MMWQS)



MALAYSIA MARINE WATER QUALITY STANDARDS (MMWQS)

PARAMETER (µg/l) unless otherwise stated	CLASSIFICATION					
	CLASS 1	CLASS 2	CLASS 3	INTERIM CLASS EI	INTERIM CLASS E2	INTERIM CLASS E3
	Sensitive Marine Habitats	Fisheries (including Mariculture)	Industry, Commercial Activities & Coastal Settlements	Estuaries		
				Coastal Plain	Lagoon	Complex Distributary Network
Dissolved Oxygen (mg/l)	>6.0	>5.0	>3.0	>5.0	>5.0	>5.0
Total Suspended Solid (mg/l)	25.0	50.0	100.0	30.0	30.0	30.0
Phosphate	5.0	75.0	670.0	100.0	180.0	180.0
Nitrate	10.0	60.0	700.0	200.0	570.0	430.0
Ammonia	35.0	50.0	320.0	5.0	10.0	10.0
Mercury	0.04	0.04	0.04	0.04	0.04	0.04
Cadmium	0.50	2.00	3.00	1.00	1.00	1.00
Chromium (VI)	0.14	10.00	20.00	10.00	10.00	10.00
Copper	1.30	2.90	8.00	1.00	1.00	1.00
Cyanide	2.00	7.00	14.00	5.00	5.00	5.00
Lead	2.20	8.50	12.00	1.30	2.00	2.00
Zinc	7.00	50.00	100.0	16.00	5.00	5.00
Arsenic (III)	1.00	3.00	3.00	3.00	1.00	1.00
Aluminium	27.00	27.00	55.00	27.00	27.00	27.00
TBT	0.001	0.010	0.050	0.002	0.002	0.002
PAH	100.0	200.0	1000.0	5.0	5.0	5.0
Total Phenol	1.0	10.0	100.0	10.0	10.0	10.0
Oil & Grease (mg/l)	0.01	0.14	5.00	1.00	1.00	1.00
Faecal Coliform (cfu/100ml)	70	70	70	70	70	70
Temperature (°C)	≤ 2 °C increase over maximum ambient					
pH	6.5 – 9.0					
Marine litter	Free from marine litter					

ATTACHMENT 6

New Malaysian Ambient Air Quality Standards



NEW MALAYSIAN AMBIENT AIR QUALITY STANDARDS

POLLUTANTS	AVERAGING TIME	AMBIENT AIR QUALITY STANDARD		
		IT-1 (2015)	IT-2 (2018)	Standard (2020)
		µg/m ³	µg/m ³	µg/m ³
Particulate Matter with the size of less than 10 micron (PM ₁₀)	1 year	50	45	40
	24 hour	150	120	100
Particulate Matter with the size of less than 2.5 micron (PM _{2.5})	1 year	35	25	15
	24 hour	75	50	35
Sulfur 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 year	200	200	180
	8 hour	120	120	100
*Carbon Monoxide (CO)	1 year	35	35	30
	8 hour	10	10	10

ATTACHMENT 7

Guidelines for Environmental Noise Limits & Control



GUIDELINES FOR ENVIRONMENTAL NOISE LIMITS AND CONTROL

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 LEVELS
L_{Aeq}	Existing L_{Aeq}

Notes:

- 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.
- 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.

FOURTH SCHEDULELimiting Sound Level (L_{Aeq}) from Road Traffic (for New Roads and/or Redevelopment of Existing Roads)

RECEIVING LAND USE CATEGORY	L_{Aeq} DAY 7.00 am – 10.00 pm	L_{Aeq} NIGHT 10.00 pm – 7.00 am
Noise sensitive areas, low density residential areas	60 dBA	55 dBA
Suburban and urban residential (medium and density)	65 dBA	60 dBA
Commercial and mixed development	70 dBA	65 dBA
Industrial	75 dBA	75 dBA

Note: in situations where the existing sound levels of receptors are higher than limits prescribed above, or within (less than) 2 dBA of the above prescribed limits, the maximum permissible levels stipulated in Schedule 3 shall apply.

FIFTH SCHEDULELimiting Sound Level (L_{Aeq} and L_{max}) from Railway and Transit Trains (for New Railway & Transit Lines and Realignments)

RECEIVING LAND USE CATEGORY	L_{Aeq} DAY 7.00 am – 10.00 pm	L_{Aeq} NIGHT 10.00 pm – 7.00 am	L_{max} Day & Night
Noise sensitive areas, low density and suburban residential areas	60 dBA	55 dBA	75 dBA*
Urban residential areas	65 dBA	60 dBA	80 dBA*
Commercial and mixed development	70 dBA	65 dBA	80 dBA*
Industrial	75 dBA	75 dBA	NA

Note:

- * L_{max} noise levels prescribed herein are for train pass-by events only; assessed on trains pass-by events averaged over one hour (i.e. averages of train pass-by L_{max} noise levels from all trains in one hour). Care in measurements must be exercised to ensure the L_{max} levels being measured and assessed are not from extraneous noise sources (typically road traffic vehicle pass-by, horns, siren. etc.) not related to train pass-by events.
- In situations where the existing L_{Aeq} sound levels of receptors are higher than limits prescribed above or within (less than) 2 dBA of the prescribed limits, the maximum permissible L_{Aeq} levels stipulated in Schedule 3 shall apply.

SIXTH SCHEDULEMaximum Permissible Sound Levels (Percentile 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 – 7.00 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	75 dBA
	L_{max}	90 dBA	85 dBA	85 dBA
	L_{Aeq}	-	-	*Note 1
Commercial and mixed development	L_{10}	80 dBA	80 dBA	75 dBA
Industrial	L_{10}	80 dBA	80 dBA	80 dBA

Notes:

- *At night-time, the maximum permissible levels as stipulated in Schedule 3 for respective residential density type shall apply.
- **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.
- 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).

ATTACHMENT 8

Schedule of Recommended Vibration Limits



SCHEDULE OF RECOMMENDED VIBRATION LIMITS**SCHEDULE 1**

Recommended Limits for Damage Risk in Buildings from Steady State Vibration

DAMAGE DESCRIPTION	VERTICAL VIBRATION PEAK VELOCITY V_{max} [mm/s] (0 TO PEAK) (10-100 Hz)
Safe	Less than 3
Caution level (damage not necessarily inevitable)	3 to 5
Minor damage	5 to 30
Major damage	More than 30

Source: ISO DP 4688:1975

SCHEDULE 2

Recommended Limits for Damage Risk in Buildings from Short Term Vibration

TYPE OF STRUCTURE	VIBRATION VELOCITY V_i [mm/s] AT FOUNDATION (AS DEFINED BY THE RESPECTIVE RATING CURVES OF FIGURE 1)	VIBRATION VELOCITY V_i [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

Source: DIN 4150/3

SCHEDULE 3

Recommended Limits for Damage Risk in Buildings from Single Event Impulsive Excitation*

TYPE OF STRUCTURE	GROUND VIBRATION PEAK PARTICLE VELOCITY V_{max} [mm/s]	
	AT LOW FREQUENCY <40 Hz	AT HIGH FREQUENCY >40 Hz
Industrial buildings and buildings of similar design	40	50
Commercial buildings, dwelling and buildings of similar design and/or use	20	50
Structures that, because of their particular sensitivity to vibration, do not correspond to those listed above, or of great intrinsic value (e.g. residential buildings, or buildings that are under preservation order)	12	50

* Single event impulsive excitation not exceeding 3 occurrences per day.

Source: Adapted from DIN 4150/3 and Swiss Standard for Vibration Damage to Buildings

SCHEDULE 4

Acceptable Road Traffic Induced Vibrations in Buildings

TYPE OF BUILDING AND FOUNDATION	RECOMMENDED VERTICAL VELOCITY LIMIT $V_{\max}$ [mm/s]
Especially sensitive buildings, and buildings of cultural and historical value	1
Newly built buildings, and/or foundation of a foot plate (spread footings)	2
Buildings on cohesion piles	3
Building on bearing piles or friction piles	5

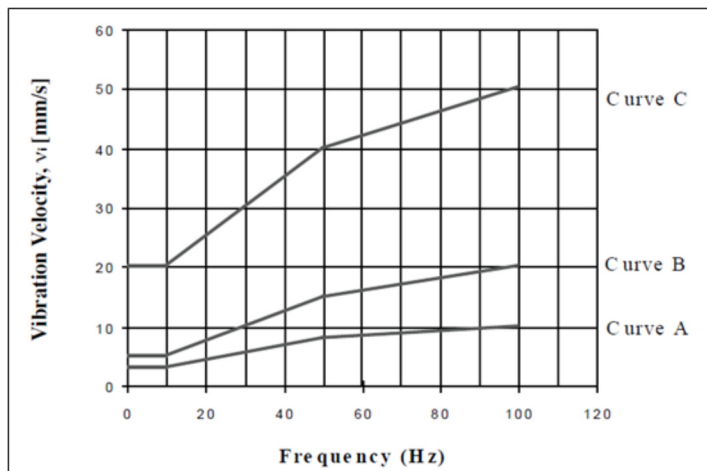


FIGURE 1 Foundation vibration velocity limiting values for vectorial sum of vibration levels in three orthogonal axes

SCHEDULE 5

Recommended Limits for Human Response and Annoyance from Steady State Vibrations

RECEIVING LAND USE CATEGORY	DAY TIME (7.00 am – 10.00 pm)	NIGHT-TIME (10.00 pm – 7.00 am)
Vibration sensitive areas	Curve 1	Curve 1
Residential	Curve 2 to Curve 4	Curve 2
Commercial, business	Curve 4 to Curve 8	Curve 4
Industrial	Curve 8 to Curve 16	Curve 8 to Curve 16

SCHEDULE 6

Recommended Limits for Human Response and Annoyance from Short Term Vibrations

RECEIVING LAND USE CATEGORY	DAY TIME (7.00 am – 10.00 pm)	NIGHT-TIME (10.00 pm – 7.00 am)
Vibration sensitive areas	Curve 1	Curve 1
Residential	Curve 8 to Curve 16	Curve 4
Commercial, business	Curve 16 to Curve 20	Curve 16 to Curve 20
Industrial	Curve 32	Curve 32

The above stipulated curves are defined in Figure 2 and 3. The base Curve 1 is based on the vibration perception threshold for human response as defined by BS 6472:1992 and ISO 2631. The designated numbers of subsequent curves are multiplying factors of the base curve.

Source: ISO 2631 and BS 6472

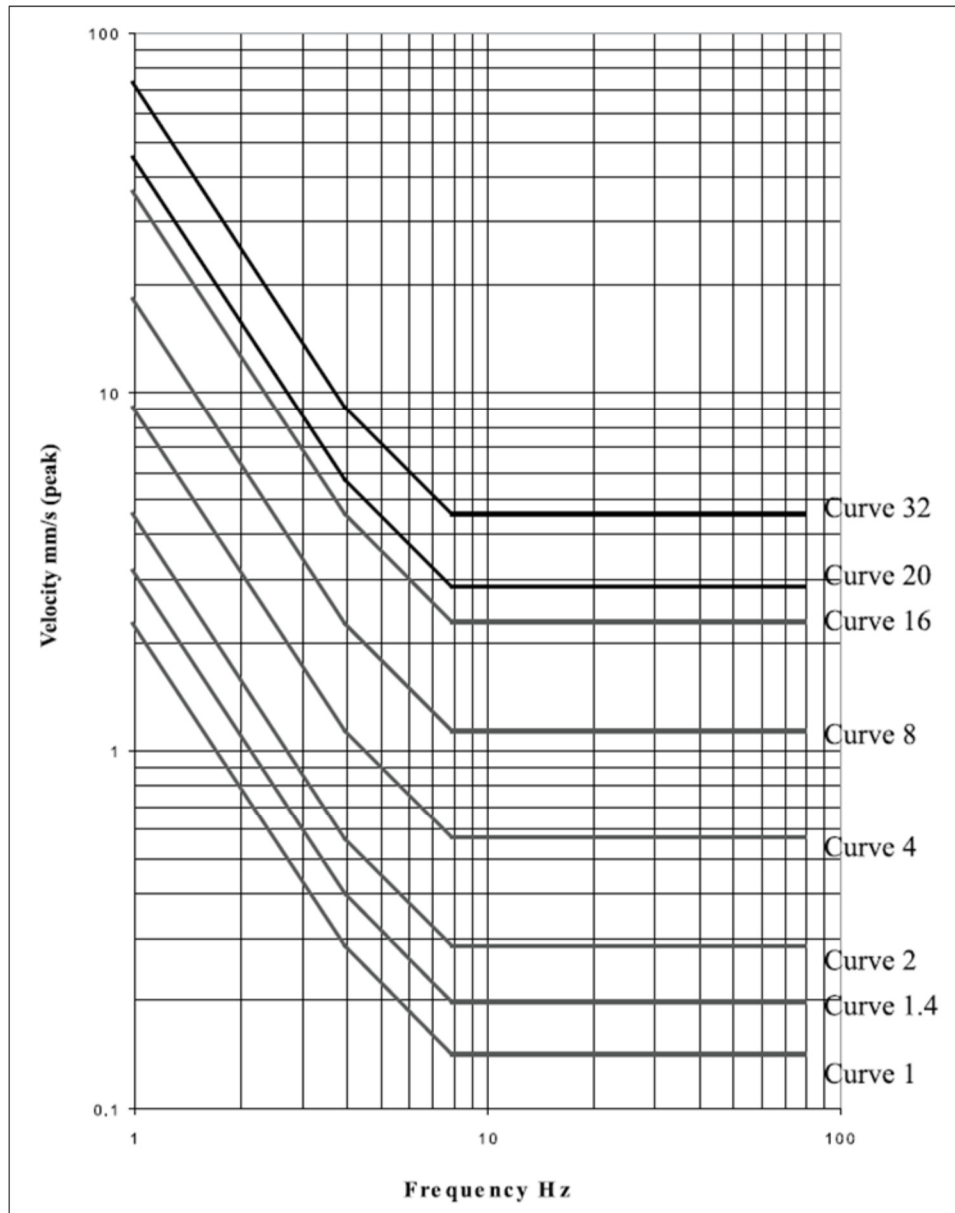


FIGURE 2
Building vibration z-axis curves for peak velocity

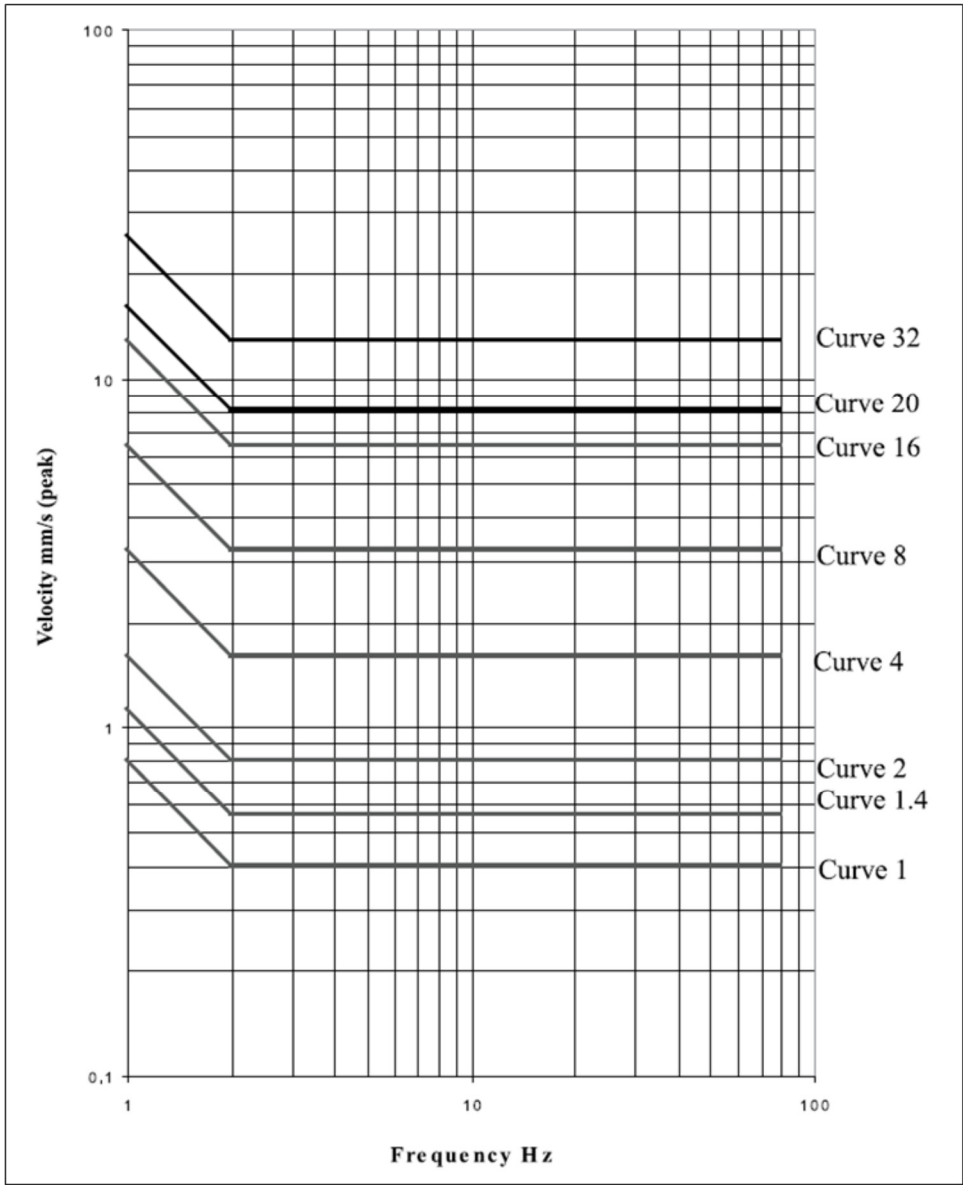


FIGURE 3
Building vibration x and y-axis curves for peak velocity

ATTACHMENT 9

FDA Derived Intervention Level (DIL) or
Criterion for Each Radionuclide Group



FDA Derived Intervention Level (DIL)
or Criterion for Each Radionuclide Group^{(a),(b)}

Radionuclide Group	All Components of the Diet		Alternate units for Milk ^(c)
	(Bq/kg)	(pCi/kg)	(pCi/L)
Sr-90	160	4300	4400
I-131	170	4600	4700
Cs-134 + Cs-137	1200	32,000	33,000
Pu-238 + Pu-239 + Am-241	2	54	56
Ru-103 + Ru-106 ^(d)	$[(C_3 / 6800) + (C_6 / 450)] < 1$	$[(C_3 / 18,00) + (C_6 / 12,00)] < 1$	$[(C_3 / 190,000) + (C_6 / 12,000)] < 1$

Notes:

- (a) The DIL for each radionuclide group is applied independently (see discussion in Appendix D). Each DIL applies to the sum of the concentrations of the radionuclides in the group at the time of measurement.
- (b) Applicable to foods as prepared for consumption. For dried or concentrated products such as powdered milk or concentrated juices, adjust by a factor appropriate to reconstitution, and assume the reconstitution water is not contaminated. For spices, which are consumed in very small quantities, use a dilution factor of 10.
- (c) Conversion to units of pCi/L given for convenience for milk, assuming a density of 1.03 kg/L. Due to rounding, the reference DIL value for Ru-106 is the same in pCi/L as in pCi/kg.
- (d) Due to the large difference in DILs for Ru-103 and Ru-106, the individual concentrations of Ru-103 and Ru-106 are divided by their respective DILs and then summed. The sum must be less than one. C₃ and C₆ are the concentrations, at the time of measurement, for Ru-103 and Ru-106, respectively

ATTACHMENT 10

Minimum Requirements for Environmental Monitoring of Nuclear Power Projects



APPENDIX B Minimum requirements for a nuclear power plant's programme of environmental radiation surveillance, implemented by the licensee

Control target	Number of monitoring instruments or samples and measurement or sampling sites	Collection frequency (number/period)	Analysis and frequency
B01. External radiation	External radiation dose rate measuring stations in the site area (or its vicinity) and outside of it at a distance of approx. 5 km from the power plant	—	Continuous measurement and recording
B02. External radiation	10–20 dosimeter stations evenly spread in the key directions at 1–10 km from the power plant	Continuous collection; dosimeters replaced four times a year	Gamma dose 4 times a year
B03. Radioactive substances in the form of airborne particles and iodine in the air	4–5 air sample collectors 1–10 km from the power plant	Continuous collection; filters replaced twice a month, except the closest collector which is replaced once a week during annual maintenance	Gamma emitters twice a month (once a week)
B04. Deposition	3–5 rainwater collectors 1–10 km from the plant	Continuous collection; change from the closest collector once a month and from the others four times a year	Gamma emitters and ^3H from the closest collector once a month; other gamma emitters and ^3H four times a year.
B05. Indicator organisms in the terrestrial environment	A minimum of one indicator species that enriches radionuclides	1–2 times a year	Gamma emitters 1–2 times a year
B06. Garden products	1–10 km from the power plant; a minimum of 1 species	1–2 times a year	Gamma emitters 1–2 times a year
B07. Domestic water	From the power plant	4 times a year	Gamma emitters and ^3H 4 times per year
B08. Seawater or lake water depending on plant site	From at least one location near the discharge opening	2–4 times a year	Gamma emitters and ^3H from the closest point 4 times a year
B09. Special areas	If necessary, special areas in the environment of the nuclear power plant that may be significant in terms of radiation exposure to the environment, living populations or humans may be selected as control targets. Special areas may include, for example, landfill runoff from the site area, water from the wastewater treatment plant and products grown or farmed near the nuclear facility (such as when residual heat from a power plant is utilized in the production of foodstuffs).		