

BACKGROUND

Around the globe, all Oil and Gas companies including PETRONAS continues to address the challenges of Sand Management across a wide ranging portfolio of reservoirs especially fields with rapid depletion and high water cut base on their geographical locations.

How to manage and handle sand remains important to the industry for maintaining well and plant integrity, as well as increasing operations efficiency and field recovery factors. It is important to understand the Sand Management life cycle of design, installation and operation.

In PETRONAS, all future and new development project, in order to mitigate and control sand carry over to surface facilities i.e. downhole screen etc, subsea desander as well as new technologies and applications are extensively explore by PAC and PETRONAS to be considered during design stage. For existing facilities and old platform, PAC is encouraged to retrofit the existing facilities to manage sand at surface facilities via Desander, Hydrocyclectc or any other technology proven available in the market. PETRONAS set guideline for all existing facilities with high water cut and massive sand to limit and control production via bean down the well or limit well production with max 70% water cut (WC) and below. If the well produces more than 70%, PAC needs to consult PETRONAS for mitigation and way forward.

In statistic for offshore Malaysia, most of old producing fields (that have been producing > 20 years), PETRONAS have wells with WC ranging from 30-70%. PETRONAS inventory of the old/existing fields versus new development is almost > 60% of the population.

Legislative and PETRONAS Requirement

REFERENCES

A) Malaysian Acts / Regulations:

a) Environmental Quality Act 1974

- Environmental Quality (Scheduled Waste) Regulations 2005
- Environmental Quality (Prescribed Conveyance) (Scheduled Wastes) Order 2005
- Environmental Quality (Prescribed Premises) (Scheduled Wastes Treatment and Disposal Facilities) (Amendment) Order 2006
- Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 1987
- Environmental Quality (Industrial Effluent) Regulations 2009
- Exclusive Economic Zone Act 1984 (Section 2, 9, 21 and 22)

b) Custom Act 1967

- Customs (Prohibition of Export) Order (Amendment) (No. 2) 1993
- Customs (Prohibition of Import) Order (Amendment) (No. 2) 1993

c) Atomic Energy Licensing Act 1984

- Code of Practice on Radiation Protection Relating to Technically Enhanced Naturally Occurring Radioactive Material (TENORM) in Oil and Gas Facilities
- AELB Guidelines on Radiological Monitoring for Oil and Gas Facilities Operators Associated With Technologically Enhanced Naturally Occurring Radioactive Materials (TENORM), LEM/TEK/30 Revision 2, September 1996

d) Marine Acts

- The Merchant Shipping Ordinance, 1952
- Baselines of Maritime Zones Act 2006
- Merchant Shipping (Oil Pollution) Act 1994

e) Fisheries Acts

- Fisheries (Maritime) Regulations 1967
- Fisheries (Maritime) (Sarawak) Regulations 1976
- Sabah Biodiversity Enactment 2000
- Sarawak Biodiversity Centre Ordinance, 1997
- Sabah Environment Protection Enactment 2002

B) International Regulations / Conventions

- Basel Convention on the Control of Trans boundary Movements of Hazardous Wastes and their Disposal 1989
- MARPOL 73/78 - International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978
- The convention for the Protection of the marine Environment of the North-East Atlantic – OSPAR Convention

C) PETRONAS Procedures and Guidelines for Upstream Activities (PPGUA), Health, Safety and Environment (Volume 3).

D) PETRONAS E&P Minimum Environmental Specifications (MES), Revision 1.

E) PETRONAS Technical Standards (PTS):

- PTS 60.3005 Waste Management
- PTS 60.3202 Environmental Aspects and Impacts Assessment Guide
- PTS 60.3206 Environmental, Social and Health Impact Assessment
- PTS 60.3006 PETRONAS Group Minimum Environmental Management Standards Implementation Guide



PETRONAS E&P MINIMUM ENVIRONMENTAL SPECIFICATIONS (MES)

REVISION 1

**ISSUED BY
PETROLEUM MANAGEMENT UNIT
PETRONAS
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PREAMBLE

Effective July 2011, every Production Sharing (PS) Contractor of PETRONAS shall endeavor to comply with the following PETRONAS E&P Minimum Environmental Specifications (PETRONAS E&P MES) in conducting its Petroleum Operations, onshore or offshore Malaysia.

PETRONAS E&P MES complements PETRONAS Procedures and Guidelines for Upstream Activities (PPGUA Rev. 2, 2008) and may be added to or amended from time to time upon written notice by PETRONAS, provided such additions or amendments are consistent with the provisions of the Production Sharing Contract (PSC). In the event of conflict between PETRONAS E&P MES and the PSC, the latter shall prevail. However, prevailing legislations shall be complied with, at all times.

PS Contractor shall be responsible for ensuring that anyone performing work for the PSC, whether its personnel or employees, or subcontractors, should meet the provisions stipulated in these specifications and provisions stipulated pursuant thereto. PS Contractor shall also establish an internal control system so as to efficiently ensure that these specifications are met.

EXECUTIVE SUMMARY

PETRONAS E&P MES document provides specifications to all PS Contractor operating in Malaysia in managing their environmental aspects with regards to Upstream Petroleum Operations and Activities to ensure that they are carried out prudently and effectively in line with the best practices currently prevalent in the oil and gas industry.

This document provides some technical clarification on relevant environmental issues faced and ascertains standard approach among PS Contractor in its endeavor to protect, conserve and minimize the impact of upstream petroleum operations and activities to the environment. This is in line with PETRONAS commitment towards superior environmental performance through continuous improvement, adapting best practices and encouraging PS Contractor to move beyond regulatory compliance.

1.0 INTRODUCTION

PETRONAS E&P MES is a set of requirements that PETRONAS adopts for implementation among PS Contractor. The purpose is to specify PETRONAS requirements on selected key environmental aspects of the Petroleum Operations Activities. This specification applies to all phases of Petroleum Operations and Activities; starting from planning till design, construction, installation, operation, production and decommissioning.

1.1 Definitions

Below are definitions commonly referred to in this document, unless the context stated otherwise:-

a. APHA Methods

The APHA methods for analysis of effluent and produced water refers to Standard Methods for the Examination of Water and Wastewater, published jointly by the American Public Health Association, the American Water Works Association and the Water Environment Federation of the United States of America, 21st Edition.

b. Associated Gas (AG)

Associated Gas is natural gas which is found in association with crude oil either dissolved in the oil or as a cap of free gas above the oil.

c. Best Available Technique (BAT)

Effective techniques that are accessible to occupier that are developed on a scale that allows implementation in relevant industrial sector, under economically and technically viable conditions, taking into consideration costs and advantages. Similar terms are best available technology, best practicable means or best practicable environmental options.

d. Drill Cuttings

Fragment of rock formations dislodged by drilling bit and brought to the surface by drilling mud.

e. Environment

Surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans and their interrelation.

f. Environmental Aspect (EA)

Any feature of an organization's activities, products, or services that may have an 'impact' to the surrounding environment. A significant environmental aspect is an environmental aspect that has or can have a significant environmental impact. For example drilling, piling works, flowline installation, pipe-laying, flaring, hydrotesting, produced water discharge, cementing, well clean-up, scheduled waste disposal etc.

g. Environmental Impact (EI)

Any change(s) to the environment, whether adversely or beneficially, wholly or partially resulting from an organization's activities, products or services. For example water pollution, disturbance to seabed sediments (impacting water quality), air emissions, black smoke release etc.

h. Environmentally Hazardous Substance (EHS)

A substance that is included in the EHS Reference List, or if not on the list, must be assigned a hazard category under the Global Harmonized System (GHS) classification scheme, as implemented by the Department of Occupational Safety and Health (DOSH) Malaysia. This EHS Reference List which is based on the published European Annex I to the Substance Directive (Dir. 67/548/EEC) is adopted by the Department of Environment (DOE), Malaysia. Typical EHS include biocides, emulsion breakers, corrosion inhibitors, dispersants etc.

i. Environmental Management Plan (EMP)

EMP forms part of the conditions for the approval of an Environmental Impact Assessment (EIA). In addition, EMP provides the mitigation framework against environmental impact, mechanism to assess the effectiveness of management and conservation measures and ensures compliance with all legislative requirements.

j. Environmental Performance Monitoring

Routine or scheduled monitoring of certain selected parameters or effluent/emission characteristics, as an indicator that a treatment process is functional and capable of treating the industrial effluent or mixed effluent.

k. Environmentally Sensitive Area (ESA)

An area(s) where special measures or controls taken to protect the natural environment/habitats which are exposed to high level of vulnerability e.g. marine park, mangrove, residential area, nesting area, coral reef, etc.

l. Facilities/Installations

Includes operated terminals (crude oil/gas), major offshore platforms, major pipelines and floating production and storage vessels.

m. Fugitive Emission

Emissions of gases or vapors from pressurized equipment due to seepage and various other unintended or irregular releases of gases, mostly from production operations activities. For example valves, pump seals, flanges, sampling connections, etc.

n. Greenhouse Gas (GHG)

Greenhouse gases are chemical compounds that contribute to the global warming impact. Principal GHG gases are carbon dioxide (CO₂), methane (CH₄), nitrous oxide, ozone, and certain halocarbon compounds. Greenhouse gases absorb heat and 'trap'

it in the lower atmosphere causing a global-warming effect. GHG emissions from upstream operations include routine process emissions (flaring for safe discharge of access gas/venting of excess gas), non-routine process emissions including process upsets (shutdowns/start up) emissions from maintenance activities and well services (well tests/well clean-up), combustions (turbines/compressors, engines, boilers/heaters using gas/diesel) and fugitive sources (relief valves, flanges).

o. Malaysian Standard (MS)

Applicable Malaysian Standard in this text is for stationary source emissions - MS 1596:2003 "Determination of Concentration and Mass Flow of Particulate Matter in Flue Gas for Stationary Source Emissions" for isokinetic testing and MS 1723:2003.

"Performance Evaluation of Air Pollution Control and Treatment Systems: Mechanical Dust Collectors" for performance evaluation.

p. New facilities

New facilities mentioned in item 2.4 (e) applies to facilities which has not reached PETRONAS Milestone Review 4 (MR4-Key activity Surface Development) at the time when this document becomes effective.

q. Non-Associated Gas (NAG)

Non-Associated Gas is natural gas that does not contain significant quantities of crude oil in hydrocarbon reservoirs.

r. Oil Spill Contingency Plan

Refer to as a plan/guide on strategic and practical actions including reporting requirement in the event of an oil spill incident to the surrounding environment (land/sea) from upstream operations and installation (including drilling, production operations etc).

s. Parties

Refer to as entities which are involved in an agreement or similar arrangement made during handover/operatorship transfer of asset and/or facility.

t. Prescribed Activities

Activities that are prescribed under Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 1987, Act 1974, Natural Resource & Environmental Ordinance 1993 and Environmental Protection Enactment 2002.

u. Prescribed Premises

Premises or facilities prescribed by the Environmental Quality (Prescribed Premises) (Scheduled Wastes Treatment and Disposal Facilities) Order 1989.

v. Produced Water

Produced water is mainly formation water trapped in the reservoir rock and brought up along with oil or gas during production. It can contain minor amounts of chemicals added downhole during production. This water exists under high pressure and temperature, and depending on the geologic formation or reservoir characteristics, it usually contains oil (dispersed droplets/dissolved oil), bacteria, inorganic salts and metals (mercury), with some elevated levels of naturally occurring radioactive material (NORM). Offshore produced water is either treated offshore prior to discharge overboard or treated at onshore terminals to be discharged to marine environment.

w. Scheduled Waste

Any waste falling within the categories of waste listed in the First Schedule to the Environmental Quality (Scheduled Wastes) Regulations 2005.

x. Significant Parameters

Parameters determined through an Industrial Effluent Characteristic Study (IECS) which exceed acceptable conditions for discharge limits.

y. Upstream Operations

Refer to as exploration and production (E&P) which explores, recovers and produces crude oil and natural gas. The upstream sector includes the searching for potential underground or underwater oil and gas fields, drilling of exploratory & development wells, and subsequently operating the wells that recover and bring the crude oil and/or raw natural gas to the surface.

z. Volatile Organic Compounds (VOCs)

Refer to organic chemical compounds which have significant vapor pressures and which can affect the environment and human health.

1.2 Abbreviations

BAT	–	Best Available Techniques
DOE	–	Department of Environment
DOSH	–	Department of Occupational Safety and Health
E&P	–	Exploration and Production
EEZ	–	Exclusive Economic Zone Act 1984
EIA	–	Environmental Impact Assessment
EMS	–	Environmental management system
EQA	–	Environmental Quality Act
ESA	–	Environmentally Sensitive Area
GRI	–	Global Reporting Institute
HSE	–	Health, Safety and Environment
IECS	–	Industrial Effluent Characterization Study
IER	–	Environmental Quality (Industrial Effluent) Regulations 2009
IETS	–	Industrial Effluent Treatment System
IPIECA	–	International Petroleum Industry Environmental Conservation Association
LTOBM	–	Liquid Toxicity Oil Based Mud
MES	–	Minimum Environmental Specifications
NOSCP	–	National Oil Spill Contingency Plan
OSCP	–	Oil Spill Contingency Plan
OSPAR	–	Convention for the Protection of the Marine Environment of the North-East Atlantic

OSR	–	Oil Spill Response
PMU	–	Petroleum Management Unit, PETRONAS
PPGUA	–	PETRONAS Procedures and Guidelines for Upstream Activities
PS Contractor	–	Production Sharing Contractor
PWTS	–	Produced Water Treatment System
SBM	–	Synthetic Based Mud
VOC	–	Volatile Organic Compound

2.0 PETRONAS E&P MINIMUM ENVIRONMENTAL SPECIFICATIONS (MES)

PETRONAS E&P MES are developed based on 17 areas of environmental concern affecting Malaysia's E&P operation and activities, which are described as follows:

2.1 Environmental Management System (EMS) or its equivalent

- a. An EMS or its equivalent shall be established by PS Contractor with the following key elements included:-
 - i. Environmental aspect and impact register;
 - ii. Environmental legal register;
 - iii. Environmental objectives and targets.

2.2 Environmental Impact Assessment (EIA)

- a. An EIA shall be conducted by PS Contractor for prescribed activities (refer Appendix A) related to oil and gas industries as stipulated under the following legislations:-
 - i. Environmental Quality Act 1974;
 - ii. Natural Resources & Environmental Ordinance (Sarawak) 1993; and
 - iii. Environmental Protection Enactment (Sabah) 2002.
- b. All EIA studies and approvals related, including Environment Management Plan (EMP) shall be submitted to PETRONAS.

2.3 Environmental Risk/Impact Assessment

- a. For non-prescribed activities, an Environmental Risk/Impact Assessment shall be conducted to identify activities that may potentially cause adverse environmental impact. Such activities shall include but not be limited to seismic survey, exploration drilling, pipe laying or replacement (<50km) etc. For example, activities/installation close to Environmentally Sensitive Areas or designated by Federal/State Government.

2.4 Design of Pollution Control Equipment

- a. Onshore air pollution control for fuel burning equipment, chimney or stacks shall be designed to meet emission limits specified in Environmental Quality (Clean Air) Regulations 1978.
- b. Industrial Effluent Characteristic Study (IECS) shall be conducted to identify any significant parameters in the effluent/produced water discharges.
- c. Industrial Effluent Treatment System (IETS) shall be designed to meet Environment Quality (Industrial Effluent) Regulations 2009 discharge limit.
- d. Produced Water Treatment System (PWTS) for offshore facilities shall be designed to meet 40 ppm or lower of oil-in-water (based on impact/risk assessment studies).
- e. All new facilities shall be designed for zero “continuous” flaring/venting during normal operation.
- f. Cold venting should be avoided. Exceptions should be documented from a technical, economic and environmental point of view.

2.5 Assurance and Control of Environmental Data

- a. Assurance or control framework shall be ascertained to ensure environmental baseline and performance data, reports and notifications are controlled. Data or records shall be QA/QC checked and authorized by competent persons or with authority, prior to submission to PETRONAS and disclosure for submission to authorities.

2.6 Greenhouse Gas (GHG) and Energy Management

- a. All offshore and onshore facilities/installations to take precautionary steps to minimize GHG emission from major facilities/installations or sources of activities.
- b. Non-associated Gas (NAG) shall not be flared or vented without prior approval of PETRONAS except for cases specified under Section 9, item 9.4.1, PPGUA Rev. 2, 2008;
- c. Associated gas (AG) shall not be flared or vented without prior approval from PETRONAS except for cases specified under Section 9, item 9.4.2, PPGUA Rev. 2, 2008;
- d. PS Contractor shall establish and maintain GHG and Energy Management Plan or equivalent, which include the following but not limited to:
 - i. An inventory of GHG* emissions based on parameter specified by PETRONAS Group HSE Reporting Protocol (IPIECA, GRI or other internationally acceptable protocols);
 - ii. GHG emissions quarterly and annual performance monitoring for major installations; GHG emission forecast of major installations (with 1+4 years look-ahead).
- e. PS Contractor shall identify opportunities for improvement (based on economics/commercial options) to reduce or minimize GHG from flaring, venting and/or combustion as part of Energy Management Plan or equivalent.

*Note: Expressed as CO₂-equivalent (CO₂-e) = CO₂ (tonnes) + 21 x CH₄ (tonnes).

2.7 Black Smoke and Particulate Emission for onshore facilities

- a. No black smoke emission shall be observed during normal petroleum operations of onshore facilities.
- b. During emergency/process-upset situations, black smoke shade shall not exceed the limits specified in Environmental Quality (Clean Air) Regulations 1978.
- c. Particulate emission (PM₁₀) shall not exceed Standard C of Environmental Quality (Clean Air) Regulations 1978.

2.8 Volatile Organic Compounds (VOCs)

- a. Best Available Technique (BAT) should be applied to minimize (or if possible eliminate) releases of VOCs from oil storage, offloading, fugitives and cold venting.

2.9 Produced Water Discharges

- a. All offshore produced water discharges shall meet PETRONAS oil-in-water limits of 40 ppm or lower (based on risk assessment studies and/or design specifications) and maintained at all times. Any continuous breach of limits shall be investigated and immediately reported to PETRONAS as per PPGUA requirements.
- b. All onshore produced water discharges shall meet the discharge limits specified in Environment Quality (Industrial Effluent) Regulations 2009.
- c. Performance monitoring shall be conducted on PWTS.
- d. Any environmentally hazardous contaminants such as Mercury found in produced water discharge shall be monitored and data shall be made readily available for reporting to PETRONAS.

2.10 Use and Discharge of Environmentally Hazardous Substances (EHS)

- a. Risk assessment shall be conducted and DOE approval shall be obtained prior to discharge of EHS into marine environment.
- b. Use of EHS shall follow recommended manufacturer dosage.

2.11 Sampling and Method of Analysis

- a. Produced water/effluent discharge shall follow acceptable sampling protocol and carried out twice a week.
- b. Analysis of effluent and produced water shall follow APHA Methods.
- c. Sampling and analysis of particulate matter in flue gas shall follow applicable Malaysian Standards (MS).

- d. Oil-in-water analyzer shall be made available on all facilities to periodically monitor oil-in-water concentration in produced water discharges.

2.12 Wastes Management

- a. All waste materials from exploration, drilling and related production operations shall be managed, handled and disposed-off as per applicable legislative requirements.
- b. All scheduled wastes generated from offshore installations/activities shall meet the requirements of Environmental Quality (Scheduled Wastes) Regulations 2005.
- c. Wastes which are not allowed to be disposed off/ discharged into sea or cannot be processed and disposed at offshore rigs shall be brought back to shore for further handling. Any dumping of scheduled wastes to the seas is strictly prohibited.
- d. Any on-site and off-site storage areas for scheduled waste shall be design, construct and maintain in accordance with DOE Guidelines for Storage of Scheduled Wastes.
- e. PS Contractor shall identify opportunities to re-use, reduce and re-cycle of waste for drilling or maintenance campaign as part of waste minimization effort.
- f. Scheduled waste tracking record/inventory shall meet the requirements of Environmental Quality (Scheduled Wastes) Regulations 2005.

2.13 Drilling Mud/Fluids and Cuttings

- a. Only water-based-mud/fluids and low toxicity/synthetic oil based mud/fluids is permitted for drilling use. Spent water based mud can be disposed into marine environment.
- b. Low Toxicity Oil Based Mud (LTOBM) or Synthetic Based Mud (SBM) shall be minimized and used only when necessary (based on geological formation/drilling requirements). Spent LTOBM and SBM are prohibited to be disposed into marine environment.
- c. Cuttings drilled with LTOBM or SBM shall be processed to base fluid retained on cuttings maximum of 6.9% wet weight basis per well average before disposed into marine environment.
- d. Drill cuttings and mud are prohibited to be discharge into environmentally sensitive areas.

- e. Management and disposal of spent mud and cuttings shall be as per Environmental Quality (Scheduled Wastes) Regulations 2005.
- f. PS Contractor shall identify opportunities to re-use, reduce and re-cycle mud as part of Drilling Waste Minimization program.

2.14 Mercury Management

- a. Any facilities/installations identified contaminated with Mercury shall be monitored periodically.
- b. Application of technologies to treat/remove mercury or its contaminants shall be approved by PETRONAS and supported by detail submission of environmental risk assessment studies.
- c. Mercury contaminated waste shall be managed in accordance with Environmental Quality (Scheduled Wastes) Regulations 2005.

2.15 Prevention of Pollution from Oil/ Hazardous Chemical Spills

- a. Drilling or Production facilities shall undertake oil spill risk assessment prior to commencement of operations.
- b. Drilling or Production facilities shall be equipped with spill response equipments that commensurate with the risk to prevent, reduce and control oil/chemicals spills.
- c. All decks of vessel or shipboard equipments containing contaminants/hazardous chemicals which are associated with drilling or production operations shall be equipped with secondary containment such as curbs, gutters, drip-pans etc. Where possible and necessary (based on risk and exposure), the secondary containment shall be installed to collect, piped and return, with safeguards for overflow, without contravening the applicable Malaysian legislations or any international conventions. Such arrangements shall not, in any way, impede safe navigation of the vessel.
- d. Operation shall be suspended as soon as possible if the continuation of the operation

causes, or likely to cause hydrocarbon spill into the environment.

- e. Immediate action shall be taken to stop the release of oil/chemical into the environment and minimize its impact to the environment.
- f. Any major oil spills from drilling/production operations shall be recorded, notified and reported to PETRONAS immediately as stipulated in Section 18, PPGUA Rev. 2, 2008. An incident investigation report shall be submitted within one (1) month to PETRONAS
- g. Any minor oil spills from drilling/production operations shall be recorded, notified and reported to PETRONAS as stipulated in Section 18, PPGUA Rev. 2, 2008.

2.16 Oil Spill Contingency Plan

- a. PS Contractor's Oil Spill Contingency Plan (OSCP) shall be developed in accordance with National Oil Spill Contingency Plan (NOSCP). The plan shall be developed in such a manner that it is able to interface with the response system adopted by the Government.
- b. The OSCP shall have at least these following objectives:-
 - i. Establish more effective and efficient response to an oil spill incidents by using and developing appropriate response strategies with the aim of reducing ecological, economic and amenity damage
 - ii. Exercise cooperative approach between all parties concerned in ensuring an effective response
 - iii. Optimize available resource capabilities in terms of equipment and personnel in managing oil spills.
- c. For PS Contractor Tier 1 oil spill response, the basis of OSR equipments determination shall be made via oil spill risk probability or exposure volume.
- d. For PS Contractor Tier 2 and 3 oil spill response, sufficient coordination and deployment of response and recovery equipment from PIMMAG, other mutual aid arrangement or third party service provider shall be made available.
- e. Post-environmental impact assessment and post-environmental monitoring shall be conducted for Tier-2 and Tier-3 oil spill incidents.

2.17 Environmental Due Diligence

- a. Environmental due diligence shall be conducted by parties involved in the handover or operatorship transfer of asset/facility and report shall be submitted to PETRONAS in order to identify environmental risks and liabilities prior to the handover or operatorship transfer of assets/facilities.

APPENDIX A: List of Prescribed Activities

Note: The list provided was extracted from the current relevant legislation for E&P sector operation/activity only. For activities that are not listed under Appendix A of this document, reference shall be made to the latest relevant legislative requirement.

Environmental Quality (Prescribed Activities)(Environmental Impact Assessment) Order 1987

Regulation 2: The activities specified in the Schedule are prescribed to be prescribed activities.

SCHEDULE

12. PETROLEUM:

- a) Oil and gas fields development.
- b) Construction of off-shore on on-shore pipelines in excess of 50 kilometres in length.
- c) Construction of oil and gas separation, processing, handling, and storage facilities.

Natural Resources and Environment Ordinance (Prescribed Activities)(Amendment) Order, 1997 (First Schedule)

“Prescribed activities” means any of the activities specified in the First Schedule.

7. ANY OTHER ACTIVITIES WHICH MAY DAMAGE OR HAVE AN ADVERSE IMPACT ON QUALITY OF ENVIRONMENT OR NATURAL RESOURCES OF THE STATE INCLUDING THE FOLLOWING:-

- vi. Any development activity intended to be carried out within a water catchment area declared under Section 8 of the Water Ordinance, 1994 (Cap. 13).
- x. The clearing of vegetation on any land or breaking up of any land for any purpose of an area exceeding 50 hectares.

Environmental Protection Enactment (Prescribed Activities)(Environmental Impact

Assessment) Order, 2005 (Second Scheduled)

3. Prescribed activities under the Environment Protection (Prescribed Activities) Order 2005 are categorised into the First and Second Schedules.

SECOND SCHEDULE

9. QUARRIES -

- (ii) Earthwork involving extraction, removal, filling or dumping earth with a volume of 40,000 cubic meters or more*

* may be applicable to construction of onshore crude oil and/or gas terminals

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**PETRONAS Procedures
and Guidelines for Upstream
Activities (PPGUA 3.0)**

**HEALTH, SAFETY AND
ENVIRONMENT
VOLUME 3**

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Executive Summary

Volume 3 provides the procedures and guidelines for managing Health, Safety and Environment (HSE) and all Emergency Communication aspects of the Contractor's upstream Petroleum Operations. It is designed to ensure that the operations and activities are carried out prudently and effectively in line with the best practices currently prevalent in the industry as well as providing the means by which PETRONAS will be able to assess and steward the Contractor's performance.

In this respect, the Contractor shall have in place a documented Health, Safety and Environment Management System (HSEMS) or its equivalent to ensure that the operational integrity of its upstream operations meets the PETRONAS HSE requirements inclusive of statutory requirements. The Emergency Communication Procedure is developed to ensure that the Contractor communicates and reports to PETRONAS in the event of an incident and emergency.

It is the Contractor's obligation to ensure that the elements of HSEMS are embedded into the critical aspects of their exploration and production (E&P) life cycle from exploration to decommissioning.

The system shall ensure continuous improvement in performance and provide evidence that all risks and critical operations have been assessed to minimise the risks to as low as reasonably practicable (ALARP).

Contact Information

All correspondence related to this volume shall be addressed to:

General Manager
Health, Safety and Environment
Petroleum Management Unit

Definition

TERM	DEFINITION
Environmental Cost Benefit Analysis Evaluation	Financial technique that compares monetary value of an environmental damage or benefits against the monetary value of a project costs in evaluating and prioritizing environmental issues for business decision purposes.

Section 1: Health, Safety and Environment

1.1 Integrating a Health, Safety and Environment Management System (HSEMS) in an Exploration & Production (E&P) Life Cycle

Contractor's business processes and operations shall adhere to PETRONAS guidelines and all relevant laws and regulations.

Contractor should note that all the requirements addressed in this section, shall apply to upstream activities and facilities located both onshore and offshore.

Contractor must ensure that their HSEMS is integrated into the critical activities of the following E&P phases:

- a) Exploration
- b) Development
- c) Fabrication/Installation/Hook-up and Commissioning
- d) Production
- e) Decommissioning/Abandonment

1.2 Health, Safety & Environment Management System: Requirements and Expectations

Contractor shall establish their HSEMS based on PETRONAS' HSEMS PTS 60.0101 requirements or equivalent which best suit their business and operational needs.

Contractor must ensure that their HSEMS remain relevant throughout E&P operations. In the event of entering a new phase, the Contractor is obliged to update the document accordingly.

A copy of the Contractor's HSEMS manual and revisions shall be submitted to PETRONAS within one (1) month of Contractor's management endorsement.

PETRONAS expects the Contractor to be self-regulatory in managing HSE aspects which is comply with relevant HSE laws and regulations. In the absence of regulatory requirements and PETRONAS standards, the Contractor should apply international standards and best practices.

Contractor's HSEMS is required to address and subscribe to the following elements:

1.2.1 Leadership and Commitment

Contractor's management team must demonstrate strong and visible leadership. They are expected to show a high level of commitment and accountability in all areas including the allocation of the resources needed to develop and implement the HSEMS. Contractor's management team shall communicate their HSE expectations and prioritise HSE matters in any meeting or engagement.

1.2.2 Policy and Strategic Objectives

Contractor shall have a written HSE policy that includes but not limited to prohibition of drug and alcohol abuse, environment, stop work, health and safety. The highest level of the Contractor's management team should endorse this policy. Contractor must establish strategic objectives to support these policies and set a framework for setting and reviewing HSE plans and targets.

1.2.3 Organisation, Responsibilities, Resources, Standards & Document

Contractor must establish an organisation structure that outlines the specific roles and responsibilities in the management of HSE issues. The management representative must be appointed by and be accountable to the Contractor's management team on implementation of HSE strategies.

Contractor must allocate sufficient resources including allocation of competent personnel at HSE critical positions, budget, training and hardware including emergency management facilities to ensure effective implementation of the HSEMS. In addition, the Contractor must develop a system to ensure and review the competency of the HSE critical position and personnel.

Contractor must have systematic control over HSE documents for easy identification, accessibility and periodic review. The following list contains the minimal documentation and records that should be in place:

- a) HSE Plan
- b) HSE Organization Chart
- c) Job Descriptions including HSE responsibilities (for non-HSE personnel)
- d) HSEMS Documentation Register/Master list
- e) Procedure on HSEMS Documentation Control
- f) HSE Requirements for Third Party Contractor
- g) HSE training matrix and records
- h) Legal register and other statutory requirements.

Refer to Appendix 1: List of Health, Safety and Environment Documents for Submission.

1.2.4 Evaluation and Risk Management

Contractor must ensure that there is a structured HSE risk management and analysis process in place that identify and establish an inventory list of all health, safety and environmental risks and hazards for all E&P operations.

The Hazard and Effects Management Process (HEMP) or its equivalent, must be applied in order to evaluate the severity, effects and probability of any potential hazardous situation. Contractor is also required to establish a control mechanism to eliminate or minimise risk to ALARP.

When identifying HSE hazards, the Contractor must incorporate the findings from the HSE risk assessment as stipulated in the regulations. Contractor should be guided by the phases laid out in Appendix 2: Risk Assessment Activities by E&P Phases, when implementing and managing HSE risks.

The complete list of risk assessment reports that needs to be submitted to PETRONAS can be found in Appendix 1: List of Health, Safety and Environment Documents for Submission.

1.2.5 Planning

Contractor shall ensure that their HSE Plan is strategically developed in line with their corporate strategic objectives. Contractor is required to develop both, an annual and a five-year HSE plan which have to be submitted to PETRONAS by December of the preceding year.

Contractor must track the implementation of their HSE Plan including any HSE activities carried out by third party contractors. Contractor must also develop a site-specific HSE plan for each project (e.g. rejuvenation, Enhanced Oil Recovery (EOR), field survey, drilling) which they shall make available to PETRONAS.

The HSE plan shall consist but not limited to the following:

- a) **Procedures and Work Instructions:**
Contractor must establish written procedures or work instructions for all HSE critical activities. These must be based on PETRONAS Technical Standards (PTS) or acceptable international standards.
- b) **Management of Change:**
Contractor must establish written procedures for planning and implementing all changes. This will include any changes made to equipment, organization, personnel and procedures, both permanent and temporary, to assess HSE impact and avoid adverse HSE consequences.
- c) **Contingency and Emergency Planning:**
Contractor must develop, document and implement an Emergency Response and Oil Spill Contingency Plan, both at the company's premises and at the worksite.

Contractor must ensure that the emergency response preparedness and capabilities are maintained at all times including, but not limited to, drills and exercise. Contractor must ensure a timely and efficient response and recovery to any emergency regardless of the severity of the incident.

Refer to Section 2: Emergency Communication Procedure in this volume.

1.2.6 Implementation and Monitoring

All activities and tasks conducted by the Contractor and their third party contractors must comply with work instructions developed prior to the commencement of work.

Monitoring facilitates the control of HSE critical activities and processes. The detail and frequency of measurement needs to reflect the nature and extent of the risks involved. There should be regular and intensive monitoring for high risk facilities, plants and activities.

HSE Key Performance Indicators (KPI) must be in place to measure the implementation of the HSEMS and to evaluate stakeholder concerns.

Contractor must have an effective HSE Performance Monitoring System in place as well as establishing and maintaining records to ensure HSE targets are met. HSE performance reporting requirements and its frequency is stipulated in the PETRONAS E&P HSE KPI Definition and Reporting Guideline.

1.2.7 Assurance

Contractor must develop the HSE assurance procedures and programme. Contractor must also conduct assurance at a scheduled interval to ensure effective implementation of HSEMS and compliance to statutory requirements.

Contractor must carry out regular inspection and management visits at all locations.

The annual HSE assurance programmes must be submitted to PETRONAS as part of the Contractor's annual HSE Plan.

Contractor must extend an invitation to PETRONAS to participate at least one (1) month prior to the scheduled assurance exercise. Contractor must give PETRONAS a copy of the final HSEMS assurance report one (1) month after completion of the audit exercise.

Contractor must develop and maintain a system to ensure:

- a) Assurance findings are recorded
- b) Prioritised corrective actions are identified
- c) Action parties are assigned
- d) Targeted completion dates are identified
- e) Findings are tracked to final close-out.

Contractor should refer to Volume 7, Section 11: Operating Performance Improvement for Priority 1 Risk Matrix.

1.2.8 Review

Contractor's appointed management representative must conduct a regular HSEMS review to ensure its continuity and effectiveness.

1.3 PETRONAS Inspection and Assurance

PETRONAS reserves the right to conduct HSE site visits, inspections or technical assurances at the Contractor's operational locations, wherever and whenever necessary. PETRONAS will notify the Contractor at least one (1) month prior to the exercise. Contractor must fully cooperate and make all the necessary arrangements throughout the exercise. The inspection and assurance team should consist of personnel from PETRONAS or its appointed representative(s) and where applicable, the Contractor's shareholders or equity partners.

1.4 Key Performance Indicator (KPI) and Reporting

Contractor must monitor and report on the effectiveness of their Health, Safety and Environment (HSE) performance/ management system /strategy using the Key Performance Indicators (KPI), stipulated in PETRONAS E&P HSE KPI Definition and Reporting Guideline.

Contractor's HSE Performance Report must be submitted to PETRONAS on a monthly basis. The report is due by 10th of the following month.

1.5 Incident Investigation & Reporting

All incidents must be investigated by the Contractor as soon as possible. For an incident involving a third party contractor, the Contractor's representative must be the team leader for all investigations and reporting of the HSE incident categories listed below:

- a) Fatality
- b) Major Oil Spill
- c) Lost Workday Case (LWC)/ Medical Treatment Case (MTC)/ Restricted Work Case (RWC)
- d) Major Property Damage
- e) Major and Minor Process fire
- f) Major non-process fire
- g) Regulatory Occupational Illness cases
- h) Major Loss of Primary Containment (LOPC)

- i) High potential near misses

The above incident categories are defined in accordance with PETRONAS E&P HSE KPI Definition and Reporting Guideline.

Contractor must notify PETRONAS immediately of any incident related to their operations. The detail incident notification procedures to be followed are stipulated in Section 2: Emergency Communication Procedure.

PETRONAS reserves the right to participate in any investigation that is undertaken by the Contractor. A preliminary incident investigation report, for any of the incidents listed below, must be submitted to PETRONAS within a month from the date of the incident:

- a) Fatality
- b) LTI, RWC, MTC
- c) Major Process and Non-Process Fire
- d) Minor Process Fire
- e) Major Property Damage
- f) High Potential Near Misses
- g) Major Oil Spill

This shall be followed by the final incident investigation report once it has been endorsed by the Contractor's management.

PETRONAS has the option to request an investigation report on any incidents as and when required.

If requested, presentation to PETRONAS shall be conducted by Contractor.

1.6 Offshore Safety Passport

All personnel working offshore must undergo relevant training and be medically fit in accordance with the Minimum Industrial Standard – Basic Offshore Safety and Emergency Training (MIS BOSET) and the PETRONAS Guideline on Medical Assessment of Fitness to Work for Offshore Workers.

Any exemption on the training requirement as per MIS BOSET must be based on personnel risk exposure and the Contractor is fully responsible for any exemption given.

An Offshore Safety Passport (OSP) is a document issued by the Contractor to all personnel that have undergone the relevant training and are medically fit to work offshore.

Contractor must have a system in-place for managing the issuance of Offshore Safety Passports for different categories of offshore workers working for and on-behalf of their company. Contractor must also update My Safety Database System (MySDS) within 5 days of the date that the OSP was issued.

1.7 Drug and Alcohol Abuse

PETRONAS prohibits the abuse of drugs and alcohol which is against the approved policy of the Contractor. It is the Contractor's obligation and responsibility to establish a written policy and procedure that includes, but not limited to:

- a) Systematic method of identification,

- b) Screening,
- c) Testing and,
- d) Verification process,

This shall be implemented throughout the organisation and must be followed by the employees and appointed third party contractors to ensure that all workplaces are alcohol and drug free at all times.

1.8 Third Party Contractor HSE Management

Contractor must ensure that any appointed third party contractors are licensed and/or registered with PETRONAS and are in full adherence to HSE and project requirements.

Contractor must monitor their third party contractor's HSEMS to ensure compliance to their own HSE policy, guidelines and standards.

Contractor must further ensure that there is a system in place to manage the third party contractor's HSE in line with PETRONAS' PTS 60.0305 (Contractor HSE Management) or equivalent.

Contractor must develop annual third party contractor HSE Assurance Programmes as part of their annual Contractor's HSE Plan.

The documented evidence pertaining to the assurance should be made available at all times together with any follow-up action taken.

1.9 Process Safety Management (PSM)

Contractor must establish a system to manage process safety. The system must address the following scope as the minimum requirement:

- a) Mechanical Integrity (MI)
- b) Management of Change (MOC)
- c) Operating Procedure (OP)
- d) Process Hazard Analysis (PHA)
- e) Pre-Activity Safety Review (PASR)
- f) Process Safety Information (PSI)
- g) Design Integrity (DI)
- h) Proprietary and Licensed Technology Assessment (PLTA)

PETRONAS E&P Minimum Process Safety Requirement must be the guiding principle for the Contractor to use when implementing PSM in their company.

Process Safety KPIs must be reported to the PETRONAS as part of the monthly HSE performance reporting. The reportable process safety KPIs are outlined in the PETRONAS E&P HSE KPI and Reporting Guideline.

1.10 Environmental Protection

In addition to regulatory requirements, PETRONAS E&P Minimum Environmental Specifications (MES) must be the reference point and guiding principle for the Contractor to use when planning and implementing environment management.

When specific environment requirements are not established or when there is a need to consider measures beyond such minimum requirements, an Environmental Cost Benefit

Analysis Evaluation should be applied to establish the appropriate level of environmental protection required.

Environmental reporting to regulatory bodies in relation to facilities and operations performance, which should include but not limited to emissions, effluent and offshore produced water discharge, must be copied to PETRONAS.

Section 2: Emergency Communication Procedure

2.1 Incident

An incident is defined as an event or chain of events, which has caused or could have caused injury, illness and/or damage (loss) to assets, the environment, reputation or third parties. An incident includes the release or near release of any hazard into the environment or one that has the potential to precipitate an emergency, disaster and/or crisis, as defined in PETRONAS' PTS 60.0501: Incidents Classification, Investigation and Reporting.

2.1.1 Emergency

An emergency means an adverse situation or incident that has an impact on operations, personnel, reputation, environment and property which can usually be brought under control by the Contractor, as defined in PETRONAS' PTS 60.0112 - Group Contingency Planning Standard.

2.1.2 Disaster

A disaster is an event that causes great harm or damage to the Company's reputation, its operations or process and results in significant economic or legal liabilities, requiring PETRONAS Groups' support and intervention, as defined in PETRONAS' PTS 60.0112: Group Contingency Planning Standard.

2.1.3 Crisis

A crisis is defined as a significant business disruption that invites extensive media coverage and public scrutiny which will affect the organization's normal operations and could have political, financial and governmental impact on its business, as defined in PETRONAS' PTS 60.0112: Group Contingency Planning Standard.

2.2 PETRONAS' Three-Tiered Response Approach Model

PETRONAS' three-tiered response approach provides a clear demarcation of the roles and responsibilities of the Contractor, PETRONAS and relevant government agencies or authorities. The three-tiered response is defined as follows:

2.2.1 Tier 1 – Minor

A situation where there is no danger to life and where the risk of damage to property, environment and business is minimal. These emergencies fall within the control of the Contractor, as defined in PETRONAS' PTS 60.0112: Group Contingency Planning Standard.

2.2.2 Tier 2 – Major

A situation where there is danger to life and risk of damage to property, environment and business. The emergency falls within the control of the Contractor with limited external assistance, as defined in PETRONAS PTS 60.0112: Group Contingency Planning Standard.

2.2.3 Tier 3 – Crisis

A situation where there is the potential for multiple fatalities/injuries and severe damage to property, environment and business which involves neighbouring sites and surrounding communities. This type of emergency is clearly beyond the control of the Contractor and requires action from PETRONAS, the government or other external parties, as defined in PETRONAS PTS 60.0112: Group Contingency Planning Standard.

2.3 Incident Notification

Contractor must notify PETRONAS of all reportable incidents within the time frame as shown in Appendix 3 and Appendix 4 using the Incident Notification Form as defined in Appendix 5.

All reportable incidents must be notified by the quickest means possible such as Short Messaging System (SMS) or a phone call. The incident notification must be sent by facsimile or e-mail to PETRONAS Communication Centre (COMCEN) as soon as possible after the initial notification.

Contractor must notify the relevant government agencies or authorities in accordance with the applicable regulatory requirements and provide updates to PETRONAS COMCEN for all notifications. The incident notification process flow is described in Appendix 6.

Contractor must ensure all reportable incidents are reported into MyHSE Online.

In the event of prolonged emergency, updates must be sent to PETRONAS COMCEN at appropriate intervals, on a daily basis, until the emergency /crisis has been resolved or the deactivation of the Emergency Control Centre (ECC) has taken place whichever is later.

2.4 Emergency Response Plan (ERP)

Contractor must establish and maintain an Emergency Response Plan (ERP) for all worksites under their operation, including non-permanent installations such as drilling rigs, seismic vessels marine facilities (e.g. working barge, accommodation barge, etc.) and fabrication yards. The ERP shall contain, as a minimum, the emergency organization, role and responsibilities of Emergency Response Team (ERT) and Emergency Management Team (EMT), communication flow and Incident Action Plan (IAP) for any possible emergencies.

2.5 Disaster and Crisis Situation

In the event of a disaster and a crisis situation where the response is clearly beyond the capacity and capabilities of the Contractor, the following action must be taken by the Contractor, as part of the response procedure:

2.5.1 District Level Crisis Situation

Contractor must alert the respective government emergency services (e.g. Police, Malaysian Maritime Enforcement Agency (MMEA), Hospital, Department of Environment (DOE) in accordance with Majlis Keselamatan Negara (MKN) Directive 18 and 20.

2.5.2 State & National Crisis Situation

Contractor must inform PETRONAS COMCEN for further assistance that may be required from the government or emergency services

2.6 Media and Press Release

2.6.1 Holding Statement Preparation

Contractor shall prepare a Holding Statement for any reportable incident that has an impact on the reputation and credibility of the Contractor or PETRONAS, both in terms of the media and public concern, which necessitates the activation of the Emergency Control Centre (ECC). The Holding Statement must be prepared in accordance with the sample provided in Appendix 7.

The Holding Statement should contain preliminary information relating to the incident or emergency. It is prepared for interim use until detail Press Statement is prepared and approved.

Contractor must issue a Holding Statement to PETRONAS COMCEN after the Contractor's management has endorsed it. PETRONAS COMCEN will inform the Petroleum Management Unit (PMU) and Group Corporate Affairs Division (GCAD) Media Relations upon receipt of the Holding Statement from the Contractor.

2.6.2 Media Release Preparation

Contractor must obtain PETRONAS written approval for any incident that requires a media release as per Appendix 8.

For any incident that requires a media release, the Contractor must follow the media release flowchart shown in Appendix 8. The flowchart is applicable for all media releases at all stages of the incident.

Abbreviations

TERM	IN FULL
ALARP	As Low As Reasonably Practicable
BODYVAC	Body Evacuation
CHRA	Chemical Health Risk Assessment
CIMAH	Control of Industrial Major Accident Hazards
COMCEN	Communication Centre
DI	Design Integrity
DOE	Department of Environment
DOSH	Department of Occupational Safety and Health
E&P	Exploration and Production
ECC	Emergency Control Centre
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMT	Emergency Management Team
EOR	Enhanced Oil Recovery
EQA	Environmental Quality Act
ERP	Emergency Response Plan
ERT	Emergency Response Team
GCAD	Group Corporate Affairs Division (PETRONAS)
HAZID	Hazard Identification

TERM	IN FULL
HAZOP	Hazard and Operability
HEMP	Hazards and Effects Management Process
HSE	Health, Safety and Environment
HSEMS	Health, Safety and Environment Management System
HUC	Hook Up and Commissioning
IAP	Incident Action Plan
INF	Incident Notification Form
KPI	Key Performance Indicator
LOPC	Loss of Primary Containment
LTI	Loss Time Injury
LWC	Lost Workday Cases
MEDEVAC	Medical Evacuation
MES	Minimum Environmental Specifications
MI	Mechanical Integrity
MIS BOSET	Minimum Industrial Standard – Basic Offshore Safety and Emergency Training
MKN	Majlis Keselamatan Negara
MMEA	Malaysian Maritime Enforcement Agency
MOC	Management of Change
MTC	Medical Treatment Case
MyHSE	My Health, Safety and Environment
MySDS	My Safety Database System
NREB	Natural Resources and Environment Board
OP	Operating Procedure
OSP	Offshore Safety Passport
PASR	Pre-activity Safety Review
PHA	Process Hazard Analysis
PLTA	Proprietary and Licensed Technology Assessment
PMU	Petroleum Management Unit
PPD	Permanent Partial Disability
PSI	Project Safety Information
PSM	Process Safety Management
PTD	Permanent Total Disability
PTS	PETRONAS Technical Standards
QRA	Quantitative Risk Assessment
RWC	Restricted Work Case
SMS	Short Messaging System
TD	Technical Data
USD	United States Dollar

Appendix 1

List of Health, Safety and Environment Documents for Submission

No.	List of Submission	Frequency	Deadline	Reporting Level
General				
1	HSEMS Manual	Every revision	Within one (1) month after endorsement	PMU HSE
2	HSE Plan	Yearly	December of the preceding year	PMU HSE
3	Emergency Response Plan	Once	One (1) month before commencement	PMU HSE
4	HSE KPI report	Monthly	Every 10th of the following month	PMU HSE
5	HSE Audit report	Upon request	-	PMU HSE
6	Preliminary Incident Investigation report	Once	One (1) month after the date of incident	PMU HSE
7	Final Incident Investigation report	Once	(Refer to 1.5.5)	PMU HSE
Exploration				
8	Safety risk assessment report	Upon request	-	PMU HSE
9	Security risk assessment report	Upon request	-	PMU HSE
10	Environment Impact Assessment report	Once	One (1) month after DOE approval	PMU HSE
11	Environmental Risk Assessment report	Upon request	-	PMU HSE
12	Health Risk Assessment report	Upon request	-	PMU HSE
Development				
13	Safety Risk Assessment report	Upon request	-	PMU HSE
14	Health Risk Assessment report	Upon request	-	PMU HSE
15	Hazard Identification (HAZID) report	Upon request	-	PMU HSE
16	Hazard and Operability (HAZOP) report	Upon request	-	PMU HSE
17	Quantitative Risk Assessment (QRA) report	Upon request	-	PMU HSE
18	Environment Impact Assessment report	Once	One (1) month after DOE approval	PMU HSE
19	EIA Approval Conditions and Environment Management Plan (EMP) report	Once	-	PMU HSE
Production				
20	CIMAH/ Operations HSE Case report	Once	One (1) month before commencement	PMU HSE

21	Safety Risk Assessment report	Upon request	-	PMU HSE
22	Post EIA monitoring report	Upon request	-	PMU HSE
23	Health Risk Assessment report	Upon request	-	PMU HSE
No.	List of Submission	Frequency	Deadline	Reporting Level
Abandonment & Decommissioning				
24	Environment Impact Assessment (EIA) report	Once	One (1) month after DOE approval	PMU HSE
25	Environment Management Plan (EMP) report	Once	-	PMU HSE
26	Safety Risk Assessment report	Upon request		PMU HSE
27	Health Risk Assessment report	Upon request	-	PMU HSE

Appendix 2

Risk Assessment Activities by E&P Phases

Phases	Risk Assessment required
Exploration	
Data acquisition e.g. seismic, electromagnetic, air borne gravity magnetic	Safety risk assessment Security risk assessment Environment risk assessment /Environmental Impact Assessment (as required under EQA 1974)* Health Risk Assessment
Exploration drilling	Safety risk assessment Security risk assessment Environment risk assessment /Environmental Impact Assessment (as required under EQA 1974)* Health Risk Assessment *applicable for onshore (State DOE, i.e. NREB)
Development	
Facilities Design	Health Risk Assessment (focus on Ergonomic/Human Factors) Safety Risk Assessment Health Impact Assessment (onshore) Social Impact Assessment (onshore) Quantitative Risk Assessment (QRA) Environment Risk Assessment / Environmental Impact Assessment (as required under EQA 1974)* Design HSE Case (recommended) *At this stage EIA proposal is required. Full EIA is subject to DOE decision.
Fabrication/Installation/ HUC	Safety Risk Assessment Health Risk Assessment Environment Risk Assessment/ Environmental Impact Assessment (as required under EQA 1974) Security Risk Assessment
Production	
Onshore	CIMAH Safety Risk Assessment Health Risk Assessment (including CHRA) Security Risk Assessment Environmental Impact Assessment (as required under EQA 1974) Post EIA Monitoring
Offshore	Operation HSE Case Safety Risk Assessment Health Risk Assessment Security Risk Assessment Environmental Impact Assessment (as required under EQA 1974) Post EIA Monitoring
Abandonment and Decommissioning	

Offshore & Onshore	Environmental Management Plan (EMP) Health Risk Assessment
--------------------	---

Appendix 3

Incident Notification Table

Incident Classification	Notification Period		Remarks
	No ECC Activation	With ECC Activation	
Fatality / Lost of Vital Sign	Immediate		
PPD/PTD/LWC/RWC/MTC	Within 24 hours	Immediate	
Missing Person	Immediate		
Man Overboard	Within 24 hours		
MEDEVAC / BODYVAC	Within 24 hours		
Endemic/Pandemic Disease	Within 24 hours	Immediate	
Detection of Contagious Disease(s)	Within 24 hours	Immediate	
Major Fire (Process & Non Process)	Immediate		
Minor Fire (Process & Non Process)	Within 24 hours	Immediate	
Major LOPC	Immediate		
Major Oil & Chemical Spills (>5bbls)	Within 24 hours	Immediate	
Major Property Damage	Immediate		
High Potential Near Misses	Within 24 hours		
Sighting of Armed Boat	Immediate		Parallel notification to PMU HSE for faster coordination with relevant authorities.
Hijacking	Immediate		
Piracy / Sea robbery	Immediate		
Sighting foreign submarine / foreign warship / foreign aircraft	Immediate		
Security Intrusion	Within 24 hours		e.g. Personnel intrusion to offshore platform

For notification of incident which is not listed in the Appendix 3 above, refer to Appendix 4: Incident Matrix


Appendix 4

Incident Matrix

Tier / ECC	No ECC Activation	With ECC Activation
Tier 1	Within 24 hours	Immediate
Tier 2	Within 24 hours	Immediate
Tier 3	Immediate	Immediate


Appendix 5

Incident Notification Form

 <p>PETRONAS</p>	<p>COMCEN</p> <p>Tel: +603-2331 2144/42/43 E-mail : comcen@petronas.com.my</p>	<p>CONTRACTOR:</p> <p>Tel : Fax :</p>
<p>To: Fax (Mandatory) and SMS.</p> <p><input type="checkbox"/> COMCEN - +603-2161 1696 <input type="checkbox"/> COMCEN - 012-3748702 & 012 - 3168496</p>		

NOTIFICATION LIST (For COMCEN Used Only)

MANDATORY	
<p><input type="checkbox"/> Tier 1 (Minor Emergency)</p> <p>And/or</p> <p><input type="checkbox"/> Incident Rating 3 – 24 Hours</p>	<p><input type="checkbox"/> HEAD PMU HSE - +603-2331 0815</p>
<p><input type="checkbox"/> Tier 2 (Major Emergency) – Immediate</p> <p><input type="checkbox"/> Tier 3 (Crisis) – Immediate</p> <p>And/or</p> <p><input type="checkbox"/> Incident Rating 4 – Immediate</p> <p><input type="checkbox"/> Incident Rating 5 – Immediate</p>	<p><input type="checkbox"/> HEAD PMU HSE - +603-2331 0815</p>

	INCIDENT NOTIFICATION FORM					Contractor:	
						TEL:	
						FAX:	
In case of Emergency <input type="checkbox"/> Initial *** <input type="checkbox"/> Subsequent <input type="checkbox"/> Stand Down	Emergency Response Level <input type="checkbox"/> Tier 1 <input type="checkbox"/> Tier 2 <input type="checkbox"/> Tier 3 *** Mandatory fields for initial notification					Major Incident Classification <input type="checkbox"/> Rating 1 <input type="checkbox"/> Rating 4 <input type="checkbox"/> Rating 2 <input type="checkbox"/> Rating 5 <input type="checkbox"/> Rating 3	
*** SECTION A: BASIC INFORMATION ***							
Department Responsible:		Date Prepared:					
		Time Prepared:					
Incident Location:	<input type="checkbox"/> Onshore:		Incident Date:				
	<input type="checkbox"/> Offshore:		Incident Time:				
*** SECTION B: NATURE OF INCIDENT / TYPE OF INCIDENT ***							
HSE	<input type="checkbox"/> Fire / Explosion		<input type="checkbox"/> Injury		<input type="checkbox"/> Environment		<input type="checkbox"/> Others: ()
	<input type="checkbox"/> Loss of Containment / Gas Leak				Spillage / Release Volume:		
					Recovered Volume:		
Security	<input type="checkbox"/> Industrial Unrest		<input type="checkbox"/> Kidnapping / Hostage		<input type="checkbox"/> Bomb / Death Threat		<input type="checkbox"/> Community Disturbance
	<input type="checkbox"/> Others: ()						
Transportation	<input type="checkbox"/> Land		<input type="checkbox"/> Water		<input type="checkbox"/> Air		Please specify:
*** SECTION C: INCIDENT POTENTIAL ***							
<input type="checkbox"/> Incident Under Control				<input type="checkbox"/> Incident currently not under control, but can be handled with available resources			
<input type="checkbox"/> Incident will require additional resources (e.g. authorities, contractors, mutual aid)				<input type="checkbox"/> Incident will likely generate significant public affairs / community, authorities relations issues			
*** SECTION D: CASUALTY / FATALITY ***							
Number of Injured Person <input type="checkbox"/> PETRONAS: () <input type="checkbox"/> Contractor: () <input type="checkbox"/> 3rd Party: ()				Number of Fatality <input type="checkbox"/> PETRONAS: () <input type="checkbox"/> Contractor: () <input type="checkbox"/> 3rd Party: ()			
SECTION E: AUTHORITIES INFORMED or EQUIVALENT (International Operations)							
Date Informed:	<input type="checkbox"/> Police	<input type="checkbox"/> BOMBA (Fire Dept.)	<input type="checkbox"/> Medical	<input type="checkbox"/> DOSH	<input type="checkbox"/> DOE	<input type="checkbox"/> Other: ()	
SECTION F: INCIDENT CLASSIFICATION (Refer to next page for general guidance)							
<input type="checkbox"/> People	1	2	3	4	5	<input type="checkbox"/> Process Incident <input type="checkbox"/> Non Process Incident	
<input type="checkbox"/> Environment	1	2	3	4	5		
<input type="checkbox"/> Asset / <input type="checkbox"/> Business Disruption	1	2	3	4	5		

<input type="checkbox"/> Reputation	1	2	3	4	5	
<input type="checkbox"/> Security	1	2	3	4	5	

SECTION G: BRIEF DESCRIPTION OF INCIDENT (Who, What & Consequence)

SECTION H: MITIGATION ACTION TAKEN

SECTION I: COMMENT / ADDITIONAL INFORMATION

SECTION J: STAND DOWN TIME: (Incident Terminated - All Clear Alarm)

*** Prepared / Reported by ***	Name:		Signature:
	Designation:		
*** Approved and Submitted by ***	Name:		Signature:
	Designation:		

General Guidance for Incident Classification (Based on Actual Impact of Incident)

Class	Rating	People	Asset	Environment	Reputation	Security
Minor	1	Slight injury or health effect First Aid Case	Slight damage No disruption Fire/Explosion causing less than USD25K of direct cost	Slight effect Contained within secondary containment	Slight impact Public awareness exist	Slight impact Trespassing
	2	Minor injury or health effect Medical treatment, LTI of 4 days or less	Minor damage Brief disruption, < 2 hours Fire/Explosion causing less than USD25K of direct cost	Minor effect Causing volatilization to atmosphere and limited contamination of soil or water within the containment area	Limited impact Some local public concern	Minor impact Minor criminal case
Major	3	Major injury or health effect Permanent partial disability, LTI more than 4 days	Local damage Shutdown of a single unit Fire/Explosion causing USD25K and more of direct cost	Local effect Spill spreading outside the secondary containment but within facility perimeter	Considerable impact Regional public concern. Extensive adverse attention in local media	Major impact Major criminal case resulting in injury Arson
	4	Single fatality or Permanent Total Disability	Major damage Shutdown of multiple units Fire/Explosion causing USD25K and more of direct cost	Major effect Spill spreading outside perimeter causing major contamination	National impact National public concern. Extensive adverse attention in national media	Serious impact Major criminal case resulting in single fatality Kidnapping
	5	Multiple fatalities	Extensive damage Total facility shutdown Fire/Explosion causing USD25K and more of direct cost	Massive effect Spill spreading outside perimeter causing massive contamination	International impact Extensive adverse attention in international media	Extensive impact Major criminal case resulting in multiple fatalities Bomb threat

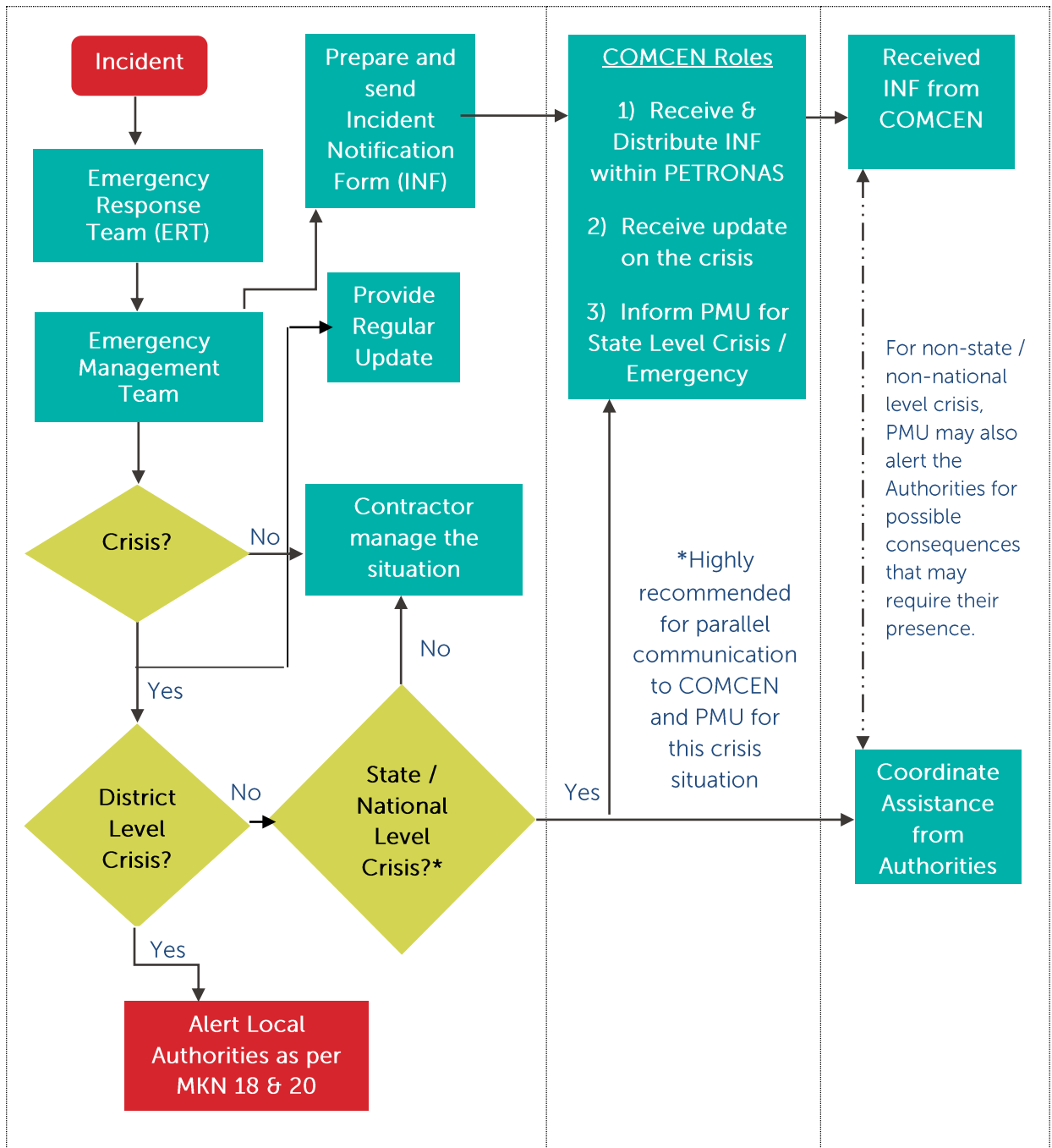
(Details in Appendix 6 of PTS 60.0501 Incidents, Classification, Investigation and Reporting)

A process safety incident is the "Unexpected / unplanned / uncontrolled release of toxic, reactive or flammable liquids and gases in processes involving highly hazardous chemicals"

Appendix 6

Incident & Emergency Notification Flowchart

CONTRACTOR	PETRONAS COMCEN	PETRONAS PMU
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Appendix 7

Holding Statement

Operator's Name :
 Operator's Address :
 Date :

Holding Statement

We wish to inform that (type of incident) has occurred on (date and time) at (name of affected facility/place).

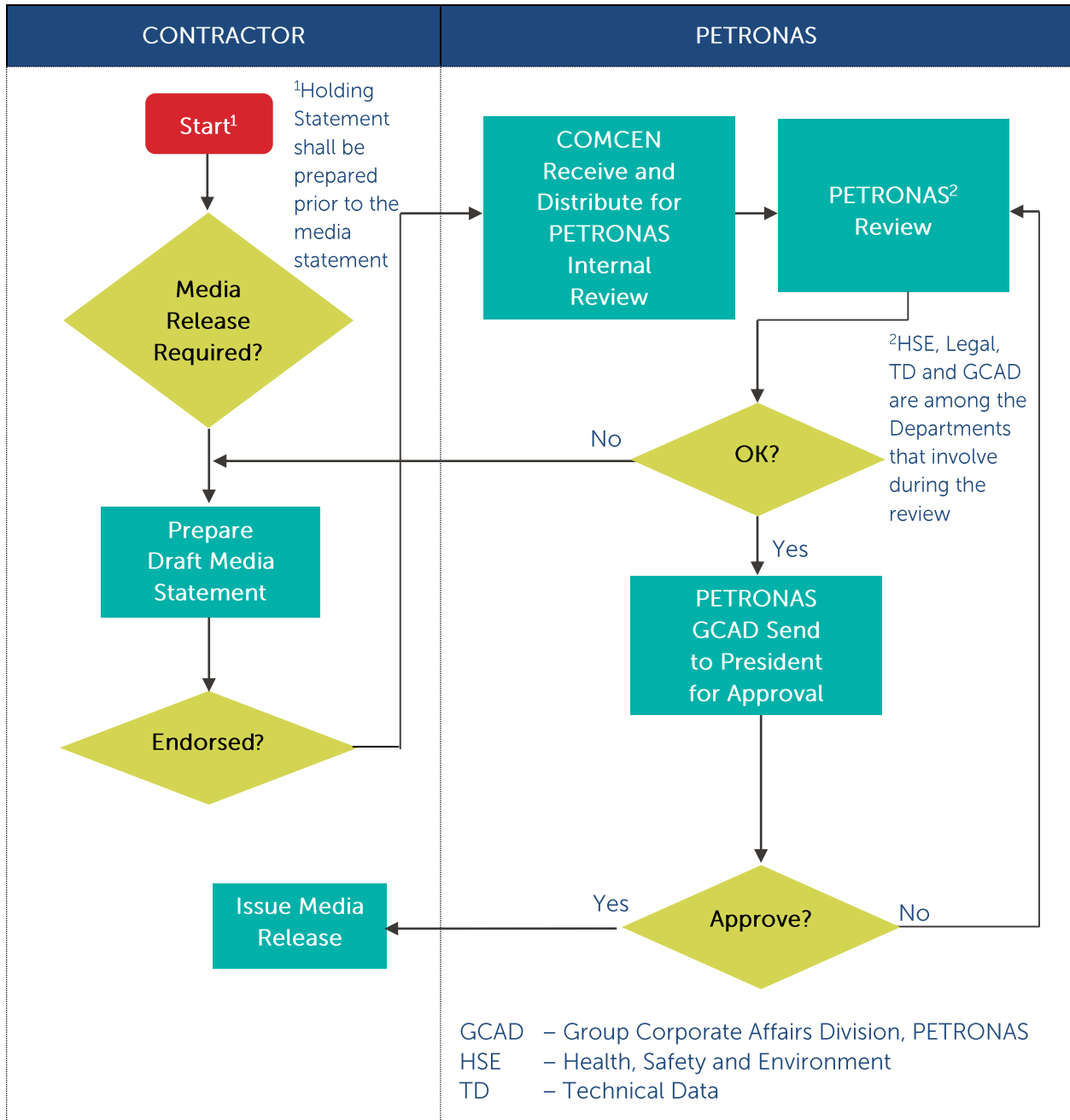
At this moment, we are unable to provide additional details.

We will release more information on this matter as soon as we are in the position to do so.

Signature :
Designation :

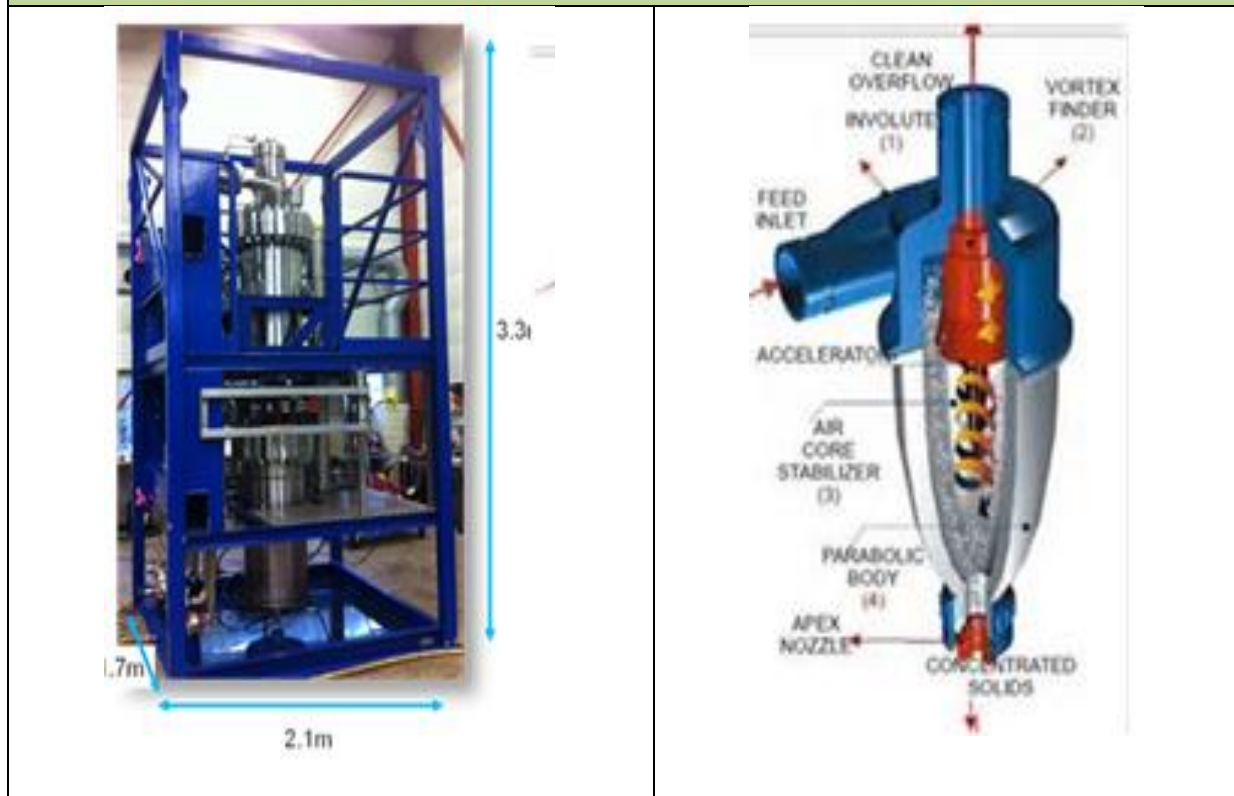
Appendix 8

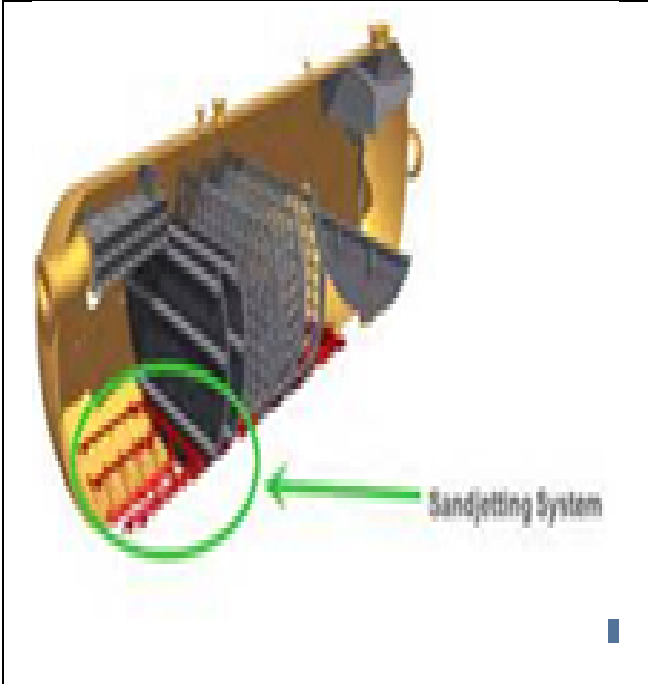
Media Release Process



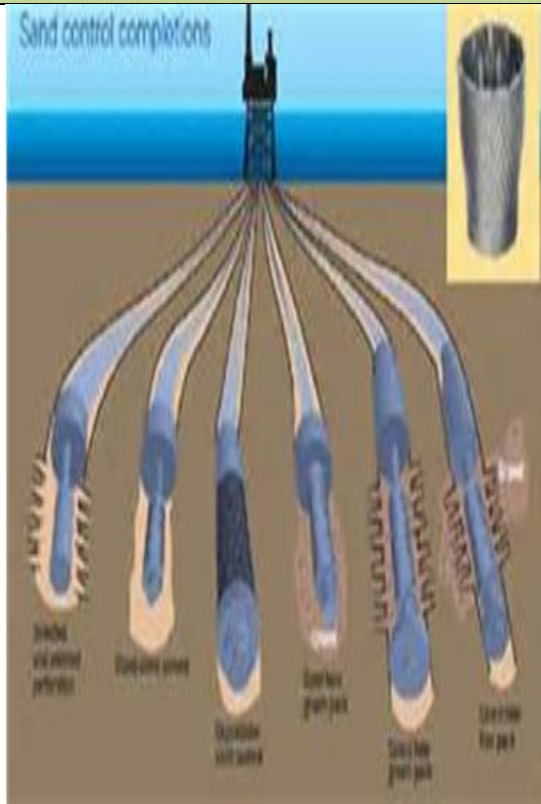
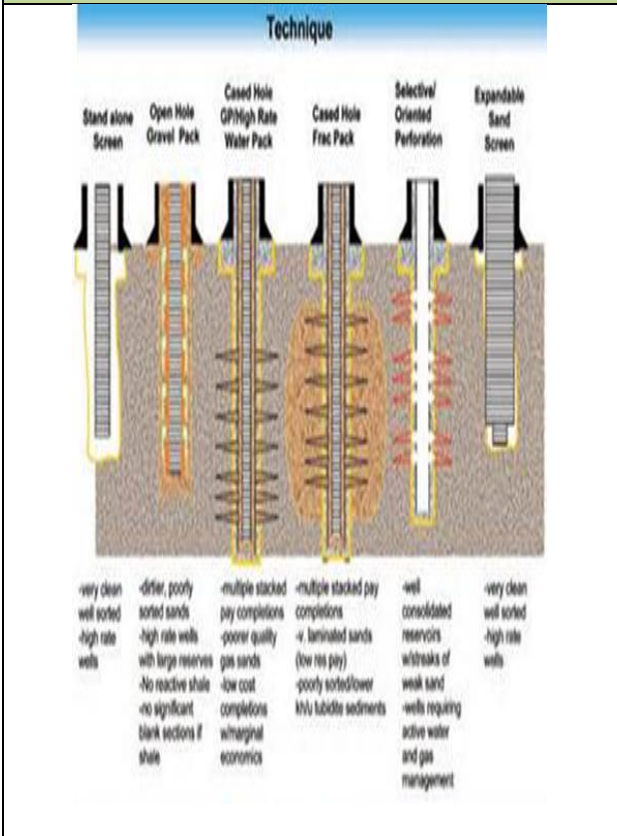
PRODUCED SAND CONTROL MANAGEMENT COMPOSITIONAL ANALYSIS

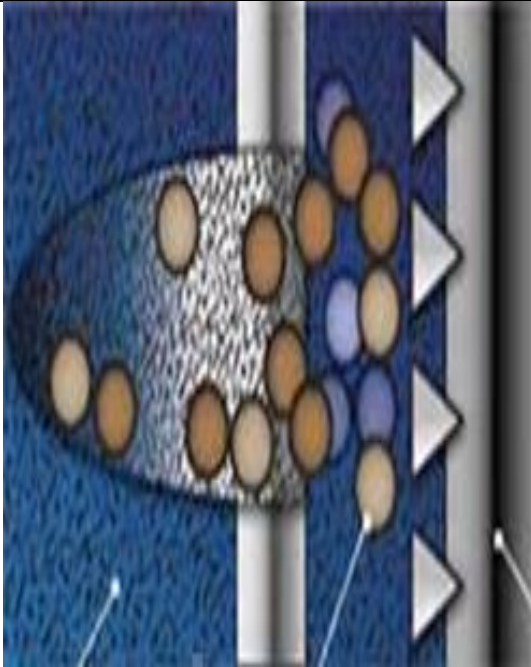
TYPE OF SAND REMOVAL EQUIPMENT OFFSHORE – SURFACE FACILITIES





TYPE OF SAND REMOVAL EQUIPMENT OFFSHORE – SUBSURFACE FACILITIES





AVAILABLE SAND CONTROL TECHNIQUES

<p><u>NO SAND EXCLUSION DEVICE</u> (Many of these are termed “Sand Management”)</p>	<p><u>WITH SAND CONTROL</u></p>
<ul style="list-style-type: none"> • Maintenance and Workover 	<ul style="list-style-type: none"> • Chemical Consolidation
<ul style="list-style-type: none"> • Cyclonic Surface Separation 	<ul style="list-style-type: none"> • Resin-Coated Gravel
<ul style="list-style-type: none"> - Wellhead Desanders 	<ul style="list-style-type: none"> • Slotted Liner or Screens Without Gravel Pack
<ul style="list-style-type: none"> - Wellstream Desanders 	<ul style="list-style-type: none"> • Open Hole or Cased Hole
<ul style="list-style-type: none"> • Rate Exclusion 	<ul style="list-style-type: none"> • FracPacking and Fracturing
<ul style="list-style-type: none"> • Selective Completion Practices 	<ul style="list-style-type: none"> • Expandable Screens
<ul style="list-style-type: none"> • Oriented Perforating 	<ul style="list-style-type: none"> • Vent Screens
<ul style="list-style-type: none"> • High Density Perforating 	<ul style="list-style-type: none"> • Other
<ul style="list-style-type: none"> • Phase Oriented Perforating 	
<ul style="list-style-type: none"> • Horizontal Wells 	
<ul style="list-style-type: none"> • Fracturing 	
<ul style="list-style-type: none"> • Other, e.g. Wormhole formation 	

SUMMARY – SOME SAND CONTROL OPTIONS	
<ul style="list-style-type: none"> • Open Hole <ul style="list-style-type: none"> - Liner - Screen - Gravel pack - Prepacked screen 	<ul style="list-style-type: none"> • Carrier Fluid <ul style="list-style-type: none"> - Brine - Gel - Cross-linked - High rate - Above frac gradient
<ul style="list-style-type: none"> • Cased Hole <ul style="list-style-type: none"> - Prepack Perfs - FracPack - Water Frac 	<ul style="list-style-type: none"> • Gravel tyoe <ul style="list-style-type: none"> - Sand - Artificial
	<ul style="list-style-type: none"> • Gravel Size
<ul style="list-style-type: none"> • FracPack <ul style="list-style-type: none"> - With or without screens 	<ul style="list-style-type: none"> • Resin-Coated Gravel
<ul style="list-style-type: none"> • Expandable Screens 	<ul style="list-style-type: none"> • Resin Placement
<ul style="list-style-type: none"> • Vertical or Horizonatal Well 	<ul style="list-style-type: none"> • Other Choices

APPENDIX 6

MAJOR SAND CONTROL METHODS

There are two major methods for sand control: chemical sand consolidation and mechanical gravel packing.

Chemical Sand Control – Sand Consolidation

Chemically sand consolidation is the process whereby the sand grains in a zone surrounding the wellbore is consolidated using a plastic material. The method is best applied to those formation intervals that are relatively free of clays and fines, have a uniform permeability, are thin (less than 15-ft or 5-m usually), and have no prior history of sand production. If these criteria are met, consolidation systems are attractive. However, high temperature may rule out the use of chemical consolidation procedures.

Mechanical Sand Control – Gravel Packing Method

Gravel packing is the most widely used method. This method has a great statistical chance for success in most types of completion. These benefits of favorable reliability, cost and versatility make gravel packing preferred method of sand control in most, but certainly not all cases. Gravel packing methodology can further be divided into internal casing gravel pack (IGP), open-hole gravel packing (OHGP) and miled casing under reamed gravel packing (MCUGP).

Other Sand Control Methods

Other methods used are the sand lock using resin-coated gravels. As a general rule, a method of sand control must be selected before sand production occurs. The older the well the less is the chance of success. Treatment becomes more complicated and time consuming.

HEAVY METAL COMPOSITIONAL ANALYSIS

Compositional Analysis (Dry Basis)

Metals	TTLC	STLC
	mg/kg	mg/L
Antimony (Sb)	500	15
Arsenic (As)	500	5
Barium (Ba)	10000	100
Beryllium (Be)	75	0.75
Cadmium (Cd)	100	1
Chromium (Cr)	2500	5
Chromium-VI (CrVI)	500	5
Cobalt (Co)	8000	80
Copper (Cu)	2500	25
Lead (Pb)	1000	5
Mercury (Hg)	20	0.2
Molybdenum (Mo)	3500	350
Nickel (Ni)	2000	20
Selenium (Se)	100	1
Silver (Ag)	500	5
Thallium (TI)	700	7
Vanadium (V)	2400	24
Zinc (Zn)	5000	250

FOOT NOTE:

STLC : Soluble Threshold Limit Concentration

TTLC : Total Threshold Limit Concentration

METHOD OF SAMPLING AND EXAMINATION

The method of sampling and examination shall be in accordance with the “Test Method for Evaluating Solid Waste, Physical/Chemical Methods”, USEPA Publication SW -846, Latest Edition



Background Document

Establishment of a list of Predicted No Effect Concentrations (PNECs) for naturally occurring substances in produced water.

(OSPAR Agreement 2014-05)¹

Contents

- 1 Executive summary
- 2 Background
 - 2.1 Objective
- 3 Selection of produced water substances to be included in a substance based risk assessment approach
 - 3.1 Produced water substances
 - 3.2 Criteria and selection
 - 3.3 Selected substances
 - 3.3.1 Metals
 - 3.3.2 Monoaromatic hydrocarbons (BTEX)
 - 3.3.3 Dispersed oil
 - 3.3.4 Polycyclic aromatic hydrocarbons (PAHs)
 - 3.3.5 Phenol/alkyl phenols
 - 3.3.6 Organic acids
- 4 Selection of PNECs
 - 4.1 Collection of established PNECs
 - 4.2 Criteria for selecting PNECs

¹ This Agreement is in English only.

It was agreed that this Background Document would be published on the OSPAR website as an OSPAR Agreement. OIC 2014 agreed to replace Table 1 (PNECs and EQSs for naturally occurring substances found in produced water) in Appendix 5 of the OSPAR RBA Guidelines (Agreement 2012/7) with a link to this Background document

- 4.3 Surrogate PNECs and grouping
- 5 Selected PNECs
- 6 Update and deviation
 - 6.1 Update
 - 6.2 Deviation
 - 6.2.1 New toxicity data
 - 6.2.2 Monitoring data
- 7 PNEC fact sheets
 - 7.1 BTEX
 - 7.1.1 Benzene
 - 7.1.2 Toluene
 - 7.1.3 Ethylbenzene
 - 7.2 Naphthalenes
 - 7.2.1 Naphthalene (incl. C1-C3 alkyl homologues)
 - 7.3 2-3 ring PAHs
 - 7.3.1 Acenaphthene
 - 7.3.2 Acenaphthylene
 - 7.3.3 Fluorene
 - 7.3.4 Anthracene
 - 7.3.5 Phenanthrene (incl. C1-C3 alkyl homologues)
 - 7.4 4 ring PAHs
 - 7.4.1 Fluoranthene
 - 7.4.2 Pyrene
 - 7.4.3 Benz[a]anthracene
 - 7.4.4 Chrysene
 - 7.5 5-6 ring PAHs
 - 7.5.1 Dibenz[a,h]anthracene
 - 7.5.2 Benzo[a]pyrene
 - 7.6 Dispersed oil
 - 7.7 Metals
 - 7.7.1 Dealing with metals

- 7.7.2 Total versus dissolved concentrations
- 7.7.3 Background concentrations
- 7.7.4 Arsenic
- 7.7.5 Cadmium
- 7.7.6 Chromium
- 7.7.7 Copper
- 7.7.8 Nickel
- 7.7.9 Mercury
- 7.7.10 Lead
- 7.7.11 Zinc
- 7.8 Alkyl phenols
 - 7.8.1 Phenol (incl. C0-C3 alkyl phenols representative)
 - 7.8.2 Butylphenol (C4 alkyl phenols representative)
 - 7.8.3 Pentyl phenol (C5 alkyl phenols representative)
 - 7.8.4 Octylphenol (C6-C8 alkyl phenols representative)
 - 7.8.5 Nonylphenol (C9 alkyl phenols representative)
- 8 References
- 9 Appendix 1
 - 9.1 Environmental Quality Standards derived under the Water Framework Directive
 - 9.1.1 Derivation of EQS values
 - 9.2 PNECs derived under the Risk Assessments under Existing Substances Regulations (ESR)
 - 9.3 Differences between WFD and REACH

Chemical Hazard and Risk Management (CHARM)

The OCNS conducts hazard assessments on chemical products that are used offshore.

The CHARM model calculates the ratio of Predicted Effect Concentration against No Effect Concentration (PEC:NEC). This is expressed as a Hazard Quotient (HQ), which is then used to rank the product.


The HQ is converted to a colour banding, illustrated in Table 1, which is then published on the **Definitive Ranked Lists of Registered Products, Excel format (ZIP, 385.22 KB, updated 26 August 2014)**.

Data used in the CHARM assessment include toxicity, biodegradation and bioaccumulation.

The CHARM model is divided into four main algorithms:

- production
- completion/work-over
- drilling
- cementing.

Table 1: OCNS HQ and colour bands

Minimum HQ value	Maximum HQ value	Colour banding	
>0	<1	Gold	 Lowest hazard Highest hazard
≥1	<30	Silver	
≥30	<100	White	
≥100	<300	Blue	
≥300	<1000	Orange	
≥1000		Purple	

MALAYSIA MARINE WATER QUALITY CRITERIA AND STANDARD

Parameter	CLASS 1	CLASS 2	CLASS 3	CLASS E
BENEFICIAL USES	Preservation, Marine Protected areas, Marine Parks	Marine Life, Fisheries, Coral Reefs, Recreational and Mariculture	Ports, Oil & Gas Fields	Mangroves Estuarine & River-mouth Water
Temperature (°C)	≤ 2°C increase over maximum ambient	≤ 2°C increase over maximum ambient	≤ 2°C increase over maximum ambient	≤ 2°C increase over maximum ambient
Dissolved oxygen (mg/L)	>80% saturation	5	3	4
Total suspended solid (mg/L)	25 mg/L or ≤ 10% increase in seasonal average, whichever is lower	50mg/L (25 mg/L) or ≤ 10% increase in seasonal average, whichever is lower	100 mg/L or ≤ 10% increase in seasonal average, whichever is lower	100 mg/L or ≤ 30 % increase in seasonal average, whichever is lower
Oil and grease (mg/L)	0.01	0.14	5	0.14
Mercury* (µg/L)	0.04	0.16 (0.04)	50	0.5
Cadmium (µg/L)	0.5	2 (3)	10	2
Chromium (VI) (µg/L)	5	10	48	10
Copper (µg/L)	1.3	2.9	10	2.9
Arsenic (III)* (µg/L)	3	20(3)	50	20 (3)
Lead (µg/L)	4.4	8.5	50	8.5
Zinc (µg/L)	15	50	100	50
Cyanide (µg/L)	2	7	20	7
Ammonia (unionized) (µg/L)	35	70	320	70
Nitrite (NO ₂) (µg/L)	10	55	1,000	55
Nitrate (NO ₃) (µg/L)	10	60	1,000	60
Phosphate (µg/L)	5	75	670	75
Phenol (µg/L)	1	10	100	10
Tributyltin (TBT) (µg/L)	0.001	0.01	0.05	0.01
Faecal coliform (Human health protection for seafood consumption) - most Probable Number (MPN)	70 faecal coliform 100mL-1	100 faecal coliform 100mL-1 & (70 faecal coliform 100mL-1)	200 faecal coliform 100mL-1	100 faecal coliform 100mL-1 & (70 faecal coliform 100mL-1)
Polycyclic Aromatic Hydrocarbon (PAHs) ng/g	100	200	1000	1000

*IMWQS in parentheses are for coastal and marine water areas where seafood for human consumption is applicable.