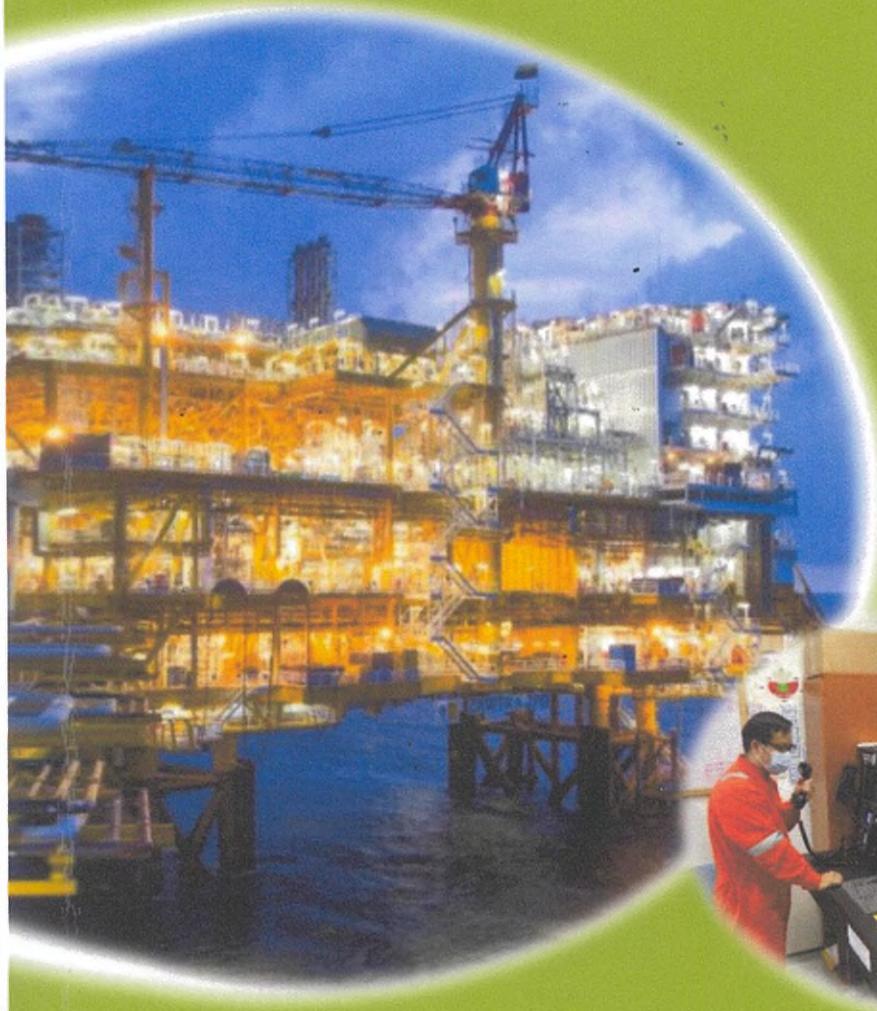


2nd Monitoring Report of Zawtika Offshore Development Project (February - July 2023)



Executive Summary

REM-UAE Laboratory and Consultant Co., Ltd. conducted compliance audit of implementation of environmental mitigation measures and monitoring program for Zawtika Offshore Development Project, following the Environmental Management Plan - EMP (revised) of Zawtika Offshore Development Project in Block M9 which Environmental Conservation Department (ECD) replied to PTTEPI on 4th October 2022 according to the letter no. EIA-2/10 Approved (EMP) (2556/2022), and Myanma Oil and Gas Enterprise (MOGE) replied to PTTEPI 13th October 2022 according to the letter no. MD-(100) 3/6 (1390) 2022. This is the 2nd monitoring report, covering the period from February to July 2023.

The objective of the review was to evaluate the effectiveness of implementation of the Environmental Management Plan, including both mitigation and monitoring measures, defined in the EMP report. Reporting of observed problems, obstacles and recommendations for issued identified during the review were provided in order to improve the effectiveness of the existing environmental mitigation and monitoring measures.

The assessment process includes (1) site observation, (2) interview with PTTEPI' representatives and document review and (3) sample collection and analysis.

1. Project Description

Zawtika is a gas field development project located in Block M9 and a small portion of Block M11. The field lies in the Gulf of Martaban, approximately 225 km south of Yangon and 207 km west of the Myanmar coast.

The development of offshore Zawtika is comprised of Phase 1A and 1B, as well as additional potential future development phases. The Zawtika Phase 1A offshore facilities consists of ZPQ (Processing platform integrated with Living Quarter module), a bridged-link wellhead platform WP1, two remote wellhead platforms WP2 and WP3, associated intra-field sealines and 28" diameter with 230 km long offshore gas transportation pipeline. The development of Zawtika Phase 1B, which is currently ongoing, consists of 4 remote wellhead platforms, namely WP4, WP5, WP6, and WP7 including their associated pipelines.

2. ZPQ Processing System

The process starts with well fluids from remote wellhead platforms flowing into the ZPQ. They are cooled by seawater and arrive marginally above seawater temperature. Well fluids from bridge connected wellhead platform (WP1) are cooled (by air cooler system) before being mixed with the rest of the well fluids.

The incoming well fluids then pass through the production separators, where they are separated into gas, condensate and water streams. Separated gas from separators is compressed in the 1st stage gas compressor to remove some condensate prior to delivery to gas dehydration, where water is removed. Dry gas passed from the dehydration unit is cooled and compressed at 2nd stage gas compressor train and passed to the 28" offshore export pipeline to the onshore section. Some of dry gas is diverted to be used as fuel for other processes and power generation supplied for the ZPQ.

Production liquids separated from the gas consist of condensate and produced water. Condensates will be burned using smokeless burners at WP1.

Regarding produced water, there is no evidence of heavy metal Hg, As from gas and water analysis for all the explored areas. PTTEPI has conducted monthly produced water analysis since the beginning of their operations, and no heavy metals have been found. As such, produced water separated from the production separators and some from the condensate flash drum at the maximum design of 20,000 bpd is being sent to a de-oiler unit to separate residual condensate back to flash drum prior to tipping overboard with the treated water to meet the Myanmar's National Environmental Quality Guidelines (NEQG) Standards.

3. Emission and Effluent Management

3.1 Flaring

ZPQ is equipped with High pressure (HP) and Low pressure (LP) gas flare systems that cater for safe and reliable disposal of planned and unplanned releases of hydrocarbon gas from the production facilities. Flare knock out drums are provided on the HP and the LP systems. The configuration of level control is on/off gap level control, as normally no continuous liquid is expected. The normal liquid level is controlled to be as low as practically possible to maximize the available volume for any liquid relief and also the gas area to improve liquid knock-out. Liquids from both HP and LP flare knock out drums are collected in closed drain vessels.

At all wellhead platforms (WP1-WP7), a temporary (removable type) flare boom and a gas-liquid burner for well cleanup is provided. Two tie-in points (one at East and one at West sides of the platform) are provided for the temporary burner on all of the WPs.

PTTEPI has also installed a smokeless burner at WP1, primarily for the disposal of excess condensate.

3.2 Waste and Wastewater

Waste generated from the Project activities will be segregated into 2 main types according to criteria of danger as non-hazardous waste and hazardous waste.

4. Utilities

4.1 Power and Energy Use

ZPQ is equipped with 3 dual fuel gas turbine power generation units, each of 3.7 MW site rated capacity, which supply all required power to ZPQ and WP1. Multiple gas turbine driven units with adequate capacity to ensure availability of power when a unit is not operational are provided.

A treble fuel design (fuel gas, condensate and diesel) for all three power generation units has been selected, but the connection is made for fuel gas and diesel only. Electric motor start systems are provided for all three power generators.

Emergency diesel power generation of 1.28 MW is provided for essential load in case of turbine generator trip. A black start diesel generator of 280 kW is also provided for the initial start.

4.2 Water Use

Two reverse osmosis water production units with capacity of 1.5 m³/hr, total 3 m³/hr are provided for freshwater production using RO membrane. The water produced by these units is suitable for consumption, plus other intermittent uses, such as eyewash, safety shower, etc. Fresh water from the freshwater units is supplied and stored in freshwater storage tanks. The stored fresh water is then transferred via pumps to the pressurized freshwater vessel for distribution to various users. Potable water suitable for drinking is supplied after treatment of fresh water by a sterilizer.

5. Emergency Shutdown System

ZPQ is designed to provide fully automatic, integrated and centralized platform/process control. The control room operator is able to monitor, detect, and handle process upsets from the control room through Process Control system (PCS), Safety Instrument System and Fire and Gas System (SIS and FGS) for facilities on ZPQ, the bridge connected wellhead platform and remote wellhead platforms.

The ZPQ semi-automatic start-up sequences and automatic safe shutdowns are implemented in the control system. Closed circuit television (CCTV) monitors are provided in the control room to monitor critical process equipment/systems. Online analyzers are provided to monitor the content in the feed/sales gas.

6. Project's Environmental, Social and Health Policies

PTTEPI management is fully committed to providing a safe, secured and healthy workplace and conducting its operations in a manner that protects the environment. These commitments are in accordance with PTTEP's Corporate Vision, Mission, and Values and PTTEPI's SSHE Policy. Proactive individual involvement, responsibility and accountability are expected of all employees, contractors and third-party personnel. PTTEPI SSHE Management System (SSHE MS) is designed to align all stakeholders' efforts to enable attainment of these principles.

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.

7. Compliance Status

The results determined that the project completely complied on the Mitigation Measures during production phase with 98.7% and 1.3%. do not have a situation that follows the Mitigation Measures. For unplanned events, 84.6% are completely complied on the Mitigation Measures and 15.4% do not have situation follows the Mitigation Measures (NA).

PTTEPI complied with most of the mitigation measures prescribed in the EMP. Main issues are summarized below.

7.1 Environmental Mitigation Measures Compliance Result in Production Phase

- **Air Quality** - Routine inspection and preventive maintenance for all machinery were conducted as per annual PM and Inspection Plan. Annual pollutant release inventory was recorded on a monthly basis. Moreover, venting and flare were performed as per the Vent and Drain Philosophy, and HP and LP Flare System Startup. The volumes of gas flared for all flaring events were daily recorded by project staff.
- **Seawater & Sediment Quality** - Project has a vessel for support operation activities, which complied with the requirements of MARPOL 73/78. Oil-contaminated wastewater was collected in the drum for disposal by an onshore contractor, the license waste management service. The deck of the vessel was regularly cleaned by staff to minimize oil and chemical contamination in rainwater. Emergency spill response equipment was provided near all oil and chemical storage areas. After usage all were kept in the hazardous waste container and sent to dispose by DOWA, the license waste management service in Myanmar.
- **Ecology and Biodiversity** - Sewage was collected to treat at treatment system and monitored to control all parameters as requirements of MARPOL 73/78 and Myanmar's NEQG. All equipment of the water treatment system was regularly inspected as per the annual PM and Inspection Plan.

Produced water was collected to treat at ZPQ and monitored every day to control TOG value as per requirements of Myanmar's NEQG.

Produced sand was collected in the container and sent to dispose at onshore by DOWA, the license waste management service in Myanmar. The volume was recorded daily by the control room with manifest document.

Hazardous waste was collected in the red container separated from the general waste, which was collected in the blue ones, all containers were sent to dispose at onshore. The manifest for hazardous waste disposal was kept and recorded.

Furthermore, non-hazardous waste was segregated as food waste, paper, recycled waste and other waste and kept in the bins attached with colour code. The food waste was grinded to a size less than 25 mm before discharge into the sea as per the requirements under MARPOL 73/78. All waste was recorded regularly when sent to dispose at onshore.

- **Fishing** - ZPQ regularly observed an area of 24 nautical miles from ZPQ and WPs. A 500m safety zone was established to ensure only permit vessels can operate in this area. When another vessel moved into the safety zone, the alarm in the radio room at ZPQ was warned. In addition, support vessels were used to contact other vessels when they moved into the safety zone around ZPQ and WPs. The appropriate lights and warning signals were already provided on ZPQ and WPs and all vessels to prevent accidental collision.
- **Obstruction to Navigation** - ZPQ regularly observed an area of 24 nautical miles from ZPQ and WPs. A 500m safety zone was established to ensure only permit vessels can operate in this area. When another vessel moved into the safety zone, the alarm in the radio room at ZPQ was warned. Support vessels were used to contact other vessels when they moved into the safety zone around ZPQ and WPs. The appropriate lights and warning signals were already provided on ZPQ and WPs and all vessels to prevent accidental collision.

- **Occupational Health and Safety** - PTTEPI's Occupational Health Management Standard was prepared and applied for Zawtika project. All staff wear appropriate PPE at all working times. The safety training schedule was performed as per SSHE annual training plan. The safety case or emergency drill was performed as per SSHE Emergency Drill & Exercise Plan. Lifesaving program standard was specified in Zawtika Offshore Field Emergency Response Plan and others related plan. Offshore Medical Emergency Response Plan (MERP) and Myanmar Asset Crisis Management Plan were already implemented. First-aid kits and a medical room were provided. The medic was standing by at medic room for medical treatment. In case of emergency, the patient will be pre-treated by the doctor and will be sent to the hospital in Yangon by helicopter as per The Offshore Medical Emergency Response Plan (MERP). Safety methods for working with machines/ equipment and procedures for safety operation were already implemented. The SDS was attached to all chemical storage areas.

In the summary of incident records during February to July 2023, there was a minor incident about chemical leak from Corrosion Inhibitor (CI) leak outside of containment. However, there was not an injury case, and the incident was recorded details of incidents, investigating the cause, and making the prevention guidelines immediately.

7.2 Environmental Mitigation Measures Compliance Result in Unplanned Events

- **Vessel collision** - PTTEPI's Emergency and Crisis Management Plan was implemented in which the procedures in the event of an accidental vessel collision were included. The notice to the mariner was already submitted to government authorities after rig mobilization. ZPQ regularly observed an area of 24 nautical miles from ZPQ and WPs. A 500m safety zone was established to ensure only permit vessels can operate in this area. When another vessel moved into the safety zone, the alarm in the radio room at ZPQ was warned. Support vessels were used to contact other vessels when they move into the safety zone around ZPQ and WPs. The appropriate lights and warning signals were already provided on ZPQ and WPs and all vessels to prevent accidental collision.
- **Accidental Spills** - PTTEPI's Emergency and Crisis Management Plan was already implemented which the oil or chemical spills was included. The exercise of oil or chemical spills was regularly performed. The incident and nearmiss record were collected by project staff. Waste management procedure was already implemented and followed. The chemical was separated into store according to their characteristics. The lubricants, fuels, paints and other chemicals were stored only in necessary amounts at operation area. The bun or dip tray was already provided at all oil and chemical storage areas. Any spilled oil and chemical were collected into drum and sent to dispose by DOWA, the license waste management service in Myanmar. The appropriate lights and warning signals were already provided on ZPQ, WPs and all vessels to prevent accidental collision. Routine inspection and preventive maintenance for all machinery were conducted as per the annual PM and Inspection Plan. The Tropical Cyclone Procedure was implemented including the emergency drill was performed as per the SSHE Emergency Drill & Exercise Plan. The SDS was attached to all chemical storage areas. Hazardous waste was collected in the red container separated from the general waste, which was collected in the blue ones, all containers were sent to dispose at onshore. The manifest for hazardous waste disposal was kept and recorded. The control valve was already installed and

monitored by the control room. The inspection was performed regularly as per the annual PM and Inspection Plan.

- **Tropical cyclone** - The Tropical Cyclone Procedure was implemented. Also, the emergency drill was performed as per the SSHE Emergency Drill & Exercise Plan.
- **Fire or Explosion** - The firefighting equipment and alarm were provided in the area and regularly inspected by operators. The emergency drill was performed as per the SSHE Emergency Drill & Exercise Plan. PTTEPI's Emergency and Crisis Management Plan was implemented in case of fire or explosion occurrence. The firewater system was regularly inspected by the operator. Condensate burning was performed as per the Liquid Burner Operation Procedure which the safety instructions were clarified in this document. The air consumption of the burner package was checked by the operator to ensure adequate air flow as per the Liquid Burner Operation Procedure. The gas detection system was installed at WP-1 and regularly checked by the operator. The alarm was monitored by the control room. The CCTV was already installed at the burner area and monitored by the control room.

7.3 Environmental Monitoring Result

The results of environmental impact monitoring determined that the project completely complied with the monitoring measures following the EMP report (revised version).

1) Air Quality Monitoring

The Air Quality at ZPQ was monitored through combustion sources of flare system. The air quality was recorded daily by metering systems at the control room. The volume of diesel from production and vessel transportation was recorded, and the Greenhouse Gas (GHG) emissions were summarized yearly by PTTEPI.

2) Noise Monitoring

Noise contour measurements were conducted by STS Green Co., Ltd. at ZPQ and ZWP1 during March 1-3, 2019. All results were plotted as noise contour map covering all work areas in ZPQ including Lower Deck, Main Deck, Upper Deck, Cooler Deck, Sea Deck (East Side), and Sea Deck (West Side) and ZWP1 including Lower Deck and Upper Deck, and the noise contour maps were installed on each location along with warning signs to wear ear earmuff/earplug in high noise area. For the next survey, the noise contour survey will be revisited every 5 years in 2024 or when there is a significant change of operation.

Noise dose measurements in terms of equivalent noise level (Time Weight Average, TWA) were conducted during October 6-10, 2022, in total 16 employees, and all results complied with Occupational Safety and Health Administration OSHA Standard (not exceed 90 dB(A)).

Noise level measurements were conducted during October 7-10, 2022. All area of $L_{eq\ 12\ hrs}$ results were complied with Ministerial Regulations on the Standard, Administration, Management and Implementation of Safety, Occupational Health, and Working Environment in Relation to Heat, Light and Noise B.E. 2559 (not exceed 115 dB(A)).

3) Seawater Quality Monitoring

The Seawater Quality Monitoring was specified in the monitoring measures for the project during production operations phases which the project must monitor every 3 years after the EMP report was approved. The EMP report was replied to on 13th October 2022 according to letter no. MD-(100) 3/6 (1390) 2022 from MOGE as shown in Appendix A. However, the seawater quality monitoring will be conducted within 2023 and reported in the next reports.

4) Sediment Quality Monitoring

The Sediment Quality Monitoring was specified in the monitoring measures for the project during production operations phases which the project must monitor every 3 years after the EMP report was approved. The EMP report was replied to on 13th October 2022 according to letter no. MD-(100) 3/6 (1390) 2022 from MOGE as shown in Appendix A. However, the sediment quality monitoring will be conducted within 2023 and will be reported in the next reports.

5) Produced Water Monitoring

Produced water monitoring at ZPQ was conducted from wastewater treatment system discharged point during February to July 2023. The result found that oil and grease complied with National Environmental Quality (Emission) Guidelines.

6) Produced Sand Monitoring

The Produced sand volume was monitored and recorded daily by control room, and there is no discharge produced sand from the ZPQ project. The produce sand was collected in the container and sent to dispose at onshore by DOWA, the license waste management service in Myanmar.

7) Sewage Monitoring

Sewage was collected to treat at treatment system and monitored to control all parameters as requirements of MARPOL 73 / 78 and Myanmar's NEQG. Sewage monitoring was conducted by REM-UAE Laboratory and Consultant Company Limited in July 2023 from sewage treatment system discharge point at ZPQ. The result found that almost all parameters complied with MARPOL73/78 as specified in National Environmental Quality (Emission) Guidelines except the pH. However, PTTEPI was continually monitored onboard sewage in August 2023, and found that pH was complied with MARPOL73/78, and PTTEPI will continually monitor sewage, as specified in the measure for surveillance of environmental impact from project operation.