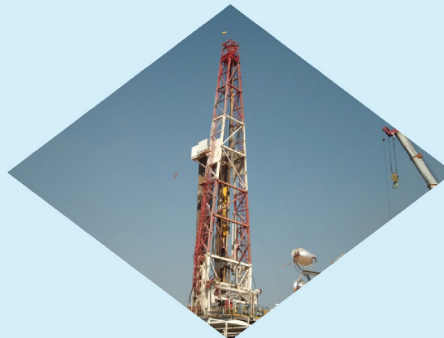


**Monitoring Report of Myanmar Onshore Block MOGE-3  
Exploration Drilling Campaign  
(Drilling Phase of Monatkan Well Site) during January-June 2019**

**PTTEP South Asia Limited (PTTEP SA)**



## Table of Content

	Page
<b>Executive Summary</b>	<b>1</b>
<b>Chapter 1 Introduction</b>	<b>1-1</b>
1.1 Introduction	1-1
1.2 Objective	1-1
1.3 Briefly Information of The Project	1-2
1.3.1 General Information and Background	1-2
1.3.2 Project Location	1-2
1.3.3 Status of Current Operation	1-5
1.4 Layout and Facilities in Construction and Installation Phase	1-6
1.4.1. Layout of Wellsite and Access Road	1-6
1.4.2. Facilities in Basecamp, Central Campsite and Accommodation Areas	1-11
1.5 Drilling Operations Phase	1-13
1.6 Emissions, Discharges and Waste Generation	1-14
1.7 Safety, Security, Health and Environment Management System	1-16
1.7.1 PTTEP Corporate Vision and Mission	1-16
1.7.2 PTTEP Myanmar Asset Safety Security Health and Environment (SSHE) Policy	1-16
1.7.3 SSHE Management System Manual	1-17
1.8 Environmental Impact Monitoring and Mitigation Measure Implementation Compliance	1-18
<b>Chapter 2 Environmental Mitigation Measures Implementation Compliance Audit</b>	<b>2-1</b>
<b>Chapter 3 Environmental Monitoring Results</b>	<b>3-1</b>
3.1 Environmental Monitoring Plan	3-1
3.2 Air Quality Monitoring	3-5
3.2.1 Air Quality Monitoring Station	3-5
3.2.2 Air Quality Monitoring Method	3-7
3.2.3 Air Quality Monitoring Results	3-8
3.2.4 Comparison of Air Quality Monitoring	3-10

## Table of Content

	Page
3.3 Noise Level Monitoring	3-11
3.3.1 Noise Level Monitoring Station	3-11
3.3.2 Noise Level Monitoring Method	3-13
3.3.3 Noise Level Monitoring Results	3-13
3.3.4 Comparison of Noise Level Monitoring	3-14
3.4 Cuttings Monitoring	3-15
3.4.1 Cuttings Monitoring at Moenatkone well site	3-15
3.4.2 Cuttings Monitoring Method	3-16
3.4.3 Presevation Methods for cutting sample	3-16
3.4.4 Cuttings Monitoring Results	3-16
3.5 Chemical Used for Drilling Monitoring	3-18
3.5.1 Chemical Used for Drilling Monitoring Method	3-18
3.5.2 Chemical Used for Drilling Monitoring Results	3-18
3.6 Hazardous and Non-hazardous waste	3-19
3.7 Social Monitoring	3-19
3.7.1 Social Monitoring Methods	3-20
3.7.2 Social Monitoring Result	3-20
3.8 Public and Occupational Health and Safety Monitoring	3-20
3.8.1 Public and Occupational Health and Safety Method	3-21
3.8.2 Public and Occupational health and safety monitoring Results	3-21
<b>Chapter 4 Environmental Mitigation Measures Compliance Audit and Environmental Monitoring</b>	
<b>Conclusion</b>	<b>4-1</b>
4.1 Environmental Mitigation Measures Compliance Audit Conclusion	4-1
4.2 Environmental Monitoring Results Conclusion	4-9

## List of Table

	<b>Page</b>
Table 1-1 Coordinates of Block MOGE-3 Boundary	1-2
Table 1-2 Coordinates of Four Drilling Location within Block MOGE-3	1-2
Table 1-3 Status of each wellsite for Myanmar Onshore Block MOGE-3 Exploration Drilling Campaign	1-5
Table 1-4 PTTEPI SSHE Management System	1-18
Table 2-1 Auditor Experience	2-1
Table 2-2 General Mitigation Measures Implementation Compliance Result Summary	2-3
Table 2-3 Environmental Mitigation Measures Implementation Compliance Result Summary in Drilling Phase	2-5
Table 2-4 Environmental Mitigation Measures Implementation Compliance Result Summary for Unplanned Event	2-27
Table 3-1 Environmental Monitoring Plan of Myanmar Onshore Block MOGE-3 Exploration Drilling Campaign in Drilling Phase at Moenatkone well site	3-2
Table 3-2 Air Quality Monitoring Plan	3-5
Table 3-3 Coordinate of Air Quality Monitoring Station of Moenatkone (MNK) well site	3-5
Table 3-4 Sampling Method, Analysis Method and Standard Methods of Air Quality	3-7
Table 3-5 Air Quality Monitoring Results	3-10
Table 3-6 Comparison of Air Quality Monitoring Results	3-11
Table 3-7 Noise Level Monitoring Plan	3-11
Table 3-8 Coordinate of Noise Level Monitoring Stations	3-11
Table 3-9 Sampling Method, Analysis Method and Standard Methods of Noise Level	3-13
Table 3-10 Noise Level Monitoring Results	3-14
Table 3-11 Comparison of Noise Level Monitoring Results	3-15
Table 3-12 Cutting and Stock Barite Monitoring Plan	3-15
Table 3-13 Parameters and Analyses Methods for Cuttings Monitoring	3-16
Table 3-14 Monitoring parameter, container, preservation method for Cuttings	3-16
Table 3-15 The Results of Chloride in Mud and Cuttings Monitoring	3-16
Table 3-16 The Results of Oil on Cuttings in Mud and Cuttings Monitoring	3-17
Table 3-17 The Results of Total Mercury and Total Cadmium in stock barite Monitoring	3-17
Table 3-18 Quantity of Chemical Used for Drilling Process of Moenatkone well sites	3-18
Table 3-19 Social Monitoring Plan	3-19
Table 3-20 Public and Occupational Health and Safety monitoring Plan	3-20
Table 3-21 The incident record	3-21



## List of Figure

	<b>Page</b>
Figure 1-1 Four Drilling Location within Block MOGE-3	1-3
Figure 1-2 Moenatkone (MNK) Wellsite in Drilling Phase	1-5
Figure 1-3 Moenatkone Wellsite Layout	1-7
Figure 1-4 Ngabetkya Wellsite Layout	1-8
Figure 1-5 Padaukpin Wellsite Layout	1-9
Figure 1-6 Sakangyi Wellsite Layout	1-10
Figure 1-7 Central Campsite for drilling phase	1-12
Figure 2-1 Mitigation Measures Compliance Audit in March 3, 2019	2-1
Figure 2-2 Speed limit sign	2-36
Figure 2-3 Tool box talk	2-36
Figure 2-4 Water Sprey within wellsite	2-36
Figure 2-5 All worker used PPE during working.	2-36
Figure 2-6 Vehicle used dust flap.	2-36
Figure 2-7 H <sub>2</sub> S Alarm System	2-36
Figure 2-8 Soundproof Generator	2-37
Figure 2-9 Lighting within Wellsite	2-37
Figure 2-10 Machinery with Drip pan	2-37
Figure 2-11 Drainage System around wellsite.	2-37
Figure 2-12 Chemicals Storage Area	2-37
Figure 2-13 Fuel Storage Tank	2-37
Figure 2-14 Toilet with septic tank	2-38
Figure 2-15 Cutting pit and Mud pit	2-38
Figure 2-16 Fence around Project Area	2-38
Figure 2-17 Guard house at main gate	2-38
Figure 2-18 Alcohol test	2-38
Figure 2-19 Access road	2-38
Figure 2-20 Left hand drive car	2-39
Figure 2-21 Convoy escort of major movement	2-39
Figure 2-22 Example of Warning signs at the access road	2-39
Figure 2-23 Water pit	2-39
Figure 2-24 Separate waste container	2-39
Figure 2-25 Shale shaker	2-39
Figure 2-26 Shale Shaker, chemical mixed tank placed on concrete pad	2-39
Figure 2-27 Spill cleanup kits	2-40
Figure 2-28 Assembly point in front of wellsite	2-40
Figure 2-29 Ambulance and medical personnel were provided in emergency case.	2-40

## List of Figure (Cont.)

	<b>Page</b>
Figure 2-30 BOP (Blow Out Preventer)	2-40
Figure 2-31 Fire extinguisher	2-40
Figure 2-32 Inspection of fire extinguishers	2-40
Figure 2-33 Fire suit and SCBA	2-40
Figure 2-34 Windsock	2-40
Figure 3-1 Air Quality Monitoring Station	3-6
Figure 3-2 Air Quality Monitoring in drilling phase phase of Moenatkone (MNK) well site	3-7
Figure 3-3 Distribution of fire alerts near the project are	3-9
Figure 3-4 Wildfire around project area during air quality monitoring.	3-9
Figure 3-5 Filter of air quality monitoring	3-9
Figure 3-6 Noise Level Monitoring Station	3-12
Figure 3-7 Noise Level Monitoring in drilling phase of Moenatkone well site	3-13
Figure 3-8 Grievance Handling Process	3-20
Figure 4-1 The Results of General Mitigation Measures Implementation Compliance	4-2
Figure 4-2 The Results of Environmental Mitigation Measures Implementation Compliance in Drilling Phase	4-7
Figure 4-3 The Results of Environmental Mitigation Measures Implementation Compliance in Unplanned Events	4-9
Figure 4-4 Summary of Monitoring Measure Implementation Results	4-12

## Appendix

### Appendix A Submission Letter of EIA Report and Revised EIA Report

Appendix A-1 Submission Letter of EIA Report

Appendix A-2 Submission Letter of Revised EIA Report

Appendix A-3 Approval Letter of EIA Revised Report For Block MOGE-3

### Appendix B Mitigation Measure

### Appendix C Waste Management and The quantity of hazardous waste

Appendix C-1 Waste Management

Appendix C-2 The quantity of hazardous waste

### Appendix D Land Transportation

Appendix D-1 Land Transport Safety Procedure

Appendix D-2 Journey Management and Driver Safety Procedure of Contractor

Appendix D-3 Land Transport Safety JMP Record

### Appendix E Occupational Health and Safety

Appendix E-1 SSHE Policy

Appendix E-2 Myanmar Asset Emergency Management plan

Appendix E-3 Inspection

Appendix E-4 Training

Appendix E-5 Permit to work

Appendix E-6 PTTEP Spill Contingency Plan

Appendix E-7 Incident Case

### Appendix F Social

Appendix F-1 Grievance Handling Guideline

Appendix F-2 Hr Procedure for Recruitment of Contractor

Appendix F-3 Public information

### Appendix G Layout of Well Site and Access Road

Appendix G-1 Layout of Well Site

Appendix G-2 Layout of Access Road

### Appendix H SDS of drilling chemicals

### Appendix I Analysis Report

### Appendix J Certificate of instrument

### Appendix K Certificate of Laboratory

## ***Executive Summary***

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## Executive Summary

REM-UAE Laboratory and Consultant Company Limited conducted the compliance audit as per implementation of environmental mitigation measures and monitoring program for Myanmar Onshore Block MOGE-3 Exploration Drilling Campaign.

The objective of the audit was to evaluate the effectiveness of implementation as per Environmental Management Plan, including both mitigation measure and monitoring program, defined in the EIA report. Report includes specific comply requirements, any potential problems or obstacles and propose recommendations for improvement in order to ensure the effectiveness of the prevention and mitigation measures.

The evaluation process includes (1) meeting with PTTEP SA personnel, (2) site observation and interview with PTTEP SA's representatives, and (3) document review.

### 1. Project Overview

PTTEP SA was granted the petroleum Production Sharing Contract (PSC) for Block MOGE-3, which is in Magway Region, in Central Myanmar. Block MOGE-3 encompasses 1,217 km<sup>2</sup>, and is in the south of Magway Region, in the Dry Zone in the central Myanmar lowlands. PTTEP SA plans to drill four (4) exploration drilling wells during 2018-2019 located in Thayet Township, Magway Region, Myanmar.

Four wellsites were started to construction phase in 2018 and drilling phase in 2019. The wellsites name are listed as below;

- Padaukpin wellsite – Aung Myay-1 (AMY-1)
- Sakangyi wellsite – Pyae Sone Kywe-1 (PSK-1)
- Ngabatkya wellsite – Aung Chan Thar-1 (ACT-1)
- Moenatkone wellsite – Aung Pyae Hlyan-1 (APH-1)

### 2. Drilling Operations Phase

All operations on these wells were carried out in accordance with the appropriate international API standards, PTTEP SA Drilling Management System, copies of which was provided at the rig site and must be read and understood by everyone involved in these operations. Drilling operations and associated services conducted on a 24-hour basis. Drill crews will work alternate 12-hour shifts rotated from duty on a maximum 28-day schedule, as is standard oil and gas industry practice. The basic steps of drilling an exploration well are summarized below.

- Drilling the Hole - The drill string is a series of long, hollow steel pipes, which can be screwed together. The drill bit, which has a larger diameter than the drill string, is the cutting tool and is screwed to the end of the drill string. A hoist system within a derrick over the well allows the drill string to be assembled and broken down into manageable sections.



- Drilling Fluids System - The drill string and bit are lubricated and cooled by a drilling fluid, commonly referred to as mud. This mud is stored in large steel tanks beside the rig, from where it is pumped down through the drill string.
- Mud Cleaning Equipment - When the drilled cuttings are brought to the surface with the drilling fluids, they were first pass through a mud treatment system commonly consisting of shale shakers. This comprises of a vibrating frame fitted with a series of fine mesh screens, which separate most of the drill cuttings from the drilling mud.
- Casing and Cementing - Various sections of the hole were drilled at different diameters, with the size of the borehole decreasing with depth. Each section of the hole lined with thick steel tubing, known as casing, which was fully cemented in place. This ensures that the hole remains stable and that the surrounding geological formations, those that may act as freshwater aquifers, are not contaminated. This casing also helps in the process of controlling the pressure of any gas that the well might penetrate, as it is prevented from flowing into shallower, less pressurized formations.

#### Blowout Preventative Measures:

A complex series of valves, known as the “blowout preventer” (BOP), is attached to the top of the conductor below the derrick floor. All further casing strings are also attached into this blowout preventer. These are powerful hydraulically-activated valves and rams that can be closed around the drill pipe to isolate the well bore should unexpectedly high formation pressure be encountered. If formation pressure exceeds the hydrostatic head of the drilling mud, it may cause the well to flow strongly, referred to as a “kick”. A kick can also occur if a highly permeable formation, such as a naturally fractured limestone, is encountered and a large volume of mud is suddenly lost into the formation. The blowout preventer is the primary safety mechanism for well control. The series of valves act independently and when closed in an emergency form a series of increasingly secure barriers that isolate the well so that a plan of action can be developed to bring it back under control.

### **3. Facilities and Utilities**

#### **1) Access Road**

PTTEP SA used existing local roads for transportation as much as possible to each wellsite. However, due to the wellsites being located in an agricultural area, the new access roads were constructed to connect the wellsites to the existing main roads for transportation of drilling rig and drilling equipment. PTTEP SA considered the impact to the nearby villages and design the road accordingly. The land required for the access roads would follow land acquisition committee consideration and decision for compensation and access route. PTTEP SA considered the final access road route depending on the land compensation committee consideration and approval. PTTEP SA obtained permission from the relevant local authorities and contracted with land owners prior to construction of the access roads.

The well locations can be accessed by car using existing local roads from Thayet Township. But most of the existing local earth road cannot be used in the rainy season. Therefore, new access roads were designed as

single lane, un-surfaced roads, constructed of compacted laterite and selected material. The roads constructed 5 m with side slopes of 2:1, constructed with 200 mm of compacted laterite and 200 selected materials.

## 2) Central Campsite and Accommodation Areas

PTTEP SA constructed the Central Campsite (CCS) nearby Thayet Township. The container cabin is providing for workers' accommodation. The detail of facilities that providing within CCS as below.

### 2.1) Potable Water

During the exploration drilling phase, the drinking/consumption water (~600 liters of water bottled) required daily and another 600 liters to be used for hygienic purposes. Water source during the exploration drilling phase transport from nearest village tube well.

### 2.2) Drainage Control within Central Campsite

There are no potentially harmful chemicals stored at the central campsite that could drain offsite. The fuel tank for the camp generator was placed on an impermeable membrane and banded to contain potential fuel leaks. The spill kits and absorbents were provided at the central campsite site to clean up any potential fuel or oil spills during vehicle maintenance or use.

### 2.3) Central Camp Site Sewage System

A set of concrete septic tanks were built into the work camp pad at the outer edges and there is the capacity of 8000 litres (8 m<sup>3</sup>). No pump out of septic sludge is required as the concrete septic tanks and any sewage sludge would be left in septic tanks onsite at the end of the drilling campaign.

Wastewater from the campsite, including both grey water and black water, were treated separately. Grey water was treated in a soak pit and Black water was treated in septic tank and soak pit.

A waste management plan was prepared that defines waste types, disposal methods and locations consistent with waste management laws and regulations.

### 2.4) Central Campsite Power

The central campsite is as a container types with the power being generated from portable diesel engine generator. The engines are running 24 hours a day to power up the lighting, equipment and other necessity. For cooking, cylinder gas also to be considered.

All power for the base camp site is providing by the camp's 100 KVA diesel power generator. Estimated fuel consumption is 0.5 m<sup>3</sup> per day during full accommodation. On-site fuel storage capacity consists of one 25 m<sup>3</sup> tank. Estimated total fuel usage is about 30 m<sup>3</sup> (based on 60 days of drilling).

## 4. Emissions, Discharges and Waste Generation

### 4.1 Waste Drilling Mud and Cuttings

- **Waste Drilling Mud:** The solid and liquid phases are separated on-site by industry standard physical and chemical means (shaking, centrifuging and flocculation). At the end of the first well location, the left-over drilling mud was transferred and used at the next well location. At the end of drilling campaign, the left-over mud will be sent back to mud contractor for reuse or disposal or use for PTTEP offshore drilling campaign. If the well is actually abandoned rather than completed as a producer, some of this mud will be used to make the kill weight spacer between the cement plugs.
- **Waste Drilling Solids:** There are alternatives for waste cuttings disposal and management at this moment. The first alternative is to do the bioremediation onsite after the rig move out from location. The second option is to send all cuttings to the DOWA waste management facility.

### 4.2 Wastewater

- **Contaminated Runoff:** In case of rainfall during drilling operation, runoff may happen from the wellsite will drain into the cuttings pit which was designed to contain the runoff from the wellsite combined with rain falling on the waste pit during extreme heavy rain. The pit will be enclosed by an earth embankment to prevent the excess water drain into the.
- **Wastewater from consumption:** The wastewater and sewage were collected in a plastic-lined sewage pit. A septic tank was installed on all locations for preliminary wastewater treatment then overflow to infiltration field.

### 4.3 Non-Hazardous Waste and Hazardous Waste

The PTTEP SA exploration program would handle waste according to PTTEP SA Standards. All wastes were classified and segregated before responsible disposal. All wastes would be collected, stored, and segregated in arranged containers such as non-hazardous waste, plastic waste, metal waste and hazardous waste.

The contractor provided storage area for all wastes and PTTEP SA strictly enforced good housekeeping practices within wellsite and Central Campsite.

For non-hazardous waste, waste management plan was prepared that defines waste types, disposal methods and locations consistent with waste management laws and regulations. The local government of Thayet township municipal was the responsible agency for managing waste to disposal.

For Hazardous Waste, the wellsite and accommodation campsite were generated a low volume of hazardous waste. Any hazardous waste was transferred to Yangon for disposal of at an approved waste disposal area (YCDC) or DOWA waste management facility.

The medical waste was transferred to Yangon for disposal of at an approved waste disposal area (YCDC) or handover to medical service company for dispose at approved hospital.

#### 4.4 Air Emission

- Dust: the main air quality issue while exploration drilling activity, the handling, and storage of bulk drilling mud additives, including barite, bentonite, calcium carbonate and cement powder resulted in relatively minor fugitive dust emissions. Any emissions were reduced significantly by the standard procedure of equipping all silos with bag filters.
- Combustion emission: Combustion product from construction phase was diesel combustion. Diesel combustion from the on-site electrical power generation units and from vehicles were emitted greenhouse gases. The amount of emissions would be varying with time, depend on the operational activity and power demand.

#### 4.5 Noise

During the drilling phase, noise will be generated from project vehicles, generators and drilling operations.

### 5. Safety, Security, Health and Environment Management System

#### 5.1 PTTEP Corporate Vision and Mission

All levels of line management at PTTEPI are responsible for implementing and maintaining its SSHE policy and SSHE MS. Both documents are reviewed and revised at regular intervals.

- **Vision Mission and Corporate Values**

**Vision:** "Energy Partner of Choice" through Competitive Performance and Innovation for Long-term Value Creation."

**Mission:** "PTTEP operates globally to provide reliable energy supply and sustainable value to all stakeholders."

#### 5.2 PTTEP Myanmar Asset Safety Security Health and Environment (SSHE) Policy

PTTEP Myanmar Asset is committed to safe Exploration and Production (E&P) Operations in Myanmar with an ultimate goal of "Target Zero - Nobody Gets Hurts in Our Operations" which covers (1) Zero Injury, (2) Zero Major Accident (e.g. zero major hydrocarbon leak, vehicle accident, ship collision), and (3) Zero Spill or External Complaint (e.g. zero complaint by authorities/ communities/ sea users).

To accomplish this, PTTEP Myanmar Asset implements Safety, Security, Health and Environmental Management System (SSHE-MS) that outlines the main principles and accountabilities to drive for continuous improvement. We are committed to:

- Comply with Myanmar SSHE laws, other applicable requirements and PTTEP Standards.
- Perform hazard identification and SSHE risk assessments so that risks are As Low As Reasonably Practicable (ALARP).
- Hold employees accountable for SSHE performance by setting and monitoring SSHE Plans and KPIs.

- Prevent operational and process incidents by implementing asset integrity programs and monitoring of Safety Critical Elements addressed in Safety Cases and complying with Management of Change (MOC) Standard.
- Work with contractors and suppliers to achieve PTTEP's SSHE requirement.
- Ensure all employees and contractors are assessed and maintain the required level of job and SSHE competency.
- Apply "Stop Work Authority Policy" for unsafe work by implementing Behavior-Based Safety (BBS) programs to improve positive SSHE culture.
- Implement security management for potential threats to safeguard personnel, assets, information and reputation.
- Promote occupational health and hygiene in the workplace by conducting health risk assessments, medical
- Surveillances, education and regular industrial hygiene monitoring.
- Prevent environmental impacts by strictly following the mitigation measures stated in Environmental Impact Assessment.
- Promote sustainable development by implementing waste management, greenhouse gas reduction and energy efficiency programs.
- Report, investigate and analyse SSHE incidents to prevent recurrence and close out corrective actions with evidence.
- Ensure that emergency and crisis management plans are proactive and effective.
- Ensure policy and SSHE Management System compliance through regular SSHE audits and Senior Management visits with corrective actions follow up for continuous improvement.

Strong leadership and commitment is a key successful implementation of this policy which is required from PTTEP employees and contractors at all levels.

### 5.3 SSHE Management System Manual

PTTEP SA's SSHE Management System Manual objective is to serve as practical interpretation of Company SSHE policy with respect to their moral obligations for SSHE issues for all persons working on, visiting or affected by operations at sites for which PTTEP SA has responsibility.

The manual covers details on the are as specified in Table 1. The document is designed to serve as a comprehensive guide for all Operational Assets to develop its own SSHE management system and related documents. This document also provides an overview of SSHE management system approach.

It should be noted that PTTEP SA currently does not have its own internal SSHE policies, however PTTEP International Limited (PTTEPI) Myanmar Asset policies will be applied. For this project, PTTEP SA will adopt all of PTTEPI's relevant SSHE policies and procedures. Throughout this chapter, SSHE policies, procedures and documents was referred to as belonging to PTTEP SA, however they actually belong to PTTEPI and are



being adopted by PTTEP SA for this project. The detail Plan and Procedure have been submitted at EIA report.

**Table 1 PTTEPI SSHE Management System**

Document Code	Document
Myanmar-0550-STD-014	SSHE Regulatory Compliance Standard
11027-PDR-SSHE-505_37-R01	Myanmar Asset Land Transport Safety Procedure
11027-PDR-SSHE-503/01-R02	Myanmar Asset Waste Management Procedure
11027-PDR-SSHE-502-006-R00	Myanmar Asset Emergency Management Plan
11027-PDR-SSHE-501-005-R00	Myanmar Asset Crisis Management Plan
11027-PDR-SSHE-564-002-R00	Myanmar Asset Alcohol and Drugs Testing Procedure
11027-PDR-SSHE-530-004-R00	Myanmar Asset Security Management Procedure
11027-PDR-SSHE-501/03-R02	Myanmar Asset Spill Contingency Plan
Myanmar-SSHE-11027-PDR-508	Fitness to Work Procedure
Myanmar-0550-MNL-004	Land Campaign Blowout Contingency Plan
11027-PDR-SSHE-501-005-R00	Myanmar Asset Crisis Management Plan
11027-PDR-SSHE-340-003-R01	SSHE Training and Competency Procedure
Myanmar 13036-PDR-078	PTTEPI SSHE Requirements for Contractors
11027-PDR-SSHE-501-007-R02	MOGE-3 Operations Medical Emergency Response Plan (MERP)

## 6. Compliance Status

### 6.1 General Mitigation Measures Implementation Compliance

The results determined that the project have completely complied on the mitigation measures requirements for the finished and on-going operations while some activities (12.5%) do not have operation during the audit.

- PTTEP SA concerns the safety, security, health and environment of the employees and wellbeing of the environment. The company addresses this regulation to the contract employees and contractor to comply with the requirements; the mitigation must be followed with the Company's SSHE Policy.
- PTTEP SA compiled these mitigation and monitoring measures strictly and monitoring report of the project will submit to MOGE and ECD biannually in order to inform all activities.
- The letter about the project activities was sent to local government. Moreover, PTTEP SA had two times of public consultation with stakeholder already. Another plan of public consultation with stakeholder will conduct if needed. PTTEP SA will refer to the grievance mechanism if there is any compliance from stakeholder and community.
- PTTEP SA apply grievance handling guideline for immediately action in case any complaints raised from the stakeholder. However, there was no complaint from previous activity during January – June 2019.
- If any objects, fossils or archaeological are encountered in the project area, PTTEP SA will stop all drilling activities and inform the government agencies such as District and Township Administrator, Local Archeological Department, Fossil Research Center and Geological Museum immediately to

examine at the wellsite. However, there was no encountered any objects, fossils or archaeological from previous activity.

- All private land was permitted by land owners or authorized persons prior to start any activity. For access roads, the upgrade of existing road and construction of new road was considered and approved by local administrative officers and land owners under MOGE supervision.

## **6.2 Environmental Mitigation Measures Compliance Result in Drilling Phase**

The results determined that the project have fully complied on the environmental mitigation measures with 100.0%.

### **1) Air Quality**

Status of Moenatkone wellsite was drilling phase which have no land clearance activity. PTTEP SA prepared safety land transport procedure and enforced the contractor to follow regulation of speed limitation 5 km/hr within wellsite and 10 km/hr along the access road. The speed limitation signs were provided along the access road. In addition, requirement on speed limitation was communicated to all worker in daily tool box talk before working by the header of contractor/safety officer. The truck was covered during transport material to the wellsite. Most of truck was used for transport material within wellsite. Moreover, the contractor had provided staffs for cleaning during transportation.

The project provided spray water truck to within project area depending on the atmospheric conditions to reduced dust dispersion. The contractor provided PPE sufficiently for all workers and controlled to use PPE during working. The vehicle that used in the project has the dust flaps to reduce the dust dispersion. To ensure all machinery and vehicles are properly checked, PTTEP SA specified the contractor to regularly check and maintain the machines and vehicles.

PTTEP SA prepared safety land transport procedure and enjoined the contractor to follow regulation. Moreover, training program in defensive driving was provided for contractor. The project provided H<sub>2</sub>S monitor and alarm system within project area. In case of H<sub>2</sub>S levels in the gas stream exceed 10 ppm, the project will implement appropriate safety zones. Moreover, the project also provided H<sub>2</sub>S safety basic training for project staff.

### **2) Noise**

No need to use noise barrier due to project area far away from sensitive area. However, the soundproof generator was used to minimize noise disturbance. PTTEP SA specified the contractor to regularly check and maintain the machines and vehicles. Soundproof generator was used in project area to minimize noise disturbance. PTTEP SA specified the contractor to regularly check and maintain the machines and vehicles.

### **3) Heat and Light**

Drilling rig located distantly to sensitive receptors, there were a few houses of community around the wellsite. The project has provided adequate night lighting within project area.

#### **4) Surface Water Quality**

The project strictly implemented the mitigation measure for construction and installation phase. PTTEP SA designed layout of the wellsite, the access road and campsite before starting the construction to minimize areas requiring soil stabilization. The contractor provided drip pans and absorbents to contain any spillage from vehicle and machinery while transferring fuel or changing of engine oil. Water drainage ditch around the wellsite was constructed as specify in the measure.

PTTEP SA reiterated staffs and constructors to strictly keep clean both within wellsite and avoid water source nearby the wellsite. Moreover, PTTEP SA has provided training program to contractors on regulation and prohibition including control the performed as defined. Moreover, the contractor provided storage area for chemical and oil within wellsite. The project provided drainage, buffer zone and earth bund surrounding wellsite area. The fuel storage tank was surrounded by bund wall and placed on tarpaulins to prevent contaminated to soil in case of spill. The project installed concrete lined septic tank at the wellsite for hold and treating sewage.

#### **5) Soil quality**

The project strictly implemented the mitigation measure for drilling phase as described in 4.1. Site Runoff and Drainage.

#### **6) Groundwater Quality**

The project installed steel casing and cement in place to prevent chemical leak or contaminate into rock formation. The project strict steel casing to well wall by cementing to prevent chemical contaminate to ground water level. The project installed HDPE liner in the mud and cutting pit in order to prevent contaminated to groundwater. Moreover, the project regularly inspects HDPE liner to prevent worn out.

#### **7) Terrestrial Flora and Fauna**

PTTEP SA has provided training program to contractors on regulation and prohibition including control the performed as defined. Fence was installed around the wellsite to separate the project area and nearby area. The security guard was available 24-hour at temporary resting area to restrict people and vehicles.

#### **8) Transport**

Routine inspection and preventive maintenance for all vehicles were conducted as per inspection plan. Alcohol testing was randomly check. Worker will immediately stop working if alcohol is found more than 0%. Moreover, the project provided drug test kits within wellsite to conduct drug test. PTTEP SA prepared safety land transport procedure and enjoined the contractor to follow regulation of speed limitation 5 km/hr within wellsite and 10 km/hr along the access road. The speed limitation signs should provide along access road. However, speed limitation was communicated to all worker in daily tool box talk before working by the header of contractor/safety officer. The contractor controlled the truck not to over loading to prevent damage on road surface. Moreover, the access road was in good condition and ready for use. In case of the road was damaged from project activity, the contractor will repair to prevent unsafe to user.

Safety equipment and emergency equipment were installed on project vehicles as per company standards. The project provided left hand drive car as a priority to use in project activities. Moreover, PTTEP SA informed local authority on the oversized load and put an escort in front of this convoy, the project also conducted rig move route survey before major movement and avoiding transportation of heavy equipment during rush hours. The project provided traffic sign along the access road as specified in mitigation measure.

PTTEP SA implemented the grievance handling guideline and immediately acted in case any complaints raised from the stakeholder. However, during January – June 2019 there was no complaint raised from PTTEP SA activity. Training program on Safety, Security Health and Environment Management System (SSHE-MS) and other concerned safety standards have been provided to the contractor for implementation as PTTEP SA's plan.

#### **9) Water Use**

The project strictly implements the mitigation measure for construction and installation phase as described in 10.1 Use of water public utility for construction and domestic use for drilling phase including:

- PTTEP SA has followed requirements of well drilling procedure for groundwater.
- Moenatkone The contractor has own water source for using in project area which do not generate the affect to the community.

#### **10) Power Use**

The project installed diesel-powered generators to supply all project power demand.

#### **11) Waste Management**

The project strictly implemented the mitigation measure for construction and installation phase as described in 12.1 Non-Hazardous waste management for drilling phase including:

- PTTEP SA developed waste management plan and required the contractor to implement. Separate waste containers were provided at wellsite. The local government of Thayet township municipal was the responsible agency for managing waste to disposal.
- The contractor provided storage area for chemicals and PTTEP SA strictly enforced all workers to maintain a good housekeeping practices within wellsite and surrounding.
- Toilet with septic tank was provided sufficiently for all staffs in order to treat wastewater before release to environment.

For drilled cuttings, the solid (drilling cutting) and liquid (drilling mud) phases are separated on-site by shale shaker. At the end of the first well location, the left-over drilling mud will be transferred and used for the next well location. At the end of drilling campaign, the left-over mud will be sent back to mud contractor for reuse or disposal or use for other PTTEP offshore drilling campaign. The project assigned SCOMI which is licensed contractor to do bioremediation onsite or offsite disposal for mud and cutting wastes after rig moving out from location. PTTEP SA developed waste management plan and controlled the contractor to implement. Waste containers were provided at wellsite and the quantity of hazardous

waste was recorded by contractor. In addition, the contractor provided storage area for chemicals and PTTEP SA strictly enforced all workers to maintain a good housekeeping practices within wellsite and surrounding.

Training program on Safety, Security Health and Environment Management System (SSHE-MS) and other concerned safety standards have been provided to the contractor for implementation as PTTEP SA's plan. The contractor provided PPE sufficiently for all workers and controlled to use PPE during working. The fuel storage tank was surrounded by bund wall and placed on tarpaulins to prevent contamination to soil in case of spill. Drilling mud system, shale shaker and mixed chemical tank were placed on concrete pad surrounding with drainage system to collect drilling fluid to cutting pit. The project used oil catch pans under vehicles and performed maintenance only on impervious surfaces. The project provided spill cleanup kits within project area. Cutting was temporary stored in cutting pit with HDPE liner in order to prevent contamination to groundwater before bioremediation onsite or sent for disposal at approved waste management facility after rig moving out from location. The project constructed waste pit and cutting pit with sufficient volume. Level of cuttings and dirty water in waste pit was monitored to prevent overflow, the frequency of monitoring may be increased depended on the weather condition.

## **12) Socio-Economy**

The contractor hired temporary workers in local area, according to the job description. In addition, the contractor purchased goods/consumers products in local area.

## **13) Occupational and Public Health**

The project strictly implements the mitigation measures for drilling phase described in 2.1 Well Drilling and Vehicle and Equipment Use, 11.2 Hazardous waste management, 11.3 Handling and Disposal of drill cuttings, sludge and chemicals and 12.1 Employment opportunities and Use of local goods and services.

Drilled Cutting was temporary stored in cutting pit with HDPE liner in order to prevent contamination to groundwater before bioremediation onsite or sent for disposal at approved waste management facility after the rig move out from location. When drilling activity complete, the project will dispose of waste kept in waste pit by approved waste management facility. The project has prepared on health screening to all workers before employment. Emergency respond procedure, ambulance, medical personnel and training were provided in case of emergency. Moreover, the contractor cooperated with nearby hospital to support if need for serious injuries or emergencies case. The contractor hired qualified local workers, according to the job description. PTTEP SA has provided training program to contractors on regulation and prohibition including control the performed as defined requirements.



### 6.3 Environmental Mitigation Measures Compliance Result for Unplanned Events

The results determined that the project operations have fully complied (100% complied) with the environmental mitigation measures for unplanned event.

#### 1) Blowout

The shallow gas hazard was identified by examination of existing wells. The project provided Drilling Program and extensive SSHE Management System procedures and operational controls in place. Moreover, Internal hazardous operation was reviewed and “Table Top Drilling” was exercised as per specified in drilling program. The project selected proper drilling fluid formulation, and provided well kill fluids/systems, loss control and weighting agents. The project monitored of downhole condition and mud return. The project carefully uses high quality materials in well construction (casing and cement grades). The project installed Blowout Preventor (BOP) and other safety equipment including testing before drilling for correctness and availability of equipment to comply with the drilling program and standard strictly. The project provided PTTEP SA's Emergency Response Plan and Blow Out Contingency Plan and control the contractor to performed as defined requirements.

#### 2) Fire or Explosion (not associated with Blowout)

Training program on Safety, Security Health and Environment Management System (SSHE-MS) and other concerned safety standards have been provided to the contractor for implementation as PTTEP SA's plan. Fire extinguishers, fire suit and SCBA were provided at wellsite including inspection once a month. Moreover, the assembly point, windsock, an emergency respond procedure and firefighting training were provided.

#### 3) Fuel, Chemical or Hazardous Waste/Materials Spill

PTTEP SA developed waste management plan and controlled the contractor to implement. Separate waste containers were provided at wellsite. The contractor provided drip pans and absorbents to contain any potential spillage from vehicle and machinery while transferring fuel or changing of engine oil. The project provided SDS of drilling chemicals at wellsite as specify in the mitigation measure. Concrete rig pad with drainage system was constructed as specified in the mitigation measure. The project used oil catch pans under vehicles and performed maintenance only on impervious surfaces.

PTTEP SA has provided training program to contractors as regulation requirements including control their performing as defined requirements. Moreover, the project provided drainage, buffer zone and earth bund surrounding wellsite area. Drilling mud system, shale shaker and mixed chemical tank were placed on concrete pad surrounding with drainage system to collect drilling fluid to cutting pit. The contractor provided chemicals storage area on concrete pad with bund wall and PTTEP SA strictly enforced good housekeeping practices within wellsite and surrounding for all workers. Training program on Safety, Security, Health and Environment Management System (SSHE-MS) and other concerned safety standards have been provided to the contractor for implementation as PTTEP SA's plan.

Cutting was temporary stored in cutting pit with HDPE liner in order to prevent contaminated to groundwater before bioremediation onsite after the rig move out from location or sent for disposal at approved waste management facility. PTTEP SA prepared the safety land transport procedure and enforced the contractor to follow regulation. Moreover, the contractor provided journey management plan and journey management record.

#### **4) Transportation Accidents**

Training program on Safety, Security, Health and Environment Management System (SSHE-MS) and other concerned safety standards have been provided to the contractor for implementation as PTTEP SA's plan. PTTEP SA prepared safety land transport procedure and enforced the contractor to follow regulation of speed limitation 5 km/hr within wellsite and 10 km/hr along the access road. The speed limitation signs are provided along access road and the speed limitation was communicated to all worker in daily tool box talk before working by the header of contractor/safety officer. Moreover, PTTEP SA prepared safety land transport procedure and enforced the contractor to follow regulation.

PTTEP SA informed local authority on the oversized load and put an escort in front of this convoy, the project also conducted rig move route survey before major movement and avoiding transportation of heavy equipment during rush hours. PTTEP SA implements the grievance handling guideline and act immediately in case any complaints raised from the stakeholder. However, during January – June 2019 there was no complaint from activity.

Fence was installed around the wellsite to separate the project area and nearby area. The security guard was 24-hr provided at temporary resting area to restrict people and vehicles. Emergency respond procedure, ambulance, medical personnel and training were provided to respond in emergency case. Moreover, the contractor cooperated with nearby hospital to support in serious injuries or emergencies case.

#### **5) Earthquakes**

Training program on Safety, Security, Health and Environment Management System (SSHE-MS) and other concerned safety standards have been provided to the contractor for implementation as PTTEP SA's plan.

### **6.4 Environmental Monitoring Result**

The results of Environmental Impact Monitoring determined that the project completely complied with 100%.

#### **1) Air Quality Monitoring**

Air quality monitoring was conducted for drilling phase at Moenatkone wellsite during March 3-4 2019 by REM- UAE Laboratory and Consultant Company Limited. The results of average 1 hr Nitrogen Dioxide (NO<sub>2</sub>), average 24 hrs Sulphur Dioxide (SO<sub>2</sub>) were complied with Myanmar National Environmental Quality (Emission) Guidelines (2015) and WHO Air quality guideline (2006) and amendment. While, average 24

hours  $PM_{10}$ , average 24 hours  $PM_{2.5}$  and average 8 hrs Ozone ( $O_3$ ), not complied with Myanmar National Environmental Quality (Emission) Guidelines (2015) and WHO Air quality guideline (2006) and amendment in some period of time. However, average 24 hrs  $H_2S$  was not specified in the standard.

For average 24 hours  $PM_{10}$ , average 24 hours  $PM_{2.5}$  and average 8 hrs Ozone ( $O_3$ ) which not complied with the standards may be the result from wildfire around project area during monitoring period. The nearest wildfire was occurred approximately 500 meters from Moenatkone main gate in the same day of air quality monitoring.

## 2) Noise Level Monitoring

Noise level was conducted for drilling phase of Moenatkone (MNK) wellsite during March 3-4, 2019 by REM-UAE Laboratory and Consultant Company Limited at 1 station; Moenatkone station (N2). The result 2019 found that  $L_{Aeq\ 24\ hours}$ ,  $L_{Amax}$  and  $L_{Adn}$  were 52.5 dB(A), 52.8-87.8 dB(A) and 58.4 dB(A), respectively. The Myanmar National Environmental Quality (Emission) Guidelines (2015) and WHO guideline for community noise (1999) were not specify the standard for  $L_{Aeq\ 24\ hours}$ ,  $L_{Amax}$  and  $L_{Adn}$ .

## 3) Cuttings Monitoring

- **Chloride (for WBM):** Referring to analysis no. T19AE726-0009, cuttings were collected by project staff. The result of chloride (for WBM) was Non-detectable. Chloride (for WBM) for Onshore Oil and Gas was not specified in National Environmental Quality (Emission) Guidelines.
- **Oil on Cuttings (for SBM):** Referring to analysis no. T19AE726-0001 to T19AE726-0008 and T19AE7260010. Mud and Cuttings were collected by project staff. The results found that %OOC (dry weight) was vary from 0.02-22.5%. Oil on Cutting for Onshore Oil and Gas was not specified in National Environmental Quality (Emission) Guidelines.
- **Mercury and Cadmium (in stock Barite):** Referring to analysis no. T19AE726-0011, mud and cutting were collected by project staff. Total mercury and total cadmium (in stock barite) was analyzed, the results found that total mercury and total cadmium (in stock barite) was 3.61 and 0.795 mg/kg (dry weight). Total mercury and total cadmium (in stock barite) for Onshore Oil and Gas were not specified in National Environmental Quality (Emission) Guidelines.

## 4) Chemical Used for Drilling

Chemical used for the drilling phase are not different from the list that mention in EIA report. Moreover, MSDS sheets are to be provided at the work site. Monitoring the type and quantity of chemicals used at Moenatkone wellsite as shown in Chapter 3 Section 3.5.2.

## **5) Hazardous and Non-hazardous waste**

The PTTEP SA exploration program would handle waste according to PTTEP SA Standards. All wastes were classified and segregated before responsible disposal. All wastes would be collected, stored, and segregated in arranged containers such as non-hazardous waste, plastic waste, metal waste and hazardous waste. The contractor provided storage area for all wastes and PTTEP SA strictly enforced good housekeeping practices within well site and Central Campsite.

For non-hazardous waste, waste management plan was prepared that defines waste types, disposal methods and locations consistent with waste management laws and regulations. The local government of Thayet township municipal was the responsible agency for managing waste to disposal.

For Hazardous Waste, the well site and accommodation campsite were generated a low volume of hazardous waste. Drilling waste was transferred to Yangon for disposal of at an approved waste disposal area (DOWA).

The medical waste was handover to medical service company for dispose at approved hospital.

## **6) Social Monitoring**

Social monitoring results for drilling phase of Moenatkone (MNK) wellsite by PTTEP SA. There were no any complaints from the community throughout the project operation.

## **7) Public and Occupational Health and Safety Monitoring**

Public and Occupational health and safety monitoring results for drilling phase of Moenatkone (MNK) wellsite were done by PTTEP SA. There were 1 High Potential Incident case from project activity throughout the project operation. PTTEP SA had strictly follow PTTEP SA's procedure for all case such as record data, find cause of accidents and performed mitigation measures.

***Chapter 1***  
***Introduction***

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## **Chapter 1**

### **Introduction**

#### **1.1 Introduction**

The Myanmar Onshore Block MOGE-3 Exploration Drilling Campaign (“the Project”) is an existing development operated by PTTEP South Asia Limited (PTTEP SA), a subsidiary of PTTEP, PTTEP SA plans to drill four (4) exploration drilling wells in Block MOGE- 3 during 2018-2019 located in Thayet Township, Magway Region, Myanmar. The Environmental Impact Assessment (EIA) Report for Myanmar Onshore Block MOGE- 3 Exploration Drilling Campaign was submitted to Myanmar Oil and Gas Enterprise (MOGE) and Environmental Conservation Department (ECD) on 28<sup>th</sup> September 2018, according to the submission letter no. PTTEP SA 13253/01-2967/2018 (Appendix A-1). After that ECD called reviewed team meeting on 1<sup>st</sup> November 2018 and requested PTTEP SA to revise the EIA report. Then PTTEP SA submitted the revised EIA report on 23<sup>rd</sup> November 2018 (Appendix A-2). EIA report was approved 1<sup>st</sup> November 2019 by MOGE and ECD according to the approval letter number MD – (15) 3/6 (2631) 2019 and EIA-2/ Petroleum (2301/2019) respectively (Appendix A3). As per commitment in EIA Report, PTTEP SA has the responsibility to follow the environmental impact monitoring and mitigation measures including submits the monitoring report to MOGE and ECD. Therefore, PTTEP SA, as the project owner, has assigned a qualified third party, REM- UAE Laboratory and Consultant Company Limited to perform compliance audit of the mitigation measures and perform the monitoring at frequency specified in the EIA’s environmental management plan and report the results to MOGE and ECD as prescribing in EIA.

In this monitoring report, environmental impact monitoring and mitigation measures implementation compliance are covered for Myanmar Onshore Block MOGE-3 Exploration Drilling Campaign during Drilling Phase (audit conducted at Moenatkone Wellsite).

#### **1.2 Objective**

The main objectives of this report are:

- To evaluate the effectiveness of implementation of the Environmental Impact Assessment, including both mitigation and monitoring measures as per commitment in EIA Report; and
- To report any potential problems or obstacles and propose recommendation for improvement in order to ensure the effectiveness of the prevention and mitigation measures.

### 1.3 Briefly Information of The Project

#### 1.3.1 General Information and Background

- 1) Project Name: Myanmar Onshore Block MOGE-3 Exploration Drilling Campaign
- 2) Project Location: Block MOGE-3 lies within Thayet and Kamma Townships in Thayet District of Magway Region
- 3) Project Owner: PTTEP South Asia Limited
- 4) Report Preparation: REM-UAE Laboratory and Consultant Company Limited
- 5) Project Start Date: Project was started in 2018.

#### 1.3.2 Project Location

Block MOGE-3 lies within Thayet and Kamma Townships in Thayet District of Magway Region. The block encompasses 1,217 square kilometers (km<sup>2</sup>) and is located in the Southern part of Magway region in the dry, central zone of the Myanmar lowlands. The block boundaries of MOGE-3 are shown in Table 1-1.

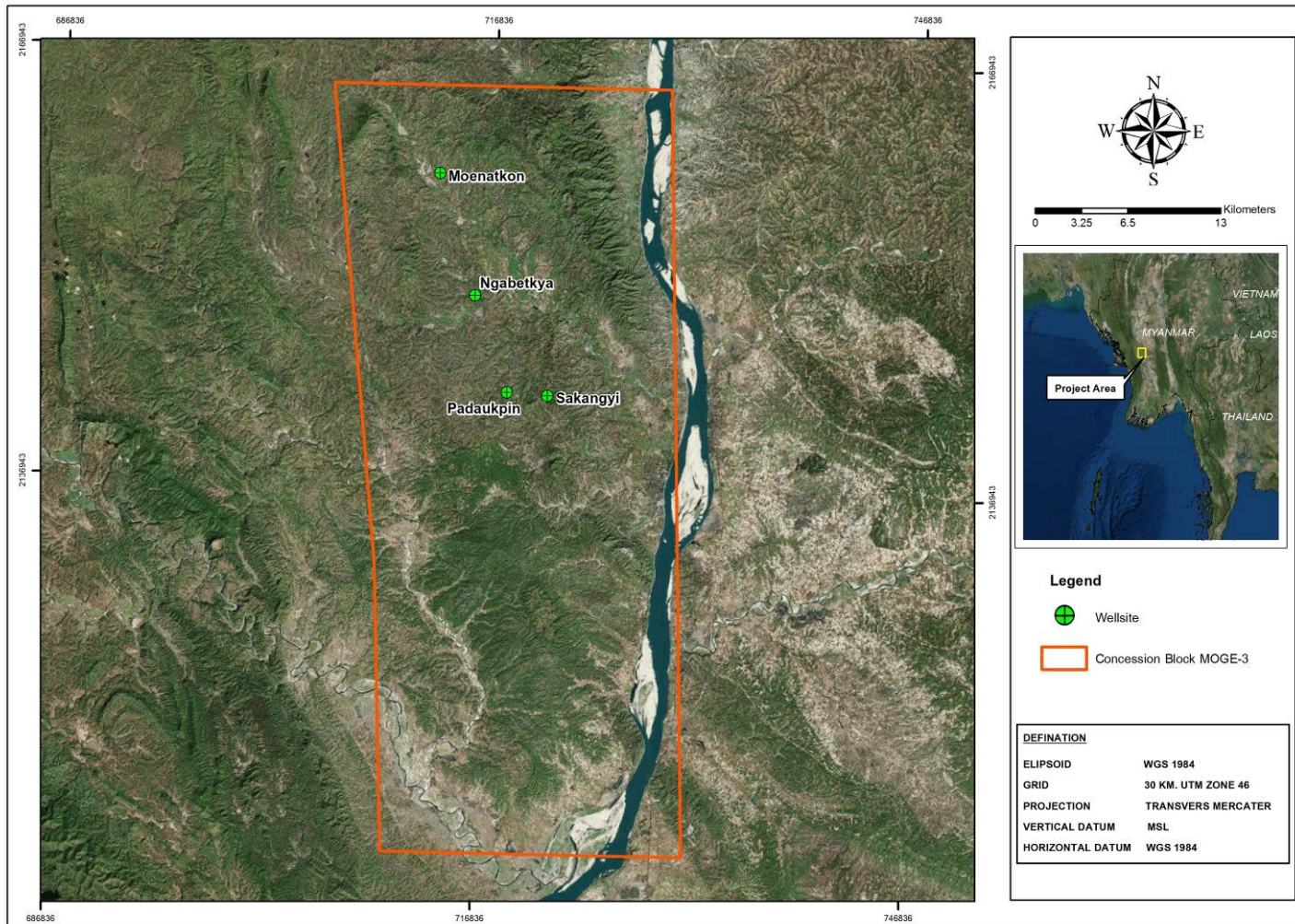
**Table 1-1 Coordinates of Block MOGE-3 Boundary**

Corner point	Coordinates (UTM Datum WGS 1984)		
	Zone	East (X)	North (Y)
<b>A</b>	46Q	705437.87	2164705.93
<b>B</b>	46Q	729049.83	2164991.86
<b>C</b>	46Q	731479.28	2111501.61
<b>D</b>	46Q	710428.60	2111249.24
<b>E</b>	46Q	709319.72	2131534.74

Four (4) drilling locations were selected to operate in 2018-2019 for drilling campaign. Four drilling locations are shown in Table 1-2 and Figure 1-1.

**Table 1-2 Coordinates of Four Drilling Location within Block MOGE-3**

Wellsite	Coordinates (UTM Datum WGS 1984)		
	Zone	East (X)	North (Y)
Moenatkone (MNK)	46Q	709266.43	2158633.42
Ngabetkya (NBK)	46Q	708668.74	2149921.69
Padaukpin (PDP)	46Q	718230.84	2143521.79
Sakangyi (SKG)	46Q	721062.26	2143376.77



**Figure 1-1 Four Drilling Location within Block MOGE-3**





### 1.3.3 Status of Current Operation

Four drilling locations were started to construction and installation phase in 2018. During audit, main activity of the project is drilling phase of Moenatkone wellsite. The status of each wellsite during the audit is summarized as Table 1-3.

**Table 1-3 Status of each wellsite for Myanmar Onshore Block MOGE-3 Exploration Drilling Campaign**

Wellsite	Status
Moenatkone (MNK)	Drilling Phase
Ngabetkya (NBK)	Site Preparation and access road construction
Padaukpin (PDP)	Site Preparation, access road construction and drilling pad construction
Sakangyi (SKG)	Site clearing

**Remark :** PTTEP SA, 2019.

The example for current condition of Moenatkone wellsite as shown in Figure 1-2.



**Figure 1-2 Moenatkone (MNK) Wellsite in Drilling Phase**

## **1.4 Layout and Facilities in Construction and Installation Phase**

### **1.4.1. Layout of Wellsite and Access Road**

#### **1) Layout of Wellsite**

The wellsite layout for Moenatkone, Ngabetkya, Padaukpin and Sakangyi are shown in Figure 1-3 to Figure 1-6.

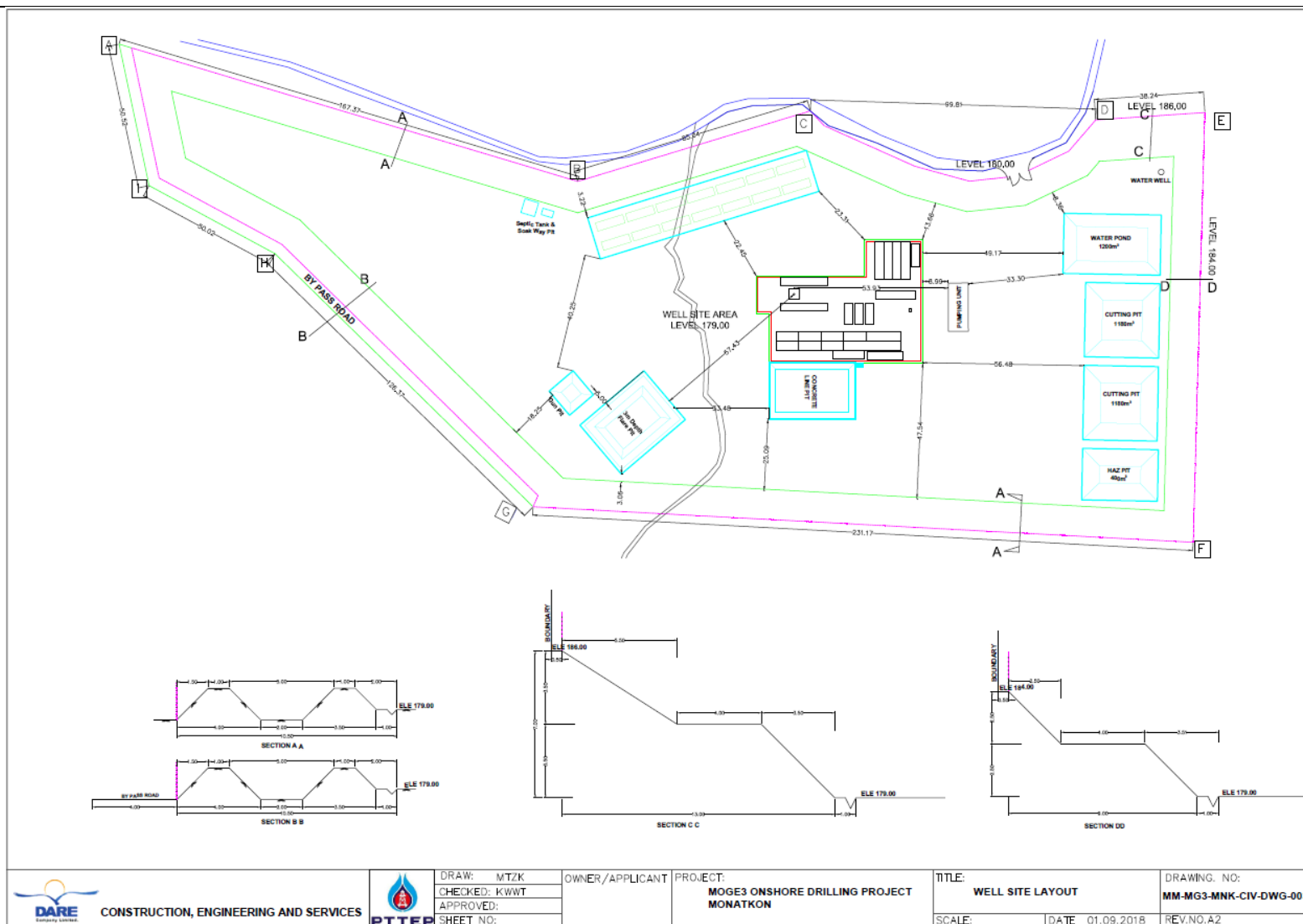


Figure 1-3 Moenatkone Wellsite Layout

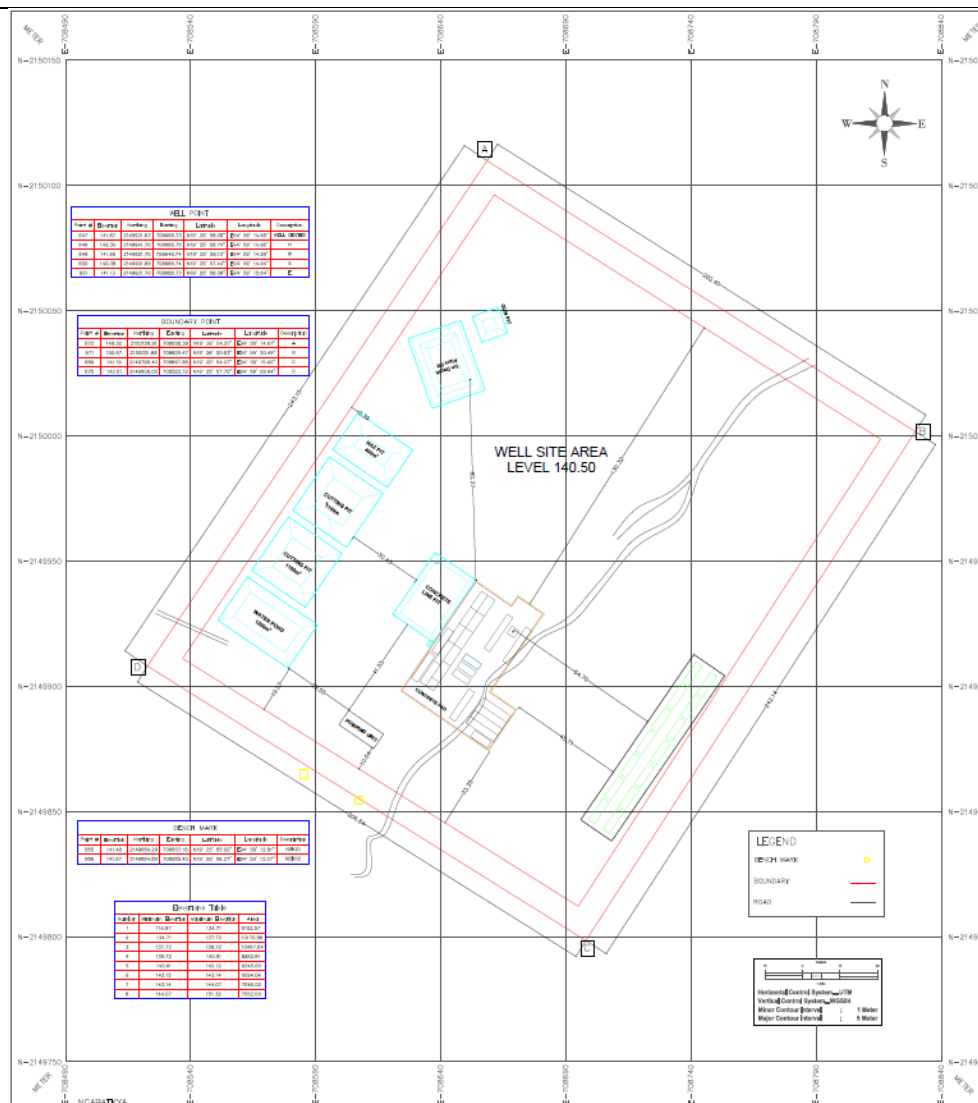
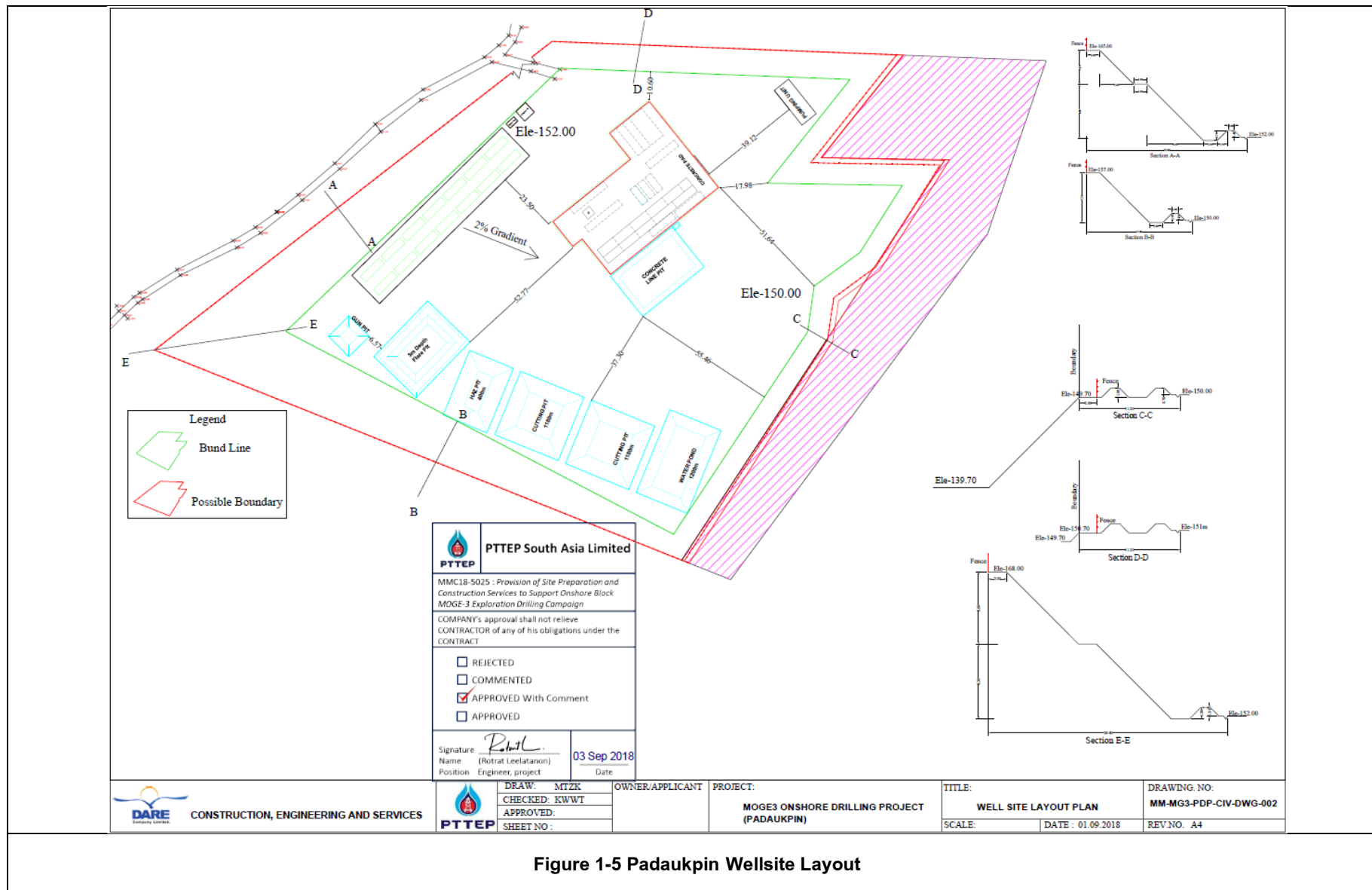
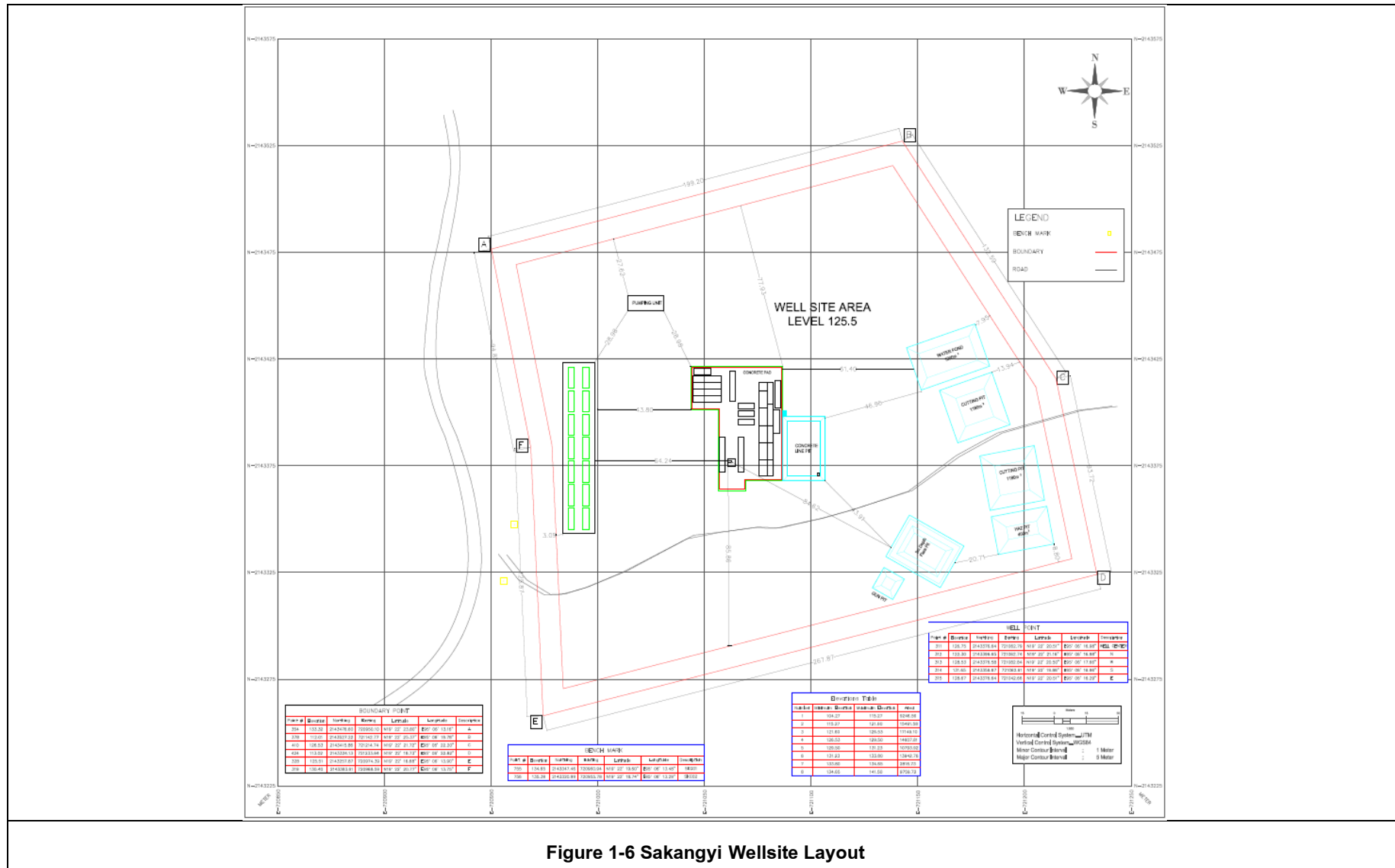


Figure 1-4 Ngabetkya Wellsite Layout







## 2) Access Road

PTTEP SA used existing local roads for transportation as much as possible to each wellsite. However, due to the wellsites being located in an agricultural area, the new access roads were constructed to connect the wellsites to the existing main roads for transportation of drilling rig and drilling equipment. PTTEP SA considered the impact to the nearby villages and design the road accordingly. The land required for the access roads would follow land acquisition committee consideration and decision for compensation and access route. PTTEP SA considered the final access road route depending on the land compensation committee consideration and approval. PTTEP SA obtained permission from the relevant local authorities and contracted with land owners prior to construction of the access roads.

The well locations can be accessed by car using existing local roads from Thayet Township. But most of the existing local earth road cannot be used in the rainy season. Therefore, new access roads were designed as single lane, un-surfaced roads, constructed of compacted laterite and selected material. The roads constructed 5 m with side slopes of 2:1, constructed with 200 mm of compacted laterite and 200 selected materials.

### **1.4.2. Facilities in Basecamp, Central Campsite and Accommodation Areas**

PTTEP SA constructed the Central Campsite (CCS) nearby Thayet Township. The container cabin is providing for workers' accommodation. The detail of facilities that providing within CCS as below.

#### 1) Potable Water

During the exploration drilling phase, the drinking/consumption water (~600 liters of water bottled) required daily and another 600 liters to be used for hygienic purposes. Water source during the exploration drilling phase transport from nearest village tube well.

#### 2) Drainage Control within Central Campsite

There are no potentially harmful chemicals stored at the central campsite that could drain offsite. The fuel tank for the camp generator was placed on an impermeable membrane and bunded to contain potential fuel leaks. The spill kits and absorbents were provided at the central campsite site to clean up any potential fuel or oil spills during vehicle maintenance or use.

### 3) Central Camp Site Sewage System

A set of concrete septic tanks were built into the work camp pad at the outer edges and there is the capacity of 8000 litres (8 m<sup>3</sup>). No pump out of septic sludge is required as the concrete septic tanks and any sewage sludge would be left in septic tanks onsite at the end of the drilling campaign.

Wastewater from the campsite, including both grey water and black water, were treated separately. Grey water was treated in a soak pit and Black water was treated in septic tank and soak pit.

A waste management plan was prepared that defines waste types, disposal methods and locations consistent with waste management laws and regulations.

### 4) Central Campsite Power

The central campsite is a container types accommodation with the power being generated from portable diesel engine generator. The engines are running 24 hours a day to power up the lighting, equipment and other necessity. Cylinder gas was using for cooking purpose.

All power for the central camp site is providing by the camp's 100 KVA diesel power generator. Estimated fuel consumption is 0.5 m<sup>3</sup> per day during full accommodation. On-site fuel storage capacity consists of one 25 m<sup>3</sup> tank. Estimated total fuel usage is about 30 m<sup>3</sup> (based on 60 days of drilling).

Currently, Central Campsite for drilling phase as shown in Figure 1-7.



**Figure 1-7 Central Campsite for drilling phase**



**Figure 1-7 (Cont.) Central Campsite for drilling phase**

### **1.5 Drilling Operations Phase**

All operations on these wells were carried out in accordance with the appropriate international API standards, PTTEP SA Drilling Management System, copies of which was provided at the rig site and must be read and understood by everyone involved in these operations. Drilling operations and associated services conducted on a 24-hour basis. Drill crews will work alternate 12-hour shifts rotated from duty on a maximum 28-day schedule, as is standard oil and gas industry practice. The basic steps of drilling an exploration well are summarized below.

- **Drilling the Hole** - The drill string is a series of long, hollow steel pipes, which can be screwed together. The drill bit, which has a larger diameter than the drill string, is the cutting tool and is screwed to the end of the drill string. A hoist system within a derrick over the well allows the drill string to be assembled and broken down into manageable sections.
- **Drilling Fluids System** - The drill string and bit are lubricated and cooled by a drilling fluid, commonly referred to as mud. This mud is stored in large steel tanks beside the rig, from where it is pumped down through the drill string.
- **Mud Cleaning Equipment** - When the drilled cuttings are brought to the surface with the drilling fluids, they were first pass through a mud treatment system commonly consisting of shale shakers. This comprises of a vibrating frame fitted with a series of fine mesh screens, which separate most of the drill cuttings from the drilling mud.
- **Casing and Cementing** - Various sections of the hole were drilled at different diameters, with the size of the borehole decreasing with depth. Each section of the hole lined with thick steel tubing, known as casing, which was fully cemented in place. This ensures that the hole remains stable and that the

surrounding geological formations, those that may act as freshwater aquifers, are not contaminated.

This casing also helps in the process of controlling the pressure of any gas that the well might penetrate, as it is prevented from flowing into shallower, less pressurized formations.

#### Blowout Preventative Measures:

A complex series of valves, known as the “blowout preventer” (BOP), is attached to the top of the conductor below the derrick floor. All further casing strings are also attached into this blowout preventer. These are powerful hydraulically-activated valves and rams that can be closed around the drill pipe to isolate the well bore should unexpectedly high formation pressure be encountered. If formation pressure exceeds the hydrostatic head of the drilling mud, it may cause the well to flow strongly, referred to as a “kick”. A kick can also occur if a highly permeable formation, such as a naturally fractured limestone, is encountered and a large volume of mud is suddenly lost into the formation. The blowout preventer is the primary safety mechanism for well control. The series of valves act independently and when closed in an emergency form a series of increasingly secure barriers that isolate the well so that a plan of action can be developed to bring it back under control.

### **1.6 Emissions, Discharges and Waste Generation**

Emissions, discharges and waste generation was conformed to applicable government regulations in Myanmar such as Myanmar Environmental Conservation Law (2012) and National Environmental Quality (Emission) Guideline.

#### **1.6.1. Waste Drilling Mud and Cuttings**

- Waste Drilling Mud: The solid (drilled cutting) and liquid (drilling mud) phases are separated on-site by oil and gas standard physical and chemical means (shaking, centrifuging and flocculation). At the end of the first well location, the left-over drilling mud was transferred and used at the next well location. At the end of drilling campaign, the left-over mud will be sent back to mud contractor for reuse or disposal or use for PTTEP offshore drilling campaign. If the well is actually abandoned rather than completed as a producer, some of this mud will be used to make the kill weight spacer between the cement plugs.
- Waste Drilling Solids: There are alternatives for waste cuttings disposal and management at this moment. The first alternative is to do the bioremediation onsite after the rig move out from location. The second option is to send all cuttings to the approved waste management contractor e.g. DOWA waste management facility at Thilawa Special Economic Zone (SEZ) in Yangon.

### 1.6.2. Wastewater

- Contaminated Runoff: In case of rainfall during drilling operation, runoff may happen from the wellsite will drain into the cuttings pit which was designed to contain the runoff from the wellsite combined with rain falling on the waste pit during extreme heavy rain. The pit will be enclosed by an earth embankment to prevent the excess water drain into the pit.
- Wastewater from consumption: The wastewater and sewage were collected in a plastic-lined sewage pit. A septic tank was installed on all locations for preliminary wastewater treatment then overflow to infiltration field.

### 1.6.3. Non-Hazardous Waste and Hazardous Waste

The PTTEP SA exploration program would handle waste according to PTTEP SA Standards. All wastes were classified and segregated before responsible disposal. All wastes would be collected, stored, and segregated in arranged containers such as non-hazardous waste, plastic waste, metal waste and hazardous waste.

The contractor provided storage area for all wastes and PTTEP SA strictly enforced good housekeeping practices within wellsite and Central Campsite.

For non-hazardous waste, waste management plan was prepared that defines waste types, disposal methods and locations consistent with waste management laws and regulations. The local government of Thayet township municipal was the responsible agency for managing waste to disposal. For Hazardous Waste, the wellsite and accommodation campsite were generated a low volume of hazardous waste. Drilling waste was transferred to Yangon for disposal of at an approved waste disposal area (DOWA).

The medical waste was handover to medical service company for dispose at approved hospital.

### 1.6.4. Air Emission

- Dust: the main air quality issue while exploration drilling activity, the handling, and storage of bulk drilling mud additives, including barite, bentonite, calcium carbonate and cement powder resulted in relatively minor fugitive dust emissions. Any emissions were reduced significantly by the standard procedure of equipping all silos with bag filters.
- Combustion emission: Combustion product from exploration drilling project was diesel combustion. Diesel combustion from the on-site electrical power generation units and from vehicles were emitted greenhouse gases. The amount of emissions would be varying with time, depend on the operational activity and power demand.



#### 1.6.5. Noise

During the drilling phase, noise will be generated from project vehicles, generators and drilling operations.

### 1.7 Safety, Security, Health and Environment Management System

#### 1.7.1 PTTEP Corporate Vision and Mission

All levels of line management at PTTEPI are responsible for implementing and maintaining its SSHE policy and SSHE MS. Both documents are reviewed and revised at regular intervals.

- **Vision Mission and Corporate Values**

**Vision:** "Energy Partner of Choice" through Competitive Performance and Innovation for Long-term Value Creation."

**Mission:** "PTTEP operates globally to provide reliable energy supply and sustainable value to all stakeholders."

#### 1.7.2 PTTEP Myanmar Asset Safety Security Health and Environment (SSHE) Policy

PTTEP Myanmar Asset is committed to safe Exploration and Production (E&P) Operations in Myanmar with an ultimate goal of "Target Zero - Nobody Gets Hurts in Our Operations" which covers (1) Zero Injury, (2) Zero Major Accident (e.g. zero major hydrocarbon leak, vehicle accident, ship collision), and (3) Zero Spill or External Complaint (e.g. zero complaint by authorities/ communities/ sea users).

To accomplish this, PTTEP Myanmar Asset implements Safety, Security, Health and Environmental Management System (SSHE-MS) that outlines the main principles and accountabilities to drive for continuous improvement. We are committed to:

- Comply with Myanmar SSHE laws, other applicable requirements and PTTEP Standards.
- Perform hazard identification and SSHE risk assessments so that risks are As Low As Reasonably Practicable (ALARP).
- Hold employees accountable for SSHE performance by setting and monitoring SSHE Plans and KPIs.
- Prevent operational and process incidents by implementing asset integrity programs and monitoring of Safety Critical Elements addressed in Safety Cases and complying with Management of Change (MOC) Standard.
- Work with contractors and suppliers to achieve PTTEP's SSHE requirement.
- Ensure all employees and contractors are assessed and maintain the required level of job and SSHE competency.
- Apply "Stop Work Authority Policy" for unsafe work by implementing Behavior-Based Safety (BBS) programs to improve positive SSHE culture.



- Implement security management for potential threats to safeguard personnel, assets, information and reputation.
  - Promote occupational health and hygiene in the workplace by conducting health risk assessments, medical
  - Surveillances, education and regular industrial hygiene monitoring.
  - Prevent environmental impacts by strictly following the mitigation measures stated in Environmental Impact Assessment.
  - Promote sustainable development by implementing waste management, greenhouse gas reduction and energy efficiency programs.
  - Report, investigate and analyse SSHE incidents to prevent recurrence and close out corrective actions with evidence.
  - Ensure that emergency and crisis management plans are proactive and effective.
  - Ensure policy and SSHE Management System compliance through regular SSHE audits and Senior Management visits with corrective actions follow up for continuous improvement.
- Strong leadership and commitment is a key successful implementation of this policy which is required from PTTEP employees and contractors at all levels.

### **1.7.3 SSHE Management System Manual**

PTTEP SA's SSHE Management System Manual objective is to serve as practical interpretation of Company SSHE policy with respect to their moral obligations for SSHE issues for all persons working on, visiting or affected by operations at sites for which PTTEP SA has responsibility.

The manual covers details on the are as specified in Table 1-5. The document is designed to serve as a comprehensive guide for all Operational Assets to develop its own SSHE management system and related documents. This document also provides an overview of SSHE management system approach. It should be noted that PTTEP SA currently does not have its own internal SSHE policies, however PTTEP International Limited (PTTEPI) Myanmar Asset policies will be applied. For this project, PTTEP SA will adopt all of PTTEPI's relevant SSHE policies and procedures. Throughout this chapter, SSHE policies, procedures and documents was referred to as belonging to PTTEP SA, however they actually belong to PTTEPI and are being adopted by PTTEP SA for this project. The detail Plan and Procedure have been submitted at EIA report and monitoring report of Myanmar Onshore Block MOGE-3 Exploration Drilling Campaign (Construction and Installation Phase).

**Table 1-4 PTTEPI SSHE Management System**

Document Code	Document
Myanmar-0550-STD-014	SSHE Regulatory Compliance Standard
11027-PDR-SSHE-505_37-R01	Myanmar Asset Land Transport Safety Procedure
11027-PDR-SSHE-503/01-R02	Myanmar Asset Waste Management Procedure
11027-PDR-SSHE-502-006-R00	Myanmar Asset Emergency Management Plan
11027-PDR-SSHE-501-005-R00	Myanmar Asset Crisis Management Plan
11027-PDR-SSHE-564-002-R00	Myanmar Asset Alcohol and Drugs Testing Procedure
11027-PDR-SSHE-530-004-R00	Myanmar Asset Security Management Procedure
11027-PDR-SSHE-501/03-R02	Myanmar Asset Spill Contingency Plan
Myanmar-SSHE-11027-PDR-508	Fitness to Work Procedure
Myanmar-0550-MNL-004	Land Campaign Blowout Contingency Plan
11027-PDR-SSHE-501-005-R00	Myanmar Asset Crisis Management Plan
11027-PDR-SSHE-340-003-R01	SSHE Training and Competency Procedure
Myanmar 13036-PDR-078	PTTEPI SSHE Requirements for Contractors
11027-PDR-SSHE-501-007-R02	MOGE-3 Operations Medical Emergency Response Plan (MERP)

### 1.8 Environmental Impact Monitoring and Mitigation Measure Implementation Compliance

Environmental Mitigation Measures Implementation Compliance audit result, Environmental Impact Monitoring result and Environmental Mitigation Measures Compliance Audit and Environmental Impact Monitoring conclusion as shown in Chapter 2, Chapter 3 and Chapter 4, respectively.

***Chapter 2***  
***Environmental Mitigation Measures***  
***Implementation Compliance Audit***

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## Chapter 2

### Environmental Mitigation Measures Implementation Compliance Audit

Environmental Mitigation Measures Implementation Compliance audit was carried out by REM- UAE Laboratory and Consultant Company Limited together with representatives from PTTEP SA. The auditor team experience is summarized in Table 2-1.

**Table 2-1 Auditor Experience**

Name	Position	Education	Experience
1. Mr Nopparat Wonganurakchai	Environmental (Auditor)	<ul style="list-style-type: none"> <li>B.Sc. (Environmental Science), Silapakorn University</li> <li>M.Sc. (Environmental Science), Burapha University</li> </ul>	21 years experience in field of Oil and Gas, Petrochemical industry, pipeline and etc.

The audit conducted against the mitigation measures specified in Environmental Impact Assessment (EIA) as detailed in Appendix B.

Audit was performed at Moenatkone, on March 3, 2019 during drilling phase (Figure 2-1) and document checking by setting 4 levels of evaluation as follows;

- Completely complied on the Mitigation Measures (✓) refers the project can complete comply with the measure without any barriers.
- Mostly complied on the Mitigation Measures (✓) refers the project can mostly comply with the measure without any barriers.
- Do not complied on the Mitigation Measures (✗) refers the project cannot comply with the measure because of some barriers.
- Do not have situation follows the Mitigation Measures (NA) refers during the project operations do not have any of situation follow the Mitigation Measures



**Figure 2-1 Mitigation Measures Compliance Audit in March 3, 2019**

Although the project does not comply with the mitigation measures, REM-UAE Laboratory and Consultant Company Limited will identify the cause of problems, barriers and solutions ways. The details are shown in Table 2-2 to Table 2-4 and conclusion as below;

- The results determined that the project completely complied on the general mitigation Measures Implementation Compliance for all finished and on-going work while some activities (12.5% of total mitigation) do not have situation during the audit, specified as NA.
- The results determined that the project completely complied on the environmental mitigation measures implementation compliance in Drilling Phase with 100.0%.
- The results determined that the project completely complied on the environmental mitigation measures implementation compliance in unplanned event with 100.0%

**Table 2-2 General Mitigation Measures Implementation Compliance Result Summary**

Mitigation Measures	Status	Details	Remarks
<b>General Measures</b>			
1. Mitigation and monitoring measures set forth in this document must be incorporated into contractual agreements for all contractors, including: design, construction, and operation in order to obtain practical and effective execution of the project.	✓	PTTEP SA concerns the safety, security, health and environment of the employees and wellbeing of the environment. The company addresses this regulation to the contract employees and contractor to comply with the requirements; the mitigation must be followed with the Company's SSHE Policy.	Appendix E-1
2. Report compliance with these mitigation and monitoring measures to MOGE in congruence with schedule.	✓	PTTEP SA compiled these mitigation and monitoring measures strictly and monitoring report of the project will submit to MOGE and ECD in order to inform all activities. This report is the monitoring report of Myanmar Onshore Block MOGE-3 Exploration Drilling Campaign (Drilling Phase of Moenatkone Wellsite).	-
3. Provide stakeholder relation plans to explain about the project when needed for communication of construction and drilling activities.	✓	The letter about the project activities was sent to local government such as date on activity, transportation of equipment, transportation route and security compliance. Moreover, PTTEP SA had two times of public consultation with stakeholder already. Another plan of public consultation with stakeholder will conduct if needed. PTTEP SA will refer to the grievance mechanism if there is any compliance from stakeholder and community.	Appendix F-1 and Appendix F-3
4. Operator must set up a contact point to receive any complaints from the stakeholder regarding its exploration activities. Further, the Operator must provide assistance and rectify the cause of such complaints as determined appropriate, as soon as possible.	✓	PTTEP SA apply grievance handling guideline for immediately action in case receive any complaints raised from the stakeholder. However, there was no complaint from activity.	Appendix F-1
5. If impacts and/ or damages result from project activities, the Operator must implement all necessary measures to mitigate these impacts and/ or damages as soon as possible.	✓	PTTEP SA apply grievance handling guideline for immediately action in case receive any complaints raised from the stakeholder. However, there was no complaint from activity.	Appendix F-1

**Table 2-2 General Mitigation Measures Implementation Compliance Result Summary**

Mitigation Measures	Status	Details	Remarks
6. MOGE will investigate complaints lodged by people living in the surrounding area concerning any disturbance by project activities, or any damage of public infrastructure resulting from project operations. The Operator will inform the public within 30 days if the investigation proves that the Operator did not comply with mitigation and monitoring measures.	✓	PTTEP SA apply grievance handling guideline for immediately action in case receive any complaints raised from the stakeholder. However, there was no complaint from activity.	Appendix F-1
7. During the project period, if archaeological finds or fossils are encountered in the project area, the project team must immediately report the findings to the appropriate government office, e.g. District and Township Administrator, Local Archeological Department, Fossil Research Center and Geological Museum. In addition, the project team must cooperate with the government agencies in an effort to verify the findings in the project area. If it is proven that these findings are archaeological finds or fossils, the Operator must follow the regulations strictly.	NA	If any objects, fossils or archaeological are encountered in the project area, PTTEP SA will stop all drilling activities and inform the government agencies such as District and Township Administrator, Local Archeological Department, Fossil Research Center and Geological Museum immediately to examine at the wellsite. However, there was no encountered any objects, fossils or archaeological from project activities.	-
8. The Operator will start operations only when the Operator has received the necessary approval, permit or agreement from the landowner or responsible agency. Moreover, the Operator will improve or construct access roads when approved by the authorized local government agencies and/or landowner. All activities will operate under the control of MOGE.	✓	All private land was permitted by land owners or authorized persons prior to start any activity. For access roads, the upgrade of existing road and construction of new road was considered and approved by local administrative officers and land owners under MOGE supervision.	-

**Table 2-3 Environmental Mitigation Measures Implementation Compliance Result Summary in Drilling Phase**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
<b>Physical Environmental Impact Assessment</b>						
1. Air Quality	1.1 Vehicle and Equipment use	1.1.1 Deterioration of air quality due to dust.	1.1.1.1 Minimize land clearance to a minimum especially during the drier months.	✓	During status of Moenatkone wellsite was drilling phase which has no land clearance activity.	-
			1.1.1.2 Limit vehicle on access road and site	✓	PTTEP SA prepared safety land transport procedure and enforced the contractor to follow regulation of speed limitation 5 km/hr within wellsite and 10 km/hr along the access road. The speed limitation signs were provided along the access road. Furthermore, speed limitation was communicated to all worker in daily tool box talk before working by the header of contractor/safety officer.	Figure 2-2 Figure 2-3 and Appendix D-1
			1.1.1.3 Cover trucks transporting materials with tarpaulins or plastic to prevent any loose material from blowing away and also to prevent dust dispersion.	✓	The truck was covered during transport material to the wellsite. Most of truck was used for transport material within wellsite. Moreover, the contractor had provided staffs for cleaning during transportation.	-
			1.1.1.4 Spray water on roads when needed to keep dust down.	✓	The project provided spray water truck to within project area depending on the atmospheric conditions to reduced dust dispersion.	Figure 2-4



**Table 2-3 Environmental Mitigation Measures Implementation Compliance Result Summary in Drilling Phase**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
			1.1.1.5 Clean tires of the vehicles before leaving site if needed.	✓	No needed to clean tires of the vehicles before leaving site due to the access road as the laterite road and there were a few houses of community around the wellsite. However, the contractor provided water spraying within the wellsite and along the access road to minimize impact of dust dispersion from transportation.	Figure 2-4
			1.1.1.6 Provide personal protective equipment to exposed field workers.	✓	The contractor provided PPE sufficiently for all workers and controlled to use PPE during working.	Figure 2-5 and Appendix E-1
			1.1.1.7 Use vehicles with dust flaps.	✓	The vehicle that used in the project has the dust flaps to reduce the dust dispersion.	Figure 2-6
	1.2 Equipment use during Site and Road Construction	1.2.1. Deterioration of air quality due to vehicles emissions.	1.2.1.1. Ensure all machinery and vehicles are properly checked and inspected	✓	PTTEP SA specified the contractor to regularly check and maintain the machines and vehicles.	Appendix E-3
	1.3 Well Drilling	1.3.1. Deterioration of air quality due to hydrogen sulphide	1.3.1.1 Turn off all vehicles and equipment when not in use as well as prohibit vehicles from idling.	✓	PTTEP SA prepared safety land transport procedure and enjoined the contractor to follow regulation. Moreover, training program in defensive driving was provided for contractor.	Appendix D-1 and Appendix E-4

**Table 2-3 Environmental Mitigation Measures Implementation Compliance Result Summary in Drilling Phase**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
			1.3.1.2 If H <sub>2</sub> S levels exceed 10 ppm in the gas stream, implement appropriate safety zones.	✓	The project has provided H <sub>2</sub> S monitor and alarm system within project area. In case of H <sub>2</sub> S levels in the gas stream exceed 10 ppm, the project will implement appropriate safety zones. Moreover, the project has also provided H <sub>2</sub> S safety basic training for project staff.	Figure 2-7 and Appendix E-4
			1.3.1.3 All crew are instructed and rehearsed in H <sub>2</sub> S procedures.	✓	The project has provided H <sub>2</sub> S safety basic training for all project staff and conduct regular H <sub>2</sub> S drill.	Appendix E-4
	1.4 Vehicle and Equipment use	1.4.1 Climate change due to GHG Release	1.4.1.1 Turn off all vehicles and equipment when not in use as well as prohibit vehicles from idling.	✓	PTTEP SA prepared safety land transport procedure and enjoined the contractor to follow regulation. Moreover, training program in defensive driving was provided for all drivers.	Appendix D-1 and Appendix E-4
2. Noise	2.1 Well Drilling and Vehicle and Equipment Use	2.1.1 Increase the noise levels during exploration drilling	2.1.1.1. Install noise barrier when needed at the wellsite boundary toward nearest community	✓	The project no need to use noise barrier due to drilling location is far away from nearest community. However, the soundproof generator was used to minimize noise disturbance. PTTEP SA specified the contractor to regularly check and maintain the machines and vehicles.	Figure 2-8 and Appendix E-3
			2.1.1.2. Ensure use of mufflers or ear plug on diesel/gas driven machinery	✓	Soundproof generator was used in project area to minimize noise disturbance during drilling phase.	Figure 2-8

**Table 2-3 Environmental Mitigation Measures Implementation Compliance Result Summary in Drilling Phase**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
			2.1.1.3. Ensure all machinery and vehicles are properly checked and inspected.	✓	PTTEP SA specified the contractor to regularly check and maintain the machines and vehicles.	Appendix E-3
3. Heat and Light	3.1 Functional lighting on vehicles and drill rig, camp site and wellsite during Drilling Wells.	3.1.1 Lighting on the site at night	3.1.1.1. Drilling Rig located in area distant to sensitive receptors.	✓	Drilling rig located distantly to sensitive receptors, there were a few houses of community around the wellsite.	-
			3.1.1.2. Keep night lighting to a minimum, consistent with safety and security.	✓	The project has provided adequate night lighting within project area.	Figure 2-9
			3.1.1.3. Direct lighting to the inside of the wellsites.	✓	The project has provided adequate night lighting within project area.	Figure 2-9
4. Surface Water Quality	4.1 Site Runoff and Drainage	4.1.1 Contamination of surface water from runoff and drainage	4.1.1.1 Implement construction and installation phase mitigation measures in 5.1 including - The proposed drill site and campsite will be orientated and designed to minimize areas requiring soil stabilization - Provide drip pans and absorbents to contain any spillage from vehicle and machinery while transferring fuel or changing of engine oil.	✓	The project strictly implements the construction and installation phase mitigation measure in 5.1 Construction of roads and well /camp sites and site runoff and drainage for drilling phase including - PTTEP SA designed layout of the wellsite, the access road and campsite before starting the construction to minimize areas requiring soil stabilization. - The contractor provided drip pans and absorbents to contain any spillage from vehicle and machinery while transferring fuel or changing of engine oil.	Figure 2-10 Figure 2-11 Figure 2-12 Appendix E-4 and Appendix G

**Table 2-3 Environmental Mitigation Measures Implementation Compliance Result Summary in Drilling Phase**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
			<ul style="list-style-type: none"> <li>- Provide drainage and sediment traps around project area to reduce suspended particles in runoff from the well site and to contain minor oil spills.</li> <li>- Avoid construction of the well pad in areas where such construction obstructs water drainage.</li> <li>- Prohibit workers from cleaning machines/ equipment in/ near a water source.</li> <li>- Prohibit workers and contractors discharging or discarding project waste, chemicals, and oil into public water sources.</li> </ul> <p>Provide a suitable storage area for construction materials ( such as soil, sand, and stone), chemicals (i.e., paint and thinner), and oil (i.e., fuel and lubricating oil).</p>		<ul style="list-style-type: none"> <li>- Water drainage ditch around the wellsite was constructed as specify in the measure.</li> <li>Moreover, the project provided regularly check the drainage system during drilling phase to prevent blockage</li> <li>- PTTEP SA has provided training program to contractors on regulation and prohibition including control the performed as defined.</li> <li>- The contractor provided storage area for chemical and oil within wellsite.</li> </ul>	
			4.1.1.2. Provide drainage, buffer zone and earth bund surrounding wellsite area.	✓	The project has provided drainage, buffer zone and earth bund surrounding wellsite area.	Figure 2-11

**Table 2-3 Environmental Mitigation Measures Implementation Compliance Result Summary in Drilling Phase**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
			4.1.1.3. The fuel storage will be surrounded by a bund wall in case of spill.	✓	The fuel storage tank was surrounded by bund wall and placed on tarpaulins to prevent contaminated to soil in case of spill.	Figure 2-13
	4.2 Hazardous/ nonhazardous waste management	4.2.1 Degradation of surface water quality from disposal of domestic sewage and grey water	4.2.1.1. Install concrete lined septic tank and soak away pit at the wellsite for holding & treating sewage.	✓	The project has installed concrete lined septic tank at the wellsite for hold and treating sewage.	Figure 2-14
5. Soil Quality	5.1 Drill site/ Site Runoff and Drainage	5.1.1 Contamination of soil from runoff	5.1.1.1 Implement drilling phase mitigation measures in 4.1 including - The proposed drill site and campsite will be orientated and designed to minimize areas requiring soil stabilization - Provide drip pans and absorbents to contain any spillage from vehicle and machinery while transferring fuel or changing of engine oil. - Provide drainage and sediment traps around project area to reduce suspended particles in	✓	The project strictly implements drilling phase mitigation measure in 4.1.	Figure 2-10 Figure 2-11 Figure 2-12 Figure 2-13 Appendix E-4 and Appendix G

**Table 2-3 Environmental Mitigation Measures Implementation Compliance Result Summary in Drilling Phase**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
			<ul style="list-style-type: none"> <li>- runoff from the well site and to contain minor oil spills.</li> <li>- Avoid construction of the well pad in areas where such construction obstructs water drainage.</li> <li>- Prohibit workers from cleaning machines/ equipment in/ near a water source.</li> <li>- Prohibit workers and contractors discharging or discarding project waste, chemicals, and oil into public water sources.</li> </ul> <p>Provide a suitable storage area for construction materials ( such as soil, sand, and stone), chemicals (i.e., paint and thinner), and oil (i.e., fuel and lubricating oil).</p>			
6. Groundwater Quality	6.1 Loss of circulation during Drilling wells	6.1.1 Groundwater degradation from drilling	6.1.1.1 Install steel casing and cement in place to prevent chemical leak or contaminate into rock formation.	✓	The project has installed steel casing and cement in place to prevent chemical leak or contaminate into rock formation.	Appendix E-5
			6.1.1.2 Strict steel casing to well wall by cementing to prevent chemical contaminate to ground water level.	✓	The project has strict steel casing to well wall by cementing as specified in the measure to prevent chemical contaminate to ground water level.	Appendix E-5

**Table 2-3 Environmental Mitigation Measures Implementation Compliance Result Summary in Drilling Phase**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
	6.2 Infiltration from the waste pit and sub irrigation field	6.2.1 Deterioration of shallow Groundwater	6.2.1.1. Install HDPE liner in the cuttings and dirty water waste pit. Monitor liner for tears or leaks during installation and operations.	✓	The project has installed HDPE liner in the mud and cutting pit in order to prevent contaminated to groundwater. Moreover, the project regularly inspects HDPE liner to prevent worn out.	Figure 2-15
<b>Ecological Environmental Impact Assessment</b>						
7. Terrestrial Flora and Fauna	7.1 Drilling Activities and Labor and Accommodations	7.1.1 Aquatic biota and habitat disturbed from workers' activities	7.1.1.1 Fishing will be prohibited to workers.	✓	PTTEP SA has provided training program to contractors on regulation and prohibition including control the performed as defined.	Appendix E-4
			7.1.1.2 Clearly mark signs showing the boundary of the project area	✓	Fence was installed around the wellsite to separate the project area and nearby area. The security guard was at temporary resting 24 hr. to restrict people and vehicles.	Figure 2-16 and Figure 2-17
			7.1.1.3 Prohibit workers from cleaning machines/ equipment in a public water source.	✓	PTTEP SA has provided training program to contractors on regulation and prohibition including control the performed as defined.	Appendix E-4
			7.1.1.4 Prohibit workers and contractors discharging or discarding project waste, chemicals, oil into public water sources.	✓	PTTEP SA has provided training program to contractors on regulation and prohibition including control the performed as defined.	Appendix E-4

**Table 2-3 Environmental Mitigation Measures Implementation Compliance Result Summary in Drilling Phase**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
<b>Social Impact Assessment</b>						
8. Transport	8.1 Rig Move and Equipment and Vehicle Use.	8.1.1 Disruption of traffic	8.1.1.1 Ensure all vehicles are in good operating condition and comply with project safety standards. Drivers must be healthy, have valid licenses, and by no means allowed to drink alcohol or take forms of medicine or illicit drugs that can affect performance.	✓	Routine inspection and preventive maintenance for all vehicles were conducted as per inspection plan. Alcohol testing was randomly check. Worker will immediately stop working if alcohol is found more than 0% . Moreover, the project provided drug test kits within wellsite to conduct drug test.	Figure 2-18 and Appendix E-3
			8.1.1.2 Strictly follow speed limits	✓	PTTEP SA prepared safety land transport procedure and enjoined the contractor to follow regulation of speed limitation 5 km/hr within wellsite and 10 km/hr along the access road. The speed limitation signs have provided along access road. Furthermore, speed limitation was communicated to all worker in daily tool box talk before working by the header of contractor/safety officer.	Figure 2-2 Figure 2-3 and Appendix D-1
			8.1.1.3 Weight of the trucks shall not exceed the limit set by the Myanmar regulations to reduce damage to road surfaces or structures.	✓	The contractor has controlled the truck not to over loading to prevent damage on road surface. Moreover, the access road was in good condition and ready for use. In case of the road was damaged from project activity, the contractor will repair to prevent unsafe to user.	Figure 2-19



**Table 2-3 Environmental Mitigation Measures Implementation Compliance Result Summary in Drilling Phase**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
			8.1.1.4 Safety equipment and emergency equipment must be installed on vehicles such as tool box safety belts and portable fire extinguisher etc. as per company standards.	✓	Safety equipment (eg. Fire extinguisher) and emergency equipment (eg. First Aid kit) were installed on project vehicles as per company standards.	-
			8.1.1.5 Provide left hand drive car as priority.	✓	The project provided left hand drive car as a priority to use in project activities.	Figure 2-20
			8.1.1.6 Notify the local authority on the oversized load and put an escort in front of this convoy with horn and hazard lights.	✓	PTTEP SA informed local authority on the oversized load and put an escort in front of this convoy. Moreover, the project also conducted rig move route survey before major movement.	Figure 2-21 and Appendix D-2
			8.1.1.7 Consult with local authority before major movement.	✓	PTTEP SA informed local authority on the oversized load and put an escort in front of this convoy. Moreover, the project also conducted rig move route survey before major movement.	Figure 2-21 and Appendix D-2
			8.1.1.8 Restrict/ avoid movement of heavy equipment during rush hours.	✓	The contractor informed about transportation duration and route for heavy equipment to local people. Moreover, avoiding transportation of heavy equipment during rush hours.	Appendix D-1
			8.1.1.9 Provide traffic signs or flags at junction of access roads and main roads.	✓	The project provided traffic sign along the access road as specified in mitigation measure.	Figure 2-22

**Table 2-3 Environmental Mitigation Measures Implementation Compliance Result Summary in Drilling Phase**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
			8.1.1.10 Investigate any complaints and handle appropriately. Keep records of complaints and follow-up.	✓	PTTEP SA provided grievance handling guideline to receive any complaints from the stakeholder and resolve the complaint in the immediate. During January – June 2019 there was no complaint from previous activity.	Appendix F-1
			8.1.1.11 Obtain approval from MOGE and/or appropriate government offices before constructing, upgrading or reroute access roads.	✓	The letter was sent to local government about the construction activities of project such as date on activity, transportation of equipment, transportation route and security compliance before start.	Appendix F-3
			8.1.1.12 Strictly enforce training programs to reduce transport incident cases by its contractors.	✓	Training program on Safety, Security Health and Environment Management System (SSHE-MS) and other concerned safety standards have been provided to the contractor for follow with the PTTEP SA's plan.	Appendix E-4
			8.1.1.13 Restore any damage to roads that is caused by contractors or Company.	✓	The access road was in good condition and ready for use. In case of the road was damaged from project activity, the contractor will repair to prevent unsafe to user.	Figure 2-19
			8.1.1.14 Restrict local traffic in wellsite area	✓	PTTEP SA prepared safety land transport procedure and enjoined the contractor to follow regulation such as speed limit, loading of truck and transportation's time.	Appendix D

**Table 2-3 Environmental Mitigation Measures Implementation Compliance Result Summary in Drilling Phase**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
			8.1.1.15 Road Hazard Assessment will be conducted before transporting any large equipment.	✓	The project conducted rig move route survey before major movement.	Appendix D-2
			8.1.1.16 Vehicles will take direct routes where possible and avoid significant habitat areas.	✓	PTTEP SA prepared safety land transport procedure and enjoined the contractor to follow regulation.	Appendix D-1
			8.1.1.17 Construction vehicles will follow speed limits.	✓	PTTEP SA prepared safety land transport procedure and enjoined the contractor to follow regulation of speed limitation 5 km/hr within wellsite and 10 km/hr along the access road. The speed limitation signs provided along access road. Furthermore, speed limitation was communicated to all worker in daily tool box talk before working by the supervisor of contractor/safety officer.	Figure 2-2 Figure 2-3 and Appendix D-1
		8.1.2 Damage to roads	8.1.2.1. Check and restore for any damage from project activities to local roads	✓	The access road was in good condition and ready for use. In case of the road was damaged from project activity, the contractor will repair to prevent unsafe to user.	Figure 2-19
9. Water Use	9.1 Use of public utility for water resources	9.1.1 Water usage of project affects the community's water supply.	9.1.1.1 Implement construction and installation phase mitigation measures in 10.1 including - Inform authority for drilling a ground water well.	✓	The project strictly implements construction and installation phase mitigation measures in 10.1 Use of water public utility for construction and domestic use for drilling phase including:	Figure 2-23

**Table 2-3 Environmental Mitigation Measures Implementation Compliance Result Summary in Drilling Phase**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
			<ul style="list-style-type: none"> <li>- PTTEP SA to drill their own ground water wells on site.</li> <li>- Potable water and industrial water, if taken by tube wells or tanker from nearby reservoirs/ rivers, should not affect the availability of water to locals.</li> </ul>		<ul style="list-style-type: none"> <li>- PTTEP SA was follow procedure of well drilling for groundwater.</li> <li>- Groundwater well was drilled within wellsite which 8 miles and 24 miles from Moenatkone wellsite.</li> <li>- The contractor has own water source for using in project area which not be affect to water used of community.</li> </ul>	
			9.1.1.2 Investigate any complaints and handle appropriately. Keep records of complaints and follow-up.	✓	PTTEP SA provided grievance handling guideline to receive any complaints from the stakeholder and resolve the complaint in the immediate. During January – June 2019 there was no complaint from previous activity.	Appendix F-1
10. Power Use	10.1 Power for drilling operations and work camp	10.1.1 Increase or decrease of available power for local community	10.1.1.1 Install diesel-powered generators to supply all project power related needs.	✓	The project installed diesel-powered generators to supply all project power demand.	Figure 2-8
11. Waste Management	11.1 Non-Hazardous waste management	11.1.1 Domestic waste can be a fire hazard, constitute windblown litter, attract vermin, contaminated surface and	11.1.1.1 Implement construction and installation phase mitigation measures in 12.1 including <ul style="list-style-type: none"> <li>- A PTTEP SA Waste Management Plan for this drilling campaign will be developed.</li> <li>- Store hazardous waste in appropriately designed areas</li> </ul>	✓	The project strictly implements construction and installation phase mitigation measures in 12.1. Non Hazardous waste management for drilling phase including: <ul style="list-style-type: none"> <li>- PTTEP SA developed waste management plan and controlled the contractor to implement. Separate waste containers were provided within wellsite. The local government</li> </ul>	Figure 2-12 Figure 2-14 Figure 2-24 and Appendix C-1

**Table 2-3 Environmental Mitigation Measures Implementation Compliance Result Summary in Drilling Phase**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
		groundwater and vector for disease	<p>and safe containers that are suitable for transporting/ transferring.</p> <ul style="list-style-type: none"> <li>- Ensure treatment and disposal according to accepted international standard.</li> <li>- Enforce “ Good Housekeeping” practices.</li> <li>- Domestic and general waste to be segregated and stored using suitability labeled.</li> <li>- Dispose of waste in labelled containers for possible recycling</li> <li>- Implement requirements for waste management and related laws</li> <li>- Install septic tanks and soak away pit for holding sewage.</li> <li>- Non- hazardous wastes will be taken to an approved waste site</li> </ul>		<p>of Thayet township municipal was the responsible agency for managing waste to disposal.</p> <ul style="list-style-type: none"> <li>- The contractor provided storage area for chemicals and PTTEP SA strictly enforced good housekeeping practices within wellsite and surrounding for all workers.</li> <li>- Toilet with septic tank was provided sufficiently for all staffs in order to treat wastewater before release to environment.</li> </ul>	
	11.2 Hazardous waste management	11.2.1 Hazard waste contaminate to environment.	11.2.1.1. Ensure treatment and disposal of hazardous waste by licensed contractor.	✓	The project assigned SCOMI which is licensed contractor to do bioremediation onsite or offsite waste disposal at DOWA waste management facility in Thilawa SEZ after the rig move out from location.	-

**Table 2-3 Environmental Mitigation Measures Implementation Compliance Result Summary in Drilling Phase**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
			11.2.1.2. Segregate and store hazardous waste in appropriate and safe containers that are suitable for transporting/transferring. Make sure all containers are clearly labeled.	✓	PTTEP SA developed waste management plan and controlled the contractor to implement. Separate waste containers were provided within wellsite.	Figure 2-24 and Appendix C-1
			11.2.1.3. Always check and record the type(s) and amount of hazardous waste generated.	✓	The quantity of hazardous waste was recorded by contractor.	Appendix C-2
			11.2.1.4. Dispose of waste in labeled containers for possible recycling or reuse.	✓	The contractor provided waste management plan and controlled the all worker to implement.	Appendix C-1
			11.2.1.5. Prohibit open burning of any waste at project site.	✓	The constructor enforced all workers not to burn any wastes in the project area.	-
			11.2.1.6. Enforce "Good Housekeeping" practices.	✓	The contractor provided storage area for chemicals and PTTEP SA strictly enforced good housekeeping practices within wellsite and surrounding for all workers.	Figure 2-12
			11.2.1.7. All hazardous waste will be collected in skips ready for treatment and disposal. Hazardous wastes will be transported and disposed at approved waste management facility.	✓	The project provided waste pit to collected hazardous waste ready to treatment and disposal.	Figure 2-15

**Table 2-3 Environmental Mitigation Measures Implementation Compliance Result Summary in Drilling Phase**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
	11.3 Handling and Disposal of drill cuttings, sludge and chemicals.	11.3.1 Localized change in water quality and soil quality from chemical composition of drill fluids	11.2.1.8. Provide Manifest System for transportation of hazardous waste to treatment area or disposal area.	✓	The project provided waste manifest for hazardous waste transportation to disposal area	Appendix C-2
			11.3.1.1 Drill cuttings and adhered fluids will not be discharged to surrounding area.	✓	The project assigned SCOMI which is licensed contractor to do bioremediation onsite or offsite waste disposal at DOWA waste management facility in Thilawa SEZ after the rig move out from location so the fluids will not be discharged to surrounding area.	-
			11.3.1.2 Volume of cuttings and fluids discharged will be minimised through use of solids control equipment.	✓	For drilled cuttings and drilling fluids, the solid (drilled cutting) and liquid (drilling mud) phases are separated on-site by shale shaker. At the end of the first well location, the left-over drilling mud will be transferred and used at the next well location. At the end of drilling campaign, the left-over mud will be sent back to mud contractor for reuse or disposal or use for PTTEP offshore drilling campaign.	Figure 2-25
			11.3.1.3 Store all chemicals in secured storage area.	✓	The contractor provided chemical storage area and PTTEP SA strictly enforced good housekeeping practices within wellsite and surrounding for all workers.	Figure 2-12

**Table 2-3 Environmental Mitigation Measures Implementation Compliance Result Summary in Drilling Phase**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
			11.3.1.4 Hazardous wastes materials will be handled and stored in accordance with the corresponding SDS.	✓	The contractor provided separated waste container for hazardous waste.	Figure 2-24
			11.3.1.5 Implement awareness training on the hazards of the chemicals.	✓	Training program on Safety, Security Health and Environment Management System (SSHE-MS) and other concerned safety standards have been provided to the contractor for follow with implementation as the PTTEP SA's plan	Appendix E-4
			11.3.1.6 Enforce use of PPE.	✓	The contractor provided PPE sufficiently for all workers and controlled to use PPE during working.	Figure 2-5
			11.3.1.7 Handle chemicals only in well-ventilated and controlled areas	✓	The contractor provided chemical storage area in well-ventilated and controlled areas.	Figure 2-12
			11.3.1.8 Fuel storage tanks to be surrounded by bund wall.	✓	The fuel storage tank was surrounded by bund wall and placed on tarpaulins to prevent contamination to soil in case of spill.	Figure 2-12
			11.3.1.9 Isolate any area(s) that might be contaminated from non-contaminated areas. Provide water drainage system around the contaminated area for collecting water into the concrete pit.	✓	Drilling mud system, shale shaker and mixed chemical tank were placed on concrete pad surrounding with drainage system to collect drilling fluid to cutting pit.	Figure 2-12 and Figure 2-26



**Table 2-3 Environmental Mitigation Measures Implementation Compliance Result Summary in Drilling Phase**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
			11.3.1.10 Use oil catch pans under vehicles when performing maintenance. Conduct maintenance only on impervious surfaces (i.e. on tarpaulin sheet).	✓	The project used oil catch pans under vehicles and performed maintenance only on impervious surfaces.	-
			11.3.1.11 Provide spill cleanup kits and training for designated rapid response teams to clean up any spills. In the event of oil or chemical spill, implement spill response plan.	✓	The project provided spill cleanup kits within project area. Moreover, training program on Safety, Security Health and Environment Management System (SSHE-MS) and other concerned safety standards have been provided to the contractor for follow with implementation as the PTTEP SA's plan	Figure 2-27 and Appendix E-4
			11.3.1.12 Deposit treated cuttings into the cuttings pit, where they are to be temporarily held before bioremediation onsite after the rig move out from location or sent for disposal at approved waste management facility.	✓	Drilled cutting was temporary stored in cutting pit with HDPE liner in order to prevent contamination to groundwater before bioremediation onsite or sent for disposal at approved waste management facility after rig moving out from location.	Figure 2-15
			11.3.1.13 Monitor level of cuttings and dirty water in waste pit.	✓	The project constructed waste pit and cutting pit with sufficient volume. Level of cuttings and dirty water in waste pit was monitored to prevent overflow, the frequency of monitoring may be and increased the frequency depended on to suitable the weather condition.	-

**Table 2-3 Environmental Mitigation Measures Implementation Compliance Result Summary in Drilling Phase**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
			11.3.1.14 Implement land transportation procedure	✓	The project strictly implements land transportation procedure.	Appendix D-1
12. Socio-Economy	12.1 Employment opportunities and Use of local goods and services	12.1.1 Employment and income	12.1.1.1. Employ qualified local workers if possible.	✓	The contractor hired temporary workers in local area, according to the job description.	Appendix F-2
			12.1.1.2. Purchase local supplies and services, whenever possible.	✓	The contractor purchased goods/consumers products in local area.	-
Health Impact Assessment						
13. Occupational and Public Health	13.1 Rig, Generators and Equipment	13.1.1 Health impact from noise	13.1.1.1 Implement drilling phase mitigation measures in 2.1.	✓	The project strictly implements the mitigation measures for drilling phase described in 2.1 Well Drilling and Vehicle and Equipment Use.	-
			13.1.1.2 Provide PPE to workers on site	✓	The contractor provided PPE sufficiently for all workers and controlled to use PPE during working.	Figure 2-5
	13.2 Non-Hazardous waste management	13.2.1 Health impact from Non-Hazardous Waste	13.2.1.1 Implement drilling phase mitigation measures in 12.1.	✓	The project strictly implements the mitigation measures for drilling phase described in 12.1 Employment opportunities and Use of local goods and services	-
	13.3 Handling and Disposal of Hazardous Waste	13.3.1 Health impact from hazardous Waste	13.3.1.1 Implement drilling phase mitigation measures in 11.2.	✓	The project strictly implements the mitigation measures for drilling phase described in 11.2 Hazardous waste management.	-

**Table 2-3 Environmental Mitigation Measures Implementation Compliance Result Summary in Drilling Phase**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
	13.4 Hazardous waste management and chemical handling	13.4.1 Health impact from Mud, Chemicals and Drilling Waste	13.4.1.1 Implement drilling phase mitigation measures in 11.3.	✓	The project strictly implements the mitigation measures for drilling phase described in 11.3 Handling and Disposal of drill cuttings, sludge and chemicals.	-
	13.5 Labour and Accommodations	13.5.1 Health impact from Communicable Diseases	13.5.1.1 Implement construction and installation phase mitigation measures in 12.1 Non Hazardous waste management including <ul style="list-style-type: none"> <li>- A PTTEP SA Waste Management Plan for this drilling campaign will be developed.</li> <li>- Store hazardous waste in appropriately designed areas and safe containers that are suitable for transporting / transferring.</li> <li>- Ensure treatment and disposal according to accepted international standard.</li> <li>- Enforce " Good Housekeeping" practices.</li> <li>- Domestic and general waste to be segregated and stored using suitability labeled.</li> </ul>	✓	The project strictly implements construction and installation phase mitigation measure in 12.1 Non Hazardous waste management for drilling phase including: <ul style="list-style-type: none"> <li>- PTTEP SA developed waste management plan and controlled the contractor to implement. Separate waste containers were provided within wellsite. The local government of Thayet township municipal was the responsible agency for managing waste to disposal.</li> <li>- The contractor provided storage area for chemicals and PTTEP SA strictly enforced good housekeeping practices within wellsite and surrounding for all workers.</li> <li>- Toilet with septic tank was provided sufficiently for all staffs in order to treat wastewater before release to environment.</li> </ul>	Figure 2-12 Figure 2-14 Figure 2-24 and Appendix C-1

**Table 2-3 Environmental Mitigation Measures Implementation Compliance Result Summary in Drilling Phase**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
			<ul style="list-style-type: none"> <li>- Dispose of waste in labelled containers for possible recycling.</li> <li>- Implement requirements for waste management and related laws.</li> <li>- Install septic tanks and soak away pit for holding sewage.</li> <li>- Non- hazardous wastes will be taken to an approved waste site</li> </ul>			
			13.5.1.2 Deposit treated cuttings into the cuttings pit, where they are to be temporarily held before bioremediation onsite after the rig move out from location or sent for disposal at approved waste management facility.	✓	Drilled cutting was temporary stored in cutting pit with HDPE liner in order to prevent contamination to groundwater before bioremediation onsite or sent for disposal at approved waste management facility after rig moving out from location.	Figure 2-15
			13.5.1.3 Drainage and removal of waste from waste pit upon completion of drilling.	✓	When drilling activity complete, the project will dispose waste kept in waste pit by approved waste management facility.	Appendix C
			13.5.1.4 Health screening of workers before employment.	✓	The project has prepared on health screening to all workers before employment.	-

**Table 2-3 Environmental Mitigation Measures Implementation Compliance Result Summary in Drilling Phase**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
			13.5.1.5 On-site health clinic (drilling operations) and referral system during all of project operations with external health agencies to ensure timely diagnosis and treatment of workers' illness and injury.	✓	Emergency respond plan, ambulance, medical personnel and training were provided in case of emergency. Moreover, the contractor cooperated with nearby hospital at Thayet Township to support if need for serious injuries or emergencies case.	Figure 2-29, Appendix E-1 Appendix E-2 and Appendix E-4
			13.5.1.6 Considering on hiring of qualified local workers to reduce reliance on outside labor and increase local employment.	✓	The contractor hired qualified local workers, according to the job description.	Appendix F-2
			13.5.1.7 Do not allow workers to enter communities near the drill site.	✓	PTTEP SA has provided training program to contractors on regulation and prohibition including control the performed as defined requirements.	Appendix E-4
			13.5.1.8 Provide awareness to workers on preventive measures for the prevention of communicable and local diseases.	✓	PTTEP SA has provided training program to contractors on regulation and prohibition including control the performed as defined requirements.	Appendix E-4

**Table 2-4 Environmental Mitigation Measures Implementation Compliance Result Summary for Unplanned Event**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
1. Blowout	1.1 Drilling	1.1.1 Release of uncontrolled volumes of hydrocarbons, Fire and Explosion	1.1.1.1 Examination of existing wells to identify shallow gas hazards.	✓	The shallow gas hazard was identified by examination of existing wells.	Appendix E-5
			1.1.1.2 Drilling and Well Control Standard Operating Procedures and extensive SSHE Management System procedures and operational controls in place.	✓	The project provided Drilling Program and extensive SSHE Management System procedures and operational controls in place.	Appendix E-2 and Appendix E-5
			1.1.1.3 Internal hazardous operations reviews and "Table Top Drilling" exercises to test procedures and individual personnel performances against the drilling plan.	✓	Internal hazardous operation was reviewed and "Table Top Drilling" exercised were conducted as per specified in drilling program.	Appendix E-5
			1.1.1.4 Select proper drill fluid formulation, provide well kill fluids/ systems, loss control and weighting agents.	✓	The project selected proper drilling fluid formulation, and provided well kill fluids/ systems, loss control and weighting agents.	Appendix E-5
			1.1.1.5 Very careful monitoring of down hole conditions and mud returns.	✓	The project monitored of downhole condition and mud return.	Appendix E-5
			1.1.1.6 Use of appropriate, high quality materials in well construction (casing and cement grades).	✓	The project carefully uses high quality materials in well construction ( casing and cement grades).	Appendix E-5

**Table 2-4 Environmental Mitigation Measures Implementation Compliance Result Summary for Unplanned Event**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
			1.1.1.7 Provide a blowout preventer ( BOP) stack that is sized appropriately in proportion to the maximum formation pressure; and test as per procedures.	✓	The project installed Blowout Preventor ( BOP) and other safety equipment including testing before drilling for correctness and availability of equipment to comply with the drilling program and standard strictly.	Figure 2-30 and Appendix E-5
			1.1.1.8 Follow PTTEP SA's Emergency Response Plan and Blow Out Contingency Plan	✓	The project provided PTTEP SA's Emergency Response Plan and Blow Out Contingency Plan and control the contractor to performed as defined requirements.	Appendix E-5
			1.1.1.9 PTTEP SA's SSHE Integrated Management System Procedures and operational controls will be in place to prevent a blowout/explosion.	✓	The project provided PTTEP SA's Emergency Response Plan and Blow Out Contingency Plan and control the contractor to performed as defined requirements.	Appendix E-5
2. Fire or Explosion (not associated with Blowout)	2.1 Fuel Storage and Ignition Sources	2.1.1 Possible explosion or fire of drilling rig or at campsite, or fuel storage area	2.1.1.1 PTTEP SA's SSHE Integrated Management System Procedures and operational controls to prevent a fire/explosion.	✓	Training program on Safety, Security Health and Environment Management System (SSHE-MS) and other concerned safety standards have been provided to the contractor for implementation as PTTEP SA's plan.	Appendix E-2 and Appendix E-4
			2.1.1.2 PTTEP SA's Emergency Response Plan including specific management procedures to mitigate the impacts if a fire/explosion occurs.	✓	Training program on Safety, Security Health and Environment Management System (SSHE-MS) and other concerned safety standards have been provided to the contractor for implementation as PTTEP SA's plan.	Appendix E-2 and Appendix E-4

**Table 2-4 Environmental Mitigation Measures Implementation Compliance Result Summary for Unplanned Event**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
			2.1.1.3 Install fire extinguishers, alarms and windsocks (to be audible and visible from whole site).	✓	Fire extinguishers, fire suit, SCBA and alarm system were provided at wellsite including monthly inspection. Moreover, the assembly point/muster point, windsock, an Emergency Response Plan and firefighting training were provided.	Figure 2-28 Figure 2-31, Figure 2-32, Figure 2-33, Figure 2-34 Appendix E-2 Appendix E-3 and Appendix E-4
			2.1.1.4 Pre- arranged call out support from local fire brigades	✓	Emergency Response Plan and firefighting training have been provided to the contractor for respond if fire/explosion case. Moreover, the contractor cooperated with local fire brigades to support fire/explosion case.	Appendix E-2 and Appendix E-4
3. Fuel, Chemical or Hazardous Waste/Materials Spill	3.1 Storage of Fuel, chemicals, hazardous materials or waste	3.1.1 Potential risk of spills to the environment affecting air quality, soil quality, surface water, groundwater, biota and people	3.1.1.1 Chemicals, Hydrocarbons and hazardous materials or waste will be securely stored and use governed by safe operating procedures.	✓	PTTEP SA developed waste management plan and controlled the contractor to implement. Separate waste containers were provided at wellsite.	Figure 2-24 and Appendix C-1



**Table 2-4 Environmental Mitigation Measures Implementation Compliance Result Summary for Unplanned Event**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
			3.1.1.2 Spill containment and recovery equipment will be available near storage areas.	✓	The contractor provided drip pans and absorbents to contain any potential spillage from vehicle and machinery while transferring fuel or changing of engine oil. In addition, spill contingency plan and training were provided.	Figure 2-10 and Appendix E-6
			3.1.1.3 Procedures for response to Chemicals, Hydrocarbons and hazardous materials or waste spills will be included in PTTEP SA's ERP and Spill Contingency Plan.	✓	Spill contingency plan was provided. Training program on Safety, Security Health and Environment Management System (SSHE-MS) and other concerned safety standards have been provided to the contractor for implementation as PTTEP SA's plan.	Appendix E-1, Appendix E-2, Appendix E-4 and Appendix E-6
			3.1.1.4 SDS Sheets will be posted in areas where Chemicals, Hydrocarbons and hazardous materials or waste is stored and with the SSHE Officer.	✓	The project provided SDS of drilling chemicals at wellsite as specify in the mitigation measure.	Appendix H
			3.1.1.5 Construct drainage system around wellsites and concrete rig pad which mud tanks, shakers, generators and fuel tanks sit on to divert any spills into the concrete pit.	✓	Concrete rig pad with drainage system was constructed as specified in the mitigation measure.	Figure 2-26

**Table 2-4 Environmental Mitigation Measures Implementation Compliance Result Summary for Unplanned Event**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
			3.1.1.6 Use oil catch pans under vehicles when performing maintenance. Conduct maintenance only on impervious floor (e.g. tarpaulin sheet).	✓	The project used oil catch pans under vehicles and performed maintenance only on impervious surfaces.	-
			3.1.1.7 Provide drip pans and absorbents to contain any spillage.	✓	The contractor provided drip pans and absorbents to contain any potential spillage from vehicle and machinery while transferring fuel or changing of engine oil. In addition, spill contingency plan and training were provided.	Figure 2-10 and Appendix E-6
			3.1.1.8 Provide spill cleanup kits and training for designated rapid response teams to clean up any spills. In the event of oil or chemical spill, implement ERP.	✓	The contractor provided drip pans and absorbents to contain any spillage from vehicle and machinery while transferring fuel or changing of engine oil. However, Emergency Response Plan and training were provided.	Figure 2-10 Appendix E-4 and Appendix E-2
			3.1.1.9 Prohibit workers from cleaning machines/equipment in/near a public water source.	✓	PTTEP SA has provided training program to contractors as regulation and requirements including control their performing as defined requirements.	Appendix E-4
			3.1.1.10 Prohibit workers and contractors discharging or discarding project waste, chemicals, and oil into public water sources.	✓	PTTEP SA has provided training program to contractors as regulation and requirements including control their performing as defined requirements.	Appendix E-4

**Table 2-4 Environmental Mitigation Measures Implementation Compliance Result Summary for Unplanned Event**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
			3.1.1.11 Maintain oil traps along perimeter drainage around concrete pad to prevent any spills from flowing off site.	✓	The project provided drainage, buffer zone and earth bund surrounding wellsite area.	Figure 2-11
			3.1.1.12 Isolate any area(s) that might be contaminated from non-contaminated areas.	✓	Drilling mud system, shale shaker and mixed chemical tank were placed on concrete pad surrounding with drainage system to collect drilling fluid to cutting pit.	Figure 2-12 and Figure 2-26
			3.1.1.13 Store Chemicals and hazardous materials on concrete pad.	✓	The contractor provided chemicals storage area on concrete pad with bund wall and PTTEP SA strictly enforced good housekeeping practices within wellsite and surrounding for all workers.	Figure 2-12 and Figure 2-26
			3.1.1.14 Procedures for response to chemical spills will be included in PTTEP SA's ERP.	✓	Training program on Safety, Security, Health and Environment Management System (SSHE-MS) and other concerned safety standards have been provided to the contractor for implementation as PTTEP SA's plan.	Appendix E-1, Appendix E-2 and Appendix E-4
			3.1.1.15 Deposit treated cuttings into the cuttings pit, where they are to be temporarily held before bioremediation onsite after the rig move out from location or sent for disposal at approved waste management facility.	✓	Cutting was temporary stored in cutting pit with HDPE liner in order to prevent contaminated to groundwater before bioremediation onsite after the rig move out from location or sent for disposal at approved waste management facility.	Figure 2-15

**Table 2-4 Environmental Mitigation Measures Implementation Compliance Result Summary for Unplanned Event**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
			3.1.1.16 Implement transportation plan.	✓	PTTEP SA prepared the safety land transport procedure and enforced the contractor to follow regulation. Moreover, the contractor provided journey management plan and journey management record.	Appendix D
4. Transportation Accidents	4.1 Vehicle and Equipment Use	4.1.1 Possible injury or death to personnel; and localized contamination of environment	4.1.1.1 Follow SSHE Integrated Management System Procedures.	✓	Training program on Safety, Security, Health and Environment Management System (SSHE-MS) and other concerned safety standards have been provided to the contractor for implementation as PTTEP SA's plan.	Appendix E-1, Appendix E-2 and Appendix E-4
			4.1.1.2 Limit the speed of project vehicles, according to the road condition.	✓	PTTEP SA prepared safety land transport procedure and enforced the contractor to follow regulation of speed limitation 5 km/hr within wellsite and 10 km/hr along the access road. The speed limitation signs provided along access road and speed limitation was communicated to all worker in daily tool box talk before working by the header of contractor/safety officer.	Figure 2-2 Figure 2-3 and Appendix D-1
			4.1.1.3 Maintain construction equipment and vehicles.	✓	PTTEP SA specified the contractor to regularly check and maintain the machines and vehicles.	Appendix E-3
			4.1.1.4 Notify the local authority on the oversized load and put an escort in front of this convoy with horn and hazard lights.	✓	PTTEP SA prepared safety land transport procedure and enforced the contractor to follow regulation such as speed limit, loading of truck and transportation's time.	Appendix D-1

**Table 2-4 Environmental Mitigation Measures Implementation Compliance Result Summary for Unplanned Event**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
			4.1.1.5 Consult with community leaders on plan and transportation route before movement of large equipment.	✓	PTTEP SA informed local authority on the oversized load and put an escort in front of this convoy. Moreover, the project also conducted rig move route survey before major movement and avoiding transportation of heavy equipment during rush hours	Figure 2-21 and Appendix D-2
			4.1.1.6 Restrict/ avoid movement of heavy equipment during rush hours.	✓	The contractor informed about transportation duration and route for heavy equipment to local people. Moreover, avoiding transportation of heavy equipment during rush hours.	Appendix D-2
			4.1.1.7 Provide traffic signs or flags at junction of access road and main road.	✓	The project provided traffic sign along the access road as specified in mitigation measure.	Figure 2-22
			4.1.1.8 Investigate any complaints and handle appropriately. Keep records of complaints and follow-up.	✓	PTTEP SA implements the grievance handling guideline and act immediately incase any complaints raised from the stakeholder. However, during January – June 2019 there was no complaint from activity.	Appendix F-1
			4.1.1.9 Strictly enforce training programs to reduce transport and drilling incidents by its contractors.	✓	Training program on Safety, Security, Health and Environment Management System (SSHE-MS) and other concerned safety standards have been provided to the contractor for implementation as PTTEP SA's plan.	Appendix E-4

**Table 2-4 Environmental Mitigation Measures Implementation Compliance Result Summary for Unplanned Event**

Environmental Factors/Events	Activity	Potential Impacts	Mitigation Measures	Status	Details	Remarks
			4.1.1.10 Restore any damage to roads caused by project vehicles.	✓	The access road was in good condition and ready for use. In case of the road was damaged from project activity, the contractor will repair to prevent unsafe to user.	Figure 2-19
			4.1.1.11 Implement emergency response training, fire training and response drills.	✓	Training program on Safety, Security, Health and Environment Management System (SSHE-MS) and other concerned safety standards have been provided to the contractor for implementation as the PTTEP SA's plan.	Appendix E-1, Appendix E-2 and Appendix E-4
			4.1.1.12 Prohibit trespassers from entering the construction site.	✓	Fence was installed around the wellsite to separate the project area and nearby area. The security guard was 24 hr at temporary resting. to restrict people and vehicles.	Figure 2-16 and Figure 2-17
			4.1.1.13 Referral system with external medical facilities for serious injuries or emergencies	✓	Emergency Response Plan, ambulance, medical personnel and training were provided to respond in emergency case. Moreover, the contractor cooperated with nearby hospital to support in serious injuries or emergencies case.	Figure 2-29, Appendix E-1 Appendix E-2 and Appendix E-4
5. Earthquakes	5.1 Physical shifting of earths surface	5.1.1 Potential physical disruption cause building collapse, blowouts, fires or spills	5.1.1.1 Implement PTTEP SA' s Emergency Response Plan.	✓	Training program on Safety, Security, Health and Environment Management System (SSHE-MS) and other concerned safety standards have been provided to the contractor for implementation as PTTEP SA's plan.	Appendix E-1, Appendix E-2 and Appendix E-4



Access road



Project area

Figure 2-2 Speed limit sign



Figure 2-3 Tool box talk



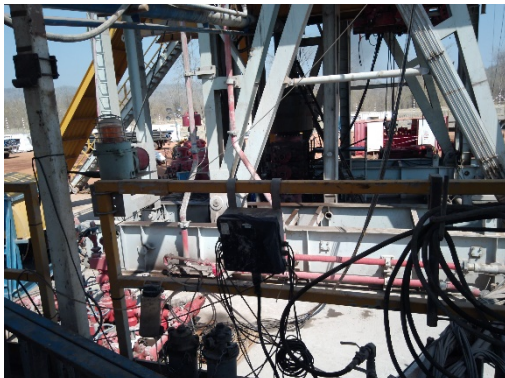
Figure 2-4 Water Sprey within wellsite



Figure 2-5 All worker used PPE during working.



Figure 2-6 Vehicle used dust flap.



H<sub>2</sub>S Alarm and H<sub>2</sub>S Sensor



H<sub>2</sub>S Monitor

Figure 2-7 H<sub>2</sub>S Alarm System





**H<sub>2</sub>S Station**

**Figure 2-7 (Cont.) H<sub>2</sub>S Alarm System**



**Figure 2-8 Soundproof Generator**



**Figure 2-9 Lighting within Wellsite**



**Figure 2-10 Machinery with Drip pan**



**Figure 2-11 Drainage System around wellsite.**



**Figure 2-12 Chemicals Storage Area**



**Figure 2-13 Fuel Storage Tank**





**Figure 2-14 Toilet with septic tank**



**Cutting pit**



**Mud pit**

**Figure 2-15 Cutting pit and Mud pit**



**Figure 2-16 Fence around Project Area**



**Figure 2-17 Guard house at main gate**



**Figure 2-18 Alcohol test**



**Figure 2-19 Access road**





**Figure 2-20 Left hand drive car**



**Figure 2-21 Convoy escort of major movement**



**Figure 2-22 Example of Warning signs at the access road**



**Figure 2-23 Water pit**



**Figure 2-24 Separate waste container**



**Figure 2-25 Shale shaker**



**Figure 2-26 Shale Shaker, chemical mixed tank  
placed on concrete pad**





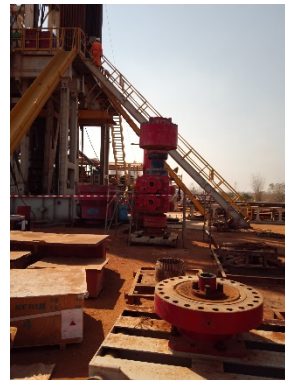
**Figure 2-27 Spill cleanup kits**



**Figure 2-28 Assembly point in front of wellsite**



**Figure 2-29 Ambulance and medical personnel were provided in emergency case.**



**Figure 2-30 BOP (Blow Out Preventer)**



**Figure 2-31 Fire extinguisher**



**Figure 2-32 Inspection of fire extinguishers**



**Figure 2-33 Fire suit and SCBA**



**Figure 2-34 Windsock**

***Chapter 3***  
***Environmental Monitoring Results***

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## **Chapter 3**

### **Environmental Monitoring Results**

Environmental monitoring was conducted as specified in EIA which the project has assigned REM- UAE Laboratory and Consultant Company Limited to performed the environmental monitoring. This chapter presents the environmental monitoring results of Myanmar Onshore Block MOGE-3 Exploration Drilling Campaign during Drilling Phase (audit conducted at Moenatkone Well Site), the detail is presented as follow;

#### **3.1 Environmental Monitoring Plan**

Environmental monitoring for Myanmar Onshore Block MOGE-3 Exploration Drilling Campaign during Drilling Phase (audit conducted at Moenatkone Well Site) is shown inTable 3-1.

**Table 3-1 Environmental Monitoring Plan of Myanmar Onshore Block MOGE-3 Exploration Drilling Campaign in Drilling Phase at Moenatkone well site**

Environmental Quality	Parameter	Period/Frequency	Location	Implemented	
				Complied	Not complied
1. Air Quality	<ul style="list-style-type: none"> <li>• PM-10</li> <li>• PM-2.5</li> <li>• NO<sub>2</sub></li> <li>• SO<sub>2</sub></li> <li>• O<sub>3</sub></li> <li>• H<sub>2</sub>S</li> </ul>	<b>Duration :</b> 1 day continuously <b>Frequency :</b> <ul style="list-style-type: none"> <li>• Once during drilling phase</li> <li>• As within 1 km of a community regular monitoring will be required.</li> <li>• In case of any complaint regarding air quality, an additional air quality measurement may be conducted in response to specific complaints ( if necessary)</li> </ul>	Nearest sensitive receptor or downwind of complaint area (if necessary) <u>Moenatkone (MNK) well site :</u> - Moenatkone station (A2)	<ul style="list-style-type: none"> <li>• Monitored by REM- UAE Laboratory and Consultant Co., Ltd. during March 3-4, 2019. The result as shown in Section 3.2.3</li> </ul>	-
2. Noise	<ul style="list-style-type: none"> <li>• L<sub>Aeq</sub> 24 hrs</li> <li>• L<sub>Amax</sub></li> <li>• L<sub>Adn</sub></li> </ul>	<b>Duration :</b> 1 day continuously <b>Frequency :</b> <ul style="list-style-type: none"> <li>• Once during drilling phase</li> <li>• If within 1 km of a community regular monitoring will be required</li> <li>• In case of a complaint regarding noise from project site, an additional noise measurement may be conducted ( if necessary)</li> </ul>	100 meter from Drilling Rig / Sensitive Receptor <u>Moenatkone (MNK) well site :</u> - Moenatkone station (N2)	<ul style="list-style-type: none"> <li>• Monitored by REM- UAE Laboratory and Consultant Co. , Ltd. during March 3-4, 2019. The result as shown in Section 3.3.3</li> </ul>	-

**Table 3-1 Environmental Monitoring Plan of Myanmar Onshore Block MOGE-3 Exploration Drilling Campaign in Drilling Phase at Moenatkone well site**

Environmental Quality	Parameter	Period/Frequency	Location	Implemented	
				Complied	Not complied
3. Cuttings from drilling (in case of further using cuttings)	<ul style="list-style-type: none"> <li>• Chloride (for WBM)</li> <li>• Oil on Cuttings (for SBM)</li> <li>• Mercury (in stock Barite)</li> <li>• Cadmium (in stock Barite)</li> </ul>	<b>Duration</b> : Upon Completion of Drilling Phase before mixing / burial disposal in waste pit.	Exploration drilling well	<ul style="list-style-type: none"> <li>• Monitored by REM- UAE Laboratory and Consultant Co., Ltd. The result as shown in Section 3.4.</li> </ul>	-
4. Chemical use for drilling	<ul style="list-style-type: none"> <li>• Type of chemical</li> <li>• Volume of use</li> </ul>	<b>Duration</b> : Daily and report after drilling is completed	Project Area	<ul style="list-style-type: none"> <li>• Monitored by PTTEP SA. The result as shown in Section 3.5.</li> </ul>	
5. Hazardous and Non-hazardous waste	<ul style="list-style-type: none"> <li>• Manifest Disposal and Tracking Report</li> </ul>	<b>Duration</b> : During Drilling Phase	At all project locations	<ul style="list-style-type: none"> <li>• Monitored by PTTEP SA. The result as shown in Section 3.6.</li> </ul>	

**Table 3-1 Environmental Monitoring Plan of Myanmar Onshore Block MOGE-3 Exploration Drilling Campaign in Drilling Phase at Moenatkone well site**

Environmental Quality	Parameter	Period/Frequency	Location	Implemented	
				Complied	Not complied
6. Social	<ul style="list-style-type: none"> <li>• Complaint</li> <li>• Monitoring and solving</li> </ul>	<b>Duration</b> : Throughout drilling phase	Project area, community around project area, and transportation route	<ul style="list-style-type: none"> <li>• Monitored by PTTEP SA throughout Drilling Phase of Moenatkone Well Site. The result as shown in Section 3.7.</li> </ul>	-
7. Public and Occupational Health and Safety	<ul style="list-style-type: none"> <li>• Accidental statistics</li> <li>• cause of accidents</li> <li>• Mitigation measures</li> </ul>	<b>Duration</b> : Throughout drilling phase	Project area, community around project area, and transportation route	<ul style="list-style-type: none"> <li>• Monitored by PTTEP SA throughout Drilling Phase of Moenatkone Well Site. The result as shown in Section 3.8.</li> </ul>	-



### 3.2 Air Quality Monitoring

Air quality monitoring was conducted for drilling phase of Moenatkone well site by REM-UAE Laboratory and Consultant Company Limited. The detail as shown in Table 3-2.

**Table 3-2 Air Quality Monitoring Plan**

Environmental Quality	Parameter	Location	Period
Air Quality	<ul style="list-style-type: none"> <li>• PM-10</li> <li>• PM-2.5</li> <li>• NO<sub>2</sub></li> <li>• SO<sub>2</sub></li> <li>• O<sub>3</sub></li> <li>• H<sub>2</sub>S</li> </ul>	<u>Moenatkone (MNK) well site :</u> - Moenatkone station (A2)	March 3-4, 2019

#### 3.2.1 Air Quality Monitoring Station

Air quality monitoring station as shown in Table 3-3 and Figure 3-1.

**Table 3-3 Coordinate of Air Quality Monitoring Station of Moenatkone (MNK) well site**

Monitoring Station	Coordinates (UTM Datum WGS 84)		
	Zone	East (X)	North (Y)
<b>Moenatkone (MNK) well site</b>			
- Moenatkone station (A2)	46Q	711576	2159310

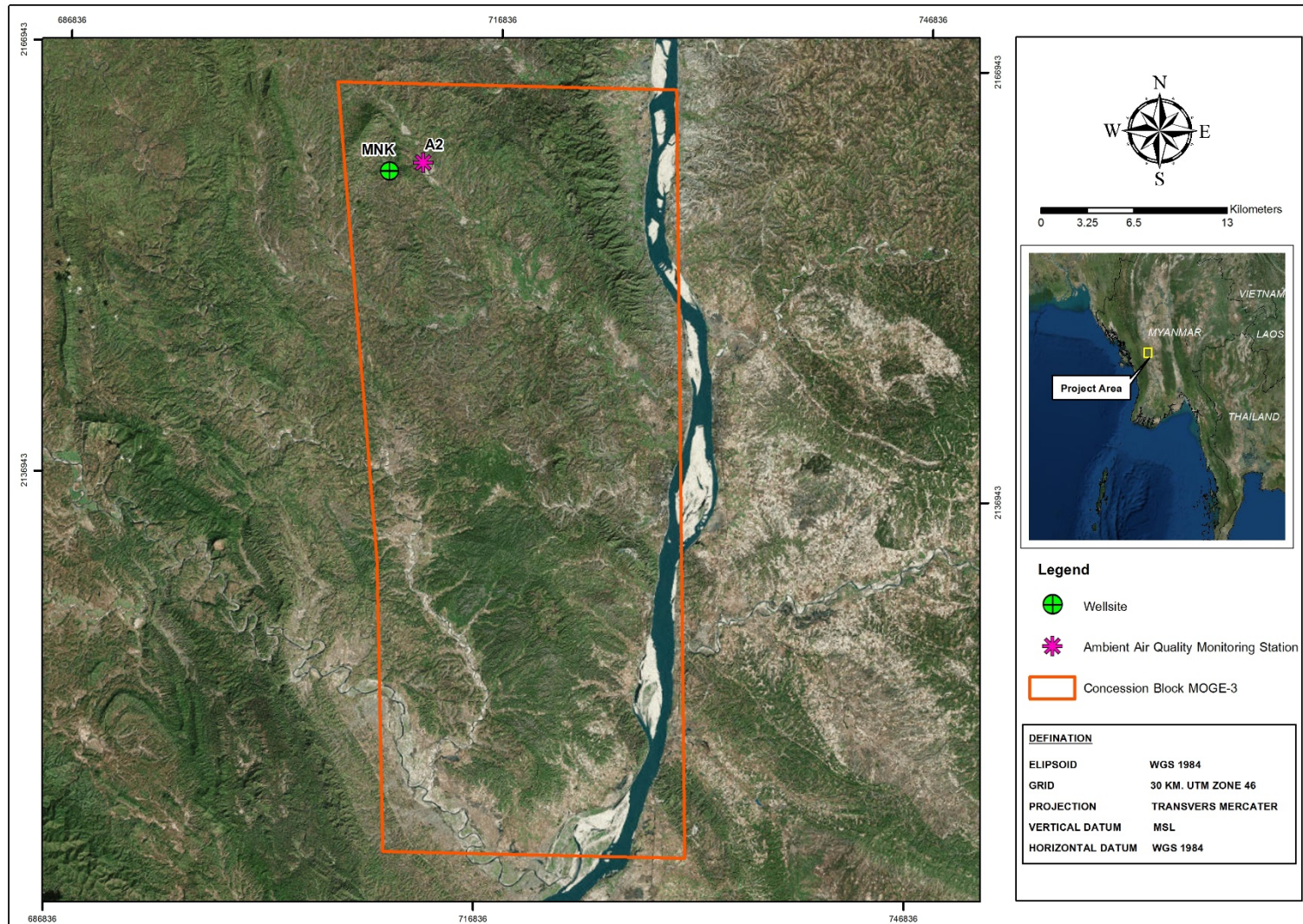


Figure 3-1 Air Quality Monitoring Station

### 3.2.2 Air Quality Monitoring Method

Sampling method, analysis method and standard methods of air quality are shown in Table 3-4.

**Table 3-4 Sampling Method, Analysis Method and Standard Methods of Air Quality**

Parameters	Sampling Method	Analysis Method	Standard Methods
1. Particulate matter Less than 10 $\mu\text{m}$ (PM-10) Average 24 hr	High Volume PM-10 Air Sampler	Gravimetric Method	40 CFR-Chapter I-Part 50, Appendix J
2. Particulate matter Less than 2.5 $\mu\text{m}$ (PM-2.5) Average 24 hr	High Volume PM-10 Air Sampler	Gravimetric Method	40 CFR-Chapter I-Part 50, Appendix J
3. Nitrogen Dioxide ( $\text{NO}_2$ ) Average 1 hr	$\text{NO}_2$ Analyzer	Chemiluminescence Method	40 CFR-Chapter I-Part 50, Appendix F
4. Sulphur Dioxide ( $\text{SO}_2$ ) Average 1 hr	$\text{SO}_2$ Analyzer	UV-Fluorescence Method	40 CFR-Chapter I-Part 50, Appendix A-1
5. Ozone ( $\text{O}_3$ )	$\text{O}_3$ Analyzer	Chemiluminescence Method	40 CFR-Chapter I-Part 50, Appendix D
6. $\text{H}_2\text{S}$	Low Volume Sampling	methylene blue method	APHA701

Air quality monitoring during January – June 2019, in drilling phase phase of Moenatkone (MNK) well site was conducted during March 3-4, 2019 as shown in Figure 3-2.



**Moenatkone station (A2)**

**Figure 3-2 Air Quality Monitoring in drilling phase phase of Moenatkone (MNK) well site**

### 3.2.3 Air Quality Monitoring Results

Result of air quality monitoring during drilling phase phase of Moenatkone (MNK) well site as below.

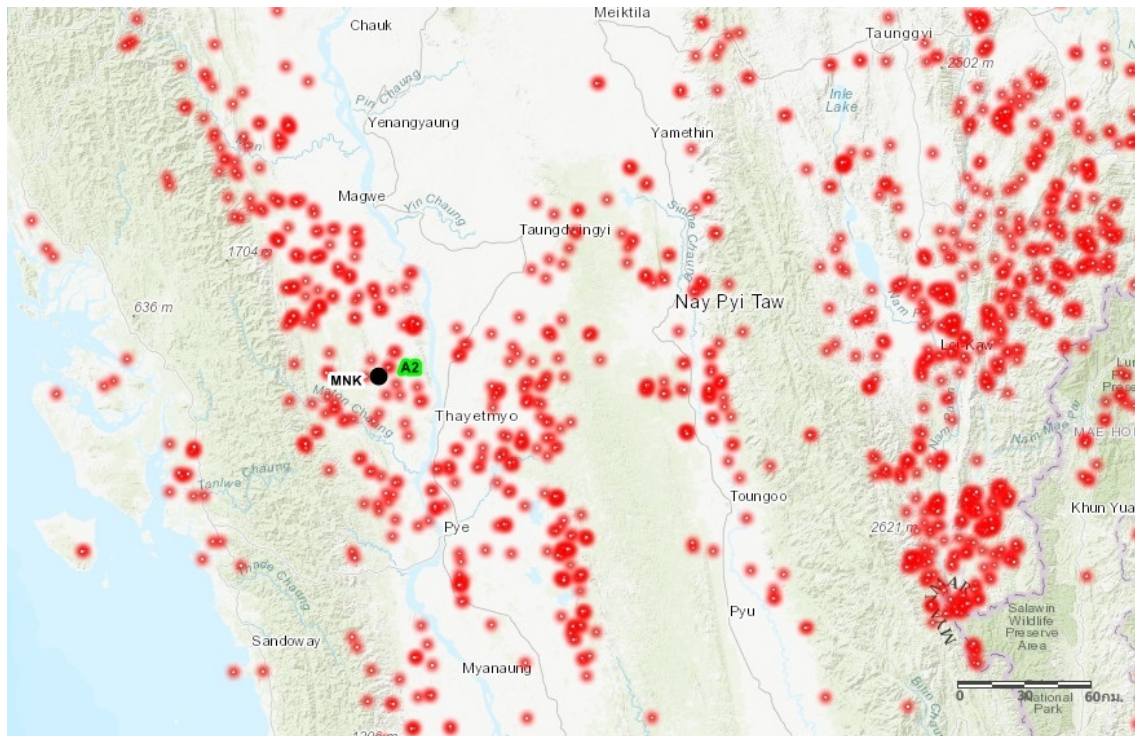
Referring to analysis report number T19AD285-0001, the results of average 1 hr Nitrogen Dioxide ( $\text{NO}_2$ ), average 24 hrs Sulphur Dioxide ( $\text{SO}_2$ ) were complied with Myanmar National Environmental Quality (Emission) Guidelines (2015) and WHO Air quality guideline (2006) and amendment. While, average 24 hours  $\text{PM}_{10}$ , average 24 hours  $\text{PM}_{2.5}$  and average 8 hrs Ozone ( $\text{O}_3$ ), not complied with Myanmar National Environmental Quality (Emission) Guidelines (2015) and WHO Air quality guideline (2006) and amendment in some period of time. However, average 24 hrs  $\text{H}_2\text{S}$  was not specified in the standard. Detail of the result as shown in Table 3-5.

Distribution of fire alerts (Figure 3-3) captured by the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Aqua satellite during March 1-5, 2019 . Places where MODIS detected actively burning fires are marked in red. During the area's dry season (roughly fall-winter in the Northern Hemisphere), intentional land management fires, as well as accidental forest fires that spread from agricultural areas, are common in Southeast Asia. In Myanmar, wildfires are a serious problem with local and wide reaching regional impacts. Myanmar has highest burn rate in Southeast Asia and ranks 11th globally in terms of forest fires. Between 2003 and 2012, more than 17.732 million hectares burned in Myanmar (reference: <http://www.fao.org/myanmar/news/detail-events/ru/c/1234252/>).

Accordingly, the results of average 24 hours  $\text{PM}_{10}$ , average 24 hours  $\text{PM}_{2.5}$  and average 8 hrs Ozone ( $\text{O}_3$ ) which not complied with the standards may be the result from wildfire around project area during monitoring period. The nearest wildfire was occurred approximately 500 meters from Moenatkone main gate in the same day of air quality monitoring. Wildfire around project area as shown in Figure 3-4 and Filter of air quality monitoring as shown in Figure 3-5.

The details of analysis report, certificate for laboratory instrument and approval registration certificate of laboratory are shown in Appendix I, J and K.





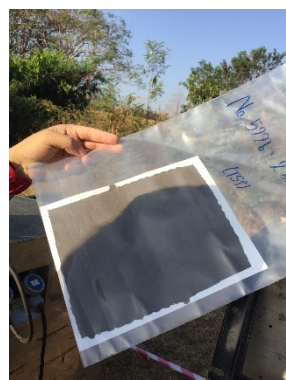
**Reference:** <https://fires.globalforestwatch.org/map/#activeLayers=activeFires&activeBasemap=topo&activeImagery=&planetCategory=null&planetPeriod=null&x=96.258774&y=18.557408&z=7>

**Edit by:** REM-UAE Laboratory and Consultant Company Limited

**Figure 3-3 Distribution of fire alerts near the project are**



**Figure 3-4 Wildfire around project area during air quality monitoring.**



**Figure 3-5 Filter of air quality monitoring**

**Table 3-5 Air Quality Monitoring Results**

Parameter	Result <sup>1/</sup>	Standard <sup>2/</sup>	Standard <sup>3/</sup>	Unit
	Moenatkone station (A2)			
Date	March 3-4, 2019	-	-	-
1. Average 24 hours PM <sub>10</sub>	62	50	50	µg/m <sup>3</sup>
2. Average 24 hours PM <sub>2.5</sub>	56	25	25	µg/m <sup>3</sup>
3. Average 1 hour NO <sub>2</sub>	10.2-17.5	200	200	µg/m <sup>3</sup>
4. Average 24 hours SO <sub>2</sub>	8.65-16.8	20	20	µg/m <sup>3</sup>
5. Average 8 hours O <sub>3</sub>	91.4-127.1	100	100	µg/m <sup>3</sup>
6. Average 24 hours H <sub>2</sub> S	<0.001	- <sup>4/</sup>	- <sup>4/</sup>	mg/m <sup>3</sup>

**Remark:** <sup>1/</sup> Reference condition is 25 degree celsius at 1 atmosphere

<sup>2/</sup> Myanmar National Environmental Quality (Emission) Guidelines (2015)

<sup>3/</sup> WHO Air quality guideline (2006) and amendment

<sup>4/</sup> Not specify in the standard

\* the results of air quality monitoring which not complied with the standards may be the result from wildfire around project area during monitoring period

### 3.2.4 Comparison of Air Quality Monitoring

Comparison of air quality monitoring results between drilling phase and previous activities which was Moenatkone station (A2). The results found that all parameters had trended to increase when compared with construction and installation phase in October 2018, whereas average 24 hours PM<sub>10</sub>, average 24 hours PM<sub>2.5</sub>, average 1 hr Nitrogen Dioxide (NO<sub>2</sub>), average 24 hrs Sulphur Dioxide (SO<sub>2</sub>), average 24 hrs H<sub>2</sub>S had trended to decrease when compared with baseline.

Due to air quality monitoring period of baseline data and in drilling phase were a dry season which has a high risk of wildfire. From the latest quality monitoring during March 3-4, 2019, there were wildfire both nearby project area and the general area around the project area. While, air quality monitoring in construction phase conducted during the rainy season, so the result of air quality was better than the dry season. However, most of the parameter in baseline still higher than the construction and installation phase and drilling phase. Detail of the result as shown in Table 3-6.

**Table 3-6 Comparison of Air Quality Monitoring Results**

Monitoring Station	Date	Results					
		Average 24 hours PM <sub>10</sub>	Average 24 hours PM <sub>2.5</sub>	Average 1 hour NO <sub>2</sub>	Average 24 hours SO <sub>2</sub>	Average 8 hours O <sub>3</sub>	Average 24 hours H <sub>2</sub> S
Moenatkone station (A2)	Baseline (Feb 6-11, 2018) <sup>1/</sup>	109	90	24	44	27	0.019
	Construction and Installation Phase (Oct 20-21, 2018)	24	17	2.8-9.4	4.8	64.6-83.3	<0.001
	Drilling Phase (Mar 3-4, 2019)	62	56	10.2-17.5	8.65-16.8	91.4-127.1	<0.001
Standard <sup>2/</sup>		50	25	200	20	100	- <sup>4/</sup>
Standard <sup>3/</sup>		50	25	200	20	100	- <sup>4/</sup>
Unit		µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	µg/m <sup>3</sup>	mg/m <sup>3</sup>

**Remark:** <sup>1/</sup> Baseline data received from EIA report for Myanmar Onshore Block MOGE-3 Exploration Drilling Campaign

<sup>2/</sup> Myanmar National Environmental Quality (Emission) Guidelines (2015)

<sup>3/</sup> WHO Air quality guideline (2006) and amendment

<sup>4/</sup> Not specify in the standard

### 3.3 Noise Level Monitoring

Noise level was conducted for drilling phase of Moenatkone (MNK) well site during March 3-4, 2019 by REM-UAE Laboratory and Consultant Company Limited. The detail as shown in Table 3-7.

**Table 3-7 Noise Level Monitoring Plan**

Environmental Quality	Parameter	Location	Period
Noise level	<ul style="list-style-type: none"> <li>• L<sub>Aeq</sub> 24 hrs</li> <li>• L<sub>Amax</sub></li> <li>• L<sub>Adn</sub></li> </ul>	<u>Moenatkone (MNK) well site :</u> - Moenatkone station (N2)	March 3-4, 2019

#### 3.3.1 Noise Level Monitoring Station

Noise level monitoring station as shown in Table 3-8 and Figure 3-6.

**Table 3-8 Coordinate of Noise Level Monitoring Stations**

Monitoring Station	Coordinates (UTM Datum WGS 84)		
	Zone	East (X)	North (Y)
<b>Moenatkone (MNK) well site</b>			
1. Moenatkone station (N2)	46Q	711581	2159354



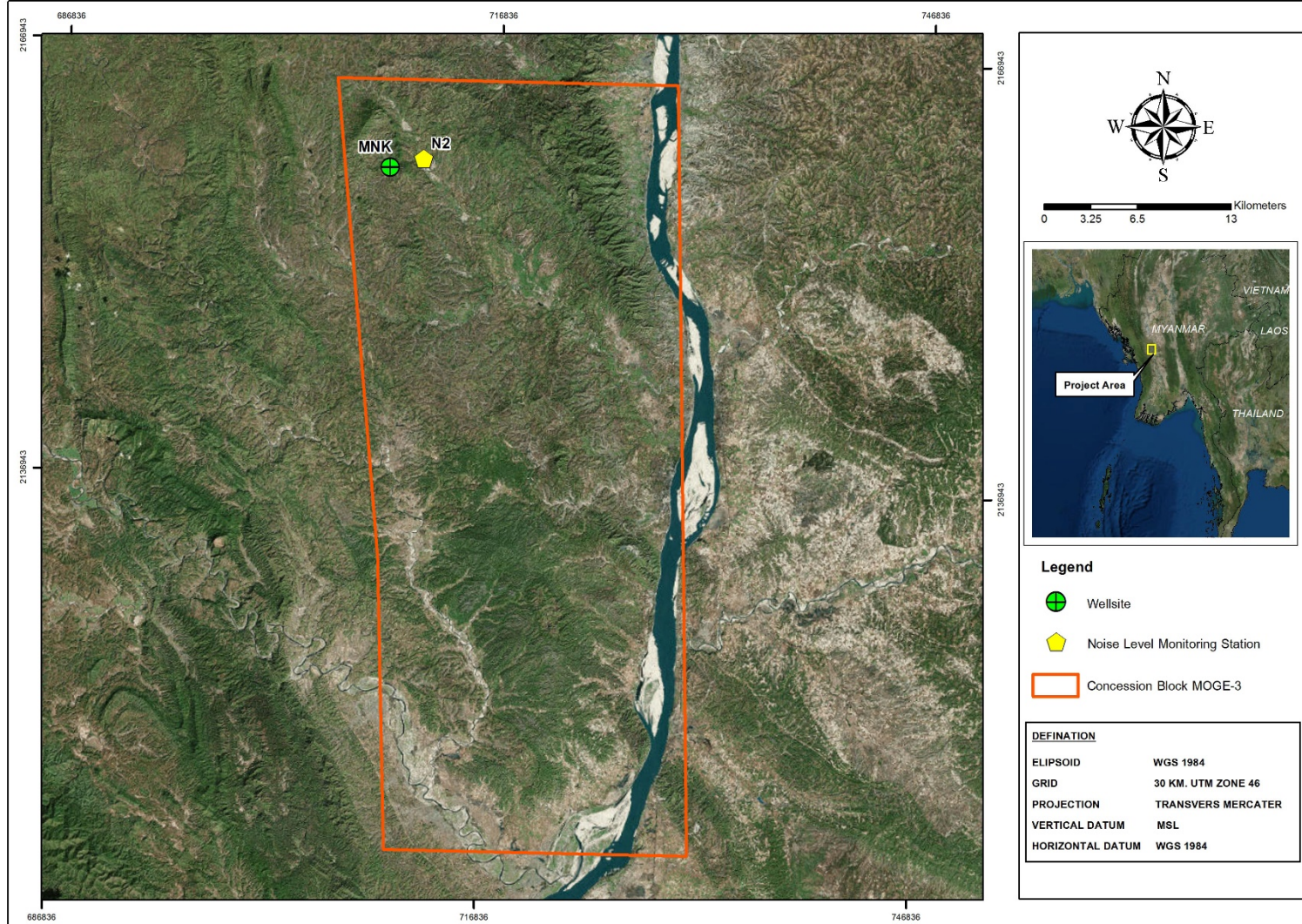


Figure 3-6 Noise Level Monitoring Station



### 3.3.2 Noise Level Monitoring Method

Sampling method, analysis method and standard methods of noise level are shown in Table 3-9.

**Table 3-9 Sampling Method, Analysis Method and Standard Methods of Noise Level**

Parameter	Sampling Method	Analytical Method	Standard Method
1. Noise Level			
- $L_{Aeq}$ 24 hours - $L_{Amax}$ - $L_{Adn}$	Integrated Sound Level Meter	Integrated Sound Level Meter	ISO 1996/1

Noise level monitoring in drilling phase of Moenatkone well site during January – June 2019 was conducted during March 3-4, 2019 as shown in Figure 3-7.



**Moenatkone station (N2)**

**Figure 3-7 Noise Level Monitoring in drilling phase of Moenatkone well site**

### 3.3.3 Noise Level Monitoring Results

Referring to analysis report number T19AD285-0001, the results of noise level monitoring of Moenatkone station (N2) during March 3-4, 2019 found that  $L_{Aeq}$  24 hours,  $L_{Amax}$  and  $L_{Adn}$  were 52.5 dB(A), 52.8-87.8 dB(A) and 58.4 dB(A), respectively. All results are shown in Table 3-10. For Myanmar National Environmental Quality (Emission) Guidelines (2015) and WHO guideline for community noise (1999) were not specify the standard for  $L_{Aeq}$  24 hours,  $L_{Amax}$  and  $L_{Adn}$ .

The details of analysis report, certificate for laboratory instrument and approval registration certificate of laboratory are shown in Appendix I, J and K.

**Table 3-10 Noise Level Monitoring Results**

Parameter	Result	Standard <sup>1/</sup>	Standard <sup>2/</sup>	Unit
	Moenatkone station (N2)			
Date	March 3-4, 2019	-	-	-
1. $L_{Aeq}$ 24 hours	52.5	- <sup>3/</sup>	- <sup>3/</sup>	dB(A)
2. $L_{Amax}$	52.8-87.8	- <sup>3/</sup>	- <sup>3/</sup>	dB(A)
3. $L_{Adn}$	58.4	- <sup>3/</sup>	- <sup>3/</sup>	dB(A)

**Remark:** <sup>1/</sup> Myanmar National Environmental Quality (Emission) Guidelines (2015)

<sup>2/</sup> WHO guideline for community noise (1999)

<sup>3/</sup> Not specify in the standard

### 3.3.4 Comparison of Noise Level Monitoring

Comparison of present noise level monitoring results which monitored during March 3-4, 2019 with baseline results found that  $L_{Amax}$  in drilling phase of Moenatkone well site at Moenatkone station (N2) had trended to increase from baseline data. There were no comparison for  $L_{Aeq}$  24 hours and  $L_{Adn}$  due to no monitoring results in baseline EIA. While the comparison of noise level monitoring result in drilling phase of Moenatkone well site with Construction and Installation Phase, found that the results are similar. Moreover, Myanmar National Environmental Quality (Emission) Guidelines (2015) and WHO guideline for community noise (1999) were not specify the standard for  $L_{Aeq}$  24 hours,  $L_{Amax}$  and  $L_{Adn}$ , as shown in Table 3-11.

However, there was no any complaint about annoyance noise from the project's activities throughout drilling phase of Moenatkone Well Site during January – June 2019.

**Table 3-11 Comparison of Noise Level Monitoring Results**

Monitoring Station	Date	Results		
		L <sub>Aeq</sub> 24 hours	L <sub>Amax</sub>	L <sub>Adn</sub>
Moenatkone station (N2)	Baseline (February 6-11, 2018) <sup>1/</sup>	– <sup>2/</sup>	77	– <sup>2/</sup>
	Construction and Installation Phase (October 20-21, 2018)	52.9	53.7-87.3	58.6
	Drilling Phase (March 3-4, 2019)	52.5	52.8-87.8	58.4
Standard <sup>3/</sup>		– <sup>5/</sup>	– <sup>5/</sup>	– <sup>5/</sup>
Standard <sup>4/</sup>		– <sup>5/</sup>	– <sup>5/</sup>	– <sup>5/</sup>
Unit		dB(A)	dB(A)	dB(A)

**Remark:** <sup>1/</sup> Baseline data received from EIA report for Myanmar Onshore Block MOGE-3 Exploration Drilling Campaign

<sup>2/</sup> Not monitoring

<sup>3/</sup> Myanmar National Environmental Quality (Emission) Guidelines (2015)

<sup>4/</sup> WHO guideline for community noise (1999)

<sup>5/</sup> Not specify in the standard

### 3.4 Cuttings Monitoring

Cuttings monitoring at Moenatkone well site as specified in EIA was conducted by REM-UAE Laboratory and Consultant Company Limited for Myanmar Onshore Block MOGE-3 Exploration Drilling Campaign. The detail as shown in Table 3-12.

**Table 3-12 Cutting and Stock Barite Monitoring Plan**

Environmental Quality	Parameter	Location	Sample Received Date
Cuttings	1. Chloride (for WBM) 2. Oil on Cuttings (for SBM) 3. Mercury (in stock Barite) 4. Cadmium (in stock Barite)	Moenatkone well site	April 12, 2019

#### 3.4.1 Cuttings Monitoring at Moenatkone well site

Cuttings Monitoring were conducted at Moenatkone well site as shown in Table 3-2. Example of Cuttings Sample of Moenatkone well site received on April 12, 2019.

### 3.4.2 Cuttings Monitoring Method

Details of Cuttings monitoring including parameters and analysis methods are shown in Table 3-13.

**Table 3-13 Parameters and Analyses Methods for Cuttings Monitoring**

Parameter	Analysis Method*
1. Chloride (for WBM)	BS 1377 : Part 3: 1990
2. Oil on Cuttings (for SBM)	Soxhlet Extraction Method (SM:5520 E)
3. Mercury (in stock Barite)	Acid Digestion and Cold Vapour AAS Method (U.S. EPA 2007:7471 B)
4. Cadmium (in stock Barite)	Acid Digestion and Direct Air Acetylene Flame Method (U.S. EPA 1996:3050 B and U.S. EPA 2007:7000 B)

**Remark:** \* Based on Standard Methods for the examination of water and wastewater, APHA, AWWA, WEF, 23<sup>rd</sup> edition, 2017

### 3.4.3 Presevation Methods for cutting sample

All samples were preserved with specific procedure and storage as shown in Table 3-14.

**Table 3-14 Monitoring parameter, container, preservation method for Cuttings**

Parameter	Container	Preservation Method *
1. Chloride (for WBM)	Polyethylene Bottle 500 mL	Refrigerate $\leq 6^{\circ}\text{C}$
2. Oil on Cuttings (for SBM)	Glass Amber 500 mL	Refrigerate $\leq 6^{\circ}\text{C}$
3. Mercury (in stock Barite)	Polyethylene Bottle 500 mL	Refrigerate $\leq 6^{\circ}\text{C}$
4. Cadmium (in stock Barite)	Polyethylene Bottle 500 mL	Refrigerate $\leq 6^{\circ}\text{C}$

**Remark:** \* Based on Standard Methods for the examination of water and wastewater, APHA, AWWA, WEF, 23<sup>rd</sup> edition, 2017

### 3.4.4 Cuttings Monitoring Results

#### 1. Chloride (for WBM)

Referring to analysis no. T19AE726-0009, cuttings were collected by project staff. The result of chloride (for WBM) was Non-detectable. Chloride (for WBM) for Onshore Oil and Gas was not specified in National Environmental Quality (Emission) Guidelines. The monitoring results as shown in Table 3-15. The analysis results, certificate for laboratory instrument and approval registration certificate of laboratory are shown in Appendix G,H and I.

**Table 3-15 The Results of Chloride in Mud and Cuttings Monitoring**

Station	Chloride (for WBM) (%w/w)	Sample Condition	Detection Limit
Moenatkone wellsite			
26" AUNG PYAE HLYAN-1: APH-1 (Cutting)	ND	Grey Cuttings	0.01
<b>Guideline</b>	<sup>1/</sup>	-	-

**Remark:** ND: NON-DETECABLE

<sup>1/</sup> Chloride (for WBM) for Onshore Oil and Gas was not specified in National Environmental Quality (Emission) Guidelines.

## 2. Oil on Cuttings (for SBM)

Referring to analysis no. T19AE726-0001 to T19AE726-0008 and T19AE7260010. Mud and Cuttings were collected by project staff. The results found that %OOC (dry weight) was vary from 0.02 - 22.5%. Oil on Cutting for Onshore Oil and Gas was not specified in National Environmental Quality (Emission) Guidelines. The monitoring results as shown in Table 3-16. The analysis results, certificate for laboratory instrument and approval registration certificate of laboratory are shown in Appendix G,H and I.

**Table 3-16 The Results of Oil on Cuttings in Mud and Cuttings Monitoring**

Station	Oil on Cuttings (for SBM) %OOC (dry weight)	Sample Condition
Moenatkone wellsite		
12 ¼" AUNG PYAE HLYAN-1 (APH-1) ST (MUD SBM)	5.10	Brown Mud
12 ¼" AUNG PYAE HLYAN-1 (APH-1) ST (Cuttings)	2.63	Brown Cuttings
26" AUNG PYAE HLYAN-1 (APH-1) (MUD SBM)	0.02	Grey Mud
8 ½" AUNG PYAE HLYAN-1 (APH-1) ST (MUD SBM)	4.98	Brown Mud
8 ½" AUNG PYAE HLYAN-1 (APH-1) ST (Cuttings)	1.82	Brown Cuttings
17 ½" AUNG PYAE HLYAN-1 (APH-1) ST (MUD SBM)	12.3	Brown Mud
17 ½" AUNG PYAE HLYAN-1 (APH-1) ST (Cuttings)	1.15	Brown Cuttings
17 ½" AUNG PYAE HLYAN-1 (APH-1) (MUD SBM)	22.5	Brown Mud
17 ½" AUNG PYAE HLYAN-1 (APH-1) (Cuttings)	4.10	Brown Cuttings
<b>Guideline</b>	- <sup>1/</sup>	-

**Remark:** <sup>1/</sup> Oil on Cutting for Onshore Oil and Gas was not specified in National Environmental Quality (Emission) Guidelines.

## 3. Mercury and Cadmium (in stock Barite)

Referring to analysis no. T19AE726-0011, mud and cutting were collected by project staff. Total mercury and total cadmium (in stock barite) was analyzed, The results found that total mercury and total cadmium (in stock barite) was 3.61 and 0.795 mg/kg (dry weight). total mercury and total cadmium (in stock barite) for Onshore Oil and Gas were not specified in National Environmental Quality (Emission) Guidelines. The monitoring results as shown in Table 3-17. The analysis results, certificate for laboratory instrument and approval registration certificate of laboratory are shown in Appendix I, J and K.

**Table 3-17 The Results of Total Mercury and Total Cadmium in stock barite Monitoring**

Station	Total Mercury (in stock Barite) mg/kg (dw)	Total Cadmium (in stock Barite) mg/kg (dw)	Sample Condition
Moenatkone wellsite			
26" AUNG PYAE HLYAN-1 (APH-1) (STOCK BARITE)	3.61	0.795	Grey Powder
<b>Guideline</b>	- <sup>1/</sup>	- <sup>1/</sup>	-

**Remark:** <sup>1/</sup> Total mercury and total cadmium (in stock barite) for Onshore Oil and Gas were not specified in National Environmental Quality (Emission) Guidelines.

Chloride, Oil on cutting, Total Mercury and Total Cadmium for Onshore Oil and Gas were not specified in National Environmental Quality (Emission) Guidelines. For cuttings and fluids management in accordance with applicable standards provided in the IFC EHS Onshore Oil and Gas Development guideline. The project temporary stored mud and cutting in cutting pit with HDPE liner in order to prevent contaminated to groundwater before bioremediation onsite after the rig move out from location or sent for disposal at approved waste management facility.

### 3.5 Chemical Used for Drilling Monitoring

Chemical used for drilling monitoring of Moenatkone well sites specifies to record type and quantity of fluid and chemical used for the drilling and the details as below:

#### 3.5.1 Chemical Used for Drilling Monitoring Method

chemical usage is monitored daily at each well site by record product's name, chemical's name and quantity. The contractor is responsible for recorded the daily chemical used, and reporting to PTTEP SA.

#### 3.5.2 Chemical Used for Drilling Monitoring Results

Chemical used for the drilling phase are not different from the list that mention in EIA report. Moreover, MSDS sheets are to be provided at the work site. Type and quantity of fluid/chemical used for drilling of Moenatkone wellsite throughout drilling phase as shown in Table 3-18.

**Table 3-18 Quantity of Chemical Used for Drilling Process of Moenatkone well sites**

PRODUCTS	UNIT	Total
Mud Volume Consumed	Cubic Meter	1385.4
CAUSTIC SODA	Metric Ton	0.8
DRILL GEL	Metric Ton	8
GLUTARALDEHYDE	Cubic Meter	0.208
Hydro STAR NF	Metric Ton	2
HYDRO ZAN	Metric Ton	3.1
SODA ASH	Metric Ton	0.725
FIBROSEAL M	Metric Ton	2.1546
OPTA CARB 5	Metric Ton	3.00
OPTA CARB 25	Metric Ton	13.00
OPTA CARB 50	Metric Ton	10.5
OPTA CARB 150	Metric Ton	9
Diaseal M	Metric Ton	1.270
CALCIUM CHLORIDE	Metric Ton	25.25
CONFI-GEL	Metric Ton	7.35
CONFI-MOD	Cubic Meter	0.624
CONFI-MUL P 250	Cubic Meter	12.064
CONFI-MUL S 250	Cubic Meter	10.816
CONFI-TROL F	Cubic Meter	2.08

**Table 3-18 (Cont.) Quantity of Chemical Used for Drilling Process of Moenatkone well sites**

PRODUCTS	UNIT	Total
CONFI-BLOCK	Metric Ton	3.250
CONFI-BLOCK (CONFI TROL)	Metric Ton	7.031
LIME	Metric Ton	17.300
SARALINE 185V (Jan 19)	Cubic Meter	325
DRILL BAR	Metric Ton	1260.5
HYDRO SEAL G	Metric Ton	4

Remark : PTTEP SA, January 2020

### 3.6 Hazardous and Non-hazardous waste

The PTTEP SA exploration program would handle waste according to PTTEP SA Standards. All wastes were classified and segregated before responsible disposal. All wastes would be collected, stored, and segregated in arranged containers such as non-hazardous waste, plastic waste, metal waste and hazardous waste.

The contractor provided storage area for all wastes and PTTEP SA strictly enforced good housekeeping practices within well site and Central Campsite.

For non-hazardous waste, waste management plan was prepared that defines waste types, disposal methods and locations consistent with waste management laws and regulations. The local government of Thayet township municipal was the responsible agency for managing waste to disposal.

For Hazardous Waste, the well site and accommodation campsite were generated a low volume of hazardous waste. Drilling waste was transferred to Yangon for disposal of at an approved waste disposal area (DOWA). The medical waste was handover to medical service company for dispose at approved hospital.

### 3.7 Social Monitoring

Social monitoring was conducted for drilling phase of Moenatkone (MNK) well site during January – June 2019 by PTTEP SA. The detail as shown in Table 3-19.

**Table 3-19 Social Monitoring Plan**

Environmental Quality	Parameter	Location	Period
Social	<ul style="list-style-type: none"> <li>Complaint</li> <li>Monitoring and solving</li> </ul>	Project area, community around project area, and transportation route - Moenatkone (MNK) well site	Throughout drilling phase of Moenatkone (MNK) well site

### 3.7.1 Social Monitoring Methods

Social monitoring is the investigation of complaints from the community. PTTEP SA provided grievance handling guideline to receive any complaints from the stakeholder and resolve the complaint in the immediate (Appendix F-1). If any damage occurs, PTTEP SA will be responsible to solve and track them. In addition, problem's cause will be analyzed to prevent same problem occurring again. The Grievance Handling Process of PTTEP SA as shown in Figure 3-8.



Figure 3-8 Grievance Handling Process

### 3.7.2 Social Monitoring Result

Social monitoring results for drilling phase of Moenatkone (MNK) well site during January – June 2019 was done by PTTEP SA. There was no any complaints from the community throughout the project operation.

### 3.8 Public and Occupational Health and Safety Monitoring

Public and Occupational Health and Safety monitoring was conducted drilling phase of Moenatkone (MNK) well site during January – June 2019 by PTTEP SA. The detail as shown in Table 3-20.

Table 3-20 Public and Occupational Health and Safety monitoring Plan

Environmental Quality	Parameter	Location	Period
Public and Occupational Health and Safety	<ul style="list-style-type: none"> <li>Accidental statistics</li> <li>Cause of accidents</li> <li>Mitigation measures</li> </ul>	Project area, community around project area, and transportation route - Moenatkone ( MNK) well site	Throughout drilling phase of Moenatkone (MNK) well site during January – June 2019



### 3.8.1 Public and Occupational Health and Safety Method

PTTEP SA provided SSHE Management System Manual and training program on Safety, Security Health and Environment Management System (SSHE-MS) and other concerned safety standards have been provided to the contractor for follow with the PTTEP SA's plan. Public and Occupational health and safety monitoring was conducted by recording the accident during working time; including causes, accident level, and performed mitigation measures. Monitoring program and report were conducted throughout operation period following the specified measures in EIA report.

### 3.8.2 Public and Occupational health and safety monitoring Results

Public and Occupational health and safety monitoring results for drilling phase of Moenatkone (MNK) well site was done by PTTEP SA. There were 1 High Potential Incident case from project activity throughout the project operation. The details are summarized in Table 3-21 and Appendix E-7.

**Table 3-21 The incident record**

No.	Location	Date of incident	Summary of incident	Actions To Prevent Recurrences
1.	Moenatkone well site	15 Jan 2019	The vehicle (truck trailer) was lurched over to the left and very quickly the center of balance tipped to the left and the mud tank broke its bindings and fell to the ground. The mud tank came to rest on its side and landed on the bullock cart (50%) the man and girl were narrowly missed.	<ol style="list-style-type: none"> <li>1. To revise the existing Risk Assessment in order to cover all terrain.</li> <li>2. To revise the vehicle check list with the additional load securing</li> <li>3. To assign specialist for load securing for onshore rig move operation. (according to Australia load restraint guideline 2018)</li> <li>4. To identify the trailer truck selection criteria base on key metric of grade ability, start ability.</li> <li>5. To provide all access road engineering details to support trailer selection</li> <li>6. To organize training to all involved personnel for the safe load securing in rig move operation.</li> <li>7. To organize the drive techniques session to all trailer drivers by the experience truck pusher.</li> <li>8. To identify access route condition &amp; quality with industrial standard for next well.</li> </ol>

Remark : PTTEP SA, 2019

## ***Chapter 4***

# ***Environmental Mitigation Measures Compliance Audit and Environmental Monitoring Result***

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## Chapter 4

### Environmental Mitigation Measures Compliance Audit and Environmental Monitoring Conclusion

From the monitoring of environmental mitigation measures compliance audit and environmental monitoring during Drilling Phase (audit conducted at Moenatkone wellsite), it was found that the project has implemented the mitigation measures specified in EIA report and the results are summarized as following details:

#### 4.1 Environmental Mitigation Measures Compliance Audit Conclusion

Environmental Mitigation Measures Implementation Compliance audit was carried out by REM-UAE Laboratory and Consultant Company Limited together with representatives from PTTEP SA. The audit conducted against the mitigation measures specified in EIA report.

Audit and document checking by setting 4 levels of evaluation as follows;

- Completely complied on the Mitigation Measures (✓) refers the project can complete comply with the measure without any barriers.
- Mostly complied on the Mitigation Measures (✓) refers the project can mostly comply with the measure without any barriers.
- Do not complied on the Mitigation Measures (✗) refers the project cannot comply with the measure because of some barriers.
- Do not have situation follows the Mitigation Measures (NA) refers during the project operations do not have any of situation follow the Mitigation Measures

Although the project does not comply with the mitigation measures, REM- UAE Laboratory and Consultant Company Limited will identify the cause of problems, barriers and solutions ways.

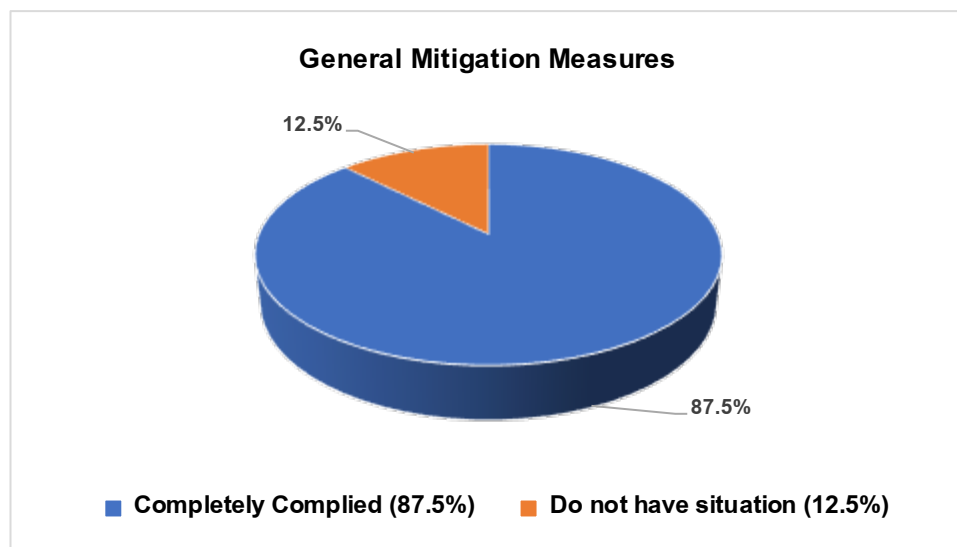
##### 4.1.1 General Mitigation Measures Implementation Compliance

- PTTEP SA concerns the safety, security, health and environment of the employees and wellbeing of the environment. The company addresses this regulation to the contract employees and contractor to comply with the requirements; the mitigation must be followed with the Company's SSHE Policy.
- PTTEP SA compiled these mitigation and monitoring measures strictly and monitoring report of the project will submit to MOGE and ECD biannually in order to inform all activities.
- The letter about the activities of project was sent to local government. Moreover, PTTEP SA had two times of public consultation with stakeholder already. Another plan of public consultation with

stakeholder will conduct if needed. PTTEP SA will refer to the grievance mechanism if there is any compliance from stakeholder and community.

- PTTEP SA apply grievance handling guideline for immediately action in case receive any complaints raised from the stakeholder. However, there was no complaint from activity during January – June 2019.
- If any objects, fossils or archaeological are encountered in the project area, PTTEP SA will stop all drilling activities and inform the government agencies such as District and Township Administrator, Local Archeological Department, Fossil Research Center and Geological Museum immediately to examine at the wellsite. However, there was no encountered any objects, fossils or archaeological from previous activity.
- All private land was permitted by land owners or authorized persons prior to start any activity. For access roads, the upgrade of existing road and construction of new road was considered and approved by local administrative officers and land owners under MOGE supervision.

The results determined that the project have completely complied on the mitigation measures requirements for the finished and on-going operations while some activities (12.5%) do not have operation during the audit, results are shown in Figure 4-1.



**Figure 4-1 The Results of General Mitigation Measures Implementation Compliance**

#### **4.1.2 Environmental Mitigation Measures Implementation Compliance Result Summary in Drilling Phase**

##### **1) Air Quality**

Status of Moenatkone wellsite was drilling phase which have no land clearance activity. PTTEP SA prepared land transport safety procedure and enforced the contractor to follow regulation of speed limitation 5 km/hr within wellsite and 10 km/hr along the access road. The speed limitation signs were provided along the access road. In addition, requirement on speed limitation was communicated to all worker in daily tool box talk before working by the header of contractor/safety officer. The truck was covered during transport material to the wellsite. Most of truck was used for transport material within wellsite. Moreover, the contractor had provided staffs for cleaning during transportation.

The project provided spray water truck to within project area depending on the atmospheric conditions to reduced dust dispersion. The contractor provided PPE sufficiently for all workers and controlled to use PPE during working. The vehicle that used in the project has the dust flaps to reduce the dust dispersion. To ensure all machinery and vehicles are properly checked, PTTEP SA specified the contractor to regularly check and maintain the machines and vehicles.

PTTEP SA prepared land transport safety procedure and enjoined the contractor to follow regulation. Moreover, training program in defensive driving was provided for contractor. The project provided H2S monitor and alarm system within project area. In case of H2S levels in the gas stream exceed 10 ppm, the project will implement appropriate safety zones. Moreover, the project also provided H2S safety basic training for project staff.

##### **2) Noise**

No need to use noise barrier due to project area far away from sensitive area. However, the soundproof generator was used to minimize noise disturbance. PTTEP SA specified the contractor to regularly check and maintain the machines and vehicles. Soundproof generator was used in project area to minimize noise disturbance. PTTEP SA specified the contractor to regularly check and maintain the machines and vehicles.

##### **3) Heat and Light**

Drilling rig located distantly to sensitive receptors, there were a few houses of community around the wellsite. The project has provided adequate night lighting within project area.

##### **4) Surface Water Quality**

The project strictly implemented the mitigation measure for construction and installation phase. PTTEP SA designed layout of the wellsite, the access road and campsite before starting the construction to minimize areas requiring soil stabilization. The contractor provided drip pans and absorbents to contain

any spillage from vehicle and machinery while transferring fuel or changing of engine oil. Water drainage ditch around the wellsite was constructed as specify in the measure.

PTTEP SA reiterated staffs and constructors to strictly keep clean both within wellsite and avoid water source nearby the wellsite. Moreover, PTTEP SA has provided training program to contractors on regulation and prohibition including control the performed as defined. Moreover, the contractor provided storage area for chemical and oil within wellsite. The project provided drainage, buffer zone and earth bund surrounding wellsite area. The fuel storage tank was surrounded by bund wall and placed on tarpaulins to prevent contaminated to soil in case of spill. The project installed concrete lined septic tank at the wellsite for hold and treating sewage.

#### **5) Soil quality**

The project strictly implemented the mitigation measure for drilling phase as described in 4.1. Site Runoff and Drainage.

#### **6) Groundwater Quality**

The project installed steel casing and cement in place to prevent chemical leak or contaminate into rock formation. The project strict steel casing to well wall by cementing to prevent chemical contaminate to ground water level. The project installed HDPE liner in the mud and cutting pit in order to prevent contaminated to groundwater. Moreover, the project regularly inspects HDPE liner to prevent worn out.

#### **7) Terrestrial Flora and Fauna**

PTTEP SA has provided training program to contractors on regulation and prohibition including control the performed as defined. Fence was installed around the wellsite to separate the project area and nearby area. The security guard was at available 24 hr at temporary resting area to restrict people and vehicles.

#### **8) Transport**

Routine inspection and preventive maintenance for all vehicles were conducted as per inspection plan. Alcohol testing was randomly check. Worker will immediately stop working if alcohol is found more than 0%. Moreover, the project provided drug test kits within wellsite to conduct drug test. PTTEP SA prepared land transport safety procedure and enjoined the contractor to follow regulation of speed limitation 5 km/hr within wellsite and 10 km/hr along the access road. The speed limitation signs should provide along access road. However, speed limitation was communicated to all worker in daily tool box talk before working by the header of contractor/safety officer. The contractor controlled the truck not to over loading to prevent damage on road surface. Moreover, the access road was in good condition and ready for use. In case of the road was damaged from project activity, the contractor will repair to prevent unsafe to user.

Safety equipment and emergency equipment were installed on project vehicles as per company standards. The project provided left hand drive car as a priority to use in project activities. Moreover, PTTEP SA informed local authority on the oversized load and put an escort in front of this convoy,

the project also conducted rig move route survey before major movement and avoiding transportation of heavy equipment during rush hours. The project provided traffic sign along the access road as specified in mitigation measure.

PTTEP SA implemented the grievance handling guideline and immediately acted in case any complaints raised from the stakeholder. However, during January – June 2019 there was no complaint raised from PTTEP SA activity. Training program on Safety, Security Health and Environment Management System (SSHE- MS) and other concerned safety standards have been provided to the contractor for implementation as PTTEP SA's plan.

#### **9) Water Use**

The project strictly implements the mitigation measure for drilling phase is same as mitigation measure for construction and installation phase described in 10.1 Use of water public utility for construction and domestic, including:

- PTTEP SA has followed requirements of well drilling procedure for groundwater.
- At Moenatkone wellsite, the contractor has own water source for using in project area which do not generate affect to the community.

#### **10) Power Use**

The project installed diesel-powered generators to supply all project power demand.

#### **11) Waste Management**

The project strictly implemented the mitigation measure for construction and installation phase as described in 12.1 Non-Hazardous waste management for drilling phase including:

- PTTEP SA developed waste management plan and required the contractor to implement. Separate waste containers were provided at wellsite. The local government of Thayet township municipal was the responsible agency for managing waste to disposal.
- The contractor provided storage area for chemicals and PTTEP SA strictly enforced all workers to maintain a good housekeeping practices within wellsite and surrounding.
- Toilet with septic tank was provided sufficiently for all staffs in order to treat wastewater before release to environment.

For drilled cuttings, the solid (drilling cutting) and liquid (drilling mud) phases are separated on-site by shale shaker. At the end of the first well location, the left-over drilling mud will be transferred and used for the next well location. At the end of drilling campaign, the left-over mud will be sent back to mud contractor for reuse or disposal or use for other PTTEP offshore drilling campaign. The project assigned SCOMI which is licensed contractor to do bioremediation onsite or offsite disposal for mud and cutting wastes after rig moving out from location. PTTEP SA developed waste management plan and controlled the contractor to implement. Waste containers were provided at wellsite and the quantity of hazardous waste was recorded by contractor. In addition, the contractor provided storage area for chemicals and

PTTEP SA strictly enforced all workers to maintain a good housekeeping practices within wellsite and surrounding.

Training program on Safety, Security Health and Environment Management System (SSHE-MS) and other concerned safety standards have been provided to the contractor for implementation as PTTEP SA's plan. The contractor provided PPE sufficiently for all workers and controlled to use PPE during working. The fuel storage tank was surrounded by bund wall and placed on tarpaulins to prevent contamination to soil in case of spill. Drilling mud system, shale shaker and mixed chemical tank were placed on concrete pad surrounding with drainage system to collect drilling fluid to cutting pit. The project used oil catch pans under vehicles and performed maintenance only on impervious surfaces. The project provided spill cleanup kits within project area. Cutting was temporary stored in cutting pit with HDPE liner in order to prevent contamination to groundwater before bioremediation onsite or sent for disposal at approved waste management facility after rig moving out from location. The project constructed waste pit and cutting pit with sufficient volume. Level of cuttings and dirty water in waste pit was monitored to prevent overflow, the frequency of monitoring may be increased depended on the weather condition.

## **12) Socio-Economy**

The contractor hired temporary workers in local area, according to the job description and The contractor purchased goods/consumers products in local area.

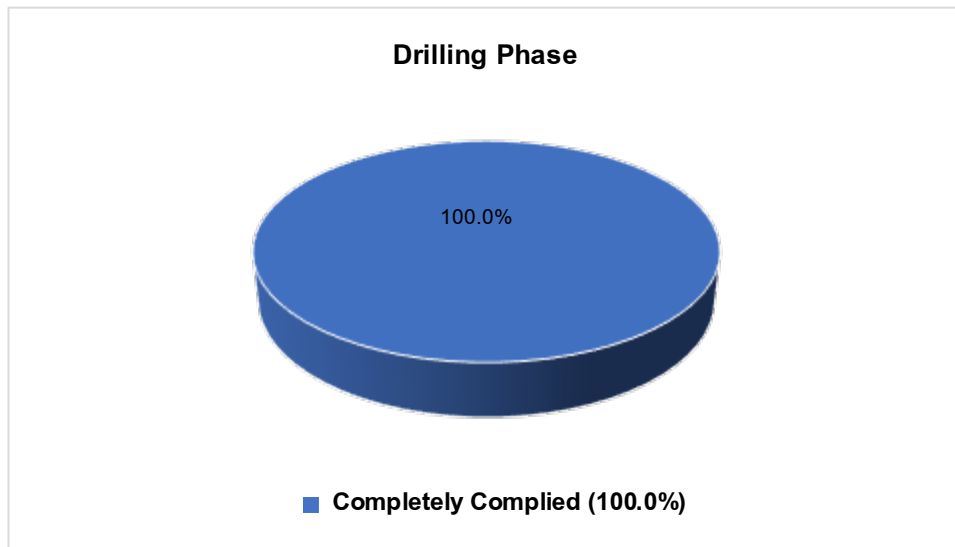
## **13) Occupational and Public Health**

The project strictly implements the mitigation measure for drilling phase described in 2.1 Well Drilling and Vehicle and Equipment Use, 11.2 Hazardous waste management, 11.3 Handling and Disposal of drill cuttings, sludge and chemicals and 12.1 Employment opportunities and Use of local goods and services.

Drilled Cutting was temporary stored in cutting pit with HDPE liner in order to prevent contamination to groundwater before bioremediation onsite or sent for disposal at approved waste management facility after the rig move out from location. When drilling activity complete, the project will dispose of waste kept in waste pit by approved waste management facility. The project has prepared on health screening to all workers before employment. Emergency respond procedure, ambulance, medical personnel and training were provided in case of emergency. Moreover, the contractor cooperated with nearby hospital to support if need for serious injuries or emergencies case. The contractor hired qualified local workers, according to the job description. PTTEP SA has provided training program to contractors on regulation and prohibition including control the performed as defined requirements.



The results determined that the project have fully complied on the environmental mitigation measures with 100.0%. The results are shown in Figure 4-2.



**Figure 4-2 The Results of Environmental Mitigation Measures Implementation Compliance in Drilling Phase**

#### **4.1.3 Environmental Mitigation Measures Implementation Compliance Result Summary in Unplanned Event**

##### **1) Blowout**

The shallow gas hazard was identified by examination of existing wells. The project provided Drilling Program and extensive SSHE Management System procedures and operational controls in place. Moreover, Internal hazardous operation was reviewed and “Table Top Drilling” was exercised as per specified in drilling program. The project selected proper drilling fluid formulation, and provided well kill fluids/systems, loss control and weighting agents. The project monitored of downhole condition and mud return. The project carefully uses high quality materials in well construction (casing and cement grades). The project installed Blowout Preventor (BOP) and other safety equipment including testing before drilling for correctness and availability of equipment to comply with the drilling program and standard strictly. The project provided PTTEP SA’s Emergency Response Plan and Blow Out Contingency Plan and control the contractor to performed as defined requirements.

##### **2) Fire or Explosion (not associated with Blowout)**

Training program on Safety, Security Health and Environment Management System (SSHE-MS) and other concerned safety standards have been provided to the contractor for implementation as PTTEP SA’s plan. Fire extinguishers, fire suit and SCBA were provided at wellsite including inspection once a month. Moreover, the assembly point, windsock, an emergency respond procedure and firefighting training were provided.

### 3) Fuel, Chemical or Hazardous Waste/Materials Spill

PTTEP SA developed waste management plan and controlled the contractor to implement. Separate waste containers were provided at wellsite. The contractor provided drip pans and absorbents to contain any potential spillage from vehicle and machinery while transferring fuel or changing of engine oil.

The project provided SDS of drilling chemicals at wellsite as specify in the mitigation measure. Concrete rig pad with drainage system was constructed as specified in the mitigation measure. The project used oil catch pans under vehicles and performed maintenance only on impervious surfaces.

PTTEP SA has provided training program to contractors as regulation requirements including control their performing as defined requirements. Moreover, the project provided drainage, buffer zone and earth bund surrounding wellsite area. Drilling mud system, shale shaker and mixed chemical tank were placed on concrete pad surrounding with drainage system to collect drilling fluid to cutting pit. The contractor provided chemicals storage area on concrete pad with bund wall and PTTEP SA strictly enforced good housekeeping practices within wellsite and surrounding for all workers. Training program on Safety, Security, Health and Environment Management System (SSHE-MS) and other concerned safety standards have been provided to the contractor for implementation as PTTEP SA's plan.

Cutting was temporary stored in cutting pit with HDPE liner in order to prevent contaminated to groundwater before bioremediation onsite after the rig move out from location or sent for disposal at approved waste management facility. PTTEP SA prepared the safety land transport procedure and enforced the contractor to follow regulation. Moreover, the contractor provided journey management plan and journey management record.

### 4) Transportation Accidents

Training program on Safety, Security, Health and Environment Management System (SSHE-MS) and other concerned safety standards have been provided to the contractor for implementation as PTTEP SA's plan. PTTEP SA prepared safety land transport procedure and enforced the contractor to follow regulation of speed limitation 5 km/hr within wellsite and 10 km/hr along the access road. The speed limitation signs are provided along access road and the speed limitation was communicated to all worker in daily tool box talk before working by the header of contractor/safety officer. Moreover, PTTEP SA prepared safety land transport procedure and enforced the contractor to follow regulation.

PTTEP SA informed local authority on the oversized load and put an escort in front of this convoy, the project also conducted rig move route survey before major movement and avoiding transportation of heavy equipment during rush hours. PTTEP SA implements the grievance handling guideline and act immediately in case any complaints raised from the stakeholder. However, during January – June 2019 there was no complaint from activity.

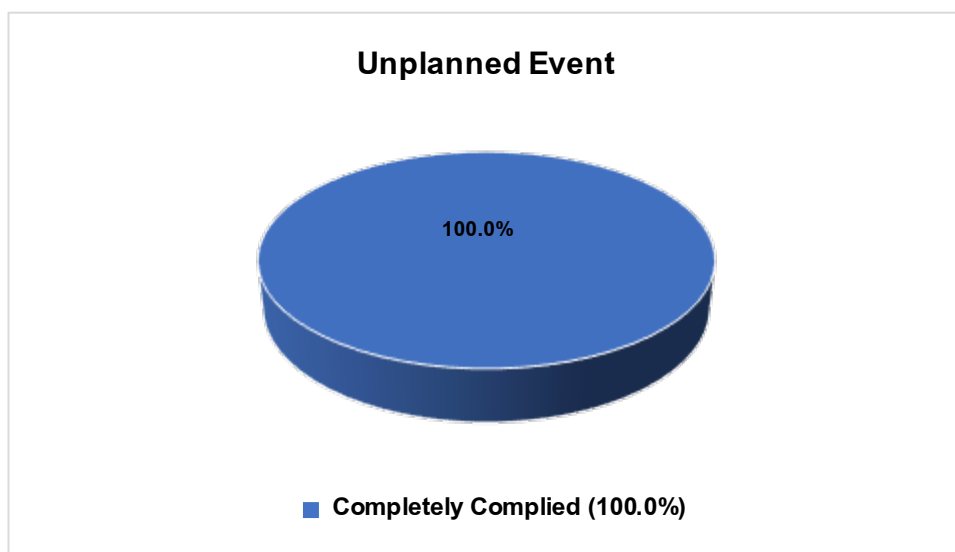
Fence was installed around the wellsite to separate the project area and nearby area. The security guard was 24 hr provided at temporary resting area to restrict people and vehicles. Emergency response

procedure, ambulance, medical personnel and training were provided to respond in emergency case. Moreover, the contractor cooperated with nearby hospital to support in serious injuries or emergencies case.

### 5) Earthquakes

Training program on Safety, Security, Health and Environment Management System (SSHE-MS) and other concerned safety standards have been provided to the contractor for implementation as PTTEP SA's plan.

The results determined that the project operations have fully complied (100% complied) with the environmental mitigation measures for unplanned event. The results are shown in Figure 4-3.



**Figure 4-3 The Results of Environmental Mitigation Measures Implementation Compliance in Unplanned Events**

## 4.2 Environmental Monitoring Results Conclusion

Environmental monitoring programs implemented during project's period is provided as follow

### 1) Air Quality Monitoring

Air quality monitoring was conducted for drilling phase of Moenatkone wellsite during January – June 2019 by REM-UAE Laboratory and Consultant Company Limited. the results of average 1 hr Nitrogen Dioxide ( $\text{NO}_2$ ), average 24 hrs Sulphur Dioxide ( $\text{SO}_2$ ) were complied with Myanmar National Environmental Quality (Emission) Guidelines (2015) and WHO Air quality guideline (2006) and amendment. While, average 24 hours  $\text{PM}_{10}$ , average 24 hours  $\text{PM}_{2.5}$  and average 8 hrs Ozone ( $\text{O}_3$ ), not complied with Myanmar National Environmental Quality (Emission) Guidelines (2015) and WHO Air quality guideline (2006) and amendment in some period of time. However, average 24 hrs  $\text{H}_2\text{S}$  was not specified in the standard.

Distribution of fire alerts (Figure 3-3 in Chapter 3) captured by the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Aqua satellite during March 1-5, 2019. Places where MODIS detected actively burning fires are marked in red. During the area's dry season (roughly fall-winter in the Northern Hemisphere), intentional land management fires, as well as accidental forest fires that spread from agricultural areas, are common in Southeast Asia. In Myanmar, wildfires are a serious problem with local and wide-reaching regional impacts. Myanmar has highest burn rate in Southeast Asia and ranks 11th globally in terms of forest fires. Between 2003 and 2012, more than 17.732 million hectares burned in Myanmar (reference: <http://www.fao.org/myanmar/news/detail-events/ru/c/1234252/>).

Accordingly, the results of average 24 hours  $PM_{10}$ , average 24 hours  $PM_{2.5}$  and average 8 hrs Ozone ( $O_3$ ) which not complied with the standards may be the result from wildfire around project area during monitoring period. The nearest wildfire was occurred approximately 500 meters from Moenatkone main gate in the same day of air quality monitoring. Wildfire around project area.

## 2) Noise Level Monitoring

Noise level was conducted for drilling phase of Moenatkone (MNK) wellsite during March 3-4, 2019 by REM- UAE Laboratory and Consultant Company Limited at 1 station ; Moenatkone station (N2). The result 2019 found that  $L_{Aeq\ 24\ hours}$ ,  $L_{Amax}$  and  $L_{Adn}$  were 52.5 dB(A), 52.8-87.8 dB(A) and 58.4 dB(A), respectively. The Myanmar National Environmental Quality (Emission) Guidelines (2015) and WHO guideline for community noise (1999) were not specify the standard for  $L_{Aeq\ 24\ hours}$ ,  $L_{Amax}$  and  $L_{Adn}$ .

## 3) Cuttings Monitoring

- **Chloride (for WBM):** Referring to analysis no. T19AE726-0009, cuttings were collected by project staff. The result of chloride (for WBM) was Non-detectable. Chloride (for WBM) for Onshore Oil and Gas was not specified in National Environmental Quality (Emission) Guidelines.
- **Oil on Cuttings (for SBM):** Referring to analysis no. T19AE726-0001 to T19AE726-0008 and T19AE7260010. Mud and Cuttings were collected by project staff. The results found that %OOC (dry weight) was vary from 0.02-22.5%. Oil on Cutting for Onshore Oil and Gas was not specified in National Environmental Quality (Emission) Guidelines.
- **Mercury and Cadmium (in stock Barite):** Referring to analysis no. T19AE726-0011, mud and cutting were collected by project staff. Total mercury and total cadmium (in stock barite) was analyzed, The results found that total mercury and total cadmium (in stock barite) was 3.61 and 0.795 mg/kg (dry weight). total mercury and total cadmium (in stock barite) for Onshore Oil and Gas were not specified in National Environmental Quality (Emission) Guidelines.

#### **4) Chemical Used for Drilling Monitoring**

Chemical used for the drilling phase are not different from the list that mention in EIA report. Moreover, MSDS sheets are to be provided at the work site. Monitoring the type and quantity of chemicals used at Moenatkone wellsite as shown in Chapter 3 Section 3.5.2.

#### **5) Hazardous and Non-hazardous waste**

The PTTEP SA exploration program would handle waste according to PTTEP SA Standards.

All wastes were classified and segregated before responsible disposal. All wastes would be collected, stored, and segregated in arranged containers such as non-hazardous waste, plastic waste, metal waste and hazardous waste.

The contractor provided storage area for all wastes and PTTEP SA strictly enforced good housekeeping practices within well site and Central Campsite.

For non-hazardous waste, waste management plan was prepared that defines waste types, disposal methods and locations consistent with waste management laws and regulations. The local government of Thayet township municipal was the responsible agency for managing waste to disposal.

For Hazardous Waste, the well site and accommodation campsite were generated a low volume of hazardous waste. Drilling waste was transferred to Yangon for disposal of at an approved waste disposal area (DOWA).

The medical waste was handover to medical service company for dispose at approved hospital.

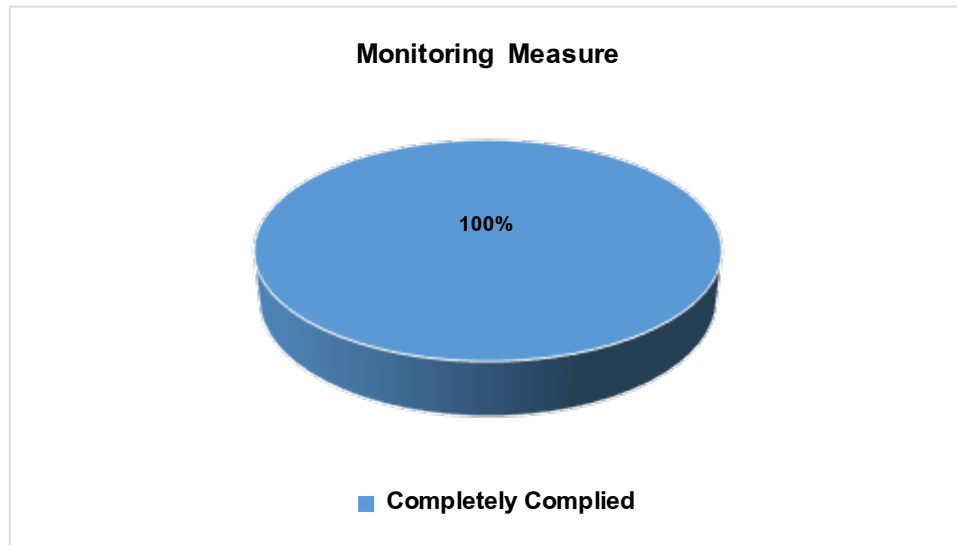
#### **6) Social Monitoring**

Social monitoring results for drilling phase of Moenatkone (MNK) wellsite during January – June 2019 by PTTEP SA. There was no any complaints from the community throughout the project operation.

#### **7) Public and Occupational Health and Safety Monitoring**

Public and Occupational health and safety monitoring results for drilling phase of Moenatkone (MNK) wellsite during January – June 2019 were done by PTTEP SA. There were 1 High Potential Incident case from project activity throughout the project operation during January – June 2019. PTTEP SA had strictly follow PTTEP SA's procedure for all case such as record data, find cause of accidents and performed mitigation measures.

The results of Environmental Impact Monitoring determined that the project completely complied with 100% as shown in Figure 4-4.



**Figure 4-4 Summary of Monitoring Measure Implementation Results**