

Environmental Management System of Petroleum Industries: A case study of Oil and Gas Exploration in the Zamrud Field Conservation Areas

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ABSTRACT

Background: The Zamrud Field is one of the oil fields managed by Caltex Pacific Indonesia (CPI) a production sharing contractor of Pertamina. It is located in the Coastal Plain and Pekanbaru (CPP) Block. The government of Indonesia has designated Zamrud as a conservation area. The petroleum industry in Zamrud fields has received 14001 ISO Certificate on Environmental Management System. The production sharing contract between CPI and the Government of Indonesia expired in August 2002

Methods: This case study describes how CPI managed the development of oil and gas production and compared to the environmental management system for petroleum industries that should be taken in the Zamrud conservation areas.

Results: A number of specific measures were employed by CPI to protect this sensitive area including a green seismic project, zero-discharge drilling, water management, preservation of nature and regular monitoring and impact assessment. There are two important points that should be in consideration for the environmental management system by CPI in the Zamrud areas, including top soil utilization to maintain biological and nutrients quality and re-vegetation in all areas of significant disturbances.

Conclusion: oil and gas exploration and production in conservation areas has to be managed through high commitment to good environmental and social practices.

Key words : Environmental Management System (EMS), Petroleum Industries, Zamrud Field

INTRODUCTION

The Zamrud field is located within a conservation area of 28,000 hectares in the eastern part of Sumatra in Riau province. The 3,400-hectares of Zamrud Field is in a lowland coastal and rain forest area. There are two pristine lakes and a large portion of the Zamrud oil reserves is found under the lakes at a depth of about 3,000 feet. The Field was discovered in 1975 and began to produce in 1982. This oil field was managed by Caltex Pacific Indonesia, a production sharing contractor of Pertamina. Current production from the Zamrud field is about 23,000 barrels oil per day and 250,000 barrels of water per day.

The CPI initiate that the area should be regarded as a conservation area and was supported by the government of Indonesia who declared the Zamrud Field as an official conservation area. This decision has many consequences in developing and managing the oil and gas production of the Zamrud fields.

METHOD:

This case study describes how CPI managed the development of oil and gas production and compared to the environmental management system for petroleum industries that should be taken in the Zamrud conservation areas.

RESULTS.

ENVIRONMENTAL IMPACT

The potential environmental impact results from land clearing (associated with seismic surveying and construction) and from waste production (associated with all areas of operation). This direct impact also has consequences in giving disturbances and impacting the local community. The impact of mining operation under petroleum tenures includes:

Physical:

- Significant land disturbances.
- Erosion, subsidence, instability.
- Alteration of water courses.
- Effects on quality, quantity and availability of surface water or ground water.
- Salination of water and land.
- Acid drainage.
- Heavy metal contamination.

Ecological:

- Direct impacts on vegetation through clearing & construction.
- Loss of habitat.
- Loss of biodiversity on rare or endangered flora and fauna.
- Potential for spreading plant diseases.
- Impact of toxic or hazardous materials.

Land Use:

- Major changes of land use.

Social:

- Large influx of population to area
- Potential effects on the health, safety, quality of life of individuals or workers and communities through effects of traffic, odor, noise, gas, air pollution.

ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

The environment has been a major issue for mining companies for many years. Many companies have realised that to achieve the best results it is necessary to include environmental programs in the company strategy; and to integrate environmental management into site and project operation ^(1,2,3). One of the tools use is the environmental management system (EMS) The suggestions in this document are based on International and British Standards (ISO 14000 and BS 7750). Briefly, an EMS is a structured approach to managing an environmental program.

The EMS adopts the three-part strategy used in others quality systems:

- performance review.
- setting targets and objectives.
- the implementation plan.

Based on this environmental management systems, These potential impacts to the environment have been managed by the CPI through:

- application of advanced and efficient technologies
- innovative management practice
- initiatives management, such as 'green' seismic surveying, zero discharge drilling and zero produced water discharge, regular monitoring and assessments, and community involvement programs.

Green Seismic Operation

The Government of Indonesia (GOI) declared two restricted areas within the Zamrud Field. One is a large conservation zone when the destruction or harvesting the flora is prohibited and the second is a smaller area, within the larger zone, where the disturbance of flora and fauna is also prohibited. These areas were off limits to seismic activity. In 1995, CPI carried out a 3-D seismic survey to obtain better reservoir characterization in a non destructive manner. The potential objections included: tree felling, illegal logging, oil spill/pollution, waste disposal, and land clearing. Careful measures were taken to avoid the pollution risk:

- refueling boats, using electrical generators and air gun operation. Only kerosene engines were allowed in the lake area,

because of its lower flashpoint than traditional gasoline system.

- Access trail to jungle and lakes were limited to slanted and to hard-to- identify trails.
- Slant line cutting methods was used to prevent erosion
- No open fire were permitted in the conservation areas.
- All waste were transported to the company's disposal facility outside the conservation areas.
- GPS based station was put on temporary wooden platform in the lake, so that no base station land clearing was required.

Zero-discharge Drilling

A zero-discharge mud system was used to ensure no drilling solids or fluids were discharged into the environment. The system includes:

- All drill cuttings was collected in containers and treated in Centralized Mud Treatment Facility (CMTF) outside the conservation area.
- Re-use the mud system from well to well.
- Cement and rig wash were transported to an off site dump.
- Steel tanks were used to catch fluids and solids to reduce the surface well- site size needed to accommodate the rig
- 500 barrel tanks was places outside the location to back up flood of the road to outside area.

Fluid Management

Production fluid from the Zamrud was carefully managed and all fluids were flowed through a 24 inch production line to the Zamrud Gathering Station located about 25 kilometers from the Zamrud Field and outside of the conservation area. The gas was separate and passed to the flare stack. The oil and water were separated through two wash tank units and the oil then flowed to the shipping tank. Produced water was treated at the Water Cleaning Plant facility and no formation of water was discharged to the environment.

Environmental Impact Assessments (EIA) and Measures

The EIA and measures implemented in Zamrud Field involving:

- Ambient air quality (associated gas handling by flare stack).
- Liquid wastes (produced water management and drilling mud/cutting treatment).
- Shallow ground water (cased hole methods for injectors and producers)
- Canal construction and management.
- Baffle installation at the canal to control water levels.

Environmental Management

- Vegetation considerations (minimized land clearing by directional drilling).
- Wild-life animal considerations (drilling wells in sparsely populated wild-life areas).
- Aquatic biota considerations (well drilling with a minimum 200 meters from the lake side).

The environmental management system in Zamrud Field seems in line with Environmental Management Policy for activities under petroleum tenure^(4,5,6) :

- The Environmental Protection Act 1994 (EP act)
- The Petroleum Act 1923 (P act) :
Regulates the search for and the production and transport of petroleum and natural gas
- The Petroleum (Submerged Lands) Act 1982 for the exploration for and exploitation of the petroleum resources of certain submerged lands adjacent to the coast.

Based on the Code of Environmental Practice (1991) by the Australian Petroleum Exploration Association Limited (APEA)

Code of Practice (Environmental Management for onshore Petroleum Tenures), the Environmental Management System taken by CPI has 3 points that was in line with the Code of Practice of APEA 91, including ⁽⁷⁾:

Land Management

1. Disturbance was kept to a minimum necessary to conduct activities and significant disturbance did not exceed 500 m² at any one location.
2. Erosion prevention:
 - Diversion banks was constructed across line tracks.
 - Blade spillage windrows construction on the contour when reshaping areas of disturbances.
 - Pits and sumps were backfilled upon completion use.

Waste management, such as collection and disposal waste at the disposal site. However, there is still a question about is it true that all potential impacts to the environment could be managed in line with the company's 'Vision, Mission and Values'? There are two important points that should be in consideration in the environmental management system by CPI in the Zamrud areas, including :

- Top soil utilization (maintain biological and nutrients quality)
- Re-vegetation in all areas of significant disturbances (re-vegetation of the top soil to all disturbed areas)

CONCLUSION

Oil and gas exploration and production conservation areas has to be managed through high commitment to good environmental and social practices. The key to ensure preservation of the environment is the integration of environmental and social consideration throughout the project cycle in each phase of oil field development from planning, organizational commitment, corporate environmental policy, EIA, community involvement, performance indicators, environmental management program, documentation and record, operational and emergency procedures, reporting and evaluation, environmental audits, emission and performance monitoring and measurements through remediation or abandonment.

Early assessment of the potential environmental and social impacts of a proposed project is very important to minimized the potential risk to the environment. Monitoring of the ecological impacts must become a fundamental part of industrial planning .

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