

PETRONAS GUIDELINE ON PRODUCED SAND DISPOSAL



PETRONAS


**PETRONAS GUIDELINES ON PRODUCED SAND
DISPOSAL**


MPM/HSE/GD/07/00

**ISSUED BY
HEALTH, SAFETY & ENVIRONMENT
MALAYSIA PETROLEUM MANAGEMENT
PETRONAS
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PETRONAS GUIDELINE ON PRODUCED SAND DISPOSAL

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Executive Summary

This guideline was developed by Malaysia Petroleum Management (MPM) PETRONAS in collaboration with Petroleum Arrangement (PA) Contractors as a recommended practice on produced sand management and disposal for operation facilities in offshore and onshore, in Malaysia.

This guideline also provides process flow and information on submission plan related to recommend produced sand disposal activities in compliance to the Environmental Quality (Scheduled Waste) Regulations 2005. This guideline was prepared based on the recommendation and consultancy between MPM HSE and Hazardous Substances Division, DOE Putrajaya. A Task Force Working Group on Produced Sand Disposal Guideline which consists of MPM and PA Contractors was established (and completed) in 2013 to discuss in more details about this guideline.

This guideline serves as guidance for PA Contractors to manage produced sand production and disposal from offshore and onshore oil and gas operating facilities in compliance to DOE and PETRONAS requirements.

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Acknowledgement

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Abbreviation

AELB	Atomic Energy License Board
CHARM	Chemical Hazard and Risk Management
DOE	Department of Environment
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EQA	Environmental Quality Act
ESI	Environmental Sensitivity Index
GLP	Good Laboratory Practices
HSE	Health, Safety & Environment
MES	Minimum Environmental Specifications
MPM	Malaysia Petroleum Management
OCNS	Offshore Chemical Notification Scheme
OSPAR	Oslo and Paris Convention
PA	Petroleum Arrangement
PPGUA	Procedures and Guidelines for Upstream Activities
RIA	Radiological Impact Assessment
SAMM	Skim Akreditasi Makmal Malaysia
SW	Schedule Waste
TAC	Total Activity Concentration
TENORM	Technologically Enhanced Naturally Occurring Radioactive Material
USEPA	US Environmental Protection Agency

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Appendix 3 PETRONAS E&P Minimum Environmental Specifications (MES)

Appendix 4 PETRONAS Procedures and Guidelines for Upstream Activities
(PPGUA Vol.3) Health, Safety and Environment

Appendix 5 Produced Sand Control Management Compositional Analysis

Appendix 6 Major Sand Control Methods

Appendix 7 Heavy Metal Compositional Analysis

Appendix 8 Background Document OSPAR

Appendix 9 Chemical Hazard and Risk Management (CHARM)

Appendix 10 Malaysia Marine Water Quality Criteria and Standard

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SECTION 1

INTRODUCTION

1.1 BACKGROUND

- 1.1.1 The development of this guideline, entitled Sand Disposal Guideline, is part of Malaysia Petroleum Management initiative in ensuring good environmental management practices for all offshore and onshore oil and gas facilities operating in Malaysia.
- 1.1.2 This guideline is a guidance document for PA Contractors in order to manage their sand disposal activities, particularly offshore disposal. The guideline is prepared by referring to current practices done by other oil and gas industries, across regions and European GOM (Gulf of Mexico) offshore practices, other international best practices and also current regulations available related to waste management.
- 1.1.3 This guideline is also to assist production with high and massive sand produced offshore and onshore due to high water cut and reservoir declining issues at present and near future. Further details are explained in Appendix 1.

1.2 OBJECTIVE

The objective of this guideline is to facilitate PA contractors in produced sand disposal management. The guideline will guide PA contractors on the procedures required to submit the application for special waste as per Regulation 7 of EQA 1974 and Guideline of Special Waste Management, subject to meeting the specification in this guideline and DOE approval.

The guideline also provides a guidance to PA contractors in applying one-off approval for offshore produced sand disposal from DOE.

1.3 APPLICABILITY

This guideline is applicable for any produced sand disposal activities from existing and future production activities both offshore and onshore facilities in Malaysia.

1.4 DOCUMENT CUSTODIAN

MPM HSE Governance Section is the custodian of this document. Its content shall be reviewed and updated, prior to distribution of the controlled copies to all relevant parties.

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SECTION 2

REQUIREMENT

2.1 LEGISLATIVE AND PETRONAS REQUIREMENT

2.1.1 Below are the relevant legislative requirements which are relevant but are not limited and applicable to this guideline:

- Atomic Energy Licensing Act 1984
- Exclusive Economic Zone Act 1984
- Environmental Quality Act 1974
- Marine Acts
- Fisheries Act 1985
- International Regulations/Conventions
- PETRONAS Requirements.

Details of these legislatives are in Appendix 2.

2.1.2 PETRONAS E&P Minimum Environmental Specifications (MES) (refer to Appendix 3) shall be the reference point and guiding principle for the PA contractors to use when planning and implementing environment management as described in PETRONAS Procedures and Guidelines for Upstream Activities (PPGUA Vol.3) Health, Safety and Environment requirements, Section 1.10. (Refer to Appendix 4).

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SECTION 3

PRODUCED SAND MANAGEMENT

3.1 PRINCIPLES OF PRODUCED SAND MANAGEMENT

3.1.1 The produced sand management shall apply the following general approach in waste management principles:

- protection of the environment and human health
- waste management best practices – 4R concepts (Reduce, Reuse, Recycle & Recovery)
- life cycle thinking - “cradle to grave”
- the polluter pays' principle
- 'the proximity' principle.

3.1.2 Produced Sand is sand that is transported to the surface as by product of oil and gas production operation. Produced sand originating from the reservoir is separated from the formation fluids during hydrocarbon processing. The produced sand can be contaminated with hydrocarbons, but the oil content can vary substantially depending on location, depth, and reservoir characteristics.

3.1.3 The produced sand is classified as SW 422 under EQA (Scheduled Waste) Regulation 2005 First Scheduled. In selecting the best option for current existing facilities, priority shall be given to protection of human health and environment in order to minimize risks associated with the waste. For future facilities design, feasible options for the management of waste shall be evaluated during the design stage and integrated into the production facility.

The key determining factor includes:

- regulatory requirement

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- waste characteristic
- site location
- technical feasibility
- availability of infrastructure and equipment.
- cost

3.2 PRODUCED SAND CONTROL MANAGEMENT

Sand management for surface facilities can be managed by Cyclonic Surface Separation consists of Wellhead Desanders, Wellstream Desanders, and Sand Jetting which are installed inside the separator. The surface cyclones can be in the form of single or, in other cases, a multiplicity of cyclone inserts housed in a customized vessel.

Sand removal/mitigation at reservoir level can done through Resin-Coated Gravel, Slotted Liner or Screens Without Gravel Pack, Open Hole or Cased Hole, Slotted Liner or Screen With Gravel Pack, Open Hole or Cased Hole, Frac Packing and Fracturing, Expandable Screens and Vent Screens. (Refer to Appendix 5).

The two major sand control methods are described in Appendix 6.

**SECTION 4
PROCEDURES**

4.1 PROCEDURES FLOW CHART

The procedures flow chart is summarized as per Figure 1.

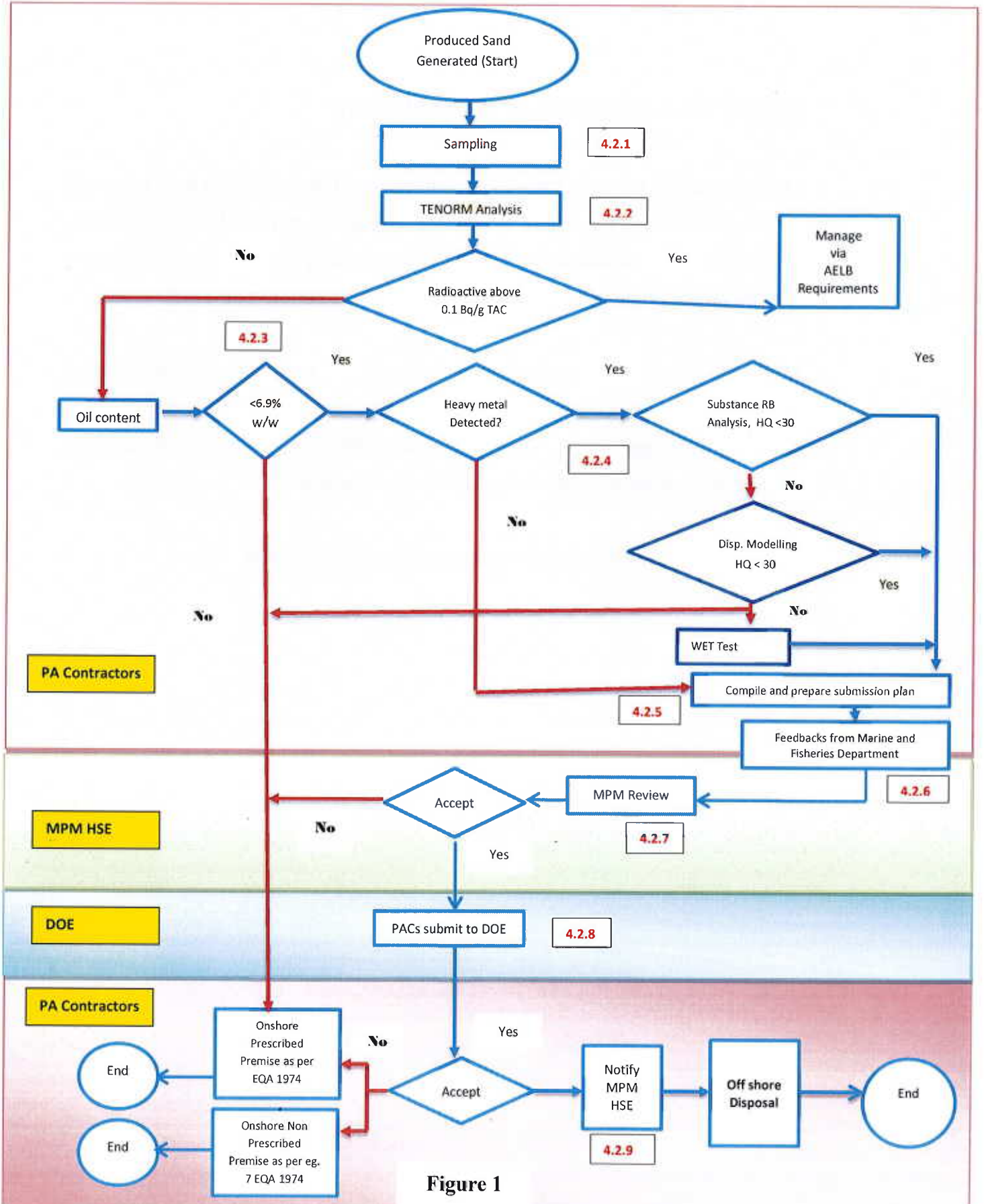


Figure 1

4.2 APPLICATION PROCEDURES

This section will briefly explain the steps involve in the procedures as shown in the flow chart (figure 1)

4.2.1 Sampling

Sampling shall be conducted as specified in section 5.1

4.2.2 TENORM Analysis

Produced sand samples shall be tested first for TENORM Analysis as per AELB Act 1984. Details are specified in Section 5.2.1 and 5.2.2.

4.2.3 Produced Sand Treatment

Produced sands which not classified as TENORM waste shall be further treated with chemicals or any other technologies which can reduce the oil percentage in the sand. Details are specified in Section 5.2.3

4.2.4 Test Analysis Requirements

Certain tests analysis shall be performed and results from the analysis will be used to determine whether the produced sand can be allowed for offshore disposal by DOE. Details are specified in Section 5.2.4 (a) – (c).

4.2.5 Submission Plan

PA contractors shall compile all the relevant document and prepare the submission plan to be submitted to DOE. Details on the contents are specified in Section 6.

4.2.6 Other Agencies Comments/Feedbacks

Comments/Feedbacks from relevant agencies are required as the supporting documents for the proposed site. These comments/feedbacks shall be attached together with the submission plan.

4.2.7 MPM Review

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Prior to the submission of submission plan to DOE, PA contractors shall first submit the plan to MPM HSE for review purpose.

4.2.8 Submission to DOE

PA contractors shall submit the submission plan to DOE once accepted by MPM HSE for approval

4.2.9 Notification to MPM HSE

PA contractors shall notify MPM HSE once DOE approved the application.

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SECTION 5

SAMPLING AND ANALYSIS

This section provides some information on sand sampling and analysis requirements.

5.1 DETAILS OF SAMPLING

5.1.1 Sampling of the produced sand shall be conducted in accordance to with the “Test Method for Evaluating Solid Waste, Physical/Chemical Methods”, USEPA Publication SW -846, Latest Edition

5.1.2 Produced sand samples shall be analyzed at the lab facilities accredited by Skim Akreditasi Makmal Malaysia (SAMM) or Good Laboratory Practices (GLP) scheme.

5.2 ANALYSIS

The sample analysis requirement for produced sand shall be done in accordance to the type of tests and sequences as listed in procedures process flow (Figure 1). Details will be explained further in Section 5.2.4.

Sample of the produced sand shall be tested for the following tests:

5.2.1 TENORM Analysis

- a. Disposal of materials, wastes and equipment that are contaminated with Technologically Enhanced Naturally Occurring Radioactive Material (TENORM), shall comply with all applicable laws and regulations in Malaysia but not limited to the following:
 - Atomic Energy Licensing Act, 1984
 - Radiation Protection (Licensing) Regulations, 1986

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- Radiation Protection (Basic Safety Standards) Regulations, 1988
 - Radiation Protection (Transport) Regulations, 1989
 - LEM/TEK/30 SEM 2. 1996 – Guidelines on Radiological Monitoring for Oil and Gas Facilities Operators Associated with TENORM.
- b. Control limit for TENORM waste disposal is 0.3 mSv/y based on dose constraint. A Radiological Impact Assessment (RIA) shall be conducted to assess the dose received by a critical group of the public as a result of the disposal of TENORM waste higher than 0.1 Bq/g TAC. The calculated dose shall not exceed the stipulated control limit.

5.2.2 Non TENORM Analysis

Samples that do not category under TENORM waste shall be treated as Scheduled Waste as per Environmental Quality (Scheduled Waste) Regulations 2005.

5.2.3 Produced Sand Treatment

Produced sand shall be treated to reduce the oil content by using any available technologies. Current available technologies can be in the form of:

a. Chemical treatment

Selection of chemicals that will be used for the produced sand treatment shall be:

- i. Biodegradable
- ii. Not classified as hazardous chemicals under CLASS regulations 2014
- iii. Approved by Department of Environment, or
- iv. Listed in the OSPAR List of Substances Used and Discharged

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Offshore which Are Considered to Pose Little or No Risk to the Environment (PLONOR).

b. Process Enhancement

Process enhancements can be done by introducing the best technologies and practices which can clean or reduce the amount of oil in produced sand. The enhancements also be considered as one of the methods that can be used for sand treatment.

5.2.4 Tests Requirements

The treated produced sand shall then be tested for the following tests:

5.2.4.1 Oil Content Analysis

- a. Acceptability of the discharge of produced sand will depend on the concentration of oil in the produced sand and its aromatic content. In all cases, the produced sand shall be treated *in-situ* to reduce oil concentrations to the lowest level practicable.
- b. Treated produced sand shall target the maximum value of 6.9% weight of oil concentration in produced sand.
- c. Produced sands that can be treated below the target specified in (ii) are considered as acceptable and can proceed to the other tests requirement (5.2.4.1 (b) and (c)). Otherwise, the produced sands shall be disposed at the onshore DOE's prescribed premises

5.2.4.2 Heavy Metal Compositional Analysis

- a. Produced sands shall be tested for heavy metal listed in Appendix 7 in accordance with "Test Method for Evaluating Solid Waste,

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Physical/Chemical Methods”, USEPA Publication SW 846, latest edition.

- b. Substance Risk Based Analysis shall be conducted for produced sands that show traces of any heavy metal listed in Appendix 7. Produced sands which do not show any traces of heavy metal, can proceed to the submission plan preparation and do not require to conduct ecotoxicity test.
- c. In case where mercury is detected in the produced sand, the disposal shall be done at DOE’s prescribed premises as per EQA 1974.

5.2.4.3 Substance Risk Based Analysis

- a. Samples for produced sand that contain heavy metals above the maximum values specified in Appendix 7 shall be further analyzed using the risk based approach. as The Predicted Environmental Concentration (PEC) from the analytical results of the particular metal will be divided by the Predicted No Effect Concentration (PNEC) to generate the Hazard Quotient (HQ). PNEC value can be obtained from available relevant sources including OSPAR background document. The HQ value is referred to OCNS CHARM for bands. $HQ < 30$ (Silver) is considered as safe for offshore disposal.
- b. If $HQ > 30$, dispersion modelling which based on certain dilution factor will be used to further determine HQ value. By having dispersion modelling, getting the result of $HQ < 30$ can be considered safe for offshore disposal.
- c. Results which show $HQ > 30$ (after dilution) will have two choices:
 - i. To do Whole Effluent Toxicity test for the contaminated sand.

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- ii. To dispose it at the onshore disposal facilities or to submit application to dispose at onshore non-prescribed premises according to Special Waste Management requirements.

5.2.5 Tests Validity

Test results from 5.2.4.1, 5.2.4.2 and 5.2.4.3 can be used for the same disposal site. No repeated tests are required, unless when required by DOE.

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SECTION 6

DISPOSAL PLAN

6.1 DISPOSAL SUBMISSION PLAN

PA Contractors shall ensure that the disposal plan shall include the following 6 items as listed below:

- Proposed Site
- Risk Assessment
- Baseline Data
- Collection of Baseline Data
- Methods of Handling
- Point of Discharge
- Monitoring and Reporting
- Test Results

6.2 PROPOSED SITE

6.2.1 Site selection shall ensure that the disposal material does not interfere with legitimate commercial and economic uses of the marine environment nor produce undesirable effects on vulnerable marine ecosystems.

6.2.2 The site selection shall consider the following but not limited to:

- economic and technical feasibility
- risk considerations.

6.2.3 The proposed site shall be assessed and mitigation plan shall be developed. The risk assessment for the proposed site shall be done and shall also contain;

- site coordinate/geospatial data (latitude and longitude approved by Marine and Fisheries Department)
- approval from any other relevant agencies

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- list of environmental sensitive areas and man-made facilities/structures that may be affected as per current Environmental Sensitivity Area (ESI) reports published by PETRONAS.

6.3 RISK ASSESSMENT

The risk assessment report for the proposed site, including the mitigation plan shall be submitted together with the disposal plan. The assessment shall be prepared by the consultant registered under EIA Consultants Registration Scheme.

6.4 BASELINE DATA

6.4.1 THE PURPOSES OF HAVING BASELINE DATA ARE:

- To describe the current condition of the environment and community e.g. sensitive areas, etc.
- To collect necessary data to predict the effects of the (proposed) activity
- As a reference for post project monitoring / future performance monitoring of operations
- To provide evidence from any liability due to historical pollution by others.

6.4.2 COLLECTION OF BASELINE DATA

In collecting the baseline data, the following shall be considered:

- Availability of published / secondary data – e.g. reports, journals, local newspapers or newsletter, etc.
- Source and accessibility of data
- Relevance of data to project
- Data quality (reliability, accuracy & obsolescence)
- Need for any primary data through field sampling, surveys etc.
- Sampling network – number of sampling stations
- Complexity of data collection process and/or methodology

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- Complexity of data analysis
- HSE Legal requirement - including international protocol, national and local legislation
- Seasonal variation, variation during day time and night time.

6.5 METHODS OF HANDLING

Produced sand shall be handled according to:

- a) Offshore – International Maritime Organization (IMO) for International Maritime Dangerous Goods (IMDG) Code
- b) Onshore – Environmental Quality (Scheduled Waste) Regulations 2005

6.6 POINT OF DISCHARGE

The disposal of produced sand which is approved by DOE to be disposed offshore, shall be monitored closely. The produced sand can be discharged overboard gradually at the discharged point within the platform area. The point of discharge diagram shall be mentioned in the proposal.

6.7 MONITORING AND REPORTING

6.7.1 MONITORING

Environmental monitoring describes the processes and activities that need to take place to characterize and monitor the quality of the environment. Monitoring plan shall include:

- Number of sampling points (minimum eight points within two concentric per disposal site)
- Frequency of monitoring (minimum once a year)
- Parameters to be measured in accordance to Malaysia Marine Water Quality Criteria and Standard (Refer to Appendix 10).

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6.7.2 MONITORING REPORT

Report on monitoring shall be kept in place by PA Contractors and shall be made readily available upon request by the authorities.

6.8 TEST RESULTS

All the test results as mentioned at sections 5.2.4.1, 5.2.4.2 and 5.2.4.3 shall be attached together with the proposal submission plan and submitted to MPM HSE for review purpose before submitting to DOE for final approval.

SECTION 7

SUBMISSION AND NOTIFICATION

7.0 DISPOSAL PLAN SUBMISSION AND NOTIFICATION PROCESS

7.1 SUBMISSION

7.1.1 The plan shall be submitted to MPM HSE for review at least 3 months before the implementation date.

7.1.2 MPM HSE shall review the submission proposal plan and decide whether the proposal can be accepted. If the proposal is not accepted, the disposal of the produced sand shall be done at onshore prescribed premises as per EQA 1974.

7.1.3 The submission plans that have been accepted by MPM HSE shall then be submitted to DOE by PA contractors for final approval.

7.2 NOTIFICATION APPROVAL

PA Contractors shall inform MPM HSE immediately once the approval is given by DOE.

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