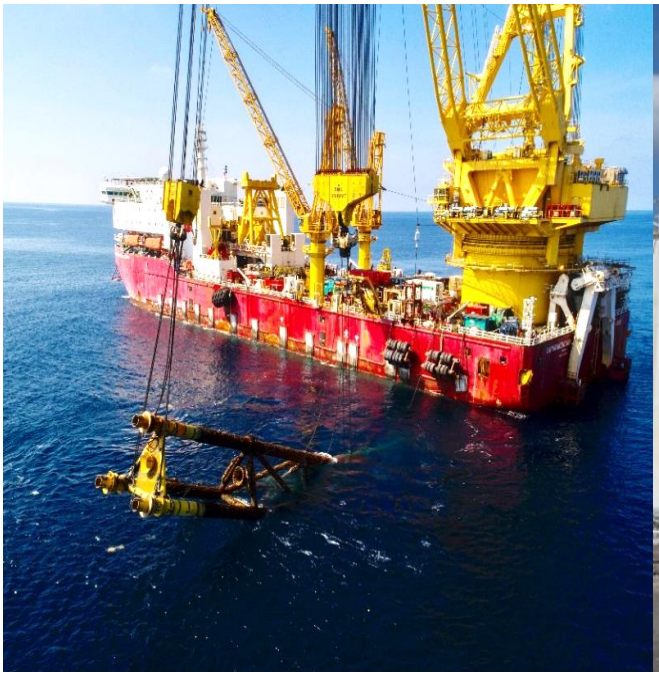
KEMENTERIAN TENAGA, SAINS, TEKNOLOGI, ALAM SEKITAR DAN PERUBAHAN IKLIM
MINISTRY OF ENERGY, SCIENCE, TECHNOLOGY, ENVIRONMENT, & CLIMATE CHANGE

JABATAN ALAM SEKITAR MALAYSIA

ENVIRONMENTAL GUIDELINE FOR DECOMMISSIONING OF OIL AND GAS FACILITIES IN MALAYSIA



DEPARTMENT OF ENVIRONMENT

MINISTRY OF ENERGY, SCIENCE, TECHNOLOGY, ENVIRONMENT AND CLIMATE CHANGE MALAYSIA

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PREFACE

Decommissioning in the oil and gas industry represents the end of productive life of facilities. The activities conducted during decommissioning may pose environmental risks or impacts that need to be controlled or minimised. The requirement to manage the impacts of the decommissioning activities is required as part of Environmental Impact Assessment (EIA) for the facility and its Conditions of Approval.

The purpose this Guideline is to provide environmental management requirements and best practices for decommissioning of oil and gas facilities in Malaysia, including preparation of Decommissioning Environmental Plan (DEP). It provides guidance to project proponent, qualified persons, and relevant authorities on structured environmental management at each phase of decommissioning.

This Guideline focuses on considerations for environmental protection and addresses the general technical issues of decommissioning. Its content adopts DOE Environmental Mainstreaming Self-Regulation (SR), a strategic tool to instill self-regulation culture in managing decommissioning activities.

Amongst the vital elements towards proper environmental management of decommissioning activities to be considered are compliance with relevant laws and regulations, selection of decommissioning options and methods, and waste management

The Technical Committee of this Guideline, chaired by Director General of Environmental Quality, Malaysia had endorsed the Environmental Guidelines for Decommissioning of Oil and Gas Facilities in Malaysia on 30th March 2019.

(DATO' DR. AHMAD KAMARULNAJUIB BIN CHE IBRAHIM)
Director General of Environmental Quality,
Malaysia

ACKNOWLEDGEMENT

Department of Environment Malaysia (DOE) would like to express its appreciation to Petroliam Nasional Berhad (PETRONAS) for its support and commitment to jointly develop this Guideline.

Special appreciation to the DOE-PETRONAS Joint Working Group members for the contributions of technical expertise and work experience that have driven timely completion of this Guideline.

We would further like to state our appreciation to other stakeholders whom have provided input and feedback during the development of the Guideline.

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1 INTRODUCTION

The oil and gas industry in Malaysia builds, operates and maintains facilities across a diverse value chain covering Upstream and Downstream business activities. The facilities are located onshore and offshore of Malaysia Territorial Waters including within the Exclusive Economic Zone.

Identification and mitigation of potential environmental risks and impacts from the activities are the cornerstone in project planning and execution phase. These assessments commonly embarked during project inception stage. Control and mitigation measures to minimise environmental risks and impacts during the entire project lifecycle involved namely the construction, commissioning and operational phases, and subsequently, decommissioning phase upon cessation of operation.

"Decommissioning" in the oil and gas industry represent the end of productive life of facilities, which process comprise removal of assets' installation and possible restoration of the site whilst avoiding environmental impact. Decommissioning could also be termed as "abandonment" phase. Business decision to decommission is made based on various factors such as (i) end of economic life, (ii) asset integrity, (iii) Health, Safety, Security and Environment (HSSE) concerns, (iv) depleting reserve or well performance, or (v) when a facility is no longer required during project development or operations. The typical lifetime of a facility is shown in Figure 1.1, in which, successful completion of the decommissioning phase will result to release from regulatory control.

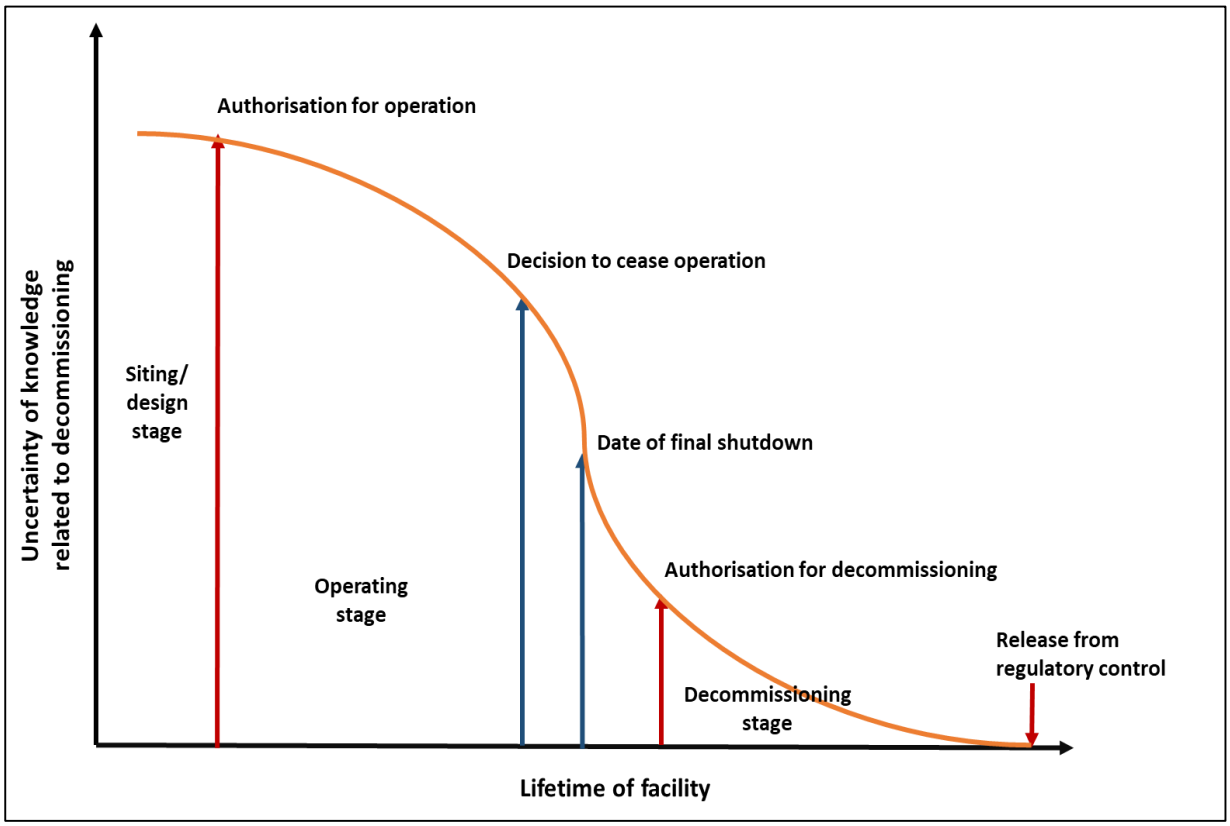


Figure 1.1 Typical lifetime of a facility

Decommissioning activities may pose risk and impact to the environment, utilization of natural resources, and well-being of surrounding communities. It is important for industry players to be mindful of the potential environmental risks and impacts during decommissioning phase. Owner or

Occupier of the facility is accountable to ensure that the affected site does not pose significant risk to human and the environment.

The "Environmental Guideline for Decommissioning of Oil and Gas Facilities in Malaysia" (hereinafter known as the "Guideline") is prepared to provide guidance on environmental management when undertaking decommissioning activities. It is required as part of Environmental Impact Assessment (EIA) and its Conditions of Approval.

This Guideline is the result of a collaborative effort between the Department of Environment Malaysia (DOE or JAS) and Petroliam Nasional Berhad (PETRONAS).

The content of the Guideline adopts DOE Environmental Mainstreaming Self-Regulation (SR), a strategic tool to instil self-regulation culture in managing decommissioning activities. The established approach in SR is integrated into all decision-making processes related to decommissioning activities.

This Guideline focuses on considerations for environmental protection and addresses the general technical issues of decommissioning. Details on engineering, health, safety, security, financial and any other potential implications as result of the decommissioning activities shall not be addressed in this Guideline.

1.1 PURPOSE

The purpose of this Guideline is to provide guidance in managing the environment when undertaking *planning, execution and closure* (collectively defined as "decommissioning activities") of oil and gas facilities in Malaysia. The Guideline set the requirements at each decommissioning activity; including preparation and submission of Decommissioning Environmental Plan (DEP).

1.2 SCOPE AND APPLICABILITY

(1) This Guideline is only applicable to the decommissioning activities for oil and gas facilities in Malaysia that fall under the category of prescribed activities in accordance to Section 34A, Environmental Quality Act, 1974. It shall be applicable to facilities onshore and offshore that is within 12 nautical miles of Malaysian waters.

(2) For Upstream oil and gas facilities in Malaysia, PETRONAS oversees all aspects of decommissioning activities from conceptual to closeout in accordance to established processes of the PETRONAS Procedure and Guideline for Upstream Activities ("PPGUA"). Under Part IV of the EEZ Act (1984), the Director General of DOE may issue directions as are, or take necessary action as is, on matters related to any segment or element of the environment or related interests.

The approval for decommissioning activities on facilities conducted within the EEZ is to be obtained from *Jawatankuasa Menimbang dan Meluluskan Permohonan di bawah Seksyen 21(1) dan Seksyen 22 Akta Zon Ekonomi Eksklusif 1984* ("JKZEE") under the Ministry of Domestic Trade and Consumer Affairs.

(3) This Guideline addresses environmental management of decommissioning activities; issues in relation to engineering, health, safety, security, financial and other implications shall not be addressed in detail in this Guideline.

1.3 ROLES AND RESPONSIBILITIES

(1) Owner/Occupier of facility is accountable to ensure that requirements outlined in this Guideline is adhered to.

(2) A written notification shall be submitted to DOE upon the decision to decommission a facility is reached. Sample of notification letter is shown in Appendix 1.1.

(3) This Guideline serves as a minimum requirement and should be complemented by industry best practices.

(4) Preparatory works that do not influence decommissioning activities or options should be carried out prior to submission of a DEP; e.g. removal of certain equipment and cleaning works.

1.4 OVERVIEW OF THE OIL AND GAS BUSINESS

Oil and gas business is commonly divided into Upstream and Downstream activities**.**

Upstream oil and gas activities refer to oil and gas exploration and production. Upstream facilities include wells, offshore and onshore structures, onshore terminals, pipelines, platform topsides, platform substructures, floater installations, subsea installations, auxiliary equipment and other objects used for exploration, production, storage and transportation of hydrocarbon.

Downstream oil and gas activities refer to the monetization of hydrocarbon namely refining of petroleum crude oil and the processing and purifying of raw natural gas, as well as marketing and distribution of products derived from crude oil and natural gas. Downstream facilities refer to equipment, installations and assets required to refine, process, store and distribute the products to the market and buyers.

A general overview of the business is illustrated in Figure 1.2. Upstream facilities may be located onshore or offshore, which can be within Malaysia territorial waters or the Exclusive Economic Zone of Malaysia as illustrated in Figure 1.3. Typical facilities located onshore and offshore are shown in Figure 1.4 and Figure 1.5 respectively.

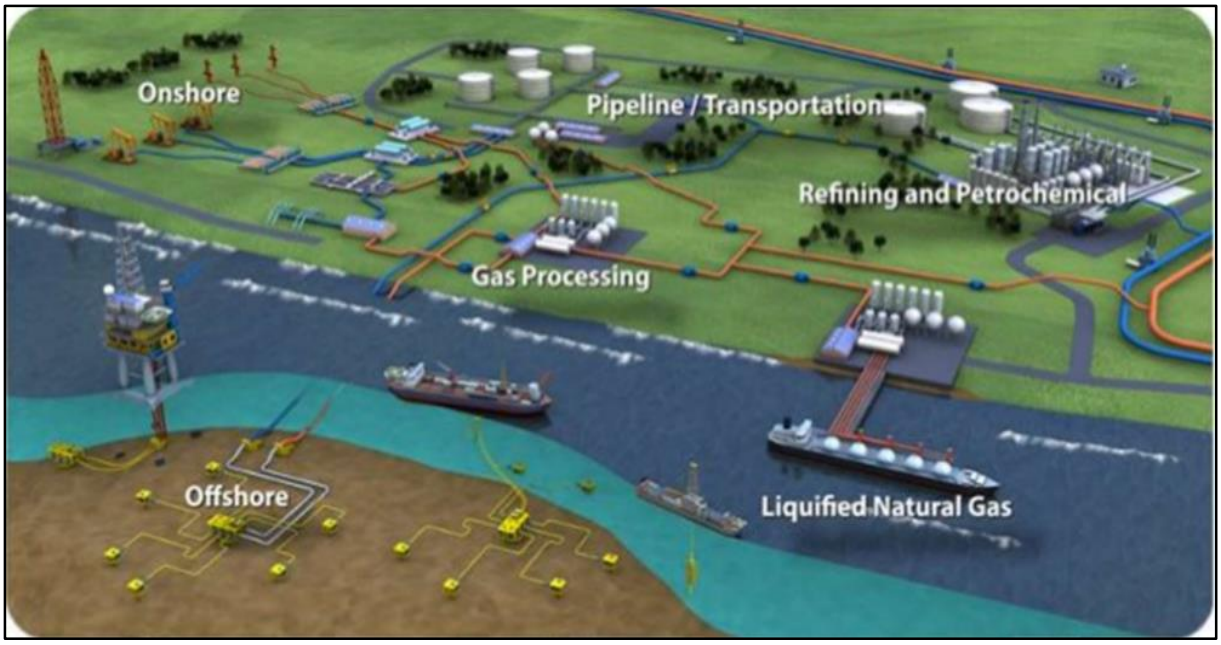


Figure 1.2 General overview of Oil and Gas Business

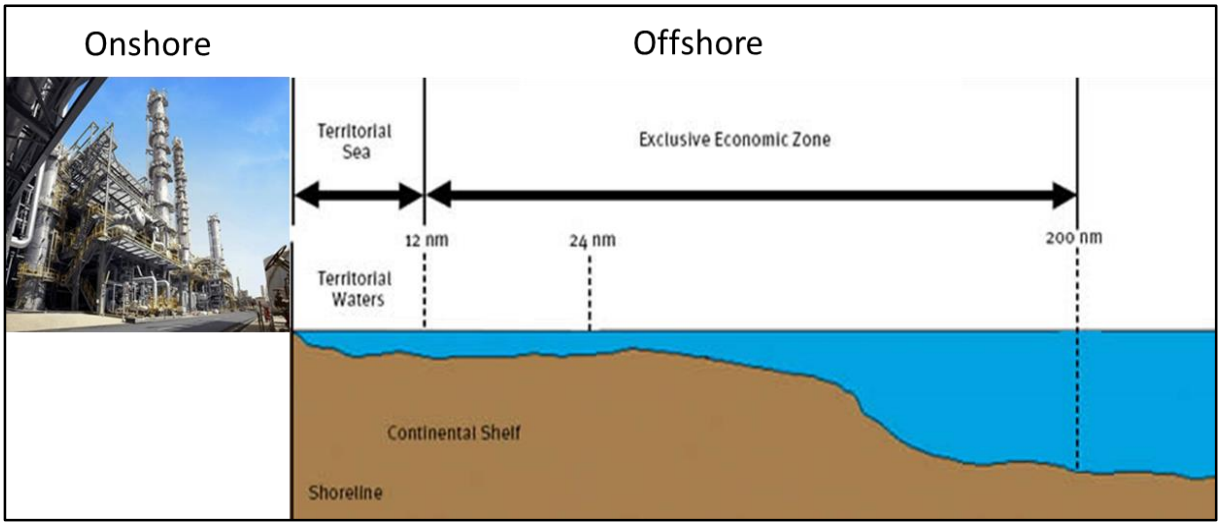


Figure 1.3 Basic illustration of territorial waters and Exclusive Economic Zone

Refinery Plant

Gas Processing Plant

Crude Oil Terminal

Petrochemical Plant

Figure 1.4 Typical Onshore Facilities

Offshore Platform

Offshore Platform

Pipeline End Manifold (PLEM)

Floating Liquefied Natural Gas Plant (FLNG)

Figure 1.5 Typical Offshore Facilities

1.5 GLOSSARY OF TERMS

1.5.1 Specific Definition of Terms

	Terminology	Definition
1.	Decommissioning	A formal process to permanently remove assets after active service, with due regard for potential impacts on the environment. The term 'decommissioning' is intended to include activities i.e. safe removal of hazards, demolition and remediation. (Source: IPIECA Oil and Gas Industry Guidance on Voluntary Sustainability Reporting, 2015) In this Guideline, the terms "decommissioning" and "abandonment" are used interchangeably.
2.	Occupier	Occupier means a person in occupation or control of:- i. Any facility; or ii. In relation to facility where different parts of which are occupied by different persons, the respective persons in occupation or control of each part; or iii. Any vehicle or ship Note: In the case of Upstream facilities, PETRONAS is the regulatory body for Upstream Business in Malaysia as stated under the Petroleum Development Act, 1974. Therefore, occupier here refers to petroleum arrangement contractors.
3.	Owner	Owner in relation to any facility means: i. The registered proprietor of the facility; ii. The lessee of a lease including a sub-lease of the facility, where registered or otherwise; iii. The agent or trustee of any of the owners described in subparagraphs (i) and (ii) of this definition or where the owner as described in subparagraphs (i) and (ii) cannot be traced or has died, his legal personal representatives; or iv. The person for the time being receiving the rent of the facilities whether on his own account or as agent or trustee for any other person or as receiver or who would receive if the facilities were let to a tenant. Note: In the case of Upstream Facilities, Owner means PETRONAS being the regulatory body for Upstream Business in Malaysia as stated under the Petroleum Development Act, 1974.
4.	Local Authority	Any person or body of persons appointed under any written law to exercise and perform the powers and duties, which are conferred or imposed on a local authority under any written law.

	Terminology	Definition
5.	Decommissioning Environmental Plan (DEP)	A structured plan of action, which is explicit, illustrative, action-oriented, time-bound, and outlines control, mitigation, monitoring and management requirements arising from environmental risk and impact assessment. This refers to decommissioning activities.
6.	Facility/Facilities	Oil and gas facilities located onshore or offshore e.g. structures (platforms, jackets, and piles), topside, pipelines, Floating Production Systems ("FPS"), refineries, storage depot, processing plant, blending plant.
7.	Total Removal	Total removal of facility, which involves disposal of all buildings, structures, pipelines and equipment at ground or seabed level.
8.	Partial Removal	Unlike total removal, partial removal involves leaving portions of the facility in place when this is compatible with the anticipated future use.
9.	Upstream	Upstream oil and gas activities refer to oil and gas exploration and production activities. Upstream facilities include wells, offshore and onshore structures, onshore terminal, pipelines, platform topside, platform substructure, floating installations, subsea installations, equipment and other objects used for exploration, production, storage and transportation of hydrocarbon.
10.	Downstream	Downstream oil and gas activities refer to the monetization of hydrocarbon namely refining of petroleum crude oil and the processing and purifying of raw natural gas, as well as the marketing and distribution of products derived from crude oil and natural gas. Downstream facilities refers to the facilities, installations and assets required to refine, process, store and distribute the products to the market and buyers.
11	Site Screening Level	Means the soil and groundwater criteria or concentration adopted under the contaminated land management framework that define if a land has a potential soil and groundwater contamination concern.
12.	Remediation	Any action undertaken to eliminate, reduce, control or mitigate the risk resulting from contamination of the soil and/or groundwater media.

1.5.2 Specific Abbreviations

Abbreviation	Description
ASCOPE	ASEAN Council on Petroleum
AELB	Atomic Energy Licensing Board
CGSO	Chief Government Security Office (a unit under the Prime Minister's Department of the Malaysian federal government).
DEP	Decommissioning Environmental Plan
DOE	Department of Environment (Jabatan Alam Sekitar (JAS))
DOSH	Department of Occupational Safety & Health
EIA	Environmental Impact Assessment
EEZ	Exclusive Economic Zone
EQA	Environment Quality Act
IMO	International Maritime Organization
IPIECA	Global Oil and Gas Industry Association for Environmental and Social Issues
JKZEE	*Jawatankuasa Menimbang & Meluluskan Permohonan di bawah Seksyen 21(1) dan Seksyen 22 Akta Zon Ekonomi Eksklusif, 1984*
MARPOL	International Convention for the Prevention of Pollution from Ships
MDTCA	Ministry of Domestic Trade, and Consumer Affairs
PPGUA	PETRONAS Procedure and Guidelines for Upstream Activities
SSL	Site Screening Level
SSTL	Site Specific Target Limit
TENORM	Technologically Enhanced Naturally Occurring Radioactive Material
UNCLOS	United Nations Convention on the Law of the Sea

2 LAWS, REGULATIONS AND GUIDELINES

There are various laws and regulations at Federal and State levels that govern activities relating to overall decommissioning of oil and gas facilities in Malaysia. In addition to legal compliance, the oil and gas industry adopts international guidelines, industry best practices, and comply with relevant international treaties and conventions.

The Owner/Occupier shall comply with the laws of Malaysia that is applicable to the decommissioning of oil and gas facilities. Main laws, regulations and international conventions/treaties relevant to decommissioning activities are as follow (not in hierarchal):

Environment Quality Act, 1974
The Environmental Quality Act, 1974 ("EQA") was formulated in 1974 to prevent, abate, and control pollution and to enhance the environmental quality in Malaysia. Regulations and Orders have been established under the EQA to control and manage various environmental aspects.

The administration of the EQA is entrusted to the DOE Malaysia. The DOE, an agency of the Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC), is the authority established under the EQA and plays a key role in the enforcement of the provisions of the Act and its subsidiary regulations.

Petroleum Development Act, 1974
The Petroleum Development Act,1974 (PDA) provides for exploration and exploitation of petroleum whether onshore or offshore by a Corporation in which will be vested the entire ownership in and the exclusive rights, powers, liberties and privileges in respect of the said petroleum, and to control the carrying on of downstream activities and development relating to petroleum and its products; to provide for the establishment of a Corporation under the Companies Act, 1965 known as Petroliam Nasional Berhad or PETRONAS and for the powers of that Corporation; and to provide for matters connected therewith or incidental thereto.

Exclusive Economic Zone Act, 1984
An Act pertaining to the Exclusive Economic Zone and certain aspects of the continental shelf of Malaysia and to provide for the regulation of activities in the zone and on the continental shelf and for matters connected therewith.

United Nations Convention on the Law of the Sea ("UNCLOS"), 1982
UNCLOS governs all aspects of sea use including maritime boundary delimitation, resource exploitation (hydrocarbons, minerals and fisheries), environmental protection and navigation including that of areas beyond national jurisdiction

Pursuant to Article 210 of UNCLOS, states that are parties to UNCLOS are legally obliged to adopt laws and regulations to prevent, reduce and control pollution of the marine environment by dumping, which must be no less effective than the global rules and standards. Article 210 also provides that such laws, regulations and measures must ensure that dumping is not carried out without the permission of the competent authorities of States.

Article 60(3) of UNCLOS states that any installations or structures that are abandoned or disused shall be removed as necessary to ensure safety of navigation, taking account of any generally accepted international standards established by the IMO. Such removal shall have due regard to fishing, the

protection of the marine environment, and the rights and duties of other states. Appropriate publicity shall be given to the depth, position and dimensions of any installations or structures not entirely removed.

International Maritime Organization ("IMO") Guidelines & Standards, 1989

In October 1989, the IMO adopted guidelines and standards for the Removal of Offshore Installations and Structures on a nation's Continental Shelf or its Exclusive Economic Zone (Resolution A.672 (16)). The IMO guidelines and standards provide that, in general, an abandoned or disused offshore installation or structure on a Continental Shelf or an Exclusive Economic Zone should be removed as soon as reasonably practical once it is no longer serving the prime purpose for which it was originally designated.

The IMO guidelines also provide for leaving offshore installations wholly or partially in place if complete removal:

- is not technically feasible;
- would involve extreme cost; or
- would pose an unacceptable risk to personnel or the marine environment, but should ensure in such cases that an unobstructed water column sufficient to ensure safety of navigation (and, in any event, of not less than 55 m.) is maintained above the partially removed installation.

The IMO Guidelines and Standards which were designed essentially to ensure the safety of navigation, are not intended to preclude a coastal state from imposing more stringent removal requirements for existing or future installations or structures on its continental shelf or in its exclusive economic zone.

The IMO guidelines also state that disposal options are to take into account:

- any potential effect on the safety of uses of the sea;
- the rate of deterioration of the material and its present and possible future effect on the marine environment;
- the potential effect on the marine environment;
- the risk that the material will shift from its present position at some future time;
- the costs, technical feasibility and risks of injury to personnel associated with removal; and
- the determination of a new use or other reasonable justification for allowing the installation (or parts thereof) to remain on the seabed.

Basel Convention on the Control of Trans boundary Movements of Hazardous Wastes and their Disposal

The Basel Convention adopted in March 1989, is an international agreement for addressing the problems and challenges posed by hazardous wastes.

In order to protect human health and the environment, the Basel Convention requires all practical steps be taken to minimise generation of hazardous wastes and measures be in place to control hazardous wastes storage, transport, treatment, reuse, recycling, recovery and final disposal.

Because hazardous wastes pose such a potential threat to human health and the environment, one of the guiding principles of the Basel Convention is that, in order to minimise the threat, hazardous wastes should be dealt with as close to where such hazardous wastes are produced as possible. Only

if a State does not have the capability of managing or disposing the hazardous waste in an environmentally sound manner, should transboundary movement be considered.

The list of applicable law, regulations and international treaty include (non-exhaustive list):

a) National Law and Regulation
   1. Petroleum Development Act, 1974
   2. Exclusive Economic Zone Act, 1984
   3. Continental Shelf Act, 1966 (Revised 1972)
   4. Merchant Shipping Ordinance, 1952
   5. Environmental Quality Act, 1974 and its regulations thereunder.
   6. Occupational Safety and Health Act, 1994
   7. Factory and Machinery Act, 1967
   8. Malaysian Maritime Enforcement Agency Act, 2004
   9. Atomic Energy Licensing Act, 1984
   10. Fisheries Act, 1985
   11. Customs Duties (Exemption) Order, 2013
   12. Petroleum (Safety Measures) Act, 1984
   13. Merchant Shipping Act (Oil Pollution) Act, 1994
   14. Petroleum (Safety Measures) Act, 1984
   15. Protected Areas and Protected Places Act, 1959

b) State Enactments (where applicable)

c) Guidelines
   1. DOE. Environmental Impact Assessment Guideline in Malaysia (EGIM)
   2. DOE. Environmental Essential for Siting of Industries in Malaysia (EESIM)
   3. DOE. Contaminated Land Management and Control Guideline
   4. Atomic Energy Licensing Board (AELB), Guidelines on Radiological Monitoring for Oil and Gas Facilities Operators Associated with TENORM
   5. AELB 2009, Guidelines for Decommissioning of Facilities with Radioactive Materials
   6. National Oil Spill Contingency Plan
   7. DOSH 2011, Guidelines on Mercury Management in Oil and Gas Industry
   8. ASCOPE Decommissioning Guidelines for Oil & Gas Facilities
   9. LEM/TEK/58 Code of Practice on Radiation Protection Relating to TENORM in Oil and Gas Facilities

d) International Conventions/Treaties
   1. United Nations Convention on the Law of the Sea (UNCLOS), 1982
   2. International Maritime Organization (IMO) Guidelines & Standards, 1989
   3. International Convention for the Prevention of Pollution from Ships, 1973 and the modifying Protocol, 1978 (MARPOL 73/78)
   4. Basel Convention on the Control of Trans boundary Movements of Hazardous Wastes and their Disposal

2.1 STAKEHOLDER ENGAGEMENT

Owner/Occupier shall carry out consultation with relevant stakeholders affected by the decommissioning activities. The consultation shall be conducted during the pre-decommissioning phase as part of the scoping. All correspondences during engagement sessions shall be documented.

Owner/Occupier may be required to obtain licensing/permits from relevant stakeholders including local authorities prior to execution of decommissioning.

The list of stakeholders is shown below (non-exhaustive list):

Stakeholder	**Area of Consultation and Liaison.**
Attorney General's Chambers	Legal aspects of maritime affairs.
Chief Government Security Office (CGSO)	Prepare and issue license for protected areas (under Protected Areas and Protected Places Act 1959)
Department of Environment	Protection and preservation of environment.
Department of Fisheries	Fishing Industry, marine parks and reserves; including coral reefs and artificial reefs, enforcement of fishing activities.
Department of Occupational Safety and Health	Policies and legislations of occupational safety and health.
Jawatankuasa Menimbang dan Meluluskan Permohonan di bawah Seksyen 21(1) dan 22 Akta Zon Ekonomi Eksklusif (JKZEE)	License to install, remove or operation of structure, sub-surface cables or pipelines within EEZ and Malaysian continental shelves.
Local Authorities	Disposal and potential use of platforms on land.
Marine Department Malaysia	Safety of navigation, shipping services e.g. shipping certification, registration and licensing, supervising examination for seafarers.
Malaysian Maritime Enforcement Agency	Maritime search and rescue, coastal and air surveillance, maritime safety and security, prevent piracy.
Petroliam Nasional Berhad (PETRONAS)	Oversee and approve all aspects of upstream abandonment phases from conceptual to close out.
Road Transport Department Malaysia	Road traffic safety and efficiency for movement of materials, equipment and wastes.

3 DECOMMISSIONING OVERVIEW

Decommissioning activities consists of several phases. For facilities located offshore, the activities start with securing the wells. This is followed by removing structures and pipes connecting the platform to the ground. Such operations must be performed with care and require both specialized personnel and sophisticated techniques, aimed at minimizing environmental impact. The removal phase is followed by management of materials/equipment/wastes and the final processing of potentially polluting products, such as metallic and plastic wrecks, combustible oils, etc. Typical upstream and downstream production facilities lifecycle is shown in Figure 3.1 and Figure 3.2, respectively.

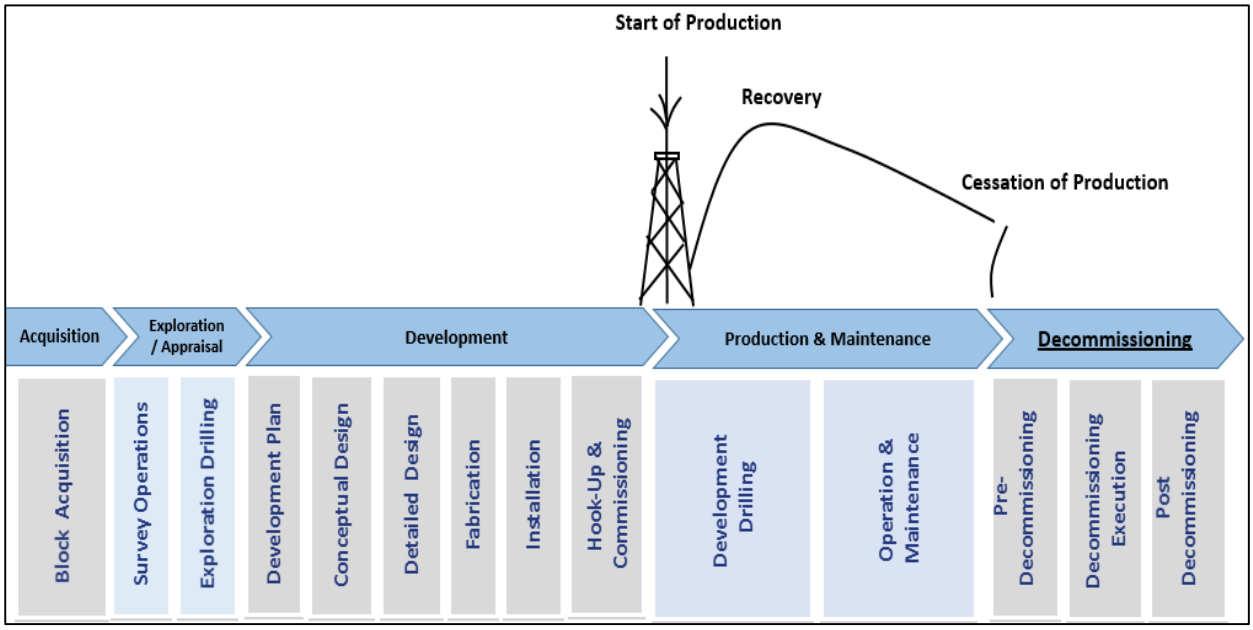


Figure 3.1 Typical exploration and production lifecycle for upstream facility

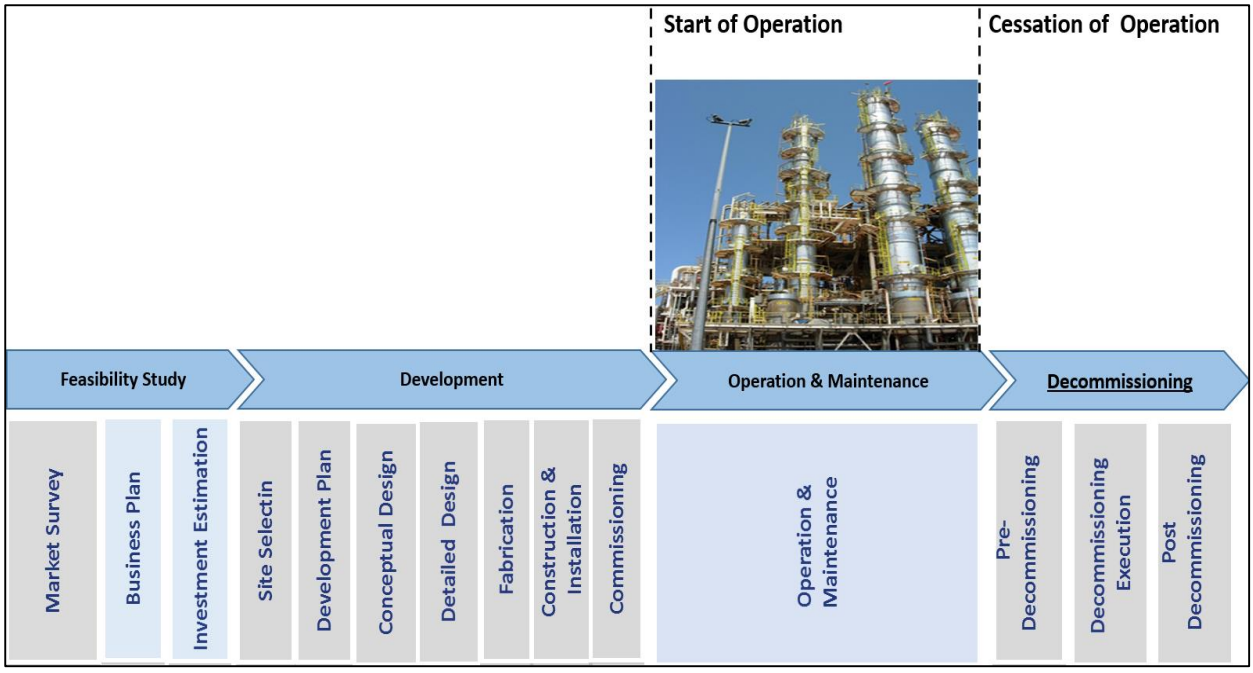


Figure 3.2 Typical lifecycle for downstream facility

For facilities located onshore, decommissioning is the closure of an industrial facility followed by the removal of process equipment, buildings and structures. Site remediation may be required to remove chemical substances or hazardous materials from the environment, or to an acceptable risk level. Decommissioning may result in the change of future land use.

The decommissioning costs involved uncertainties and can be very expensive, depending on number of variable factors such as the facilities typology, site geomorphology, choice of whether total or partial removal of facilities, and market conditions.

Facilities removal may be more complicated than the installation, as the latter may be the outcome of a constant overlaying process over the years. Therefore, adequate resources and planning are paramount to minimise risks and impacts from economic and environmental aspects.

3.1 DECOMMISSIONING PHASES PROCESS FLOW

Process flow for activities in each decommissioning phase, and roles and responsibilities of affected parties are shown in Figure 3.3 and Figure 3.4 for Downstream and Upstream facilities, respectively.

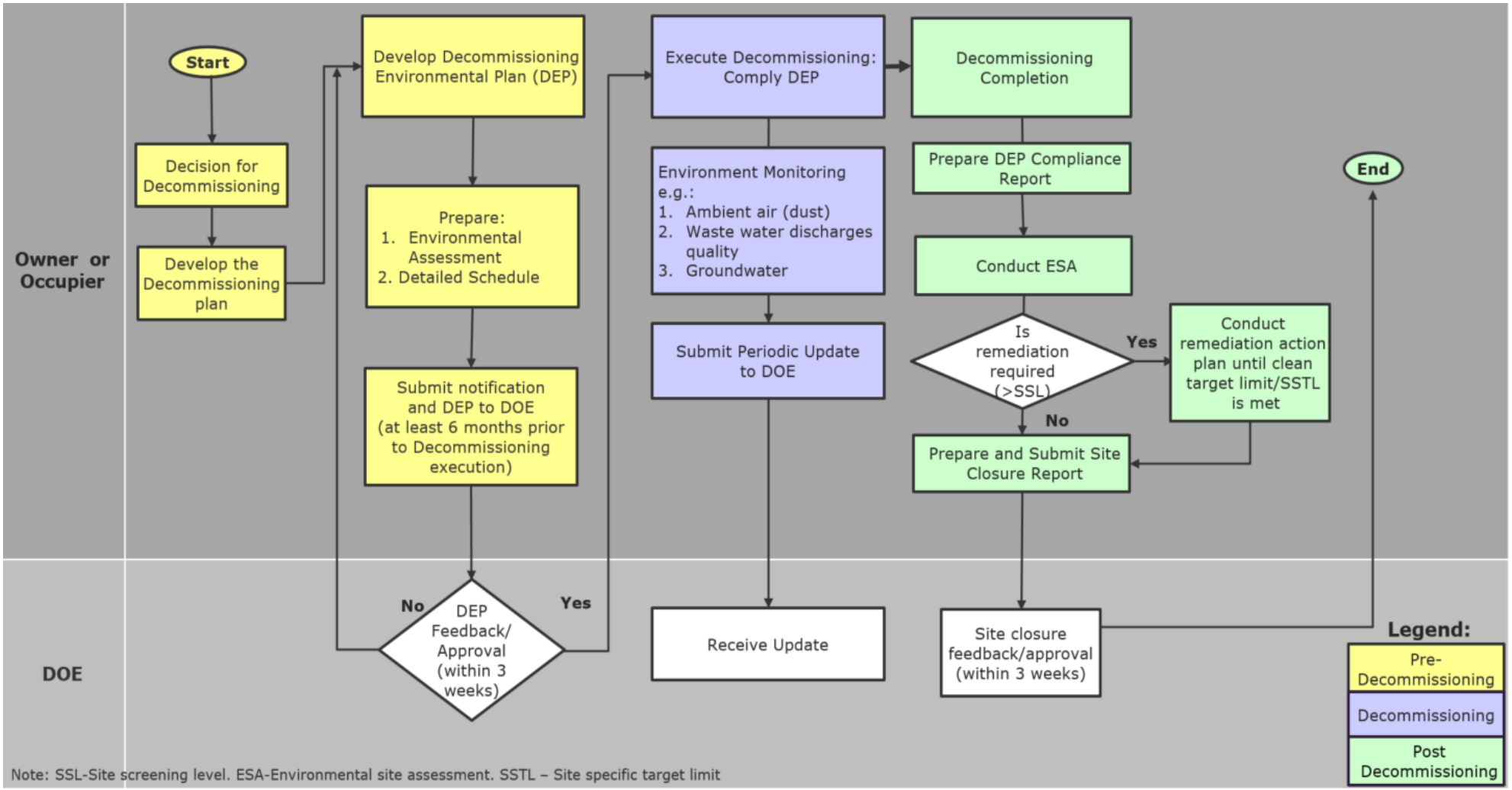
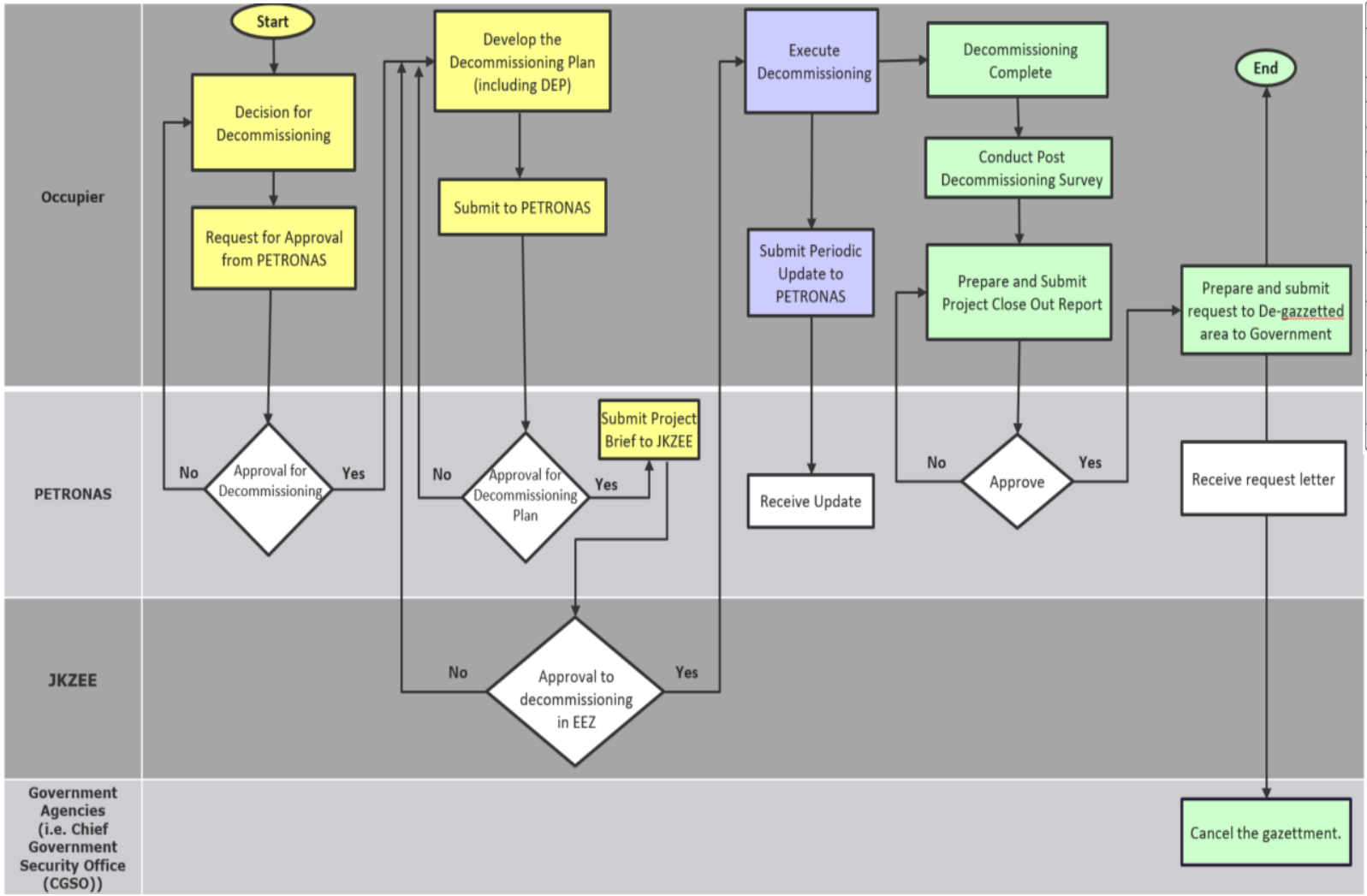


Figure 3.3 Approval Process Flow for Downstream Facilities



	Members of JKZEE
1	Kementerian Perdagangan Dalam Negeri dan Hal Ehwal Pengguna
2	Majlis Keselamatan Negeri
3	Jabatan Peguam Negara
4	Kementerian Pengangkutan Malaysia
5	Jabatan Keselamatan dan Kesihatan Pekerjaan
6	Jabatan Alam Sekitar
7	Jabatan Perikanan Malaysia
8	Jabatan Laut Malaysia
9	Kementerian Komunikasi dan Multimedia Malaysia
10	Pusat Hidrografi Nasional, Tentera Laut Diraja Malaysia
11	Agensi Penguatkuasaan Maritim Malaysia
12	Suruhanjaya Komunikasi dan Multimedia Malaysia
13	Suruhanjaya Tenaga

Note:

1. For facilities within 12 nautical miles, DEP shall be approved by DOE.
2. Owner/occupier shall seek DOE's endorsement/feedback through JKZEE.

Legend:

Pre-Decommissioning

Decommissioning

Post Decommissioning

Figure 3.4 Approval Process Flow for Upstream Facilities

3.2 DECOMMISSIONING METHOD STATEMENT AND GUIDING PRINCIPLES

Decommissioning plan shall take into account the interests of relevant stakeholders, including potential future users of the sea or land. The relevant stakeholders shall be consulted during the environmental assessment process.

3.2.1 Method statement

Decommissioning requires several steps to ensure that work carried out is safe and has no or minimal impact to public and the environment. Upon selection of decommissioning option, the first step is to evaluate engineering aspects such as maintaining facility safety envelope prior completion of decommissioning activities. Selected options shall apply waste management hierarchy in managing waste/materials as described in Section 6. Typical method statement for dismantling and decommissioning of offshore facilities is shown in Appendix 3.1.

3.2.2 Guiding Principles

The decommissioning activities shall be guided by the following principles, adapted from Environmental Impact Assessment (EIA) Guidelines in Malaysia:

- Pro-active
- Transparency
- Credibility
- Cost effective
- Practical
- Social accountability

Pro-active
Owner/occupier are encouraged to plan for decommissioning at the early stages of project development, as part of an overall project development strategy. Decommissioning shall be considered as part of the design and concept selection stages of facility development. This will ensure decommissioning obligations and associated costs can be factored into overall project costs and planning.

Transparency
The environmental assessment and planning shall be conducted in a transparent manner involving inputs from all relevant stakeholders. The DEP shall be clear, concise, informative, transparent, balanced, easily accessible, and understood by the stakeholders.

Credibility
The environmental assessment and planning shall be performed with integrity, rigor, fairness, and objectivity. It should apply established and appropriate techniques to address key areas of environmental concerns.

Cost-effectiveness
The decommissioning environmental management plan including pollution prevention and mitigating measures and the necessary follow-up measures should be cost-effective subject to best industry practices.

Practical
The information and outputs provided by the environmental assessment process is documented in the DEP. It should be in the form that is readily usable for planning and practically implemented during decommissioning activities.

Social Accountability
The Owner/Occupier and decision makers are accountable to the stakeholders for decisions and actions. The Owner/Occupier is responsible for regulatory compliance at all times.

3.2.3 Circular Economy

During decommissioning phases, the opportunities of applying circular economy principles should be considered. It can be applied in the form of recycling, such as improving the value of materials and steels or reuse equipment, structure and pipeline. Simplified illustration of circular economy is shown in Appendix 3.2.

3.3 ENVIRONMENTAL MAINSTREAMING AND SELF-REGULATION FOR DECOMMISSIONING

Environmental mainstreaming has been integrated into all DOE recent regulations. This is reflected through DOE requirement for self-regulation being the long-term goal and culture towards mainstream environment. The implementation of environmental mainstreaming promotes and instil self-regulation in all industries where it has seen positive results in optimising operations of pollution control system (PCSs), prevention of PCS failure, cost savings in PCS operation, systematic management of performance monitoring data and improved regulatory compliance. It also complements existing command and control approach of DOE, resulting in environmental ownership and commitment from the industries.

For decommissioning activities, the implementation of environmental mainstreaming through self-regulation goal will enhance effectiveness in managing environmental impacts at every phases of decommissioning. Self- regulation culture in decommissioning means the Owner/Occupier will be fully responsible and accountable in minimising impacts to the environment by application of effective pollution prevention and mitigation measures and self-demonstration of regulatory compliance at all decommissioning phases.

DOE has formulated a set of environmental mainstreaming (“EM”) tools to be implemented in the organisation and industrial premises. The EM tools include:

1. Environmental Policy (EP)
2. Environmental Budgeting (EB)
3. Environmental Monitoring Committee (EMC)
4. Environmental Facility (EF)
5. Environmental Competency (EC)
6. Environmental Reporting and Communication (ERC)
7. Environmental Transparency (ET)

3.4 5S WORKING TOOL

The 5S system is a working tool for ISO 9001:2015 that was develop to help managers and work personnel systematically achieve greater organization, standardization, efficiency and safety in the workplace. 5S principles stands for:

- Seiri – Sort - Sisih
- Seiton – Set – Susun
- Seiso - Shine – Sapu
- Seiketsu – Standardise – Senggara
- Shitsuke – Sustain – Sikap

Decommissioning activities should apply the 5S tool. Implementation of 5S for decommissioning activities should eliminate or reduce sources and potential environmental impact. Example of 5S application for decommissioning activities is shown in Appendix 3.3.

4 DECOMISSIONING FRAMEWORK

Decommissioning framework is a series of action steps to be adhered to in completing the decommissioning of facilities. The framework comprise of three main phases namely pre-decommissioning, decommissioning execution and post-decommissioning phases, as shown in Figure 4.1.

Owner/Occupier will conclude a decision to decommission based on feasibility study carried out. The scope includes but not limited to performance of facility, review of facility, cost estimates and asset integrity study.

4.1 PRE - DECOMMISSIONING PHASE

Pre-decommissioning is the planning and preparation stage, which include scoping, evaluation and planning.

Decommissioning plan shall be in accordance with national laws and international obligations and have regard to:

- the precautionary principle
- best available techniques and best environmental practice
- risk based approach
- waste hierarchy principles
- other uses of the sea and neighboring area.
- health and safety
- cost effectiveness.

4.1.1 Scoping

Scoping document is prepared to select the best decommissioning options and establish preliminary estimates of technical scope, cost, and schedule for the decommissioning. Key activities for scoping are data gathering, assessment of decommissioning options and development of preliminary schedule.

Decommissioning Options Assessment ("DOA") requires various consideration based on facilities description and other data such as those listed in the Table 4.1.

Table 4.1 Typical data and information required for scoping

Upstream (facilities located offshore)	**Downstream & Upstream (facilities located onshore)**
i. Facilities description	i. Facilities description
ii. Waste description	ii. Waste description
iii. License and permits from local authority	iii. License and permits from local authority
iv. Regulatory requirements	iv. Regulatory requirements
v. Environmental Impact Assessment (EIA) (Report and EIA Conditions of Approval)	v. EIA (Report and EIA Conditions of Approval)
vi. Environmental Management Plan (EMP) and environmental monitoring data	vi. EMP and environmental monitoring data
	vii. Environmental Site Assessment (ESA)
	viii. Past spillage and incident records
	ix. Land use history and planning

Typical decommissioning options are:

i. Re-use or relocate of equipment/parts for other facilities in different location;
ii. Re-use of equipment/parts for different purpose other than oil and gas industry e.g. artificial reef/rigs-to-reefs, aquaculture, platform for alternative energy station (for offshore structures);
iii. Recycle of unserviceable equipment and uncontaminated / non-hazardous demolition wastes as scrap;
iv. Leave in place; and
v. Disposal of dismantled unmarketable equipment/parts etc. as waste.

Further details of typical facilities decommissioning options for offshore facilities is shown in Appendix 4.1.

4.1.2 Evaluation and Planning

The decommissioning options depends on a number of factors, such as type of construction, size, distance from shore, weather conditions, complexity of the removal operation, safety considerations of the workers, regulatory standards, and stakeholder acceptance. The selected options shall be evaluated to determine the work scope and activities.

Environmental impacts shall be assessed for the selected options. The evaluation covers:

i. Decommissioning execution strategy – man-power resources, waste management, dismantling, relocation, reuse activities.
ii. Potential environmental impact and its mitigation measures to As Low as Reasonably Practicable (ALARP).

This information gathered from the activities shall be used to prepare the decommissioning plan and the DEP. Owner/Occupier shall submit the DEP to the DOE. The typical content of the DEP and further details are shown in Appendix 4.2 and Section 5, respectively.

4.1.2.1 Decommissioning Strategy

The key to optimising asset value in a decommissioning project is allowing enough time to establish a strategy that allows Owner/Occupier to choose the best methods for decommissioning. Decommissioning strategy should be evaluated and determined at early stage of pre-decommissioning phase to ensure that when decommissioning is executed, it is done in a safe, environmentally sound and cost effective manner.

Decommissioning strategy for onshore and offshore facility is evaluated with the following considerations:

i. Legislative and regulatory framework;
ii. Waste management;
iii. Availability of skilled human resources at the outset of the decommissioning activities;
iv. Specific facility/site reuse demands;
v. Complexity and size facility;
vi. Existing environmental condition; and
vii. Decommissioning costs.

In the oil and gas industry, there are three broad strategies commonly applied for facility, which may need to be adapted for specific cases. However, the base case shall be total removal. In determining which strategies to adopt for a particular feature, it is important to consider how to minimise liability in the most cost-effective manner.

i. Transfer of the Asset

If the Owner/Occupier decides that any facility are worth selling to other potential uses who have lower overhead cost. In this case, liability for the site shall be assessed and agreed with the buyer.

ii. Partial Removal

This strategy requires environmental value of the area and both soil and groundwater that may has been impacted by operations shall be evaluated and not pose unacceptable risk to human and environment.

iii. Total Removal

After completion of decommissioning, both soil and groundwater shall be evaluated and not pose unacceptable risk to human and environment. This strategy is likely to be the most favourable in terms of practicability and acceptability.

4.1.2.2 Decommissioning Options Assessment

Onshore Facilities

Owner/Occupier shall conduct analysis to determine the best practical decommissioning option for each facility and/or the whole facilities.

The analysis starts with evaluation of the facility condition, analyse the facility sale performance and perform market study prior to issuance of Request for Information (RFI). A typical decommissioning option analysis is shown as in Figure 4.1.

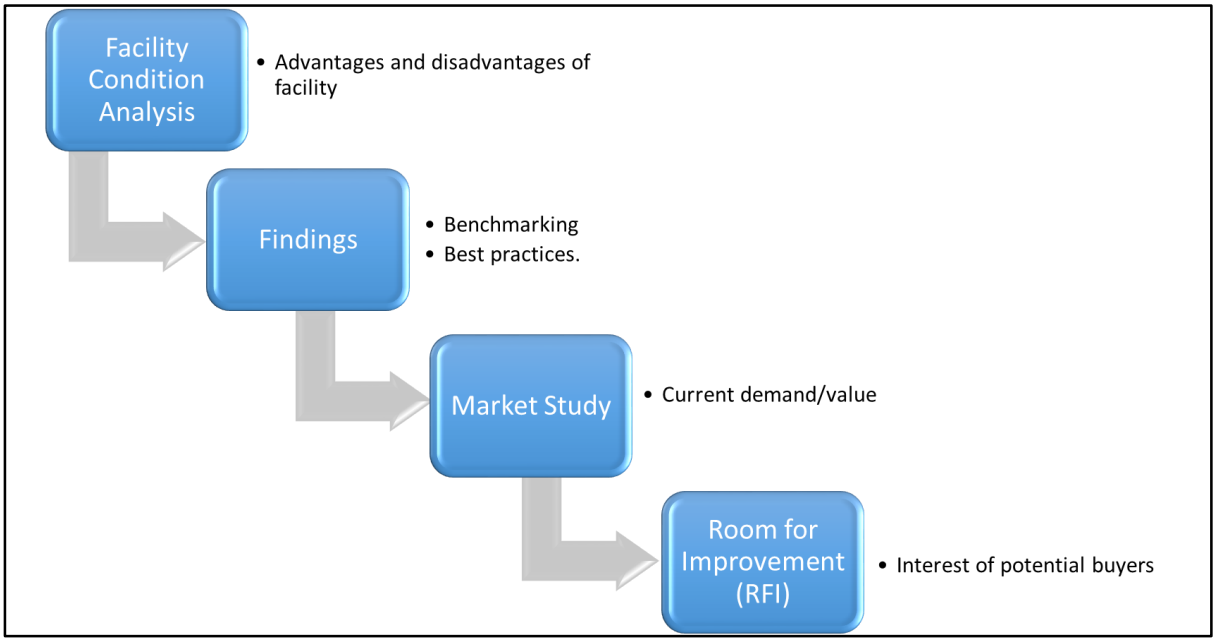


Figure 4.1: Decommissioning Option Analysis

Based on the analysis findings, suitable options for a facility will be determined. Three (3) options should be evaluated. The options are sell as whole plant (dismantling), sell as partial plant and sell as scrap (demolition). Generally, dismantle should be the preferred option due to various advantages compared the other options as shown in Table 4.2.

Table 4.2 Example of Decommissioning Options Assessment for Onshore Facilities

No	Options	Advantage	Disadvantage
1	**Sell as whole facility** • Dismantling, demolition and logistics under buyer's scope • Scrap disposal under buyer's scope • Site reinstatement	• Single point responsibility • Less interfacing • Better control on overall project deliverables • Minimize number of tender packages • Reduce overall project timeline	• Limited number of buyers • Effective control on sub-contractors may be compromised
2	**Sell as partial/ part of facility** • Dismantling of purchased item under buyer's scope • Demolition of remaining item and site reinstatement • Scrap disposal • Logistics for purchased item under buyer's scope	• More potential buyers • Better control of demolition and site reinstatement activities	• More tender packages to be managed • Longer overall project timeline due to demolition and site reinstatement after equipment sales • More interfacing • Complex and messy
3	**Sell as scrap** • Dismantling, demolition and site reinstatement	• Single point responsibility • Shortest overall project timeline • Potential lowest demolition cost • Less complex	• Possible lowest value

Dismantle option should be selected provided there were potential buyers or users. The facilities should be demolished if there is no interested buyers/users.

Offshore Facilities

Typical decommissioning options for offshore facilities are described in Table 4.3, with details in Appendix 4.1.

Table 4.3 Typical offshore decommissioning options

No.	Installation Type	Option
1	Onshore Terminal	Reuse for other than oil and gas purposes
		Relocate for another oil and gas operation in a different location
		Complete removal, disposal and land
2	Pipeline	Reuse
		Preserve for future use
		Leave in-situ
		Complete or partial removal and disposal on land
3	Well	Permanent plug and abandon.
4	Platform topside	Reuse for other than oil and gas purposes e.g. government or commercial use e.g. military base, research centre, hotel

		Relocate for another oil and gas operation in a different location.
		Complete removal and disposal on land
5	Floater installations	Returned to Owner
		Relocate for another oil and gas operation in a different location
		Reuse for other than oil and gas purposes e.g. government or commercial use e.g. military base, research centre, hotel
		Preserve for future use
6	Subsea installations	Relocate for another oil and gas operation in a different location
		Reuse for other than oil and gas purposes e.g. artificial reef, training, etc.
		Preserve for future use
		Complete removal and disposal on land

4.1.2.3 Decommissioning Plan

Decommissioning Plan Objective

Decommissioning plan shall be developed after the strategy is determined at early stage pre-decommissioning phase. The decommissioning plan should identify and develop detailed implementation plan and procedures required for completion of the decommissioning process and activities.

The plan shall be developed with objectives to enable to:

i. identify facilities/materials requiring removal (e.g. stored raw materials, chemicals and products, above or below ground piping, buildings, structures, foundations, instrumentation, electrical and mechanical equipment);
ii. identify facilities required for future operations or the anticipated land use;
iii. identify operational and/or logistical constraints associated with decommissioning;
iv. identify health hazards and develop appropriate procedures to minimize exposure;
v. identify areas and activities for implementation of 5S concept to eliminate and reduce sources waste and potential environmental impacts;
vi. develop a contaminated material (chemicals, scales, sludges) removal strategy;
vii. develop a planned sequence for equipment removal; and develop safety procedures;
viii. ensure that measures are in place to maximize, to the greatest reasonable extent, the recycling and re-use of decommissioned plant, materials, equipment and infrastructure; and
ix. ensure that measures are in place to safely dispose of all excess materials and wastes and to clean up any contaminated areas on site.

Basis in Developing Decommissioning Plan

Decommissioning plan should be developed based on site information that can be obtained by:

i. Identification of the types of activities to be carried out on the site, including waste handling;
ii. Identification of potential hazards, including an evaluation of the raw materials and waste products typically stored on-site, site hydrogeology, sewer and bund integrity.
iii. Identification of control measures to prevent incidents.
iv. Identification of all items and materials, including buildings that may be decommissioned, rendered safe or removed from site for disposal or recovery in the event of closure of the facility.

v. Identification of all possible on-site locations where cleaning, decontamination or remediation works may be required in the event of decommissioning to prevent environmental pollution.

Decommissioning Activities

The typical decommissioning activities are shown in Table 4.4.

Table 4.4: Typical Activities to be included in a Decommissioning Plan

Facilities	Activities
Upstream Facilities Located Offshore within 12 nautical miles.	i. Down-hole abandonment of wells. ii. Decontamination and cleaning of equipment. iii. Dismantling and decommissioning. iv. Removal of wastes and/or chemicals for disposal or re-use. v. Removal of transformers, instrumentation and electrical systems for reuse or disposal. vi. Removal of platform (topside and substructure). vii. Removal of pipeline and riser. viii. Removal of floating structure. ix. Removal of subsea, umbilical, riser and flow lines (SURF). x. Mobilization and demobilization of equipment and materials. xi. Management of wastes and materials (reuse, resale, recycle, disposal). xii. Site closure assessment.
Downstream & Upstream Facilities Located Onshore	i. Decontamination and cleaning of equipment. ii. Dismantling and removal of equipment and materials. iii. Removal of wastes and/or chemicals for disposal or re-use. iv. Treatment and/or disposal of process fluids and sludge. v. Removal of transformers, instrumentation and electrical systems for reuse or disposal. vi. Isolation of underground piping, tanks and structures that are left in place. vii. Packaging and transportation of equipment. viii. Installation of access controls and/or signposting (notification) for remaining structures. ix. Demolition of identified equipment and materials. x. Removal of bridges, drainage culverts, roads and other civil works not needed for future access or erosion control. xi. Management of wastes and materials (reuse, resale, recycle, disposal). xii. Environmental Site Assessment. xiii. Site remediation (if necessary). xiv. Site closure assessment.

4.1.2.4 Decommissioning Environmental Plan (DEP)

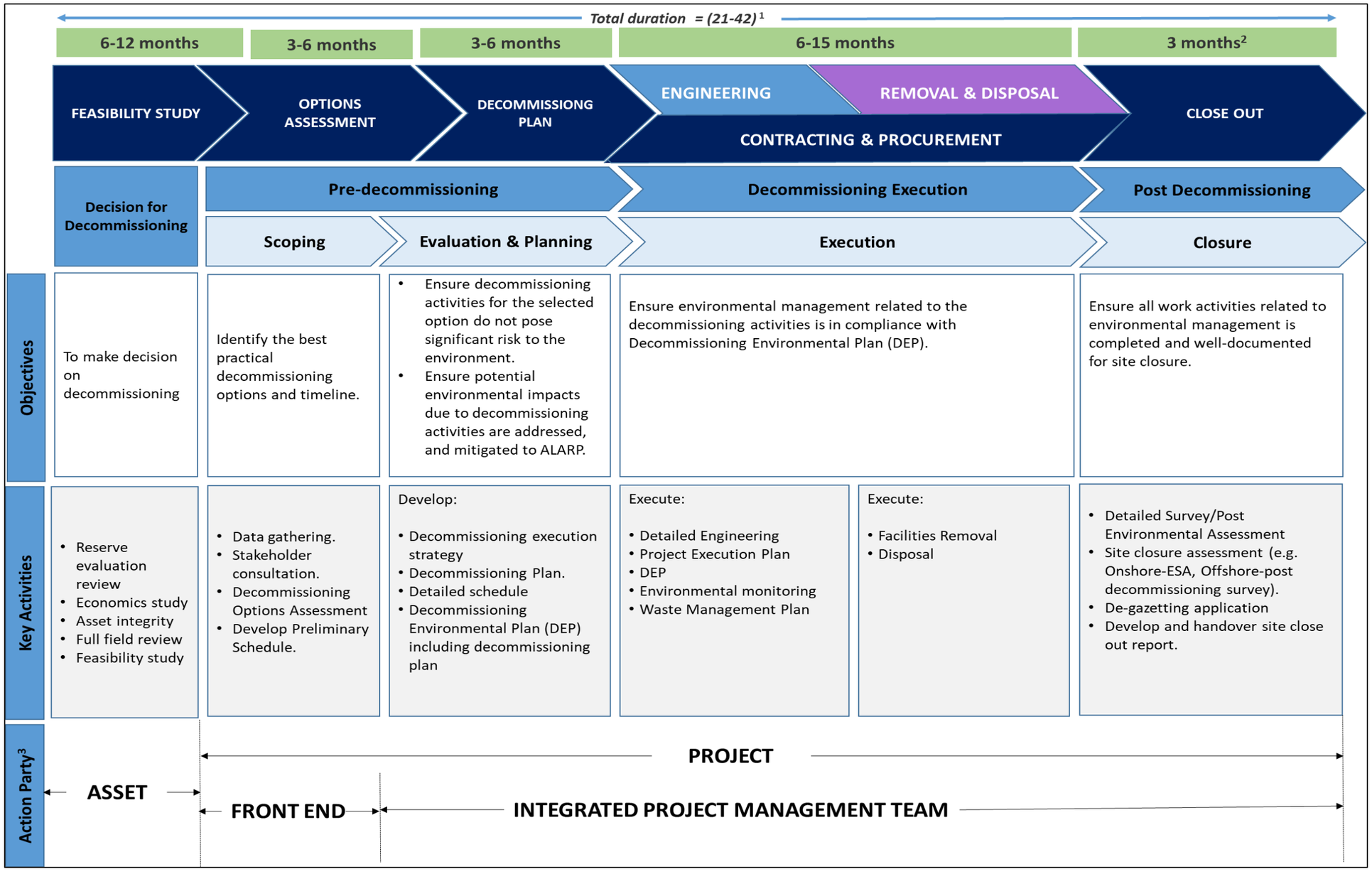
DEP shall be prepared during pre-decommissioning phase and submitted for endorsement by DOE. Details to develop DEP is described in Section 5.

4.1.2.5 Waste Management Plan (WMP)

WMP shall be prepared during pre-decommissioning phase, as part of DEP. Details to develop WMP is described in Section 6.

4.1.2.6 Detailed Decommissioning Schedule

Detailed decommissioning schedule shall be prepared during pre-decommissioning phase, based on the selected decommissioning option. Depending on type, complexity and historical site condition, typically it may take between 21 to 42 months from feasibility to site closure for offshore facilities as shown in Figure 4.2.



Note:
1. Proposed timeline for decommissioning activities
2. Typical timeline for offshore facilities. For onshore facilities, site closure depends on ESA findings.
3. Proposed action party within Owner/Occupier organization

Figure 4.3 Overview of Decommissioning Framework

4.2 DECOMMISSIONING EXECUTION PHASE

Prior to execution phase, the facilities shall be totally shut down, clear of hazardous materials and declared safe and stable (including electrical systems) for decommissioning activities to proceed. Execution shall be conducted in accordance to decommissioning plan and in compliance with DEP.

Owner/Occupier shall implement monitoring, maintenance and management of the decommissioning site. The recommended environmental monitoring programme in the DEP shall be executed and progress reported to DOE. Periodic monitoring programme should be conducted for decommissioning execution phase exceeding one year and based on assessment. The table of content of the Environmental Monitoring report is in Appendix 4.3.

4.3 POST DECOMMISSIONING PHASE AND SITE CLOSURE

Post decommissioning environmental assessment shall be conducted upon completion of decommissioning activities with intent to record and evaluate the impacts from operations and decommissioning activities. It also serves to ascertain and record any environmental impacts from remaining structures left *in-situ.*

4.3.1 Onshore Facilities

For onshore facilities, Environmental Site Assessment (ESA) shall be conducted in accordance with the "DOE Contaminated Land Management Guideline No.2: Assessment and Reporting Contaminated Sites". The site assessment and management process is shown in Appendix 4.4. The ESA report shall be included in the Site Closure report. The table content of the report is shown in Appendix 4.5.

The Site Closure report shall be prepared upon completion of the decommissioning activities and submitted to DOE for endorsement. The Site Closure report shall determine performance standards for closure i.e. clean-closure or closure with condition. For site with contamination exceeding Site Screening Level ("SSL"), site-specific risk assessments should be carried out to determine appropriate clean-up level for soil and groundwater. Upon site closure endorsement from the DOE, the site will not subjected to Section 34A of the EQA. The table of content for the report is shown in Appendix 4.6.

4.3.2 Offshore Facilities

For offshore facilities, post-decommissioning environmental site survey/monitoring shall be conducted. The report shall be submitted to DOE (upon request) for information and a sample of the table of content is shown in Appendix 4.7.

5 DECOMMISSIONING ENVIRONMENTAL PLAN

Decommissioning Environmental Plan (DEP) is a site-specific plan developed to ensure that appropriate environmental management practices are followed during the decommissioning phases of an oil and gas facility. It include requirements for site closure and monitoring activities, which may be required during and after decommissioning activities are completed.

The preparation and implementation of DEP help to ensure that any potential environmental impacts caused by decommissioning activities are mitigated in accordance with the proposed mitigation actions.

DEP is intended for use by all personnel involved with decommissioning activities. Owner/Occupier shall prepare and submit DEP to DOE for endorsement prior any decommissioning activities. Decommissioning will not commence until endorsement received from DOE.

Following submission of the DEP, DOE may seek clarification or revisions to the DEP from the Owner/Occupier. Following endorsement of the DEP, DOE shall issue an official letter for decommissioning activities to commence at site.

The content of a DEP report may vary depending on the size and scope of the decommissioning activities. Recommended format and Table of Content for the DEP report is provided in Appendix 4.2. The following sub-sections describes the major sections in the DEP report.

	Chapter	Description
1.	**Introduction**	This decommissioning title shall include its specific location. This chapter shall contain at a minimum the following information: i. Name/Title of Decommissioning. ii. Name and contact details of Owner/Occupier: Contact person (of top management), address, telephone number, email address). iii. Name and contact details of DEP Preparer: Preparer team leader, address, telephone number, email address. iv. Location of the decommissioning site, including where applicable lot numbers, sub-district and district name v. Relevant maps showing project location and sensitive receptors. vi. Current and future land use map (for onshore facilities). vii. Brief overview of the decommissioning activities and schedule. viii. Objective and scope of DEP.
2.	**Regulatory Requirement and Company Policy**	To include Owner/Occupier corporate policy statement on environmental management and protection. In absence of such policy, the corporate HSSE policy is acceptable, provided it includes the requirement for environmental management and protection. At minimum to describe stakeholder consultation with relevant federal and state authorities. These authorities shall be engaged in a timely manner to avoid any delay in decommissioning execution.

	Chapter	Description
3.	**Decommissioning Organisation Structure**	Decommissioning Organisation Structure shall provide at minimum the organisation chart of the decommissioning teams with roles and responsibilities. The teams should include at minimum Owner/Occupier, main contractors and consultants involved in decommissioning activities. It should include the man-power allocation in the organisation chart.
4.	**Decommissioning and Site Closure Plan**	Description of decommissioning and site closure plan shall include: • Background of decommissioning site, its operation activities and description of facilities. For onshore facilities, to describe the adjacent land uses. • Brief decommissioning Strategy, Options, Method Statement, Environmental Mainstreaming, and 5S incorporation into the plan. Decommissioning plan shall describe the activities during execution phase (refer to typical activities described in Section 4), and materials/equipment to be decommissioned. From the activities, Owner/Occupier shall provide inventory of materials and wastes to be decommissioned, options for removal and disposal, and final selection of removal and disposal. This information should be used in the Waste Management Plan. Decommissioning schedule shall be provided for all phases from decision to decommission until site closure. Waste management plan shall include list of waste and sources, estimated waste volume, waste management method, waste receptor, and tracking of waste movement. The principle management of scheduled waste should be applied and described for the decommissioning activities. Site closure is the final stage of decommissioning activities. Owner/occupier shall provide commitment to ensure site is safe for closure and will not pose unacceptable risk to human health and environment. Site closure report shall be submitted upon completion of decommissioning activities.
5.	**Environmental Assessment**	This chapter shall describe the environmental assessment of existing operation and decommissioning activities (at all phases – pre, during and post decommissioning), and its mitigating measures and monitoring program. Periodic monitoring programme should be carried out for Decommissioning Execution Phase exceeding one year, based on assessment. Owner/occupier shall describe any EIA Conditions of Approval, written approvals/correspondences by authorities related to the decommissioning site.

	Chapter	Description
		Owner/Occupier shall provide, where applicable: • land-disturbing pollution prevention and mitigating measures (LD P2M2); • pollution prevention and mitigating measures including three functional areas namely Air, Wastewater and Waste; and • other best industrial practices such as industrial ecological concept.
6.	**Emergency Response Plan**	At minimum, the plan shall include: Name and contact details (mobile phone number, email address) of professional preparing the ERP and schedule for its preparation and submission to the DOE.

5.1 KEY ENVIRONMENTAL CONCERNS DURING DECOMMISSIONING ACTIVITIES

Depending on the facilities to be decommissioned, potential environmental concerns are as follow:

- Air emission and odour pollution management
- Noise and vibration management
- Wastewater management
- Marine pollution
- Waste and hazardous waste management, including radioactive substance
- Soil and groundwater contamination
- Erosion and sediment
- Impact to ecosystem and biodiversity
- Deterioration of materials left in place (aesthetic value)

List of potential environmental impacts for decommissioning activities is shown in Appendix 5.1.

6 WASTE MANAGEMENT

6.1 WASTE MANAGEMENT PLAN

Waste Management Plan (WMP) shall be established during pre-decommissioning phase to determine preferred or best waste management strategy. WMP shall be included in the DEP.

WMP shall include:

a. a list of wastes and their respective sources;
b. estimated waste volume to be generated throughout the duration of decommissioning phases;
c. waste management method e.g. reduction, reuse, recycling, recovery, treatment, disposal;
d. availability of site to accept the waste, market, service provider etc. for the waste.
e. tracking of waste movement adopting either the approach of cradle-to-cradle or cradle-to-grave.

The information required for preparation of WMP is as shown in Appendix 6.1. Circular economy principle (section 3.2.3) should be applied.

The principle management for wastes management in descending order of preference is described below and shown in Figure 6.1.

a. Elimination – the elimination of waste at source
b. Reduction – the generation of less waste through more efficient practices
c. Reuse – the use of materials or products that are reusable in their original form
d. Recycle – the conversion of wastes into usable materials
e. Recovery - the extraction of energy or material from wastes
f. Disposal and treatment

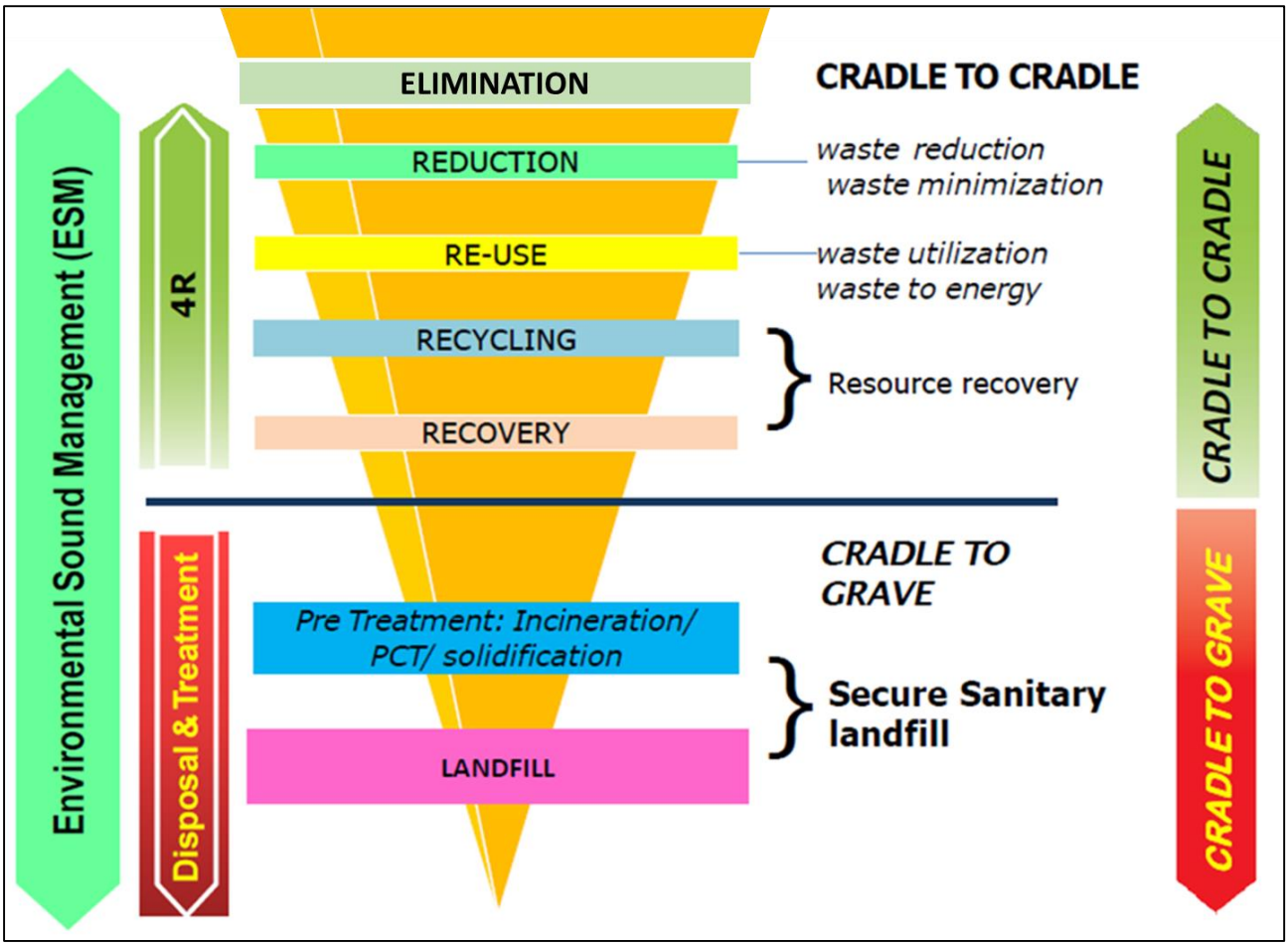


Figure 6.1 Waste Management Hierarchy

Waste management shall comply with (where applicable):

- Environmental Quality (Scheduled Wastes) Regulations 2005
- Atomic Energy Licensing Act, 1984.
- Akta Pengurusan Sisa Pepejal dan Pembersihan Awam, 2007 and local regulatory requirements domestic waste.

6.2 WASTE TYPES AND SOURCES

Typical waste types are generated from the following activities:

- Equipment Purging, Decontamination, Clean-Up of Equipment and Facility, Pipeline Pigging;
- Dismantle, Demolishing and Removal of Equipment, Facility and Structure;
    - Dismantling of major piping and valves and cablings;
    - Dismantling of major equipment;
    - Dismantling of undergrounds structures and trenches;
    - Demolishing of structure, raft foundations and pits;
    - Removal or disposal of marine growth on subsurface structures; and
    - Disposal of valuable scrap, materials, warehouse spares;
- Earthwork Activities.

Particular emphasis shall be given to the removal of:

i. Mercury (and other heavy metals) in sludge
ii. Explosive materials e.g. smoke signal from lifeboat
iii. Polychlorinated biphenyls (PCBs) in oils from capacitors, transformers and other electrical switchgear
iv. Hydrocarbon liquids / sludge and other hazardous materials
v. Lubricating oils from rotating equipment (pumps, compressors etc.)
vi. Asbestos containing materials in insulation, gaskets, packing, partition boards and cement roof sheets
vii. Pyrophoric iron scale in vessels and pipes, containing iron sulphides prone to spontaneous combustion (important to keep these wet).
viii. Low Specific Activity (LSA) contamination in scale and sludge, arising from Naturally Occurring Radioactive Material (NORM)

Typical waste type and sources during each decommissioning activities shown in Appendix 6.2.

6.3 WASTE MANAGEMENT OPTIONS

The selection of waste management options shall be made in accordance to waste management principle and based on assessment criteria; namely technical, health, safety, environment (HSE), feasibility, and cost.

6.3.1 Non-hazardous Waste

Based on waste management principles, non-hazardous wastes shall be managed through the following options:

i. Re-use of equipment or parts at different similar facilities;
ii. Re-use of equipment or parts for different purpose e.g. artificial reef, hotel, restaurant, aquaculture, platform for alternative energy station (for offshore structures);
iii. Sell to potential buyers;
iv. Donation of serviceable equipment;
v. Recycling of unserviceable equipment and uncontaminated or non-hazardous demolition wastes as scrap; and
vi. Disposal of dismantled unmarketable equipment or parts etc. as waste.

6.3.2 Hazardous/Scheduled Waste

Hazardous / Scheduled waste shall be managed in accordance to the waste management principle and relevant environmental regulations and conventions in Section 2.

7 EMERGENCY RESPONSE PLAN

This chapter outlines the requirements for the Emergency Response Plan (ERP) in providing guidelines on handling any emergency incidents that may potentially occur at decommissioning site. ERP shall be established and included in the DEP. The ERP should be based on existing ERP during operation, with Incident Action Plan (IAP) for specific credible scenarios/pollutant during decommissioning.

The objectives of the ERP are to ensure that immediate and appropriate actions are directed towards any emergency, which interrupts normal safe working conditions of the proposed activities in order the following to be addressed:

a) Risk and problems arising are dealt with utmost speed;
b) Emergency incident is kept under control and does not spread to adjacent facilities;
c) Minimize loss of life or injuries, property damage, environmental impairment and business interruption in the immediate and more distant environment of the proposed project; and
d) Basis for training and emergency preparedness for all personnel involved.

7.1 EMERGENCY RESPONSE PROCEDURES

The ERP shall cover response procedures for emergencies that may occur during decommissioning activity. At minimum, it shall consist of the following details:

a) Description of the Response Organization comprising structure, roles, responsibilities and decision-making authorities, as well as unified command with authorities.
b) Activations and Operations - Summary of equipment resources to be used to respond to particular condition or emergency, type of equipment, its capacity and location. The procedures also define each key person's duties, when and how the emergency equipment is to be employed, and the action to be carried out.
c) Notification and Communication System - notification criteria, reporting procedures and policies regarding government notification.
d) Evacuation Procedures - measures to evacuate personnel in the event of damage from severe weather, sea, erosion or other event.
e) On-Site First Aid medical support, MEDEVAC facilities and other emergency facilities such as survival equipment.
f) Public and Media Information – managing stakeholders (internal and external) and media including Standard Holding Statement (SHS).
g) Demobilisation – responsibilities, release priorities, decontamination requirements.
h) Declaration of Stand Down – the responsibility of declaration and post mortem requirement.
i) Post Emergency – re-entry precautions and evidence management.
j) Training in emergency response management to maintain a high level of preparedness at all times.

7.2 EMERGENCY SCENARIOS

The ERP shall spell out the procedures for all emergency situations and incidents that could occur due to natural causes, equipment or structural failure or human error. The emergency plan covers potential events/major hazards that may occur at or near the Project site. The list of potential events is:

- Fire or Explosion;
- Structural Failure;
- Personnel Injuries;
- Medical conditions/emergencies;

- Extreme weather condition;
- Gas leak;
- Bomb threat; and
- Spills of Oil and Hazardous Materials.

7.3 EMERGENCY RESPONSE ORGANIZATION

An Emergency Response Team (ERT) shall be set up to handle any emergency incidents. The roles of the ERT include:

a) Assess the emergency situation
b) To control or limit any effect that an emergency or potential emergency may have onsite or on neighboring areas
c) To facilitate emergency response and to provide such assistance on the site as is appropriate to the occasion
d) To prevent escalation of emergency situation
e) To provide a communication channel with local, regional and federal emergency response networks
f) To communicate all vital information with management and external responder at site
g) Conform to management and authorities' directive

7.4 EMERGENCY RESPONSE EQUIPMENT

In line with the ERP, an emergency response set-up shall be established. The emergency response set-up includes emergency reporting system, emergency response equipment and facilities. Emergency equipment should be ready on-site and regular inspection on this equipment is necessary. These include but not limited to:

a) Fire Fighting System e.g. portable wheeled fire extinguisher, fire hydrant, hose reel system, fire water pump, monitor
b) First aid e.g. first aid kit, stretcher, blankets
c) Oil spill equipment e.g. spill kit
d) Personal Protection Equipment (PPE) e.g. escape packs/face shields, self-contained breathing apparatus (SCBA), chemical protective suit, goggles, safety helmet, safety boots, PVC apron, dust mask, earplugs and others as appropriate
e) Emergency Communications e.g. telephone system, walkie-talkie, intercom system, alarm and detection systems

7.5 EMERGENCY REPORTING AND INVESTIGATION

Emergency reporting shall be established in a systematic manner inclusive of an investigation procedure for appropriate response action to avoid recurrence of similar incident. All incident reports and lesson learnt are to be shared for continuous improvement.

7.6 TRAINING AND AWARENESS PROGRAMMES

Emergency preparedness training is required for personnel assigned to handle an emergency. Training program including drills and exercises should be established and maintained for ERT. The types of training include fire control, the use of fire extinguisher, spill kit, first aid, etc. Refresher training should be conducted continuously to maintain the competency of the ERT. The best method to evaluate an

emergency response plan is to conduct drills, by simulating an emergency with several observers to watch and record personnel performance in the drills. Drills are excellent training aids. Drills can also pinpoint any weaknesses in the emergency response plan for improvements.

7.7 REVIEW AND UPDATE OF ERP

The ERP shall be reviewed and revised from time-to-time. Continuous review for improvements is to ensure sustained effectiveness and up-to-date ERP, aligned with any changes to the Company standards and/or relevant regulations.

7.8 OIL SPILL CONTINGENCY PLAN

The Oil Spill Contingency Plan ("OSCP") is intended to cover response to oil spill associated with the decommissioning activity, and is part of ERP. In the event of an oil spill, the OSCP shall be implemented in accordance with National Oil Spill Contingency Plan.

8 SUBMISSION OF DOCUMENTS TO DOE

The owner or occupier shall submit the relevant reporting listed in **Table 8.1**.

Table 8.1 List of submission to the DOE

No	Document Title	When to Submit	Remarks
1	Notification Letter and Decommissioning Environmental Plan (DEP)	Pre-Decommissioning Phase. At least six months prior to Decommissioning Execution Phase.	To seek endorsement from the DOE. Note: For Upstream, endorsement/feedback through PETRONAS.
2	Environmental Monitoring	Decommissioning Execution Phase.	Periodic monitoring programme applicable for decommissioning execution phase exceeding one year.
3	Environmental Site Assessment (ESA) For onshore facilities)	Post Decommissioning Phase.	For Offshore Facilities – post decommissioning environmental monitoring/survey (submission to DOE upon request).
4	Site Closure Report	Post Decommissioning Phase. Owner/Occupier to specify timeline for post decommissioning environmental monitoring/survey.	To seek endorsement for site closure from DOE (applicable for onshore facility)

9 REFERENCES

1. DOE. Guidance Document for Preparation and Submission of Environmental Management Plan (EMP).
2. DOE. Contaminated Land Management and Control Guideline No.1 – No.3 Year 2009.
3. Atomic Energy Licensing Board (AELB). 1996. Guidelines on Radiological Monitoring for Oil and Gas Facilities Operators Associated with Technologically Enhanced Naturally Occurring Radioactive Materials (TENORM).
4. Atomic Energy Licensing Board (AELB). 2009. Code of Practice on Radiation Protection Relating to Technologically Enhanced Naturally Occurring Radioactive Materials (TENORM) in Oil and Gas Facilities.
5. Atomic Energy Licensing Board (AELB). 2009. Guidelines for Decommissioning of Facilities Contaminated with Radioactive Materials.
6. Department of Occupational Safety and Health (DOSH). 2011. Guidelines on Mercury Management in Oil and Gas Industry.
7. Department of Energy and Climate Change (DECC). 2011. Guidance Notes on Decommissioning of Offshore Oil & Gas Installations and Pipelines under Petroleum Act 1998, Aberdeen, UK.
8. International Association of Oil & Gas Producer (OGP). 2012. Decommissioning of Offshore Concrete Gravity Based Structures (CGBS) in the OSPAR Maritime Area / Other Global Regions, Report No. 484. London, UK.
9. ASCOPE Decommissioning Guideline
10. Thailand Decommissioning Guidelines for Upstream Installations.
11. National Guidelines for Decommissioning Industrial Site, Canadian Council of Ministers of the Environment
12. Guidelines for Decommissioning, Abandonment and Restoration of the Oil and Gas Industry Assets in Brunei Darussalam (September 2009)
13. OECD UK Dec 2016 (https://www.lexology.com/library/detail.aspx?g=06ad2b58-2646-4cbf-9c5f-f5de60145a41)
14. http://www.dmp.wa.gov.au/Documents/Petroleum/PET-DecommissioningGuideline.pdf
15. Oil and Gas Industry Guidance on Voluntary Sustainability Reporting, 2015 http://www.ipieca.org/media/1404/reporting_guidance_3rd_editn_lr_endorsement.pdf)
16. Guided Self-Regulation Approach on the Hazardous Waste Management in Malaysia, Mr. Zaidi Mohamed, Principal Assistant Director Environment Institute Of Malaysia (EiMAS) DOE, MoNRE. For Strategies and Practices for Water Pollution Enforcement Workshop, November 8-10 2016 Taiper, R.O.C (Taiwan).

APPENDIX 1.1: SAMPLE OF NOTIFICATION LETTER TO THE DOE

Ref : XX-XXX

Tarikh

Pengarah,
Jabatan Alam Sekitar,
(Alamat Jabatan Alam Sekitar)

Tuan,

MAKLUMAN UNTUK PEMBERHENTIAN OPERASI DAN KERJA-KERJA "DECOMMISSIONING" UNTUK LOJI (NAMA SYARIKAT/LOJI)

Merujuk kepada perkara di atas, pihak kami ingin memaklumkan kepada pihak Jabatan Alam Sekitar (JAS) berkenaan pemberhentian operasi dan kerja-kerja *decommissioning* untuk loji (Nama Syarikat/Loji).

2. Kerja-kerja *decommissioning* dijangka akan bermula dari (Tarikh) sehingga selesai pada (Tarikh). Lokasi Tapak Loji (berserta Lattitud dan Longtitud yang menggunakan peta yang dibenarkan oleh JAS) adalah seperti berikut: XXXXX.

3. Sekiranya pihak tuan mempunyai sebarang pertanyaan berkenaan dengan perkara ini, sila hubungi XX/XX (Tel: XX/XX).

Sekian, terima kasih.

bp (Nama Syarikat)

(NAMA)
Pengurus Besar/Ketua Pegawai Eksekutif

Sk:
1. Ketua Pengarah JAS Putrajaya
2. Pengarah JAS Negeri

APPENDIX 3.1: TYPICAL METHOD STATEMENT FOR DISMANTLING AND DECOMMISSIONING OF OFFSHORE FACILITIES

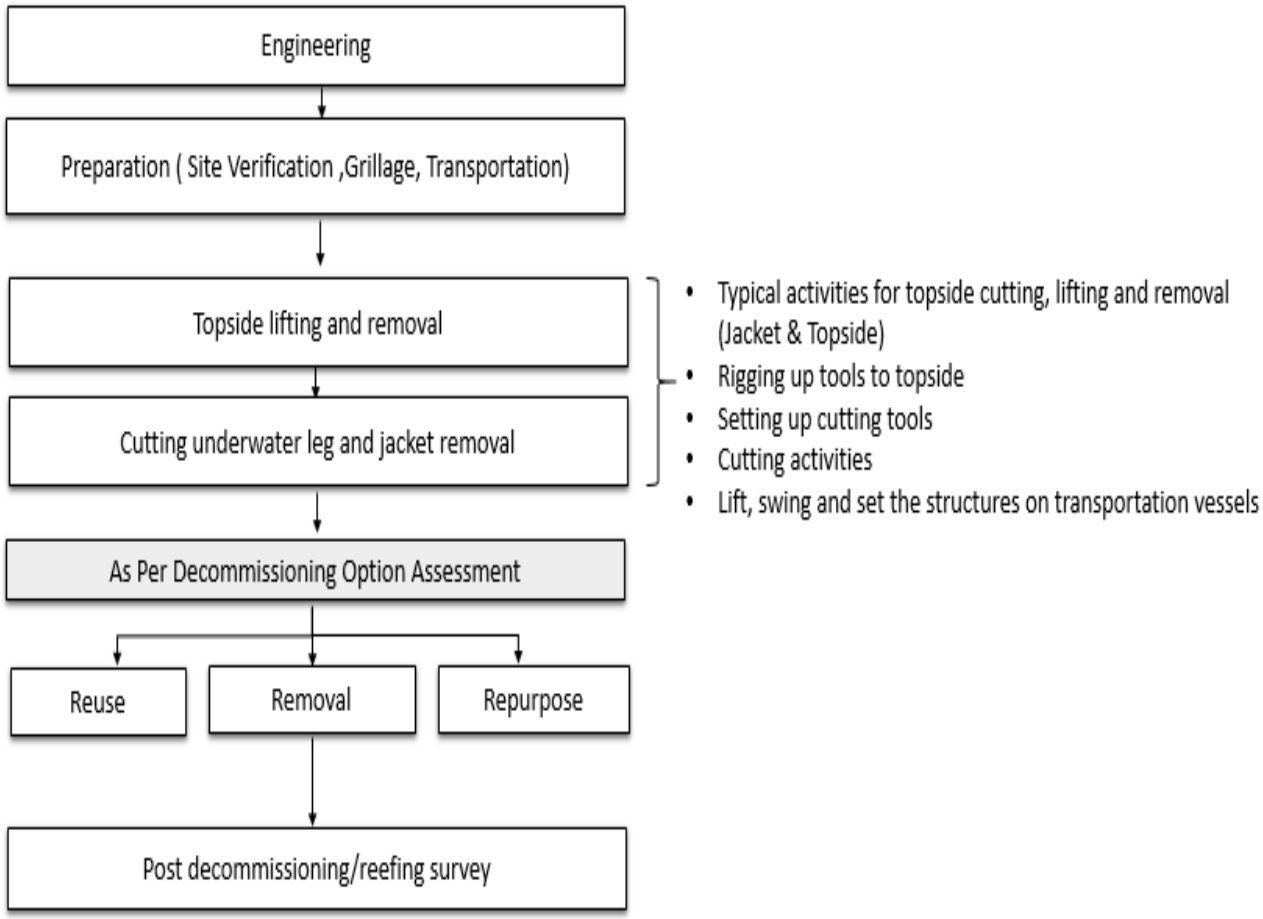
Dismantling and Decommissioning involve these activities:

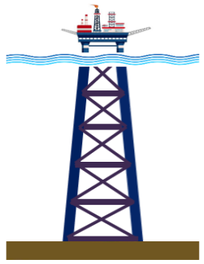
a) Engineering: Preparation on engineering for the dismantling and decommissioning

b) Preparation (Site verification, grillage and transportation): Preparation includes Marine Spread preparation, logistic support, trial cut for cutting tools and pre-qualification process for welders

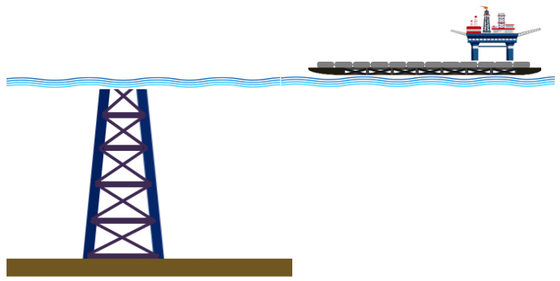
c) Topside and jacket lifting and removal: Topside and jacket removal options include removal by a crane vessel or alternative lifting system in one piece or in multiple lifts, piece small or piece medium removal using hydraulic shears and other cutting techniques to dismantle the topsides and/or jacket offshore in small or medium size pieces. The pieces are then loaded into standard cargo containers to the final destination according to the decommissioning options that has been approved.

Chart below shows the process of activities involved during the dismantling and decommissioning.

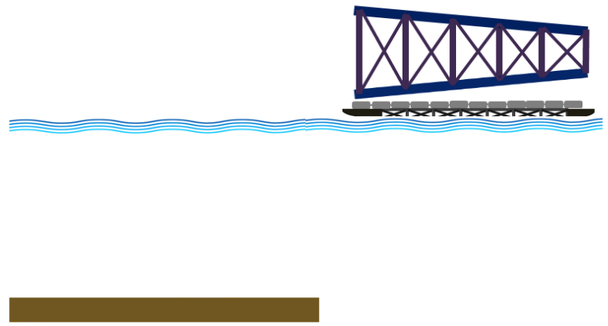




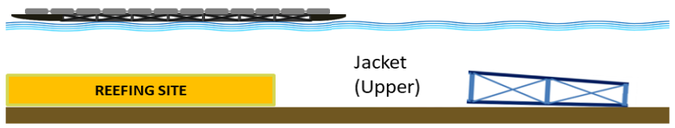
Method Statement for Dismantling and Decommissioning
Sequence 1 – Cutting Topside Leg.



Method Statement for Dismantling and Decommissioning
Sequence 2-Topside Removal.
Sequence 3- Underwater Jacket leg Cutting



Method Statement for Dismantling and Decommissioning
Sequence 4- Jacket Removal



Method Statement for Dismantling and Decommissioning
Sequence 5a- Transportation to Reefing Site

Method Statement for Dismantling and Decommissioning
Sequence 5b- Transportation to Onshore

Figure A3.1: Illustration of Method Statement for Dismantling and Decommissioning for Offshore Facilities.

APPENDIX 3.2: ILLUSTRATION OF CIRCULAR ECONOMY

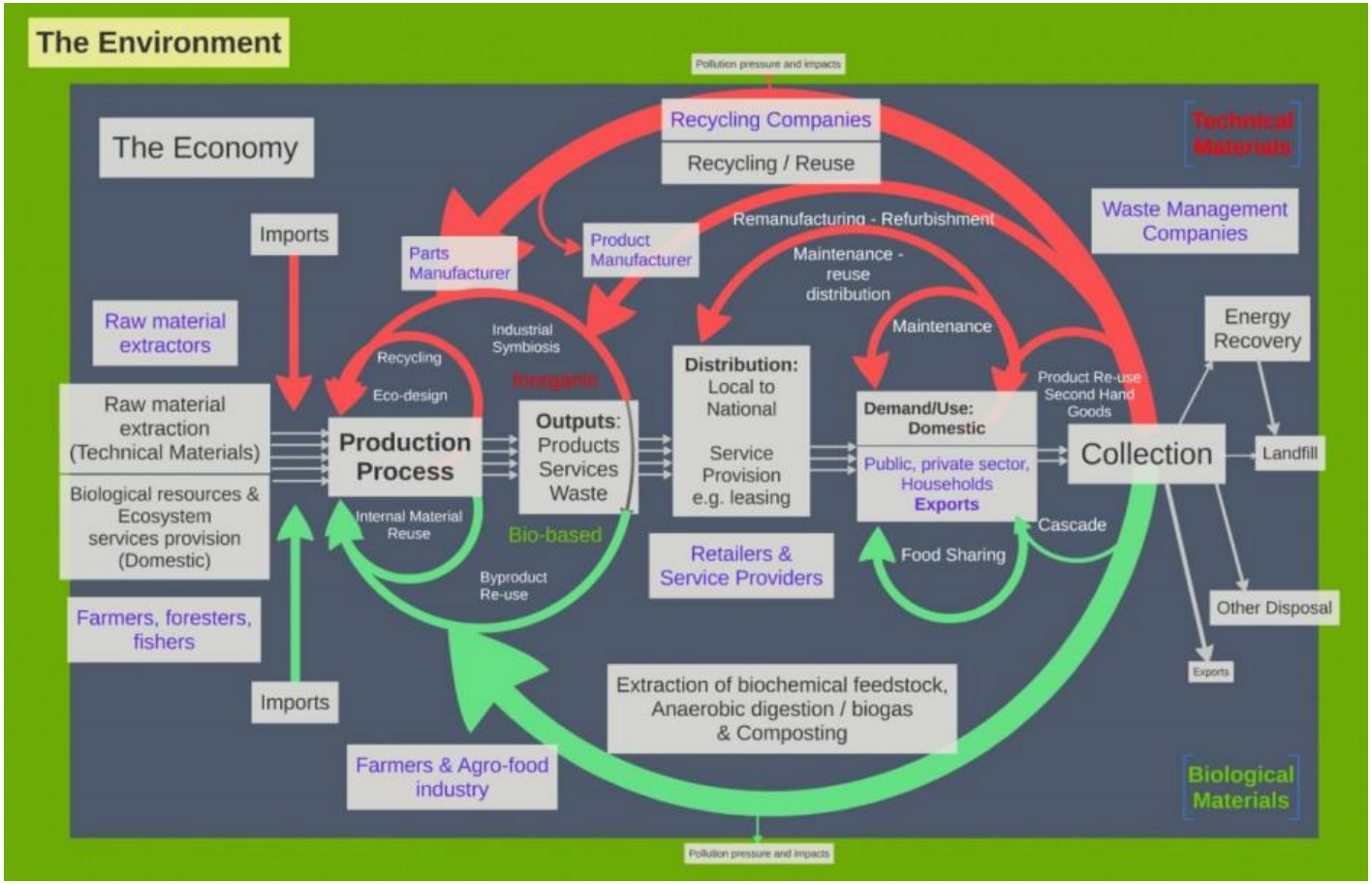


Figure A 3.2 (i): Example of simplified circular economy concept

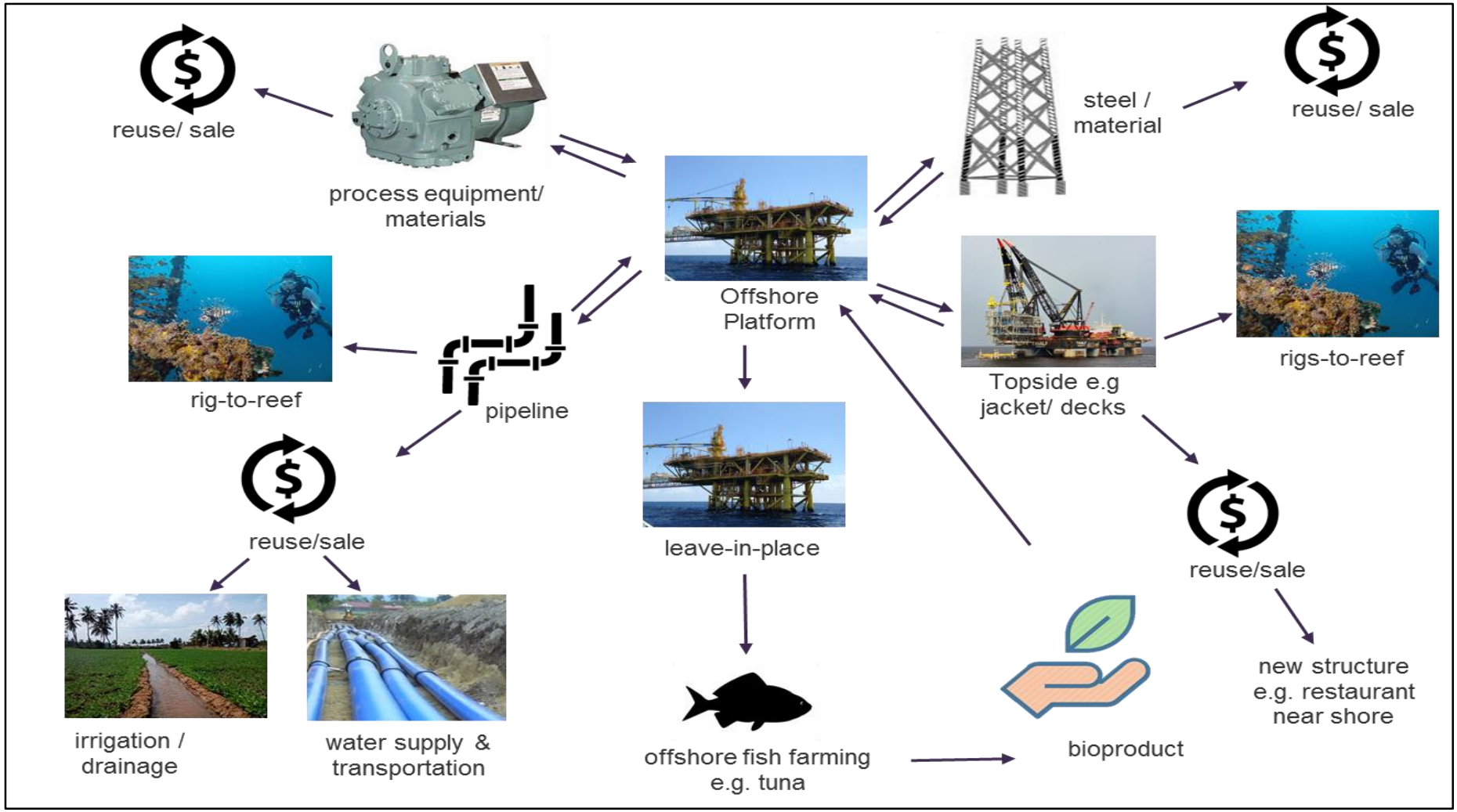


Figure A.3.2 (ii) Example of simplified circular economy for offshore platform decommissioning

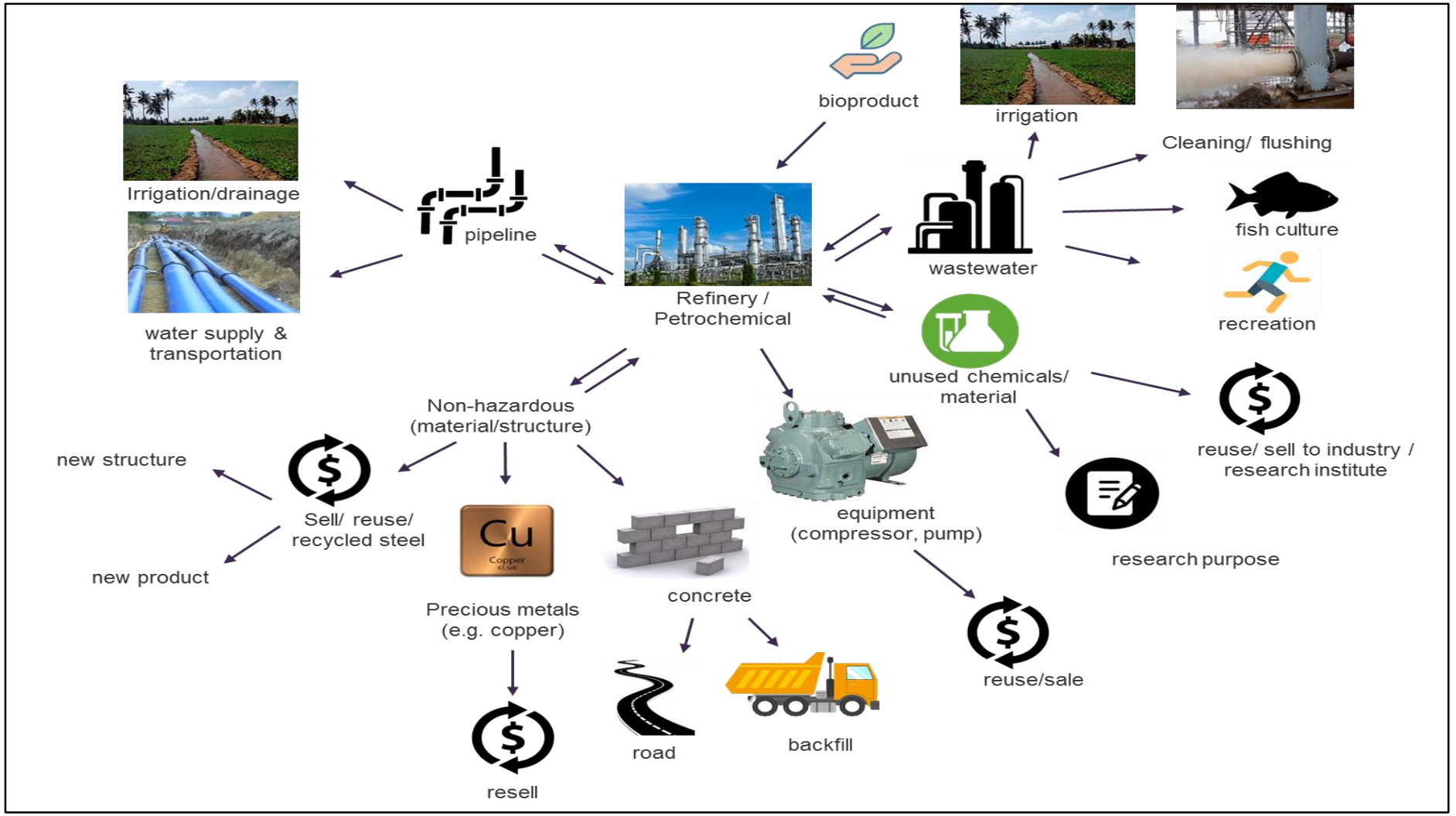


Figure A.3.2 (iii) Example of simplified circular economy for refinery plant decommissioning

APPENDIX 3.3: EXAMPLE OF 5S TOOL APPLICATION FOR DECOMMISSIONING ACTIVITIES of A PETROCHEMICAL PLANT

1) SORT

The following identification and listing shall be conducted:

i) Equipment for decontamination.
ii) Emission to air.
iii) Discharges to water, soil and ground water.
iv) Unused chemicals and product.
v) Scheduled Waste.
vi) Marketable used equipment/facility.
vii) Scrap.

2) SET IN ORDER

The following documents shall be prepared:

i) Decomm Environmental Policy (Environmental Mainstreaming Self - Regulation (SR)
ii) Establish EPMC (Environmental Performance Monitoring Committee) and ERCMC(Environmental Regulatory Compliance Monitoring Committee. (SR)
iii)Waste labelling / inventory.
iv) Implementation of Decommissioning Plan.
v) Environmental Management Plan including assessment of three functional area (Air, Water, Waste).
vi) Locate the coordinates of potential sources of contamination on plot plan.
vii)Identification of underground utilities that may be left for future use and update site drawing.

3) SHINE

i) Housekeeping
1) Air
a) All machineries shall be maintained and serviced.
b) No open burning
2) Waste
a) Recyclable – Waste oil, scrap metals and other recyclables shall be sent to approved recyclers.
b) Domestic Waste shall be sent to approved landfill.
c) Scheduled Waste (Contaminated Rags, Discarded Drums) shall be sent to Kualiti Alam.
3) Water and Soil
a) Leakage or spillage shall be avoided.
b) Drip pans for generator sets shall be installed to contain spillage.
c) Spill kit shall be used to contain and clean up minor spillages for machineries.
d) All spillage shall be recorded.
ii) Site walkabout / site surveillance shall be conducted.
iii) Debris from dismantling activities shall be removed.
iv) Site levelling location shall be identified.
v) Competent Person shall be appointed.
(Environmental Mainstreaming Self -Regulation (SR)

4) STANDARDIZATION

The following Standard Operating Procedures (SOP) shall be established/reviewed/updated to EMC:

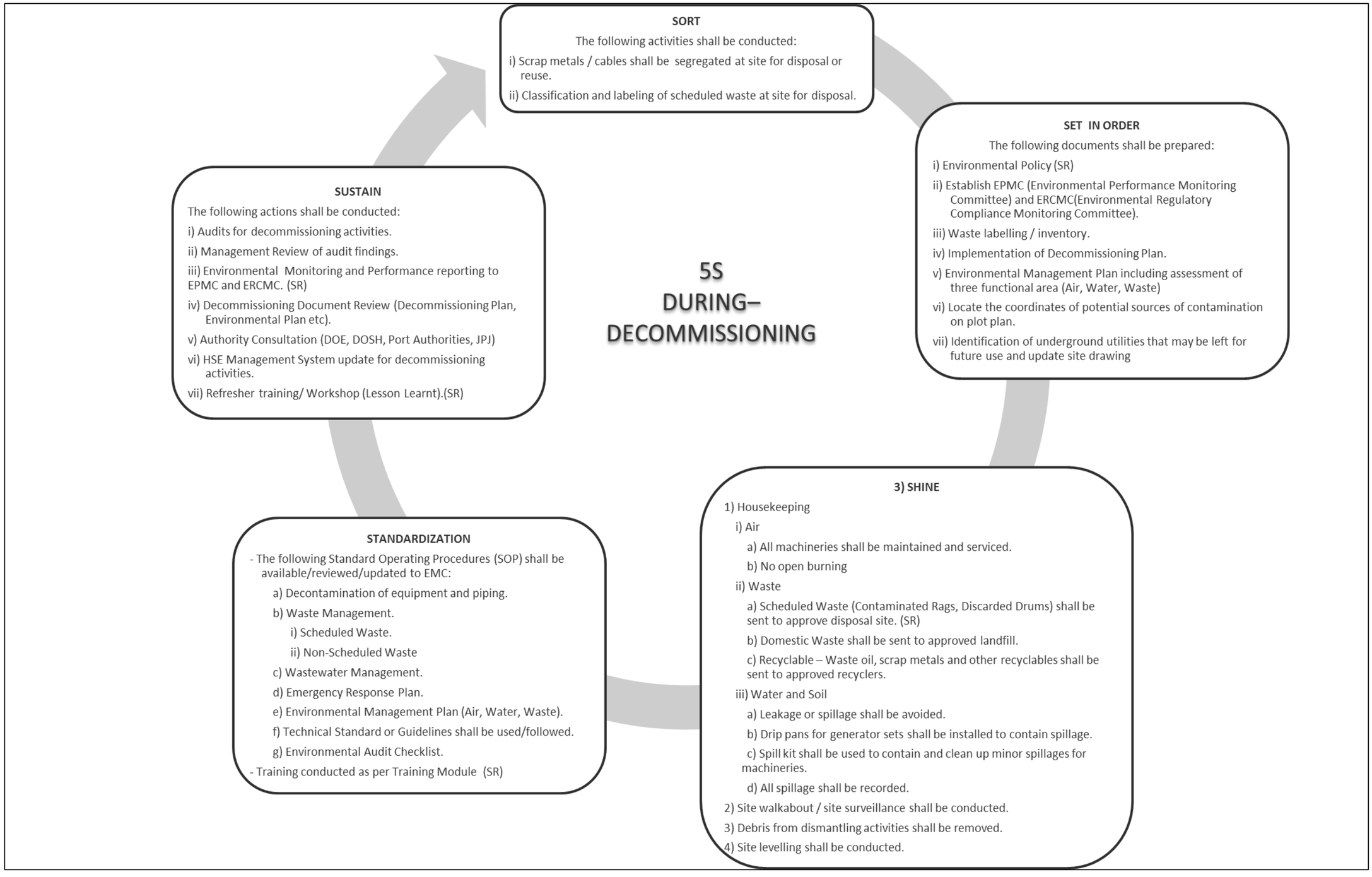
a) Decontamination of equipment and piping.
b) Waste Management.
i) Scheduled Waste.
ii) Non-Scheduled Waste
c) Wastewater Management.
d) Emergency Response Plan.
e) Environmental Management Plan (Air, Water, Waste).
f) Guideline (Technical Standard and Guidelines to be used/followed).
g) Checklist (Environmental Audit Checklist)
h) Training Module (SR)

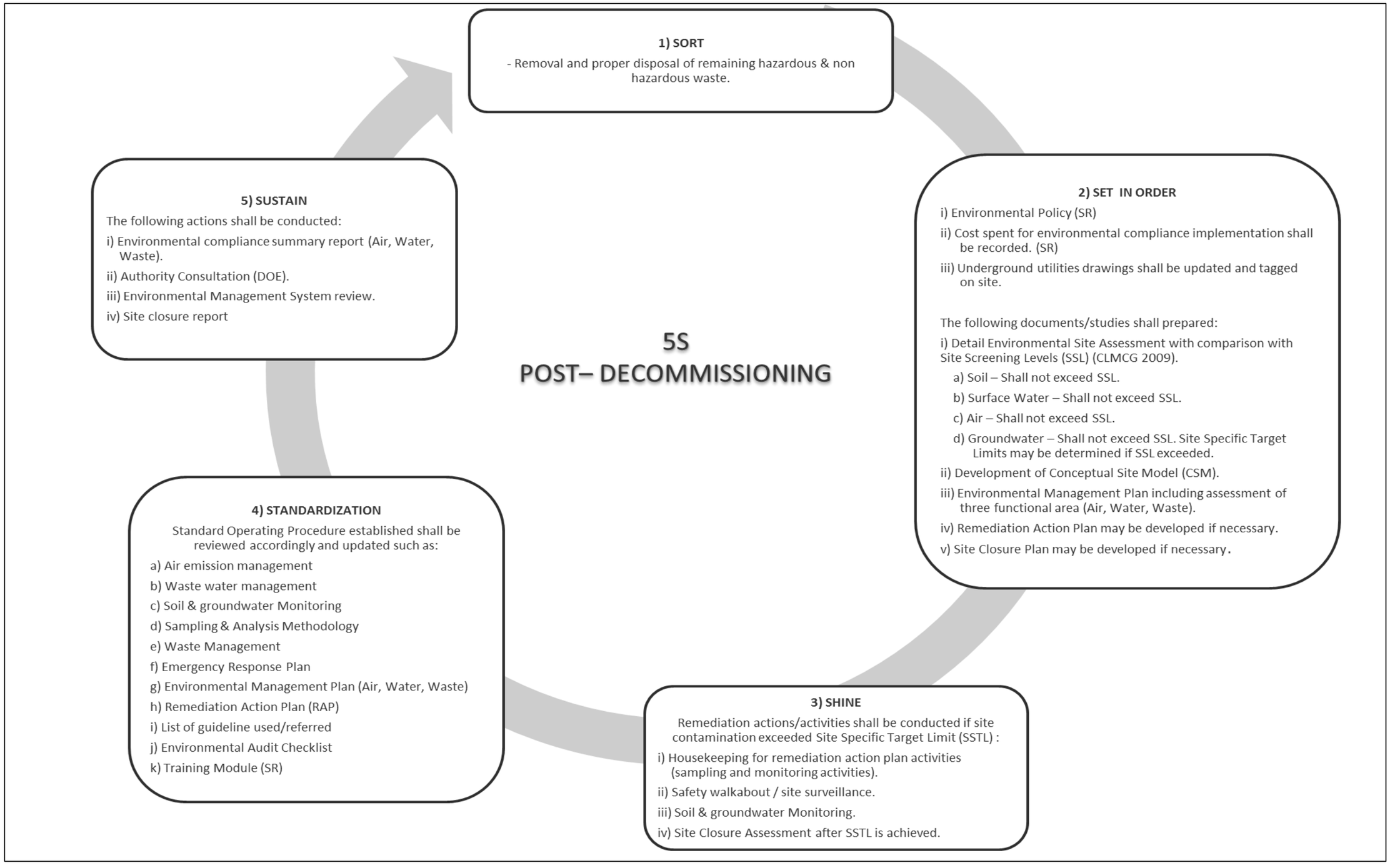
5) SUSTAIN

The following actions shall be conducted:

i) Audits for decommissioning activities.
ii) Management Review of audit findings.
iii) Environmental Monitoring and Performance reporting to EPMC and ERCMC. (SR)
iv) Decommissioning Document Review (Decommissioning Plan, Environmental Management Plan etc).
v) Authority Consultation (DOE, DOSH, Port Authorities, JPJ.
vi) HSE Management System update for decommissioning activities.
vii) Refresher training/ Workshop (Lesson Learnt).(SR)

5S
PRE– DECOMMISSIONING


5S
DURING–
DECOMMISSIONING
SORT
The following activities shall be conducted:
i) Scrap metals / cables shall be segregated at site for disposal or reuse.
ii) Classification and labeling of scheduled waste at site for disposal.
SET IN ORDER
The following documents shall be prepared:
i) Environmental Policy (SR)
ii) Establish EPMC (Environmental Performance Monitoring Committee) and ERCMC(Environmental Regulatory Compliance Monitoring Committee).
iii) Waste labelling / inventory.
iv) Implementation of Decommissioning Plan.
v) Environmental Management Plan including assessment of three functional area (Air, Water, Waste)
vi) Locate the coordinates of potential sources of contamination on plot plan.
vii) Identification of underground utilities that may be left for future use and update site drawing
3) SHINE
1) Housekeeping
i) Air
a) All machineries shall be maintained and serviced.
b) No open burning
ii) Waste
a) Scheduled Waste (Contaminated Rags, Discarded Drums) shall be sent to approve disposal site. (SR)
b) Domestic Waste shall be sent to approved landfill.
c) Recyclable – Waste oil, scrap metals and other recyclables shall be sent to approved recyclers.
iii) Water and Soil
a) Leakage or spillage shall be avoided.
b) Drip pans for generator sets shall be installed to contain spillage.
c) Spill kit shall be used to contain and clean up minor spillages for machineries.
d) All spillage shall be recorded.
2) Site walkabout / site surveillance shall be conducted.
3) Debris from dismantling activities shall be removed.
4) Site levelling shall be conducted.
STANDARDIZATION
- The following Standard Operating Procedures (SOP) shall be available/reviewed/updated to EMC:
a) Decontamination of equipment and piping.
b) Waste Management.
i) Scheduled Waste.
ii) Non-Scheduled Waste
c) Wastewater Management.
d) Emergency Response Plan.
e) Environmental Management Plan (Air, Water, Waste).
f) Technical Standard or Guidelines shall be used/followed.
g) Environmental Audit Checklist.
- Training conducted as per Training Module (SR)
SUSTAIN
The following actions shall be conducted:
i) Audits for decommissioning activities.
ii) Management Review of audit findings.
iii) Environmental Monitoring and Performance reporting to EPMC and ERCMC. (SR)
iv) Decommissioning Document Review (Decommissioning Plan, Environmental Plan etc).
v) Authority Consultation (DOE, DOSH, Port Authorities, JPJ)
vi) HSE Management System update for decommissioning activities.
vii) Refresher training/ Workshop (Lesson Learnt).(SR)


1) SORT
- Removal and proper disposal of remaining hazardous & non hazardous waste.
2) SET IN ORDER
i) Environmental Policy (SR)
ii) Cost spent for environmental compliance implementation shall be recorded. (SR)
iii) Underground utilities drawings shall be updated and tagged on site.
The following documents/studies shall prepared:
i) Detail Environmental Site Assessment with comparison with Site Screening Levels (SSL) (CLMCG 2009).
a) Soil – Shall not exceed SSL.
b) Surface Water – Shall not exceed SSL.
c) Air – Shall not exceed SSL.
d) Groundwater – Shall not exceed SSL. Site Specific Target Limits may be determined if SSL exceeded.
ii) Development of Conceptual Site Model (CSM).
iii) Environmental Management Plan including assessment of three functional area (Air, Water, Waste).
iv) Remediation Action Plan may be developed if necessary.
v) Site Closure Plan may be developed if necessary.
3) SHINE
Remediation actions/activities shall be conducted if site contamination exceeded Site Specific Target Limit (SSTL) :
i) Housekeeping for remediation action plan activities (sampling and monitoring activities).
ii) Safety walkabout / site surveillance.
iii) Soil & groundwater Monitoring.
iv) Site Closure Assessment after SSTL is achieved.
4) STANDARDIZATION
Standard Operating Procedure established shall be reviewed accordingly and updated such as:
a) Air emission management
b) Waste water management
c) Soil & groundwater Monitoring
d) Sampling & Analysis Methodology
e) Waste Management
f) Emergency Response Plan
g) Environmental Management Plan (Air, Water, Waste)
h) Remediation Action Plan (RAP)
i) List of guideline used/referred
j) Environmental Audit Checklist
k) Training Module (SR)
5) SUSTAIN
The following actions shall be conducted:
i) Environmental compliance summary report (Air, Water, Waste).
ii) Authority Consultation (DOE).
iii) Environmental Management System review.
iv) Site closure report
5S
POST– DECOMMISSIONING

APPENDIX 4.1: EXAMPLE OF DECOMMISSIONING OPTIONS FOR OFFSHORE FACILITIES

Typical facility decommissioning options:

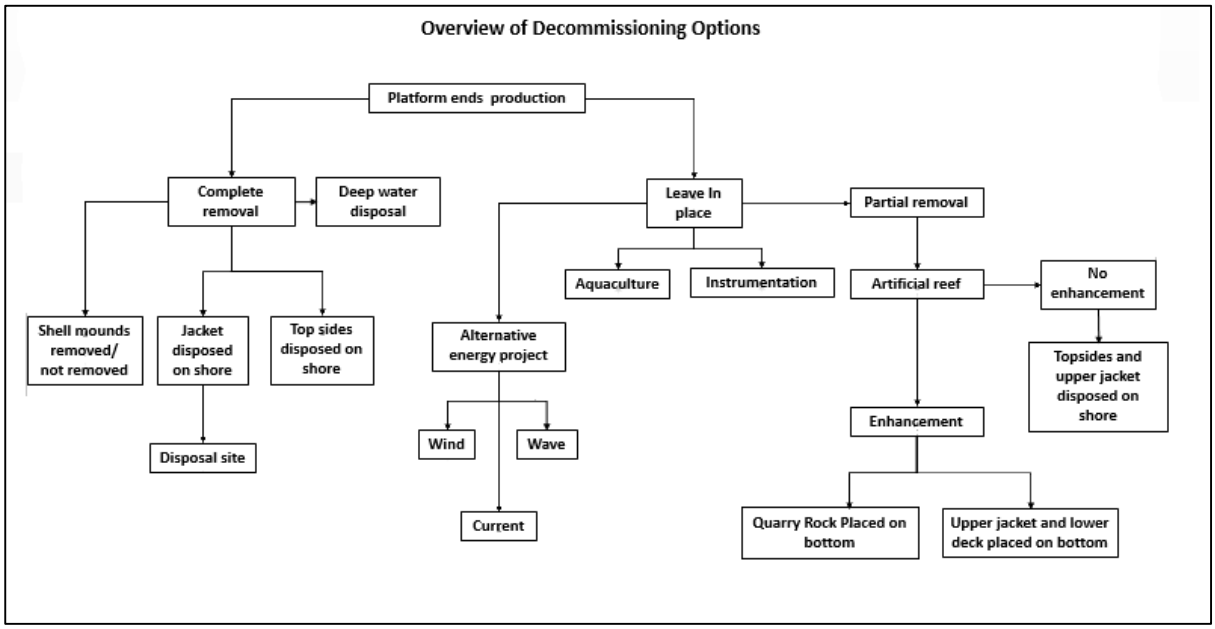


Figure A4.1-1 Decommissioning Options

Source: http://www.dmp.wa.gov.au/Documents/Petroleum/PET-DecommissioningGuideline.pdf

Common decommissioning options on offshore facilities practised worldwide are summarised below:

Re-use of installation

Re-use installation (or parts of) for oil and gas production offshore in another location. Most of the jackets and structures are most likely to have reached the end of their design life upon decommissioning phase, thus making re-use unlikely. However, certain plant and equipment (e.g. compressors) may be available for sale and/or re-use.

Recycling

Clean and bring installations (or parts of) onshore. Break them up into scrap for recycling. Identify recycling options are nearest to site.

Disposing as Waste on Land

Clean and bring installations (or parts of) onshore. Dispose of them in licensed, permanent waste disposal sites. Operation of dismantling and transport to shore needs careful consideration to ensure health and safety risks are controlled and well managed.

Emplacement / Toppling on Site

The topside can be stripped out and/or the jacket is toppled to the seabed at its piled location. This requires a high degree of confidence in the mechanism and control to ensure toppling occurs as planned. Clean the installation. Either place the sections removed from the installations on the seabed close to the lower part of the jacket; or topple part of the installation onto the seabed. Leave a minimum clear water depth of 55 m from the surface of the sea to the remains (unless designated as an artificial reef).

Leave in Place

This option is only to be practised for deferral cases and is not an option for permanent abandonment. Clean the installation. Make safe and maintain it. Leave in place to enable future re-use at the site or at an alternative site after total removal. Some steel structures may be temporarily mothballed in this way, but sufficient maintenance is essential to ensure integrity.

Artificial Reefs

Clean installation offshore. Place on the seabed to form artificial reef to encourage marine life. The future creation of artificial reefs when considered shall take into account the issue of residual liability. If an artificial reef is created, the structure must be clearly marked on admiralty charts.

Other Uses

Clean installation (or parts of) and use for other purposes, for example, as lighthouse, marine research centre, meteorological station, or possible site for alternative energy generation.

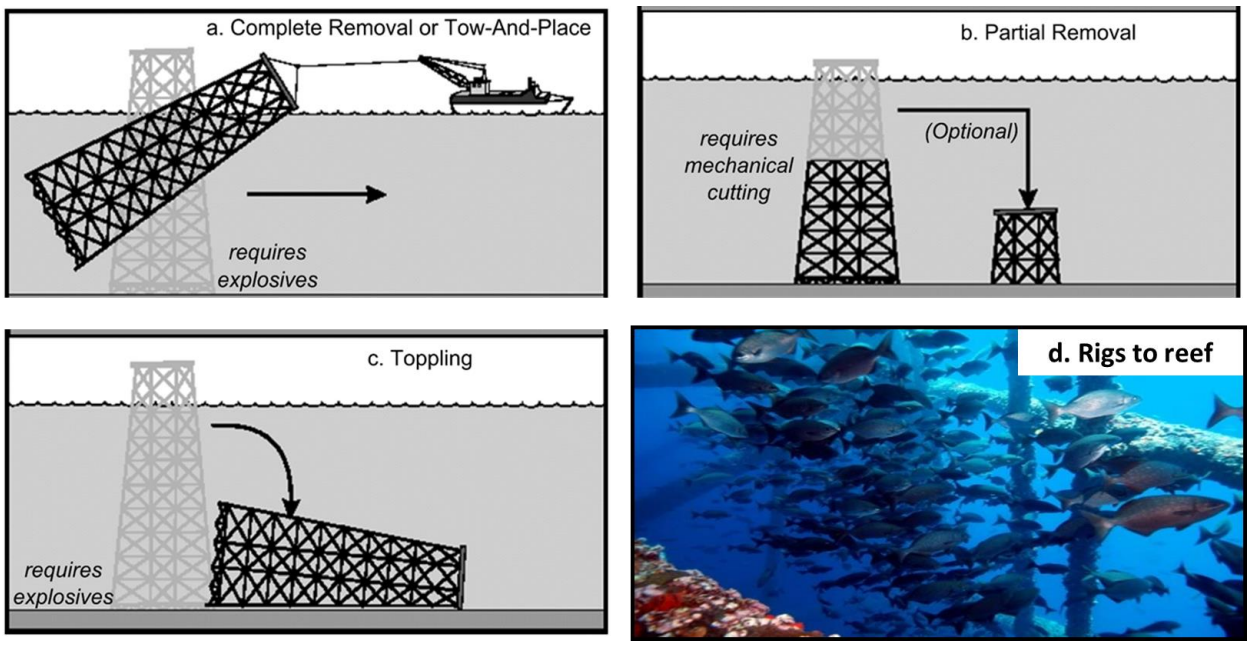


Figure A4.1-2 Illustration of some decommissioning options for offshore facilities.

APPENDIX 4.2: TYPICAL CONTENT OF DECOMMISSIONING ENVIRONMENTAL PLAN (DEP) REPORT

Owner/Occupier Declaration

1 INTRODUCTION

1.1 BACKGROUND
1.2 SITE LOCATION
1.3 DESCRIPTION OF THE FACILITIES TO BE DECOMMISSIONED
1.4 CURRENT AND POTENTIAL FUTURE LANDUSE (for onshore facilities)
1.5 OBJECTIVE AND SCOPE OF DEP
1.6 DECOMMISSIONING ENVIRONMENTAL PLAN PREPARER

2 REGULATORY REQUIREMENT AND POLICY

2.1 ENVIRONMENTAL REGULATORY REQUIREMENTS
2.2 ENVIRONMENT POLICY
2.3 STAKEHOLDER CONSULTATION
2.4 DECOMMISSIONING METHOD STATEMENT

3 DECOMMISSIONING ORGANIZATIONAL STRUCTURE

3.1 ORGANIZATIONAL STRUCTURE AND ROLES & RESPONSIBILITIES
- *DECONTAMINATION*
- *DISMANTLE AND DISPOSAL*
- *ENVIRONMENT/GSR (EPCMC, ERCMC)*
- *ENVIRONMENTAL SITE ASSESSMENT, REMEDIATION (for on shore facilities) AND SITE CLOSURE*

3.2 [*Any other additional organization structure involved in decommissioning activities]*

4 DECOMMISSIONING AND SITE CLOSURE PLAN

4.1 DECOMMISSIONING DESCRIPTION AND STRATEGY
- STRATEGY
- DECOMMISSIONING OPTIONS
- 5S CONCEPT
- DECOMMISSIONING PLAN
  - DESCRIPTION OF DECOMMISSIONING ACTIVITIES
  - DESCRIPTION OF ITEMS TO BE DECOMMISSIONED
  - INVENTORY OF MATERIALS AND WASTES
  - DETAILED PROJECT IMPLEMENTATION SCHEDULE

4.2 WASTE MANAGEMENT PLAN
4.3 SITE CLOSURE PLAN

5 ENVIRONMENTAL ASSESSMENT

5.1 ENVIRONMENT ASSESSMENT OF EXISTING OPERATION
5.2 ENVIRONMENT ASSESSMENT OF DECOMMISSIONING ACTIVITIES including mitigation measures and audit/monitoring program
5.3 EIA CONDITIONS OF APPROVAL
5.4 APPLICABLE STANDARDS AND REGULATIONS
5.5 EXISTING WRITTEN APPROVALS / CORRESPONDENCES BY AUTHORITIES
5.6 POLLUTION PREVENTION AND MITIGATION MEASURES (P2M2)

- LAND DISTURBING P2M2 FOR ONSHORE FACILITY (WHERE APPLICABLE)
- AIR POLLUTION AND NOISE CONTROL
- WATER POLLUTION CONTROL
  - Marine water and seabed environmental monitoring/survey (offshore facilities)
  - Soil, surface water and groundwater monitoring (onshore facilities)
- MATERIAL AND WASTE MANAGEMENT
  - Raw materials
  - Solid waste
  - Scheduled / Hazardous waste / Radioactive waste
  - Biomass / earth / marine growth
  - Spoils/Dredge materials/Construction wastes
  - Housekeeping measures following best practices e.g. 5S

6 EMERGENCY RESPONSE PLAN (ERP)

The ERP shall provide name and contact details (mobile phone number, e-mail address) of the professional tasked to prepare the ERP and the schedule for its preparation and submission to DOE.

7 CONCLUSION

8 DEP Preliminary Pages

Declaration and Checklist

DEP preliminary pages shall include the Environmental Pledge by top management of Owner/Occupier, and Declaration by the DEP Preparer. The declaration shall be type written on the official letterhead of the Owner/Occupier as follow:

Owner/Occupier:

I hereby declare that the entire DEP Report and the accompanying facts and information are 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 pollution prevention and mitigation measures (P2M2s) described in the Report. I have allocated sufficient funds for the above purpose.

Name of Owner/Occupier:
National Registration Identification Card (NRIC) Number:
Designation:
Signature: Date:
Company stamp:

DEP Preparer:

Declaration by Team Leader of DEP Preparer
"I hereby confirm that the entire DEP Report were completed by a team of experts in their respective fields. I shall be accountable to the recommendations based on technical evaluation and information provided by the Owner/Occupier.

Name of DEP Preparer Team Leader:
National Registration Identification Card (NRIC) Number:
Designation:
Signature: Date:
Company stamp:

Functional Areas	Name of Expert	Signature and date
Air Pollution	Ali bin Muthu	
Wastewater	Wati binti Kassim	
Waste	Indra bin Man	

This checklist is intended to assist DEP Preparer during submission of DEP, and shall be attached with DEP.

	Notes
Decommissioning Title	To insert title
Name and Details of Owner/Occupier	To insert name and details
Name and Details of DEP Preparer	To insert name and details – Team Leader only
Decommissioning overview and schedule	Incorporated in page xx of the DEP
Decommissioning Organisation Structure, including decommissioning executor	Incorporated in page xx of the DEP
Brief decommissioning and site closure plan	Incorporated in page xx of the DEP
Environmental assessment	Incorporated in page xx of the DEP
Recommended pollution prevention and mitigation measures and EIA Conditions of Approval	Incorporated in page xx of the DEP
Environmental monitoring, if required	Incorporated in page xx of the DEP
Emergency Response Plan	Incorporated in page xx of the DEP

APPENDIX 4.3: TYPICAL CONTENT OF ENVIRONMENTAL MONITORING REPORT (where applicable).

The Environmental Monitoring Report shall cover:

1. Introduction
2. Decommissioning work description and overall current progress update
3. Objective of environmental monitoring
4. Scope of monitoring in accordance to recommendation in DEP.
   (A) Onshore decommissioning
      - Ambient air quality monitoring e.g. Particular Matter 10 Micron, Particular Matter 2.5 Micron and Total Suspended Particulate (TSP)
      - Boundary noise monitoring
      - Noise level measurement
      - Water quality monitoring e.g. surface water and groundwater
      - Soil quality monitoring

   (B) Offshore decommissioning
      - Seawater quality monitoring
      - Seabed sediment monitoring
      - Biological monitoring

5. Results, data interpretation including trending, analyses and discussion
6. Conclusion and recommendation
7. References
8. Appendices

APPENDIX 4.4: SITE MANAGEMENT AND ASSESSMENT PROCESS FLOW

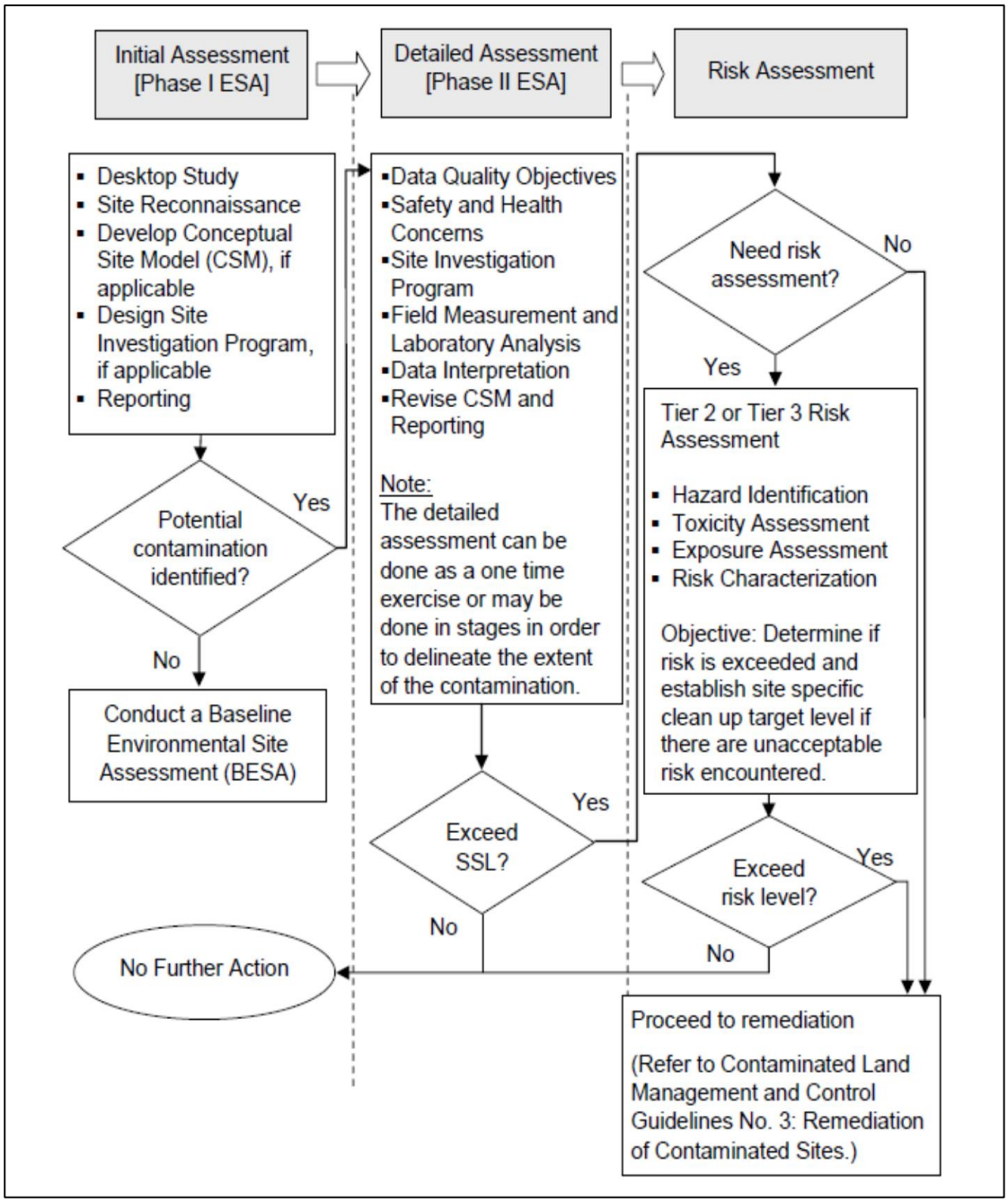


Figure A4.4-1 Site Management and Assessment Process Flow
(Source: DOE Contaminated Land Management Guideline, 2009)

APPENDIX 4.5: EXAMPLE OF TABLE OF CONTENT FOR ENVIRONMENTAL SITE ASSESSMENT (ESA) REPORT FOR DOWNSTREAM AND ONSHORE FACILITIES

List of Figures
List of Tables
List of Appendices
Abbreviations
Executive Summary

1. Introduction
    a. Background
    b. Objective
    c. Limitations of Report
    d. Consultant
2. Methodology
    a. Scope of Assessment
    b. Deviation from Work Plan
    c. Field Methodology
        i. Health and Safety
        ii. Field Activities
    d. Chemicals Analyses and Methods
        i. Field Quality Assurance/Quality Control Protocol
3. Project Description
    a. Site Setting
    b. Current Use of Site
        i. Site Operations
        ii. Distribution of Site Inventories
    c. Site History
    d. Adjacent Property Land Use
    e. Physical Setting
        i. Geology
        ii. Hydrogeology
    f. Potential Site Conditions
4. Environmental Historical Records and Regulatory Requirement
    a. Environmental Regulatory and Database Review
    b. Previous Environmental Assessments
    c. Aerial Photographs
5. Results and Discussions
    a. Evaluation and Results
    b. Subsurface Condition
        i. Soil Profile
        ii. Hydrogeological Setting
    c. Analytical Data
        i. Assessment Criteria
        ii. Soil Vapour Survey
        iii. Soil Sampling and Analytical Results
        iv. Groundwater Sampling and Analytical Results
        v. Surface Water Sampling and Analytical Results
        vi. Laboratory Data Validation
6. Conceptual Site Model

a. Conceptual Site Model (CSM)
b. Potential Sources
c. Potential Migration Routes and Exposure Pathways
d. Potential Transport Mechanisms and Exposure Pathways
e. Potential Receptors
f. Discussions of Findings

7. Conclusion and Recommendation
    a. Conclusions
    b. Recommendations (e.g. whether site is ready for closure, or further remediation and/or monitoring is required prior to closure).
8. References

APPENDIX 4.6: EXAMPLE OF TABLE OF CONTENT FOR CLOSE-OUT REPORT TABLE OF CONTENT FOR DOWNSTREAM AND ONSHORE FACILITIES

The Decommissioning Close-Out report shall cover:

List of Figures
List of Tables
List of Appendices
Abbreviations
Executive Summary

1. Introduction
    a. Background
    b. Objective
    c. Team Members
2. Legislation, Standards and Guideline applicable to the Project
3. Site Description
    a. Location and land use using approved maps.
    b. Facility description
        i. Process & Utility
        ii. Materials & Waste Management including Waste Management Plan (WMP)
        iii. Emission & Effluent
    c. Future Land Use
4. Plant Decommissioning Plan and Implementation
    a. Decommissioning Plan
    b. Decommissioning Options Assessment
    c. DEP
5. Existing Environmental Setting
    a. Topography
    b. Hydrology and Water Resources
    c. Ambient Air and Water Quality
    d. Emissions and Discharges
6. Site Closure Assessment - summary of ESA Findings and environmental monitoring results.
7. Conclusions & Recommendations
8. References
9. Appendices

APPENDIX 4.7: EXAMPLE OF TABLE OF CONTENT FOR POST DECOMMISSIONING ENVIRONMENTAL SURVEY REPORT FOR OFFSHORE FACILITIES

List of Figures
List of Tables
List of Appendices
Abbreviations
Executive Summary

1. Introduction
    a. Background
    b. Objective
    c. Limitations of Report
    d. Preparer
2. Project Description
3. Methodology of Environmental Monitoring/Survey
    a. Scope of Work:
        - Site Survey
        - Water Sampling
        - Sediment Sampling
        - Biological Sampling
    b. Analyses and Methods
4. Results, data interpretation including trending, analyses and discussion
5. Conclusion and Recommendation
6. References

APPENDIX 5.1: EXAMPLE OF TEMPLATE FOR IDENTIFICATION OF POTENTIAL ENVIRONMENTAL IMPACT FOR DECOMMISSIONING ACTIVITIES

1. Onshore Facilities (covers downstream and upstream facilities located onshore/near shore).

Activities	Sub Activity	Aspect	Potential Impact	Mitigation Measures
Shutdown, Decontamination and Mothball	• Water Flushing • High pressure water jetting	Treated flushed water discharges effluent treatment plant (ETP).	• Pollution to receiving water bodies (river or coastal). • Excessive water consumption	• Ensure requirement to treat flush water is stated in Standard Working Procedure (SWP) and implemented at site. • Ensure existing ETP capable to cater the estimated wastewater volume and loading through proper assessment and planning prior to conducting the activity. • Assess potential 3R for water flushing activities.
	Pit and tank de-sludging	Generation of scheduled waste.	Soil/groundwater contamination due to spillage of scheduled waste.	Ensure management and handling of scheduled waste in accordance to Environmental Quality (Scheduled Wastes) Regulations, 2005.
Dismantle, removal and salvage	• Disassemble and cutting of cleaned piping / valves and cablings.	Noise during cutting activities.	Increase of ambient noise level.	• Select low noise generation cutting equipment. • Assess the need of additional control such as absorber, noise insulation.
		Generation of non-hazardous construction waste (e.g. steel, bricks, woods, concrete)	Incremental waste load at municipal disposal site.	Implement 3R such selling of scrap metals, reuse of building materials.
	• Disassemble of equipment containing radioactive (e.g. fire detector).	Generation of radioactive wastes.	Radioactive land contamination due to improper disposal of equipment.	Equipment containing radioactive shall be returned to the original supplier as per purchasing agreement.
		Land disturbance	• Land erosion and sedimentation	Ensure sufficient erosion/sedimentation control measures provided at site.

Activities	Sub Activity	Aspect	Potential Impact	Mitigation Measures
	Excavation of underground structure, piping, cabling, etc.		• Surface Water Pollution (river or coastal)	
		Fugitive dust emission	Ambient air pollution (incremental dust level)	• Water spraying on the disturbed soil. • Wash dirty vehicle wheels.
		Smoke emissions from operating heavy machineries/ equipment	Ambient air pollution (e.g. SOx, NOx, CO)	• Minimized potential emission by conducting regular maintenance of Equipment/heavy machineries.
		Noise during excavation works.	Increase of ambient noise level.	Activities that generated high noise level such as pile drivers, generators and compressors should be confined to daytime
		Accidental spillage/leakage from heavy machineries and during maintenance activities.	• Soil contamination • Groundwater/Surface Water contamination	• Minimize potential leakage by conducting regular maintenance of Equipment/heavy machineries. • Provide secondary containment for activities involving used of oil. • Provision of spill kit at site.
	Demolition of physical structure	Generation of concrete dust due to demolition of concrete structure.	Air pollution from dust generated from demolition works.	Provide hoarding to separate public and work areas.
		Noise generation	Excessive noise from heavy machineries and demolition works.	Movement of heavy vehicles will be restricted to daytime periods and driven at low speeds.
		Generation of demolition wastes i.e. dismantled structure, raft and foundations, undergrounds, etc.	Incremental waste load at municipal disposal site. i.e. bricks, concrete, etc.	Implement 3R such selling of scrap metals, reuse of building materials.

Activities	Sub Activity	Aspect	Potential Impact	Mitigation Measures
Site Reinstatement	Earthwork (e.g. levelling, turfing)	Land disturbance	• Land erosion and sedimentation • Surface Water Pollution (e.g. suspended solids and turbidity)	Ensure sufficient erosion/sedimentation control measures provided at site. Application of LDP2M2.
		Fugitive dust emission	• Ambient air pollution (incremental dust level)	• Water spraying on the disturbed soil. • Wash dirty vehicle wheels.
		Fugitive emissions from heavy machineries/ equipment	• Ambient air pollution from smoke emitted from machineries.	• Minimized potential emission by conducting regular maintenance of equipment/heavy machineries.
		Accidental spillage/leakage from heavy machineries and during maintenance activities.	• Soil contamination • Groundwater/Surface Water contamination	• Minimize potential leakage by conducting regular maintenance of equipment/heavy machineries. • Provide secondary containment for activities involving use of oil. • Provision of spill kit at site.
		Noise generation from heavy machineries and demolition works.	Increase of ambient noise level.	Movement of heavy vehicle should be restricted to daytime periods and shall be driven at low speed.

Note: non-exhaustive list

2. Offshore Facilities

Activities	Sub Activity	Aspect	Impact	Measures
Use of vessels during all decommissioning activities	Vessel / Rigs usage	Direct discharge or spillage of sewage/ballast water.	Potential surface water pollution including BOD, floating solids, coliform bacteria.	Ensure discharge at allowable areas.
		Accidental fuel spills	Potential marine water pollution.	Minimize potential leakage/spill by conducting regular maintenance. Ensure ERP is in place for any spill events.
Post Cessation of Production (COP) activities – Shutdown & Decontamination	• Water Flushing • High pressure water jetting	Generation of flush water/used water which may contain trace level of contaminants.	Potential marine water pollution from the flushing water.	Ensure water quality is within limit prior to discharge. For any sludge from flushed water, ensure waste is categorised and managed according as per regulatory requirements.
Removal of cleaned facilities, Facilities Make Safe, Removal and Remediation of Pipeline, Platform Topside, Platform Substructure and Subsea Installations	Disassemble of piping/ valves and cablings	Generation of solid waste e.g. disused equipment / components i.e. nut and bolts contaminated with hydrocarbon	Potential land contamination due to spill or improper disposal of solid waste.	Ensure waste is managed as per regulatory requirements. Minimise waste generation wherever possible using the concept of reduce, reuse, recycle (3R).
	Disassemble electrical & electronics equipment	Generation of hazardous waste materials (Scheduled waste).	Potential land contamination due to scheduled waste to the environments	Ensure waste is managed as per regulatory requirements. Minimise waste generation wherever possible using the

Activities	Sub Activity	Aspect	Impact	Measures
				concept of reduce, reuse, recycle (3R).
	Lifting of Heavy Lift Structure/ Equipment/piping	Spillage of mechanical fluid from crane.	Potential spillage and contamination of scheduled waste to the environments.	Minimize potential leakage/spill by conducting regular maintenance. Ensure ERP is in place for any spill events.
	Beneficial use of platform and subsea installations (e.g. rigs to reef)	Disturbance to the seabed	Short-term impacts - transient, localized increases in turbidity. Crushing and dislocation of some organisms within the benthic community.	Minimise impact by proper placement of rigs to reduce seabed disturbance.
		Reuse of rigs as artificial reef.	Long-term impact – promoting marine life diversity around the rigs to reef area.	Rigs to reef placement shall be located at designated area, upon approval from Fisheries Department and other relevant agencies.
Well Plug and Abandonment	Well Plug and Abandonment Activities	Accidental spillage of fluid or gas leakages due to improper plugins.	Potential marine water pollution from leakages.	Ensure well plug and abandonment according to approved standard operating procedure (SOP).

Note: non-exhaustive list

APPENDIX 6.1: TYPICAL information required for preparation of WASTE MANAGEMENT PLAN

				Waste Management		
Name of Waste[5]	**Source of Waste**	**Estimated Quantity Generated (Tonne)**	**Frequency of Generation[1]**	**Estimated Quantity**	**Waste Management Methods[2]**	**Location[3]**

Note:

1. Frequency: annually, ad-hoc or routine, etc.
2. Waste Management methods includes Storage*, Reduce, Recycle, Recover, Treatment or Disposal.
3. Location refers to on-site or off-site. If off-site, include the name of the off-site facility
4. Storage* mean no other treatment method/facility available at the location or country.
5. For scheduled wastes, to include waste code.

APPENDIX 6.2: TYPICAL WASTE TYPE AND SOURCES

Table 1: Waste Generation during the Decontamination, Clean-up of Equipment and Facility

Waste Type	Waste Sources
Electric/electronic equipment	i. Main substation panel and CCB panel ii. Generator set iii. Fire alarms iv. Motor such as compressors, pumps, fans, blowers, agitators, centrifuges v. PA System vi. Transformers vii. Switchboard viii. UPS system ix. VSD Systems
Expired/spent chemical	i. Chemical store ii. Laboratory iii. Process area
Spent oil	i. Storage tank ii. Warehouse iii. Crude oil tank
Mercury	Generation of Mercury from process equipment, vessels.
Pyrophoric	Generation of pyrophoric material from: i. Metal scales from vessel ii. Filters in sour service iii. Iron sponge in sweeting unit
Radioactive Materials	i. Waste comprise of Technologically Enhanced Naturally Occurring Radioactive Materials (TENORM) from producing reservoirs in the form of scales or liquid effluents, ii. radioactive sources used in well logging and tracer tests iii. scale and sludge in production tubing, heater and salt water tanks
Other types of scheduled wastes	i. Platform inventory such as hydrocarbon liquids and gases by draining, venting and purging with water ii. Lubricating oil recovered from rotating equipment (pumps, compressors, etc.). iii. Fluids and sludge recovered from process vessels (separation/dehydration vessels, etc.) and tanks. iv. Fluids recovered from purging of flow lines, fuel gas lines and pipelines v. Tanks or pits and their materials content such as acid, bases, oil, chemical etc. vi. Laboratory – spent or expired chemicals vii. Chemical Store – spent chemicals viii. Warehouse – spent lubricating oil, spent SBM ix. Schedule wastes yard x. Contaminated soil and groundwater xi. Wastewater xii. Produced water treatment system xiii. Hydrocyclone xiv. Firefighting chemicals

Table2: Example Type of Waste Generated during Dismantling, Demolishing and Removal of Equipment, Facility and Structure

Waste Type	Waste Sources
Scrap Metal	i. Cleaned process equipment, vessels, columns, tanks

Waste Type	Waste Sources
	ii. Office equipment – table, chairs, cabinets iii. Cleaned jacket, platform, living quarters, decks, topsides iv. Cleaned pipelines, risers, piping, flow lines, umbilical, PLEMS v. Subsea equipment vi. Maintenance, workshop equipment vii. Rebar used in foundation
Asbestos	Generation of asbestos from office areas warehouse and process areas i. Ceiling ii. wall iii. Gaskets, packing
Polychlorinated biphenyls (PCBs)	Generation of PCBs from maintenance and process areas: i. capacitors ii. transformers and other electrical switchgear
Radioactive wastes	Generation of radioactive wastes from maintenance and process areas such as: i. equipment level gauge meter ii. Smoke detectors iii. TENORM wastes
Packaging	Generation of packaging from warehouse and process areas such as the following: i. cleaned used drums ii. containers (plastic, metal or glass) iii. bags iv. carton v. boxes vi. pallets vii. Styrofoam viii. Cardboard
Wooden waste	Generation of wooden waste from warehouse, process areas such as the following: i. plywood ii. chip-wood iii. wooden pallet
Plastic waste	Generation of waste from warehouse, process areas, office areas such as the following: i. PVC plumbing pipe ii. PVC siding iii. Styrofoam insulation iv. plastic sheet v. Fiberglass insulation
Electrical waste	Generation of electrical waste from warehouse, process areas, office areas such as the following: i. Electrical cable ii. Insulation material iii. transformers iv. instrumentation and electrical system v. fire protection system including automatic gas detection, heat and smoke detection, CO_2 system, sprinkler and deluge systems at critical areas of the facility, fire water system and fire-fighting resources.
Explosive wastes	vi. Smoke signal from lifeboat

Waste Type	Waste Sources
Domestic/Kitchen waste	Generation of domestic/kitchen waste from canteen such as: i. Food waste/kitchen waste ii. Paper waste iii. Used stationaries iv. Plastic waste (drinking bottles, packaging material) v. Wood waste vi. Glass waste vii. Metal waste (aluminium cans)
Clinical waste	Generation of clinical waste from clinic such as: i. human or animal tissue, blood or other body fluids, excretions. ii. drugs or other pharmaceutical products. iii. swabs or dressings, or syringes, needles. iv. sharp instruments of any substance, arising from medical, dental, nursing, veterinary or pathological laboratory practice.
Sanitary waste	Generation of sanitary waste from: i. Toilets ii. Sewage treatment plant

Table 3: Waste Generation during Earthwork

Waste Type	Earthwork activities
Soil and Concrete debris	Generation of soil and concrete debris from: i. Excess soil from excavation and grading work ii. Building demolition iii. Demolition of bridges, drainage culverts, roads
Scheduled Waste - Contaminated soil	From leaks, spill areas that have been identified in environmental site assessment or due diligent activities prior to decommissioning