



# Offshore M9 East Appraisal/Exploration Drilling

REPORT

**ENVIRONMENTAL IMPACT ASSESSMENT**

**Artelia Myanmar/Artelia Eau & Environnement**

**RSE International Department**

N°10, Za Bu Rit street, 4th floor, Kyun Taw South Ward,  
Sanchaung Township, Yangon.

MYANMAR

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# QUALITY SHEET

<i>Project description</i>	
<b>Project name</b>	<b>Offshore M9 East Appraisal/Exploration Drilling in Block M9</b>
<b>Project N°</b>	<b>8512408</b>
<b>Client</b>	<b>PTTEPI</b>
<b>Project location</b>	<b>The Republic of the Union of Myanmar</b>
<b>Document type</b>	<b>Report</b>
<b>Document name</b>	<b>8512408_PTTEP-EIA-Drilling campaign BM9</b>

<i>Study performed by Artelia Eau &amp; Environment</i>			
	<b>Name</b>	<b>Date</b>	<b>Visa</b>
<b>Author 1</b>	<b>SHWUNN LAK YADANAR SOE</b>	<b>17/09/2019</b>	
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<b>Reviewed &amp; Approved by</b>	<b>Philip BUTLER / Charles BOUHELIER</b>	<b>06/09/2019</b>	

<i>List of revision</i>			
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<b>2</b>	<b>1</b>	<b>20/12/2017</b>	<b>Draft report</b>
<b>3</b>	<b>2</b>	<b>15/01/2018</b>	<b>Final draft report</b>
<b>4</b>	<b>3</b>	<b>30/01/2018</b>	<b>Final report</b>
<b>5</b>	<b>4</b>	<b>12/10/2018</b>	<b>Final report</b>
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<b>7</b>	<b>6</b>	<b>word/pdf</b>	<b>PTTEPI</b>

**ARTELIA Eau & Environnement**  
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**REPUBLIC OF THE UNION OF MYANMAR**  
**MINISTRY OF NATURAL RESOURCES AND ENVIRONMENTAL**  
**CONSERVATION**  
**ENVIRONMENTAL CONSERVATION DEPARTMENT**

**SUBMISSION FORM OF**  
**ENVIRONMENTAL IMPACT ASSESSMENT REPORT AND**  
**ENVIRONMENTAL MANAGEMENT PLAN**

This is the official submission form of an Environmental Impact Assessment (EIA) Report together with an Environmental Management Plan (EMP) under *Environmental Impact Assessment Procedure Notification No.616/2015*. This form shall be completed in its entirety and submitted to the Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation, along with all required EIA and EMP Report.

**Project Proponent Information**

Proponent Name:	<b>PTTEP International Limited</b>	Company Registration Number by DICA (if any):	<b>84 FC</b>
Contact name of Proponent:	<b>Hsu Myat Maw</b>		
Proponent's address for correspondence:	<b>Vantage Tower, 623 Pyay Road, Kamayut Township, Yangon, Republic of the Union of Myanmar</b>		
Telephone (fixed/mobile):	<b>09784443327</b>	Fax:	<b>01 661814</b>
		Email address:	<a href="mailto:hsumyatm@pttep.com">hsumyatm@pttep.com</a>

**Project Information**

Project Title	<b>Offshore Block M9 East Appraisal/Exploration Drilling</b>
Project Location (Address)	<b>Offshore Block M9, Gulf of Martaban, Andaman Sea</b>

**Report type**

<input type="checkbox"/> New report	<input checked="" type="checkbox"/> Revised report	Date of submission (dd/mm/yyyy)
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**Check list of necessary contents for EIA report**

The EIA Report shall contain the following information (see also Article 63 of EIA Procedure)

<input checked="" type="checkbox"/> a) Executive Summary
<input checked="" type="checkbox"/> b) Introduction
<input checked="" type="checkbox"/> c) Policy, Legal and Institutional Framework
<input checked="" type="checkbox"/> d) Description of the Project and Alternatives Selection
<input checked="" type="checkbox"/> e) Description of the Surrounding Environment
<input checked="" type="checkbox"/> f) Impact and Risk Assessment and Mitigation Measures
<input checked="" type="checkbox"/> g) Cumulative Impact Assessment (If applicable)
<input checked="" type="checkbox"/> h) Environmental Management Plan
<input checked="" type="checkbox"/> i) Public Consultation and Disclosure
<input checked="" type="checkbox"/> j) Conclusion and recommendations

**Check list of necessary contents for EMP**

The EMP, prepared as an all-inclusive or a standalone document, shall contain the following information (see also Article 2s to t), and Article 63 – 8.0 of EIA Procedure No.616/2015)

<input checked="" type="checkbox"/> a) Executive Summary (if separate volume)
<input checked="" type="checkbox"/> b) Project Description (if separate volume)
<input checked="" type="checkbox"/> c) Health Policies and Commitments, legal requirements and institutional arrangements(if separate volume)
<input checked="" type="checkbox"/> d) Summary of impacts and mitigation measures (if separate volume)
<input checked="" type="checkbox"/> e) Overall budget for implementation on the EMP
<input checked="" type="checkbox"/> f) Management and Monitoring Sub-Plans for each identified impact
<input checked="" type="checkbox"/> g) Contents of each sub-plan

### Proposed measure for information disclosure of the report

The EIA report shall be disclosed to civil society not later than 15 days after submission (in accordance with Article 65 of EIA Procedure Notification No.616/2015)

Duration/date of disclosure	Methodology (Public meeting, WEB, newspaper and so on)	Accessible place (Address, URL of web site, and so on)	Type of documents to be disclosed
25.7.2017 - 29.8.2017	1 <sup>st</sup> Public meeting	Township and village level Public Consultation	Scoping Report
Nov 2017	PTTEPI Website	<a href="https://www.pttep.com/en/Sustainabledevelopment/Business/Capitalprojectmanagement.aspx">https://www.pttep.com/en/Sustainabledevelopment/Business/Capitalprojectmanagement.aspx</a>	Scoping Report
Nov 2017	Newspaper	The Mirror / Global New Light of Myanmar	Scoping Report
24.10.2017 - 30.10.2017	2 <sup>nd</sup> Public meeting	Township and village level Public Consultation	EIA Report
3.2.2018	PTTEPI Website	<a href="https://www.pttep.com/en/Sustainabledevelopment/Business/Capitalprojectmanagement.aspx">https://www.pttep.com/en/Sustainabledevelopment/Business/Capitalprojectmanagement.aspx</a>	EIA Report
3.2.2018	Newspaper	The Mirror / Global New Light of Myanmar	EIA Report
17.6.2019	Newspaper	Daily Eleven/ Global New Light of Myanmar	EIA Report

### Signature (Representative of the project proponent)

I, the undersigned Proponent (or representative, there of), hereby state that the information provided in/with the application and the report ensure;

- a) the accuracy and completeness of the EIA and the EMP report;
- b) that the EIA and the EMP report have been prepared in strict compliance with applicable laws including EIA Procedure Notification No. 616/2015 and with the TOR for the EIA; and
- c) that the Project will at all times comply fully with the commitments, mitigation measures, and plans in the EIA and EMP Report.

Signature:



Date of submission:  
(dd/mm/yyyy)

Name:

Hsu Myat Maw

#### FOR OFFICE USE ONLY

Date received:

Project Identification Number:

The proponent submitted the reports with the forms of;  Paper copy  Digital copy

Recorded by:

Additional comments, notes or recommendations (attached if necessary):

PTTEPI 13253/01-2540/2019

(SSHE Department)

Tel. +95 1 652700

28<sup>th</sup> August 2019

**DIRECTOR GENERAL**

Environmental Conservation Department

Office No. (53)

Ottathiri Township

Nay Pyi Taw, Myanmar

**Subject: Commitment letter for EIA Report M9 East Appraisal and Exploration Drilling Campaign in Offshore Block M9**

Dear Sir,

We refer to the EIA report of M9 East Appraisal and Exploration Drilling Campaign, which was prepared and finalized by Artelia Myanmar and Artelia Eau & Environment in accordance with the Environmental Conservation Law, Rule and EIA Procedures under the instructions of Ministry of Natural Resources and Environmental Conservation (MONREC).

Intending to be legally bounded hereby and financially liable to the Ministry of Natural Resources and Environmental Conservation hereunder, we:

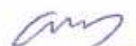
Endorse and confirm to Environmental Conservation Department;

- a) The EIA Report is accurate, consolidated and complete
- b) The EIA has been conducted in accordance with the relevant laws, including the EIA Procedure (2015)
- c) The Project will fully follow the commitments, mitigation measure and plans set out in this EIA Report

Sincerely yours,



*for* **Piya Sukhumpanumet**  
General Manager  
PTTEP International Limited (Yangon Branch)



Cc:

Deputy Managing Director

Director (Offshore)

Director (Admin.)

Director (Planning)

PMP, PMC, EMW, PMP/H, PMC/P, EMW/D

PMM/L, PMM/A, PMM/S

Myanma Oil and Gas Enterprise

Myanma Oil and Gas Enterprise

Myanma Oil and Gas Enterprise

Myanma Oil and Gas Enterprise


PTTEPI

Combined Comments and Suggestions of submitted EIA report for Exploration Drilling at Block M-9

No.	Findings	Revised information	Comments & Suggestions	Response
<b>(1)</b>	<b>Commitment</b>			
(a)	<p>In the report, it is found that there is no commitment for “<b>mitigation measures, commitments and management plan</b>” and no promise to prove the environmental &amp; social assessment are complete and comprehensive. It is found that there is no description about “Commitment letter” either. To include “Commitment Letter” for</p> <ol style="list-style-type: none"> <li>1. This environmental assessment is accuracy and perfect</li> <li>2. To promise that this EIA was carried out with respect to the EIA procedures, related laws/ regulations and developed according to EIA report requirements.</li> <li>3. To promise that the project will always completely comply the mentioned commitments, measures and plan.</li> </ol>	<p>Page 40, Chapter 3.3, Section 3.3.1 and 3.3.2 only commitment statement was described, but there is no commitment letter as refer in Appendix 3. and in Appendix 6. only title was described. Therefore, there is no commitment letter in the report as described.</p>	<p>??? To check with Ma Hnin for the content that is not relevant</p> <p>According to Article 62 of EIA Procedure, Project proponent need to include Commitment list in the EIA report.</p>	<p>In EIA Procedure, only mentioned to include commitment statement. PTTEPI included commitment letter in the EIA report.</p>
(b)	<p>There is no “list” of commitments for each chapter. To include “list of commitments” for each chapter in both Myanmar and English version.</p>	<p>Revised report not included “list of commitments”.</p>	<p>To include “list of commitments” for each chapter in both Myanmar and English version.</p>	<p>In Executive Summary, 1.7.2 is the commitment for all the mitigation measure that also provide with responsible person. In EIA Procedure, there is no specific requirement to provide commitment list.</p>



(2)	Executive Summary			
(a)	<p>In page 37, section (1.3.1): It is said that the project will start on 3<sup>rd</sup> and 4<sup>th</sup> of 2018 for 12 wells and finish on 3<sup>rd</sup> and 4<sup>th</sup> of 2019. Since the duration only for drilling 12 wells is 360 days, it is found that, that time schedule (total 360 days) could not be sufficient for testing, abandoning and moving to another well location.</p>	<p>Revised report Executive summary (1.3.1) and Project Description Section (4.3) described project schedule, however, which is not clear and not the updated schedule.</p>	<p>To provide clear and detail update schedule</p>	<p>Update in revised report.</p>
(b)	<p>In the report, fig 17, 25, 27: block maps are not clear at describing nearest islands, distances from coastal lines, project location. In order to know the exact location of the project, to include maps; describing project location, distances from shoreline, nearest islands, protected areas.</p>		<p>The quality of the maps result low due to the resolution issue while converting the document to pdf. However, some of the map are updated for clearer review. (for instance figure 1, 16, 17, 23, 26, 39, 41 etc)  (page 10, 86, 98, 105, 151, 161, etc)</p>	
(c)	<p>In page 45, section 1.4.2.7, It is found that the project locate far from Mainmahla island 170 km from nearest well site, Thameehla and Moscow island: 128km and 167km respectively. Also stating that the impacts will not damage RAMSAR sites, wildlife bird conservation areas.</p> <p>In order to know whether the impact is existed or not, to include maps with distances between the project and nearest island, protected areas.</p>	<p>Revised EIA report included Figure 1 as per comment.</p>	<p>No specific additional comment.</p>	<p>-</p>

(d)	In executive summary, page 35 to 68: alternative selection: regarding drilling fluids and cuttings, there is few information about that the project will use low toxicity WBM and biodegradable SBM, but not include detail information/description. In proposed project, to precisely and comprehensively describe which drilling fluid will be used how the cuttings will be managed and the reason of selecting them.	The synopsis information for executive summary is updated in section 1.3.2. (page 5)	No specific additional comment.	-
<b>(3)</b>	<b>Introduction</b>			
(a)	Page 70, Section 2.2 of EIA report described some company information, however Responsible person and contact details not provided. Therefore, responsible person and contact details need to provide in the EIA report.	Revised report Section 1.3, 2.2 and Chapter 4, Table 1 and Table 2 included 10 PTTEPI's key responsible person. However, only one key responsible person need to include in the EIA report.	To revise	One responsible person provided as comment.
(b)	In page 71, section 2.3: There is no description for local and international experts' expertise area and role of responsibilities on the project. And there is no information for contact/address of the responsible person from third party. To include all the information of expertise and responsibilities of third-party consultants' for the proposed projects. To indicate the "study component, expertise area, educational degrees, experiences" of consultants and to mention which consultant is expert at which field and taking which kind of responsibility for this project.	Despite, further information of consultants and their roles are updated in section 2.3 (page 3-7), however, document from ECD for those specialist also need to add in the EIA repot.	To revise	<p>Consultant information send to ECD on 1<sup>st</sup> September 2017 and ECD approved on 14 November 2017 with no objection to undertake EIA study.</p> <div style="text-align: center;">  <p>ARTELIA - Certificate for Consultant Regi:</p> </div>
<b>(4)</b>	<b>Policy Legal and Institutional Framework</b>			

(a)	<p>In page 75, table 11: to make addition of existing and enact laws/ sections and to include “commitment” for those law. The following existing laws are for addition: (to be advised by legal expert form Office of the Attorney General)</p> <ol style="list-style-type: none"> <li>1. The protection of rights of National Races Law (2015) (section 5)</li> <li>2. The settlement of Labour dispute Law 2012 (section 38/39/40/51)</li> <li>3. The employment and skill development law 2013(section 5/14/30 a,b)</li> <li>4. Protection and Preservation of Ancient Antiquities Law 2015 (section 12)</li> <li>5. The Protection and Preservation of Ancient Monument Law (2015) (section 12/15/20)</li> <li>6. The Protection and Preservation of Cultural Heritage Regions Law, 1998 (section 13/22)</li> <li>7. Myanmar Insurance law 1993 (section 15/16)</li> <li>8. Myanmar Engineering Council law 2013 (section 20+24+25 / 37/31 a)</li> <li>9. Union of Myanmar Marine Fisheries Law (25 April 1990, amended 1993) (section 40)</li> <li>10. Inland Navigation Law, 2015</li> <li>11. Myanmar territorial sea and maritime zone law 1977 (section 18.d)</li> <li>12. Fresh Water Fisheries Law 1991 (section 40)</li> <li>13. The protection and Prevention of Cultural Heritage Area 2015 (section 20/23/29.b)</li> </ol>	Laws are updated in section 3.2.2 revised EIA report.	No specific additional comment.	-
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	<p>14. Employment and skill development law, 2013</p> <p>15. Conservation of Rivers, Creeks and Water Resources Law 2006 (section 24.b/21.a,b/19/11.a,b)</p> <ul style="list-style-type: none"> <li>- To not describe laws which are repealed.</li> <li>- To include related “international convention and regional agreements” and highlight the important/ main article</li> <li>- To not copy the “Objective of the Law”</li> <li>- To read the “laws and regulations” thoroughly and make “the commitment” clearly for project owner.</li> <li>- The enactment years must correct and update</li> <li>- To laws include legal commitment by mentioning the sections from the laws. Must know the project nature and must include related/required laws.</li> <li>- To inform the related authorities and archeology department immediately, if discovered ancient heritage material.</li> </ul>			
<b>(5)</b>	<b>Description of surrounding environment</b>			
(a)	<p>Although there is description about recently finished baseline survey, but there is no detail info for survey area (which is related to drilling operation), baseline data. For example: there is several times of writing “in ERM report 2018” but there is no data about survey area, data and To include a map of environmental baseline survey area by linking with the well operation.</p>	<p>Information in section 5.2 Physical Environment, section 5.2.4 Marine Sediments and section 5.3.1 Marine Biological Environment updated in revised EIA report.</p>	<p>No specific additional comment.</p>	<p>-</p>

	It is expected to have some same information for M9 and M11, but it should not be the same and to describe separate baseline data and information for M9, (Must different form M11 and if the information are same, to give explanation clearly)			
(b)	<p>In report, page 150, section 5.2.6: Vulnerability to natural disaster: It is found that the block M9 has potential to expose tropical storms (according to OCHA, 2013) during May to November. To describe the possibility of impacts to the project by cyclone hazard and the level for cyclone hazard.</p> <p>To include Natural Disaster management Plan and related information for management plans.</p>	The information is updated in section 8.9.6 Emergency and Crisis Management Plan of revised EIA report.	No specific additional comment.	-
(c)	<p>In report, page 151, section 5.3.1: Marine Biological Environment: the drilling will be within the water depth of 50 to 800 m, and in page 106, table 16: the water depth for 12 wells is between 100 and 152 m. So, it is found that the drilling operation for all wells is within epipelagic zone. And then, there is no description about the distances between nearest India islands (example, the biodiversity data for Narcodam island). To mention the distances between nearest India islands.</p> <p>What are the management plan for impacts on crossing maritime borders?</p> <p>To clearly describe the biodiversity data of nearest island with Map.</p> <p>To describe how to plan/ manage for the marine biodiversity within epipelagic zone.</p>	The information in section 5.5.7 Marine Transportation, section 5.3.2.1 Geographical and Ecological Description, section 6.3.3.2 Discharges from Drilling, Section 6.3.5 Impacts from Noise and Light, section 6.3.6 Hazardous and Non-Hazardous waste and section 6.6.2 Offshore Biological Environment and Mitigation Measure Table updated in revised EIA report.	No specific additional comment.	-

(d)	<p>In report, page 151, section 5.5: Socio Economic Environment: The basic information described in M9 are same with that of M11 report. Although it is expected to have some similar description for M9 and M11, there is no separate data/ information for M11 project area. To identify and include individual baseline information for M9.</p>	<p>Socio Economic Environment information are updated in section 5.5 of revised EIA report.</p>	<p>No specific additional comment.</p>	<p>-</p>
(e)	<p>In section 5, it is found that the baseline survey was conducted for block M9 in 2018, February/ the primary data collection was conducted for seawater quality, sediment quality and benthic community. Moreover, another complicated information is that there is a study by ERM-Siam Co,ltd for seabed sediment quality, macrobenthos communities, water quality, plankton communities. To state clearly for all baseline survey data conducted, year by years.</p>	<p>Physical and Biological Environment information are updated in section 5.2 and 5.3 of revised EIA report.</p>	<p>No specific additional comment.</p>	<p>-</p>
(f)	<p>In page 45, it is found that there are about 20 different bird species in Myanmar water according to IUCN and among them, 6 species are possibly occurred in block M9: 4 are least concern while 2 as near threaten.</p> <p>But in pageies 175, table 35 (Sensitive components of the environment): it is described as “<b>A total of threatened 20 seabird species are currently identified by the IUCN in Myanmar waters. Amongst these spec, 4 species are identified as near threatened and 16 species are recorded as least concern. Taking into account the typical habitat of these seabirds, seven species could potentially occur within the project area</b>”. Thus,</p>	<p>Bird species name are mentioned in section 1.4.2.6 and 5.3.1.7 in revised report.</p>	<p>No specific additional comment.</p>	<p>-</p>

	<p>there is differences in numbers and there is no description for the name of those six near threaten species</p> <p>And the information are also same with M11, and to describe clearly.</p>			
(g)	<p>In page (172), Section (5.5.7), Marine Transportation Figure, it is found that the project is located within the main shipping lane from Yangon heading to the Straits of Malacca in the south and there is potential for tanker routes to be established near the project area. Since there is potential tanker route in future, it must include the manage plan to prevent environmental impacts for project facilities due to travelling of tankers.</p>	<p>The clear map showing international shipping lane and project area is updated in section 5.5.7 of revising report</p>	<p>No specific additional comment.</p>	-
<b>(6)</b>	<b>Project Description and Alternative Selection</b>			
(a)	<p>In page 4, section 1.3.1.3/1.3.2/4.7.1, it is found that there is flaring plan. To include comprehensive mitigation measure and numbers of flaring since the proposed 12 wells will use flaring method.</p>	<p>The information included in executive summary section 1.3.1.2 of revised EIA report.</p>	<p>To described in revised EIA report that Well Testing and Flaring will not be conducted.</p> <p>No specific additional comment.</p>	<p>Well testing phase will not be included in this campaign and explanation is introduced in (page 5)</p>
(b)	<p>It is found that there is no information for “cementing chemicals” which will be used for the project. To include list of cementing chemicals and their amounts</p>	<p>The comprehensive information about the list of cementing chemicals is already included in section 4.4.2.4, Drilling Fluid (Mud &amp; Cutting)</p>	<p>No specific additional comment.</p>	-
(c)	<p>In page 39, it is found that the produced water will be generate but there is no information regarding the amount of produced water and no comparison with EQEG guidelines. In EQEG guideline, there is</p>	<p>Revised report mentioned that this campaign not related to Produced Water and Sand.</p>	<p>To follow according EQEG Guideline</p>	<p>PTTEP will follow EQEG Guideline</p>

	<p>guideline “<b>Re-inject, discharge to sea maximum one day oil and grease discharge should not exceed 42 mg/l; 30 days average should not exceed 29 mg/l</b>”. Thus, it must describe the amount is discharging produced water in mg/l, and content of oil and grease in the discharge amount.</p>			
(d)	<p>There is no information about produced sand whether to use “ship to shore” or “discharge overboard” and no comparison with EQEG guidelines.</p> <p>To describe clearly whether to use “ship to shore” or “discharge overboard</p> <p>-if “ship to shore” was carried out, where to dispose and how is the management plan</p> <p>-If “discharge overboard” was carried out, how to reduce oil concentration under 1% and how to dry the produced sand since it is mentioned in EQEG as follow “no discharge to sea except when oil concentration lower than 1% by weight on dry sand”</p> <p>To complete the report with above comments</p>	<p>Revised report mentioned that this campaign not related to Produced Water and Sand.</p>	<p>To follow according EQEG Guideline</p>	<p>PTTEP will follow EQEG Guideline</p>
(e)	<p>In page 257, while meeting with stakeholders in Myeik in PCM, during Q&amp;A session. Although the project proponent answered that the waste will not be disposed in shoreline/ hazardous waste will be send to DOWA (Management company) and food waste will be managed with MARPOL regulations.</p> <p>But in page 41, the project will comply PTTEPI's Waste Management Procedure (WMP) which is to</p>	<p>Revised EIA report included Inventory of wastes discharge and emissions in section 1.3.2, Inventory of Wastes Discharge in section 4.7 and Waste Management Plan in 8.9.2.</p>	<p>To follow according EQEG Guideline</p>	<p>PTTEP will follow EQEG Guideline</p>



	<p>sort out solid and liquid waste onboard and discharge onshore identified area to continue refining, discharging. Apart from that information, there is no comprehensive information for “how * where to manage/dispose the waste generated from those wells since the anticipated amount of waste per well is 2611 kg.</p> <p>To include type and amount of waste/ transportation method/ final discharge point/ management plan</p> <p>To hire waste management private facility if necessary.</p> <p>To describe clearly where and how to store and manage wastes/produced water and amount of waste from drilling wells as the campaign is planned for 12 wells.</p>			
(f)	<p>In section 4.4.1.1, the duration for mobilization of equipment, drilling unit is described as 5 days but there is no description for duration of moving the rig from one location to another. To mention the overall duration of the activities, including the moving the rig from one place to another</p>	<p>Information is updated in section 4.4.1.1 of revised report.</p>	<p>No specific additional comment.</p>	-
(g)	<p>In page 110, section 4.4.1.3, it is found that 156 employees will be working on the rig during all phases; installation, drilling, testing, and abandonment. But no description whether those workers are from the region or other place. To clearly describe the number of workers from the region or other place who will be working for construction and operation phases.</p>	<p>Information is updated in section 4.4.1.3 of revised report</p>	<p>No specific additional comment.</p>	-

(h)	In page 124, section 4.4.2.4.4, table 21 in Mud and cutting quantities, it is found that the amount of cuttings for one well but there is no data for that of all 12 wells. To mention the cumulated amount of cuttings and waste for 12 wells and to describe how to manage them.	The information included in section 4.4.2.4.4. and 4.7.2.1.1 of revised EIA report.	To follow according EQEG Guideline	PTTEP will follow EQEG Guideline
(i)	In page 125, section 4.4.3, it is found that water from well testing phase will be checked and tested before disposing to the sea, but there is no information that the water quality is comply with the quality guideline. To mention the guidelines for disposal of water during well testing phase.	Information is updated in EIA report that well testing and flaring will not be conducted in this campaign	To described in the EIA report that well testing and flaring will not be conducted.	Revised in report
(j)	In page 129, section 4.5.3, it is found that drilling activities will be supplied by 6 generators driven by diesel engines. However, there is no description about storage capacity of fuel storage tank and method for refilling fuel. To include the storage capacity of fuel tank and to describe in detail how to refill the diesel fuel safely (especially for long term drilling plan)	Information for storage capacity of fuel tank is updated in section: 4.5.4 of revised EIA report.	No specific additional comment.	-
(k)	In page 132, section 4.7, it is found that emissions are mentioned only for 30 days drilling and there is no estimate calculation of emission data for testing & abandoning phases. The included emission data are lower than expected. To make correction for emission/ discharge data (more than 360 days period)	The information for emission is updated in mentioned section 4.7 of revised EIA report.	No specific additional comment.	-
(l)	In page 132, section 4.7.6, there is no detail information on management plan for accidental release of oil spill. Since the oil spill is expected as	Spill Contingency Plan in section 8.9.5 and Emergency & Crisis	No specific additional comment.	-

	the most severity impact. To describe plans for most dangerous accidental release/ spill.	Management Plan in section 8.9.6 are updated in revised EIA report.		
(m)	In page 141, section 4.8.7, there is information for cutting dispersion modelling for block M9, but there is no detail information for proposed 12 wells. This EIA must not mean only for one well and the report must cover/ perform assessment for all the impacts. To carry out the modelling for impacts.	Spill Contingency Plan in section 8.9.5 and Emergency & Crisis Management Plan in section 8.9.6 are updated in revised EIA report.	No specific additional comment.	-
(n)	It is found that there is no information for machinery list which will be used for the projects, therefore to include the machinery list for the project such as heavy machinery, support vessel, rig etc).	The information is updated in section 4.5.1 of revised EIA report.	No specific additional comment.	-
(o)	Although the report mentioned that wells are appraisal and exploration, but there is no clear statement for which well is appraisal and which well is exploration. To include the type of well, location of each well and drilling procedure for each well in detail.	The coordinate and depth of each well location is already included in section 4.2.2 "Drilling Activity Area, Table Types Coordinates of the twelve potential wells of revised EIA report.	No specific additional comment.	-
(p)	In page 107 to 108, fig 16, it is found that there are coordinates for proposed well location but there is no data for other oil and gas activities such as existing operation (with water depth) within block M9. To integrate existing operation within block M9 and exact location for all 12 appraisal/exploration well, comprehensively.	The information described in section 4.2.2 Project Description and the in section 7.2 Cumulative Impact of revised EIA report.	No specific additional comment.	-
(q)	It is found that there are potential coordinates for 12 well in page 107, section 4.2.4 therefore need to specify whether all the locations are already identified or not.	The information updated in section 4.2.2 Project Description of revised EIA report.	No specific additional comment.	-

(r)	In page 53, table 3, it is found that there have potential impact for seawater and sediment, and indirect impact for marine ecosystem due to the discharge of wastewater and waste. To describe detail how the mitigation measure is implement/plan for those impacts.	The information updated in section 6 Impact and Risk Assessment of revised EIA report.	No specific additional comment.	-
(s)	In page 108, section 4.4.1.2, it is found that Thaketa shore base will be used as primary shore base for supplying office building, supply tools, etc., therefore to include how is it managed for temporary waste and chemical storage for not to have environmental impact.	The management for storage of waste and chemical is updated in Section 8 EMP chapter of revised EIA report.	No specific additional comment.	-
<b>(7)</b>	<b>Impacts, Risk Assessment and Mitigation Measures</b>			
(a)	In page 13,52,217, it is found that the project will Comply with MARPOL 73/78 Annex IV – prevention of air pollution from ships, and if applicable based on age of vessels (MARPOL Annex VI Chapter 4 – ship energy efficiency management). To explain why “ <b>Annex IV MARPOL 73/8</b> ” is used because “Annex IV of MARPOL 73/8” is for “ <i>Regulation for the Prevention of Pollution by Sewage from Ship</i> ” and, “Annex VI of MARPOL 73/78” is for “ <i>Regulation for the Prevention of Pollution by Air Pollution from Ship</i> ”	The information updated in Section 1.7.2 Mitigation Measure table 8.5 and 8.13 of revised EIA report.	No specific additional comment.	-
(b)	It is found that there is only general (very basic) information of control & mitigation measures for drilling fluids and cuttings and there is no detail management plan for oil on cutting. To include methods and plans for oil on cutting and to include control and mitigation for impacts on water quality due to discharge of cuttings and drilling fluids.	The information updated in section 6.3.3 and 8.13 EMP Chapter and Storage of waste and Chemical of revised EIA report.	No specific additional comment.	-

(c)	<p>In page 191, it is found that the marine mammals will flee due to underwater noise but there is only few information for the behaviors of marine species due to that impact and also there is only few measures to mitigate the impacts.</p> <p>And there is no monitoring plan to watch the mutual communicating behavior of marine mammals after the underwater noise impact.</p> <p>And the report has no description for potential impacts for number of marine mammals due to 18 months drilling duration. To identify the level of impact, mitigation measures and monitoring plan for marine species due to underwater noise and to consider the impacts for 18 months drilling time.</p>	<p>The information updated in section 6.6.3, 6.3.5.3 and 8.13 EMP Chapter of revised EIA report.</p>	<p>No specific additional comment.</p>	<p>-</p>
(d)	<p>In page 195, section 6.3.8.1, there is no separate mitigation measure for potential impacts on small scale and large-scale fishery, (especially to organize public consultation meeting with fishermen and fishery association)</p> <p>And there is no information for discussing of potential impacts on fishery due to 18months drilling activities.</p> <p>To include the information such as: direct informing the fishermen and fishery association about drilling time and location.</p> <p>To include mitigation measure for small boats.</p> <p>And to describe the total impacts for all 12 wells, not mentioning only for one well.</p>	<p>The information updated in section 8.5 Summary of Impact and Mitigation Measures table of revised EIA report.</p>	<p>No specific additional comment.</p>	<p>-</p>

(e)	<p>In page 198, section 6.4, it is found that the assessment for “environmental hazards &amp; risk assessment” is not sufficient.</p> <p>And the description for major spill and the amount of major spill is too general (especially for 18 months drilling)</p> <p>Also in annex 3, the cutting and sediment dispersion is described for only one well. Therefore, to include the updated impact assessment for hazardous spill and to describe the modelling for spillage material.</p>	The information is updated in revised EIA report.	No specific additional comment.	-
(f)	<p>In page 200, section 6.5, although there is information for stimulating suspended sediment and cuttings, but it is not sufficient for impact assessment.</p> <p>And there is no detail discussion for discharge of cuttings and impacts of sediment transport.</p> <p>And the report has no description for distances between one well and another.</p> <p>To combine the findings from the modelling studies in order to know the project impacts.</p> <p>To describe the total area of suspended sediments at the seabed from all 12 wells.</p> <p>And to describe the dumping of sediments at seabed due to that 12 wells.</p>	The information for dispersion modelling is mentioned in section 6.5 of revised EIA report.	No specific additional comment.	-
(g)	In page 208, section 6.6. it is found that the “summary of project’s impacts and mitigation measures” are same for both M9 and M11.	The assessment are performed based on per well condition and the campaign is considered as long	No specific additional comment.	-

	<p>M9 has 12 appraisal/exploration wells and M11 has one well.</p> <p>To revise this section by taking into account all the comments as mentioned since this report is for M9 which has 12 wells.</p>	<p>duration project which is unlikely to be resulted as cumulative impact.</p> <p>The key issue of the project, cutting dispersion is conducted according to ECD comment in order to anticipate the severity of the impact.</p>		
(h)	<p>In page 213, section 7, cumulative impact chapter, it is found that there is no consideration for potential impacts of 12 drilling wells, and weak assessment for simultaneous impacts.</p> <p>There is no map/list of other projects nearby. For example: existing Zawtika project and nearby fishing grounds.</p> <p>There is no information about the existing pipelines and existing fishing gears since the project impact the surrounding environment.</p> <p>To describe the potential impacts of 12 wells.</p> <p>To include maps and to describe detail for impacts of marine mammals' mutual interacting behavior/ impact for increasing of marine traffic and "management plan" for potential accidents.</p>	<p>The information updated in section 7.2 and 7.4 Cumulative Impacts of revised EIA report.</p>	No specific additional comment.	-
(i)	<p>In page 53, table 3, in "key impacts and mitigation measures", there are mostly "Negligible" level for control and mitigation of cumulative impacts; such as (atmospheric emission, air quality, GHG, seawater quality and sediment quality, etc.). To provide impact calculation, impact level and methodology.</p>	<p>The information provided in section 6.3.1 of revised EIA report.</p>	No specific additional comment.	-

(j)	<p>At section 1.3.2, page 40, it is mentioned that operations of engines, other machineries, vessels, chopper during drilling operation which will generate CO<sub>2</sub>. Duration of 12 drilling wells will take 360 days, 30 days at each well. One well will generate 5836.74 kg-tonnes of CO<sub>2</sub> which will make a total of 70040.83 kg-tonnes of CO<sub>2</sub> during 360 days.</p> <p>At section 1.5.1, page 46, the generation of GHG in this project will be less impact on air quality than the projects like Floating production storage and offloading (FPSO) since the proposed project will be short term, the generation of GHG will not have impacts on air quality in the long term. Since it is mentioned that duration of 12 drilling wells will take 360 days, 30 days at each well. One well will generate 5836.74 kg-tonnes of CO<sub>2</sub> which will make a total of 70040.83 kg-tonnes of CO<sub>2</sub> during 360 days, it is required to include the detailed plan for the generation of GHG for future drilling operation projects.</p>	The information provided in section 6.3.1 of revised EIA report.	No specific additional comment.	-
(k)	<p>At tables 3, 4 and 5 on page from 53 to 64, regarding the impacts, it is mentioned that mitigation measures in those tables will follow MARPOL 73/78. It is found that it does not mention the reason for using Annex in MARPOL 73/ 78. It is required to mention in detail regarding the reason for using Annex in MARPOL 73/ 78 for impacts and mitigation measures.</p>	Information is updated in section 3.2.4 of revised EIA report.	No specific additional comment.	-
(l)	<p>On page 4, during drilling operation, general waste generation will be approximately of 1,887 kg, non-hazardous 184 kg, recyclable waste with 5</p>	The Waste Management Plan is updated in 8.9.2 of revised EIA report.	No specific additional comment.	-



	containers, 70 kg of chemical containers, hazardous waste 470 kg which makes a total of 2611 kg approximately. It is found that hazardous wastes will be disposed at Dowa in Thilawa. Since approximate 50.7 tonnes of hazardous waste will be generated, it is required to include the onshore location at which those wastes will be treated and disposed.			
<b>(8)</b>	<b>Environmental Management Plan</b>			
(a)	At chapter 8 on page 215 to 238, it is found that EMP does not meet the requirements in article 63. It is required that EMP in the report meets the requirements in article 63.	The information updated in section 8.9.2 EMP section of revised EIA report.	No specific additional comment.	-
(b)	It is found that the budget is not included for the implementation of the EMP but over 1 million USD per year for mitigation measures and 50,000 USD for monitoring program. It is required to include the budget for the implementation of the EMP.	The information is updated in section 8.6 of revised EIA report.	No specific additional comment.	-
(c)	At chapter 8 in page 217, it is found that there is no monitoring program which includes frequency, scope, methodology, responsible parties and budget for air quality and GHG emission. It is required to draw up monitoring program which includes frequency, scope, methodology, responsible parties and budget for air quality and GHG emission.	The monitoring program is updated in section 8.6 of revised EIA report.	No specific additional comment.	-
(d)	At section 4.5.5.3 on page 131 in the report, it is found the summary of Ballast System. It is required to include Ballast water management plan in order	Ballast Water Management Plan is updated in section 8.9.3 of revised EIA report.	No specific additional comment.	-

	to prevent invasive/ harmful aquatic organisms and pathogens from entering Myanma water borders.			
(e)	At section 1.4.2.4, 1.4.2.5 on page 44 in the report, it is found that dolphins usually the block M9 and three groups of Pantropical Spotted Dolphin ( <i>Stenella attenuate</i> ) were found during marine baseline study by ERM in 2018. It is required to include the plan for catching, hunting, killing and vessel collision for whales, turtle species, dugongs and other rare type of marine species.	The information updated in vessel collision section of revised EIA report.	No specific additional comment.	-
(f)	<p>On page 51, although it is that the following management plans should be implemented in the report, those plans are not included in the environmental management plans and to include those plan.</p> <ul style="list-style-type: none"> <li>• Preventive Maintenance Plan (for optimization and servicing of engines and other equipments)</li> <li>• Chemical Management Plan/ Standard</li> <li>• Waste Management Procedure</li> <li>• Blowout Contingency Plan</li> <li>• Spill Contingency Plan</li> <li>• Emergency Management Plan</li> <li>• Crisis Management Plan</li> <li>• Grievance Mechanism (for handling of complaints by project stakeholders and third parties)</li> <li>• Training and Awareness Programme</li> </ul>	The information updated in section 8.9.2 EMP section of revised EIA report.	No specific additional comment.	-

	Monitoring Plan (through which the efficiency of management and mitigation measures can be verified).			
<b>(9) Public Consultation and Project Disclosure</b>				
(a)	<p>Regarding the public consultation meetings, during <b>scoping stage, 4 meetings</b> were held, which are;</p> <ol style="list-style-type: none"> <li>1. Meeting with Myanmar Fishery Federation by 27 participants on 25<sup>th</sup> July 2017</li> <li>2. Meeting at Dawei with 94 participants on 23<sup>rd</sup> August 2017.</li> <li>3. Meeting at Yay Phyu with 103 participants on 24<sup>th</sup> August 2017</li> <li>4. Meeting at Myeik with 64 participants on 29<sup>th</sup> August 2017</li> </ol> <p>Regarding the public consultation meetings, during <b>EIA stage, 4 meetings</b> were held, which are;</p> <ol style="list-style-type: none"> <li>5. Meeting at Dawei with 69 participants on 26<sup>th</sup> October 2017</li> <li>6. Meeting at Yay Phyu with 100 participants on 27<sup>th</sup> October 2017</li> <li>7. Meeting at Myeik with 49 participants on 31<sup>st</sup> October</li> </ol> <p>Public consultant was conducted 4 times for Scoping and 4 time for EIA and total 8 time. However, some of the meeting attendance is only government authorities with 20 local fishermen and not much PAPs (Project Affected Persons) attending the meeting. Since the participation of PAPs are very few during the meetings, it is</p>	Public consultant was conducted 4 times for Scoping and 4 time for EIA and total 8 time, however only one time for each place for Scoping stage and EIA stage. Therefore, more public consultation should be arranged.	Public consultant was conducted 4 times for Scoping and 4 time for EIA and total 8 time, however only one time for each place for Scoping stage and EIA stage. Therefore, more public consultation should be arranged for enough consultation with PAPs.	PTTEP conducted Public Consultation as required in EIA procedure as 1 time for Scoping Stage and 1 time for EIA stage. In addition, PTTEP have ongoing public consultations for ongoing project such as M9 West Drilling (Scoping Stage conducted on 22 <sup>rd</sup> to 25 <sup>th</sup> May 2018, and EIA Stage on 1 <sup>st</sup> , 2 <sup>nd</sup> and 14 <sup>th</sup> August 2018) and M9 Appraisal Drilling (Scoping Stage conducted on 19 <sup>th</sup> to 23 <sup>rd</sup> August 2019 and EIA Stage conducted on 10 <sup>th</sup> to 13 <sup>th</sup> Mar 2020). Furthermore, additional Public Consultation will be conducted if there is any issue/complaint

	required to conduct more public consultation meetings and include their comments, suggestions and recommendations in the revised report.			from PAPs and or stakeholders.
(b)	It is found that further public consultation meetings are not mentioned in the report since it is important during 1-year project drilling operation. It is also required to upload the EIA report in the website for public disclosure. It is required to include further and/or future public consultation meetings before and during the project.	Revised report mention that additional consultations will be conducted if there are any complaints from Stakeholder before starting and during the project.	To follow according to EIA Procedure	PTTEP will follow.
<b>(10)</b>	<b>General</b>			
(a)	The executive summary should cover project description chapter, regulation chapter, impacts and mitigation measures chapter, public consultation and disclosure and so forth. Thus, the executive summary in the proposed project should be prepared in both English and Burmese Languages by covering each chapter in the EIA report.		No specific additional comment.	-
(b)	At the proposed project, it is required to include more detailed information of fishery business.		No specific additional comment.	-
(c)	It is required to integrate the suggestions and demands of stakeholders into the project by conducting continuous consultations.		No specific additional comment.	-
(d)	Spelling mistakes are identified in the whole report and it is required to revise the report carefully because the information used in M9 are mentioned by stating the information used in M11.		No specific additional comment.	-
(e)	It is required to revise the maps due to low quality and difficult to read the labels.		No specific additional comment.	-

No.	RT members comments	Response	
1	<p><b>Daw Aye Win, Director, Office of Attorney General</b>            To follow the ECD suggestion form no. 1 to 5, 7 and 9</p> <ol style="list-style-type: none"> <li>1. The Protection and Preservation of Cultural Heritage Regions Law 2019 (section 35.d)</li> <li>2. Myanmar Engineering Council Law 2013 (section 30,34)</li> <li>3. Myanmar Territorial Sea and Maritime Zone Law 2017 (section 31.b since MOGE said the project zone can be categorized as special economic zone)</li> <li>4. Environmental Conservation Law 2012 (section 7. ("o"), 14,15,24,29)</li> <li>5. Environmental Conservation Rules 2014 (no. 69)</li> <li>6. EIA procedure (section 102 to 110, 113, 115,117)</li> <li>7. EQES</li> <li>8. Myanmar Investment Law 2016 (section 51, 65 (b to q))</li> <li>9. Myanmar Investment Rules 2017 (no. 202,204,206)</li> <li>10. The Labor Organization Law 2011 (section 17 to 22)</li> <li>11. The Settlement of Labor Dispute Law 2012 (section 38,39,40,51)</li> <li>12. Payment of Wages Law 2016 (section 3,4,5,14, ch.13)</li> <li>13. The Social Security Law 2012 (section 11.a, 15.a, 18.b, 48,75)</li> <li>14. Prevention from Danger of Hazardous Chemical and Associated Material Law 2013 (section 15,16,17,27)</li> <li>15. Myanmar Fire Brigade Law 2015 (section 25)</li> <li>16. 1972 Public Health Law</li> <li>17. 1995 The Prevention and Control of Communicable Diseases Law 9section 3,4,9,11)</li> <li>18. 2006 Control of Smoking and Consumption of Tobacco Product Law (section 9)</li> <li>19. Myanmar Port Authority Law 2015 (section 23.b,c, 19.a,b, 80.a,b)</li> <li>20. Occupational Health and Safety Law 2019</li> <li>21. Law Relating on Oil and Petroleum Product 2017 (section 9.a,c,d, 10.a,b,e,11)</li> </ol>	No specific additional comment.	-
2	<p><b>Dr. Zaw Ye Htut, Staff Officer (Assistant Doctor), Public Health Department</b></p> <ol style="list-style-type: none"> <li>(1) To include Health Impact Assessments (HIA) and Public Health Management Plan (PHMP) in the report.           <ul style="list-style-type: none"> <li>- The HIA and PHMP must cover the surrounding civilians and project workers.</li> </ul> </li> <li>(2) Health Impact Assessments, to assess the health impacts for workers and public based on project phase (positive or negative, direct or indirect, duration, magnitude) and (e.g., air quality, water quality, income, social impact, waste, etc.,)</li> <li>(3) Public Health Management in the report           <ol style="list-style-type: none"> <li>a. In community Health and Safety,               <ul style="list-style-type: none"> <li>- To describe the mitigation measures for the impacts on community health</li> </ul> </li> <li>b. In occupational Health and Safety,               <ul style="list-style-type: none"> <li>- To describe the mitigation measures for the impacts on health impacts for Occupational Health and Safety</li> </ul> </li> </ol> </li> </ol>	No specific additional comment.	-

	<ul style="list-style-type: none"> <li>- To describe health service for the workers (clinic, first aid, emergency referral system &amp; periodic medical examination)</li> <li>- To describe the role and responsibilities of safety office</li> </ul>		
3	<p><b>U Myo Thura, Staff Officer, Environmental Conservation Department, Myeik District</b> Public Consultation Meetings arrangement</p> <ul style="list-style-type: none"> <li>- Suggested to conduct PCMs by inviting representatives of regional government office</li> <li>- To invite parliament, local people, stakeholders including CSO, NGO, nearshore and offshore fisheries association, related government officials and invite them in advance.</li> <li>- And to prepare invitation at least one month in advance.</li> </ul>	No specific additional comment.	-
4	<p><b>U Min Chit Ko, Staff Officer, Ministry of Labor, Employment and Social Security</b></p> <p>(1) There is no reference document described in Page 215, Table 60 as follows;</p> <ul style="list-style-type: none"> <li>- To attach Table 60 reference documents in Annex</li> <li>- To describe the organizational structure for occupational safety and health</li> </ul> <p>(2) There is no description about Labor Welfare Program.</p> <ul style="list-style-type: none"> <li>- To include labor welfare program</li> <li>- To include labor health care program</li> <li>- To include labor physical development plan</li> </ul> <p>(3) To mention the working time, rest time, off-days and holidays for the workers</p>	No specific additional comment.	-
5	<p><b>U Min Maung, Assistance Manager, Department of Marine Administration</b></p> <p>(1) In section 5.2.5: Seawater quality and in section 5.5.7: Marine Transportation Figure, it is found that there is potential tanker route near the project.</p> <ul style="list-style-type: none"> <li>- It is found that there is possible tanker route near block M9, and hence to describe the plans for possible impacts on small vessels, fishing boats, and project facilities.</li> </ul> <p>(2) In Key Potential Impacts and Mitigation Measure chapter page 13, 52 and 217 to explain details and clearly describe why MARPOL 73/78 is used in the report</p>	No specific additional comment.	-
6	<p><b>U Kyaw Zay Ya, Deputy Director (Offshore) Myanma Oil and Gas Enterprise</b></p> <p>(1) The report described that there is no impacts on PAs and RAMSA sites because project locate far from those areas.</p> <ul style="list-style-type: none"> <li>- To describe the distances from the islands, coastline and PAs with a clear map.</li> </ul> <p>(2) It is described that the flaring will used in well testing phase.</p> <ul style="list-style-type: none"> <li>- To include the mitigation measures for flaring</li> </ul>	No specific additional comment.	-
7	<p><b>Dr. Soe Moe Aung, Geologist (Offshore) Myanma Oil and Gas Enterprise</b></p> <p>(1) It is found that there is potential occurrence of tropical storm within the block</p> <ul style="list-style-type: none"> <li>- To mention the hazardous level for tropical storms and to describe the tropical (natural disaster) management plans for well drilling activities.</li> </ul> <p>(2) It is described that the project is in epipelagic zone.</p> <ul style="list-style-type: none"> <li>- To describe how is it managed for the biodiversity in epipelagic zone.</li> </ul> <p>(3) It is found that there is no description about cement chemical list in the report.</p> <ul style="list-style-type: none"> <li>- To describe the list and amount of cement chemical</li> </ul>	No specific additional comment.	-

8	<p><b>U Zaw Myo Kyaw, Deputy Director, Department of Archaeology, National Museum and Library</b></p> <p>(1) In the report, it is described as “The conservation of Antique Object Law”</p> <ul style="list-style-type: none"> <li>- To correct as “The Protection and Preservation of Antique Objects Law 2015”.</li> <li>- And to write as “The person who finds any object which has no owner or custodian, he shall promptly inform the relevant ward or village tract administrator if he knows or it seems reasonable to assume that the said object is an antique object”.</li> </ul> <p>(2) It is described as “The protection and preservation of cultural heritage regions law 2009”</p> <ul style="list-style-type: none"> <li>- To correct the year to “2019”</li> </ul>	No specific additional comment.	-
9	<p><b>Dr. Than Naing, Assistant Director, Department of Meteorology and Hydrology</b></p> <p>Section 5.2.6 “Vulnerability to natural disaster”, to include the historical data for storms that happened around in project area.</p>	No specific additional comment.	-

## CONTENTS

<b>1.</b>	<b>Executive summary (English)</b>	<b>1</b>
<b>1.1.</b>	<b>INTRODUCTION</b>	<b>1</b>
1.1.1.	CONTEXT	1
1.1.2.	PRESENTATION OF PROJECT PROPONENT	1
<b>1.2.</b>	<b>POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK</b>	<b>2</b>
<b>1.3.</b>	<b>DESCRIPTION OF THE PROPOSED PROJECT</b>	<b>3</b>
1.3.1.	PRESENTATION OF PROJECT ACTIVITIES	3
1.3.2.	TYPE OF DRILLING FLUIDS (MUD)	6
1.3.3.	INVENTORY OF WASTES DISCHARGE AND EMISSIONS	6
<b>1.4.</b>	<b>DESCRIPTION OF THE SURROUNDING ENVIRONMENT</b>	<b>8</b>
1.4.1.	PHYSICAL ENVIRONMENT	8
1.4.2.	BIOLOGICAL ENVIRONMENT	9
1.4.3.	SOCIO-ECONOMIC ENVIRONMENT	11
<b>1.5.</b>	<b>IMPACT AND RISK ASSESSMENT AND MITIGATION MEASURES</b>	<b>12</b>
1.5.1.	ENVIRONMENTAL AND SOCIAL IMPACT OF THE PROPOSED PROJECT	12
1.5.2.	MODELLING STUDIES	14
<b>1.6.</b>	<b>CUMULATIVE IMPACTS</b>	<b>14</b>
<b>1.7.</b>	<b>ENVIRONMENTAL MANAGEMENT PLAN</b>	<b>15</b>
1.7.1.	INTRODUCTION	15
1.7.2.	KEY IMPACTS AND MITIGATION MEASURES/COMMITMENT TABLE	16
1.7.3.	SUMMARY OF SIGNIFICANT IMPACTS BY PROJECT ACTIVITIES	34
<b>1.8.</b>	<b>PUBLIC CONSULTATION AND PROJECT DISCLOSURE</b>	<b>35</b>
1.8.1.	RESULTS FROM PROJECT'S PUBLIC CONSULTATION	35
1.8.2.	PROJECT DISCLOSURE	35
<b>.1</b>	<b>အစီရင်ခံစာ အကျဉ်းချုပ်</b>	<b>36</b>
<b>1.1.</b>	<b>နိဒါန်း</b>	<b>36</b>
1.1.1.	ရည်ညွှန်းချက်	36
1.1.2.	စီမံကိန်းလုပ်ကိုင်သောကုမ္ပဏီ၏ အကြောင်းအရာဖော်ပြချက်	37
<b>1.2.</b>	<b>မူဝါဒ၊ ဥပဒေနှင့် အဖွဲ့စည်းဆိုင်ရာ ဥပဒေမူဘောင်</b>	<b>37</b>
<b>1.3.</b>	<b>အဆိုပြုစီမံကိန်း အကြောင်းအရာဖော်ပြချက်</b>	<b>39</b>



1.3.1.	စီမံကိန်းလုပ်ငန်းစဉ်များ တင်ပြခြင်း	39
1.3.2.	တွင်းတူးရည် (ရွံ့) နှင့် ဖြတ်စာအမျိုးအစားများ	42
1.3.3.	အညစ်အကြေးစွန့်ပစ်မှုနှင့် ထုတ်လွှတ်မှုစစ်တမ်း	44
<b>1.4.</b>	<b>စီမံကိန်းအနီး ပတ်ဝန်းကျင်အကြောင်းအရာများဖော်ပြချက်</b>	<b>46</b>
1.4.1.	ရုပ်ပတ်ဝန်းကျင်ဆိုင်ရာ အကြောင်းအချက်များ	46
1.4.2.	သက်ရှိဇီဝဆိုင်ရာ အကြောင်းအချက်များ	47
1.4.3.	လူမှု-စီးပွားဆိုင်ရာ အကြောင်းအချက်များ	50
<b>1.5.</b>	<b>ပတ်ဝန်းကျင်အပေါ်သက်ရောက်မှုနှင့်ဘေးအန္တရာယ်ရှိမှုဆန်းစစ်ခြင်းနှင့် လျော့နည်းစေရေးနည်းလမ်းများ</b>	<b>51</b>
1.5.1.	အဆိုပြုစီမံကိန်းကြောင့် ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်အပေါ်သက်ရောက်နိုင်မှု	51
1.5.2.	CUTTING DISPERSION STUDY အား မော်ဒယ်ပုံစံငယ်ဖြင့်လေ့လာခြင်း	54
<b>1.6.</b>	<b>စုပေါင်းသက်ရောက်မှုများ</b>	<b>55</b>
<b>1.7.</b>	<b>ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ်</b>	<b>56</b>
1.7.1.	နိဒါန်း	56
1.7.2.	အဓိကသက်ရောက်မှုများနှင့် လျော့ပါးစေရေးနည်းလမ်းများ	58
1.7.3.	စီမံကိန်း၏လုပ်ငန်းများကြောင့် ဖြစ်ပေါ်နိုင်သော ထင်ရှားသော သက်ရောက်မှုများ အကျဉ်းချုပ်	73
<b>1.8.</b>	<b>အများပြည်သူနှင့် တိုင်ပင်ဆွေးနွေးခြင်းနှင့် သတင်းအချက်အလက်များ ထုတ်ဖော်တင်ပြခြင်း</b>	<b>75</b>
1.8.1.	ဆွေးနွေးညှိနှိုင်းမှုများ၏ရလဒ်များ	75
1.8.2.	သတင်းအချက်အလက်များထုတ်ဖော်တင်ပြခြင်း	75
<b>2.</b>	<b>Introduction</b>	<b>75</b>
<b>2.1.</b>	<b>CONTEXT</b>	<b>75</b>
<b>2.2.</b>	<b>PRESENTATION OF THE PROJECT PROPONENT</b>	<b>76</b>
<b>2.3.</b>	<b>PRESENTATION OF ENVIRONMENTAL AND SOCIAL EXPERTS (INCLUDING HEALTH EXPERT)</b>	<b>77</b>
<b>2.4.</b>	<b>OBJECTIVES OF THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA) STUDY</b>	<b>79</b>
<b>2.5.</b>	<b>EIA METHODOLOGY</b>	<b>79</b>

<b>3.</b>	<b>Policy Legal and Institutional Framework</b>	<b>80</b>
<b>3.1.</b>	<b>CORPORATE ENVIRONMENTAL AND SOCIAL POLICY</b>	<b>80</b>
3.1.1.	PTTEPI'S SSHE POLICY	80
3.1.2.	PTTEPI'S CORPORATE SOCIAL RESPONSIBILITY POLICY	82
3.1.3.	ENVIRONMENTAL MANAGEMENT IN PTTEPI	82
<b>3.2.</b>	<b>POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK</b>	<b>82</b>
3.2.1.	MYANMAR EIA PROCEDURE	82
3.2.2.	MYANMAR LEGISLATION RELEVANT TO THE PROPOSED PROJECT	84
3.2.3.	INTERNATIONAL ARRANGEMENTS	105
3.2.4.	INTERNATIONAL PRACTICE GUIDELINES AND INTERNATIONAL CONVENTION RELEVANT TO THE PROJECT	106
<b>3.3.</b>	<b>CONTRACTUAL AND OTHER COMMITMENTS</b>	<b>113</b>
3.3.1.	STATEMENT OF COMMITMENTS	113
3.3.2.	OTHER COMMITMENTS	113
<b>3.4.</b>	<b>MYANMAR LEGAL AND INSTITUTIONAL FRAMEWORK</b>	<b>114</b>
3.4.1.	MYANMAR LEGAL FRAMEWORK	114
3.4.2.	MYANMAR INSTITUTIONAL FRAMEWORK	115
<b>3.5.</b>	<b>ENVIRONMENTAL STANDARDS AND VALUES TO BE USED FOR THE PROJECT</b>	<b>116</b>
<b>3.6.</b>	<b>HEALTH STANDARDS FOR PROJECTS WITH HEALTH IMPACTS</b>	<b>118</b>
<b>4.</b>	<b>Project Description and Alternatives Selection</b>	<b>120</b>
<b>4.1.</b>	<b>PROJECT BACKGROUND</b>	<b>120</b>
<b>4.2.</b>	<b>DESCRIPTION OF THE LOCATION AND THE SITE</b>	<b>120</b>
4.2.1.	CONCESSION AREA	120
4.2.2.	DRILLING ACTIVITY AREA	121
<b>4.3.</b>	<b>TIME BOUNDARIES</b>	<b>123</b>
<b>4.4.</b>	<b>DESCRIPTION OF THE PROPOSED PROJECT AND ASSOCIATED FACILITIES</b>	<b>124</b>
4.4.1.	MOBILIZATION AND INSTALLATION PHASE	124
4.4.2.	DRILLING PHASE	126
4.4.3.	WELL PLUG AND ABANDONMENT / DEMOBILIZATION OF THE EQUIPMENT	139
<b>4.5.</b>	<b>FACILITIES AND UTILITIES</b>	<b>141</b>
4.5.1.	LIST OF HEAVY MACHINERIES ON RIG	141
4.5.2.	ACCOMMODATION	141
4.5.3.	WATER SUPPLY AND USAGE	141
4.5.4.	POWER SUPPLY	142
4.5.5.	TRANSPORTATION	142

4.5.6.	PRIMARY HEALTH CARE FACILITY _____	142
4.5.7.	WELL CONTROL AND SAFETY EQUIPMENT _____	142
<b>4.6.</b>	<b>IMPLEMENTATION COSTS _____</b>	<b>144</b>
<b>4.7.</b>	<b>INVENTORY OF WASTE DISCHARGES AND EMISSIONS _____</b>	<b>145</b>
4.7.1.	ATMOSPHERIC EMISSIONS _____	145
4.7.2.	DRILLING DISCHARGES TO THE SEA _____	146
4.7.3.	WASTEWATER _____	146
4.7.4.	SOLID WASTE _____	147
4.7.5.	ODOUR, NOISE AND LIGHT _____	148
4.7.6.	ACCIDENTAL RELEASES _____	148
4.7.7.	PROJECT EMISSIONS TARGET _____	149
<b>4.8.</b>	<b>DESCRIPTION OF THE ALTERNATIVE SELECTION _____</b>	<b>151</b>
4.8.1.	PROJECT SELECTION CRITERIA _____	151
4.8.2.	« NO PROJECT » ALTERNATIVE _____	151
4.8.3.	ALTERNATIVE WELL LOCATIONS _____	151
4.8.4.	LOCATION OF THE LOGISTICS BASE _____	151
4.8.5.	SELECTION OF DRILLING UNIT _____	151
4.8.6.	CHOICE OF DRILLING FLUID _____	152
4.8.7.	CUTTINGS AND DRILLING FLUIDS HANDLING _____	154
4.8.8.	CHOICE OF CEMENT ADDITIVES _____	154
4.8.9.	SUMMARY OF PROJECT ALTERNATIVES _____	156
<b>5.</b>	<b>Description of the Surrounding Environment</b>	<b>157</b>
<b>5.1.</b>	<b>STUDY AREA AND AREA OF INFLUENCE _____</b>	<b>157</b>
5.1.1.	MARINE BASELINE SURVEY _____	159
<b>5.2.</b>	<b>PHYSICAL ENVIRONMENT _____</b>	<b>159</b>
5.2.1.	CLIMATE _____	159
5.2.2.	GEOLOGY _____	162
5.2.3.	BATHYMETRY – OCEANOGRAPHY _____	162
5.2.4.	MARINE SEDIMENTS _____	163
5.2.5.	SEAWATER QUALITY _____	164
5.2.6.	VULNERABILITY TO NATURAL DISASTER _____	164
<b>5.3.</b>	<b>BIOLOGICAL ENVIRONMENT _____</b>	<b>165</b>
5.3.1.	MARINE BIOLOGICAL ENVIRONMENT _____	165
5.3.2.	COASTAL BIOLOGICAL ENVIRONMENT _____	173
<b>5.4.</b>	<b>SENSITIVE AND PROTECTED AREAS _____</b>	<b>175</b>
5.4.1.	THE IUCN RED LIST _____	175
5.4.2.	PROTECTED AREAS _____	176

<b>5.5.</b>	<b>SOCIO-ECONOMIC ENVIRONMENT</b>	<b>177</b>
5.5.1.	ADMINISTRATIVE ORGANIZATION AND GOVERNANCE	178
5.5.2.	DEMOGRAPHY	180
5.5.3.	ECONOMY	180
5.5.4.	PUBLIC HEALTH COMPONENTS	181
5.5.5.	FISHERY AND AQUACULTURE ACTIVITIES	182
5.5.6.	COASTAL TOURISM	185
5.5.7.	MARINE TRANSPORTATION	186
5.5.8.	MAIN PORTS IDENTIFIED FOR THE INSTALLATION OF THE LOGISTIC BASE	186
<b>6.</b>	<b>Impact and Risk Assessment and Mitigation Measures</b>	<b>187</b>
<b>6.1.</b>	<b>SUMMARY OF IMPACT PRODUCING FACTORS AND ENVIRONMENTAL SENSITIVITIES</b>	<b>187</b>
6.1.1.	SUMMARY OF THE PROJECT COMPONENTS LIKELY TO IMPACT THE ENVIRONMENT	187
6.1.2.	SUMMARY OF THE ENVIRONMENT SENSITIVITY	187
<b>6.2.</b>	<b>METHODOLOGY TO ASSESS IMPACTS</b>	<b>191</b>
6.2.1.	IMPACT ASSESSMENT PARAMETERS	191
6.2.2.	ASSESSMENT OF POTENTIAL IMPACT CAUSE EFFECT MATRIX	195
<b>6.3.</b>	<b>IMPACTS ASSESSMENT OF RESIDUAL EFFECTS</b>	<b>197</b>
6.3.1.	PHYSICAL PRESENCE OF THE DRILLING RIG AND SUPPORT VESSELS	197
6.3.2.	CONSUMPTION OF NATURAL RESOURCES & ENERGY USE	197
6.3.3.	IMPACT FROM DISCHARGES TO SEA	199
6.3.4.	AIR QUALITY AND GLOBAL WARMING	203
6.3.5.	IMPACTS FROM NOISE AND LIGHT	205
6.3.6.	IMPACTS FROM HAZARDOUS AND NON-HAZARDOUS WASTE	208
6.3.7.	IMPACTS FROM CHEMICALS	210
6.3.8.	IMPACTS ON THE SOCIO-ECONOMIC ENVIRONMENT	212
6.3.9.	MATRIX OF RESIDUAL IMPACTS	213
<b>6.4.</b>	<b>ENVIRONMENTAL HAZARDS AND RISK ASSESSMENT</b>	<b>215</b>
<b>6.5.</b>	<b>MODELLING STUDIES</b>	<b>217</b>
6.5.1.	THE ANDAMAN SEA	217
6.5.2.	MODELLING SOFTWARE USED	217
6.5.3.	HYDRODYNAMIC MODEL SETTINGS	218
6.5.4.	ENVIRONMENTAL IMPACT OF DRILLING OPERATION	221
6.5.5.	DISCUSSION / CONCLUSION	225
<b>6.6.</b>	<b>SUMMARY OF PROJECT'S IMPACTS AND MITIGATION MEASURES</b>	<b>225</b>

<b>6.6.1.</b>	PHYSICAL ENVIRONMENT _____	225
<b>6.6.2.</b>	OFFSHORE BIOLOGICAL ENVIRONMENT _____	228
<b>6.6.3.</b>	COASTAL ENVIRONMENT _____	229
<b>6.6.4.</b>	HUMAN ENVIRONMENT _____	229
<b>7.</b>	<b>Cumulative Impact Assessment</b>	<b>231</b>
<b>7.1.</b>	<b>METHODOLOGY AND APPROACH</b> _____	<b>231</b>
<b>7.2.</b>	<b>CUMULATIVE IMPACT ON OTHER OIL &amp; GAS EXPLORATION AND PRODUCTION ACTIVITIES</b> _____	<b>231</b>
<b>7.3.</b>	<b>CUMULATIVE IMPACT ON TRADITIONAL FISHING</b> _____	<b>232</b>
<b>7.4.</b>	<b>CUMULATIVE IMPACT ON MARINE TRAFFIC</b> _____	<b>233</b>
<b>7.5.</b>	<b>CUMULATIVE IMPACT ON BIODIVERSITY</b> _____	<b>234</b>
<b>8.</b>	<b>Environmental and Social Management Plan</b>	<b>235</b>
<b>8.1.</b>	<b>INTRODUCTION</b> _____	<b>235</b>
<b>8.2.</b>	<b>PROJECT DESCRIPTION</b> _____	<b>235</b>
<b>8.3.</b>	<b>OVERVIEW MAP OF PROJECT AREA</b> _____	<b>236</b>
<b>8.4.</b>	<b>LEGAL REQUIREMENT, HEALTH POLICY AND COMMITMENTS OF THE PROJECT</b> _____	<b>237</b>
<b>8.4.1.</b>	PTTEPI'S COMMITMENT LETTER _____	237
<b>8.5.</b>	<b>SUMMARY OF IMPACTS AND MITIGATION MEASURES</b> _____	<b>237</b>
<b>8.6.</b>	<b>OVERALL BUDGET FOR IMPLEMENTATION OF THE EMP</b> _____	<b>246</b>
<b>8.7.</b>	<b>ENVIRONMENTAL AND SOCIAL ORGANISATION OF THE PROJECT</b> _____	<b>246</b>
<b>8.7.1.</b>	ROLES AND RESPONSIBILITIES FOR THE ESMP PRIOR TO EXPLORATION DRILLING ACTIVITIES _____	246
<b>8.7.2.</b>	ROLES AND RESPONSIBILITIES FOR THE ESMP DURING EXPLORATION DRILLING ACTIVITIES _____	247
<b>8.8.</b>	<b>PURPOSE OF EMP</b> _____	<b>248</b>
<b>8.9.</b>	<b>MANAGEMENT AND MONITORING PLANS OF THE PROJECT</b> _____	<b>250</b>
<b>8.9.1.</b>	CHEMICAL MANAGEMENT PLAN _____	250
<b>8.9.2.</b>	WASTE MANAGEMENT PLAN _____	254
<b>8.9.3.</b>	BALLAST WATER MANAGEMENT PLAN _____	260
<b>8.9.4.</b>	BLOWOUT CONTINGENCY PLAN _____	262
<b>8.9.5.</b>	SPILL CONTINGENCY PLAN _____	265
<b>8.9.6.</b>	EMERGENCY & CRISIS MANAGEMENT PLAN _____	269
<b>8.9.7.</b>	GRIEVANCE MECHANISM _____	276
<b>8.9.8.</b>	TRAINING AND AWARENESS PROGRAMME _____	278
<b>8.9.9.</b>	ENVIRONMENTAL AUDIT PROGRAMME _____	279

<b>8.10.</b>	<b>OCCUPATIONAL AND COMMUNITY HEALTH MANAGEMENT</b>	
<b>PLAN</b>		<b>281</b>
<b>8.10.2.</b>	REPORTING REQUIREMENTS TO MYANMAR AUTHORITIES	282
<b>8.10.3.</b>	PTTEPI'S INTERNAL REPORTING	282
<b>8.11.</b>	<b>CORPORATE SOCIAL RESPONSIBILITY (CSR) ACTIVITIES</b>	<b>284</b>
<b>8.12.</b>	<b>STATEMENT OF COMMITMENT</b>	<b>284</b>
<b>8.13.</b>	<b>MITIGATION MEASURES</b>	<b>284</b>
<b>9.</b>	<b>PUBLIC CONSULTATION AND DISCLOSURE</b>	<b>303</b>
<b>9.1.</b>	<b>OBJECTIVES</b>	<b>303</b>
<b>9.2.</b>	<b>METHODOLOGY AND APPROACH OF CONSULTATION PROCESS</b>	<b>304</b>
<b>9.2.1.</b>	REGULATORY FRAMEWORK	304
<b>9.2.2.</b>	APPROACH OF CONSULTATION PROCESS	304
<b>9.2.3.</b>	STAKEHOLDER IDENTIFICATION	305
<b>9.3.</b>	<b>SUMMARY OF PUBLIC CONSULTATIONS</b>	<b>306</b>
<b>9.4.</b>	<b>LOCATION AND PERIOD OF PUBLIC CONSULTATION (INCLUDING COURTESY VISIT)</b>	<b>307</b>
<b>9.5.</b>	<b>PRELIMINARY CONSULTATIONS</b>	<b>309</b>
<b>9.5.1.</b>	SUMMARY OF CONSULTATIONS AND ACTIVITIES UNDERTAKEN	309
<b>9.5.2.</b>	PUBLIC MEETINGS	309
<b>9.5.3.</b>	INDIVIDUAL MEETINGS	323
<b>9.6.</b>	<b>SECOND STAGE OF PUBLIC CONSULTATIONS</b>	<b>330</b>
<b>9.6.1.</b>	SUMMARY OF CONSULTATIONS AND ACTIVITIES UNDERTAKEN	330
<b>9.6.2.</b>	CONSULTATION WITH THE MYANMAR FISHERIES FEDERATION	331
<b>9.6.3.</b>	CONSULTATION MEETING IN DAWEI	332
<b>9.6.4.</b>	CONSULTATION MEETING IN YEBYU	333
<b>9.6.5.</b>	CONSULTATION MEETING IN MYEIK	335
<b>9.7.</b>	<b>RESULTS FROM THE EIA PUBLIC CONSULTATION</b>	<b>336</b>
<b>9.7.1.</b>	SUGGESTION FROM ALL OF THE PUBLIC CONSULTATIONS	336
<b>9.7.2.</b>	RESULTS FROM EIA PUBLIC CONSULTATION	337
<b>9.8.</b>	<b>FURTHER ONGOING CONSULTATIONS</b>	<b>337</b>
<b>9.9.</b>	<b>PROJECT DISCLOSURE</b>	<b>338</b>
<b>10.</b>	<b>Conclusion and Recommendation</b>	<b>340</b>
<b>11.</b>	<b>References</b>	<b>342</b>

## TABLES

Tabl. 1 - Contact details of PTTEPI.....	1
Tabl. 2 - PTTEPI's key person for the EIA preparation of proposed project .....	2
Tabl. 3 - Tentative schedule for project activities .....	4
Tabl. 4 - Cumulative impact identification of significant impacts associated with the appraisal drilling project.....	15
Tabl. 5 - Management Sub-Plans include in the report .....	15
Tabl. 6 - Mitigation measures/commitment list for project during the mobilization and installation phase.....	17
Tabl. 7 - Mitigation measures/commitment list for project during the drilling phase .....	23
Tabl. 8 - Mitigation measures/commitment list for project during the P&A (Plug and Abandon) and Demobilization.....	28
Tabl. 9 - Mitigation measures/commitment list for unplanned events.....	32
Tabl. 10 -Significant potential impact due to drilling discharge.....	34
Tabl. 1 - PTTEPI သို့ဆက်သွယ်ရန်လိပ်စာ.....	37
Tabl. 2 - PTTEPI မှ EIA ဆောင်ရွက်သည့် တာဝန်ရှိ ပုဂ္ဂိုလ်များ.....	37
Tabl. 3- တွင်းတူးလုပ်ငန်းလျာထား အချိန်ဇယား.....	40
Tabl. 4 - အကဲဖြတ်တွင်းတူးစီမံကိန်းနှင့်စပ်လျဉ်း၍ စုပေါင်းသက်ရောက်မှုများကို ဖော်ထုတ်သတ်မှတ်မှု.....	55
Tabl. 5- အကဲဖြတ်တွင်းတူးစီမံကိန်းနှင့် စပ်လျဉ်း၍စီမံခန့်ခွဲမှု အစီအစဉ်ခွဲများ.....	57
Tabl. 6 - ပြင်ဆင်ခြင်းနှင့် တပ်ဆင်ခြင်းအဆင့်တွင် စီမံကိန်းအတွက် လျော့ပါးစေရေးနည်းလမ်းများကတိကဝတ်ဇယား/.....	60
Tabl. 7 - တူးဖော်ရေး အဆင့်တွင် စီမံကိန်းအတွက် လျော့ပါးစေရေးနည်းလမ်းများကတိကဝတ်ဇယား/ .....	64
Tabl. 8 - ပလပ်ချုပ်ပိတ်သိမ်းခြင်း၊ ပစ္စည်းရွှေ့ပြောင်းခြင်းအဆင့်တွင် စီမံကိန်းအတွက် လျော့ပါးစေရေးနည်းလမ်းများကတိကဝတ်ဇယား/.....	68
Tabl. 9- မတော်တဆမှုများဖြစ်ပေါ်စဉ်အတွင်း စီမံကိန်းအတွက် လျော့ပါးစေရေးနည်းလမ်းများကတိကဝတ်ဇယား/ .....	70
Tabl. 10 -စီမံကိန်းလုပ်ငန်းမှ စွန့်ထုတ်မှုများကြောင့် ဖြစ်ပေါ်လာနိုင်သော ထင်ရှားသော သက်ရောက်မှုများ.....	73
Tabl. 1 - Contact details of PTTEPI.....	76
Tabl. 2 - PTTEPI's key person for the EIA preparation of proposed project .....	77
Tabl. 3 - Presentation of the environmental and social experts .....	77
Tabl. 4 - PTTEPI SSHE Management System Standards.....	81
Tabl. 5 - Main Myanmar environmental legislation applicable to the Project.....	84
Tabl. 6 - Relevant International Guidelines and International Conventions.....	106
Tabl. 7 - Summary of main emissions standards and values used for the project.....	117
Tabl. 8 - Relevant general EHS guidelines for occupational health and safety .....	119
Tabl. 9 - Coordinates of Block M9.....	120
Tabl. 10 -Types and Coordinates of the twelve potential wells.....	121
Tabl. 11 -Tentative schedule for project activities for twelve wells.....	123
Tabl. 12 -Size and depth of appraisal wells.....	127

Tabl. 13 -Drilling mud concentrations and consumption .....	131
Tabl. 14 -Type and expected volumes of drilling mud (Source: PTTEPI, 2017) .....	135
Tabl. 15 -Estimation of cuttings volumes for each well (Source: PTTEPI, 2017).....	138
Tabl. 16 -Summary of cuttings and mud management (Source: PTTEPI, 2017) .....	139
Tabl. 17 -List of Heavy Machineries on Rig (Source: PTTEPI) .....	141
Tabl. 18 -Type of water and volume of water use in the project activities (Source: PTTEPI, 2017) .....	141
Tabl. 19 -Air emission evaluation estimated for one well .....	145
Tabl. 20 -Estimated wastewater production from projected activities (rounded) .....	147
Tabl. 21 -Estimated waste production from projected activities (Source: PTTEPI, 2018) .....	148
Tabl. 22 -Project emission targets .....	149
Tabl. 23 -Components of the SBM .....	153
Tabl. 24 -Composition and volume of Cement Chemicals used for M9 .....	155
Tabl. 25 -Summary of project alternatives .....	156
Tabl. 26 -General administration data .....	179
Tabl. 27 -Mortality of Diseases in Dawei, Yebyu and Myeik .....	181
Tabl. 28 -Block M9 operation impact producing factors.....	187
Tabl. 29 -General principles for sensitivity scoring (Se).....	188
Tabl. 30 -Sensitive components of the environment .....	189
Tabl. 31 -General principles for scoring intensity (I) .....	192
Tabl. 32 -Rating impact severity .....	194
Tabl. 33 -Impact severity .....	194
Tabl. 34 -Potential impact matrix.....	196
Tabl. 35 -Impacts from project physical presence .....	197
Tabl. 36 -Impacts from resource consumption (raw materials, water, energy).....	197
Tabl. 37 -Impacts from ship system discharge .....	199
Tabl. 38 -Impacts on benthic communities from drilling discharges.....	201
Tabl. 39 -Impacts on the water column and pelagic marine life from drilling discharge .....	202
Tabl. 40 -Impacts of air emissions from marine vessel .....	203
Tabl. 41 -Impacts of air emissions from marine vessel .....	204
Tabl. 42 -Impacts of air emissions from drilling .....	204
Tabl. 43 -Impacts of air emissions from logistics.....	205
Tabl. 44 -Impacts from noise, light and odor generated by ship systems .....	206
Tabl. 45 -Impacts from noise, light and odor generated during drilling operation .....	207
Tabl. 46 -Impacts from hazardous and non-hazardous waste (offshore) .....	208
Tabl. 47 -Impacts from hazardous and non-hazardous waste (onshore).....	210
Tabl. 48 -Impacts from storage and handling of chemicals onshore .....	211
Tabl. 49 -Impacts from storage and handling of chemicals offshore.....	211
Tabl. 50 -Negative socio-economic impacts .....	212
Tabl. 51 -Positive socio-economic impacts.....	213
Tabl. 52 -Residual impact matrix .....	214



Tabl. 53 - Impacts from accidental situations.....	215
Tabl. 54 - Well location distances from nearest point of the block .....	222
Tabl. 55 - Scenarios for Block M9 .....	222
Tabl. 56 - Summary of impacts and mitigation measures during mobilization and installation phases .....	238
Tabl. 57 - Summary of impacts and mitigation measures during drilling .....	241
Tabl. 58 - Summary of impacts and mitigation measures during P&A (Plug and Abandon) and Demobilization.....	244
Tabl. 59 - PTTEPI SSHE Management System Standards.....	248
Tabl. 60 - Management Sub-Plans include in the report .....	249
Tabl. 61 - Monitoring program (source: PTTEPI, 2018).....	260
Tabl. 62 - Reporting requirements to Myanmar authorities .....	283
Tabl. 63 - Mitigation measures for project during the mobilization and installation phase.....	285
Tabl. 64 - Mitigation measures for project during the drilling phase .....	291
Tabl. 65 - Mitigation measures for project during the P&A (Plug and Abandon) and Demobilization.....	297
Tabl. 66 - Mitigation measures for unplanned events .....	300
Tabl. 1 - Stakeholders meetings summary.....	308
Tabl. 2 - Attendance list .....	323
Tabl. 3 - Attendance list .....	325
Tabl. 4 - Attendance list .....	325
Tabl. 5 - Attendance list .....	327
Tabl. 6 - Attendance list .....	329

## FIGURES

<b>Fig. 1.</b> Islands and protected areas near to the project.....	11
<b>Fig. 1.</b> စီမံကိန်းအနီးရှိထိန်းသိမ်းကာကွယ်ထားသောကျွန်းများ နှင့် နယ်မြေများ .....	50
<b>Fig. 2.</b> Geographical location of Block M9.....	75
<b>Fig. 3.</b> New EIA Procedure : Ministry of the Environmental Conservation and Forestry (now MONREC), Notification N°616 of 29 December 2015 .....	83
<b>Fig. 4.</b> The organization structure of state and region governments in Myanmar (Source: Myanmar Information Management Unit (MIMU))114	
<b>Fig. 5.</b> Geographical situation of Block M9 .....	121
<b>Fig. 6.</b> Proposed well location.....	122
<b>Fig. 7.</b> Example of semi-submersible rig (left picture: ballasted; right picture: deballasted) .....	124
<b>Fig. 8.</b> Example of a supply vessel (Source: PTTEPI, 2017) .....	125
<b>Fig. 9.</b> General well profile .....	126
<b>Fig. 10.</b> Appraisal/ Exploration well profile (Source: PTTEPI, 2017) .....	127
<b>Fig. 11.</b> Blowout preventer (BOP) stack linked to the rig .....	129

<b>Fig. 12.</b> Schematic of the mud circulation system (Source: Oil and Gas Well Drilling and Servicing eTool, <a href="https://www.osha.gov/SLTC/etools/oilandgas/drilling/mud_system.html">https://www.osha.gov/SLTC/etools/oilandgas/drilling/mud_system.html</a> , retrieved on August 22, 2017) .....	136
<b>Fig. 13.</b> Typical cutting dryer.....	137
<b>Fig. 14.</b> Schematic of typical P&A process.....	140
<b>Fig. 15.</b> Schematic of a typical subsea BOP stack .....	143
<b>Fig. 16.</b> Location of the project area .....	158
<b>Fig. 17.</b> Survey location for marine baseline samplings and marine mammal survey.....	159
<b>Fig. 18.</b> Graphical data of temperature changes in Tanintharyi region (Source: world weather) .....	160
<b>Fig. 19.</b> Participation data for Dawei and, Tanintharyi (Source: world weather).....	161
<b>Fig. 20.</b> Schematic of seasonal oceanic currents in the Bay of Bengal (Source: IEE report of 3D seismic survey in Myanmar Offshore Block M9, PTTEPI, December 2016).....	163
<b>Fig. 21.</b> Fishes caught in Tanintharyi fishing ground between November and December .....	169
<b>Fig. 22.</b> Various species of sharks and rays identified in Myanmar.....	170
<b>Fig. 23.</b> Photos of Pantropical Spotted Dolphin ( <i>Stenella attenuate</i> ) observed during the marine environmental survey (Source: ERM, 2018) .....	171
<b>Fig. 24.</b> Locations of the dolphin sighted (Source: ERM, 2018).....	171
<b>Fig. 25.</b> Turtle distribution in Myanmar according to UNEP WCMC Database (Source: IEE report of 3D seismic survey in Myanmar Offshore Block M9, PTTEPI, December 2016) .....	172
<b>Fig. 26.</b> Marine protected areas near Block M9 (source: ArcGIS).....	177
<b>Fig. 27.</b> Distances between Block M9 and locations of Yangon & Dawei .....	178
<b>Fig. 28.</b> Myanmar deep water block 2014 (Source: Total IEE report for YWB Block & Myanmar deepwater E&P operations outlook by Dr. ZawMinThan).....	181
<b>Fig. 29.</b> Ratio of fishers engaged in fisheries sub-sectors in Myanmar in 2016 (Source: DoF, 2016) .....	183
<b>Fig. 30.</b> Location of project Block M9 and international shipping lane .....	186
<b>Fig. 31.</b> Example of the effect of drill cuttings discharges.....	200
<b>Fig. 32.</b> Numerical marine Charts used in the model bathymetry .....	219
<b>Fig. 33.</b> Model bathymetry.....	220
<b>Fig. 34.</b> Drilling locations – Block M9 .....	221
<b>Fig. 35.</b> Point KKN44 – October – Block M9.....	223
<b>Fig. 36.</b> Point KKN44 – October – Block M9.....	223
<b>Fig. 37.</b> Suspended sediment concentration at -20m – Block M9 .....	224
<b>Fig. 38.</b> Suspended sediment concentration at -50m – Block M9 .....	224
<b>Fig. 39.</b> Suspended sediment concentration at -90m – Block M9 .....	224
<b>Fig. 40.</b> Location of existing oil and gas development fields, pipelines and the Block M9 .....	232
<b>Fig. 41.</b> Overlaying the Block M9 and fishing grounds .....	233
<b>Fig. 42.</b> Zawtika Platform Location Map.....	234
<b>Fig. 43.</b> Location of the Block M-9.....	236

<b>Fig. 44.</b> Proposed well locations in Block M9 .....	237
<b>Fig. 45.</b> Chemical classes and colour symbols .....	252
<b>Fig. 46.</b> Waste segregation colour code example .....	257
<b>Fig. 47.</b> Levels of Incident during blowout .....	263
<b>Fig. 48.</b> Tiered Response Framework .....	264
<b>Fig. 49.</b> Tier Level of the Oil Spill .....	266
<b>Fig. 50.</b> Spill Incident Alert Procedures Flow Chart .....	267
<b>Fig. 51.</b> Emergency & Crisis Management Procedure .....	271
<b>Fig. 52.</b> PTTEPI Emergency Management Framework .....	272
<b>Fig. 53.</b> PTTEPI cyclone aert zone .....	272
<b>Fig. 54.</b> PTTEPI Grievance Handling Process .....	277
<b>Fig. 55.</b> Courtesy visit meeting .....	307
<b>Fig. 56.</b> Consultations meeting at MFF .....	311
<b>Fig. 57.</b> Consultations meeting in Dawei .....	315
<b>Fig. 58.</b> Consultations meeting in YeByu .....	318
<b>Fig. 59.</b> Consultations meeting in Myeik .....	322
<b>Fig. 60.</b> Interview with the Department of Fisheries (Dawei) .....	324
<b>Fig. 61.</b> Interview with the Environmental Conservation Department – Tanintharyi office (Dawei) .....	327
<b>Fig. 62.</b> Interview with the Department of Marine Science – Myeik University .....	328
<b>Fig. 63.</b> Interview with the Department of Marine Administration (Dawei) .....	330
<b>Fig. 64.</b> Public consultations meeting at the Myanmar Fisheries Federation in Yangon .....	332
<b>Fig. 65.</b> Public consultations meeting at the Zayar Htet San Hotel Meeting Hall of Dawei .....	333
<b>Fig. 66.</b> Public consultations meeting in the Township Administrative Meeting Hall of Yebyu .....	335
<b>Fig. 67.</b> Public consultations meeting at the Myanmar Fisheries Federation Meeting Hall of Myeik .....	336

## APPENDICES

APPENDIX 1 – PTTEPI’s Environmental and Social Policy

APPENDIX 2 – Attendent Lists of Public Consultation Meetings

APPENDIX 3 –Modelling Report Study

APPENDIX 4 – Marine Baseline Survey (ERM)

APPENDIX 5 – PTTEPI’s Occupational Health Management Standard

## ABBREVIATION / ACRONYMS

%	Percentage
ADI	Area of Direct Impact
ALARP	As Low As Reasonably Practicable
API	American Petroleum Institute
ASEAN	Association of South East Asia Nations
bbL	Barrels of oil
BOP	Blowout Preventer
BSC	Bachelor of Science
CaCl	Calcium Chloride
CH <sub>4</sub>	Methane
CMP	Chemical Management Plan
CO	Carbon monoxide
CO <sub>2</sub>	Carbon dioxide
CSR	Corporate Social Responsibility
°C	Degree Celsius
cm	Centimetre
DoF	Department of Fisheries
E	East
ECD	Environmental Conservation Department
EEZ	Exclusive Economic Zone
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EM	Emission factor
EMoP	Environmental Monitoring Plan
EN	Endangered
EMP	Environmental Management Plan
GHG	Greenhouse Gas
Ha	Hectare
SSHE	Health, Safety & Environment
I	Intensity
IBA	Important Bird Area

IEE	Initial Environmental Examination
IFC	International Finance Corporation
IMO	International Maritime Organization
IOGP	International Association of Oil and Gas Producers
IPIECA	International Petroleum Industry Environmental Conservation Association
IUCN	International Union for Conservation of Nature
km	Kilometre
Km <sup>2</sup>	Square kilometres
Lc	Least concern
LCM	Loss Circulation Materials
m	Meter
m <sup>3</sup>	Cubic metres
M	Magnitude
mg/l	Milligram per liter
mm	Millimetre
mi	Miles
m/s	Metre per second
MARPOL	International Convention for the Prevention of Pollution from Ships
MOECAFF (now MONREC)	Ministry of Environmental Conservation and Forestry
MOEE	Ministry of Electric Power and Energy
MONREC	Ministry of Natural Resources and Environmental Conservation
MOGE	Myanma Oil & Gas Enterprise
MSC	Master of Science
MSDS	Material Safety Data Sheet
MSL	Mean Sea Level
NaCl	Sodium chloride
N	North
NE	Northeast
NEQG	National Environmental Quality (Emission) Guidelines
nm	Nautical miles
NO <sub>2</sub>	Nitrogen dioxide

NOx	Nitrogen oxide
Nt	Near-threatened
OCNS	Offshore Chemical Notification Scheme
ODMP	Operational Discharge Management Plan
OOC	Oil on Cuttings
OSCP	Oil Spill Contingency Plan
Pa	Pascal
PPE	Personal Protective Equipment
PPR	Project Proposal Report
PTTEPI	PTTEP International Limited
PSC	Production Sharing Contract
Q3-Q4 of 2018	3 <sup>rd</sup> – 4 <sup>th</sup> quarter of 2018
Q1 of 2020	1st quarter of 2020
ROB	Retained Oil on Cuttings
ROV	Remotely Operated Vehicle
RSB	Ranong Supply Base
S	Severity
SBM	Synthetic-based mud
SDS	Safety Data Sheets
Se	Sensitivity
SEEMP	Ship Energy Efficiency Management Plan
SEP	Stakeholder Engagement Plan
SMP	Social Management Plan
SO <sub>2</sub>	Sulphur dioxide
SOPEP	Shipboard Oil Pollution Emergency Plan
SSHE	Security, Safety, Health and Environment
SW	Southwest
t/day	Ton per day
TKA	Thaketa Supply Base
TOC	Total Organic Carbon
TVDSS	True Vertical Depth Subsea
UTM	Universal Transverse Mercator

VOC	Volatile Organic Compound
VU	Vulnerable
WBM	Water-based mud
WBDS	Water Based Drilling Fluid
WGS	World Geodetic System 1984
WMP	Waste Management Plan
YCDC	Yangon City Development Committee
ZPQ	Zawtika Processing and Living Quarter Platform
ZWP-2	Zawtika Wellhead Platform 2

**Offshore M9 East Appraisal/Exploration Drilling**

Report

ENVIRONMENTAL IMPACT ASSESSMENT

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# 1. EXECUTIVE SUMMARY (ENGLISH)

*This section is presenting the general lines of the project and its main impacts, highlighting the main conclusions drawn regarding the mitigation measures taken to protect the environment according to the local constraints. The executive summary is written for the non-technical reader.*

## 1.1. INTRODUCTION

### 1.1.1. Context

Regarding the success of Zawtika Gas Field project, PTTEP International Limited (PTTEPI) plans to conduct an appraisal drilling campaign in the eastern part of Block M9 where the water depth in the project area ranges from 50 to 800 m.

The Environmental Impact Assessment (EIA) was prepared to allow environmental authorities to determine whether the project affects the environment or existing socioeconomic activities, and to decide whether the project should be allowed or not. The form, content and structure of the report may satisfy regulatory requirements by providing relevant information on environmental issues and mitigation measures to be taken into account in order to protect the environment during the scheduled offshore exploration campaign. The present document is the Executive Summary of the EIA report.

The EIA has been developed in accordance with Myanmar Environmental Conservation Law (promulgated in 2012) and the Environmental Impact Assessment Procedure (promulgated in 2015) and includes the Environmental Management Plan (EMP). International legislation addressing offshore petroleum industry and PTTEPI standards are also taken into account.

The document was prepared by a team of environmental and social consultants based locally in Myanmar and remotely in France. The project team included environmental engineers with international experience in offshore environmental impact assessment studies (including in Myanmar); a social specialist experienced in the management of offshore drilling campaigns in Asia; and an environmental engineer and project coordinator based in Yangon. The study was conducted from May 2017 to November 2018.

### 1.1.2. Presentation of Project Proponent

PTTEPI, a subsidiary of PTTEP, is the operator for the project to carry out petroleum exploration and production activities and related business in Myanmar. Contact details of PTTEPI are provided in the table below.

**Tabl. 1 - Contact details of PTTEPI**

Company name	PTTEP International Limited (Yangon Branch)
Address	Vantage Tower, 623 Pyay Road ,Kamayut Township, Yangon, Republic of Myanmar
Phone number	+95(1) 652700
Project Responsible Person	<b>Mr. Piya Sukhumpanumet</b> General Manager, PTTEPI
Principal contact person	<b>Yu San Khaing</b> Email: YuSanK@pttep.com <b>Thiri Aung</b> Email: ThiriAung@pttep.com

**Tabl. 2 - PTTEPI's key person for the EIA preparation of proposed project**

Name	Responsibility
Wichean Kaewkong	Senior Engineer, Environment
Zar Chi Saint	Engineer, Environment
Sutus Preuksjamas	Safety, Security, Health and Environmental Manager
Yu San Khaing	Coordinator, Social Development Project (Offshore) (MOGE Representative)
Suphachitra Thongchavee	Manager, Public Affairs and Communications Section
San Htet Aung Win	Head of Social Development Projects
Wunna Win	Drilling Engineer
Kamolchai Pattanapong	Vice President, Myanmar Well Operations Department
Khun Hline Myint	Geologist
Kanchit Jantarangsi	Exploration Project Manager, Myanmar Onshore Exploration Project

## 1.2. POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

The EIA was prepared in compliance with the new EIA regulation and procedure (Notification No 616 of 29 December 2015) of Myanmar, with International legislation addressing offshore petroleum industry and with PTTEPI standards and specifications.

The EIA aims are to:

- Explain this offshore exploration project, on the basis of information provided by PTTEPI;
- Ensure that environmental and social considerations are clearly quoted and integrated in the decision-making process of the project;
- Recommend procedures and practices to be followed during the project to ensure that environmental and social effects are avoided, minimized or mitigated.
- Provide guidance on environmental management programs, including auditing and contingency planning.

The proposed drilling EIA methodology involves a project description, a description of the existing environment, impact identification and evaluation, development of mitigation measures, and elaboration of guidelines for an Environmental and Social Management Plan, in compliance with PTTEPI standards.

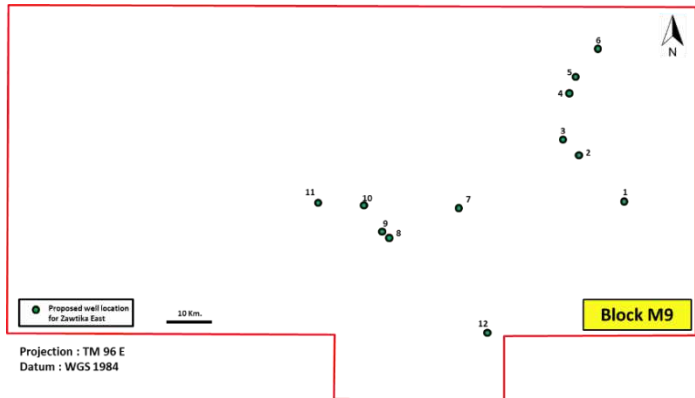
The project will be undertaken in accordance with the number of National and International standards and laws. The followings national and international laws are highlighted in Chapter 3:

- Myanmar Environmental Conservation Law (2012)
- Myanmar Environmental Conservation Rules (2014)
- Myanmar National Environmental Quality (Emission) Guidelines (2015) (NEQG Guidelines)
- Myanmar EIA Procedure (2015)
- The International Convention for the Prevention of Pollution from Ships (1973 as modified 1978)
- Protection of Biodiversity and Protected Area Law (2018)
- IFC EHS Guidelines for offshore O&G Development (2015)
- United Nations Convention on the Law of the Sea (UNCLOS)

### 1.3. DESCRIPTION OF THE PROPOSED PROJECT

#### 1.3.1. Presentation of Project Activities

The proposed project concerns the drilling of a maximum of twelve appraisal wells (see opposite figure: “Proposed well location” from PTTEPI). The main purpose is to confirm (or deny) and indicate the presence of hydrocarbon reservoirs, previously identified during a seismic acquisition campaign. This type of well brings core samples from the target formation to the surface. These cores contain an entire cross section of the rock layers in the possible reservoir and give the geologist important information from the earth’s interior, especially whether or not oil and gas are really present. That is, the activity consists in searching hydrocarbons under the seabed. The project will not include well testing phase and the following three phases will be operated :



The project will not include well testing phase and the following three phases will be operated :

- Mobilization and installation phase
- Drilling phase
- Well plug and abandonment / Demobilization of the rig

The current project schedule is tentatively planned to commencement the drilling after the approval of the authorities, in Q3-Q4 of 2018. Therefore, for drilling twelve wells in this campaign, the duration will take approximately 540 days and thus, the completion of drilling for twelve wells will enter into Q1 of 2020. The project schedule for one well is presented in the table below.



**1.3.1.1. MOBILIZATION AND INSTALLATION PHASE**

The drilling unit used for the activity will be a semi-submersible rig, which is capable of operating in seawater depths up to 500 to 3,000 m (see opposite figure of typical semi-submersible rigs). The drilling rig will be transported to determine the position and then fixed to its operational position by mooring using an anchor system without lowering any legs to the sea floor. The duration of drilling rig transportation to the project's location will take a maximum of 5 days and mobilization of the rig from one well to another will take approximately 5 days.



Two material support vessels will make round-trips between onshore logistic bases and the drilling rig (see an example of supply vessel in the opposite figure). PTTEPI will use its Thaketa Supply Base (TKA) in Yangon and Ranong Supply Base (RSB) in the port of Ranong Province (Thailand) as logistic bases. Each supply vessel will transport catering provisions, supplies, casing/tubing, fuel, drilling water, fresh water, mud and cementing materials to the drilling rig. When the drilling unit will be operational at a well location, a temporary 500 m statutory safety zone around the drilling unit will be in force, i.e. no other vessels (except the drilling unit's support vessels) may enter this area.

A helicopter will be used to transfer staff, with a capacity of 12 staff per flight. Staff transfers by helicopter from the shore bases to the project area takes 1 hour 10 minutes.

**1.3.1.2. DRILLING PHASE**

Since well testing phase (including flaring system) is excluded for this project, the drilling phase will start once in position at the designated well site. The well is drilled by using a bit that chips off pieces of rock. The drill bit is connected to the surface by segments of hollow pipe, which together are called the drill string.

The first drilling stage (riserless stage) is made by lowering the drill string from the drill deck to the seafloor and drilling into the seabed. All cuttings are set down directly onto the seafloor.

Following this initial stage, a marine riser pipe connects the drilling floor of the drilling unit to the wellhead on the seafloor in order to collect drilling mud. Drilling is undertaken by lowering the drill string through the riser to the seafloor and rotating the drill string, causing the drill bit to crush the rock. Cuttings are removed from the bottom of the hole thanks to a drilling fluid called "mud", a specially formulated mixture of natural clays, polymers, weighting agents and/or other materials suspended in a fluid medium.

Drilling is stopped at regular intervals to allow new sections of pipe to be added to the drill string or to replace the drill bit.

As the well is drilled, metal casing is placed inside the well to line it and stabilize the hole to prevent it from caving in. The casing also isolates aquifers and hydrocarbon-bearing zones through which the well passes, thus preventing liquids or gases from entering the well prematurely. After each casing string is installed, it is cemented in place. The casing also provides a firm point for the attachment of the blowout preventer (BOP) stack.

**1.3.1.3. WELL PLUG AND ABANDONMENT / DEMOBILIZATION OF THE RIG**

The well will be abandoned at the end of the project. Well abandonment for the project will follow PTTEPI procedures and in line with the regulation of Myanmar and international standards for oil and gas industry. The open hole of reservoir section will be plugged by cement plug for several intervals depending on the

zone isolation requirement. The casing and conductor will be cut at the seabed and the subsea wellhead will be retrieved back to the surface.

At the end of the drilling program, the equipment will be rig down and rig will move out and be towed using two towing vessels to the next project's proposed drilling positions.

### 1.3.2. Type of Drilling Fluids (Mud)

Three types of drilling mud will be used as follows:

- **For surface section: Water-based mud (WBM)** will be used as main drilling fluid and components are biodegradable and include barite, shale inhibitor additive and seawater. PTTEPI will use WBM as main drilling fluid for all well sections.
- **High Performance Water-based mud (HPWBM)** will be used for the intermediate and deeper hole sections. HPWBM is the improved version of WBM with different kind of inhibited water based mud systems to control the adverse effects of shaly formations, provide suitable lubricity and temperature stability.
- **Synthetic-based mud (SBM)** will be used as contingency for intermediate section and the reservoir section (option 2), where WBM is not applicable. The main components are biodegradable and include: barite, base oil and fresh water. Drilling with SBM, oil on cuttings would be brought down below 6.9% by using a cutting dryer.

### 1.3.3. Inventory of Wastes Discharge and Emissions

An offshore appraisal drilling campaign may generate emissions to air, wastewater and liquid discharges, and production of hazardous and non-hazardous wastes. Abnormal discharges such as spills of fuel oil or chemicals are also possible.

A brief description of the types of emissions and discharges that are expected to be generated from the drilling campaign is presented below:

- **Atmospheric emissions** are mainly associated with engine combustion needed to operate the drilling rig and its equipment, logistic support vessels, the use of helicopters for personnel rotations. Since the duration of the whole campaign is scheduled to last approximately 540 days for twelve (12) wells, we estimated 40 days for each one of the 12 wells. Therefore, it is expected total emission of 7,769 ktons of CO<sub>2</sub> equivalent for 40 days to drill one well. 93,228 ktons of CO<sub>2</sub> equivalent is estimated for the whole period of the 12 drilled wells (540 days).
- **Cuttings** may contain hydrocarbons from the reservoir. They are generally treated on-board to meet the specification expected by relevant Myanmar regulation and MARPOL 73/78 requirements. If the specification is reached, the cuttings will be discharged into the sea. Per one well, a total of 350 m<sup>3</sup> for normal well and 383 m<sup>3</sup> for deep well of drilling cuttings are expected to be generated from the appraisal drilling program.
- The majority of the **Cement and cement additives** used for securing the casing remains in the well. Spacer and excess lead slurry from the cementing of the first casing string (36") will be discharged close to the seabed. This cement does not settle but slowly dissolves into seawater.
- **Wastewater** is generally associated with domestic and sanitary wastewater (black and grey water) and oil contaminated wastewater (bilge and deck water). However, modern support vessels and the rig have well optimized wastewater management, with plenty of recycling, use of vacuum systems etc. Additionally, grey water is often used for flushing toilets after a small treatment. These water streams will be managed by the water storage and treatment devices on-board:
  - Domestic and sanitary wastewater will be generated as a result of the human presence on the rig and support vessels. The maximum amount of black and grey water generated per day during the project in each phase can be estimated from the number of operational staff,

and the rate of produced black water at 80 l/person/day<sup>1</sup> and grey water at 160 l/person/day (calculated from 80% of water for use at 200 l/person/day<sup>2</sup>). The estimated total generation for one well is of ~0.64 m<sup>3</sup> of black water and 1.28 m<sup>3</sup> of grey water. In terms of the whole campaign, such as 540 days for 12 wells, the estimated total generation is of 138.24 m<sup>3</sup> of black water and 276.48 m<sup>3</sup> of grey water.

- Bilge water means accumulated water in the ship holds and containing infiltration water, oil residues or any other product that would have been stored. Based on 31 m<sup>3</sup>/d typical output (0.15 m<sup>3</sup>/d typical values for the rig and 0.08 m<sup>3</sup>/d typical values for each vessel), total volume of bilge water for the drilling of one well during 40 days is estimated around 9.6 m<sup>3</sup>. 2,075.76 m<sup>3</sup> of bilge water are estimated for 12 wells drilling during 540 days.
- Deck water comprises rainwater and deck washing water of the vessel. The run-off water is collected by an open drain system. Considering a typical drilling rig and typical vessels' deck dimensions (Rig 50x100 and vessel 2x10x30, sum: 5 600 m<sup>2</sup>) as well as the typical annual rainfall values during the rainy season (from May to October) in Myanmar (~100 mm/month in average), a rough estimation of the total deck water to be produced during the drilling campaign is 620 m<sup>3</sup>.
- Ballast water is stored in specially designated ballast tanks and cannot be mixed with any other contaminants. No discharge of ballast water from other ecozones is expected to occur during the project, the rig will normally arrive on-site and leave the site de-ballasted and ballast supply vessels will perform rotations within the same marine eco-zone.
- As part of routine operation and closing operations, the subsea BOP stack elements would vent hydraulic fluid onto the ocean at the seafloor. It is anticipated that approximately 20 m<sup>3</sup> of less toxic hydraulic fluid would be vented during the drilling of a well.
- Drilling operations produce **non-hazardous waste** (glass, paper, plastic and wood) and very low amounts of **hazardous waste** (medical waste, chemical waste). Both wastes will be managed in accordance with the provisions of the waste management procedures of PTTEPI. In particular, the waste streams will be categorized on-board at source for the purpose of segregation and temporary storage prior to shipping to shore by the barge for treatment or disposal in an authorized facility.
- The estimated quantities of each waste generated during the Block M9 appraisal drilling activities are the following:

<sup>1</sup> Sewage generation rate is 0.08 m<sup>3</sup>/person/day.

<sup>2</sup> Domestic polluted water generation rate is 80% of the amount of water use (200 l) or equal to 0.16 m<sup>3</sup>/person/day.

- General waste: 2,516 kg
- Non-hazardous waste: 184 kg
- Recycled waste: 5 containers
- Chemical container: 70 kg
- Hazardous waste: 470 kg

That is, an estimated total quantity of ~3,240 kg of waste for one well will be produced during the drilling campaign.

- The potential for venting and fugitive releases exists; however, volumes will be small and unlikely to raise an odour problem. Ambient noise impacts may occur during drilling activities, however, these will be short term and at a small scale. A key factor for noise impact is the remote location of the project, which is located 260 km offshore away from people and any environmentally sensitive areas. Added to this, potential impact from extraneous light is expected to be minor, with the main sources arising from lighting and the flare (which will be used in case of success and during limited time only).
- In case of unplanned event such as an accident, drilling activity may cause accidental release of a greater or lesser importance.

## **1.4. DESCRIPTION OF THE SURROUNDING ENVIRONMENT**

### **1.4.1. Physical Environment**

#### **1.4.1.1. ATMOSPHERIC ENVIRONMENT**

Myanmar has a hot and humid climate dominated by monsoon pattern. Its climate can be described as tropical monsoon characterized by strong monsoon influences, a considerable amount of sun, a high rate of rainfall (coastal regions receiving over 5,000 mm of rain annually) and high humidity. Temperature in the Tanintharyi Division varies from 18.3°C to 35.8°C and humidity from 72% to 89%. During the forecasted period of the M9 exploration campaign (the tentative schedule is Q3-Q4 of 2018), little precipitation is anticipated, and would mostly occur in October.

The sensitivity of the atmospheric environment to changes in atmospheric emission concentrations in the magnitudes predicted as part of the exploration project is expected to be fairly low due to other similar industrial activities currently undertaken in the adjacent areas (mainly the Yadana and Zawtika gas operations). Air quality within the project area is not identified as a specific issue.

Air quality sensitivity ranks is very low.



The Block M9 area is considered to be potentially exposed to multiple natural hazards; tropical storms being the most relevant (OCHA, 2013). The most risky season occurs from May to November, with a higher risk in October.

Vulnerability to natural disaster in the prospected area is very low.

#### **1.4.1.2. MARINE SEDIMENT**

The sediment consists of high proportions of silt and clay, with high nutrient contents and organics. This seabed environment is in generally good condition, with chemical and physical characteristics, which would be reasonably sensible to changes in physical composition as a result of seabed disturbance.

Offshore sediment sensitivity is ranks as low.

#### **1.4.1.3. SEAWATER QUALITY**

The water depth in the project area ranges from 50 to 800 m, and its water quality was found to be typical of offshore open water environment exhibiting high water clarity and low nutrient levels. Although anthropogenic pollution has been recorded in surrounding blocks, seawater quality at Block M9 was considered uncontaminated with no parameter occurring at concentrations of environmental concern.

Water column sensitivity ranks as low.

### **1.4.2. Biological Environment**

PTTEPI conducted Marine Baseline Survey with ERM in Offshore Block M9 in February 2018 with the purpose to collect the primary data for seawater quality, sediment quality and benthic community. The results will be included in the Chapter 5: Description of the Surrounding Environment.

#### **1.4.2.1. PLANKTONIC AND ZOOPLANKTONIC COMMUNITIES**

Although the region presents a low abundance of crab larvae, planktonic shrimps and larvaceans, a rich abundance of zooplankton groups (including calanoid copepods, poecilostomatoid copepods and arrow worms) was observed during previous marine baseline surveys carried out in the block.

Plankton sensitivity ranks as low.

#### **1.4.2.2. BENTHIC COMMUNITIES**

Benthic communities are likely to be well presented in terms of species and abundance within the project area. Results from the marine environmental survey reported a total of 43 individuals' organisms. Infaunal assemblage structure was generally similar between stations and dominated by Annelida and arthropoda species (typical features of macrobenthos communities' soft sediment marine benthic habitat).

Benthic communities' sensitivity ranks as very low.

#### **1.4.2.3. FISH (SEA AND COASTAL ZONE)**

Through the influence of the seasonal variations imposed by the monsoon systems, the pelagic fish community appears to be widespread with a common distribution. This community contains a wide variety species, which are observed across the entire Indian Ocean.

Fish species sensitivity ranks as low.

#### 1.4.2.4. MARINE MAMMALS

Large cetaceans' species have been recorded in offshore deeper waters, which would be in line with their typical life histories. That is, based on experiences and messages from local fishermen, whales are likely to encounter in the project area.

Conducted over a period of six days, a total of three groups of Pantropical Spotted Dolphin (*Stenella attenuate*) were observed in Block M9 during the marine environmental survey (ERM, 2018). This species is reported to be among the most commonly sighted marine mammal species in Myanmar marine waters and is not a species of particular conservation concern, being listed as 'Least Concern' on the IUCN 2018 Red List of Threatened Species.

Marine mammals' sensitivity ranks as high.

#### 1.4.2.5. SEA TURTLES

Some beaches on the Myanmar coastline were identified as nesting sites for five protected turtle species: Olive Ridley Turtle (*Lepidochelys olivacea*) (*vulnerable*), Loggerhead Turtle (*Caretta caretta*) (*endangered*), Green Turtle (*Chelonia mydas*) (*endangered*), Hawksbill Turtle (*Eretmochelys imbricata*) (*critically endangered*) and Leather Back Turtle (*Dermochelys coriacea*) (*critically endangered*).

These species are internationally protected and listed as vulnerable or endangered on the IUCN red list. The project area may be on a migration path for turtles that reach Myanmar beaches during the nesting period from the end of September to March, with a peak in January-February for most species, and July to November for the green turtle. However, most observations of turtles are typically within 15 km of mainland shores in protected shallow marine waters (22-25 m), i.e. some distance from the project area. Nevertheless, some species may be encountered in the area to be explored as they are migratory species, but this could be expected all year round. The main potential population affected by the project would be the green turtle from Preparis Island during their nesting season.

Sea turtles sensitivity ranks as high.

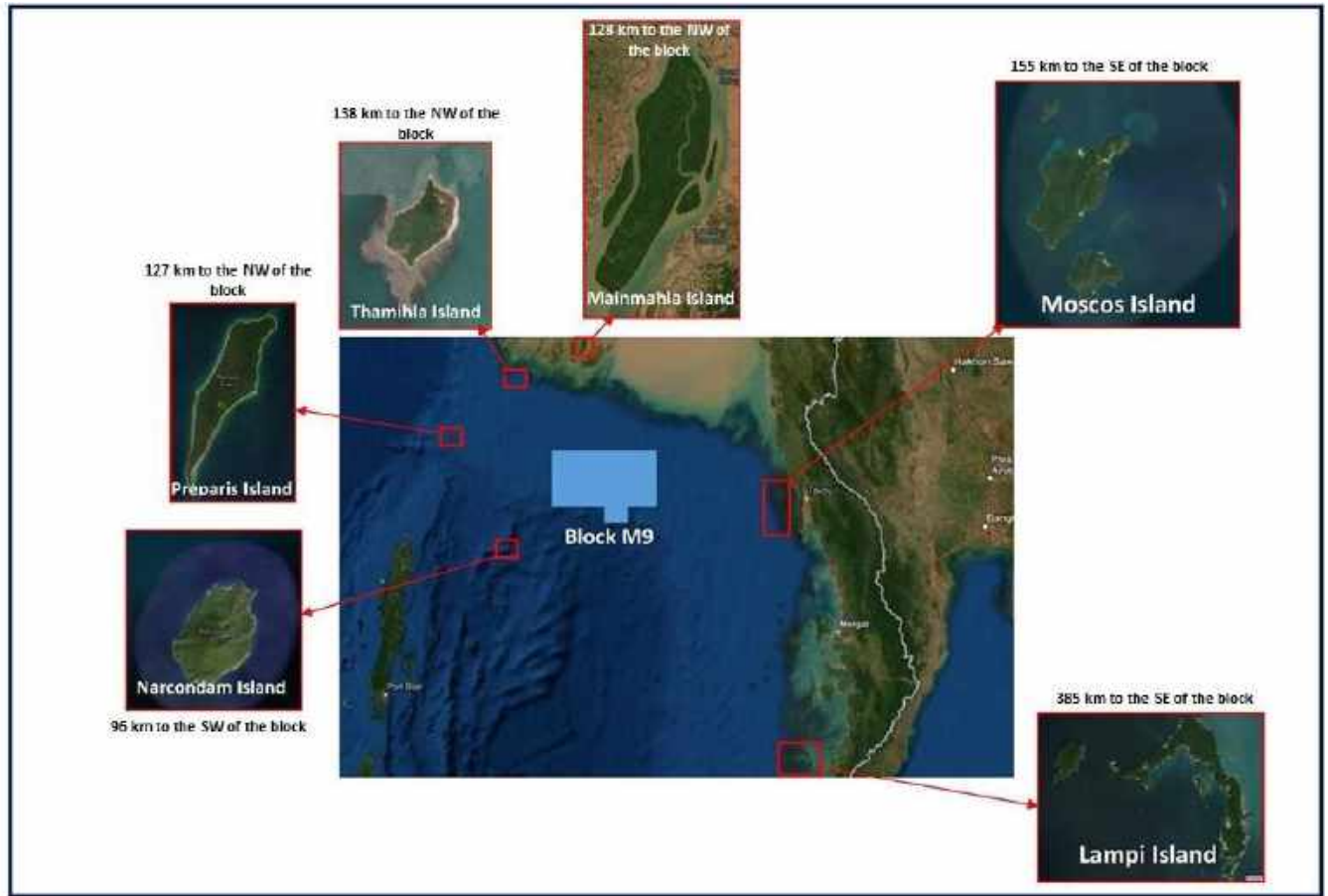
#### 1.4.2.6. MARINE BIRDS

A total of 20 seabirds are currently identified by the IUCN in Myanmar waters. Amongst these species, 4 species such as: Spotted Billed Pelican, Painted Stork, Black Head Ibis, Asian Dowitcher are identified as near threatened and 16 species are recorded as least concern. Taking into account the typical habitat of these seabirds, the project area could be used by seabirds for foraging and loafing (resting).

Marine birds' sensitivity ranks as low.

#### 1.4.2.7. SENSITIVE AND PROTECTED AREAS

Mainmahla island, Thamihla island, Preparis island and Moscos island are existing around the Block M9. Among these islands, Mainmahla island (designated as Ramsar site), Thamihla island and Moscos island are recognized as wetland wildlife sanctuaries and the approximate distances from those islands to the nearest corner of the block are presented as below:



**Fig. 1.** Islands and protected areas near to the project

Since, all of these islands and protected areas are significantly located far from the project, major impacts or influences from project operation, are not expected to be affected by the project activities.

Sensitive and protected area sensitivity ranks as very low.

### 1.4.3. Socio-economic Environment

The project area is located at ~260 km south of Yangon and 178 km west of Dawei, close in an offshore zone, with water depths comprised between 50 and 800 m. The project is not expected to have significant interactions with the on-shore human environment in Myanmar, apart from offshore marine activities such as fishing and goods transportation.

The nearest protected areas from Block M9 are the Mainmahla Kyun Wildlife Sanctuary, Thamihla Kyun Wildlife Sanctuary, and Moscov Island Wildlife Sanctuary. However, all of these protected areas are located far from the project and are not expected to experience any social impact or influence from project operation.

#### 1.4.3.1. FISHERIES

According to discussion with local regional offices, only fishery groups from Tanintharyi Region are located within Block M9. There are also indications that November to April is the best season for fishing in terms of weather condition. Fishing occurs during this period in shallow water, across the continental slope but also in deep-water.

Fishing activity sensitivity ranks as medium.

### 1.4.3.2. MARINE TRAFIC

Although the eastern edge of the block is located adjacent to the main shipping lane from Yangon heading to the Straits of Malacca in the south, Block M9 does not include international routes. However, there exists the potential for tanker routes is expected to be established near Block M9 after the accomplishment of Dawei SEZ.

Marine traffic sensitivity ranks as medium.

### 1.4.3.1. PORT INFRASTRUCTURE

PTTEPI will use Thaketa Supply Base (TKA) in Yangon and Ranong Supply Base (RSB) in the port of Ranong Province (Thailand) as logistic bases. Both supply bases consist berth, cranes and lifting equipments, warehouse, temporary waste storage facility and support PTTEPI's offshore operations.

The sensitivity is considered very low.

## 1.5. IMPACT AND RISK ASSESSMENT AND MITIGATION MEASURES

### 1.5.1. Environmental and Social Impact of the Proposed Project

The consultants who conducted this study took into account all the project activities, such as (i) the consumption of natural resources (use of freshwater, fuel oil, chemical products, drilling mud and additives), (ii) the atmospheric emissions, light and noise, (iii) the discharge of various effluents due to the presence of living quarters aboard and residual water in the sea, (iv) waste, (v) the disturbance to the seabed (installation of drilling rig, etc.), (vi) physical presence (presence of the drilling rig, support vessel), (vii) the introduction of invasive marine species, (viii) accidental release, (viii) the use of labour, subcontracting and supply, etc.

The residual impact assessment indicates that the M9 drilling project will result in negligible or minor for residual impacts following the implementation of recommended mitigation measures. Thus, it is concluded that the drilling activities will be of low overall residual impact magnitude and short duration.

A synthesis of the main environmental and societal issues is summarized below.

- The GHG emissions from the future drilling project on the **air quality** will be negligible and short-term and also must be in compliance with Myanmar National Environmental Quality (Emission) Guidelines. A total number of around 7,769 kilo tonnes CO<sub>2</sub> equivalent is expected to be generated over 40 days for each one of the 12 wells (93,228 ktons of CO<sub>2</sub> equivalent is estimated for the whole period of the 12 drilled wells (540 days)). The emission will come mainly from exhaust gas generated by diesel consumption required for the power generation of the rig.

Overall, the GHG emissions of the project can be considered negligible compared to Myanmar global GHG emissions. There may be a short-term detectable change in the air quality within the immediate area, though pollutants will be rapidly dispersed. No noticeable long-term effect on the local or regional air quality is expected.

Only the cumulative aspects, i.e. the project's emissions added to the current emissions, could generate a significant impact. The residual impact of the project is **NEGLECTIBLE** (under the condition that further studies are implemented in order to understand better about the cumulative impacts and health risks of personnel relating to the project).

- **Marine sediments and benthic communities** are expected to be principally affected by the drilling activities. The use of drilling fluids with low toxicity and high biodegradability will ensure negligible toxic effects. There may be physical disturbance of the sediments during the installation of the semi-submersible rig and drilling activities. However, these impacts will be localised and short-term (40 days per well). Drilling operations are not expected to have any noticeable effect on the marine sediment.

The main measures implemented by the project concern (i) prohibit anchor dragging and (ii) processing in place the cuttings from sections using WBM and SBM so that they are discharged via discharge line 15 m below sea surface. Finally, the residual impact on the project area is **MINOR**.

- Drilling operations are expected to have a temporary detectable impact on **water quality**. The impact will affect only a localized area in the immediate vicinity of the discharges. The sources of impact are the wastewater discharges from the rig and the supply vessels. All discharges shall be in compliance with international standards (e.g., IFC) and conventions (e.g., MARPOL).

Other key measures allowing the reduction of impacts on water are: (i) the selection of chemicals based on the lowest toxicity, the lowest potential bioaccumulation and greater biodegradability, (ii) optimization on the use of chemicals, (iii) the development of a system to treat bilge water and drainage water, with a hydrocarbon concentration limit as per Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (IFC, 2015), (iv) a waste water treatment, (v) monitoring pH before being discharged and (vi) development of a chemical management plan, discharged management plan, waste management plan (allowing only the discharge of crushed organic waste to the sea) and an environmental management plan.

Finally, the residual impact on the project area is **NEGLIGIBLE**.

- The impacts of the project on (i) water and (ii) sediment quality as well as (iii) planktonic and benthic populations may indirectly affect the **pelagic environment** by disrupting their habitats and food sources. Pelagic fish species and other vertebrates are highly mobile and will move away if they encounter unfavourable water conditions. Mitigation measures relating to them are also effective.

In order to minimize impacts on habitat and food resources, additional measures are needed with: the implementation of a lighting plan to limit emissions of stray light, while ensuring optimal safety conditions on sites. To conclude, the residual impact on the project area is **MINOR** for marine mammals and turtles. In terms of seabirds, as the activities mainly carried out offshore, 170 km offshore the Myanmar coasts, seabirds' populations should be very limited. Residual impacts are considered **NEGLIGIBLE**.

Moreover, drilling operations occur in an area where the seafloor is already affected by the oil and gas activities (i.e., Yadana and Zawtika complex for instance).

- **Noise** impacts may occur during drilling activities, however they will be short term and at a small scale. A key factor for noise impact is the remote location of the project, which is located about 200 km offshore, away from people and any environmentally sensitive areas. Added to this, potential impacts from extraneous light or odour are expected to be **negligible** compared to the existing main sources arising from lighting and the flare of the Zawtika and Yadana complex.
- Potential impact from **solid wastes** generated by the project will be limited as the waste will be transported to onshore treatment facilities at the logistic base of PTTEPI in Thaketa or Ranong. Furthermore, the implementation of a waste management plan should reduce to the minimum the impact generated by hazardous and non-hazardous disposal (onshore by authorized contractor). Residual impact is considered **NEGLIGIBLE** (if a complete route for waste disposal is identified and approved).

Since chemicals and other hazardous materials are in common use in the oil industry, there is an inherent risk of spill to be considered and consequently damage to the environment. The main measures applicable to chemicals and hazardous materials during a spill are: chemicals will be stored in tote tanks and drums stored in designated areas with bundling to prevent spillages; Separate storage areas will be provided for incompatible substances.

- There will be a positive **economic impact** from the drilling project due to the increase of direct and indirect employment. As the field is located offshore, there will be no direct effects on the coastal population of Myanmar living within the Irrawaddy Delta and coastal islands.
- Imposition of permanent and temporary exclusion zone will inevitably have some slight impacts on **navigation**. However, it is considered as **minor** due to the location of the drilling project away from the main shipping lanes. These zones will be clearly posted in notices to mariners minimizing any

potential effects. The additional footprint will come only from the logistic vessels and the mobilisation/demobilisation of the drilling rig.

- Potential impact coming from obstruction of **fishing routes and fishing areas** (coastal and offshore) is considered as **minor**, particularly considering that the site lies very close to the Zawtika field: restriction zone and maritime lines will be determined in relation with local authorities to avoid any conflict of maritime use. PTTEPI will install lighting, acoustic and other equipment necessary for the safety of the petroleum operations. PTTEPI will also minimize as much as possible any obstruction/travel within coastal and offshore fishing areas.

The routes for the logistics vessels (between the onshore base and the exploration drilling area) that are already approved by PTTEPI and the local authorities will be used for the exploration drilling project.

- The potential impact of a spill occurring is considered as minimal. PTTEPI will ensure facilities will be designed and operated following best practices in accordance with local and international regulation.

### 1.5.2. Modelling Studies

In this section, only the environmental impacts related to the release of cuttings due to drilling activity are addressed. Indeed, cuttings from the drilling operation are brought up to the rig, sort out and cleaned before being released from the rig into the Sea. The environmental impact was assessed by calculating cuttings suspensions concentrations and sediment deposits at the end of the drilling operation.

For Block M9, the drilling points are located at a depth of -130m on the continental shelf. 12 drilling points are expected, two were selected and five simulations were run over 1 month (drilling duration). Months simulated were chosen to describe all seasons. Simulation results show that the sediment deposit on the sea bottom is always below 1.9 cm. A sediment deposit of more than 1cm is observed only on January, April and October simulations. The area with a thickness deposit above 1cm corresponds to a narrow circle with a radius of 100m. The suspended sediment load in the water column is below 1mg/l for all simulations. At -20m depth, the area where the concentration is more than 0.1mg/l corresponds to a circle of 150m diameter and this 0.1 mg/l concentration is observed at -90m for only one of the simulation.

The complete report is provided in the **Error! Reference source not found.** of the present document.

## 1.6. CUMULATIVE IMPACTS

Each environmental component undergoes the cumulative impacts of all oil exploration and production activities. A great number of activities has cumulative impacts on the physical environment and indirectly affect the natural and human environment. The main cumulative activities of the project are as follows: (i) physical presence and annexation of the maritime domain, (ii) emissions and discharges that modify the physical environment and indirectly the natural environment and (iii) the production of waste that is advisable to reuse, process and/or bury with environmental consequence that are not always well controlled.

The table below presents a first assessment of cumulative impacts.

**Tabl. 4 - Cumulative impact identification of significant impacts associated with the appraisal drilling project**

<i>Environmental &amp; Social aspects</i>	<i>Project activities (Phase of activities)</i>	<i>Detail/Reason</i>
Traditional fishing	Physical presence of structures and vessels (mobilization and demobilization of equipment)	Increase in sea traffic
		Extension of restricted shipping areas
		Increase of anthropogenic pressure
		Primary increase of the fishing pressure
		Cumulated impacts of the discharges on biotopes (water, sediments, and seagrass)
Biodiversity	Physical presence of structures and vessels (mobilization and demobilization of equipment)	Increased noise may disturb marine organisms. Destruction of organisms and biotopes, and behavioural modifications.
	Drilling rig installation (mobilization of equipment)	
	Discharge of mud and cuttings (drilling operation)	
	Blowout (unplanned events)	

## 1.7. ENVIRONMENTAL MANAGEMENT PLAN

### 1.7.1. Introduction

The present study provides a recommended approach to developing a project environmental management plan, which will deliver the agreed management and mitigation measures identified in the report. The final and issued EMP will need to be developed by PTTEPI and its selected drilling contractor before the start of the project.

The general objective of the EMP is to establish required and adequate tools to eliminate, mitigate and/or compensate environmental and social impacts identified in the EIA throughout drilling activities in Block M9. The EMP described procedures, resources, roles and responsibility with regard to:

- The implementation of mitigation measures to prevent and/or minimize potential environmental impacts regarding project activities,
- The monitoring of any environmental impacts related to the project.

For each proposed measure, the EMP defines the technical content, operational program, organization and means of results control. The EMP develops with the project in a logical improvement.

The requirements of the EMP may need to be further incorporated into working documents, such as Standard Operating Procedures, Work Procedures, etc. and their dissemination guaranteed by adequate briefing and training of identified, relevant personnel.

The following table present the recommended management plans for the project:

**Tabl. 5 - Management Sub-Plans include in the report**

<i>Management Sub-Plans</i>	<i>Remark</i>
Chemical Management Plan	The outlines of Chemical Management Plan is described in this document. However, the detail procedures shall be developed by the contractor and approved and supervised by PTTEPI representatives on Site and SSHE department.

Waste Management Plan	The overview of PTTEP Waste Management Procedure is described in this document to support for Waste Management. However, the detail procedures shall be developed by the contractor on operation basis.
Blowout Contingency Plan	The outlines of Blowout Contingency Plan is described in this document. However, the contractor shall develop detail procedures with the supervision of PTTEPI representatives on site.
Spill Contingency Plan	The Spill Contingency Plan is described in this document in general. However, the contractor shall develop detail procedures with the supervision of PTTEPI representatives on site.
Emergency and Crisis Management Plan	Emergency and Crisis Management Plan is described in this document. However, the contractor shall develop detail procedures with the supervision of PTTEPI representatives on site.
Grievance Mechanism (for handling of complaints by project stakeholders and third parties)	The general context of Grievance Mechanism is presented in this document and PTTEPI will practice according to Grievance Handling Guidelines.
Training and Awareness Programme	This programme is generally described in present document. Nevertheless, practicing of training and exercises for employees and contractors will be developed for the project.
Environmental Audit Programme	The outlines of Environmental Audit Programme is described in this document. And the responsible party or appointed team leader will conduct the audit on given time schedule.
Occupational and Community Health Management Plan	The outlines of the plan is general description of health management to be practised by PTTEPI and embedded PTTEPI's Occupational Health Management Standard as an appendix for proper guidance.
Monitoring Plan (through which the efficacy of management and mitigation measures can be verified).	The monitoring programs are described in each sub-plans at the present document.

The detail explanation of each plan is described in Chapter 8: Environmental and Social Management Plan and these plans, procedures will mostly be developed by the contractors under the approval and supervision of PTTEPI representatives on Site and SSHE department.

### **1.7.2. Key Impacts and Mitigation Measures/Commitment Table**

These mitigation measures will be taken into account in project implementation and execution, such that potential adverse impacts are reduced As Low As Reasonably Practicable (ALARP). The mitigation measures to control identified impacts, comply and ensure with the standards of international practice, and are presented for each phase. Project Proponent committed to do and responsible to conduct the following list throughout the project period.



Tabl. 6 - Mitigation measures/commitment list for project during the mobilization and installation phase

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impacts	Specific action	Location	Duration	Responsibility
<b>Environmental mitigation measures</b>							
1- Air quality / GHG emissions	Air emissions from combustion due to operation of machines and engines installed on support and supply vessels.	<ul style="list-style-type: none"> <li>Regular maintenance of marine engines, generators and compressor.</li> <li>Compliance with MARPOL 73/78 Annex VI – prevention of air pollution from ships, and if applicable based on age of vessels (MARPOL Annex VI Chapter 4 – ship energy efficiency management)</li> <li>To warn vessels of any delays in required times of arrival so that they may reduce speed accordingly for energy efficiency if possible</li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>Regular maintenance of marine engines, generators and compressor.</li> </ul>	All project vessels	Mobilization and installation phase	PTTEPI/ Contractor
2- Seawater & sediment quality	<p>Discharge of oil-containing wastewater (i.e., bilge water, oil-chemical containing wastewater from engine room and deck drain) containing hydrocarbons or untreated sewage from marine vessels could potentially degrade seawater quality.</p> <p>Discharge of wastewater and sewage from drilling rig, support and supply vessels may impact seawater quality.</p>	<ul style="list-style-type: none"> <li>Rig, support and supply vessels shall be equipped with sanitary wastewater treatment unit.</li> <li>All vessel shall comply with MARPOL (discharged bilge water into the sea shall not exceed 15 mg/l) and PTTEPI's Waste Management Procedure.</li> <li>Bilge water separately collected and treated prior to discharge into the sea. All discharges should be treated and has &lt;15 ppm of oil content.</li> <li>Food waste is milled and ground to a size of &lt;25 mm in diameter prior to discharge.</li> <li>Ballast water will not be discharged into the environment without prior treatment. Ballast water discharges, if any, will comply with the international convention for the control and management of ships' ballast water and sediment (IMO, 2004).</li> <li>Marine vessels have open drain system, which collects and treats run-off water potentially contaminated with hydrocarbons and/or chemicals.</li> <li>Vessels not to be stationary when undertaking discharge.</li> <li>Suitable sewage water treatment units shall be available on the vessels and adequately sized according to the number of people working on-board.</li> <li>Chemical additives on all marine vessels will be stored in drums or tote tanks located in area equipped with means to contain any leaks or spills.</li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>Treat all sewage prior to discharge with wastewater treatment system according to MARPOL 73/78.</li> <li>See mitigation measures for specific action on hazardous and non-hazardous wastes.</li> </ul>	All project vessels	Mobilization and installation phase	PTTEPI/ Contractor

## Offshore M9 East Appraisal/Exploration Drilling

Report

## ENVIRONMENTAL IMPACT ASSESSMENT

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impacts	Specific action	Location	Duration	Responsibility
	The project will generate various types of hazardous and non-hazardous wastes. Inappropriate management (including transportation, storage and disposal) of waste will impact seawater quality.	<p>Manage waste at offshore facilities in compliance with the requirements under MARPOL 73/78 and PTTEPI's Waste Management Plan.</p> <p><b>Hazardous Waste</b></p> <ul style="list-style-type: none"> <li>Waste storage areas shall be clearly defined.</li> <li>Collected and stored in suitable containers that are protected from the environment (rain, wind, etc.).</li> <li>The vessel deck shall be cleaned to minimize the impact from oil and chemical contamination into the sea during period of rain.</li> <li>Containers equipped with means to contain any spills or leaks.</li> <li>Transferred to a suitable authorized disposal facility onshore by a certified transporter.</li> <li>Prohibit any discharge of hazardous waste into the sea.</li> </ul> <p><b>Non-hazardous waste</b></p> <ul style="list-style-type: none"> <li>Segregate non-hazardous waste, including food waste, paper, aluminum can, glass, rag and other wastes in separate containers or proper areas.</li> <li>Waste storage areas shall be clearly defined.</li> <li>Food wastes will be ground to 25 mm prior to discharge to sea. All non-food wastes will be collected and transported to shore for landfill or acceptable disposal.</li> <li>Dispose non-hazardous waste at onshore treatment facilities in accordance with the law of Myanmar and PTTEPI's Waste Management Plan.</li> <li>Transported to the onshore bases for collection and recycling by an authorized waste management contractor.</li> <li>Keep the record of waste inventories, including type and quantities updated.</li> </ul>	NEGLIGIBLE				
	Drilling rig installation and anchoring of support vessels can disturb the seafloor and consequently cause a temporary suspension of the	<ul style="list-style-type: none"> <li>Before the drilling starts, PTTEPI will coordinate with MOGE, who will then issue "Notice to Mariner" regarding project activities to concerned parties (i.e., Department of Fisheries, Ministry of Livestock, Fisheries and Rural Development, Myanmar Navy and Myanmar</li> </ul>	MINOR	<ul style="list-style-type: none"> <li>Generalisation of the vessel dynamic positioning devices for drilling.</li> </ul>	All project vessels/ Drilling	Mobilization and installation phase	PTTEPI / Contractor

**Offshore M9 East Appraisal/Exploration Drilling**

Report

**ENVIRONMENTAL IMPACT ASSESSMENT**

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impacts	Specific action	Location	Duration	Responsibility
	sediments, increasing turbidity.	Fisheries Federation).			rig		
3- Seabed characteristics	The pattern of seafloor sediment topography could be affected by rig and anchoring of support vessels.	<ul style="list-style-type: none"> <li>Conduct seafloor surveys to identify seabed features that could impact on or be impacted by rig installation.</li> <li>Prohibit anchor dragging.</li> <li>Before the drilling starts, PTTEPI will coordinate with MOGE, who will then communicate to issue "Notice to Mariner" regarding project activities to concerned parties (i.e., Department of Fisheries, Ministry of Livestock, Fisheries and Rural Development, Myanmar Navy and Myanmar Fisheries Federation).</li> </ul>		<ul style="list-style-type: none"> <li>At least 30 days prior to rig transport and installation, coordinate with MOGE, who will issue "Notice to Mariner" regarding project activities.</li> <li>Conduct seafloor surveys, prior to installation rig.</li> </ul>	All project vessels/ Drilling rig		
4- Marine life and marine ecology	Offshore activities may disturb marine mammals.	<ul style="list-style-type: none"> <li>Adoption of equipment designed to current engineering standards.</li> <li>Regular maintenance of marine engines, generators and compressor.</li> <li>Vessels to use slow speed and adapt the routes to avoid sensitive areas to marine mammals</li> <li>Adoption of passive acoustic monitoring system to observe the presence of marine mammals</li> </ul>	NINOR TO NEGLIGBLE	<ul style="list-style-type: none"> <li>Observe the presence of marine mammals prior to seafloor survey activities.</li> <li>Implement all mitigation measures for Item 2 and 3.</li> </ul>	All project vessels.	Mobilization and installation phase	PTTEPI / Contractor
	Waste, wastewater and discharges from drilling rig and vessels may cause an impact on seawater and sediments, which may indirectly affect the community of marine biota at the surface level and the seabed.	<ul style="list-style-type: none"> <li>Implement all mitigation measures for Item 2 and 3.</li> </ul>					
<b>Social mitigation measures</b>							
5- Fishing communities and fisheries	Reduced fishing area due to the presence of drilling rig and vessels, and 500 m exclusion zones.	<ul style="list-style-type: none"> <li>Before drilling starts, PTTEPI will coordinate with MOGE, who will then communicate to issue "Notice to Mariner" regarding all the project activities to concerned parties (i.e. Department of Fisheries, Ministry of Livestock, Fisheries and Rural Development, Myanmar</li> </ul>	MINOR	<ul style="list-style-type: none"> <li>At least 30 days prior to rig transport and installation, coordinate with MOGE, who will issue "Notice to Mariner" regarding project</li> </ul>	All project vessels/ Drilling rig	Mobilization and installation phase	PTTEPI / Contractor

**Offshore M9 East Appraisal/Exploration Drilling**

Report

**ENVIRONMENTAL IMPACT ASSESSMENT**

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impacts	Specific action	Location	Duration	Responsibility
		<p>Navy, and Myanmar Fisheries Federation).</p> <ul style="list-style-type: none"> <li>An exclusion zone (radius of 500 m) will be established surrounding the drilling rig.</li> <li>Use support vessels to warn off traffic.</li> <li>Provide appropriate lights and warning signals at offshore facilities to prevent accidental collision.</li> </ul>		<p>activities.</p> <ul style="list-style-type: none"> <li>Established 500 m safety zone around the drilling rig.</li> <li>Use support vessels to warn off traffic.</li> <li>Provide appropriate light and warning signals at offshore facilities.</li> </ul>	All project vessels/ Drilling rig		
	The quantity and quality of aquatic biota may decrease due to waste contamination in the sea. Contaminants may consist of non-hazardous and hazardous waste.	<ul style="list-style-type: none"> <li>Implement all mitigation measures for Item 2 and 3 above.</li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>Implement all mitigation measures for Item 2 and 3 above.</li> </ul>			
6- Shipping and navigation	Marine vessels may obstruct marine navigation during transporting the rig and equipment from onshore.	<ul style="list-style-type: none"> <li>Before drilling starts, PTTEPI will coordinate with MOGE, who will then communicate to issue "Notice to Mariner" regarding project activities to concerned parties (i.e. Department of Fisheries, Ministry of Livestock, Fisheries and Rural Development, Myanmar Navy, and Myanmar Fisheries Federation).</li> <li>Use support vessels to warn off traffic.</li> <li>Provide appropriate lights and warning signals at offshore facilities to prevent accidental collision.</li> <li>An exclusion zone (radius of 500 m) will be established surrounding the drilling rig.</li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>At least 30 days prior to rig transport and installation, coordinate with MOGE, who will issue "Notice to Mariner" regarding project activities.</li> <li>Established 500 m safety zone around the drilling rig.</li> <li>Use support vessels to warn off traffic.</li> <li>Provide appropriate light and warning signals at offshore facilities.</li> </ul>	All project vessels/ Drilling rig	Mobilization and installation phase	PTTEPI / Contractor
	The presence of the offshore facilities may obstruct navigation.						
7- Socio-economy	Increase in industrial expenditure and income (positive impact)	<ul style="list-style-type: none"> <li>Enhance utilization of local goods and services as much as possible.</li> </ul>	POSITIVE Impact	<ul style="list-style-type: none"> <li>Utilize local goods and services as much as possible.</li> </ul>	Onshore bases		PTTEPI / Contractor
<b>Health mitigation measures</b>							
8- Occupational health	Injuries or illness due to exposure to harmful	Implement relevant components of PTTEPI's SSHE Management System, including the following:	NEGLIGIBLE	<ul style="list-style-type: none"> <li>See mitigation measures.</li> </ul>	All project	Mobilization and	PTTEPI /

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impacts	Specific action	Location	Duration	Responsibility
and safety	substances or accident	<ul style="list-style-type: none"> <li>Implement PTTEPI's Occupational Health Management Standard.</li> <li>Ensure that all employees wear appropriate equipment, and implement PTTEPI's Personal Protective Equipment Standard.</li> <li>Personnel will be provided with safety training to ensure that all workers practice under safety operation and regulation of work, as per PTTEPI's SSHE Training &amp; Competency Standard.</li> </ul>			vessels/ Drilling rig/ Onshore bases	installation phase	Contractor
		<ul style="list-style-type: none"> <li>Cooperate with the nearest health centre/hospital in order to immediately support response to emergency events, as per PTTEPI's MERP. Duty Manager and Emergency Management Team for Medevac response or Medical Referral in case of emergency events.</li> </ul>					
		<p>Implement following operational measures for prevention and control of accidents:</p> <ul style="list-style-type: none"> <li>Safety Data Sheets must be provided with every chemical products.</li> <li>Adequate storage will be provided for each chemical in accordance with safety instruction (storage conditions, etc.).</li> <li>Provide spill kits on-site.</li> <li>Provide first aid kits on-site.</li> <li>Provide proper sanitary systems, including drinking water, potable water, toilet and waste management.</li> </ul>			All project vessels/ Drilling rig	Preparation and installation phase	PTTEPI / Contractor
	Injuries due to working in noisy areas.	<ul style="list-style-type: none"> <li>Regular maintenance of marine engines, generators and compressor.</li> <li>Provide personal protection equipment (ear plug for instance) to workers working on high-level noise activities.</li> </ul>					
9- Public health and Health service	Project activities could involve general public around shore bases that will be used for staff, materials and waste transportation.	<ul style="list-style-type: none"> <li>Implement PTTEPI's Occupational Health Management Standard. <b>(Error! Reference source not found.)</b></li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>See mitigation measures.</li> </ul>	Shore bases		PTTEPI
	In case of accident or illness during project activities, it	<ul style="list-style-type: none"> <li>Cooperate with the nearest health centre/hospital in order to immediately support response to emergency events, as</li> </ul>					

**Offshore M9 East Appraisal/Exploration Drilling**

Report

**ENVIRONMENTAL IMPACT ASSESSMENT**

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impacts	Specific action	Location	Duration	Responsibility
	may be required to use healthcare services around the shore bases.	per PTTEPI's MERP. Duty Manager and Emergency Management Team for Medevac response or Medical Referral in case of emergency events.					

Tabl. 7 - Mitigation measures/commitment list for project during the drilling phase

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impact	Specific action	Location	Duration	Responsibility
<b>Environmental mitigation measures</b>							
1- Air quality / GHG emissions	Air emissions from combustion due to operation of machines and engines installed on drilling rig, support and supply vessels	<ul style="list-style-type: none"> <li>Maintaining generators and compressors in good working order.</li> <li>To warn vessels of any delays in required times of arrival so that they may reduce speed accordingly for energy efficiency if possible</li> </ul>	NEGLECTIBLE	<ul style="list-style-type: none"> <li>Conduct routine inspection of machinery.</li> <li>Conduct preventive maintenance of all machinery as per maintenance schedule.</li> </ul>	All project vessels/ Drilling rig	Drilling phase	PTTEPI/ Contractor
	Exhaust gases from helicopter jet fuel combustion.	<ul style="list-style-type: none"> <li>Use the helicopter only for crew transportation and emergency case</li> </ul>		<ul style="list-style-type: none"> <li>Conduct routine inspection of machinery.</li> </ul>	Onshore bases/ Drilling rig		
2- Seawater & sediment quality	Discharge of mud and cuttings into the sea could impact seawater and sediment quality.	<ul style="list-style-type: none"> <li>Use of WBM with high biodegradability and low toxicity additives as main drilling fluid for all well sections.</li> <li>For contingency and technical reason, SBM will be used with low toxicity biodegradable and non-persistent.</li> <li>The discharge of cuttings shall be complied with Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (IFC, 2015).</li> <li>Discharge of cuttings will be 15m below sea surface.</li> <li>Use of centrifuges, shale shakers and mud cleaners to separate out the cuttings from the mud.</li> <li>Drilling mud will be treated and then send back to the cycle in a continual circulation through the rig's mud handling system: recycling of mud to minimize the quantity discharge to sea.</li> <li>Optimization of the quantities of cement and the dosing of chemicals used.</li> <li>SDS available on the drilling rig</li> </ul>	MINOR	<ul style="list-style-type: none"> <li>Processing in place the cuttings from sections using WBM and SBM so that they are discharged via discharge line 15 m below sea surface.</li> <li>Recycling system for WBM and SBM and treatment of cuttings before being discharged in order to obtain a total oil concentration limit as per Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (IFC, 2015)</li> <li>Selection of chemicals added to drilling muds (according to criteria such as the lowest toxicity, the smallest bioaccumulation potential, the highest biodegradability)</li> <li>Implementation of a waste management plan and an environmental management plan.</li> </ul>	Drilling rig	Drilling phase	PTTEPI/ Contractor
	Discharge of cement could impact seawater quality.		NEGLECTIBLE				
	Chemical additives in the drilling fluid may impact seawater and sediment quality.	<ul style="list-style-type: none"> <li>Chemicals shall be selected according to their low toxicity.</li> </ul>			All project vessels/ Drilling rig		

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impact	Specific action	Location	Duration	Responsibility
	The project will generate various types of hazardous and non-hazardous wastes. Inappropriate management (including transportation, storage and disposal) of waste will impact seawater quality.	<p>Manage waste at offshore facilities in compliance with the requirements under MARPOL 73/78 and PTTEPI's Waste Management Plan.</p> <p><b>Hazardous Waste</b></p> <ul style="list-style-type: none"> <li>Waste storage areas shall be clearly defined.</li> <li>Collected and stored in suitable containers that are protected from the environment (rain, wind, etc.).</li> <li>The vessel deck shall be cleaned to minimize the impact from oil and chemical contamination into the sea during period of rain.</li> <li>Containers equipped with means to contain any spills or leaks.</li> <li>Transferred to an authorized disposal facility onshore by a certified transporter.</li> <li>Prohibit any discharge of hazardous waste into the sea.</li> </ul> <p><b>Non-hazardous waste</b></p> <ul style="list-style-type: none"> <li>Segregate non-hazardous waste, including food waste, paper, aluminium can, glass, rag and other wastes in separate containers or proper areas.</li> <li>Waste storage areas shall be clearly defined.</li> <li>Food wastes will be ground to 25 mm prior to discharge to sea. All non-food wastes will be collected for compaction and transport to shore for landfill or acceptable disposal.</li> <li>Dispose non-hazardous waste at onshore treatment facilities in accordance with the law of Myanmar and PTTEPI's Waste Management Plan.</li> <li>Transported to the onshore bases for collection and recycling by an authorized waste management contractor.</li> <li>Keep the record of waste inventories, including type and quantities updated.</li> </ul>		<ul style="list-style-type: none"> <li>See mitigation measures.</li> </ul>			
3- Seabed characteristics	The pattern of seafloor sediment topography could be affected by discharge of drilling	<ul style="list-style-type: none"> <li>Implement all mitigation measures in Item 2.</li> </ul>	NEGLIGIBLE		All project vessels/ Drilling	Drilling phase	PTTEPI / Contractor



**Offshore M9 East Appraisal/Exploration Drilling**

Report

**ENVIRONMENTAL IMPACT ASSESSMENT**

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impact	Specific action	Location	Duration	Responsibility
	mud and cuttings.				rig		
4- Marine life and marine ecology	Offshore activities may disturb marine species.	<ul style="list-style-type: none"> <li>Implement all mitigation measures for Item 2.</li> </ul>	MINOR	<ul style="list-style-type: none"> <li>Implement all mitigation measures for Item 2.</li> </ul>			PTTEPI / Contractor
	Drilling discharge may cause an impact on seawater and sediments, which may indirectly affect the community of marine biota at the surface level and the seabed.						
<b>Social mitigation measures</b>							
5- Fishing communities and fisheries	Reduced fishing area due to the presence of drilling rig and vessels, and 500 m exclusion zones.	<ul style="list-style-type: none"> <li>Before drilling starts, PTTEPI will coordinate with MOGE, who will then issue "Notice to Mariner" regarding project activities to concerned parties (i.e. Department of Fisheries, Ministry of Livestock, Fisheries and Rural Development, Myanmar Navy, and Myanmar Fisheries Federation).</li> <li>An exclusion zone (radius of 500 m) will be established surrounding the drilling rig.</li> <li>Use support vessels to warn off traffic.</li> <li>Provide appropriate lights and warning signals at offshore facilities to prevent accidental collision.</li> </ul>	MINOR	<ul style="list-style-type: none"> <li>At least 30 days prior to rig transport and installation, coordinate with MOGE, who will issue "Notice to Mariner" regarding project activities.</li> <li>Established 500 m safety zone around the drilling rig.</li> <li>Use support vessels to warn off traffic.</li> <li>Provide appropriate light and warning signals at offshore facilities.</li> </ul>	All project vessels/ Drilling rig	Drilling phase	PTTEPI / Contractor
	The quantity and quality of aquatic biota may decrease due to waste contamination in the sea. Contaminants may consist of non-hazardous and hazardous waste	<ul style="list-style-type: none"> <li>Implement all mitigation measures for Item 2 and 3 above.</li> </ul>	NEGLIGIBLE		All project vessels/ Drilling rig		PTTEPI / Contractor

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impact	Specific action	Location	Duration	Responsibility
	and mud and cuttings from drilling activities.						
6- Shipping and navigation	<p>Marine vessels may obstruct marine navigation during transporting the rig and equipment from onshore.</p> <p>The presence of the offshore facilities may obstruct navigation.</p>	<ul style="list-style-type: none"> <li>Before drilling starts, PTTEPI will coordinate with MOGE, who will then issue "Notice to Mariner" regarding project activities to concerned parties (i.e. Department of Fisheries, Ministry of Livestock, Fisheries and Rural Development, Myanmar Navy, and Myanmar Fisheries Federation).</li> <li>Use support vessels to warn off traffic.</li> <li>Provide appropriate lights and warning signals at offshore facilities to prevent accidental collision.</li> <li>An exclusion zone (radius of 500 m) will be established surrounding the drilling rig.</li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>See mitigation measures</li> </ul>	All project vessels/ Drilling rig	Drilling phase	PTTEPI / Contractor
7- Socio-economy	Increase in industrial expenditure and income (positive impact)	<ul style="list-style-type: none"> <li>Enhance utilization of local goods and services as much as possible.</li> </ul>	POSITIVE Impact	<ul style="list-style-type: none"> <li>Utilize local goods and services as much as possible.</li> </ul>	Onshore bases		PTTEPI / Contractor
<b>Health mitigation measures</b>							
8- Occupational health and safety	Injuries or illness due to exposure to harmful substances or accident	<p>Implement relevant components of PTTEPI's SSHE Management System, including the following:</p> <ul style="list-style-type: none"> <li>Implement PTTEPI's Occupational Health Management Standard.</li> <li>Personnel will be trained with the safe handling of the chemicals</li> <li>Personnel will be provided with the necessary personnel protective safety equipment.</li> <li>Personnel will be provided with safety training to ensure that all workers practice under safety operation and regulation of work, as per PTTEPI's SSHE Training &amp; Competency Standard.</li> </ul> <p>Cooperate with the nearest health centre/hospital in order to immediately support response to emergency events, as per PTTEPI's MERP. Duty Manager and Emergency Management Team for Medevac response or Medical Referral in case of emergency events.</p>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>See mitigation measures</li> </ul>	All project vessels/ Drilling rig/ Onshore bases	Drilling phase	PTTEPI / Contractor

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impact	Specific action	Location	Duration	Responsibility
		Implement following operational measures for prevention and control of accidents: <ul style="list-style-type: none"> <li>• Safety Data Sheets must be provided with every chemical product for safety and the environment.</li> <li>• Adequate storage will be provided for each chemical in accordance with safety instruction (storage conditions, etc.).</li> <li>• Provide spill kits on-site.</li> <li>• Provide first aid kits on-site</li> <li>• Provide proper sanitary systems, including drinking water, potable water, toilet and waste management.</li> </ul>					
	Injuries due to working in noisy areas.	<ul style="list-style-type: none"> <li>• Maintaining generators and compressors in good working order.</li> <li>• Provide personal protection equipment (ear plug for instance) to workers working on high level noise activities.</li> </ul>			All project vessels/ Drilling rig		PTTEPI / Contractor
9- Public health and Health service	Project activities could involve general public around shore bases that will be used for staff, materials and waste transportation.	<ul style="list-style-type: none"> <li>• Implement PTTEPI's Occupational Health Management Standard. <b>(Error! Reference source not found.)</b></li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>• See mitigation measures</li> </ul>	Shore bases	Preparation and installation phase	PTTEPI
	In case of accident or illness during project activities, it may be required to use healthcare services around the shore bases.	<ul style="list-style-type: none"> <li>• Cooperate with the nearest health centre/hospital in order to immediately support response to emergency events, as per PTTEPI's MERP. Duty Manager and Emergency Management Team for Medevac response or Medical Referral in case of emergency events.</li> </ul>					

Tabl. 8 - Mitigation measures/commitment list for project during the P&amp;A (Plug and Abandon) and Demobilization

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impact	Specific action	Location	Duration	Responsibility
<b>Environmental mitigation measures</b>							
1- Air quality / GHG emissions	Air emissions from combustion due to operation of machines and engines installed on support and supply vessels.	<ul style="list-style-type: none"> <li>Regular maintenance of marine engines, generators and compressor.</li> <li>To warn vessels of any delays in required times of arrival so that they may reduce speed accordingly for energy efficiency if possible</li> <li>Compliance with MARPOL 73/78 Annex VI – prevention of air pollution from ships, and if applicable based on age of vessels (MARPOL Annex VI Chapter 4 – ship energy efficiency management)</li> </ul>	NELIGIBLE	<ul style="list-style-type: none"> <li>Regular maintenance of marine engines, generators and compressor.</li> </ul>	All project vessels	Demobilization of the equipment	PTTEPI/Contractor
2- Marine life and marine ecology	Offshore activities may disturb marine mammals.	<ul style="list-style-type: none"> <li>Regular maintenance of marine engines, generators and compressor.</li> <li>Vessels to use slow speed and adapt the routes to avoid sensitive areas to marine mammals</li> <li>Adoption of passive acoustic monitoring system to observe the presence of marine mammals</li> </ul>	MINOR to NEGLIGIBLE	<ul style="list-style-type: none"> <li>Generalisation of the vessel dynamic positioning devices for drilling.</li> <li>At least 30 days prior to rig transport and installation, coordinate with MOGE, who will issue “Notice to Mariner” regarding project activities.</li> <li>Conduct seafloor surveys, prior to installation rig.</li> </ul>	All project vessels.		PTTEPI / Contractor
		Waste, wastewater and discharges from drilling rig and vessels may cause an impact on seawater and sediments, which may indirectly affect the community of marine biota at the surface level and the seabed.					
<b>Social mitigation measures</b>							
3- Fishing communities and	Reduced fishing area due to the presence of drilling rig and	<ul style="list-style-type: none"> <li>An exclusion zone (radius of 500 m) will be established surrounding the drilling rig.</li> <li>Use support vessels to warn off traffic.</li> <li>Provide appropriate lights and warning signals at offshore</li> </ul>	MINOR	<ul style="list-style-type: none"> <li>At least 30 days prior to rig transport and installation, coordinate with MOGE, who will</li> </ul>	All project vessels/ Drilling rig	Demobilization of the	PTTEPI / Contractor PTTEPI /

**Offshore M9 East Appraisal/Exploration Drilling**

Report

**ENVIRONMENTAL IMPACT ASSESSMENT**

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impact	Specific action	Location	Duration	Responsibility
fisheries	vessels, and 500 m exclusion zones.	facilities to prevent accidental collision.		issue "Notice to Mariner" regarding project activities. <ul style="list-style-type: none"> <li>Established 500 m safety zone around the drilling rig.</li> <li>Use support vessels to warn off traffic.</li> <li>Provide appropriate light and warning signals at offshore facilities.</li> </ul>		equipment	Contractor
	The quantity and quality of aquatic biota may decrease due to waste contamination in the sea. Contaminants may consist of non-hazardous and hazardous waste and mud and cuttings from drilling activities.	<ul style="list-style-type: none"> <li>Implement all mitigation measures for Item 2 and 3 above.</li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>Implement all mitigation measures for Item 2 and 3 above</li> </ul>	All project vessels/ Drilling rig		
4- Shipping and navigation	Marine vessels may obstruct marine navigation during transporting the rig and equipment from the drilling site to the next project's proposed drilling position.	<ul style="list-style-type: none"> <li>Use support vessels to warn off traffic.</li> <li>Provide appropriate lights and warning signals at offshore facilities to prevent accidental collision.</li> <li>An exclusion zone (radius of 500 m) will be established surrounding the drilling rig.</li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>At least 30 days prior to rig transport and installation, coordinate with MOGE, who will issue "Notice to Mariner" regarding project activities.</li> <li>Established 500 m safety zone around the drilling rig.</li> <li>Use support vessels to warn off traffic.</li> <li>Provide appropriate</li> </ul>	All project vessels/ Drilling rig	Demobilization of the equipment	PTTEPI / Contractor

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impact	Specific action	Location	Duration	Responsibility
				light and warning signals at offshore facilities.			
<b>Health mitigation measures</b>							
5- Occupational health and safety	Injuries or illness due to exposure to harmful substances or accident	Implement relevant components of PTTEPI's SSHE Management System, including the following: <ul style="list-style-type: none"> <li>● Implement PTTEPI's Occupational Health Management Standard.</li> <li>● Ensure that all employees wear appropriate equipment, and implement PTTEPI's Personal Protective Equipment Standard.</li> <li>● Personnel will be provided with safety training to ensure that all workers practice under safety operation and regulation of work, as per PTTEPI's SSHE Training &amp; Competency Standard.</li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>● See mitigation measures</li> </ul>	All project vessels/ Drilling rig/ Onshore bases	Demobilization of the equipment	PTTEPI / Contractor
		<ul style="list-style-type: none"> <li>● Cooperate with the nearest health centre/hospital in order to immediately support response to emergency events, as per PTTEPI's MERP. Duty Manager and Emergency Management Team for Medevac response or Medical Referral in case of emergency events.</li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>● See mitigation measures</li> </ul>			
	Injuries due to working in noisy	<ul style="list-style-type: none"> <li>● Implement following operational measures for prevention and control of accidents:                             <ul style="list-style-type: none"> <li>● Safety Data Sheets must be provided with every chemical product for safety and the environment.</li> <li>● Adequate storage will be provided for each chemical in accordance with safety instruction (storage conditions, etc.).</li> <li>● Provide spill kits on-site.</li> <li>● Provide first aid kits and first aid rooms</li> <li>● Provide proper sanitary systems, including drinking water, potable water, toilet and waste management.</li> </ul> </li> <li>● Regular maintenance of marine engines, generators and compressor.</li> <li>● Provide personal protection equipment (ear plug for instance) to</li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>● See mitigation measures</li> </ul>	All project vessels/	Demobilization of the	PTTEPI / Contractor

**Offshore M9 East Appraisal/Exploration Drilling**

Report

**ENVIRONMENTAL IMPACT ASSESSMENT**

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impact	Specific action	Location	Duration	Responsibility
	areas.	workers working on high level noise activities.			Drilling rig	equipment	
6- Public health and Health service	Project activities could involve general public around shore bases that will be used for staff, materials and waste transportation.	<ul style="list-style-type: none"> <li>Implement PTTEPI's Occupational Health Management Standard. (<b>Error! Reference source not found.</b>)</li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>See mitigation measures.</li> </ul>	Shore bases	P&A	PTTEPI
	In case of accident or illness during project activities, it may be required to use healthcare services around the shore bases.	<ul style="list-style-type: none"> <li>Cooperate with the nearest health centre/hospital in order to immediately support response to emergency events, as per PTTEPI's MERP. Duty Manager and Emergency Management Team for Medevac response or Medical Referral in case of emergency events.</li> </ul>					

Tabl. 9 - Mitigation measures/commitment list for unplanned events

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impact	Specific action	Location	Duration	Responsibility
1- Vessel collision	Collision could potentially occur during transport of material and rig tow-out.	<ul style="list-style-type: none"> <li>Emergency Response Plan</li> </ul>	MINOR	<ul style="list-style-type: none"> <li>In case of vessel collision, follow PTTEPI's Emergency and Crisis Management Plan including procedures in the event of an accidental vessel collision.</li> </ul>	All project vessels		
2- Spills	Accidental spills of drilling fluids, chemicals, or diesel fuel could occur throughout all project phases, and may directly affect surface water quality and indirectly affect sediment quality and marine ecology.	<ul style="list-style-type: none"> <li>Emergency Response Plan</li> <li>Oil Spill Contingency Plan shall be implemented and updated.</li> <li>Perform current monitoring and incorporate data into oil spill contingency plan</li> <li>Blowout preventer</li> <li>Requirements to have a Shipboard Oil Pollution Plan (SOPEP) in compliance with MARPOL 73/78.</li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>Implement PTTEPI's Emergency and Crisis Management Plan (in case of oil or chemical spills).</li> <li>Implement PTTEPI Spill Contingency Plan.</li> <li>Implement PTTEPI SSHE Training &amp; Competency Standard.</li> <li>Implement PTTEPI Incident Management Standard.</li> <li>Implement PTTEPI Waste Management Plan.</li> </ul>	All project vessels/ Drilling rig	Entire appraisal activities	PTTEPI / Contractor via EMP
3- Well blowout	A blowout can result in the release of hydrocarbons into the sea and surrounding environment at high pressure, potentially affecting seawater/sediment quality, marine life and marine ecology,	<ul style="list-style-type: none"> <li>On-board anti-pollution equipment.</li> <li>On-going maintenance program to ensure equipment is in good working order.</li> <li>Risk assessment prior to maintenance works or lifting operations.</li> <li>Training of personnel.</li> </ul>	MAJOR	<ul style="list-style-type: none"> <li>Implement PTTEPI's Blowout Contingency Plan.</li> <li>In case of oil or chemical spills, follow PTTEPI's Emergency and Crisis Management Plan.</li> <li>Implement PTTEPI's Spill Contingency Plan.</li> <li>Implement PTTEPI's SSHE Requirement for Contractor.</li> <li>Implement PTTEPI's</li> </ul>			



Aspects	Potential impacts	Mitigation measures	Significance of Residual Impact	Specific action	Location	Duration	Responsibility
	occupational health and safety and public health.			Incident Management procedure. <ul style="list-style-type: none"> <li>Install blowout preventer and shear ram appropriately</li> </ul>			
4- Tropical cyclone	Potential threat to the safety of offshore personnel and could result in multiple facilities and damage to assets.	<ul style="list-style-type: none"> <li>Training of personnel.</li> </ul>	MODERATE	<ul style="list-style-type: none"> <li>Implement PTTEPI SSHE Training &amp; Competency Standard.</li> <li>Implement PTTEPI's Tropical Revolving Storm Procedure and Emergency and Crisis Management Plan.</li> </ul>			
5- Fire or explosion	Fire or explosion could potentially impact air quality, health and safety concerns to PTTEPI's employees and contractors, and damages structures.	<ul style="list-style-type: none"> <li>High integrity design safety system</li> <li>Conduct regular inspections and drills for fire protection equipment</li> <li>Provide fire protection equipment, including fire extinguishers and alarms, on all offshore facilities.</li> <li>Emergency Response Plan and Crisis Management Plan.</li> </ul>	MODERATE	<ul style="list-style-type: none"> <li>Provide fire protection equipment on all offshore facilities.</li> <li>Conduct regular inspection and drills for fire protection equipment.</li> <li>Implement Emergency and Crisis Management Plan;</li> </ul>			

### 1.7.3. Summary of Significant Impacts by Project Activities

The proposed project drilling will consist the implementation of twelve appraisal wells in offshore block M9 and the comprehensive information of impacts anticipated and guidance measures for the implementation of this project are well presented in this EIA.

However, the discharges of onboard treated cuttings and mud into the seawater is considered as the most significant impacts for both physical environment such as marine sediment, seawater quality and biological environment which is marine aquatic lives.

In order to expect the magnitude of impact on physical and biological environment in pragmatically, a modelling for cutting dispersion study was conducted with the main purpose to assess environmental impact of released cuttings due to a drilling operation by calculating cuttings suspensions concentrations and sediment deposits at the end of the drilling operation.

The table represent the impacts of discharges into sea as the significant impacts of this project.

**Tabl. 10 - Significant potential impact due to drilling discharge**

Aspect	Severity of Physical Environment	Severity of Biological Environment
Discharge of bilge water, ballast water and deck water	Water column and water quality (MODERATE)	Marine mammals and marine turtles (MODERATE)
		Plankton and pelagic fish (MINOR)
Sanitary wastewater	Water column and water quality (MODERATE)	Marine mammals and marine turtles (MODERATE)
		Plankton and pelagic fish (MINOR)
Cement discharge	-	Pelagic fish (MINOR)
		Benthic community (NEGLIGIBLE)
Discharge of cuttings and mud	Sediment quality (NEGLIGIBLE)	Benthic community (NEGLIGIBLE)
	Water column and water quality (MINOR)	Plankton and pelagic fish (MINOR)
		Marine mammals and marine turtles (MINOR)

The detailed assessment of potential impacts, residual effects and complete mitigation measures are presented in Chapter 6 and Chapter 8.13 of the EIA.

## 1.8. PUBLIC CONSULTATION AND PROJECT DISCLOSURE

### 1.8.1. Results from Project’s Public Consultation

During the public consultations of both EIA and scoping stages, stakeholders discussed their views and concerns in relation to the appraisal drilling project, about which PTTEPI made some answers. Those main concerns and PTTEPI’s answers are summarized below:

- Fragility and vulnerability of the Myanmar coastal areas. PTTEPI assures that the entire appraisal drilling phase will be carried out according to the rules of the art (PTTEP’s Oil Spill Response Plan and National guidelines (NEQG)), reducing as much as possible the risks of pollution.
- Proposed actions regarding potential impacts on offshore fishery sector and potential conflicts between fisheries and the project proponent. Mariner notice will be announced through media and newspaper in order to let fishermen about project operation. Then, the chase vessels are usually allocated providing and notifying the entrance of fishing boats into the exclusion zone.
- CSR program adopted for the project. PTTEP’s CSR plans were developed since 2008 and PTTEP’s annual CSR plans are submitted to MOGE and respective departments.
- Support to local project. In case hydrocarbons are discovered in enough quantity for economic, local people of Myeik wished partnerships for local development (electricity for instance). PTTEPI took notice of the remark.

### 1.8.2. Project Disclosure

Regarding to EIA procedure, the project information shall be disclosed via Medias, state owned newspaper and PTTEPI’s websites during;

- Scoping stage period
- EIA investigation period
- After submission of EIA report to the ECD



The above advertisements was publicized on PTTEPI’s website, media and newspaper after the completion of scoping stage public consultation and EIA stage public consultation

# 1. အစီရင်ခံစာ အကျဉ်းချုပ်

## 1.1. နိဒါန်း

### 1.1.1. ရည်ညွှန်းချက်

PTTEPI သည် ဇောတိကသဘာဝဓါတ်ငွေ့စီမံကိန်းတွင် အောင်မြင်မှုရရှိပြီးနောက် PTT ရှာဖွေရေးနှင့် ထုတ်လုပ်ရေး အများပိုင် ကုမ္ပဏီ (PTTEPI) သည် လုပ်ကွက် M9 ၏ အရှေ့ဘက်အခြမ်းတွင် အကဲဖြတ်ရေးတွင်း တူးဖော်ရေးလုပ်ငန်းများ ဆက်လက်ဆောင်ရွက်ရန် စီစဉ်ခဲ့ပါသည်။ ယင်းလုပ်ကွက်တွင် ရေအနက်မှာ မီတာ ၅၀ မှ ၈၀၀ အတွင်းရှိပါသည်။

ဤပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ အစီရင်ခံစာ (EIA) သည် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဆိုင်ရာ အစိုးရအာဏာပိုင်များမှ စီမံကိန်းကြောင့် သဘာဝပတ်ဝန်းကျင်နှင့် လူမှု-စီးပွားလုပ်ငန်းများအပေါ် သက်ရောက်မှု ရှိ/မရှိ နှင့် စီမံကိန်းအား ခွင့်ပြုရန်သင့်တော်ခြင်း ရှိ/မရှိ စသော အကြောင်းအရာများကို ဆုံးဖြတ်နိုင်ရန် ရေးသားပြုစု ထားခြင်းဖြစ်ပါသည်။ အစီရင်ခံစာသည် စီမံကိန်းကာလအတွင်း သဘာဝပတ်ဝန်းကျင်အပေါ် ထိခိုက်နိုင်မှုများမှ ကာကွယ်ရန် ပတ်ဝန်းကျင်ဆိုင်ရာ အကြောင်းအရာများနှင့် လျော့ပါးစေရေးနည်းလမ်းရပ်များကို ချမှတ်ထားသော စည်းမျဉ်းများနှင့်အညီရေးဆွဲထားပါသည်။ ယခုဖော်ပြပါ အခန်းကဏ္ဍမှာ (EIA) အစီရင်ခံစာ၏အကျဉ်းချုပ် ဖော်ပြချက် ဖြစ်ပါသည်။

ယခုဖော်ပြပါ EIA အစီရင်ခံစာသည် ၂၀၁၂ ခုနှစ်တွင်ထုတ်ပြန်ခဲ့သော မြန်မာနိုင်ငံပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဥပဒေ၊ ၂၀၁၅ ခုနှစ်တွင် အတည်ပြုထုတ်ပြန်ခဲ့သော ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာလုပ်ထုံးလုပ်နည်း များနှင့် အညီရေးဆွဲ၍ ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ် (EMP)၊ ကမ်းလွန်ရေနှင့် သဘာဝဓါတ်ငွေ့ရှာဖွေရေးဆိုင်ရာ နိုင်ငံတကာပြဋ္ဌာန်းချက်များ၊ PTTEPI ၏ စံချိန်စံညွှန်းများ ကိုလည်း လိုက်နာ ထည့်သွင်းရေးသား ဖော်ပြထားပါသည်။

ဤပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာအစီရင်ခံစာကို ပြင်သစ် နိုင်ငံနှင့် ပြည်တွင်းရှိ ပတ်ဝန်းကျင်နှင့် လူမှုပတ်ဝန်းကျင်ဆိုင်ရာအကြံပေးပုဂ္ဂိုလ်များမှ ပြုစုရေးသားထားပါသည်။ အစီရင်ခံစာ ရေးသားသည့် အကြံပေးအဖွဲ့တွင် (မြန်မာနိုင်ငံအပါအဝင်) ကမ်းလွန်စီမံကိန်းများ၌ သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာ ထိခိုက်မှု ဆန်းစစ်ရေးတွင် နိုင်ငံတကာအတွေ့အကြုံရှိသော ပတ်ဝန်းကျင်ဆိုင်ရာအင်ဂျင်နီယာများ၊ အာရှဒေသတွင်း ကမ်းလွန်တူးဖော်ရေး လုပ်ငန်းများတွင်အတွေ့အကြုံရှိသော လူမှုဆက်ဆံရေးဆိုင်ရာကျွမ်းကျင်ပညာရှင်များ၊ ရန်ကုန်မြို့အခြေစိုက် ရုံးချုပ်ရှိ ဒေသခံ ပတ်ဝန်းကျင်ဆိုင်ရာအင်ဂျင်နီယာနှင့် စီမံကိန်းညှိနှိုင်းရေးမှူး စသည်တို့ဖြင့် ဖွဲ့စည်းထားပါသည်။ အစီရင်ခံစာအတွက် လေ့လာခြင်းလုပ်ငန်းရပ်များကို ၂၀၁၇ ခုနှစ်၊ မေလ မှ ၂၀၁၈ ခုနှစ် စက်တင်ဘာလ အတွင်း ဆောင်ရွက်ခဲ့ပါသည်။

**1.1.2. စီမံကိန်းလုပ်ကိုင်သောကုမ္ပဏီ၏ အကြောင်းအရာဖော်ပြချက်**

PTTEPI သည် PTTEP ၏ကုမ္ပဏီခွဲတစ်ခုဖြစ်ပြီး၊ ရေနံနှင့် သဘာဝဓါတ်ငွေ့ ရှာဖွေရေး/ထုတ်လုပ်ရေး စီမံကိန်းများ၊ ယင်းနှင့်စပ်ဆိုင်သော လုပ်ငန်းများ ကို လုပ်ကိုင်လျက်ရှိပါသည်။ PTTEPI သို့ ဆက်သွယ်ရန် လိပ်စာပြည့်အစုံမှာ

**Tabl. 1 - PTTEPI သို့ဆက်သွယ်ရန်လိပ်စာ**

ကုမ္ပဏီ	PTTEP International Limited (ရန်ကုန်ရုံးခွဲ)
လိပ်စာ	Vantage Tower, 623 Pyay Road, Kamayut Township, Yangon, Republic of Myanmar
ဆက်သွယ်ရန် ဖုန်းနံပါတ်	+95(1) 652700
စီမံကိန်းအတွက်တာဝန်ရှိ ပုဂ္ဂိုလ်	Mr. Piya Sukhumpanumet General Manager, PTTEPI
ဆက်သွယ်ရန်ပုဂ္ဂိုလ်	Yu San Khaing Email: YuSanK@pttep.com Thiri Aung Email: ThiriAung@pttep.com

**Tabl. 2 - PTTEPI မှ EIA ဆောင်ရွက်သည့် တာဝန်ရှိ ပုဂ္ဂိုလ်များ**

အမည်	ရာထူးတာဝန်
Wichean Kaewkong	Senior Engineer, Environment
Zar Chi Saint	Engineer, Environment
Sutus Preuksjamas	Safety, Security, Health and Environmental Manager
Yu San Khaing	Coordinator, Social Development Project (Offshore) (MOGE Representative)
Suphachitra Thongchavee	Manager, Public Affairs and Communications Section
San Htet Aung Win	Head of Social Development Projects
Wunna Win	Drilling Engineer
Kamolchai Pattanapong	Vice President , Myanmar Well Operations Department
Khun Hline Myint	Geologist
Kanchit Jantarangsi	Exploration Project Manager, Myanmar Onshore Exploration Project

**1.2. မူဝါဒ၊ ဥပဒေနှင့် အဖွဲ့စည်းဆိုင်ရာ ဥပဒေမူဘောင်**

အစီရင်ခံစာကို အသစ်ထုတ်ပြန်ထားသော ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာစည်းမျဉ်းနှင့် လုပ်ထုံးလုပ်နည်းများ (အမိန့်ကြေငြာစာ အမှတ် ၆၁၆/၂၀၁၅) နှင့်အညီ လိုက်နာပြင်ဆင်ထားပြီး၊ ကမ်းလွန်ရေနံ နှင့် သဘာဝဓါတ်ငွေ့ဆိုင်ရာလုပ်ငန်းများအတွက် ချမှတ်ထားသော ပြဋ္ဌာန်းချက်များ၊ PTTEPI မှ ချမှတ်ထားသော စံချိန်စံညွှန်းများ အား လိုက်နာရေးသားပြုစုထားပါသည်။

ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း (EIA) အစီရင်ခံစာ ၏ရည်ရွယ်ချက်မှာ

- PTTEPI မှ ထောက်ပံ့ပေးပို့သော အချက်အလက်များအပေါ်အခြေခံ၍ အဆိုပြုစီမံကိန်းနှင့် ပတ်သတ်သော အကြောင်းအရာများကို ရှင်းလင်းတင်ပြရန်
- ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ဆိုင်ရာ အကြောင်းအရာများအား ဆုံးဖြတ်ချက်ချမှတ်ခြင်းအဆင့်တွင် ပေါင်းစည်း၍ ထည့်သွင်းစဉ်းစားရန်
- ထောက်ခံထားသော လုပ်ထုံးလုပ်နည်းများနှင့် ကျင့်ဝတ်များကိုလိုက်နာခြင်းဖြင့် ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင် အပေါ်ထိခိုက်မှုများမရှိအောင် ရှောင်ရှားရန်၊ လျော့နည်းစေရန်နှင့် လျော့ပါးအောင် လုပ်ဆောင်နိုင်ရန်
- ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်အားစစ်ဆေးခြင်း၊ အရေးပေါ်အစီအစဉ်များထားရှိခြင်းစသော လမ်းညွှန်ချက်များပေးရန်

ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာအစီရင်ခံစာ ရေးဆွဲရာတွင် စီမံကိန်းအကြောင်းအရာဖော်ပြချက်၊ လက်ရှိပတ်ဝန်းကျင်ဆိုင်ရာအခြေအနေဖော်ပြချက်၊ သက်ရောက်နိုင်မှုများ ဖော်ထုတ်ခြင်းနှင့် သတ်မှတ်ခြင်း၊ ထိခိုက်မှုလျော့ချရေးနည်းလမ်းများ ရေးဆွဲခြင်း နှင့် ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင် စီမံခန့်ခွဲမှု အစီအစဉ်အတွက် လမ်းညွှန်ချက်ချမှတ်ခြင်း များပါဝင်ပြီး၊ PTTEPI မှ ချမှတ်ထားသော စံချိန်စံညွှန်းများကိုလည်း လိုက်နာရေးသားပြုစုထားပါသည်။

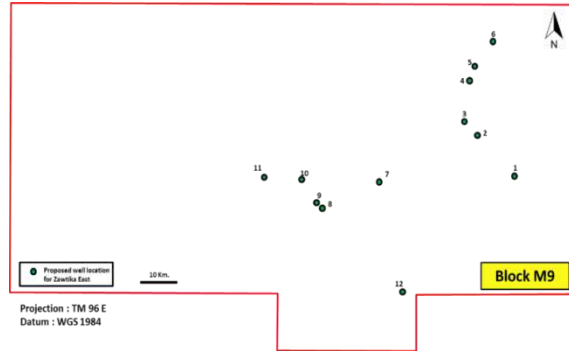
စီမံကိန်းသည် ပြည်တွင်းနှင့် နိုင်ငံတကာ စံချိန်စံညွှန်းများ၊ စည်းမျဉ်းဥပဒေများ နှင့်အညီ အကောင်အထည်ဖော်သွားမည်ဖြစ်ပါသည်။ အောက်ဖော်ပြပါ ပြည်တွင်းနှင့် နိုင်ငံတကာ ဥပဒေ၊ သဘောတူညီချက်များမှာ အခန်း ၃ တွင်ဖော်ပြထားသော မူဝါဒ နှင့် ဥပဒေ မူဘောင်များ မှ ကောက်နုတ်ထားခြင်းဖြစ်ပါသည်။

- Myanmar Environmental Conservation Law (2012)
- Myanmar Environmental Conservation Rules (2014)
- Myanmar National Environmental Quality (Emission) Guidelines (2015) (NEQG Guidelines)
- Myanmar EIA Procedure (2015)
- The International Convention for the Prevention of Pollution from Ships (1973 as modified 1978)
- Protection of Biodiversity and Protected Area Law (2018)
- IFC EHS Guidelines for offshore O&G Development (2015)
- United Nations Convention on the Law of the Sea (UNCLOS)

### 1.3. အဆိုပြုစီမံကိန်း အကြောင်းအရာဖော်ပြချက်

#### 1.3.1. စီမံကိန်းလုပ်ငန်းစဉ်များ တင်ပြခြင်း

စီမံကိန်းတွင် အကဲဖြတ်ရေးတွင်းပေါင်း အများဆုံး ၁၂ တွင်းပါဝင်မည်ဖြစ်ပြီး၊ အဓိက ရည်ရွယ်ချက်မှာ ဟိုက်ဒြိုကာဗွန် တည်ရှိနေခြင်းကိုသိရှိနိုင်ရန်နှင့် သေချာ စေရန်ဖြစ်သည်။ ယင်းမှာ လက်ရှိဇောတီကစီမံကိန်း ဖွံ့ဖြိုးရေးအတွက် အထောက်အကူပြုစေရန်ဖြစ်သည်။ ဖော်ပြပါပုံမှာ လုပ်ကွက် M9 အတွင်း စမ်းသပ်ရေးတွင်းများ တူးဖော်မည့် နေရာလျာထားချက် ဖြစ်ပါသည်။ တွင်းတူးဖော်ရေးလုပ်ငန်းရပ်တွင် အပိုင်းသုံးပိုင်းခွဲခြားထားပြီး၊ တွင်းစမ်းသပ်ခြင်း လုပ်ငန်းမပါဝင်ပါ။



တွင်းတူးဖော်ရေးလုပ်ငန်းရပ်သုံးပိုင်းမှာ

- တွင်းတူးစက်သယ်ယူခြင်းနှင့် တပ်ဆင်ခြင်း
- တွင်းတူးခြင်း
- ပလပ်ချရုံတွင်းပိတ်သိမ်းခြင်းနှင့် တွင်းတူးစက်ကိုပြန်လည်သယ်ယူခြင်း တို့ဖြစ်ပါသည်။

စီမံကိန်းလုပ်ငန်းဆောင်ရွက်မှုဇယားအရ ၂၀၁၈ ခုနှစ် တတိယနှင့်စတုတ္ထသုံးလပတ်အတွင်း စီမံကိန်းကို အကောင်အထည်ဖော်ရန် လျာထားလျက်ရှိပြီး၊ စုစုပေါင်း ၁၂ တွင်းအတွက် ခန့်မှန်းကြာမြင့်ချိန်မှာ ရက်ပေါင်း ၅၄၀ ခန့် ဖြစ်ပါသည်။ သို့ဖြစ်ရာ စီမံကိန်းသည် ၂၀၁၉ တတိယနှင့်စတုတ္ထသုံးလပတ်အတွင်း တွင်ပြီးဆုံးနိုင်ပါသည်။ တွင်းတူးရန်အတွက် လုပ်ငန်းအချိန်ဇယားကို အောက်ပါအတိုင်း ဖော်ပြထားပါသည်။





**1.3.1.1. တွင်းတူးစက်သယ်ယူခြင်းနှင့် တပ်ဆင်ခြင်း**

တွင်းတူးရာ၌ ပုံတွင်ပြထားသည့် semi-submersible ဟုခေါ်သော တွင်းတူးစက်အမျိုးအစားကို အသုံးပြုမည်ဖြစ်ပြီး၊ ယင်းမှာပင်လယ်ရေ အနက် မီတာ ၅၀၀ မှ ၃၀၀၀ အထိ အသုံးပြုနိုင်သောတွင်းတူးစက် အမျိုးအစားဖြစ်သည်။ အဆိုပါ တွင်းတူး စက်အား သတ်မှတ်ထားရာ နေရာသို့ သယ်ယူလာမည်ဖြစ်ပြီး၊ သတ်မှတ်နေရာရောက်ရှိပါက ပင်လယ်ကြမ်းပြင်သို့ထောက်တိုင်ချမည်မဟုတ်ဘဲ၊ ကျောက်ဆူးချ၍သာ နေရာချထားမည်ဖြစ်ပါသည်။ သတ်မှတ်ထားသောနေရာသို့တွင်းတူး စက်အား သယ်ဆောင်ရန် ၅ ရက်ခန့် ကြာမြင့်မည်ဖြစ်ပြီး၊ တွင်းတူးစင် တစ်ခုမှ တစ်ခုသို့ ပြောင်းရွှေ့ရန်ကြာချိန်မှာ ၇ ရက်ခန့်ဖြစ်ပါသည်။



ကုန်းတွင်းထောက်ပို့စခန်းနှင့်တူးဖော်ရေးလုပ်ငန်းဆောင်ရွက်မည့် နေရာသို့ ပစ္စည်းများသယ်ယူပို့ဆောင်ရန် ပုံတွင်ပြထားသော ထောက်ပံ့ရေး ရေယာဉ်နှစ်စီးဖြင့်ဆောင်ရွက်မည်ဖြစ်ပါသည်။ PTTEPI သည်

ရန်ကုန်တွင်ရှိသော သာကေတအခြေစိုက်စခန်းနှင့် ထိုင်နိုင်းငံ ရနောင်း ဆိပ်ကမ်းရှိ ရနောင်းအခြေစိုက်စခန်းတို့အား ထောက်ပံ့ စခန်းများအဖြစ် သတ်မှတ် အသုံးပြုမည်ဖြစ်ပြီး၊ ထောက်ပံ့ရေး ရေယာဉ် များသည် အစားအသောက်၊ ထောက်ပံ့ရေးပစ္စည်းများ၊ ရွံ့ကာပိုက်/ပိုက်၊ လောင်စာဆီ၊ တွင်းတူးရေ၊ ရေသန့်၊ ရွံ့နှင့်ဘိလပ်မြေကိုင်ရန် ပစ္စည်းများ စသည်တို့ကို တွင်းတူးစက်သို့ သယ်ယူပို့ဆောင်ကြမည် ဖြစ်ပါသည်။ သတ်မှတ်နေရာ၌ တွင်းတူးခြင်းလုပ်ငန်း ဆောင်ရွက်နေစဉ်တွင် အန္တရာယ်ကင်းရှင်းစေရန် ရည်ရွယ်ချက်ဖြင့် ထောက်ပံ့ရေးယာဉ်များမှအပ အခြားယာဉ်များ ဝင်ရောက်ခြင်း မရှိစေရန် ကန့်သတ်နယ်မြေ မီတာ ၅၀၀ ကို တွင်းတူးစက်ပတ်လည်၌ ယာယီ သတ်မှတ်ထားရှိမည် ဖြစ်ပါသည်။

လူဦးရေ ၁၂ ဦး တင်ဆောင်နိုင်သော ရဟတ်ယာဉ်ကို ဝန်ထမ်းများသယ်ယူပို့ဆောင်ရေးအတွက် ထားရှိမည်ဖြစ်ပြီး၊ ကမ်းမှ စီမံကိန်း တည်နေရာသို့ရောက်ရှိရန် ကြာချိန်မှာ ၁ နာရီ ၁၀ မိနစ် ခန့်ဖြစ်ပါသည်။

**1.3.1.2. တွင်းတူးလုပ်ငန်းလုပ်ဆောင်ခြင်း**

သတ်မှတ်နေရာသို့ တွင်းတူးစက်ရောက်ရှိသည်နှင့် တွင်းတူးခြင်းလုပ်ငန်းကို စတင်ပါသည်။ ကျောက်လွှာများကို ခွဲရန် တွင်းတူးလွန်ကို အသုံးပြုပြီး ၎င်းကို အခေါင်းပေါက်ပိုက်များဖြင့် ဆက်သွယ်ထားခြင်းဖြင့် Drill string ဟု ခေါ်တွင်ပါသည်။

ပထမအဆင့်တွင်းတူးရာတွင် Drill string ကို Drill deck မှ အောက်ခြေပင်လယ်ကြမ်းပြင်သို့ချ ၍ တွင်းတူးလုပ်ငန်းကို လုပ်ဆောင်ပါသည်။ ဤအဆင့်တွင် ဖြတ်စာများမှာ ပင်လယ်ကြမ်းပြင်သို့ အနည်ထိုင်ပါသည်။

ပထမအဆင့်ပြီးဆုံးသည့်နောက်တွင် Marine Riser Pipe ကို လွန်ခေါင်းနှင့်ချိတ်ဆက်၍ ပင်လယ်ကြမ်းပြင်သို့ တွင်းတူးရွံ့ကို သယ်ပို့ပါသည်။ Drill string ကို Riser မှတဆင့် အောက်သို့ချကာ ကျောက်လွှာများကို လွန် ဖြင့်

တူးပါသည်။ ထွက်ရှိလာသောဖြတ်စာများအား တွင်းတူးရွံ့ အကူအညီဖြင့် တွင်းအောက်ခြေမှ ဖယ်ရှားပါသည်။ တွင်းတူးရွံ့ဆိုသည်မှာ ပိုလီမာ၊ သဘာဝရွံ့၊ weighting agents နှင့်အခြားသော ရေတွင်မပျော်ဝင်သည့် ဝတ္ထုများဖြင့် ဖော်စပ်ထားသော ရွံ့တမျိုးဖြစ်ပါသည်။

တွင်းတူးခြင်းကိုပိုက်အသစ်လဲလှယ်ရန် သို့မဟုတ် လွန်သွားလဲလှယ်ရန်အချိန်များ၌ ပုံမှန်ရပ်နားခြင်းပြုလုပ် ပါသည်။

တွင်းတူးသည်တွင် Metal Casing ကို တွင်းအတွင်း ထည့်သွင်းအသုံးပြုခြင်းဖြင့် တွင်းငြိမ်စေရန် တွင်းမပြိုကျစေရန် အထောက်အကူပြုပါသည်။ အဆိုပါ casing သည် ရေအောင်းလွှာ နှင့် ဟိုက်ဒြိုကာဗွန်ဇုန်ကို ကန့်သတ်ပေးထား နိုင်ပြီး အရည်နှင့် အငွေ့များ တွင်းအတွင်းသို့ဝင်ရောက်လာခြင်းကို တားဆီးပေးပါသည်။ Casing string များဆက်သွယ်စေပြီးနောက်တွင် အင်္ဂတေကိုင်၍ မြဲမြံစေပါသည်။ Casing သည် Blow Out Preventer (BOP) ၏ firm point အဖြစ်လည်း ဆောင်ရွက်ပေးပါသည်။

**1.3.1.3. ပလပ်ချ၍တွင်းပိတ်သိမ်းခြင်းနှင့် တွင်းတူးစက်ကိုပြန်လည်သယ်ယူခြင်း**

စီမံကိန်းပြီးဆုံးချိန်တွင် တွင်းကိုပိတ်သိမ်းမည်ဖြစ်ပါသည်။ တွင်းပိတ်သိမ်းရေးလုပ်ငန်းစဉ်တွင် ရေနံနှင့်ဓာတ်ငွေ့ လုပ်ငန်းများအတွက် ချမှတ်ထားသော မြန်မာနိုင်ငံနှင့်၊ နိုင်ငံတကာစံချိန်စံညွှန်းများမှ တွင်းပိတ်သိမ်းခြင်းဆိုင်ရာ လမ်းညွှန်ချက်များအတိုင်း ဆောင်ရွက်သွားမည်ဖြစ်ပါသည်။ ရေနံနှင့်ဓာတ်ငွေ့သိုက်၏ တွင်းပေါက် (open hole) အား ဘိလပ်မြေပိုက်ချ၍ ဇုန်အလွှာအလိုက် တစ်ဖြတ်ချင်း ပိတ်သိမ်းသွားမည်ဖြစ်ပါသည်။ ရွံ့ကာပိုက် (casing) နှင့် conductor အား ပင်လယ်ကြမ်းပြင်အောက်ခြေ (seabed) တွင် ဖြတ်ချပိတ်သိမ်းခဲ့ပြီး၊ Subsea ရှိ လွန်ခေါင်း (wellhead) ကိုမူ အပေါ်သို့ပြန်လည်သိမ်းယူမည်ဖြစ်ပါသည်။

တွင်းတူးလုပ်ငန်းပြီးဆုံးသွားသည့်အခါ ပစ္စည်းများဖြုတ်သိမ်း၍ တွင်းတူးစက်ကို ဆွဲသင်္ဘောနှစ်စီးဖြင့် နောက် တနေရာသို့ ရွှေ့ပြောင်းသွားမည်ဖြစ်ပါသည်။

**1.3.2. တွင်းတူးရည် (ရွံ့) နှင့် ဖြတ်စာအမျိုးအစားများ**

တွင်းတူးရွံ့ရည် အမျိုးအစား သုံးမျိုးအား အသုံးပြုသွားမည်ဖြစ်ပါသည်။

- Surface section တွင် ရေကို အခြေခံသောရွံ့ Water-based mud (WBM) အား အဓိက တွင်းတူးရည်အဖြစ် အသုံးပြုသွားမည်ဖြစ်ပြီး၊ ပါဝင်ပစ္စည်းများမှာ barite, shale inhibitor additive နှင့် ပင်လယ်ရေ တို့ဖြစ်ပါသည်။ PTTEPI သည် Water-based mud (WBM) အား အဓိက တွင်းတူးရည်အဖြစ် တွင်း sections တိုင်းတွင် အသုံးပြုသွားမည်ဖြစ်ပါသည်။
- High Performance Water-based mud (HPWBM) အား တွင်း၏ အလယ်နှင့် အောက်ဆုံးအပိုင်းများ တူးဖော်ရာတွင် အသုံးပြုသွားမည်ဖြစ်ပါသည်။ HPWBM သည် WBM အားအဆင့်မြင့်တင်ထားသော ရွံ့ရည်ဖြစ်ပြီး၊ နန်းကျောက်လွှာများအား တူးရာတွင် ဖြစ်ပေါ်နိုင်သော adverse effects အားထိန်းချုပ်ရန်၊ ကောင်းမွန်သော အပူချိန်နှင့် ချောမွေ့မှုရရှိရန် အတွက် အသုံးပြုခြင်းဖြစ်ပါသည်။

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- Synthetic-based mud (SBM) ကိုမူ အရေးပေါ်အခြေအနေ အဖြစ် တွင်း၏ အလယ်နှင့် ဓါတ်ငွေ့ခိုအောင်းရာ အပိုင်းများ တူးဖော်ရာတွင် WBM အစား အသုံးပြုမည်ဖြစ်ပါသည်။ ပါဝင်ပစ္စည်းများမှာ barite, အဆီ (base oil) နှင့် ရေချို တို့ဖြစ်ပါသည်။ SBM ကို အသုံးပြုရာတွင် ဖြတ်စာအတွင်းအဆီပါဝင်နှုန်း (oil on cuttings) အား ဖြတ်စာ အခြောက်ခံစက် (cutting dryer) အားအသုံးပြု၍ ၆.၉ ရာခိုင်နှုန်းအောက် နည်းအောင် သန့်စင်သွားမည်ဖြစ်ပါသည်။

**1.3.3. အညစ်အကြေးစွန့်ပစ်မှုနှင့် ထုတ်လွှတ်မှုစစ်တမ်း**

ကမ်းလွန်ရေနံတွင်းတူးလုပ်ငန်းများသည် လေထုတွင်းသို့ထုတ်လွှတ်မှု၊ စွန့်ပစ်ရေ/ရေဆိုးစွန့်ထုတ်မှု နှင့် အန္တရာယ်ရှိသော/မရှိ သော စွန့်ပစ်ပစ္စည်းထုတ်လွှတ်မှုများ ရှိနိုင်သကဲ့သို့ ပုံမှန်မဟုတ်သော ကိစ္စရပ်များဖြစ်သည့် ဓါတုပစ္စည်းများနှင့် ဆီယိုဖိတ်ခြင်း ကဲ့သို့သောဖြစ်ရပ်များကိုလဲ ဖြစ်ပွားစေနိုင်ပါသည်။

အောက်ပါအကျဉ်းချုပ်ဖော်ပြချက်မှာ တွင်းတူးလုပ်ငန်းများမှ ဖြစ်ပေါ်လာနိုင်သော ထုတ်လွှတ်မှု နှင့် စွန့်ထုတ်မှု အမျိုးအစားများဖြစ်သည်။

- **လေထုတွင်းသို့ ထုတ်လွှတ်ခြင်း** ဆိုသည်မှာ အဓိကအားဖြင့် တွင်းတူးခြင်းလုပ်ငန်းလည်ပတ်ရန် အင်ဂျင်အလုပ် လုပ်ခြင်း၊ အခြားစက်ကိရိယာများ လည်ပတ်ခြင်း၊ ထောက်ပံ့ရေးရေယာဉ်များ၊ ရဟတ်ယာဉ်များအသုံးပြုခြင်း တို့ကြောင့်လေထုတွင်းသို့ ကာဗွန်ဒိုင်အောက်ဆိုဒ် ထုတ်လွှတ်ခြင်းများကို ဆိုလိုသည်။ စီမံကိန်းတစ်ခုလုံး ခန့်မှန်းကြာချိန်မှာ တွင်း (၁၂) တွင်း အတွက် ရက်ပေါင်း ၃၆၀ ရှိနိုင်ပြီး၊ တွင် တစ်တွင်းစီတွင် ရက်ပေါင်း ၄၀ ခန့်ကြာမြင့်နိုင်ပါသည်။ သို့ပါ၍ တွင်းတစ်တွင်းမှ ရက်ပေါင်း ၄၀ အတွင်း ထွက်ရှိနိုင်သော ကာဗွန်ဒိုင်အောက်ဆိုဒ်ပမာဏမှာ ၇၇၆၉ ကီလိုတန်ဖြစ်ပြီး၊ တွင်း (၁၂) တွင်း မှ ရက်ပေါင်း ၅၄၀ အတွင်း စုစုပေါင်း ထွက်ရှိနိုင်သော ပမာဏမှာ ၉၃၂၂၈ ကီလိုတန်ခန့် ထွက်ရှိနိုင်ပါသည်။
- **ဖြတ်စာများ** တွင် မြေအောက်ဓါတ်ငွေ့သိုက်တွင်ရှိနေသော ဟိုက်ဒြိုကာဗွန်များရောနှော ပါဝင်နိုင်ပါသည်။ ယင်းဖြတ်စာများကို နိုင်ငံတကာရေကြောင်းထိန်းသိမ်းရေး ဆိုင်ရာ အဖွဲ့အစည်း MARPOL ၏ ၇၃/၇၈ စည်းမျဉ်းအရလည်းကောင်း၊ မြန်မာနိုင်ငံမှချမှတ်ထားသောဥပဒေစည်းမျဉ်းစည်းကမ်းများအရ လည်းကောင်း ကုန်းပေါ်သို့ပို့ဆောင်သန့်စင်ရပါသည်။ သတ်မှတ်ထားသော စံချိန်စံညွှန်းရရှိမှသာ ဖြတ်စာများကို ပင်လယ်တွင်းသို့စွန့်ထုတ်စေပါသည်။ ဖြတ်စာများမှာ ပုံမှန်အနက်ရှိသော တွင်းများတွင် ၃၅၀ ကုဗမီတာ ခန့်ထွက်နိုင်ပြီး၊ ပို၍နက်သော တွင်းများတွင်မူ ၃၈၃ ကုဗမီတာ ခန့်အထိထွက်ရှိနိုင်ပါသည်။
- **ဘီလပ်မြေနှင့် ဘီလပ်မြေအားဖြည့်ပစ္စည်းများ** အသုံးပြုခြင်း၏အဓိကရည်ရွယ်ချက်မှာ တွင်းအတွင်းရှိ ရွှံ့ကာပိုက်ကို မြေမြေစေရန်ဖြစ်ပါသည်။ Spacer နှင့် ကနဦး ၃၆ လက်မရွှံ့ကာပိုက်ချစဉ်မှ ပိုသော ဘီလပ်မြေကို ပင်လယ်ကြမ်းပြင်နှင့် နီးကပ်သောနေရာတွင် စွန့်ထုတ်ခဲ့ပြီး ၎င်းဘီလပ်မြေသည် ပင်လယ်ရေ တွင် ဖြည်းဖြည်းစွာပျော်ဝင်သွားမည်ဖြစ်ပါသည်။
- **စွန့်ပစ်ရေဆိုးမှာ** ယေဘုယျအားဖြင့် မီးဖိုချောင်မှထွက်သော စွန့်ပစ်သောရေဆိုး၊ မိလ္လာရေဆိုး (Black water)၊ အထွေထွေရေဆိုး (Grey water) နှင့် ဆီပါသောရေဆိုးများ (သင်္ဘောဝမ်းဗိုက်နှင့် ကုန်းပတ်ပေါ် ရှိရေများ) များဖြစ်ကြပြီး၊ ၎င်းတို့ကိုသင်္ဘောပေါ်တွင်သန့်စင်သိုလှောင်ထားပြီး သန့်စင်သည့် စနစ်သို့ ပေးပို့မည် ဖြစ်ပါသည်။ ခေတ်မီ ရေယာဉ်များ နှင့် တွင်းတူးစင်များတွင် ကောင်းမွန်စနစ်ကျသော ရေဆိုးသန့်စင် စနစ်များ၊ ပြန်လည် အသုံးပြုစနစ်၊ vacuum systems စသည်တို့ပါဝင်ပြီး အထွေထွေရေဆိုး (Grey water) ကို ယာဉ်ပေါ်တွင်ပင် အနည်းငယ်သန့်စင်ပြီးနောက် မိလ္လာရေဆိုးချရာတွင် အသုံးပြုကြသည်။
  - **မီးဖိုချောင်မှထွက်သောစွန့်ပစ်သောရေဆိုးနှင့် နေ့စဉ်ထွက်ရှိသောရေဆိုး** များမှာ တွင်းတူးစက်နှင့် သင်္ဘောပေါ်ရှိ လူတို့၏လုပ်ဆောင်ချက်များကြောင့် ထွက်ရှိခြင်းဖြစ်ပြီး လုပ်ငန်းကဏ္ဍတိုင်း အတွက် တစ်ရက်လျှင် ဝန်ထမ်းတစ်ဦးမှအများဆုံး ရေဆိုးစွန့်နိုင်ချေမှာ မိလ္လာရေဆိုး (Black water) ၈၀ လီတာ နှင့် အထွေထွေရေဆိုး (Grey water) ၁၆၀ လီတာ ခန့်ရှိနိုင်မည်ဟု ခန့်မှန်းထားပါသည်။

(လူတစ်ဦး၏ နေ့စဉ်သုံးရေ ၂၀၀ လီတာ တွင် ၈၀ရာခိုင်နှုန်းသည်စွန့်ပစ်ရေအဖြစ်ထွက်ရှိသည်။) ထို့ကြောင့် စမ်းသပ်ရေးတွင်းတစ်တွင်း လျှင် စွန့်ပစ်ရေ ထွက်နိုင်သောပမာဏမှာ Black water ၀.၆၄ ကုဗမီတာ နှင့် Grey water ၁.၂၈ ကုဗမီတာ အထိရှိနိုင်ပါသည်။ စုစုပေါင်းတွင်း (၁၂) တွင်း အတွက် ရက်ပေါင်း ၃၆၀ အတွင်း ထွက်နိုင်သော စွန့်ပစ်ရေ ပမာဏမှာ Black water ၁၃၈.၂၄ ကုဗမီတာ နှင့် Grey water ၂၇၆.၄၈ ကုဗမီတာ အထိရှိနိုင်ပါသည်။

- **သင်္ဘောဝမ်းဗိုက်တွင်းရှိရေ** ဆိုသည်မှာ သင်္ဘောကိုယ်ထည်အောက်ခြေတွင်စုနေသော ရေများ၊ စိမ့်ဝင်လာသောရေများ၊ ဆီပါသောအရည်များ (သို့မဟုတ်) သိုလှောင်ထားသော ပစ္စည်းများ ကြောင့် စုဝေးနေသော စွန့်ပစ်ရေ တစ်မျိုးဖြစ်သည်။ အကြမ်းဖျဉ်း တွက်ချက်မှုအရ တစ်ရက်လျှင် ၃၁ ကုဗမီတာခန့် (တွင်းတူးစက်များအတွက် သတ်မှတ်ထားသော ရေဆိုးပမာဏ တစ်ရက်လျှင် ၀.၁၅ ကုဗမီတာ၊ ရေယာဉ်များအတွက်သတ်မှတ်ထားသော ရေဆိုးပမာဏ တစ်ရက်လျှင် ၀.၀၈ ကုဗမီတာခန့်) စွန့်ထုတ်နိုင်ပြီး၊ တွင်းတစ်တွင်းအတွက် တွက်ချက်မှုမှာ ၉.၆ ကုဗမီတာခန့်ဖြစ်ပြီး၊ စီမံကိန်းတစ်ခုလုံးအတွက် ရက်ပေါင်း ၅၄၀ အတွင်း ထွက်ရှိနိုင်သော ရေဆိုးပမာဏမှာ ၂၀၇၅.၇၆ ကုဗမီတာ ခန့်ရှိနိုင်ပါသည်။
- **ကုန်းပတ်ပေါ်ရှိရေ** မှာ မိုးရွာသွန်းမှု၊ ကုန်းပတ်ဆေးကြောမှုများကြောင့် တင်ကျန်ရစ် သော ရေများကိုဆိုလိုသည်။ မျက်နှာပြင်ပေါ်တင်ကျန်နေသောရေများကို မြောင်းဖွင့် စနစ်ဖြင့် စုဆောင်းယူပြီး၊ ပုံမှန်အရွယ်အစားရှိသော (တွင်းတူးစက် ၅၀ x ၁၀၀ မီတာ ပတ်လည်နှင့် ရေယာဉ် ၂ x ၁၀ x ၃၀ မီတာ ၊ စုစုပေါင်း ၅၆၀၀ စတုရန်းမီတာ)၊ ပုံမှန်နှစ်စဉ်မိုးရွာသွန်းမှု (မေလ မှ အောက်တိုဘာလ အထိ ပျမ်းမျှမိုးရေချိန် ၁၀၀ မီလီမီတာ) စသည်ဖြင့် ထည့်သွင်းတွက်ချက် ရာတွင် စီမံကိန်းတစ်ခုလုံးအတွက် ကုန်းပတ်ပေါ်မှ ညစ်ညမ်းရေ ပျမ်းမျှပမာဏ မှာ ၆၂၀ ကုဗမီတာ ခန့်အထိရှိနိုင်ပါသည်။
- **သင်္ဘောငြိမ်စေရန်အသုံးပြုသောရေ** ကို သီးသန့်ဒီဇိုင်းဆွဲထားသော ကန် (Ballast) အတွင်း သိုလှောင်ထားရှိပြီး အခြားမည်သည်တို့နှင့်မှ ရောနှောမှုမရှိစေရပါ။ ဂေဟစနစ်မတူညီသော အခြားနေရာများမှ သယ်လာသောရေကို စွန့်ထုတ်ခြင်း မပြုပဲ ထောက်ပံ့ရေး ရေယာဉ်ဖြင့်သာ ရေထုတ်/ဖြည့်ခြင်းလုပ်ငန်းကို တူညီသောဂေဟစနစ်အတွင်းသာ လုပ်ဆောင်ရမည် ဖြစ်သည်။
- တွင်းတူးလုပ်ငန်းလုပ်ဆောင်ချိန်နှင့် တွင်းပိတ်သိမ်းချိန်တွင်ပင်လယ်ကြမ်းပြင်အနီးရှိ Blow Out Preventer (BOP) သည် ပင်လယ်ကြမ်းပြင်သို့ ဟိုက်ဒြိုလစ်အရည်များ ထုတ်နိုင်ချေ ရှိပါသည်။ တွင်းတစ်တွင်းတူးလျှင် အဆိပ်အတောက်ပါဝင်မှုနည်းသော အရည်များ ၂၀ ကုဗမီတာခန့်အထိ စွန့်ထုတ်နိုင်ချေရှိပါသည်။
- တွင်းတူးလုပ်ငန်းများ လုပ်ဆောင်နေစဉ် အစိုင်ခဲစွန့်ပစ်ပစ္စည်းများ (ဖန်၊ စက္ကူ၊ ပလတ်စတစ်၊ သစ်သား) နှင့် အန္တရာယ်ရှိသောစွန့်ပစ်ပစ္စည်းအနည်းငယ် (ဆေးဝါး၊ ဓါတုပစ္စည်း) စသည်တို့ ထွက်နိုင်ပါသည်။ ကမ်းလွန် တွင်းတူးလုပ်ငန်းများအတွက် **PTTEPI** မှုချမှတ်ထားသော စွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲမှုအစီအစဉ် (**Waste Management Procedure**) အတိုင်း လိုက်နာ၍ အစိုင်အခဲ နှင့် အရည်များ စွန့်ပစ်မည် ဖြစ်ပါသည်။ အဓိကအားဖြင့် စွန့်ပစ်ပစ္စည်းများအား ရေယာဉ်ပေါ်၌ပင် အမျိုးအစားအလိုက် ခွဲခြားခြင်းများ ပြုလုပ်၍ ကုန်းတွင်းရှိ သတ်မှတ်နေရာ သို့ပို့ဆောင်၍ သန့်စင်ခြင်း၊ စွန့်ပစ်ခြင်းများ ပြုလုပ် မည်ဖြစ်ပါသည်။

- လုပ်ကွက် M9 ၏ တူးဖော်ရေးကာလတွင်း ထွက်ရှိနိုင်သော ခန့်မှန်း စွန့်ပစ်အညစ်အကြေးများမှာ :
  - အထွေထွေစွန့်ပစ်အမှိုက် : ၂၅၁၆ ကီလိုဂရမ်
  - အန္တရာယ်မရှိသော စွန့်ပစ်ပစ္စည်း : ၁၈၄ ကီလိုဂရမ်
  - ပြန်လည်အသုံးပြုနိုင်သော စွန့်ပစ်ပစ္စည်း : ကွန်တိန်နာ ၅ လုံး
  - ဓါတုပစ္စည်းထည့်သည့်ဘူးခွံများ : ၇၀ ကီလိုဂရမ်
  - အန္တရာယ်ရှိသော စွန့်ပစ်ပစ္စည်း : ၄၇၀ ကီလိုဂရမ်

သို့ပါ၍ တွင်းတစ်တွင်းမှ ထွက်လာနိုင်သောစွန့်ပစ်အညစ်အကြေး စုစုပေါင်းပမာဏမှာ ၂၆၁၁ ကီလိုဂရမ် ခန့်ရှိနိုင်ပါသည်။

- လုပ်ငန်းလုပ်ဆောင်နေစဉ် ဓါတ်ငွေ့အနည်းငယ် (venting) နှင့် ယိုစိမ့်မှုများကြောင့် (fugitive) လေထုတွင်းသို့ထုတ်လွှတ်မှုများရှိနိုင်သော်လည်း ယင်းပမာဏမှာ အနံ့အသက်ထွက်သည်အထိ မရှိနိုင်ပါ။ တွင်းတူးလုပ်ငန်းလုပ်ဆောင်နေစဉ်တွင် ပတ်ဝန်းကျင်၌ဆူညံသံများဖြစ်ပေါ်စေသော်လည်း ကာလတိုသာ ဖြစ်ပြီး စီမံကိန်းတည်နေရာမှာလည်း ကမ်းခြေမှ ၂၆၀ ကီလိုမီတာဝေးကွာကာ လူနေထိုင်သောနေရာများ၊ ထိခိုက်လွယ်သောဧရိယာများ နှင့်လည်းဝေးကွာပါသည်။ ထိုအချက်များနှင့် အလင်းရောင်များကြောင့် အနှောင်အယှက်ဖြစ်ခြင်းမှာ အရေးမကြီးသော အဆင့်သတ်မှတ်ချက်တွင်သာ ရှိပါသည်။ မီးရှို့ခြင်းမှာလည်း တွင်းစမ်းသပ်ခြင်း အောင်မြင်သည့်အချိန် နှင့် သတ်မှတ်ထားသော အချိန်တွင်သာ ဆောင်ရွက်မည် ဖြစ်ပါသည်။
- တွင်းတူးလုပ်ငန်းလုပ်ဆောင်ခြင်းတွင် မတော်တဆမှုကဲ့သို့သော ကြိုတင်ခန့်မှန်းရန်ခက်ခဲသော အခြေအနေ များကြောင့် လေထုတွင်းသို့ထုတ်လွှတ်မှုပမာဏ နည်း/များ မဆို ဖြစ်နိုင်ပါသည်။

## 1.4. စီမံကိန်းအနီး ပတ်ဝန်းကျင်အကြောင်းအရာများဖော်ပြချက်

### 1.4.1. ရုပ်ပတ်ဝန်းကျင်ဆိုင်ရာ အကြောင်းအချက်များ

#### 1.4.1.1. လေထုပတ်ဝန်းကျင်

မြန်မာနိုင်ငံသည် မုတ်သုံရာသီဥတုလွှမ်းမိုးခြင်းခံရသော ပူအိုက်စိုစွတ်သည့်ရာသီဥတုရှိပါသည်။ နိုင်ငံ၏ ရာသီဥတုမှာ မုတ်သုံအားကောင်းမှု၊ နေအပူရှိန်လုံလုံလောက်လောက်ရရှိမှု၊ မိုးရွာသွန်းမှုအခြေအနေ (နှစ်စဉ် ကမ်းရိုးတန်းဒေသများ တွင် မိုးရေချိန် ၁၉၈ လက်မ (၅၀၀၀ မီလီမီတာ) ခန့်နှစ်စဉ်ရရှိသည်) နှင့် စိုစွတ်မှုမြင့်မားမှုများအပေါ်မှီတည်ပါသည်။ တနင်္သာရီတိုင်းဒေသကြီးရှိပျမ်းမျှ အပူချိန်သည် ၁၈.၃ ဒီဂရီစင်တီဂရိတ်မှ ၃၅.၈ ဒီဂရီစင်တီဂရိတ်၊ စိုစွတ်မှုနှုန်းမှာ ၇၂ ရာခိုင်နှုန်းမှ ၈၉ ရာခိုင်နှုန်းအထိ ရှိပါသည်။ လုပ်ကွက် M9 အတွင်း ရှာဖွေရေးလုပ်ငန်းများ လုပ်ဆောင်နေစဉ်ကာလ ၂၀၁၈ခုနှစ် တတိယနှင့်စတုတ္ထသုံးလပတ်အတွင်း) အတွင်း မိုးအနည်းငယ်ရွာသွန်းနိုင်ချေ ရှိပြီး အောက်တိုဘာလအတွင်း အများဆုံးဖြစ်နိုင်ပါသည်။

လေထုပတ်ဝန်းကျင်သို့ သက်ရောက်နိုင်မှုများနှင့် စပ်လျဉ်း၍ ရှာဖွေရေးလုပ်ငန်းများ လုပ်ဆောင်နေချိန်ကာလ အတွင်း လေထုတွင်းသို့ထုတ်လွှတ်မှုပမာဏမှာ အနီးအပါးရှိ အခြားသော စက်မှုလုပ်ငန်းများ (ရတနာ နှင့် ဇောတိက ဓါတ်ငွေ့ထုတ်လုပ်ရေး လုပ်ငန်းများ) မှထွက်ရှိလေ့ရှိသော ပမာဏများ နှင့် နှိုင်းယှဉ်ပါက နည်းပါသည်ဟု ယူဆနိုင်ပါသည်။ စီမံကိန်းနေရာတွင်ရှိသော လေထုအရည်အသွေးမှာ အဓိကအကြောင်းအချက်အနေဖြင့် သတ်မှတ်ထားခြင်းမရှိပါ။

လေထုအရည်အသွေးအပေါ် သက်ရောက်နိုင်မှုမှာ အလွန် နည်းပါးပါသည်။

လုပ်ကွက် M9 ဧရိယာသည် မြောက်များစွာသော သဘာဝဘေးများ၊ အထူးသဖြင့် (OCHA, 2013 အရ) အပူပိုင်းမုန်တိုင်းများ နှင့်တွေ့ကြုံနိုင်ဖွယ်ရှိပါသည်။ အန္တရာယ်အများဆုံးအဖြစ် မေလ မှ နိုဝင်ဘာ လများအတွင်း နှင့် အောက်တိုဘာ လအတွင်း တွင် သဘာဝအဖြစ်ပေါ်သော မုန်တိုင်းများနှင့် တွေ့ကြုံနိုင်ပါသည်။

စီမံကိန်းသည် သဘာဝဘေးအန္တရာယ်များနှင့် တွေ့ကြုံနိုင်ဖွယ် အလွန်နည်းပါး ပါသည်။

**1.4.1.2. ပင်လယ်ပြင်ရှိ အနည်အနှစ်များ**

အနည်အနှစ်များတွင် ရွှံ့စေး၊ နုန်း နှင့် ဩဇာဓါတ်များစွာပါဝင်ပါသည်။ စီမံကိန်းနေရာရှိ ပင်လယ်ကြမ်းပြင် အနေအထားမှာ ယေဘုယျအားဖြင့်ကောင်းမွန်သော အခြေအနေတွင်တည်ရှိပြီး ဓါတုနှင့် ရုပ်ဝန်းကျင်အပေါ် သက်ရောက်နိုင်သော သွင်ပြင်လက္ခဏာများကြောင့် ပင်လယ်ကြမ်းပြင်ကို အနှောင့်အယှက်ဖြစ်ပေါ်စေနိုင်ပါသည်။

ပင်လယ်ပြင်ရှိ အနည်အနှစ်များအပေါ် သက်ရောက်နိုင်မှုမှာ နည်းပါးသော အဆင့်တွင်ရှိပါသည်။

**1.4.1.3. ရေအရည်အသွေး**

စီမံကိန်းဧရိယာအတွင်းရှိ ရေအနက်မှာ မီတာ ၅၀ မှ ၈၀၀ အတွင်းရှိပြီး၊ ကြည်လင်၍ ဩဇာဓါတ်နည်းပါးသော သဘာဝအတိုင်းရှိသည့် ရေအနေအထားတွင်တွေ့ရှိရပါသည်။ အနီးနား လုပ်ကွက်များတွင် လူတို့၏ပြုလုပ်မှုများ ကြောင့် ညစ်ညမ်းမှုအချို့ရှိသော်လည်း လုပ်ကွက် M9 ရှိရေအရည်အသွေးမှာ စိုးရိမ်ဖွယ်ရှိသော parameter များ ပါဝင်မှုကြောင့် ညစ်ညမ်းနေမှုမျိုးအား မတွေ့ရှိရပါ။

ရေအရည်အသွေးအပေါ် သက်ရောက်နိုင်မှုမှာ နည်းပါးသော အဆင့်တွင်ရှိပါသည်။

**1.4.2. သက်ရှိဇီဝဆိုင်ရာ အကြောင်းအချက်များ**

PTTEPI သည် ERM ကုမ္ပဏီနှင့်တကွ အဏ္ဏဝါပတ်ဝန်းကျင်ဆိုင်ရာအခြေခံအချက်အလက်များကောက်ယူခြင်း လုပ်ငန်းရပ် (Marine Baseline Survey) အား ၂၀၁၈ ဖေဖော်ဝါရီလတွင် လုပ်ကွက် M9 ၌ လုပ်ဆောင်ခဲ့ပါသည်။ ရည်ရွယ်ချက်မှာ အဏ္ဏဝါပတ်ဝန်းကျင်နှင့် ပတ်သတ်သော ပင်လယ်ရေ အရည်အသွေး၊ အနည်အနှစ်များ၏ အရည်အသွေးနှင့် Benthic အုပ်စုများ အစရှိသည့် အခြေခံအချက်အလက်များကိုလေ့လာ မှတ်တမ်းယူရန် ဖြစ်ပါသည်။ အဆိုပါလေ့လာရပ်မှ ရရှိသော ရလဒ် အချက်အလက်များအား အခန်း ၅ - အနီးပတ်ဝန်းကျင်ဆိုင်ရာ အကြောင်းအရာများဖော်ပြချက် တွင် ထည့်သွင်းဖော်ပြထားပါသည်။

**1.4.2.1. ရေနေသတ္တဝါအကောင်အထည်အုပ်စုများ**

အဆိုပြုနယ်စီမံကိန်းနယ်မြေတွင် ကဏန်းအကောင်အထည်အုပ်စုများ၊ ပုစွန်အကောင်အထည်အုပ်စုများနှင့် (calanoid copepods, poecilostomatoid copepods နှင့် arrow worms) ကဲ့သို့သော အခြား ရေနေ သတ္တဝါအကောင်အထည်အုပ်စုများကို အဏ္ဏဝါပတ်ဝန်းကျင်လေ့လာရေး လုပ်ငန်းဆောင်ရွက်နေစဉ်အတွင်း တွေ့ရှိရပါသည်။

ရေနေသတ္တဝါအကောင်အထည်အုပ်စုများ အပေါ်သက်ရောက်နိုင်မှုမှာ နည်းပါးသော အဆင့်တွင်ရှိပါသည်။

**1.4.2.2. မျောလှေအုပ်စုများ**

စီမံကိန်းဧရိယာအတွင်းတွင် မျောလှေအုပ်စုများကို ပေါများစွာတွေ့ရှိရပါသည်။ အဏ္ဏဝါပတ်ဝန်းကျင်လေ့လာမှု စစ်တမ်းအရ သီးခြားမျိုးစိတ်ပေါင်း ၄၃ မျိုးတွေ့ရှိရပါသည်။ Annelida နှင့် arthropoda ကဲ့သို့သော ဒေသရင်းမျိုးစိတ်မဟုတ်သည့် အစုအဝေးများသည် ယေဘုယျအားဖြင့် station များကြားတွင် တွေ့ရှိရပါသည်။

မျောလှေအုပ်စုများအပေါ်သက်ရောက်နိုင်မှုမှာ အလွန်နည်းပါးသော အဆင့်တွင်ရှိပါသည်။

**1.4.2.3. ငါးမျိုးစိတ်များ (ပင်လယ်ပြင်နှင့် ကမ်းရိုးတန်းနယ်မြေ)**

မုတ်သုံဥတုကြောင့် ရာသီအလိုက်ပြောင်းလဲမှုများရှိသော်လည်း Pelagic ငါးအုပ်စုများကိုမူ ပျံ့နှံ့စွာတွေ့ရှိရပါသည်။ ယင်းငါးအုပ်စုများတွင် မျိုးစိတ်ကွဲပေါင်းများစွာပါဝင်ပြီး အိန္ဒိယသမုဒ္ဒရာတွင်း ပေါများစွာတွေ့ရှိနိုင်ပါသည်။

ငါးမျိုးစိတ် အပေါ်သက်ရောက်နိုင်မှုမှာ နည်းပါးသော အဆင့်တွင်ရှိပါသည်။

**1.4.2.4. အဏ္ဏဝါနို့တိုက်သတ္တဝါများ**

အရွယ်အစားကြီးမားသောအဏ္ဏဝါနို့တိုက်သတ္တဝါများသည် ကမ်းလွန်ရေနက်ပိုင်း တွင် ကျက်စားနေထိုင်လေ့ရှိပါသည်။ ဒေသခံငါးဖမ်းသမားများ၏ပြောကြားချက်နှင့် အတွေ့အကြုံများအရ ဝေလငါးများသည် အဆိုပါ စီမံကိန်းဧရိယာအတွင်းသို့ ဝင်ရောက်လာလေ့ရှိကြောင်း မှတ်တမ်းများအရ လေ့လာရပါသည်။

လုပ်ကွက် M9 တွင် ERM မှ ၂၀၁၈ ခုနှစ်အတွင်းလုပ်ဆောင်ခဲ့သည့် အဏ္ဏဝါပတ်ဝန်းကျင်လေ့လာမှုမှ ခြောက်ရက်ကြာ စောင့်ကြည့်မှု ရလဒ်အရ Pantropical Spotted Dolphin (Stenella attenuate) အမျိုးအစား လင်းပိုင် အုပ်စု သုံးစု အားတွေ့ရှိခဲ့ပါသည်။ ယင်းမျိုးစိတ်မှာ မြန်မာ့အဏ္ဏဝါရေပြင်တွင် အတွေ့များသော မျိုးစိတ်အဖြစ် မှတ်တမ်းများအရသိရှိရပါသည်။ IUCN Red list ၏အခြမ်းခြောက်ခံမျိုးစိတ်များစာရင်း ၂၀၁၈ စစ်တမ်းအရ ၎င်းလင်းပိုင်မျိုးစိတ်မှာ ထိန်းသိမ်းခံ စိုးရိမ်ဖွယ်အဆင့်လင်းပိုင်မျိုးစိတ်များတွင် ပါဝင်နေခြင်းမရှိ ကြောင်း လေ့လာရပါသည်။

အဏ္ဏဝါနို့တိုက်သတ္တဝါများအပေါ် သက်ရောက်မှုထိန်းသိမ်းခြင်း မှာ မြင့်မားသော အဆင့်တွင်ရှိပါသည်။



1.4.2.5. **ပင်လယ်လိပ်များ**

မြန်မာ့ကမ်းရိုးတန်းရှိ အချို့သော ကမ်းခြေများမှာ လိပ်သားပေါက်ရာ ကမ်းခြေဒေသများအဖြစ်သတ်မှတ်ထားပြီး၊ Olive Ridley Turtle (*Lepidochelys olivacea*) (vulnerable) ၊ Loggerhead Turtle (*Caretta caretta*) (endangered) ၊ Green Turtle (*Chelonia mydas*) (endangered) ၊ Hawksbill Turtle (*Eretmochelys imbricata*) (critically endangered) နှင့် Leather Back Turtle (*Dermochelys coriacea*) (critically endangered) စသော မျိုးစိတ်များ ဥချနိုင်ရန်အတွက် ထိန်းသိမ်းနယ်မြေများအဖြစ်သတ်မှတ်ထားပါသည်။

ယင်းမျိုးစိတ်များသည် နိုင်ငံတကာတွင်လည်း ထိန်းသိမ်းခံမျိုးစိတ်များအဖြစ်သတ်မှတ်ထားပြီး၊ IUCN red list အရလည်း ထိခိုက်ပျောက်ဆုံးနိုင်ချေရှိသော၊ ခြိမ်းခြောက်ခံအဆင့်တွင် သတ်မှတ်ထားရှိပါသည်။ စီမံကိန်းဧရိယာ တဝိုက်သည် စက်တင်ဘာလ မှ မတ်လ ဥချရာသီတွင် လိပ်များရွှေ့ပြောင်းသွားလာရာ လမ်းကြောင်းပေါ် ကျရောက်နိုင်ပြီး၊ ဇန်နဝါရီလနှင့် ဖေဖော်ဝါရီလများသည် မျိုးစိတ်အများစု ရွှေ့ပြောင်းသွားလာမှု အများဆုံးလများ ဖြစ်ပါသည်။ ဇူလိုင်လ နှင့် နိုဝင်ဘာလများသည် green turtle လိပ်များ အတွေ့အများဆုံး လများဖြစ်ပါသည်။ လိပ်မျိုးစိတ်များ အများဆုံးတွေ့ရှိရမှုများမှာ ကမ်းခြေရေတိမ်ပိုင်း (၂၂ မီတာမှ ၂၅ မှတာအတွင်း) ၁၅ ကီလိုမီတာ အကွာတွင် တွေ့ရှိရပါသည်။ ရံဖန်ရံခါ၌ အချို့သောမျိုးစိတ်များသည် စီမံကိန်းဧရိယာဝန်းကျင်သို့ ရောက်ရှိလာနိုင် ပါသည်။ စီမံကိန်းလုပ်ကိုင်ခြင်းကြောင့် ပါရီပဲရစ်ကျွန်း (Preparis island) သို့ လာရောက် ဥချလေ့ရှိသည့် green turtle လိပ်မျိုးစိတ်များအပေါ် သက်ရောက်မှုရှိကောင်းရှိနိုင်ပါသည်။

ပင်လယ်လိပ်များအပေါ် သက်ရောက်မှုထိန်းသိမ်းခြင်း မှာ မြင့်မားသော အဆင့်တွင်ရှိပါသည်။

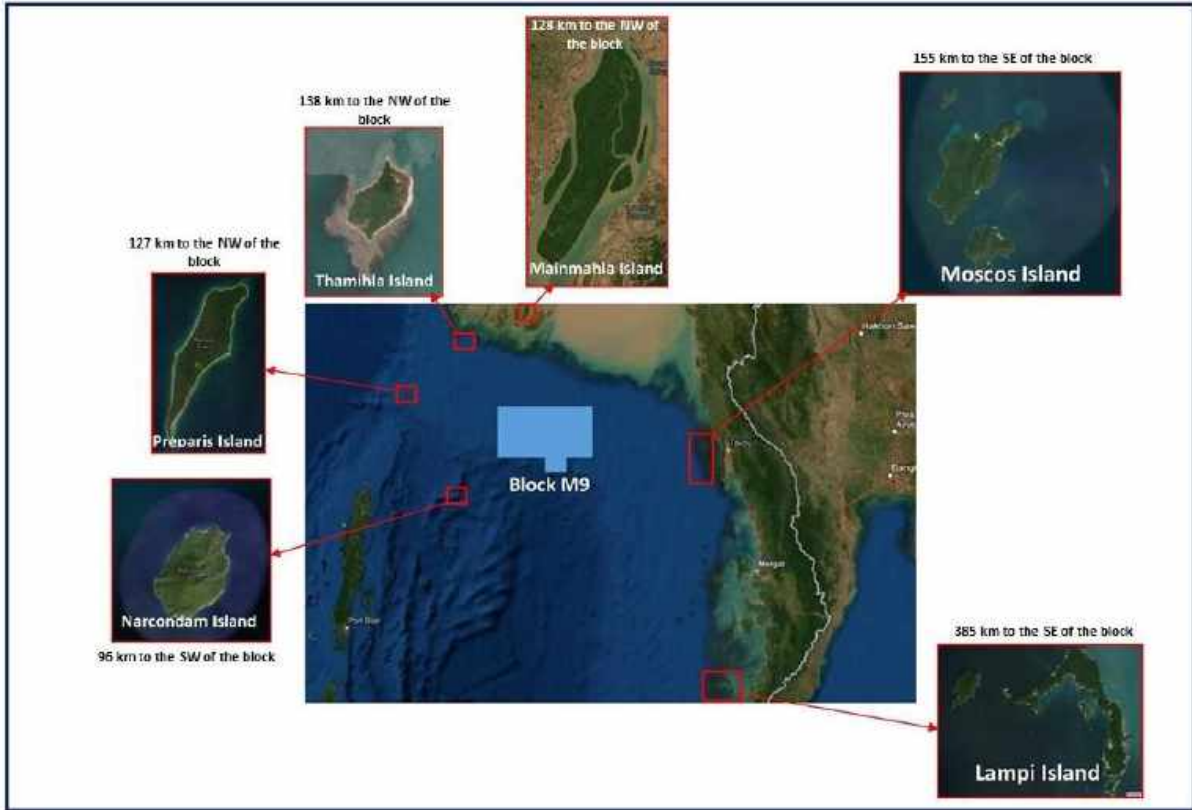
1.4.2.6. **ပင်လယ်ငှက်များ**

မြန်မာ့ရေပြင်တွင် ငှက်မျိုးပေါင်း ၂၀ ခန့် ကျက်စားကြကြောင်း IUCN မှ ထုတ်ပြန်ထားပြီး အဆိုပါ မျိုးစိတ်များ အတွင်းမှ မျိုးစိတ် ၃ ခုဖြစ်သော Spotted Billed Pelican၊ Painted Stork၊ Black Head Ibis နှင့် Asian Dowitcher ငှက်မျိုးစိတ်များအား ခြိမ်းခြောက်ခံအဆင့်ရှိမျိုးစိတ်များအဆင့်တွင်သတ်မှတ်ထားရှိပါသည်။ မျိုးစိတ် ၁၆ မျိုးမှာ စိုးရိမ်ဖွယ်မရှိသောမျိုးစိတ်များအဖြစ် တွေ့ရှိရနိုင်ပြီး စီမံကိန်းဧရိယာအား ယင်းတို့ အစာရှာရာ၊ နားရာ အဖြစ် အသုံးပြုနိုင်ပါသည်။

ပင်လယ်ငှက်များအပေါ် သက်ရောက်မှုထိန်းသိမ်းခြင်းမှာ နည်းပါးသော အဆင့်တွင်ရှိပါသည်။

1.4.2.7. **ထိန်းသိမ်းခံနယ်မြေများ**

မိန်းမလှကျွန်းတောရိုင်းတိရစ္ဆာန်ဘေးမဲ့တော၊ သမီးလှကျွန်း ၊ ပါလီပါလဲကျွန်းနှင့် မော့စကော့ကျွန်းများသည် လုပ်ကွက် M9 ဝန်းကျင်တွင် တည်ရှိပြီး၊ ယင်းတို့အနက် မိန်းမလှကျွန်း (ရမ်ဆာကွန်ဆာဗေးရှင်း ထိန်းသိမ်းနယ်မြေ)၊ သမီးလှကျွန်း နှင့် မော့စကော့ကျွန်းများမှာ wetland တောရိုင်းတိရစ္ဆာန်ဘေးမဲ့တော များအဖြစ် သတ်မှတ်ထားရှိပြီး၊ စီမံကိန်းနှင့် အကွာအဝေးမှာ အောက်ဖော်ပြပါပုံတွင် ပါရှိပါသည်။



**Fig. 1.** စီမံကိန်းအနီးရှိထိန်းသိမ်းကာကွယ်ထားသောကျွန်းများ နှင့် နယ်မြေများ

စီမံကိန်းသည် ထိန်းသိမ်းကာကွယ်ထားသောနယ်မြေများ နှင့် ဝေးကွာစွာ တည်ရှိခြင်းကြောင့် စီမံကိန်းလည်ပတ်ရာမှ ထွက်ပေါ်လာမည့် သက်ရောက်မှု၊ လွှမ်းမိုးမှုများ ကြုံတွေ့နိုင်ချေ မရှိနိုင်ပါ။

ထိခိုက်လွယ်ထိန်းသိမ်းခံနယ်မြေများအပေါ်သက်ရောက်မှုမှာ အလွန်နည်းပါးသော အဆင့်တွင်ရှိပါသည်။

**1.4.3. လူမှု-စီးပွားဆိုင်ရာ အကြောင်းအချက်များ**

စီမံကိန်းသည် ရန်ကုန်မြို့၏တောင်ဘက် ၂၆၀ ကီလိုမီတာ နှင့် ထားဝယ်မြို့၏အနောက်ဘက် ၁၇၈ ကီလိုမီတာ အကွာ ကမ်းလွန်ရေနက်ပိုင်းတွင်တည်ရှိပြီး၊ လုပ်ကွက်အတွင်း ရေအနက်မှာ မီတာ ၅၀ မှ ၈၀၀ အထိရှိနိုင်ပါသည်။ စီမံကိန်းသည် ငါးဖမ်းလုပ်ငန်းများ ပင်လယ်ရေကြောင်း ကုန်စည်ပို့ဆောင်ရေးလုပ်ငန်းများမှအပ ကုန်းတွင်း လူနေထိုင်ရာပတ်ဝန်းကျင်များအပေါ် သိသာသော သက်ရောက်မှုမျိုး မဖြစ်ပေါ်စေနိုင်ပါ။

လုပ်ကွက် M9 နှင့်အနီးတဝိုက်တွင် မိန်းမလှကျွန်းဘေးမဲ့တော၊ သမီးလှကျွန်းဘေးမဲ့တောနှင့် မော့စကော့ ဘေးမဲ့ တောများတည်ရှိသော်လည်း ယင်းတို့မှာ စီမံကိန်းနှင့် ကွာဝေးသဖြင့် မည်သည့်သက်ရောက်မှုကိုမျှ တွေ့ကြုံဖွယ်မရှိဟု ယူဆနိုင်ပါသည်။

**1.4.3.1. ငါးလုပ်ငန်း**

ဒေသခံအာဏာပိုင်များနှင့် တွေ့ဆုံဆွေးနွေးချက်များအရ လုပ်ကွက် M9 တွင် တနင်္သာရီဒေသမှ ငါးဖမ်းလုပ်ငန်းများ နှင့်သာ တွေ့ဆုံနိုင်ခြေရှိပါသည်။ နိုဝင်ဘာမှ ဧပြီလများသည် ငါးဖမ်းအကောင်းဆုံးရာသီများ ဖြစ်ပြီး ရေတိမ်နှင့် ကမ်းနီးငါးဖမ်းလုပ်ငန်းများသာ အများဆုံးရှိနိုင်ပြီး ကမ်းဝေးငါးဖမ်းမှုများလည်းရှိနိုင်ပါသည်။

ငါးဖမ်းလုပ်ငန်းများအပေါ် သက်ရောက်မှုမှာ အလယ်အလတ်အဆင့်တွင်ရှိပါသည်။

**1.4.3.2. အဏ္ဏဝါရေကြောင်းသွားလာမှု**

လုပ်ကွက် ၏ အရှေ့အစွန်ဘက်ခြမ်းသည် ရန်ကုန်မှ မလ္လာကာရေလက်ကြားတောင်ဘက်အခြမ်း သို့သွားရာ ပင်လယ်ရေကြောင်းအဓိကလမ်းအနီးတွင် တည်ရှိသော်လည်း၊ လုပ်ကွက်မှာ နိုင်ငံတကာ ရေကြောင်းသွားလာရေး လမ်းကြောင်းအတွင်း ကျရောက်ခြင်းမရှိပါ။ အနာဂတ်တွင် ဆီတင်သင်္ဘောကြီး များသွားလာရေးလမ်းကြောင်း သည် လုပ်ကွက် M9 အနီးပြေးဆွဲနိုင်ချေရှိပါသည်။

အဏ္ဏဝါရေကြောင်းသွားလာမှုလုပ်ငန်းများအပေါ် သက်ရောက်မှုမှာ အလယ်အလတ်အဆင့်တွင်ရှိပါသည်။

**1.4.3.3. ဆိပ်ကမ်းအဆောက်အအုံ**

PTTEPI သည် ရန်ကုန်မြို့ရှိ သာကေတအခြေစိုက်ထောက်ပံ့ရေးစခန်း (TKA) နှင့် ရနောင်းမြို့ရှိ ရနောင်းဆိပ်ကမ်း များအား အခြေစိုက်ထောက်ပံ့ရေး စခန်းများအဖြစ်အသုံးပြုသွားမည်ဖြစ်ပါသည်။ အခြေစိုက်ထောက်ပံ့ရေးစခန်း နှစ်ခုလုံးတွင် သင်္ဘောကျောက်ချရာနေရာ၊ ကရိန်း နှင့် ဝန်ချိစက်များ၊ ဂိုထောင်၊ စွန့်ပစ်အမှိုက် ယာယီသိုလှောင်ရုံများပါဝင်ပြီး၊ PTTEPI ၏ ကမ်းလွန်စီမံကိန်းအား အထောက်အကူပြုလျက်ရှိပါသည်။

စီမံကိန်းသည် ဆိပ်ကမ်းအဆောက်အအုံများအပေါ် သက်ရောက်နိုင်မှုအဆင့်မှာ အလွန်နည်းပါး ပါသည်။

## 1.5. ပတ်ဝန်းကျင်အပေါ်သက်ရောက်မှုနှင့်ဘေးအန္တရာယ်ရှိမှုဆန်းစစ်ခြင်းနှင့် လျော့နည်းစေရေးနည်းလမ်းများ

### 1.5.1. အဆိုပြုစီမံကိန်းကြောင့် ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်အပေါ်သက်ရောက်နိုင်မှု

ဤလေ့လာရပ်နှင့် အစီရင်ခံစာကိုပြုစုရေးသားသော အကြံပေးအဖွဲ့အစည်းသည် ဖော်ပြပါအချက်အလက်များအား ထည့်သွင်းစဉ်းစား၍ အစီရင်ခံစာကိုရေးသားပြုစုကြပါသည်။ (၁) သဘာဝသယံဇာတများသုံးစွဲမှု (ရေ၊ လောင်စာဆီ၊ ဓါတုဗေဒပစ္စည်းများ၊ တွင်းတူးရွံ့နှင့် အားဖြည့်ပစ္စည်းများ)၊ (၂) လေထုတွင်းသို့ထုတ်လွှတ်မှုများ၊ အလင်း နှင့် အသံ၊ (၃) ပင်လယ်တွင်းသို့ စွန့်ပစ်ရေနှင့် အခြားအညစ်အကြေးများ စွန့်ထုတ်မှု၊ (၄) စွန့်ပစ်ပစ္စည်းများ၊ (၅) (တွင်းတူးခြင်းကြောင့်) ပင်လယ်ကြမ်းပြင်ကို အနှောင့်အယှက်ဖြစ်စေမှု၊ (၆) ရုပ်ဝန်းကျင် (တွင်းတူးစက်တည်ရှိနေခြင်း၊ စသည်ဖြင့်)၊ (၇) စီမံကိန်းနေရာတွင် အခြားအဏ္ဏဝါမျိုးစိတ်ကွဲများအား ထိုးဖောက်မိမှု၊ (၈) မတော်တဆမှုများ၊ (၉) လုပ်သားများ၊ ကန်ထရိုက်များ၊ ထောက်ပံ့ရေးများ အသုံးပြုခြင်း စသည်ဖြင့် အချက်အလက်များစွာအပါအဝင်တည်ရှိနေပါသည်။

လုပ်ကွက် M9 လုပ်ငန်းမှကြွင်းကျန်ရစ်သောပစ္စည်းများကြောင့် ထိခိုက်မှုကို အောက်ပါအဆိုပြုထားသော လျော့ပါးစေရေးနည်းလမ်းလမ်းညွှန်ချက်များအတိုင်း လိုက်နာပါက လျစ်လျူရှုနိုင်သော အဆင့်သတ်မှတ်ချက် သို့မဟုတ် အရေးမကြီးသည့်အဆင့်သတ်မှတ်ချက် သို့ ရရှိနိုင်ပါသည်။ သို့ဖြစ်ပါ၍ လုပ်ကွက် M9 တွင်းတူးလုပ်ငန်း ကြောင့် ကြွင်းကျန်ပစ္စည်းများမှ ပတ်ဝန်းကျင်သို့သက်ရောက်မှုသည် အချုပ်အားဖြင့် နည်းပါးပြီး ကာလတိုသာဖြစ်မည် ဖြစ်ပါသည်။

ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်ဆိုင်ရာ အချက်အလက်များကို အောက်ပါအတိုင်း တပေါင်းတည်းဖော်ပြထား ပါသည်။

- အနာဂတ် တွင်းတူးလုပ်ငန်းစီမံကိန်းမှ မှန်လုံအိမ်အာနိသင်ဓါတ်ငွေ့များ (GHG) ထုတ်လွှတ်မှုကြောင့် လေထုအရည်အသွေး အပေါ်ထိခိုက်မှုသည် Floating production storage and offloading (FPSO) ကဲ့သို့သော စီမံကိန်းများနှင့် နှိုင်းယှဉ်ပါက ကာလတိုသာဖြစ်သဖြင့် လျစ်လျူရှုနိုင်သောအဆင့်တွင်သာ ရှိပါသည်။ ရက် ၄၀ ကြာမြင့်သော တွင်းတစ်တွင်းတူးဖော်ရေးမှ ထွက်ရှိနိုင်သော ကာဗွန်ဒိုင်အောက်ဆိုဒ် ပမာဏမှာ ၇၇၆၉ ကီလိုတန်ထွက်ရှိနိုင်ပြီး၊ စုစုပေါင်း တွင်း ၁၂ တွင်း အတွက် ရက်ပေါင်း ၅၄၀ တွင် ကာဗွန်ဒိုင်အောက်ဆိုဒ် ထွက်ရှိနိုင်သော ပမာဏမှာ ၉၃၂၅၈ ကီလိုတန်ခန့် ဖြစ်နိုင်ပါသည်။ အဓိက ထုတ်လွှတ်မှုဖြစ်ပေါ်စေသော အကြောင်းမှာ တွင်းတူးလုပ်ငန်းလုပ်ဆောင်ရာတွင် ပြုလုပ်သော ဒီဇယ်လောင်ကျွမ်းခြင်းကြောင့် ဖြစ်ပါသည်။

အချုပ်အားဖြင့်ဆိုပါက စီမံကိန်းမှထွက်ရှိသော GHG ထုတ်လွှတ်မှုသည် နှိုင်းယှက်ချက်အရ လျစ်လျူရှုနိုင်သောအဆင့်တွင်ရှိပါသည်။ စီမံကိန်းနေရာတွင် လေထုညစ်ညမ်းမှုသည် ကာလတိုသာ သက်ရောက်နိုင်ပြီး ၎င်းလေထုညစ်ညမ်းစေသောပစ္စည်းများသည် လေထုအတွင်း လျင်မြန်စွာပျံ့လွင့် သွားမည်ဖြစ်သဖြင့် ပတ်ဝန်းကျင်လေထုအရည်အသွေးသို့ ကာလကြာရှည် သက်ရောက်နိုင်သောထိခိုက်မှု မျိုးမရှိနိုင်ပါ။

စီမံကိန်းမှထွက်ရှိသော ထုတ်လွှတ်မှုများနှင့် လက်ရှိအခြေအနေတွင်ရှိနေသော ထုတ်လွှတ်မှုများ ပေါင်းစု၍ ဖြစ်သောစုပေါင်းသက်ရောက်မှုသည်သာ သိသာသော သက်ရောက်မှုကိုဖြစ်ပေါ်စေပါသည်။

စီမံကိန်းကြောင့် ကြွင်းကျန်သက်ရောက်မှုမှာ လျစ်လျူရှုနိုင်သော အဆင့်တွင်ရှိပါသည်။ (စီမံကိန်းနှင့်ဆက်စပ်နေသော လူပုဂ္ဂိုလ်၏ ကျန်းမာရေးနှင့် စုပေါင်းသက်ရောက်မှုများကို ပိုမိုသိရှိရန်မှာထပ်မံလေ့လာတွေ့ရှိချက်များ အပေါ်မူတည်ပါသည်။)

- အနည်အနှစ်များနှင့် မျောလှေအုပ်စုများကို တွင်းတူးစဉ်ကာလ၌ သက်ရောက်နိုင်ပါသည်။ ဇီဝနည်းဖြင့် ချေဖျက်လွယ်သော၊ အဆိပ်အတောက်နည်းသော တွင်းတူးအရည်ကို အသုံးပြုခြင်းဖြင့် သက်ရောက်မှုကို လျော့ချမည်ဖြစ်ပြီး၊ ပင်လယ်ရှိအနည်အနှစ်များ၏ ရုပ်ဝန်းကျင်အပေါ်သက်ရောက်မှုမှာ semi-submersible အမျိုးအစား တွင်းတူးစက်ကို တပ်ဆင်နေချိန်နှင့် တွင်းတူးလုပ်ငန်းလုပ်ဆောင်နေချိန် အတွင်းဖြစ်ပါသည်။ မည်သို့ပင်ဆိုစေကာမူ သက်ရောက်မှုများမှာ ကာလတို (တွင်းတစ်တွင်းလျှင် ရက် ၃၀ သာ ကြာမြင့်မည်ဖြစ်၍) သာ တွင်းတူးလုပ်ငန်းဆောင်ရွက်ခြင်းကြောင့် အနည်အနှစ်များအပေါ်၌ အရေးမကြီးသော အဆင့်သတ်မှတ်ချက် တွင်သာရှိပါသည်။

- အဓိကလျော့နည်းစေသောနည်းလမ်းအဖြစ် (၁) ကျောက်ဆူးတရွတ်ဆွဲခြင်းအားတားမြစ်ခြင်း (၂) WBM နှင့် SBM ကဲ့သို့သော ရွှံ့အမျိုးအစားများကို နေရာတွင်သာ ဖျော်စပ်လုပ်ဆောင်ပြီး စွန့်ပစ်ရသည့် အခါတွင်လည်းရေအောက်ကြမ်းပြင်မှ ၁၅ မီတာတွင်သာ စွန့်ပစ်စေခြင်း စသော နည်းလမ်းများကို ကျင့်သုံးအကောင်အထည်ဖော်ရမည် ဖြစ်ပါသည်။ သို့မှသာကြွင်းကျန်သက်ရောက်မှုသည် အရေးမကြီးသော အဆင့်သတ်မှတ်ချက် တွင် ရှိနိုင်မည် ဖြစ်ပါသည်။

- တွင်းတူးလုပ်ငန်းများကြောင့် ပင်လယ်ရေအရည်အသွေးသည် စွန့်ထုတ်မှုရှိသော၊ သက်ရောက်နိုင်သော ဧရိယာတဝိုက်တွင်သာ ယာယီသက်ရောက်မှုဖြစ်နိုင်ပါသည်။ တွင်းတူးစက်နှင့် ရေယာဉ်များမှ စွန့်ပစ်ရေ များ စွန့်ထုတ်ခြင်းကြောင့်လည်း ပင်လယ်ရေအရည်အသွေးအပေါ်သက်ရောက်မှုများဖြစ်စေပြီး ၎င်းတို့ကို (IFC နှင့် MARPOL ကဲ့သို့သော နိုင်ငံတကာအဖွဲ့အစည်းများ၏) စံချိန်စံညွှန်းများ၊ လုပ်ထုံးလုပ်နည်းများ နှင့်အညီ လိုက်နာထိန်းချုပ်သွားမည်ဖြစ်ပါသည်။

အခြားသောလျော့ပါးစေရေးနည်းများမှာ (၁) အဆိပ်အတောက်နည်းသော ဓါတုပစ္စည်းများရွေးချယ်မှု၊ ဇီဝနည်းအရချေဖျက်လွယ်မှုမြင့်မားပြီး Bioaccumulation နည်းစေခြင်း (၂) ဓါတုပစ္စည်းများအား ကောင်းမွန်မှန်ကန်စွာအသုံးပြုခြင်း(၃) (IFC ၂၀၁၅) ရေနံနှင့်သဘာဝဓါတ်ငွေ့လုပ်ငန်းများ၏ Environmental, Health and Safety Guidelines အရ Bilge water နှင့် Drainage water များအား သန့်စင်သောစနစ်ကို ကောင်းမွန်စွာလုပ်ဆောင်ခြင်း (၄) ရေဆိုးသန့်စင်ခြင်း (၅) စွန့်ထုတ်မှုများမပြုလုပ်မီ PH level အားစောင့်ကြည့်ဆန်းစစ်ခြင်း (၆) ဓါတုပစ္စည်းစီမံခန့်ခွဲမှုအစီအစဉ်၊ စွန့်ထုတ်မှုစီမံခန့်ခွဲမှုအစီအစဉ်၊ စွန့်ပစ်ပစ္စည်းများစီမံခန့်ခွဲမှုအစီအစဉ် (ကြိတ်ချေထားသော အစားအသောက်စွန့်ပစ်မှုသာလှူငှာခြင်းပြုကာ) နှင့် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ် စသည့် လျော့နည်းစေရေးနည်းလမ်းများကို အကောင်အထည် ဖော်ရမည်ဖြစ်ပါသည်။

သို့မှသာ ကြွင်းကျန်သက်ရောက်မှုသည် လျစ်လျူရှုနိုင်သော အဆင့် တွင် ရှိနိုင်မည် ဖြစ်ပါသည်။

- စီမံကိန်းကြောင့်ဖြစ်ပေါ်သော သက်ရောက်မှုများသည် (၁) ပင်လယ်ရေ (၂) အနည်အနှစ်များ၏ အရည်အသွေး (၃) အပင်/အကောင်မျောလှေများ နှင့် benthic အုပ်စုများ သို့ သက်ရောက်မှုများ

ဖြစ်စေသဖြင့် pelagic အုပ်စုများ၏ပတ်ဝန်းကျင်ကို တိုက်ရိုက်သက်ရောက်မှုများဖြစ်စေနိုင်ပါသည်။ Pelagic ငါးအုပ်စုများနှင့် အခြားကျောရိုးရှိ သတ္တဝါများသည် ရွှေ့ပြောင်းသွားလာလေ့ရှိကြရာ ရေအရည်အသွေးပုံစံ ပြောင်းလဲသည်နှင့် နေရာရွှေ့ပြောင်းသွားလေ့ရှိကြပါသည်။ ၎င်းတို့နှင့်သက်ဆိုင်သော လျော့နည်းစေရေး နည်းများမှာ ထိရောက်ပါသည်။

နေထိုင်မှုပုံစံ၊ အစာပင်ရင်းများအပေါ်သက်ရောက်မှုများကို လျော့နည်းစေရန် အောက်ပါတို့ကို လုပ်ဆောင် ရန်လိုအပ်ပါသည်။ အန္တရာယ်ကင်းစေရန် အမြင်နှင့် လေ့လာမှုလုပ်ဆောင်နေချိန်၌ အလင်းထုတ်လွှတ်ခြင်း ကိုကန့်သတ်၍လုပ်ဆောင်ရပါမည်။ သို့မှသာ အဏ္ဏဝါနို့တိုက် သတ္တဝါများနှင့် လိပ်များအပေါ်သက်ရောက် နိုင်သော ကြွင်းကျန်သက်ရောက်မှုသည် အရေးမကြီးသော အဆင့်သတ်မှတ်ချက် တွင် ရှိမည် ဖြစ်ပါသည်။ ပင်လယ်ငှက်များနှင့် စပ်လျဉ်း၍ စီမံကိန်းသည် ကမ်းမှ ၁၇၀ ကီလိုမီတာအကွာတွင်ရှိပါသောကြောင့် အနည်းငယ်သော ပင်လယ်ငှက်များသာ တွေ့နိုင်ပါသည်။ ပင်လယ်ငှက်များအပေါ် သက်ရောက်နိုင်သော ကြွင်းကျန်သက်ရောက်မှုသည် လျစ်လျူရှုနိုင်သော အဆင့် တွင်ရှိပါသည်။

ထို့အပြင် တွင်းတူးလုပ်ငန်းသည် ရတနာနှင့် ဇောတိက ကဲ့သို့သော ရေနံ နှင့် သဘာဝဓါတ်ငွေ့လုပ်ငန်းများ ဆောင်ရွက်မှုကြောင့် သက်ရောက်မှုရှိနေပြီးသော ပင်လယ်ကြမ်းပြင်နေရာတွင်သာ လုပ်ငန်းဆောင်ရွက်မည် ဖြစ်ပါသည်။

- တွင်းတူးလုပ်ငန်းမှထွက်ပေါ်လာသောဆူညံမှုသည်ရေတိုက်သက်ရောက်မှုသာဖြစ်နိုင်ပြီး ပမာဏအားဖြင့်လည်း သေးငယ်ပါသည်။ လူနေထိုင်မှုများ၊ ထိခိုက်လွယ်သောပတ်ဝန်းကျင်နယ်မြေများနှင့် ဝေးကွာပြီး ကမ်းမှ မီတာ ၂၀၀ ခန့်ဝေးကွာသော နေရာတွင် စီမံကိန်းသည် တည်ရှိပါသည်။ ပြင်ပမီးအလင်းရောင်များနှင့် အနံ့များသည် ဇောတိက နှင့် ရတနာ လုပ်ငန်းကြီးများမှ မီးရှို့ (flaring)ရာမှထွက်ပေါ်သော အလင်းများနှင့် ယှဉ်ပါက လျစ်လျူရှုနိုင်သော အဆင့် တွင်ရှိပါသည်။

- စီမံကိန်းကြောင့် အစိုင်အခဲ စွန့်ပစ်ပစ္စည်းများကို PTTEPI ၏ ပို့ဆောင်ရေးအခြေစိုက် စခန်းဖြစ်သည့် ရနောင်း (သို့မဟုတ်) သာကေတ အခြေစိုက်စခန်းသို့ ပို့ဆောင်ပြုပြင်သန့်စင်မည်ဖြစ်ပါသည်။

စွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲမှု အစီအစဉ်သည် အန္တရာယ်ရှိသော/မရှိသောပစ္စည်းများစွန့်ပစ်မှုကြောင့် သက်ရောက် နိုင်မှုအား (ကုန်းတွင်းသို့ကန်ထရိုက်တာမှသန့်စင်ပို့ဆောင်ကာ) လျော့ချနိုင်ပါသည်။ သို့ပါ၍ ကြွင်းကျန် သက်ရောက်မှုသည် (၎င်းစွန့်ပစ်ရာလမ်းကြောင်းအား အထည်ပြုပေးပြီးပါက) လျစ်လျူရှုနိုင်သော အဆင့် တွင်ရှိပါသည်။

ဓါတုပစ္စည်းများနှင့် အန္တရာယ်ရှိသော ပစ္စည်းများသည် ရေနံနှင့် သဘာဝဓါတ်ငွေ့လုပ်ငန်းများ၌ အသုံးများသဖြင့် ပတ်ဝန်းကျင်သို့ မတော်တဆယိုဖိတ်နိုင်သောကိစ္စရပ်များကို အထူးသတိပြုရမည် ဖြစ်ပါသည်။ ဓါတုပစ္စည်းများနှင့် အန္တရာယ်ရှိသော ပစ္စည်းများယိုဖိတ်မှုဖြစ်ပေါ်ပါက အောက်ပါ နည်းလမ်းကို လိုက်နာရပါမည်။

ဓါတုပစ္စည်းများကို သတ်မှတ်ထားသော သိုလှောင်စည်များအတွင်းသေချာစွာ ထုပ်ပိုးသိုလှောင် ထားခြင်းဖြင့် ဖိတ်စင်မှုများကိုကာကွယ်ရန်နှင့် သီးခြားထားရှိရန်လိုအပ်သောဓါတုပစ္စည်းများအား သီးသန့်နေရာသတ်မှတ် ထားရှိရမည်ဖြစ်ပါသည်။

- တိုက်ရိုက် (သို့မဟုတ်) သွယ်ဝိုက်သောနည်းဖြင့် အလုပ်ကိုင်အခွင့်အလမ်းများ ပေါ်ပေါက်လာစေခြင်း ကြောင့် ဒေသစီးပွားရေးအပေါ်တွင် ကောင်းမွန်သော သက်ရောက်မှုဖြစ်စေပါသည်။ စီမံကိန်းသည် ကမ်းလွန်ဒေသတွင်း လုပ်ဆောင်ရမည် ဖြစ်သဖြင့် ကမ်းရိုးတန်း၊ ရော့တီကမ်းရိုးတန်း တလျှောက်နှင့် လူနေထိုင်ရာကျွန်းများတွင် (ဝန်ထမ်းများကြောင့်) လူဦးရေထူထပ်လာစေခြင်းကဲ့သို့သော အကြောင်းအရာများ ဖြစ်ပေါ်နိုင်ခြင်းမရှိပါ။
- ချန်လှပ်နယ်မြေ တနည်းအားဖြင့် ကန့်သတ်ဇုန် သတ်မှတ်ထားခြင်းကြောင့် ပင်လယ်ရေကြောင်း သွားလာမှုအပေါ်တွင် အနည်းငယ်သော သက်ရောက်မှုရှိနိုင်ပါသည်။ သို့သော်လည်း စီမံကိန်းသည် အဓိကရေကြောင်းသွားလာရေးလမ်းကြောင်းနှင့် အလှမ်းဝေးသောကြောင့် သက်ရောက်မှုအဆင့်သည် အရေးမကြီးသောအဆင့် အဖြစ်သတ်မှတ် ထားပါသည်။ မလိုလားအပ်သော သက်ရောက်မှုများမှ ရှောင်ရှားနိုင်ရန် ရေကြောင်းသွားလာမှုဆိုင်ရာအသိပေးကြေငြာချက် ကို ရှင်းလင်းစွာထုတ်ဖော်အသိပေး သွားမည်ဖြစ်ပါသည်။ တွင်းတူးစင် တပ်ဆင်ခြင်း/ဖြုတ်သိမ်းခြင်း နှင့် ထောက်ပံ့ရေး ရေယာဉ်များ သွားလာခြင်းများကြောင့် ရေကြောင်းသွားလာရေးအပေါ်တွင် သက်ရောက်မှုဖြစ်ရခြင်း ဖြစ်ပါသည်။
- ငါးဖမ်းလုပ်ကွက်နှင့် ယာဉ်သွားလာရာလမ်းကြောင်းအပေါ် ဖြစ်နိုင်ချေရှိသောသက်ရောက်မှုမှာ အရေးမကြီး သောအဆင့်သတ်မှတ်ချက်တွင်ရှိပါသည်။ အထူးသဖြင့် စီမံကိန်းသည် အခြားကမ်းလွန် လုပ်ကွက်များ နှင့်နီးကပ်နေပြီး၊ အငြင်းပွားမှုများ မဖြစ်စေရန်ရည်ရွယ်ကာ ကန့်သတ်နယ်မြေနှင့် သွားလာရာ လမ်းကြောင်းများကို သက်ဆိုင်ရာ ဌာနများနှင့် ပူးပေါင်းဆုံးဖြတ်အကောင်အထည်ဖော် သွားမည်ဖြစ်ပါသည်။ PTTEPI သည် လုပ်ငန်းလုပ်ဆောင်နေစဉ် ဘေးအန္တရာယ်ကင်းရှင်းစေရန်အတွက် အလင်းစနစ်များ၊ အသံစနစ်များတပ်ဆင်သွားမည်ဖြစ်ပါသည်။ ပိတ်ဆို့မှုမဖြစ်ပေါ်စေရန်နှင့် ငါးဖမ်း လုပ်ကွက်များအတွင်း ဖြတ်သန်းခြင်းမပြုရန် PTTEPI မှ အကောင်းဆုံးလျော့ချလုပ်ဆောင်သွားမည် ဖြစ်ပါသည်။  
ကမ်းလွန်ရေနှင့်ခါတ် အကဲဖြတ်တွင်းတူးဖော်ရေး စီမံကိန်းအတွက် ထောက်ပံ့ရေး ရေယာဉ်များ သွားရာလမ်းကြောင်း (ကမ်းလွန်လုပ်ကွက်နှင့် ကုန်းတွင်းအခြေစိုက်စခန်းအကြား) သည် PTTEPI နှင့် သက်ဆိုင်ရာဌာနများမှ အတည်ပြုပေးထားပြီးဖြစ်သည်။
- ယိုဖိတ်မှုများကြောင့် ဖြစ်ပေါ်လာသော သက်ရောက်မှုများကို နည်းပါးသောအဆင့်တွင်သတ်မှတ်ထား ပါသည်။ PTTEPI သည် စီမံကိန်းလုပ်ငန်းစဉ်အား ပြည်တွင်းနှင့် နိုင်ငံတကာစည်းမျဉ်း များကို လိုက်နာ၍ စီမံကိန်းအား အကောင်အထည်ဖော်ရန် သေချာစေရမည် ဖြစ်ပါသည်။

**1.5.2. Cutting Dispersion Study အား မော်ဒယ်ပုံစံငယ်ဖြင့်လေ့လာခြင်း**

ဤအခန်းတွင် တွင်းတူးရာမှထွက်ပေါ်သော ဖြတ်စာများရေအောက်သို့သန့်စင်စွန့်ပစ်မှုကြောင့် ဖြစ်ပေါ်လာနိုင်သော ပတ်ဝန်းကျင်ပေါ်သို့သက်ရောက်မှုများကိုလေ့လာထားပါသည်။ ယင်းဖြတ်စာများသည် ပင်လယ်ရေအောက်သို့ မစွန့်ပစ်မီတွင် သင်္ဘောပေါ်တွင်အမျိုးအစားခွဲသန့်စင်မည် ဖြစ်ပါသည်။ သဘာဝပတ်ဝန်းကျင်သို့သက်ရောက်နိုင်မှုကို ဆန်းစစ်သည်ဆိုရာတွင် စီမံကိန်းပြီးဆုံးပါက ၎င်းဖြတ်စာများ ပင်လယ်ကြမ်းပြင်တွင်အနည်ထိုင်ခြင်း နှင့် ပင်လယ်ရေတွင် ပျော်ဝင်ပျံ့နှံ့နိုင်ခြေတို့ကို တွက်ချက်လေ့လာဆန်းစစ်ခြင်းဖြစ်ပါသည်။

လုပ်ကွက် M9 ရှိ တွင်းတူးမည့်နေရာမှာ ပင်လယ်ကြမ်းပြင်အောက် မီတာ ၁၃၀ အကွာတွင်ရှိပါသည်။ တွင်းပေါင်း ၁၂ တွင်းတူးမည်ဖြစ်ရာ ပုံစံငယ်နှစ်ခု နှင့် အသွင်တူပုံစံငါးခုအား အချိန်တစ်လကျော်ယူ၍ လေ့လာဆန်းစစ်ခဲ့ပါသည်။ ရာသီဥတုတိုင်း အတွက်လေ့လာမှုပြုလုပ်ခဲ့ကြပြီး ရလဒ်အနေဖြင့် အနည်အနှစ်များသည် ပင်လယ်ကြမ်းပြင်တွင် ၁.၉ စင်တီမီတာ အောက်နည်းသောပမာဏဖြင့် အနည်ထိုင်ပါသည်။ တစ်စင်တီမီတာထက်ပိုသော အနည်ထိုင်သည့် အနည်အနှစ်ပမာဏသည် ဇန်နဝါရီလ၊ ဧပြီ နှင့် အောက်တိုဘာလများတွင်သာ တွေ့ရှိခဲ့ရပါသည်။ ဧရိယာ အကျယ်အဝန်း မီတာတစ်ရာ တွင် တစ် စင်တီမီတာနှင့်အထက် အနည်ထိုင်ပြီး ပင်လယ်ရေတွင်မျောပါနေသော အနည်အနှစ်ပမာဏသည် တစ်လီတာတွင် တစ် မီလီဂရမ်နှုန်းအဖြစ် အသွင်တူပုံစံငယ်တိုင်းတွင် လေ့လာတွေ့ရှိ ရပါသည်။ ပင်လယ်ကြမ်းပြင်အောက် ၂၀ မီတာ၊ အချင်းဝက် ၁၅၀မီတာ အကျယ်အဝန်းတွင် အနည်အနှစ်စုစည်း ပါဝင်မှုမှာ တစ် လီတာတွင် ၀.၁ မီလီဂရမ်အထက်ဖြစ်ပြီး၊ ပင်လယ်ကြမ်းပြင်အောက် ၉၀ မီတာတွင် အနည်အနှစ် စုစည်းပါဝင်မှုမှာ တစ် လီတာတွင် ၀.၁ မီလီဂရမ်ရှိသည်ကို modelling ပုံစံငယ်တွင် လေ့လာရပါသည်။

တွင်းတူးဖြတ်စုများ ပျံ့နှံ့နိုင်မှု မော်ဒယ်ပုံစံငယ် လေ့လာဆန်းစစ်ချက် အပြည့်အစုံကို ယခုအစီရင်ခံစာ၏ နောက်ဆက်တွဲ ၃ တွင် ဖော်ပြထားပါသည်။

**1.6. စုပေါင်းသက်ရောက်မှုများ**

ပတ်ဝန်းကျင်ဆိုင်ရာအကြောင်းအရာတစ်ခုချင်းစီသည် ရေနံနှင့် သဘာဝဓါတ်ငွေ့ရှာဖွေ/ထုတ်လုပ်ရေး လုပ်ငန်းများ၏ စုပေါင်းသက်ရောက်မှုကိုကြိုတွေ့ရမည်ဖြစ်ပါသည်။ လုပ်ငန်းကဏ္ဍအများစုသည် ရုပ်ဝန်းကျင်ပေါ်သို့ စုပေါင်း သက်ရောက်မှုများဖြစ်ပေါ်စေပြီး၊ သဘာဝနှင့် လူမှုဝန်းကျင်အပေါ်တွင် သွယ်ဝိုက်သော သက်ရောက်မှုများ ဖြစ်ပေါ်စေပါသည်။ အဓိကကျသောစုပေါင်းသက်ရောက်မှုများမှာ (i) ပင်လယ်ရေကြောင်းဆိုင်ရာ ရေယာဉ်၊ တွင်းတူးစင်နှင့် အခြားဆက်စပ်အရာဝတ္ထုများတည်ရှိနေခြင်း (ii) ရုပ်ဝန်းကျင်ကို တိုက်ရိုက်ပြောင်းလဲစေပြီး၊ သဘာဝဝန်းကျင်သို့သွယ်ဝိုက်သောနည်းဖြင့် ပြောင်းလဲစေသော လေထုတွင်း ထုတ်လွှတ်မှုများ၊ (iii) ပြန်လည် အသုံးပြု၍ရသော/ပြန်လည်စီမံ၍ရသော (သို့မဟုတ်) မြေမြှုပ်၍ရသော စွန့်ပစ်ပစ္စည်းများအား သေချာစွာစီမံခန့်ခွဲခြင်း မရှိမှု စသည်တို့ဖြစ်ပါသည်။

အောက်ဖော်ပြပါ ဇယားသည် စုပေါင်းသက်ရောက်မှုများအတွက် ပဏာမဆန်းစစ်ဖော်ပြချက်ဖြစ်ပါသည်။

**Tabl. 4 - အကဲဖြတ်တွင်းတူးစီမံကိန်းနှင့်စပ်လျဉ်း၍ စုပေါင်းသက်ရောက်မှုများကို ဖော်ထုတ်သတ်မှတ်မှု**

ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင် လက္ခဏာရပ်များ	စီမံကိန်းလုပ်ဆောင်ချက်များ (လုပ်ငန်း အဆင့်အလိုက်)	အကြောင်းအရာ/အသေးစိတ်
မိရိုးဖလာ ငါးဖမ်းလုပ်ငန်း	တွင်းတူးစင်နှင့် ရေယာဉ်များတည်ရှိနေမှု	ပင်လယ်ရေကြောင်းသွားလာမှု လမ်းကြောင်းကျပ်ခြင်း
	(ပစ္စည်းကိရိယာများ တပ်ဆင်ခြင်းနှင့်	ငါးဖမ်းရ ဧရိယာ အကျယ်အဝန်းတိုးလာခြင်း
	ဖြုတ်သိမ်းခြင်း)	မနုဿဗေဒဆိုင်ရာ အခက်အခဲများဖြစ်ပေါ်ခြင်း



ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင် လက္ခဏာရပ်များ	စီမံကိန်းလုပ်ဆောင်ချက်များ (လုပ်ငန်း အဆင့်အလိုက်)	အကြောင်းအရာ/အသေးစိတ်
		ငါးဖမ်းလုပ်ငန်းအပေါ်သက်ရောက်မှုဖြစ်ပေါ်ခြင်း ဇီဝစွန့်ပစ်မှုများကြောင့် (ရေ အနည်အနှစ်နှင့် ပင်လယ်မြက်များအပေါ်တွင်) စုပေါင်းသက်ရောက်မှုများဖြစ်ပေါ်လာခြင်း
ဇီဝမျိုးစုံမျိုးကွဲ	တွင်းတူးစင်နှင့် ရေယာဉ်များတည်ရှိနေမှု (ပစ္စည်းကိရိယာများ တပ်ဆင်ခြင်းနှင့် ဖြုတ်သိမ်းခြင်း)	ဆူညံမှုကြောင့် ပင်လယ်နေသတ္တဝါများအပေါ်အနှောင့်အယှက်ဖြစ်စေခြင်း ဇီဝသက်ရှိ အကောင်များ ၎င်းတို့ကျက်စားရာနေရာနှင့် ဗီဇများ ပျက်စီးခြင်း
	တွင်းတူးစင် တပ်ဆင်ခြင်း (ပစ္စည်းကိရိယာများ ရွှေ့ပြောင်းစဉ်)	
	ရွှံ့နှင့် ဖြတ်စာများ စွန့်ထုတ်မှု (တွင်းတူးလုပ်ငန်းလုပ်ဆောင်စဉ်)	
	တွင်းပြိုခြင်း (ကြိုတင်မခန့်မှန်းနိုင်သောအခြေအနေများ)	

## 1.7. ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ်

### 1.7.1. နိဒါန်း

ဖော်ပြပါလေ့လာမှုသည် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ် ရေးဆွဲရန် အကြံပြုထားသည့်အကြောင်းအချက်များ ထည့်သွင်း ရေးဆွဲထားပါသည်။ ၎င်း ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်သည် လျော့ပါးစေရေးနည်းလမ်းများ နှင့် သဘောတူထား ရှိသော စီမံခန့်ခွဲမှုအစီအစဉ်များကို လမ်းညွှန်ပေးပါသည်။ PTTEPI မှ စီမံကိန်းမစတင်မီ တွင် သက်ဆိုင်ရာ တွင်းတူးဖော်ရေးကန်ထရိုက်တာကိုရွေးချယ်ပြီး၊ အပြီးသတ် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီရင်ခံစာ (EMP) ကိုရေးဆွဲရမည် ဖြစ်ပါသည်။

EMP ၏ ရည်ရွယ်ချက်မှာ တွင်းတူးလုပ်ငန်းလုပ်ဆောင်စဉ်ကာလပတ် EIA တလျှောက်တွင် ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင်အပေါ်သက်ရောက်နိုင်သော အကြောင်းအရင်းအမြစ်များကို ဖော်ထုတ် ဆန်းစစ်၍ လျော့ပါးစေရန်၊ ရှင်းလင်းစေရန် ရည်ရွယ်ရေးဆွဲခြင်းဖြစ်ပါသည်။ ၎င်း EMP တွင် လုပ်ထုံးလုပ်နည်းများ၊ တာဝန်ယူ ဆောင်ရွက်မှုများ၊ စည်းမျဉ်းများဖော်ပြပါဝင်ပါသည်။

- စီမံကိန်းလုပ်ငန်းကြောင့် ဖြစ်နိုင်ချေရှိသော ပတ်ဝန်းကျင်ဆိုင်ရာသက်ရောက်မှုများကို လျော့နည်းစေမည့် လျော့ပါးစေရေးနည်းလမ်းများကို ရေးသားတင်ပြရန်
- ပတ်ဝန်းကျင်ဆိုင်ရာမည်သည့် သက်ရောက်မှုမျိုးကို မဆို စောင့်ကြပ်ကြည့်ရှုလေ့လာရန်

အဆိုပြုထားသော လျော့ပါးစေရေးနည်းလမ်းတစ်ခုချင်းစီတွင် EMP သည် နည်းပညာဆိုင်ရာ အကြံပြုချက်များ၊ လုပ်ငန်းလည်ပတ်ရေးညွှန်ကြားချက်များ၊ အဖွဲ့အစည်းနှင့် ရလဒ်ထိန်းချုပ်မှုများ ကို သတ်မှတ်ထားရှိပါသည်။ EMP သည် စီမံကိန်းအားကြောင်းကျိုးညီညာစွာအထမြောက် အကောင်အထည်ဖော်ဆောင်နိုင်ရေးအတွက် ရည်ရွယ်ပါသည်။

EMP ၏ လိုအပ်ချက်များကို Standard Operation Procedures, Work Procedure ကဲ့သို့သော (working documents) စီမံကိန်းဆိုင်ရာမှတ်တမ်းအစီရင်ခံစာများနှင့် ပေါင်းစည်းလုပ်ဆောင်ရမည်ဖြစ်ပြီး၊ ယင်းလိုအပ်ချက်များကို သက်ဆိုင်ရာပုဂ္ဂိုလ်များမှ တာဝန်ယူ ဖြန့်ဝေ သင်ကြားပေးရမည်ဖြစ်ပါသည်။

ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာသည် အောက်ဖော်ပြပါ တိကျသော စီမံခန့်ခွဲမှုအစီစဉ်များကို အကြံပြု ထောက်ခံထားပါသည်။

**Tabl. 5 - အကဲဖြတ်တွင်းတူးစီမံကိန်းနှင့် စပ်လျဉ်း၍စီမံခန့်ခွဲမှု အစီအစဉ်ခွဲများ**

စီမံခန့်ခွဲမှုအစီစဉ်ခွဲများ	မှတ်ချက်
Chemical Management Plan/ Standard (ဓါတုပစ္စည်းစီမံခန့်ခွဲခြင်းအစီအစဉ်)	ဓါတုပစ္စည်းစီမံခန့်ခွဲခြင်းအစီစဉ်ကို အစီရင်ခံစာတွင် ထည့်သွင်းရေးဆွဲထားပြီး၊ အသေးစိတ် အစီအစဉ်သည် ကန်ထရိုက်တာများမှ အကောင်အထည်ဖော်ဆောင်ရွက်ရေးဆွဲပြီး PTTEPI မှ တာဝန်ရှိသူ SSHE department ထံသို့ တင်ပြ၍ ခွင့်ပြုချက်ရယူရမည်ဖြစ်ပါသည်။
Waste Management Plan (စွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲမှု အစီအစဉ်)	စွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲခြင်းအစီစဉ်ကို အစီရင်ခံစာတွင် အထောက်အကူအဖြစ် ထည့်သွင်းရေးဆွဲထားပြီး ကန်ထရိုက်တာများမှ လုပ်ငန်းအပေါ်အခြေခံပြီး ရေးဆွဲလုပ်ဆောင်ရမည်ဖြစ်ပါသည်။
Blowout Contingency Plan (တွင်းကန်ခြင်း၊ တွင်းပြိုခြင်း ကိုကိုင်တွယ်ဖြေရှင်းသည့်အစီအစဉ်)	တွင်းကန်ခြင်း၊ တွင်းပြိုခြင်း ကိုကိုင်တွယ်ဖြေရှင်းသည့် အစီအစဉ်ကို အစီရင်ခံစာတွင် ခြုံငုံရေးဆွဲထားပြီး၊ အသေးစိတ် အစီအစဉ်အား ကန်ထရိုက်တာများမှ အကောင်အထည်ဖော်ရေးဆွဲပြီး PTTEPI မှ တာဝန်ရှိသူထံသို့ တင်ပြ၍ ခွင့်ပြုချက်ရယူရမည်ဖြစ်ပါသည်။
Spill Contingency Plan (ယိုဖိတ်မှုများကို ကိုင်တွယ်ဖြေရှင်းသည့် အစီအစဉ်)	ယိုဖိတ်မှုများကို ကိုင်တွယ်ဖြေရှင်းသည့်အစီအစဉ်ကို အစီရင်ခံစာတွင် ထည့်သွင်းရေးဆွဲထားသော်လည်း၊ အသေးစိတ်အစီအစဉ်အား ကန်ထရိုက်တာများမှ အကောင်အထည်ဖော်ရေးဆွဲပြီး PTTEPI မှ တာဝန်ရှိသူထံသို့ တင်ပြ၍ ခွင့်ပြုချက်ရယူရမည်ဖြစ်ပါသည်။
Emergency and Crisis Management Plan (အရေးပေါ်အခြေအနေများကို စီမံခန့်ခွဲသည့် အစီအစဉ်)	အရေးပေါ်အခြေအနေများကို စီမံခန့်ခွဲသည့် အစီအစဉ် ကို အစီရင်ခံစာတွင် ခြုံငုံရေးဆွဲထားပြီး၊ အသေးစိတ် အစီအစဉ်အား ကန်ထရိုက်တာများမှ အကောင်

	အထည်ဖော်ရေးဆွဲပြီး PTTEPI မှ တာဝန်ရှိသူမှ တာဝန်ရှိသူတို့ထံသို့ တင်ပြ၍ ခွင့်ပြုချက်ရယူရမည်ဖြစ်ပါသည်။
Grievance Mechanism (စီမံကိန်းလုပ်ကိုင်သူ နှင့် တတိယအဖွဲ့အစည်းများမှ တိုင်ကြားချက်များအား ကိုင်တွယ်ဖြေရှင်းခြင်း)	အစီရင်ခံစာတွင် Grievance Mechanism ၏ ယေဘုယျအချက်အလက်များပါရှိပြီး၊ PTTEPI သည် ၎င်းတို့လက်တွေ့အသုံး Grievance Handling Guidelinesအတိုင်း ကိုင်တွယ်ဖြေရှင်းမည် ဖြစ်ပါသည်။
Training and Awareness Programme (သင်တန်းပေးခြင်းနှင့် အသိပညာပေးခြင်းအစီအစဉ်များ)	သင်တန်းပေးခြင်းနှင့် အသိပညာပေးခြင်း နှင့် ပတ်သတ်သော ယေဘုယျလမ်းညွှန်ချက်များပါရှိပြီး၊ လက်တွေ့အကောင်အထည်ဖော် လုပ်ဆောင်ခြင်းအား ကန်ထရိုက်တာများ၊ ဝန်ထမ်းများမှလိုက်နာဆောင်ရွက်ကြရမည်ဖြစ်ပါသည်။
Environmental Audit Programme (ပတ်ဝန်းကျင်ဆိုင်ရာအရည်အသွေးဆန်းစစ်ခြင်း အစီအစဉ်)	အစီရင်ခံစာတွင် Environmental Audit Programme ၏ ယေဘုယျအချက်အလက်များပါရှိပါသည်။ Environmental Audit အားသက်ဆိုင်ရာ တာဝန်ရှိပုဂ္ဂိုလ် (သို့) တာဝန်ရှိခေါင်းဆောင်မှ သတ်မှတ်ကာလများတွင် လုပ်ဆောင်ရမည်ဖြစ်ပါသည်။
Occupational and Community Health Management Plan (လုပ်ငန်းခွင်နှင့် လူမှုဝန်းကျင် ကျန်းမာရေးစီမံခန့်ခွဲမှုအစီအစဉ်)	PTTEPI သည် အစီရင်ခံစာတွင် ရေးသားဖော်ပြထားသော လမ်းညွှန်ချက်များကို လိုက်နာကျင့်သုံးရမည်ဖြစ်ပြီး၊ PTTEPI's လုပ်ငန်းခွင်နှင့် လူမှုဝန်းကျင် ကျန်းမာရေး စီမံခန့်ခွဲမှု စံနှုန်းအား လမ်းညွှန်လုပ်ဆောင်ချက်အဖြစ် နောက်ဆက်တွဲ ၅ တွင် ဖော်ပြထားပါသည်။
Monitoring Plan (စီမံခန့်ခွဲမှုများနှင့် လျော့ပါးစေရေးနည်းလမ်းများသည် ထိရောက်မှု ရှိ/မရှိ စောင့်ကြပ်ကြည့်ရှုစစ်ဆေးခြင်း လုပ်ငန်း)	စောင့်ကြပ်ကြည့်ရှုစစ်ဆေးခြင်း လုပ်ငန်းများကို စီမံခန့်ခွဲမှု အစီအစဉ် တစ်ခုစီတွင် ဖော်ပြထားပါသည်။

စီမံခန့်ခွဲမှုအစီအစဉ် အသေးစိတ်အား အခန်း (၈) ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင် စီမံခန့်ခွဲမှုတွင် ထည့်သွင်း ရေးဆွဲထားပြီး၊ ဖော်ပြပါအစီအစဉ်များကို ကန်ထရိုက်တာမှ အများဆုံးအကောင်အထည်ဖော် လုပ်ဆောင်ကာ PTTEPI မှ လုပ်ငန်းခွင် တာဝန်ရှိသူ နှင့် SSHE department တို့မှ ကြီးကြပ်ခြင်း၊ ခွင့်ပြုခြင်းကို ဆောင်ရွက်မည်ဖြစ်ပါသည်။

**1.7.2. အဓိကသက်ရောက်မှုများနှင့် လျော့ပါးစေရေးနည်းလမ်းများ**

စီမံကိန်းစတင်အကောင်အထည်ဖော်သည်နှင့် ဖော်ပြပါလျော့ပါးစေရေးနည်းလမ်းများကို လိုက်နာကျင့်သုံးခြင်းဖြင့် ဖြစ်နိုင်ချေရှိသော သက်ရောက်မှုများကိုအတတ်နိုင်ဆုံးအခြေအနေအထိ လျော့ချနိုင်မည်ဖြစ်ပါသည်။ ဖော်ပြပါ လျော့ပါးစေရေးနည်းလမ်းများသည် လိုက်နာရန်၊ သေချာစေရန်နှင့် သက်ရောက်နိုင်မှုများကို ထိန်းချုပ်ရန် ဖြစ်ပြီး နိုင်ငံတကာ လုပ်ထုံးလုပ်နည်းများအတိုင်း လိုက်နာကျင့်သုံးထားပါသည်။

အောက်ပါဇယားတွင်ဖော်ပြထားသော လျော့ပါးစေရေးနည်းလမ်းများကို အကောင်အထည်ဖော်ဆောင်ကာ စီမံကိန်း  
ကြောင့်သက်ရောက်မှုများကို လျော့နည်းသည်ထက် လျော့နည်းစေရန် လုပ်ဆောင်မည်ဟု ကတိကဝတ်ပြုပါသည်။

Tabl. 6 - ပြင်ဆင်ခြင်းနှင့် တပ်ဆင်ခြင်းအဆင့်တွင် စီမံကိန်းအတွက် လျော့ပါးစေရေးနည်းလမ်းများ/ကတိကဝတ်ဇယား

ကဏ္ဍများ	ဖြစ်နိုင်ချေရှိသည့် သက်ရောက်မှုများ	လျော့ပါးစေရေးနည်းလမ်းများ	ကြွင်းကျန်သက်ရောက်မှုများ	အရေးပါသော လုပ်ငန်းရပ်	တည်နေရာ	အချိန်ကာလ	တာဝန်ရှိမှု	
<b>ပတ်ဝန်းကျင်ဆိုင်ရာ လျော့ပါးစေရေးနည်းလမ်းများ</b>								
၁။လေထုအရည်အသွေး / ဖန်လုံအိမ်ဓါတ်ငွေ့ ထုတ်လွှတ်မှုများ	ထောက်ပံ့ရေး ရေယာဉ်ပေါ်တွင် တပ်ဆင်ထားသော အင်ဂျင်စက်များနှင့် စက်များ၏ လုပ်ဆောင်ချက်များကြောင့် ဖြစ်ပေါ်လာသော လောင်ကျွမ်းမှုများမှ ထွက်ရှိလာမည့် လေထုထုတ်လွှတ်မှုများ။	<ul style="list-style-type: none"> <li>ဖိအားသုံးစက်များ၊ မီးအားပေးစက်များ၊ ရေယာဉ်သုံးအင်ဂျင်စက်များအား ပုံမှန် ပြုပြင်ထိန်းသိမ်းခြင်း။</li> <li>နောင်နှေးမှုများရှိပါက ယာဉ်များအားကြိုတင် သတိပေးထားခြင်းဖြင့် စွမ်းအင်အသုံးချမှု အားလျော့ချခြင်း။</li> <li>MARPOL 73/ 78 နောက်ဆက်တွဲ ၄ အရ - ယာဉ်များမှထွက်ရှိသော လေထုညစ်ညမ်းမှုများအား ထိန်းသိမ်းကာကွယ်ခြင်း၊ သက်တမ်းကြာရင့်သော ရေယာဉ်များတွင် (MARPOL 73/ 78 နောက်ဆက်တွဲ ၄၊ အခန်း ၄ ရှိ- ship efficiency management) အားအသုံးချခြင်း။</li> </ul>	လျစ်လျူရှုနိုင်သောအဆင့်	<ul style="list-style-type: none"> <li>ဖိအားသုံးစက်များ၊ မီးအားပေးစက်များ၊ ရေယာဉ်သုံးအင်ဂျင်စက်များအား ပုံမှန် ပြုပြင်ထိန်းသိမ်းခြင်း။</li> </ul>	စီမံကိန်းနှင့် သက်ဆိုင်သော ရေယာဉ်များအားလုံး	ပြင်ဆင်ခြင်းနှင့် တပ်ဆင်ခြင်း လုပ်ငန်းအဆင့်	PTTEPI/ ကန်ထရိုက်တာ	
၂။ပင်လယ်ရေ အရည်အသွေးနှင့် အနည်အနှစ်အရည်အသွေး	ပင်လယ်ရေကြောင်း ရေယာဉ်များမှ ဆီပါဝင်သည့် ရေဆိုးများထုတ်လွှတ်မှု (ဆိုလိုသည်မှာ သင်္ဘောဝမ်းဗိုက်ရှိ ရေများ၊ အင်ဂျင်စက်များမှ ဓါတုပစ္စည်းများပါဝင်သည့် ရေဆိုးများနှင့် သင်္ဘောကုန်းပတ်ရှိ ရေစီးဆင်းမှု) သည် ပင်လယ်ရေအရည်အသွေးကို နိမ့်ကျစေနိုင်ခြင်း။	<ul style="list-style-type: none"> <li>တွင်းတူးစက်၊ ထောက်ပံ့ရေးရေယာဉ်များတွင် အညစ်အကြေးသန့်စင်သည့်စနစ်များ ထားရှိခြင်း</li> <li>ရေယာဉ်များအားလုံး MARPOL (သင်္ဘောမှရေဆိုးစွန့်ထုတ်မှုသည် ၁၅ မီလီဂရမ်/လီတာ ထက်မပိုစေရန်) နှင့် PTTEPI ၏ အညစ်အကြေးများအား စီမံဆောင်ရွက်ခြင်းအစီအမံများအား လိုက်နာခြင်း။</li> <li>ပင်လယ်ထဲသို့ မစွန့်ပစ်မီ ရေယာဉ်များအတွင်းတည်ရှိနေသော အညစ်အကြေးများအား စုဆောင်းထားခြင်း၊ စွန့်ပစ်ရေများအား ၁၅ ppm အောက်နည်းသော အနေအထားအထိ သန့်စင်ဆောင်ရွက်ခြင်း။</li> <li>အစားအသောက်စွန့်ပစ်ပစ္စည်းများအား မစွန့်ပစ်မီ အရွယ်အစား ၂၅ မီလီမီတာ အောက်နည်းသော အနေအထားထိရောက် အောင် ကြိုတင်ခွဲခြားခြင်း။</li> <li>သင်္ဘောတည်ငြိမ်စေရန် ဝမ်းတွင်းတည်ရှိနေသော ရေများ အား သန့်စင်ခြင်းမပြုဘဲပတ်ဝန်းကျင်သို့မစွန့်ပစ်ရန်။ ၎င်းရေများအားစွန့်ပစ်ပါက IMO၂၀၀၄ (သင်္ဘောတွင်းရှိရေနှင့် အနည်အနှစ်များအား စီမံထိန်းသိမ်းခြင်း) မှ အပြည်ပြည်ဆိုင်ရာ လုပ်ထုံး လုပ်နည်းများအတိုင်း လိုက်နာခြင်း။</li> <li>ဟိုက်ဒရိုကာဗွန်နှင့် ဓာတုပစ္စည်းများပါဝင်ပြီး ညစ်ညမ်းမှုဖြစ်စေနိုင်သော ရေများအား ရေယာဉ်များမှ စုဆောင်းထိန်းသိမ်းထားခြင်း။</li> </ul>	လျစ်လျူရှုနိုင်သောအဆင့်	<ul style="list-style-type: none"> <li>MARPOL 73/38 အရ စွန့်ပစ်မှုမပြုလုပ်မီ စွန့်ပစ်ရေစီမံခန့်ခွဲမှုအား လိုက်နာဆောင်ရွက်ရန်</li> <li>စီမံကိန်းမှ အန္တရာယ်ရှိသည့် စွန့်ပစ်ပစ္စည်းများနှင့် အန္တရာယ်မရှိသည့် စွန့်ပစ်ပစ္စည်းများမှ လျော့နည်းစေရေးနည်းလမ်းများကို အကောင်အထည်ဖော်ရန်</li> </ul>	စီမံကိန်းနှင့် သက်ဆိုင်သော ရေယာဉ်များအားလုံး	ပြင်ဆင်ခြင်းနှင့် တပ်ဆင်ခြင်း လုပ်ငန်းအဆင့်	PTTEPI/ ကန်ထရိုက်တာ	
	ထောက်ပံ့ရေး ရေယာဉ်များတွင် တွင်းတူးစက်မှ ထုတ်လွှတ်သည့် မိလ္လာရေများနှင့် ရေဆိုးများသည် ပင်လယ်ရေအရည်အသွေးအား သက်ရောက်မှု ရှိစေခြင်း။	<ul style="list-style-type: none"> <li>ရေယာဉ်များ စွန့်ပစ်ပစ္စည်းများစွန့်ပစ်နေစဉ်အတွင်း ရပ်တန့် နေခြင်းမပြုရ။</li> <li>သင့်လျော်သော အညစ်အကြေးသန့်စင်ခြင်းပြုလုပ်နိုင်ရန် အဖွဲ့များထားရှိခြင်း။</li> <li>ရေယာဉ်များတွင်တည်ရှိသော ဓာတုပစ္စည်းများအား ဖိတ်စင်ကျခြင်းမဖြစ်စေရန် ကန်များအတွင်းတွင် သိုလှောင်ထားခြင်း။</li> </ul>	လျစ်လျူရှုနိုင်သောအဆင့်					
	စီမံကိန်းမှ အန္တရာယ်ရှိသည့် စွန့်ပစ်ပစ္စည်းများနှင့် အန္တရာယ်မရှိသည့် စွန့်ပစ်ပစ္စည်းအမျိုးမျိုးကို ထုတ်လုပ်ခြင်း၊ စီမံခန့်ခွဲမှုစနစ်လွှဲများမှ (သယ်ယူပို့ဆောင်ခြင်း၊ သိုလှောင်မှုနှင့် စွန့်ပစ်ခြင်း) သည် ပင်လယ်ရေအရည်အသွေးကို ထိခိုက်စေခြင်း။	<ul style="list-style-type: none"> <li>စွန့်ပစ်ပစ္စည်းများအား PTTEPI ၏ စွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲမှုအစီအစဉ်နှင့် MARPOL 73/ 78 ၏ နည်းလမ်းများအရ ကမ်းလွန်စနစ်များတွင် ထားရှိခြင်း။</li> </ul> <p><b>အန္တရာယ်ဖြစ်စေသော စွန့်ပစ်ပစ္စည်းများ</b></p> <ul style="list-style-type: none"> <li>စွန့်ပစ်ပစ္စည်းများသိုလှောင်ရန်နေရာများအား ခွဲခြားသတ်မှတ်ထားခြင်း</li> <li>မိုးဒဏ်၊ လေဒဏ်မှ ကာကွယ်နိုင်ရန် သင့်လျော်သော ကွန်တိန်နာများ တွင် စုဆောင်းထားခြင်း။</li> <li>မိုးရာသီ၌ မိုးရွာသွန်းမှုကြောင့် ရေယာဉ်ကုန်းပတ်အား ရေနှင့်ခါတုပစ္စည်းများကြောင့် ဖြစ်ပေါ်သော ညစ်ညမ်းမှု၊ အကျိုးသက်ရောက်မှုများအား လျော့ချနိုင်ရန် သန့်ရှင်းစေခြင်း။</li> <li>ကွန်တိန်နာများအား ယိုဖိတ်ခြင်းဖြစ်စေခြင်းကို ကာကွယ်နိုင်ရန် စီမံဆောင်ရွက်ထားခြင်း။</li> <li>အညစ်အကြမ်းများကုန်းတွင်းစခန်းသို့စွန့်ပစ်ရာတွင် ခွင့်ပြုမိန့်ရရှိထားသော ယာဉ်ဖြင့်သယ်ဆောင်ခြင်း။</li> <li>ပင်လယ်ထဲသို့ မည်သည့် စွန့်ပစ်ပစ္စည်းမှ မစွန့်ပစ်ရန်တားဆီးခြင်း။</li> </ul>	လျစ်လျူရှုနိုင်သောအဆင့်					

ကဏ္ဍများ	ဖြစ်နိုင်ချေရှိသည့် သက်ရောက်မှုများ	လျော့ပါးစေရေးနည်းလမ်းများ	ကြွင်းကျန်သက်ရောက်မှုများ	အရေးပါသော လုပ်ငန်းရပ်	တည်နေရာ	အချိန်ကာလ	တာဝန်ရှိမှု
		<p><b>အန္တရာယ်မရှိသော စွန့်ပစ်ပစ္စည်း</b></p> <ul style="list-style-type: none"> <li>အန္တရာယ်မဖြစ်စေသော စွန့်ပစ်ပစ္စည်းများဖြစ်သော အစားအသောက် အကြွင်းအကျန်များ၊ စာရွက်များ၊ အလှူမီနံဘူးများ၊ ဖန်များ နှင့် အခြား အညစ်အကြေးများအား သင့်လျော်သော နေရာများတွင် သီးခြားစီခွဲထားခြင်း။</li> <li>စွန့်ပစ်ပစ္စည်းများသို့လှောင်ရာနေရာများအား သေချာစွာခွဲခြားသတ်မှတ်ထားခြင်း။</li> <li>အစားအသောက်အကြွင်းအကျန်များအား ပင်လယ်ထဲမစွန့်ပစ်မီ အစား အသောက်အကြွင်းအကျန်၏ အရွယ်အစားများအား ၂၅ မီလီမီတာအနေအထားထိ ဖြစ်အောင်ဆောင်ရွက်ခြင်း။ အစား အသောက်မဟုတ်သော စွန့်ပစ်ပစ္စည်းများအား မြေဖိုစွန့်ပစ်ရန် ကုန်းတွင်းသို့ ပို့ဆောင်ခြင်း၊ စုဆောင်းခြင်း သို့မဟုတ် သင့်လျော်မှန်ကန်စွာ စွန့်ပစ်စေခြင်း။</li> <li>မြန်မာနိုင်ငံ၏ ဥပဒေနှင့် PTTEPI ၏ စွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲမှု အစီအစဉ်အရ ကုန်းပေါ်ရှိ သန့်စင်သည့်နေရာသို့ ပေးပို့ စွန့်ပစ်ခြင်း။</li> <li>ကုန်းတွင်း စခန်းသို့ တရားဝင်ခွင့်ပြုထားသော စွန့်ပစ်ပစ္စည်း လက်ခံသည့် ကန်ထရိုက်တာများထံ ပို့ဆောင်၍ စွန့်ပစ်ခြင်း စုဆောင်းထားရှိခြင်းနှင့် recycle ပြုလုပ်ခြင်း။</li> <li>စွန့်ပစ်ပစ္စည်းအမျိုးအစားများနှင့် အရေအတွက်များအား မှတ်တမ်းတင်ထားခြင်း။</li> </ul>					
	တွင်းတူးစက် တပ်ဆင်မှု နှင့် ထောက်ပံ့ရေး ရေယာဉ်၏ ကျောက်ဆူးချခြင်းသည် ပင်လယ်ကြမ်းပြင်ကို အနှောင့်အယှက်ဖြစ်စေသောကြောင့် အနည်အနှစ်များကို ယာယီ နောက်ကျိသွားစေနိုင်ခြင်း။	<ul style="list-style-type: none"> <li>မြန်မာ့ဆိပ်ကမ်းအာဏာပိုင်များနှင့် ငါးဖမ်းလုပ်ငန်း အဖွဲ့အစည်းများ၊ မြန်မာ့ရေန် တို့အား စီမံကိန်းနှင့် သက်ဆိုင်သော တည်နေရာနှင့် ကြာချိန်များအား အသိပေးအကြောင်းကြားခြင်း</li> </ul>		<ul style="list-style-type: none"> <li>ကွန်ပျူတာ ထိန်းချုပ်စနစ် ဖြင့်ရေန်တူး သင်္ဘောကိုနေ ရာချထားခြင်း</li> <li>တွင်းတူးစက် သယ်ဆောင်မီ ရက်သုံးဆယ် ကြိုတင်၍ ရေကြောင်း သတိပေးစာ ထုတ်ပြန်မည့် မြန်မာ့ရေန် နှင့် ပူးပေါင်း လုပ်ဆောင် ရန်</li> <li>ပင်လယ် ကြမ်းပြင် အခြေအနေ အား လုပ်ငန်း မစတင်မီလေ့ လာ ရန်</li> </ul>	စီမံကိန်းနှင့် သက်ဆိုင်သော ရေယာဉ်များ အားလုံး၊ တွင်းတူးစက်	ပြင်ဆင်ခြင်းနှင့် တပ်ဆင်ခြင်း လုပ်ငန်းအဆင့်	PTTEPI/ ကန်ထရိုက် တာ
၃။ပင်လယ်ကြမ်း ပြင်၏ လက္ခဏာများ	ထောက်ပံ့ရေး ရေယာဉ်မှ ကျောက်ဆူးချခြင်း နှင့် တူးစက်ကြောင့် ပင်လယ်ကြမ်းပြင်ရှိ အနည်အနှစ်များ၏ ဖွဲ့စည်းပုံအနေအထား အပေါ်သက်ရောက်မှု ရှိစေနိုင်ခြင်း။	<ul style="list-style-type: none"> <li>တွင်းတူးစက်ကြောင့်ဖြစ်ပေါ်လာနိုင်သော ပင်လယ်ကြမ်းပြင်အပေါ်အကျိုးသက်ရောက်မှုများအား လေ့လာခြင်း။</li> <li>ကျောက်ချ၍တရုတ်တိုက်ဆွဲခြင်းကို တားမြစ်ခြင်း</li> <li>မြန်မာ့ဆိပ်ကမ်းအာဏာပိုင်များနှင့် ငါးဖမ်းလုပ်ငန်း အဖွဲ့အစည်းများ၊ မြန်မာ့ရေန် တို့အား စီမံကိန်းနှင့် သက်ဆိုင်သော တည်နေရာနှင့် ကြာချိန်များအား အသိပေးအကြောင်းကြားခြင်း</li> </ul>	အရေးမကြီး သောအဆင့်		စီမံကိန်းနှင့် သက်ဆိုင်သော ရေယာဉ်များ အားလုံး၊ တွင်းတူးစက်	ပြင်ဆင်ခြင်းနှင့် တပ်ဆင်ခြင်း လုပ်ငန်းအဆင့်	PTTEPI/ ကန်ထရိုက် တာ
၄။အဏ္ဏဝါသက်ရှိ နှင့် အဏ္ဏဝါဂေဟစနစ်	ကမ်းလွန်ပင်လယ်ပြင်ရှိ လုပ်ငန်းများကြောင့်အဏ္ဏဝါနို့တိုက် သတ္တဝါများအား အနှောင့်အယှက်ဖြစ်စေခြင်း။	<ul style="list-style-type: none"> <li>လက်ရှိအသုံးပြုနေသော အင်ဂျင်ဆိုင်ရာစံချိန်စံညွှန်းများအား အသုံးပြုခြင်း။</li> <li>အင်ဂျင်စက်များအား ပုံမှန်စစ်ဆေးခြင်း။</li> <li>အဏ္ဏဝါနို့တိုက်သတ္တဝါများရှိသော နေရာများအား ရှောင်ရှား၍ ရေယာဉ်များအား အရှိန် လျှော့မောင်းနှင်ခြင်း၊ လမ်းကြောင်းသတ်မှတ်မောင်းနှင်ခြင်း။</li> <li>ရေဒီယိုအသံလှိုင်းစနစ် ဖြင့်အဏ္ဏဝါနို့တိုက်သတ္တဝါများအား စောင့်ကြည့်ခြင်း။</li> </ul>	အရေးမကြီး သောအဆင့်	<ul style="list-style-type: none"> <li>ပင်လယ် ကြမ်းပြင်အ ခြေအနေအား မလေ့လာမီ ပင်လယ်နေ သတ္တဝါများ အားစောင့် ကြည့်ရန်</li> <li>အမှတ် ၂ နှင့် ၃ အတွက် လျော့နည်းစေ ရေး အစီအစဉ်များ အတိုင်း အကောင် အထည်ဖော် ခြင်း</li> </ul>	စီမံကိန်းနှင့် သက်ဆိုင်သော ရေယာဉ်များ အားလုံး၊		
	စွန့်ပစ်ပစ္စည်းများ၊ ရေဆိုးများ၊ ရေယာဉ်များနှင့် ရေနံ့တူးစင်မှ ထွက်ပေါ်သောစွန့်ပစ်ပစ္စည်းများသည် ပင်လယ်ကြမ်းပြင်နှင့် ပင်လယ် ရေမျက်နှာပြင်ရှိ အဏ္ဏဝါသက်ရှိ ဖွဲ့စည်းပုံကို သွယ်ဝိုက်သက်ရောက် စေနိုင်ခြင်း။	<ul style="list-style-type: none"> <li>အမှတ် ၂ နှင့် ၃ အတွက် လျော့ပါးသက်သာစေရေး အစီအစဉ်များအတိုင်း အကောင်အထည်ဖော်ခြင်း</li> </ul>					

ကဏ္ဍများ	ဖြစ်နိုင်ချေရှိသည့် သက်ရောက်မှုများ	လျော့ပါးစေရေးနည်းလမ်းများ	ကြွင်းကျန်သက်ရောက်မှုများ	အရေးပါသော လုပ်ငန်းရပ်	တည်နေရာ	အချိန်ကာလ	တာဝန်ရှိမှု
<b>လူမှုရေးဆိုင်ရာ လျော့ပါးစေရေးနည်းလမ်းများ</b>							
၅။ ငါးဖမ်းလုပ်ငန်းများနှင့် ငါးလုပ်ငန်းအဖွဲ့အစည်းများ	ကန့်သတ်ဇုန် ၅၀၀ မီတာနှင့် ရေယာဉ်များ၊ တွင်းတူးစက်များ တည်ရှိခြင်းကြောင့် ငါးဖမ်းရေယာဉ်ကို လျော့ကျစေခြင်း။	<ul style="list-style-type: none"> <li>• တွင်းတူးခြင်းလုပ်ငန်းမစတင်မီ PTTEPI သည် MOGE နှင့်အတူ စီမံကိန်းနှင့်သက်ဆိုင်သော လုပ်ငန်းစဉ်များအတွက် သတိပေးစာများထုတ်ပြန်ရန် ညှိနှိုင်းဆောင်ရွက်ခြင်း၊ (ငါးလုပ်ငန်းဦးစီးဌာန၊ မွေး မြူရေး၊ ငါးလုပ်ငန်းနှင့် ကျေးလက်ဖွံ့ဖြိုးရေးဦးစီးဌာန၊ မြန်မာ့ရေတပ်နှင့် မြန်မာနိုင်ငံငါးလုပ်ငန်း ဦးစီးဌာန စသည့်ဌာနများ)</li> <li>• ရေနံတွင်းတူးမည့် ပတ်ဝန်းကျင်ရှိ မီတာ ၅၀၀ ပတ်လည်တွင် သီးခြားဇုန်များသတ်မှတ်ထားခြင်း။</li> <li>• ရေယာဉ်သွားလာမှုများအားသတိပေးရန် ထောက်ပံ့ရေးရေယာဉ် များအသုံးပြုခြင်း။</li> <li>• မတော်တဆတိုက်မိမှုများရှောင်ရှားနိုင်ရန် ကမ်းလွန်စခန်းများတွင် သင့်လျော်သော အချက်ပြမီးများထားရှိခြင်း။</li> </ul>	အရေးမကြီးသောအဆင့်	<ul style="list-style-type: none"> <li>• တွင်းတူးစင်မ သယ်ဆောင်မီ ရက်သုံးဆယ် ကြိုတင်၍ ရေကြောင်း သတိပေးစာ ထုတ်ပြန်မည့် မြန်မာ့ရေနံနှင့် ပူးပေါင်းလုပ်ဆောင်ရန်</li> <li>• စီမံကိန်း တိုက်တွင် မီတာ ၅၀၀ ရှိအန္တရာယ် ကင်းစုန် သတ်မှတ် ထားရှိရန်</li> <li>• ထောက်ပံ့ရေး သင်္ဘောများ အသုံးပြုပြီး ရေကြောင်း သွားလာရေး အား သတိပေး စောင့်ကြပ်ရန်</li> <li>• ကမ်းလွန် စခန်းများ တွင် သင့်လျော်သော အချက်ပြမီး များထားရှိခြင်း။</li> </ul>	စီမံကိန်းနှင့် သက်ဆိုင်သော ရေယာဉ်များ အားလုံး၊ တွင်းတူးစက်	ပြင်ဆင်ခြင်းနှင့် တပ်ဆင်ခြင်း လုပ်ငန်းအဆင့်	PTTEPI/ ကန်ထရိုက်တာ
	ပင်လယ်ပြင်ရှိ စွန့်ပစ်ပစ္စည်းများကြောင့်ဖြစ်ပေါ်သော ညစ်ညမ်းမှုများမှ ရေနေသတ္တဝါများ၏ အသက်ရှင်နေထိုင်မှုပုံစံ အရည်အသွေးနှင့် ပမာဏကို လျော့ကျစေနိုင်ခြင်း။ ထိုညစ်ညမ်းမှုများတွင် တွင်းတူးလုပ်ငန်းမှ ဖြတ်စာများ ရွံ့ရည်များ၊ အန္တရာယ်ရှိသော စွန့်ပစ်ပစ္စည်းနှင့် အန္တရာယ်မရှိသော စွန့်ပစ်ပစ္စည်းများပါဝင်ခြင်း။	<ul style="list-style-type: none"> <li>• အမှတ် ၂ နှင့် ၃ အတွက် လျော့ပါးသက်သာစေရေး အစီအစဉ်များအတိုင်း အကောင်အထည်ဖော်ခြင်း</li> </ul>	လျစ်လျူရှုနိုင်သောအဆင့်	အမှတ် ၂ နှင့် ၃ အတွက် လျော့ပါးစေရေး အစီအစဉ်များအတိုင်း အကောင်အထည်ဖော်ခြင်း	စီမံကိန်းနှင့် သက်ဆိုင်သော ရေယာဉ်များ အားလုံး၊ တွင်းတူးစက်		PTTEPI/ ကန်ထရိုက်တာ
၆။ သင်္ဘောများ မောင်းနှင်ခြင်းနှင့် ရေကြောင်းအသွားအလာ	<p>ကုန်းတွင်းမှ ပစ္စည်းကိရိယာများနှင့် တူးစင် သယ်ယူပို့ဆောင်မှု လုပ်ဆောင်စဉ်အတွင်း ပင်လယ်ရေကြောင်းသုံးရေယာဉ်များ ပင်လယ်ရေကြောင်းအသွားအလာကို အဟန့်အတားဖြစ်စေခြင်း။</p> <p>ကမ်းလွန်ပင်လယ်ပြင် လုပ်ဆောင်ချက်များကြောင့် ရေကြောင်းအသွားအလာကို အဟန့်အတားဖြစ်စေခြင်း။</p>	<ul style="list-style-type: none"> <li>• တွင်းတူးခြင်းလုပ်ငန်းမစတင်မီ PTTEPI သည် MOGE နှင့်အတူ စီမံကိန်းနှင့်သက်ဆိုင်သော လုပ်ငန်းစဉ်များအတွက် သတိပေးစာများထုတ်ပြန်ရန် အတွက် ညှိနှိုင်းဆောင်ရွက်ခြင်း၊ (ငါးလုပ်ငန်းဦးစီးဌာန၊ မွေး မြူရေး၊ ငါးလုပ်ငန်းနှင့် ကျေးလက်ဖွံ့ဖြိုးရေးဦးစီးဌာန၊ မြန်မာ့ရေတပ်နှင့် မြန်မာနိုင်ငံငါးလုပ်ငန်း ဦးစီးဌာန)</li> <li>• ရေနံတွင်းတူးမည့် ပတ်ဝန်းကျင်ရှိ မီတာ ၅၀၀ ပတ်လည်တွင် သီးခြားဇုန်များသတ်မှတ်ထားခြင်း။</li> <li>• ရေယာဉ်သွားလာမှုများအားသတိပေးရန် အထောက်အပံ့ရေယာဉ်များ အသုံးပြုခြင်း။</li> <li>• မတော်တဆတိုက်မိမှုများရှောင်ရှားနိုင်ရန် ကမ်းလွန်စခန်းများတွင် သင့်လျော်သော အချက်ပြမီးများထားရှိခြင်း။</li> <li>• တွင်းတူးစက်တွင်စောင့်ကြည့်ရေးစင်များထားရှိခြင်းနှင့် ထိခိုက်မှုများ ရှောင်ရှားနိုင်ရန် ရေယာဉ်များ အဆင်သင့်ထားရှိခြင်း။</li> </ul>	လျစ်လျူရှုနိုင်သောအဆင့်	<ul style="list-style-type: none"> <li>• တွင်းတူးစင်မ သယ်ဆောင်မီ ရက်သုံးဆယ် ကြိုတင်၍ ရေကြောင်း သတိပေးစာ ထုတ်ပြန်မည့် မြန်မာ့ရေနံနှင့် ပူးပေါင်းလုပ်ဆောင်ရန်</li> <li>• စီမံကိန်း တိုက်တွင် မီတာ ၅၀၀ ရှိအန္တရာယ် ကင်းစုန်</li> </ul>	စီမံကိန်းနှင့် သက်ဆိုင်သော ရေယာဉ်များ အားလုံး၊ တွင်းတူးစက်	ပြင်ဆင်ခြင်းနှင့် တပ်ဆင်ခြင်း လုပ်ငန်းအဆင့်	PTTEPI/ ကန်ထရိုက်တာ

ကဏ္ဍများ	ဖြစ်နိုင်ချေရှိသည့် သက်ရောက်မှုများ	လျော့ပါးစေရေးနည်းလမ်းများ	ကြွင်းကျန်သက်ရောက်မှုများ	အရေးပါသော လုပ်ငန်းရပ်	တည်နေရာ	အချိန်ကာလ	တာဝန်ရှိမှု
				<ul style="list-style-type: none"> <li>သတ်မှတ်ထားရှိရန်</li> <li>ထောက်ပံ့ရေးသင်္ဘောများအသုံးပြုပြီး ရေကြောင်း သွားလာရေးအား သတိပေးစောင့်ကြပ်ရန်</li> <li>ကမ်းလွန်စခန်းများတွင် သင့်လျော်သော အချက်ပြမီးများထားရှိခြင်း။</li> </ul>			
၇။ လူမှုစီးပွားရေး	စက်မှုလုပ်ငန်းနှင့် ဆိုင်သော အသုံးစရိတ်များနှင့် ဝင်ငွေများတိုးလာခြင်း (ကောင်းကျိုးသက်ရောက်မှု)	<ul style="list-style-type: none"> <li>ဒေသတွင်း ကုန်ပစ္စည်းများနှင့် ဝန်ဆောင်မှုလုပ်ငန်းများအား တတ်နိုင်သမျှ အသုံးပြုခြင်း။</li> </ul>	ကောင်းသော သက်ရောက်မှု	<ul style="list-style-type: none"> <li>ဒေသတွင်း ကုန်ပစ္စည်းများနှင့် ဝန်ဆောင်မှုလုပ်ငန်းများအား တတ်နိုင်သမျှ အသုံးပြုခြင်း။</li> </ul>	ကမ်းခြေရှိ စခန်းများ		PTTEPI/ ကန်ထရိုက်တာ
<b>ကျန်းမာရေးဆိုင်ရာ လျော့ပါးစေရေးနည်းလမ်းများ</b>							
၈။ လုပ်ငန်းခွင်ဆိုင်ရာ ကျန်းမာရေးနှင့် လုံခြုံစိတ်ချမှု	အန္တရာယ်ရှိသော ပစ္စည်းများ (သို့) မတော်တဆမှု များကြောင့် ထိခိုက်ဒဏ်ရာရမှုများ (သို့) နာမကျန်းဖြစ်မှုများ	<p>PTTEPI ၏ SSHE အစီအစဉ်များအားအောက်ပါအတိုင်း အကောင်အထည်ဖော်ခြင်း။</p> <ul style="list-style-type: none"> <li>PTTEPI ၏ ကျန်းမာရေးဆိုင်ရာအစီအမံများအား အကောင်အထည်ဖော်ခြင်း။</li> <li>ဝန်ထမ်းများ သင့်လျော်သော အကာအကွယ်ပစ္စည်းများ (PPE) ဝတ်ဆင်စေခြင်း။</li> <li>ဝန်ထမ်းများအား safety training ပေးခြင်း၊ အလုပ်သမားများအား PTTEPI ၏ SSHE အစီအမံများအတိုင်း လုပ်ငန်းခွင် safety လုပ်ဆောင်ခြင်းများနှင့် နည်းဥပဒေများ လိုက်နာဆောင်ရွက်ခြင်း။</li> </ul> <p>PTTEPI ၏ MERP အရ တွင် ဖြစ်လာနိုင်မည့်အရေးပေါ်အခြေအနေများအတွက် တုံ့ပြန်ဆောင်ရွက်နိုင်ရန် အနီးစပ်ဆုံးဆေးရုံ ဆေးပေးခန်းများနှင့် ပူးပေါင်းဆောင်ရွက်ခြင်း။ အရေးပေါ်အခြေအနေများအတွက် တာဝန်ကျမန်နေဂျာ၊ ဆေးကုသရန် အတွက် အရေးပေါ်အဖွဲ့များထားရှိခြင်း။</p> <p>မတော်တဆမှုများထိန်းချုပ်ရန်နှင့် ကာကွယ်ခြင်းအတွက် လုပ်ငန်း လည်ပတ်ခြင်းများ အတွက်အောက်ပါအတိုင်း အကောင်အထည်ဖော်ဆောင်ရွက်ခြင်း။</p> <ul style="list-style-type: none"> <li>ဓာတုပစ္စည်းများတွင် Safety Data Sheets များပါရှိစေခြင်း။</li> <li>ဓာတုဗေဒပစ္စည်းတစ်ခုချင်းစီအတွက် ပြည့်စုံသော safety ညွှန်ကြားချက်များပါရှိစေခြင်း (သို့လျော့သည့်အခြေအနေအစရှိသဖြင့်)။</li> <li>လုပ်ငန်းခွင်အတွင်း ယိုဖိတ်မှုများအတွက် အထောက်အပံ့ပေးနိုင်သော ပစ္စည်းကိရိယာများထားရှိခြင်း။</li> <li>ရှေးဦးပြုစုသည့် ဆေးသေတ္တာများအားထားရှိခြင်း။</li> <li>သင့်လျော်သော သောက်သုံးရေ၊ အိမ်သာများနှင့် ရေဆိုးထုတ်စနစ်များထားရှိခြင်း။</li> </ul>	လျစ်လျူရှုနိုင်သော အဆင့်	<ul style="list-style-type: none"> <li>လျော့နည်းစေရေး အစီအစဉ်များအတိုင်း အကောင်အထည်ဖော်ခြင်း</li> </ul>	စီမံကိန်းနှင့် သက်ဆိုင်သော ရေယာဉ်များအားလုံး၊ တွင်းတူးစက်၊ ကုန်းတွန်းစခန်း။	ပြင်ဆင်ခြင်းနှင့် တပ်ဆင်ခြင်း လုပ်ငန်းအဆင့်	PTTEPI
	ဆူညံမှုရှိသောနေရာများတွင် လုပ်ကိုင်ခြင်းကြောင့် ထိခိုက်ဒဏ်ရာများဖြစ်ပေါ်ခြင်း။	<ul style="list-style-type: none"> <li>လက်ရှိအသုံးပြုနေသော အင်ဂျင်ဆိုင်များကို ပုံမှန် ပြုပြင်ထိန်းသိမ်းခြင်းနှင့် စံချိန်စံညွှန်းများအတိုင်းလိုက်နာအသုံးပြုခြင်း။</li> <li>လုပ်ငန်းခွင်အတွင်း အသံဆူညံမှုများရှိပါက အလုပ်သမားများ</li> </ul>	လျစ်လျူရှုနိုင်သော အဆင့်	<ul style="list-style-type: none"> <li>လျော့ပါးသက်သာစေရေး အစီအစဉ်</li> </ul>	စီမံကိန်းနှင့် သက်ဆိုင်သော ရေယာဉ်များအားလုံး၊	ပြင်ဆင်ခြင်းနှင့် တပ်ဆင်ခြင်း လုပ်ငန်းအဆင့်	PTTEPI/EM P မှတဆင့် ကန်ထရိုက်တာ



ကဏ္ဍများ	ဖြစ်နိုင်ချေရှိသည့် သက်ရောက်မှုများ	လျော့ပါးစေရေးနည်းလမ်းများ	ကြွင်းကျန်သက်ရောက်မှုများ	အရေးပါသော လုပ်ငန်းရပ်	တည်နေရာ	အချိန်ကာလ	တာဝန်ရှိမှု
		အတွက် နားကြပ်များ ထောက်ပံ့ပေးထားခြင်း။					
ဓါတ်ပြည့်သွန်းမှုများ၊ ရေနှင့် ကျန်းမာရေး ဝန်ဆောင်မှု	ဝန်ထမ်းများ၊ ပစ္စည်းများနှင့် စွန့်ပစ်ပစ္စည်းများ ကမ်းခြေနေရာအနီးကျင်သို့ သယ်ယူပို့ဆောင်မှုအတွက် ဒေသခံများအား ဝန်ထမ်းအဖြစ် အသုံးပြု၍ စီမံကိန်းလုပ်ငန်းစဉ်တွင် ပါဝင်စေနိုင်ခြင်း။	<ul style="list-style-type: none"> <li>PTTEPI ၏ ကျန်းမာရေးဆိုင်ရာအစီအစဉ်များအား အကောင်အထည်ဖော်ခြင်း။</li> </ul>		များအတိုင်း အကောင်အထည်ဖော်ခြင်း	တွင်းတူးစက် ကမ်းခြေရှိ စခန်းများ		PTTEPI
	စီမံကိန်းလုပ်ဆောင်နေစဉ်အတွင်း နာမကျန်းဖြစ်မှု (သို့) မတော်တဆဖြစ်မှုများအတွက် ကျန်းမာရေးစောင့်ရှောက်သည့် ဝန်ဆောင်မှုများအား ကမ်းခြေအနီးတွင် လိုအပ်ခြင်း။	<ul style="list-style-type: none"> <li>PTTEPI ၏ MERP အရ တွင် ဖြစ်လာနိုင်မည့် အရေးပေါ်အခြေအနေများအတွက် တုံ့ပြန်ဆောင်ရွက်နိုင်ရန် အနီးစပ်ဆုံးဆေးရုံ ဆေးပေးခန်းများနှင့်ပူးပေါင်းဆောင်ရွက်ခြင်း။ အရေးပေါ်အခြေအနေများတွင် တာဝန်ကျမန်နေဂျာ၊ ဆေးကုသရန် အတွက် အရေးပေါ်အဖွဲ့များထားရှိဖွဲ့စည်းခြင်း။</li> </ul>					

Tabl. 7 - တူးဖော်ရေး အဆင့်တွင် စီမံကိန်းအတွက် လျော့ပါးစေရေးနည်းလမ်းများ/ကတိကဝတ်ဇယား

ကဏ္ဍများ	ဖြစ်နိုင်ချေရှိသည့် သက်ရောက်မှုများ	လျော့ပါးစေရေးနည်းလမ်းများ	ကြွင်းကျန်သက်ရောက်မှုများ	အရေးပါသော လုပ်ငန်းရပ်	တည်နေရာ	အချိန်ကာလ	တာဝန်ရှိမှု
<b>ပတ်ဝန်းကျင်ဆိုင်ရာ လျော့ပါးစေရေး နည်းလမ်းများ</b>							
၁။ လေထုအရည်အသွေး / ဖန်လုံအိမ်ဓါတ်ငွေ့ ထုတ်လွှတ်မှုများ	ထောက်ပံ့ရေး ရေယာဉ်ပေါ်တွင် တပ်ဆင်ထားသော အင်ဂျင်စက်များနှင့် စက်များ၏ လုပ်ဆောင်ချက်များကြောင့် ဖြစ်ပေါ်လာသော လောင်ကျွမ်းမှုများမှ ထွက်ရှိလာမည့် လေထုထုတ်လွှတ်မှုများ။	<ul style="list-style-type: none"> <li>မီးစက်များနှင့်ဖိအားသုံးစက်များ ပုံမှန်လည်ပတ်နိုင်ရန် ပြုပြင်ထိန်းသိမ်းခြင်းများဆောင်ရွက်ခြင်း။</li> <li>နှောင့်နှေးမှုများရှိပါက ယာဉ်များအားကြိုတင် သတိပေးထားခြင်းဖြင့် စွမ်းအင်အသုံးချမှု အားလျော့ချခြင်း။</li> </ul>	လျစ်လျူရှုနိုင်သော အဆင့်	<ul style="list-style-type: none"> <li>စက်ပစ္စည်းများ ပုံမှန်စစ်ဆေးခြင်း</li> <li>ပြုပြင်ထိန်းသိမ်းရမည့် အချိန်ဇယားအလိုက် ကိရိယာများကို ပြုပြင်ထိန်းသိမ်းရန်</li> </ul>	စီမံကိန်းနှင့် သက်ဆိုင်သော ရေယာဉ်များ အားလုံး၊ တွင်းတူးစက်	အကဲဖြတ်တူးဖော်ရေး အဆင့်	PTTEPI/ ကန်ထရိုက်တာ
	ရဟတ်ယာဉ်၏ လောင်စာလောင်ကျွမ်းမှုမှ ဓါတ်ငွေ့များထွက်လာခြင်း။	<ul style="list-style-type: none"> <li>ရဟတ်ယာဉ်အား ဝန်ထမ်းသယ်ယူပို့ဆောင်ရေး နှင့် အရေးပေါ်အခြေအနေများတွင်သာ အသုံးပြုစေခြင်း။</li> </ul>		<ul style="list-style-type: none"> <li>စက်ပစ္စည်းများ ပုံမှန်စစ်ဆေးခြင်း</li> </ul>	ကမ်းခြေရှိ စခန်းများ၊ တွင်းတူးစက်		
၂။ ပင်လယ်ရေ အရည်အသွေးနှင့် အနည်အနှစ်အရည်အသွေး	ပင်လယ်ထဲသို့ ဖြတ်စာများနှင့် ရွှံ့များထုတ်လွှတ်ခြင်းကြောင့် ပင်လယ်ရေအရည်အသွေးနှင့် အနည်အနှစ်အရည်အသွေးကို သက်ရောက်မှုရှိစေခြင်း။	<ul style="list-style-type: none"> <li>ဇီဝနည်းအရချေဖျက်နိုင်ခြင်းနှင့် အဆိပ်အတောက်ပါဝင်မှု ပါဝင်မှုနည်းသော WBM ကို အသုံးပြုခြင်း။</li> <li>အရေးပေါ်အခြေအနေအတွက် အဆိပ်အတောက်ပါဝင်မှုနည်းသော ဇီဝနည်းအရချေဖျက်နိုင်သော SBM ကို အသုံးပြုခြင်း။</li> </ul>	အရေးမကြီးသော အဆင့်	<ul style="list-style-type: none"> <li>WBM/ SBM ကို အသုံးပြု၍ ဖြတ်စာများကို ပင်လယ်ကြမ်းပြင်အောက် ၁၅ မီတာတွင် စွန့်ထုတ်ခြင်း</li> <li>WBM/ SBM များ မစွန့်ထုတ်မီ သေချာ သန့်စင်စေခြင်း</li> </ul>	တွင်းတူးစက်	အကဲဖြတ်တူးဖော်ရေး အဆင့်	PTTEPI/ ကန်ထရိုက်တာ
	ဘီလပ်မြေများစွန့်ထုတ်မှုကြောင့် ပင်လယ်ရေအရည်အသွေးကို သက်ရောက်မှုရှိစေခြင်း။	<ul style="list-style-type: none"> <li>IFC, ၂၀၁၅ (Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development) အရ ဖြတ်စာများစွန့်ထုတ်စေခြင်း။</li> <li>ပင်လယ်ရေမျက်နှာပြင် ၁၅ မီတာအောက်တွင်သာ ဖြတ်စာများကို စွန့်ထုတ်စေခြင်း။</li> <li>Centrifuges, shale shakers နှင့် mud cleaners များကို ဖြတ်စာတွင်ရှိနေသော ရွှံ့များဖယ်ရှားရာတွင် အသုံးပြုခြင်း။</li> <li>ရွှံ့များကို သန့်စင်ပြီး တူးစင်၏ ရွှံ့များကို ဖယ်ရှားခြင်းစနစ် သို့မဟုတ် ပြန်လည်ပို့ဆောင်ပေးခြင်း။</li> <li>ဓာတုဗေဒပစ္စည်းများသုံးစွဲခြင်းနှင့် ဘီလပ်မြေများသုံးစွဲခြင်းကို အတတ်နိုင်ဆုံး လျော့ချချိန်ညှိသုံးစွဲခြင်း။</li> <li>ရေနံတူးစင်တွင် Safety Data sheets များထားရှိခြင်း။</li> </ul>	လျစ်လျူရှုနိုင်သော အဆင့်	<ul style="list-style-type: none"> <li>ပြန်လည်အသုံးပြုစနစ်များ လုပ်ဆောင်ခြင်း</li> <li>အဆိပ်အတောက်ပါဝင်မှုနည်း</li> </ul>			
	တွင်းတူးရွှံ့ရည်တွင် ဓါတုပစ္စည်းများပါဝင်မှုကြောင့် ပင်လယ်ရေအရည်အသွေးနှင့် အနည်အနှစ်အရည်အသွေးကို သက်ရောက်မှုရှိစေခြင်း။	<ul style="list-style-type: none"> <li>အဆိပ်အတောက်ပါဝင်မှုနည်းပါးသော ဓာတုဗေဒပစ္စည်းများကိုသာ အသုံးပြုခြင်း။</li> </ul>			စီမံကိန်းနှင့် သက်ဆိုင်သော ရေယာဉ်များ အားလုံး၊ တွင်းတူးစက်		

ကဏ္ဍများ	ဖြစ်နိုင်ချေရှိသည့် သက်ရောက်မှုများ	လျော့ပါးစေရေးနည်းလမ်းများ	ကြွင်းကျန်သက်ရောက်မှုများ	အရေးပါသော လုပ်ငန်းရပ်	တည်နေရာ	အချိန်ကာလ	တာဝန်ရှိမှု
	<p>စီမံကိန်းမှ အန္တရာယ်ရှိသည့် စွန့်ပစ်ပစ္စည်းများနှင့် အန္တရာယ်မရှိသည့် စွန့်ပစ်ပစ္စည်းအမျိုးမျိုးကို ထုတ်လုပ်ခြင်း၊</p> <p>စီမံခန့်ခွဲမှုစနစ်လွှဲမှားမှုများ (သယ်ယူ ပို့ဆောင်ခြင်း၊ သိုလှောင်မှု နှင့် စွန့်ပစ်ခြင်း) သည် ပင်လယ်ရေအရည်အသွေးကို ထိခိုက်စေခြင်း၊</p>	<p>စွန့်ပစ်ပစ္စည်းများအား PTTEPI ၏ စွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲမှုအစီအစဉ်နှင့် MARPOL 73/ 78 ၏ နည်းလမ်းများအရ ကမ်းလွန်စနစ်များတွင်ထားရှိခြင်း။</p> <p><b>အန္တရာယ်ဖြစ်စေသော စွန့်ပစ်ပစ္စည်း</b></p> <ul style="list-style-type: none"> <li>• စွန့်ပစ်ပစ္စည်းများသိုလှောင်ရန်နေရာများအား ခွဲခြားသတ်မှတ် ထားခြင်း</li> <li>• မိုးဒဏ်၊ လေဒဏ်မှ ကာကွယ်နိုင်ရန် သင့်လျော်သော ကွန်တိန်နာများ တွင် စုဆောင်းထားခြင်း။</li> <li>• မိုးရာသီ၌ မိုးရွာသွန်းမှုကြောင့် ရေယာဉ်ကုန်းပတ်အား ရေနှင့်မိတ်တူပေးပစ္စည်းများကြောင့် ဖြစ်ပေါ်သော ညစ်ညမ်းမှု၊ အကျိုးသက်ရောက်မှုများအား လျှော့ချနိုင်ရန် သန့်ရှင်းစေခြင်း။</li> <li>• ကွန်တိန်နာများအား ယိုဖိတ်ခြင်းမပြုစေခြင်းကို ကာကွယ်နိုင်ရန် စီမံဆောင်ရွက်ထားခြင်း။</li> <li>• အညစ်အကြေးများကုန်းတွင်းစနစ်သို့စွန့်ပစ်ရာတွင် ခွင့်ပြုမိန့်ရရှိထားသော ယာဉ်ဖြင့်သယ်ဆောင် ခြင်း။</li> <li>• ပင်လယ်ထဲသို့ မည်သည့် စွန့်ပစ်ပစ္စည်းမှ မစွန့်ပစ်ရန်တားဆီးခြင်း။</li> </ul> <p><b>အန္တရာယ်မရှိသော စွန့်ပစ်ပစ္စည်း</b></p> <ul style="list-style-type: none"> <li>• အန္တရာယ်မဖြစ်စေသော စွန့်ပစ်ပစ္စည်းများဖြစ်သော အစားအသောက် အကြွင်းအကျန်များ၊ စာရွက်များ၊ အလှူမိန့်ဘူးများ၊ ဖန်များ နှင့် အခြား အညစ်အကြေးများအား သင့်လျော်သော နေရာများတွင် သီးခြားစီခွဲထားခြင်း။</li> <li>• စွန့်ပစ်ပစ္စည်းများသိုလှောင်ရာနေရာများအား သေချာစွာခွဲခြားသတ်မှတ်ထားခြင်း။</li> <li>• အစားအသောက်အကြွင်းအကျန်များအား ပင်လယ်ထဲမစွန့်ပစ်မီ အစား အသောက်အကြွင်းအကျန်၏ အရွယ်အစားများအား ၂၅ မီလီမီတာအနေအထားထိဖြစ်အောင်ဆောင်ရွက်ခြင်း။ အစား အသောက်မပါသော စွန့်ပစ်ပစ္စည်းများအား မြေဖိုစွန့်ပစ်ရန် ကုန်း တွင်းသို့ ပို့ဆောင်ခြင်း၊ စုဆောင်းခြင်း သို့မဟုတ် သင့်လျော်မှန်ကန်စွာ စွန့်ပစ်စေခြင်း။</li> <li>• မြန်မာနိုင်ငံ၏ ဥပဒေနှင့် PTTEPI ၏ စွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲမှု အစီအစဉ်အရ ကုန်းတွင်းသို့သန့်စင်ပြီးမှ စွန့်ပစ်ခြင်း။</li> <li>• စွန့်ပစ်ပစ္စည်းများအား ကန်ထရိုက်တာများဖြင့် ကုန်းတွင်းစနစ်သို့ပို့ဆောင်၍ စုဆောင်းထားရှိခြင်းနှင့် recycle ပြုလုပ်ခြင်း။</li> <li>• စွန့်ပစ်ပစ္စည်းအမျိုးအစားများနှင့် အရေအတွက်များအား မှတ်တမ်းတင်ထားခြင်း။</li> </ul>		<p>သော ဇီဝနည်းအရ ချေဖျက် နိုင်သော ဓါတုပစ္စည်း ကိုအသုံးပြု ခြင်း။</p> <ul style="list-style-type: none"> <li>• စွန့်ပစ် ပစ္စည်းစီမံ ခန့်ခွဲမှု အစီအစဉ် နှင့် ပတ်ဝန်း ကျင်စီမံ ခန့်ခွဲမှုအစီ အစဉ်ကို လိုက်နာ ဆောင်ရွက် ရန်</li> </ul> <p>• လျော့ပါး သက်သာ စေရေး အစီအစဉ် များအတိုင်း အကောင် အထည်ဖော် ခြင်း</p>	<p>စီမံကိန်းနှင့် သက်ဆိုင်သော ရေယာဉ်များ အားလုံး၊ တွင်းတူးစက်</p>		
<p>၃။ ပင်လယ်ကြမ်း ပြင်၏လက္ခဏာများ</p>	<p>တွင်းတူးရွံ့ရည်နှင့် ဖြတ်စာများ စွန့်ထုတ်မှုကြောင့် ပင်လယ်ကြမ်းပြင်ရှိ အနည်အနှစ်အရည်အသွေး၏</p>	<ul style="list-style-type: none"> <li>• အမှတ်စဉ် ၂ အတွက် လျော့ပါးသက်သာစေရေး အစီအစဉ်များအတိုင်း အကောင်အထည်ဖော်ခြင်း</li> </ul>	<p>လျှစ်လျူရှုနိုင် သောအဆင့်</p>		<p>စီမံကိန်းနှင့် သက်ဆိုင်သော ရေယာဉ်များ</p>	<p>အကဲဖြတ်တူး ဖော်ရေး အဆင့်</p>	<p>PTTEPI/ ကန်ထရိုက် တာ</p>

ကဏ္ဍများ	ဖြစ်နိုင်ချေရှိသည့် သက်ရောက်မှုများ	လျော့ပါးစေရေးနည်းလမ်းများ	ကြွင်းကျန်သက်ရောက်မှုများ	အရေးပါသော လုပ်ငန်းရပ်	တည်နေရာ	အချိန်ကာလ	တာဝန်ရှိမှု
	ဖွဲ့စည်းပုံကို သက်ရောက်မှုရှိစေခြင်း။				အားလုံး၊ တွင်းတူးစက်		
၄။အထွတ်သက်ရှိနှင့် အထွတ်ဂေဟစနစ်	ကမ်းလွန်ပင်လယ်ပြင်ရှိ လုပ်ငန်းများကြောင့် အထွတ်တိုက်သတ္တများအား အနှောင့်အယှက်ဖြစ်စေခြင်း။  စွန့်ပစ်ပစ္စည်းများ၊ ရေဆိုးများ၊ ရေယာဉ်များနှင့် ရေနံတူးစင်မှ ထုတ်လွှတ်မှုများသည် ပင်လယ်ကြမ်းပြင်နှင့် ပင်လယ်ရေမျက်နှာပြင်ရှိ အထွတ်သက်ရှိ ဖွဲ့စည်းပုံကို သွယ်ဝိုက်သက်ရောက် စေနိုင်ခြင်း။	<ul style="list-style-type: none"> <li>အမှတ်စဉ် ၂ အတွက် လျော့ပါးသက်သာစေရေး အစီအစဉ်များအတိုင်း အကောင်အထည်ဖော်ခြင်း</li> </ul>	အရေးမကြီးသောအဆင့်	အမှတ် ၂ နှင့် ၃ အတွက် လျော့ပါးသက်သာစေရေး အစီအစဉ်များအတိုင်း အကောင်အထည်ဖော်ခြင်း			PTTEPI/ ကန်ထရိုက်တာ
<b>လူမှုရေးဆိုင်ရာ လျော့ပါးစေရေးနည်းလမ်းများ</b>							
	ကန့်သတ်ဇုန် ၅၀၀ မီတာနှင့် ရေယာဉ်များ၊ တွင်းတူးစင်များ တည်ရှိခြင်းကြောင့် ငါးဖမ်းဧရိယာကို လျော့ကျစေခြင်း။	<ul style="list-style-type: none"> <li>တွင်းတူးခြင်းလုပ်ငန်းမစတင်မီ PTTEPI သည် MOGE နှင့်အတူ စီမံကိန်းနှင့်သက်ဆိုင်သော လုပ်ငန်းစဉ်များအတွက် သတိပေးစာများထုတ်ပြန်ရန် အတွက် ညှိနှိုင်းဆောင်ရွက်ခြင်း၊ (ငါးလုပ်ငန်းဦးစီးဌာန၊ မွေး မြူရေး၊ ငါးလုပ်ငန်းနှင့် ကျေးလက်ဖွံ့ဖြိုးရေးဦးစီးဌာန၊ မြန်မာ့ရေတပ်နှင့် မြန်မာနိုင်ငံငါးလုပ်ငန်း ဦးစီးဌာန)</li> <li>ရေနံတွင်းတူးမည့် ပတ်ဝန်းကျင်ရှိ မီတာ ၅၀၀ ပတ်လည်တွင် သီးခြားဇုန်များသတ်မှတ်ထားခြင်း။</li> <li>ရေယာဉ်သွားလာမှုများအားသတိပေးရန် အထောက်အပံ့ရေယာဉ် များအသုံးပြုခြင်း။</li> <li>မတော်တဆတိုက်မိမှုများရှောင်ရှားနိုင်ရန် ကမ်းလွန်စခန်းများ တွင် သင့်လျော်သော အချက်ပြမီးများထားရှိခြင်း။</li> </ul>	အရေးမကြီးသောအဆင့်	<ul style="list-style-type: none"> <li>တွင်းတူးစင် မသယ်ဆောင်မီ ရက်သုံးဆယ်ကြို တင်၍ ရေကြောင်း သတိပေးစာ ထုတ်ပြန် မည့် မြန်မာ့ ရေနံနှင့် ပူးပေါင်း လုပ်ဆောင် ရန်</li> <li>စီမံကိန်း တိုက်တွင် မီတာ ၅၀၀ ရှိအန္တရာယ် ကင်းစန့် သတ်မှတ် ထားရှိရန်</li> <li>ထောက်ပံ့ ရေးသင်္ဘော များအသုံး ပြုပြီး ရေကြောင်း သွားလာ ရေးအား သတိပေး စောင့်ကြပ် ရန်</li> <li>ကမ်းလွန် စခန်းများ တွင် သင့်လျော် သော အချက်ပြမီး များထားရှိ ခြင်း။</li> </ul>	စီမံကိန်းနှင့် သက်ဆိုင်သော ရေယာဉ်များ အားလုံး၊ တွင်းတူးစက်။		PTTEPI/ ကန်ထရိုက်တာ
၅။ငါးဖမ်းလုပ်ငန်းများနှင့်ငါးလုပ်ငန်းအဖွဲ့အစည်းများ	ပင်လယ်ပြင်ရှိ စွန့်ပစ်ပစ္စည်းများကြောင့် ဖြစ်ပေါ်သောညစ်ညမ်းမှုများမှ ရေနေ သတ္တဝါများ၏ အသက်ရှင်နေထိုင်မှုပုံစံ အရည်အသွေးနှင့် ပမာဏကို လျော့ကျစေနိုင်ခြင်း။  ထိုညစ်ညမ်းမှုများတွင် တွင်းတူးလုပ်ငန်းမှ ဖြတ်စာများ ချွံ့ရည်များ၊ အန္တရာယ်ရှိသော စွန့်ပစ်ပစ္စည်းနှင့် အန္တရာယ်မရှိသော စွန့်ပစ်ပစ္စည်းများပါဝင်ခြင်း။	<ul style="list-style-type: none"> <li>အထက်တွင်ဖော်ပြထားသော အမှတ် ၂ နှင့် ၃ အတွက် လျော့ပါးသက်သာစေရေး အစီအစဉ်များအတိုင်း အကောင်အထည်ဖော်ခြင်း</li> </ul>	လျစ်လျူရှုနိုင်သောအဆင့်			အကဲဖြတ် တူးဖော်ရေး အဆင့်	PTTEPI/ ကန်ထရိုက်တာ
၆။သင်္ဘောများ မောင်းနှင်ခြင်းနှင့် ရေကြောင်းအသွားအလာ	ကုန်းတွင်းမှ ပစ္စည်းကိရိယာများနှင့် တူးစင် သယ်ယူပို့ဆောင်မှု လုပ်ဆောင်စဉ်အတွင်း ပင်လယ်ရေကြောင်းသုံးရေယာဉ်များ ပင်လယ်ရေကြောင်းအသွားအလာကို အဟန့်အတားဖြစ်စေခြင်း။  ကမ်းလွန်ပင်လယ်ပြင် လုပ်ဆောင်ချက်များကြောင့် ရေကြောင်းအသွားအလာကို	<ul style="list-style-type: none"> <li>တွင်းတူးခြင်းလုပ်ငန်းမစတင်မီ PTTEPI သည် MOGE နှင့်အတူ စီမံကိန်းနှင့်သက်ဆိုင်သော လုပ်ငန်းစဉ်များအတွက် သတိပေးစာများထုတ်ပြန်ရန် အတွက် ညှိနှိုင်းဆောင်ရွက်ခြင်း၊ (ငါးလုပ်ငန်းဦးစီးဌာန၊ မွေး မြူရေး၊ ငါးလုပ်ငန်းနှင့် ကျေးလက်ဖွံ့ဖြိုးရေးဦးစီးဌာန၊ မြန်မာ့ရေတပ်နှင့် မြန်မာနိုင်ငံငါးလုပ်ငန်း ဦးစီးဌာန)</li> <li>ရေနံတွင်းတူးမည့် ပတ်ဝန်းကျင်ရှိ မီတာ ၅၀၀ ပတ်လည်တွင် သီးခြားဇုန်များသတ်မှတ်ထားခြင်း။</li> <li>ရေယာဉ်သွားလာမှုများအားသတိပေးရန် အထောက်အပံ့ရေယာဉ် များအသုံးပြုခြင်း။</li> </ul>	လျစ်လျူရှုနိုင်သောအဆင့်	<ul style="list-style-type: none"> <li>လျော့ပါး သက်သာ စေရေး အစီအစဉ် များအတိုင်း အကောင် အထည်ဖော် ခြင်း</li> </ul>	စီမံကိန်းနှင့် သက်ဆိုင်သော ရေယာဉ်များ အားလုံး၊ တွင်းတူးစက်	အကဲဖြတ် တူးဖော်ရေး အဆင့်	PTTEPI/EMP မှတဆင့် ကန်ထရိုက်တာ

ကဏ္ဍများ	ဖြစ်နိုင်ချေရှိသည့် သက်ရောက်မှုများ	လျော့ပါးစေရေးနည်းလမ်းများ	ကြွင်းကျန်သက်ရောက်မှုများ	အရေးပါသော လုပ်ငန်းရပ်	တည်နေရာ	အချိန်ကာလ	တာဝန်ရှိမှု							
	အဟန့်အတားဖြစ်စေခြင်း။	<ul style="list-style-type: none"> <li>မတော်တဆတိုက်မိမှုများရှောင်ရှားနိုင်ရန် ကမ်းလွန်စခန်းများတွင် သင့်လျော်သော အချက်ပြမီးများထားရှိခြင်း။</li> </ul>												
ရူပမူစီမံရေး	စက်မှုလုပ်ငန်းနှင့် ဆိုင်သော အသုံးစရိတ်များနှင့် ဝင်ငွေများတိုးလာခြင်း (ကောင်းကျိုးသက်ရောက်မှု)	<ul style="list-style-type: none"> <li>ဒေသတွင်း ကုန်ပစ္စည်းများနှင့် ဝန်ဆောင်မှုလုပ်ငန်းများအား တတ်နိုင်သမျှ အသုံးပြုခြင်း။</li> </ul>	ကောင်းသော သက်ရောက်မှု	<ul style="list-style-type: none"> <li>ဒေသတွင်း ကုန်ပစ္စည်းများနှင့် ဝန်ဆောင်မှုလုပ်ငန်းများအား တတ်နိုင်သမျှ အသုံးပြုခြင်း။</li> </ul>	ကုန်းတွင်းစခန်းများ		PTTEPI							
<b>ကျန်းမာရေးဆိုင်ရာလျော့ပါးစေရေးနည်းလမ်းများ</b>														
၈။လုပ်ငန်းခွင်ဆိုင်ရာ ကျန်းမာရေးနှင့် လုံခြုံစိတ်ချမှု	အန္တရာယ်ရှိသော ပစ္စည်းများ (သို့) မတော်တဆမှု များကြောင့် ထိခိုက်ဒဏ်ရာရမှုများ (သို့) နာမကျန်းဖြစ်မှုများ	<p>PTTEPI ၏ SSHE အစီအစဉ်များအားအောက်ပါအတိုင်း အကောင်အထည်ဖော်ခြင်း။</p> <ul style="list-style-type: none"> <li>PTTEPI ၏ ကျန်းမာရေးဆိုင်ရာအစီအမံများအား အကောင်အထည်ဖော်ခြင်း။</li> <li>ဝန်ထမ်းများအား ဓါတုပစ္စည်းများကို အန္တရာယ်ကင်းစွာကိုင်တွယ်တတ်စေရန် သင်တန်းပေးခြင်း။</li> <li>ဝန်ထမ်းများအား သင့်လျော်သော အကာအကွယ်ပစ္စည်းများ (PPE) ဝတ်ဆင်စေခြင်း။</li> <li>ဝန်ထမ်းများအား safety training ပေးခြင်း၊ အလုပ်သမားများအား PTTEPI ၏ SSHE အစီအမံများအတိုင်း လုပ်ငန်းခွင် safety လုပ်ဆောင်ခြင်းများနှင့် နည်းဥပဒေများ လိုက်နာဆောင်ရွက်ခြင်း။</li> </ul>	လျစ်လျူရှုနိုင်သောအဆင့်	<ul style="list-style-type: none"> <li>လျော့ပါးသက်သာစေရေး အစီအစဉ်များအတိုင်း အကောင်အထည်ဖော်ခြင်း</li> </ul>	စီမံကိန်းနှင့် သက်ဆိုင်သော ရေယာဉ်များ အားလုံး၊ တွင်းတူးစက် ၊ ကုန်းတွင်းစခန်းများ။	အကဲဖြတ် တူးဖော်ရေး အဆင့်	PTTEPI							
	ဆူညံမှုရှိသောနေရာများတွင် လုပ်ကိုင်ခြင်းကြောင့် ထိခိုက်ဒဏ်ရာများဖြစ်ပေါ်ခြင်း။	<ul style="list-style-type: none"> <li>PTTEPI ၏ MERP အရ တွင် ဖြစ်လာနိုင်မည့်အရေးပေါ် အခြေအနေများအတွက် တုံ့ပြန်ဆောင်ရွက်နိုင်ရန် အနီးစပ်ဆုံးဆေးရုံ ဆေးပေးခန်းများနှင့် ပူးပေါင်းဆောင်ရွက်ခြင်း။</li> <li>အရေးပေါ်အခြေအနေများတွက် တာဝန်ကျမန်နေဂျာ၊ ဆေးကုသရန် အတွက် အရေးပေါ်အဖွဲ့များထားရှိခြင်း။</li> </ul> <p>မတော်တဆမှုများထိန်းချုပ်ရန်နှင့် ကာကွယ်ခြင်းအတွက် လုပ်ငန်းလည်ပတ်ခြင်းများ အတွက်အောက်ပါအတိုင်း အကောင်အထည်ဖော်ဆောင်ရွက်ခြင်း။</p> <ul style="list-style-type: none"> <li>ဓာတုပစ္စည်းများတွင် Safety Data Sheets များပါရှိစေခြင်း။</li> <li>ဓာတုပစ္စည်းတစ်ခုချင်းစီအတွက် ပြည့်စုံသော safety ညွှန်ကြားချက်များပါရှိစေခြင်း။</li> <li>လုပ်ငန်းခွင်အတွင်း ယိုဖိတ်မှုများအတွက် အထောက်အပံ့ပေးနိုင်သော ပစ္စည်းကိရိယာများထားရှိခြင်း။</li> <li>ရှေးဦးပြုစုသည့် ဆေးသေတ္တာများအားထားရှိခြင်း။</li> <li>သင့်လျော်သော ရေဆိုးထုတ်စနစ်များထားရှိခြင်း။</li> </ul>												
	ဆူညံမှုရှိသောနေရာများတွင် လုပ်ကိုင်ခြင်းကြောင့် ထိခိုက်ဒဏ်ရာများဖြစ်ပေါ်ခြင်း။	<ul style="list-style-type: none"> <li>လက်ရှိအသုံးပြုနေသော အင်ဂျင်ဆိုင်ရာစံချိန်စံညွှန်းများ အား ပြုပြင်စစ်ဆေးခြင်း</li> <li>လုပ်ငန်းခွင်အတွင်း အသံဆူညံမှုများကြောင့် အလုပ်သမားများအတွက် နားကြပ်များ တပ်ဆင်ပေးထားခြင်း။</li> </ul>						လျစ်လျူရှုနိုင်သောအဆင့်	<ul style="list-style-type: none"> <li>လျော့ပါးသက်သာစေရေး အစီအစဉ်များအတိုင်း အကောင်အထည်ဖော်ရန်</li> </ul>	စီမံကိန်းနှင့် သက်ဆိုင်သော ရေယာဉ်များ အားလုံး၊ တွင်းတူးစက် ၊	ပြင်ဆင်ခြင်းနှင့် တပ်ဆင်ခြင်း လုပ်ငန်းအဆင့်	PTTEPI/ ကန်ထရိုက်တာ		
	ဝန်ထမ်းများ၊ ပစ္စည်းများနှင့် စွန့်ပစ်ပစ္စည်းများ ကမ်းခြေနေရာအနီးဝန်းကျင်သို့ သယ်ယူပို့ဆောင်မှုအတွက် ဒေသခံများအား ဝန်ထမ်းအဖြစ် အသုံးပြု၍ စီမံကိန်းလုပ်ငန်းစဉ်တွင် ပါဝင်စေနိုင်ခြင်း။	<ul style="list-style-type: none"> <li>PTTEPI ၏ ကျန်းမာရေးဆိုင်ရာအစီအစဉ်များအား အကောင်အထည်ဖော်ခြင်း။</li> </ul>											လျစ်လျူရှုနိုင်သောအဆင့်	<ul style="list-style-type: none"> <li>လျော့ပါးသက်သာစေရေး အစီအစဉ်များအတိုင်း အကောင်အထည်ဖော်ရန်</li> </ul>
စီမံကိန်းလုပ်ဆောင်နေစဉ်အတွင်း နာမကျန်းဖြစ်မှု (သို့) မတော်တဆဖြစ်မှုများအတွက် ကျန်းမာရေးစောင့်ရှောက်သည့် ဝန်ဆောင်မှုများအား ကမ်းခြေအနီးတွင် လိုအပ်ခြင်း။	<ul style="list-style-type: none"> <li>PTTEPI ၏ MERP အရ တွင် ဖြစ်လာနိုင်မည့် အရေးပေါ် အခြေအနေများအတွက် တုံ့ပြန်ဆောင်ရွက်နိုင်ရန် အနီးစပ်ဆုံးဆေးရုံ ဆေးပေးခန်းများနှင့်ပူးပေါင်းဆောင်ရွက်ခြင်း။ အရေးပေါ်အခြေအနေများတွက် တာဝန်ကျမန်နေဂျာ၊ ဆေးကုသရန် အတွက် အရေးပေါ်အဖွဲ့များထားရှိစွမ်းဆောင်ရည်ရှိခြင်း။</li> </ul>	လျစ်လျူရှုနိုင်သောအဆင့်	<ul style="list-style-type: none"> <li>လျော့ပါးသက်သာစေရေး အစီအစဉ်များအတိုင်း အကောင်အထည်ဖော်ရန်</li> </ul>	ကမ်းခြေရှိစခန်းများ	PTTEPI									

**Tabl. 8 - ပလပ်ချုပ်ပိတ်သိမ်းခြင်း၊ ပစ္စည်းရွှေ့ပြောင်းခြင်းအဆင့်တွင် စီမံကိန်းအတွက် လျော့ပါးစေရေးနည်းလမ်းများ/ကတိကဝတ်ဇယား**

ကဏ္ဍများ	ဖြစ်နိုင်ချေရှိသည့် သက်ရောက်မှုများ	လျော့ပါးစေရေးနည်းလမ်းများ	ကြွင်းကျန်သက်ရောက်မှုများ	အရေးပါသော လုပ်ငန်းရပ်	တည်နေရာ	အချိန်ကာလ	တာဝန်ရှိမှု
<b>ပတ်ဝန်းကျင်ဆိုင်ရာ လျော့ပါးစေရေးနည်းလမ်းများ</b>							
၁။ လေထုအရည်အသွေး / ဖန်လုံအိမ်ခြံပိတ်ငွေ့ ထုတ်လွှတ်မှုများ	ထောက်ပံ့ရေး ရေယာဉ်ပေါ်တွင် တပ်ဆင်ထားသော အင်ဂျင်စက်များနှင့် စက်များ၏ လုပ်ဆောင်ချက်များကြောင့် ဖြစ်ပေါ်လာသော လောင်ကျွမ်းမှုများမှ ထွက်ရှိလာမည့် လေထုထုတ်လွှတ်မှုများ။	<ul style="list-style-type: none"> <li>ဖိအားသုံးစက်များ၊ မီးအားပေးစက်များ၊ ရေယာဉ်သုံးအင်ဂျင်စက်များအား ပုံမှန် ပြုပြင်ထိန်းသိမ်းခြင်း။</li> <li>နှောင့်နှေးမှုများပေါ်ပေါက်လာပါက ကြိုတင်အသိပေးထားခြင်းဖြင့် ရေယာဉ်များ၏အရှိန်နှင့် စွမ်းအင်အသုံးပြုမှုကို လျော့ချခြင်း။</li> <li>MARPOL 73/ 78 နောက်ဆက်တွဲ ၄ အရ - ယာဉ်များမှထွက်ရှိသော လေထုညစ်ညမ်းမှုများအား ထိန်းသိမ်းကာကွယ်ခြင်း၊ သက်တမ်းကြာရင့်သော ရေယာဉ်များတွင် (MARPOL 73/ 78 နောက်ဆက်တွဲ ၄) အခန်း ၄ ရှိ- ship efficiency management) အားအသုံးပြုခြင်း။</li> </ul>	လျစ်လျူရှုနိုင်သောအဆင့်	<ul style="list-style-type: none"> <li>စက်ပစ္စည်းများပုံမှန်စစ်ဆေးခြင်း</li> </ul>	စီမံကိန်းနှင့် သက်ဆိုင်သော ရေယာဉ်များအားလုံး။	ပစ္စည်းများရွှေ့ပြောင်းခြင်းအဆင့်	PTTEPI/ ကန်ထရိုက်တာ
၂။ အဏ္ဏဝါသက်ရှိ နှင့် အဏ္ဏဝါဂေဟစနစ်	ကမ်းလွန်ပင်လယ်ပြင်ရှိ လုပ်ငန်းများကြောင့်အဏ္ဏဝါနို့တိုက် သတ္တများအား အနှောင့်အယှက်ဖြစ်စေခြင်း။  စွန့်ပစ်ပစ္စည်းများ၊ ရေဆိုးများ၊ ရေယာဉ်များနှင့် ရေနံတူးစင်မှ ထွက်ပေါ်သောစွန့်ပစ်ပစ္စည်းများသည် ပင်လယ်ကြမ်းပြင်နှင့် ပင်လယ်ရေမျက်နှာပြင်ရှိ အဏ္ဏဝါသက်ရှိ ဖွဲ့စည်းပုံကို သွယ်ဝိုက်သက်ရောက်စေနိုင်ခြင်း။	<ul style="list-style-type: none"> <li>ဖိအားသုံးစက်များ၊ မီးအားပေးစက်များ၊ ရေယာဉ်သုံးအင်ဂျင်စက်များအား ပုံမှန် ပြုပြင်ထိန်းသိမ်းခြင်း၊ အသံဆူညံမှုလျော့ချနိုင်ရန်စစ်ဆေးခြင်း။</li> <li>အဏ္ဏဝါနို့တိုက်သတ္တဝါများရှိသော နေရာများအား ရှောင်ရှား၍ ရေယာဉ်များအား အရှိန် လျော့မောင်းနှင်ခြင်း၊ လမ်းကြောင်းသတ်မှတ်မောင်းနှင်ခြင်း။</li> <li>ရေဒီယိုအသံလှိုင်းစနစ် ဖြင့်အဏ္ဏဝါနို့တိုက်သတ္တများအား စောင့်ကြည့်ခြင်း။</li> <li>အထက်တွင်ဖော်ပြထားသော အမှတ် ၂ နှင့် ၃ အတွက် လျော့ပါးသက်သာစေရေးအစီအမံများအကောင်အထည်ဖော်ခြင်း။</li> </ul>	အရေးမကြီးသောအဆင့်	<ul style="list-style-type: none"> <li>ကွန်ပျူတာ ထိန်းချုပ်စနစ် ဖြင့်ရေနံတူး သင်္ဘောကိုနေရာချထားခြင်း</li> <li>တွင်းတူးစင်မသယ်ဆောင်မီ ရက်သုံးဆယ် ကြိုတင်၍ ရေကြောင်း သတိပေးစာ ထုတ်ပြန်မည့် မြန်မာ့ရေနှင့် ပူးပေါင်းလုပ်ဆောင်ရန်</li> <li>ပင်လယ်ကြမ်းပြင်အခြေအနေအား လုပ်ငန်း မစတင်မီ လေ့လာရန်</li> </ul>	စီမံကိန်းနှင့် သက်ဆိုင်သော ရေယာဉ်များအားလုံး။		PTTEPI/ ကန်ထရိုက်တာ
<b>လူမှုရေးဆိုင်ရာ လျော့ပါးစေရေးနည်းလမ်းများ</b>							
၃။ ငါးလုပ်ငန်းများနှင့် ငါးလုပ်ငန်းအဖွဲ့အစည်းများ	ကန်သတ်ရေးဇုန် ၅၀၀ မီတာနှင့် ရေယာဉ်များ၊ တွင်းတူးစင်များ ပါရှိခြင်းကြောင့် ငါးဖမ်းရေယာကို လျော့ကျစေခြင်း။	<ul style="list-style-type: none"> <li>ရေနံတွင်းတူးစက်ပတ်ဝန်းကျင်ရှိ မီတာ ၅၀၀ ပတ်လည်တွင် သီးခြားဇုန်များသတ်မှတ်ထားခြင်း။</li> <li>ရေယာဉ်သွားလာမှုများသတိပေးရန် အထောက်အပံ့ရေယာဉ်များအသုံးပြုခြင်း။</li> <li>မတော်တဆတိုက်မိမှုများရှောင်ရှားနိုင်ရန် ကမ်းလွန်စခန်းများတွင် သင့်လျော်သော အချုပ်ပြမီးများထားရှိခြင်း။</li> </ul>	အရေးမကြီးသောအဆင့်	<ul style="list-style-type: none"> <li>တွင်းတူးစင်မသယ်ဆောင်မီ ရက်သုံးဆယ် ကြိုတင်၍ ရေကြောင်း သတိပေးစာ ထုတ်ပြန်မည့် မြန်မာ့ရေနှင့် ပူးပေါင်းလုပ်ဆောင်ရန်</li> <li>စီမံကိန်း တိုက်တွင် မီတာ ၅၀၀ ရှိအန္တရာယ်ကင်းစနစ် သတ်မှတ်ထားရှိရန်</li> <li>ထောက်ပံ့ရေး သင်္ဘောများ အသုံးပြုပြီး ရေကြောင်း သွားလာရေးအား သတိပေးစောင့်ကြပ်ရန်</li> <li>ကမ်းလွန်</li> </ul>	စီမံကိန်းနှင့် သက်ဆိုင်သော ရေယာဉ်များအားလုံး၊ တွင်းတူးစက်။	ပစ္စည်းများရွှေ့ပြောင်းခြင်းအဆင့်	PTTEPI/EMP မှတဆင့် ကန်ထရိုက်တာ  PTTEPI

ကဏ္ဍများ	ဖြစ်နိုင်ချေရှိသည့် သက်ရောက်မှုများ	လျော့ပါးစေရေးနည်းလမ်းများ	ကြွင်းကျန်သက်ရောက်မှုများ	အရေးပါသော လုပ်ငန်းရပ်	တည်နေရာ	အချိန်ကာလ	တာဝန်ရှိမှု
				စခန်းများ တွင် သင့်လျော်သော အချက်ပြမီးများထားရှိခြင်း။			
	ပင်လယ်ပြင်ရှိ စွန့်ပစ်ပစ္စည်းများကြောင့် ရေနေသတ္တဝါများ၏ အသက်ရှင်နေထိုင်မှုပုံစံ အရည်အသွေးနှင့် ပမာဏကို လျော့ကျစေနိုင်ခြင်း။ ထိုစွန့်ပစ်ပစ္စည်းများတွင် တွင်းတူးလုပ်ငန်းမှ ဖြတ်စာများ၊ ရွှံ့ရည်များ၊ အန္တရာယ်ရှိသော စွန့်ပစ်ပစ္စည်းနှင့် အန္တရာယ်မရှိသော စွန့်ပစ်ပစ္စည်းများပါဝင်ခြင်း။	<ul style="list-style-type: none"> <li>အထက်တွင်ဖော်ပြထားသော Item 2 နှင့် 3 အတွက် လျော့ပါးသက်သာစေရေးအစီအမံများ အကောင်အထည်ဖော်ခြင်း</li> </ul>	လျစ်လျူရှုနိုင်သောအဆင့်	<ul style="list-style-type: none"> <li>အထက်တွင်ဖော်ပြထားသော Item 2 နှင့် 3 အတွက် လျော့ပါးသက်သာစေရေး အစီအမံများ အကောင်အထည်ဖော်ခြင်း</li> </ul>	စီမံကိန်းနှင့် သက်ဆိုင်သော ရေယာဉ်များ အားလုံး၊ တွင်းတူးစက် ၊		PTTEPI/ ကန်ထရိုက်တာ
၄။သင်္ဘောများ မောင်းနှင်ခြင်းနှင့် ရေကြောင်းအသွားအလာ	တွင်းတူးသည့်နေရာမှ နောက်ထပ်စီမံကိန်း၏ ခွင့်ပြုထားသော တွင်းတူးသည့်နေရာအထိ ပစ္စည်းကိရိယာများနှင့် တူးစင် သယ်ယူပို့ဆောင်မှု လုပ်ဆောင်စဉ်အတွင်း ပင်လယ်ရေကြောင်းသုံးရေယာဉ်များ ပင်လယ်ရေကြောင်းအသွားအလာကို အဟန့်အတားဖြစ်စေခြင်း။	<ul style="list-style-type: none"> <li>ရေယာဉ်သွားလာများ သတိပေးရန် အထောက်အပံ့ ရေယာဉ်များအသုံးပြုခြင်း။</li> <li>မတော်တဆတိုက်မိမှုများ ရှောင်ရှားနိုင်ရန် ကမ်းလွန်စခန်းများတွင် သင့်လျော်သော အချက်ပြမီးများထားရှိခြင်း။</li> <li>ရေနံ့တွင်းတူးပတ်ဝန်းကျင်ရှိ မီတာ ၅၀၀ ပတ်လည်တွင် သီးခြားဇုန်များသတ်မှတ်ထားခြင်း။</li> </ul>	လျစ်လျူရှုနိုင်သောအဆင့်	<ul style="list-style-type: none"> <li>တွင်းတူးစင်မ သယ်ဆောင်မီ ရက်သုံးဆယ် ကြိုတင်၍ ရေကြောင်း သတိပေးစာ ထုတ်ပြန်မည့် မြန်မာ့ရေနှင့် ပူးပေါင်းလုပ်ဆောင်ရန်</li> <li>စီမံကိန်း တိုက်တွင် မီတာ ၅၀၀ ရှိအန္တရာယ် ကင်းစုန် သတ်မှတ်ထား ရှိရန်</li> <li>ထောက်ပံ့ရေး သင်္ဘောများ အသုံးပြုပြီး ရေကြောင်း သွားလာရေး အား သတိပေး စောင့်ကြပ်ရန်</li> <li>ကမ်းလွန် စခန်းများ တွင် သင့်လျော်သော အချက်ပြမီး များထားရှိခြင်း။</li> </ul>	စီမံကိန်းနှင့် သက်ဆိုင်သော ရေယာဉ်များ အားလုံး၊ တွင်းတူးစက် ၊	ပစ္စည်းများရွှေ့ပြောင်းခြင်း အဆင့်	PTTEPI/ ကန်ထရိုက်တာ
<b>ကျန်းမာရေးဆိုင်ရာ လျော့ပါးစေရေးနည်းလမ်းများ</b>							
၅။လုပ်ငန်းခွင်ဆိုင်ရာ ကျန်းမာရေးနှင့် လုံခြုံစိတ်ချမှု	အန္တရာယ်ရှိသော ပစ္စည်းများ (သို့) မတော်တဆမှု များကြောင့် ထိခိုက်ဒဏ်ရာရမှုများ (သို့) နာကျန်းဖြစ်မှုများ	<ul style="list-style-type: none"> <li>PTTEPI ၏ SSHE အစီအစဉ်များအားအောက်ပါအတိုင်း အကောင်အထည်ဖော်ခြင်း။                             <ul style="list-style-type: none"> <li>PTTEPI ၏ ကျန်းမာရေးဆိုင်ရာအစီအမံများအား အကောင်အထည်ဖော်ခြင်း။</li> <li>ဝန်ထမ်းများ သင့်လျော်သော အကာအကွယ်ပစ္စည်းများ (PPE) ဝတ်ဆင်စေခြင်း။</li> <li>ဝန်ထမ်းများအား safety training ပေးခြင်း၊ အလုပ်သမားများအား PTTEPI ၏ SSHE အစီအမံများအတိုင်း လုပ်ငန်းခွင် safety လုပ်ဆောင်ခြင်းများနှင့် နည်းဥပဒေများ လိုက်နာဆောင်ရွက်ခြင်း။</li> </ul> </li> <li>PTTEPI ၏ MERP အရ တွင် ဖြစ်လာနိုင်မည့်အရေးပေါ် အခြေအနေများအတွက် တုံ့ပြန်ဆောင်ရွက်နိုင်ရန် အနီးစပ်ဆုံးဆေးရုံ ဆေးပေးခန်းများနှင့် ပူးပေါင်းဆောင်ရွက်</li> </ul>	လျစ်လျူရှုနိုင်သောအဆင့်	<ul style="list-style-type: none"> <li>လျော့ပါးသက်သာစေရေး အစီအစဉ်များ အတိုင်း အကောင်အထည်ဖော်ခြင်း</li> <li>လျော့ပါးသက်သာစေရေး အစီအစဉ်များ</li> </ul>	စီမံကိန်းနှင့် သက်ဆိုင်သော ရေယာဉ်များ အားလုံး၊ တွင်းတူးစက် ၊ ကုန်းတွင်း စခန်းများ။	ပစ္စည်းများရွှေ့ပြောင်းခြင်း အဆင့်	PTTEPI

ကဏ္ဍများ	ဖြစ်နိုင်ချေရှိသည့် သက်ရောက်မှုများ	လျော့ပါးစေရေးနည်းလမ်းများ	ကြွင်းကျန်သက်ရောက်မှုများ	အရေးပါသောလုပ်ငန်းရပ်	တည်နေရာ	အချိန်ကာလ	တာဝန်ရှိမှု
		ခြင်း။ အရေးပေါ်အခြေအနေများတွင် တာဝန်ကျန်နေရုံ၊ ဆေးကုသရန် အတွက် အရေးပေါ်အဖွဲ့များထားရှိဖွဲ့စည်းခြင်း။  မတော်တဆမှုများထိန်းချုပ်ရန်နှင့် ကာကွယ်ခြင်းအတွက် လုပ်ငန်းလည်ပတ်ခြင်းများ အတွက်အောက်ပါအတိုင်း အကောင်အထည်ဖော်ဆောင်ရွက်ခြင်း။ <ul style="list-style-type: none"> <li>• ဓာတုပစ္စည်းများတွင် Safety Data Sheets များပါရှိစေခြင်း။</li> <li>• ဓာတုဗေဒပစ္စည်းတစ်ခုချင်းစီအတွက် ပြည့်စုံသော safety ညွှန်ကြားချက်များပါရှိစေခြင်း။</li> <li>• လုပ်ငန်းခွင်အတွင်း ယိုဖိတ်မှုများအတွက် အထောက်အပံ့ပေးနိုင်သော ပစ္စည်းကိရိယာများထားရှိခြင်း။</li> <li>• ရှေးဦးပြုစုသည့် ဆေးသေတ္တာများအားထားရှိခြင်း။</li> <li>• သင့်လျော်သော ရေဆိုးထုတ်စနစ်များထားရှိခြင်း။</li> </ul>		အတိုင်း အကောင်အထည်ဖော်ခြင်း			
	ဆူညံမှုရှိသောနေရာများတွင် လုပ်ကိုင်ခြင်းကြောင့် ထိခိုက်ဒဏ်ရာများဖြစ်ပေါ်ခြင်း။	<ul style="list-style-type: none"> <li>• ဖိအားသုံးစက်များ၊ မီးအားပေးစက်များ၊ ရေယာဉ်သုံးအင်ဂျင်စက်များအား ပုံမှန် ပြုပြင်ထိန်းသိမ်းခြင်း။</li> <li>• လုပ်ငန်းခွင်အတွင်း အသံဆူညံမှုများကြောင့် အလုပ်သမားများအတွက် နားကြပ်များ တပ်ဆင်ပေးထားခြင်း။</li> </ul>			စီမံကိန်းနှင့် သက်ဆိုင်သော ရေယာဉ်များအားလုံး၊ တွင်းတူးစက် ၊	ပစ္စည်းများရွှေ့ပြောင်းခြင်းနှင့် ပလပ်ချခြင်းအဆင့်	PTTEPI/ ကန်ထရိုက်တာ
မ။ပြည်သူ့ကျန်းမာရေးနှင့် ကျန်းမာရေး ဝန်ဆောင်မှု	ဝန်ထမ်းများ၊ ပစ္စည်းများနှင့် စွန့်ပစ်ပစ္စည်းများ ကမ်းခြေနေရာအနီးဝန်းကျင်သို့ သယ်ယူပို့ဆောင်မှုအတွက် ဒေသခံများအား ဝန်ထမ်းအဖြစ် အသုံးပြု၍ စီမံကိန်းလုပ်ငန်းစဉ်တွင် ပါဝင်စေနိုင်ခြင်း။	<ul style="list-style-type: none"> <li>• PTTEPI ၏ ကျန်းမာရေးဆိုင်ရာ အစီအမံများအား အကောင်အထည်ဖော်ခြင်း။</li> </ul>	လျစ်လျူရှုနိုင်သောအဆင့်	<ul style="list-style-type: none"> <li>• လျော့ပါးသက်သာစေရေး အစီအစဉ်များ အတိုင်း အကောင်အထည်ဖော်ခြင်း</li> </ul>	ကမ်းခြေရှိ စခန်းများ		PTTEPI
	စီမံကိန်းလုပ်ဆောင်နေစဉ်အတွင်း နာမကျန်းဖြစ်မှု (သို့) မတော်တဆဖြစ်မှုများအတွက် ကျန်းမာရေးစောင့်ရှောက်သည့် ဝန်ဆောင်မှုများ ကမ်းခြေအနီးတွင် ထားရှိခြင်း။	<ul style="list-style-type: none"> <li>• PTTEPI ၏ MERP အရ တွင် ဖြစ်လာနိုင်မည့် အရေးပေါ်အခြေအနေများ အတွက် တုံ့ပြန် ဆောင်ရွက် နိုင်ရန် အနီးစပ်ဆုံးဆေးရုံ ဆေးပေးခန်းများနှင့် ပူးပေါင်း ဆောင်ရွက်ခြင်း။ အရေးပေါ်အခြေအနေများအတွက် တာဝန်ကျန်နေရုံ၊ ဆေးကုသရန်အတွက် အရေးပေါ်အဖွဲ့များထားရှိဖွဲ့စည်းခြင်း။</li> </ul>					

Tabl. 9 - မတော်တဆမှုများဖြစ်ပေါ်စဉ်အတွင်း စီမံကိန်းအတွက် လျော့ပါးစေရေးနည်းလမ်းများ/ကတိကဝတ်ယေး

ကဏ္ဍများ	ဖြစ်နိုင်ချေရှိသည့် သက်ရောက်မှုများ	လျော့ပါးစေရေးနည်းလမ်းများ	ကြွင်းကျန်သက်ရောက်မှုများ	အရေးပါသောလုပ်ငန်းရပ်	တည်နေရာ	အချိန်ကာလ	တာဝန်ရှိမှု
၁။ရေယာဉ်များ တိုက်မိခြင်း	တွင်းတူးစက်များ နှင့် ပစ္စည်းများသယ်ယူပို့ဆောင်စဉ်အတွင်း တိုက်မိခြင်းများ ဖြစ်ပေါ်နိုင်ခြင်း။	<ul style="list-style-type: none"> <li>• အရေးပေါ်တုံ့ပြန်ဆောင်ရွက်ခြင်းအစီအစဉ်</li> </ul>	အရေးမကြီးသောအဆင့်	<ul style="list-style-type: none"> <li>• ယာဉ်တိုက်မိမှု ဖြစ်ပေါ်ပါက PTTEPI ၏ Emergency and Crisis Management Plan အားလိုက်နာ ဆောင်ရွက်ရန်</li> </ul>	စီမံကိန်းနှင့် သက်ဆိုင်သော ရေယာဉ်များအားလုံး။	အကဲဖြတ်မှုလုပ်ဆောင်ခြင်း ကာလတစ်လျှောက်	PTTEPI/ ကန်ထရိုက်တာ
၂။ယိုဖိတ်မှုများဖြစ်ပေါ်ခြင်း	တွင်းတူးအရည်များ၊ ဓါတုပစ္စည်းများ၊(သို့) ဒီဇယ်လောင်စာများ မတော်တဆ ယိုဖိတ်မှုသည် စီမံကိန်း၏ လုပ်ငန်းစဉ်အဆင့်တိုင်းတွင် ကြုံတွေ့ရနိုင်ခြင်း။ ထိုမတော်တဆမှုများသည် အနည်အနှစ် အရည်အသွေးနှင့် အဏ္ဏဝါဂေဟစနစ်ကို သွယ်ဝိုက်၍သော်လည်းကောင်း သက်ရောက်နိုင်ခြင်းနှင့် ပင်လယ်ရေမျက်နှာပြင်အရည်အသွေး	<ul style="list-style-type: none"> <li>• အရေးပေါ်တုံ့ပြန်ဆောင်ရွက်ခြင်းအစီအစဉ်</li> <li>• ဆီများယိုဖိတ်မှုများအတွက် တန်ပြန်ဆောင်ရွက်နိုင် သော အရေးပေါ်အစီအမံများ အားအကောင်အထည်ဖော်ခြင်း နှင့် ပြုပြင်မွမ်းမံခြင်း။</li> <li>• ဆီများယိုဖိတ်မှုများအတွက် တန်ပြန်ဆောင်ရွက်နိုင် သော အရေးပေါ်အစီအမံများ အတွက် လုပ်ဆောင်ချက်များ အားစောင့်ကြည့်ခြင်း။</li> <li>• Blowout preventer</li> <li>• သင်္ဘောပေါ်၌ Oil Pollution Plan အတွက် MARPOL 73/ 78 အားလိုက်နာကျင့်သုံးခြင်း။</li> <li>• ညစ်ညမ်းမှုကို ကာကွယ်သော ပစ္စည်းကိရိယာများအား ထားရှိခြင်း။</li> </ul>	လျစ်လျူရှုနိုင်သောအဆင့်	<ul style="list-style-type: none"> <li>• ဆီယိုဖိတ်မှု များဖြစ်ပေါ်ပါ က PTTEPI ၏ Emergency and Crisis Management Plan အားလိုက်နာ ဆောင်ရွက်ရန်</li> <li>• PTTEPI ၏ Spill Contingency Plan</li> </ul>	စီမံကိန်းနှင့် သက်ဆိုင်သော ရေယာဉ်များအားလုံး၊ တွင်းတူးစက် ၊		

ကဏ္ဍများ	ဖြစ်နိုင်ချေရှိသည့် သက်ရောက်မှုများ	လျော့ပါးစေရေးနည်းလမ်းများ	ကြွင်းကျန်သက်ရောက်မှုများ	အရေးပါသောလုပ်ငန်းရပ်	တည်နေရာ	အချိန်ကာလ	တာဝန်ရှိမှု
	<p>ကို တိုက်ရိုက်သက်ရောက်မှု ရှိစေခြင်း။</p>	<ul style="list-style-type: none"> <li>စက်ကိရိယာများကောင်းမွန်စွာ အလုပ်လုပ်နိုင်ရန် ထိန်းသိမ်းခြင်းများဆက်လက်လုပ်ဆောင်ခြင်း။</li> <li>ထိန်းသိမ်းပြုပြင်မှုများမလုပ်ဆောင်မီ ဖြစ်ပေါ်လာနိုင်သော အန္တရာယ်များကို ဆန်းစစ်ခြင်း။</li> <li>ဝန်ထမ်းများအား လေ့ကျင့်သင်ကြားပေးခြင်း။</li> </ul>		<ul style="list-style-type: none"> <li>အားဆောင်ရွက်ရန်</li> <li>PTTEPI ၏ SSHE သင်တန်းနှင့် စံညွှန်းများကို လိုက်နာ ဆောင်ရွက်ရန်</li> <li>PTTEPI ၏ Incident Management procedure အား ဆောင်ရွက်ရန်</li> <li>PTTEPI ၏ Waste Management Plan အား လိုက်နာ ဆောင်ရွက်ရန်</li> </ul>			
<p>၃။တွင်းပေါက်ကွဲမှု ဖြစ်ပေါ်ခြင်း</p>	<p>ပေါက်ကွဲမှုသည် ဖိအားများနေစဉ် ဟိုက်ဒရိုကာဗွန်များ ပင်လယ်ထဲနှင့် ဘေးပတ်ဝန်းကျင်ဆီသို့ လွှတ်ထုတ်ခြင်းမှ ဖြစ်ပေါ်နိုင်ခြင်း။</p> <p>ထိုပေါက်ကွဲမှုသည် ပင်လယ်ရေ/ အနည်အနှစ်အရည်အသွေး၊ အဏ္ဏဝါသက်ရှိ နှင့် ပင်လယ်ဂေဟစနစ်၊ လုပ်ငန်းခွင်ဆိုင်ရာ ကျန်းမာရေး နှင့် လုံခြုံစိတ်ချမှုတို့ အပေါ် သက်ရောက်မှု အလားအလာရှိစေနိုင်ခြင်း။</p>		<p>အရေးကြီးသော အဆင့်</p>	<ul style="list-style-type: none"> <li>PTTEPI ၏ Blow out Contingency Plan အားဆောင်ရွက်ရန်</li> <li>ဆီယိုဖိတ်မှုများ ဖြစ်ပါက PTTEPI ၏ Emergency and Crisis Management Plan အားဆောင်ရွက်ရန်</li> <li>PTTEPI ၏ Spill Contingency Plan အားဆောင်ရွက်ရန်</li> <li>PTTEPI ၏ SSHE Requirement for Contractor အား အကောင်အထည်ဖော် ဆောင်ရွက်ရန်</li> <li>PTTEPI ၏ Incident Management procedure အားဆောင်ရွက်ရန်</li> <li>Blowout preventer နှင့် shear ram ထားရှိရန်</li> </ul>			
<p>၄။အပူပိုင်း ဆိုင်ကလုန်း</p>	<p>ကမ်းလွန်ပင်လယ်ပြင်ရှိအမှုထမ်းများ ၏ လုံခြုံမှုကို ခြိမ်းခြောက်မှုရှိနေခြင်း။</p>	<ul style="list-style-type: none"> <li>ဝန်ထမ်းများအားလေ့ကျင့်သင်ကြားပေးခြင်း။</li> </ul>	<p>အသင့်အတင့် အဆင့်</p>	<ul style="list-style-type: none"> <li>PTTEPI ၏ SSHE သင်တန်းများ</li> </ul>			



ကဏ္ဍများ	ဖြစ်နိုင်ချေရှိသည့် သက်ရောက်မှုများ	လျော့ပါးစေရေးနည်းလမ်းများ	ကြွင်းကျန်သက်ရောက်မှုများ	အရေးပါသောလုပ်ငန်းရပ်	တည်နေရာ	အချိန်ကာလ	တာဝန်ရှိမှု
	စီမံကိန်း၏လုပ်ဆောင်ချက်များ၊ ရရှိနိုင်မှုများပေါ်ထိခိုက်မှု ရှိစေခြင်း။			<ul style="list-style-type: none"> <li>နှင့် စံညွှန်းများကို လိုက်နာဆောင်ရွက်ရန်</li> <li>• PTTEPI ၏ Tropical Revolving Storm Procedure and Emergency and Crisis Management Plan အား ဆောင်ရွက်ရန်</li> </ul>			
၅။မီးလောင်ခြင်း (သို့) ပေါက်ကွဲခြင်း	မီးလောင်ခြင်း (သို့) ပေါက်ကွဲခြင်းသည် PTTEPI ၏ အလုပ်သမားများနှင့် ကန်ထရိုက်တာများ၏ ကျန်းမာရေးနှင့် လုံခြုံရေးကို သက်ရောက်မှုရှိစေခြင်း၊ လေထုအရည်အသွေးကို သက်ရောက်မှုရှိစေခြင်း နှင့် စီမံကိန်းဖွဲ့စည်းပုံကို ထိခိုက်မှုရှိစေခြင်း။	<ul style="list-style-type: none"> <li>• လုံခြုံစိတ်ချမှုမြင်မားသော စနစ်များအားအသုံးပြုခြင်း။</li> <li>• ပုံမှန်စစ်ဆေးမှုများပြုလုပ်ခြင်းနှင့် မီးဘေးအန္တရာယ်များအတွက် အစမ်းလေ့ကျင့်ခြင်းများ ဆောင်ရွက်ခြင်း။</li> <li>• ကမ်းလွန်စခန်းများတွင် မီးသတ်ဆေးဗူးများနှင့် အချက်ပြမီးများစသော မီးဘေးအန္တရာယ် အကာအကွယ်ပစ္စည်းများထားရှိခြင်း။</li> <li>• အရေးပေါ်အခြေအနေအစီအမံများဆောင်ရွက်ခြင်းနှင့် အကျပ်အတည်းများအတွက်အစီအမံများဆောင်ရွက် ခြင်း။</li> </ul>	အသင့်အတင့် အဆင့်	<ul style="list-style-type: none"> <li>• ကမ်းလွန်စီမံကိန်းများတွင် မီးလောင်မှုမှ ကာကွယ်သော ကိရိယာများ ထားရှိရန်</li> <li>• ပုံမှန်စစ်ဆေးမှုများ ပြုလုပ်ရန်</li> <li>• အရေးပေါ် စီမံခန့်ခွဲမှု အစီအစဉ်များ ထားရှိဆောင်ရွက်ရန်</li> </ul>			

**1.7.3. စီမံကိန်း၏လုပ်ငန်းများကြောင့် ဖြစ်ပေါ်နိုင်သော ထင်ရှားသော သက်ရောက်မှုများ အကျဉ်းချုပ်**

အဆိုပြုစီမံကိန်းတွင် လုပ်ကွက် M9 အတွင်း အကဲဖြတ်တွင်း (၁၂) တွင်း တူးဖော်မည်ဖြစ်ပြီး၊ စီမံကိန်း အကောင်အထည်ဖော်ဆောင်ရွက်မှုကြောင့် ဖြစ်ပေါ်နိုင်သောသက်ရောက်မှုများကို အစီရင်ခံစာ၏နောက်ပိုင်း အခန်းများတွင် ဖော်ပြထားပါသည်။

စီမံကိန်းတွင် သန့်စင်ပြီး ဖြတ်စာနှင့် တွင်းတူးရွံ့များ ပင်လယ်အတွင်းသို့စွန့်ထုတ်မှုအား ရုပ်ပတ်ဝန်းကျင်နှင့် သက်ရှိပတ်ဝန်းကျင်သို့သက်ရောက်နိုင်သော ထင်ရှားသော သက်ရောက်မှုများ အဖြစ်သတ်မှတ်ပါသည်။ ယင်းသို့ ရုပ်ပတ်ဝန်းကျင်နှင့် သက်ရှိပတ်ဝန်းကျင်တို့အပေါ်သက်ရောက်မှု ပမာဏ အား သိရှိနိုင်ရန် cutting dispersion study အား modelling ဖြင့် လေ့လာထားရှိပါသည်။ အဆိုပါလေ့လာမှုသည် စီမံကိန်းလုပ်ငန်းလုပ်ဆောင်ချိန်တွင် ပင်လယ်ရေအတွင်း ဖြတ်စာများ ပျံ့နှံ့ရောက်ရှိနိုင်မှုပမာဏ၊ အနည်ကျမှုပုံစံတို့အားလေ့လာကာ ပတ်ဝန်းကျင်အပေါ်သို့ သက်ရောက်မှု လျော့ချနိုင်ရန် ရည်ရွယ်ဆောင်ရွက်ထားခြင်းဖြစ်ပါသည်။

အောက်ဖော်ပြပါဇယားတွင် ပင်လယ်အတွင်းသို့ စွန့်ပစ်မှုများကြောင့် ဖြစ်ပေါ်နိုင်မည့် သက်ရောက်မှုများကို ထုတ်နှုတ်ထားပါသည်။

**Tabl. 10 - စီမံကိန်းလုပ်ငန်းမှ စွန့်ထုတ်မှုများကြောင့် ဖြစ်ပေါ်လာနိုင်သော ထင်ရှားသော သက်ရောက်မှုများ**

အကြောင်းအရာ	ရုပ်ပတ်ဝန်းကျင်အပေါ်သို့သက်ရောက်နိုင်မှုပမာဏ	သက်ရှိဇီဝ ပတ်ဝန်းကျင်အပေါ်သို့သက်ရောက်နိုင်မှုပမာဏ
bilge water, ballast water နှင့် deck water များစွန့်ထုတ်မှု	ပင်လယ်ရေအရည်အသွေး (အသင့်အတင့်အဆင့်)	ပင်လယ်နို့တိုက်သတ္တဝါများနှင့် ပင်လယ်လိပ်များ (အသင့်အတင့်အဆင့်)
		ရေနေသတ္တဝါအကောင်ငယ်အုပ်စုများနှင့်pelagic အုပ်စုဝင်ငါးများ (အရေးမကြီးသောအဆင့်)
မိလ္လာရေဆိုး စွန့်ထုတ်မှု	ပင်လယ်ရေအရည်အသွေး (အသင့်အတင့်အဆင့်)	ပင်လယ်နို့တိုက်သတ္တဝါများနှင့် ပင်လယ်လိပ်များ (အသင့်အတင့်အဆင့်)
		ရေနေသတ္တဝါအကောင်ငယ်အုပ်စုများနှင့်pelagic အုပ်စုဝင်ငါးများ

		(အရေးမကြီးသောအဆင့်)
ဘီလပ်မြေများစွန့်ထုတ်မှု	-	pelagic အုပ်စုဝင်ငါးများ (အရေးမကြီးသောအဆင့်)
		မော့လေးအုပ်စုဝင်များ (လျစ်လျူရှုနိုင်သောအဆင့်)
တွင်းတူးရွံ့နှင့် ဖြတ်စာများ စွန့်ထုတ်မှု	နံ့အနည်အနှစ်အရည်အသွေး (လျစ်လျူရှုနိုင်သောအဆင့်)	မော့လေးအုပ်စုဝင်များ (လျစ်လျူရှုနိုင်သောအဆင့်)
	ပင်လယ်ရေအရည်အသွေး  (အရေးမကြီးသောအဆင့်)	ရေနေသတ္တဝါအကောင်ငယ်အုပ်စုများနှင့် pelagic အုပ်စုဝင်ငါးများ (အရေးမကြီးသောအဆင့်)
		ပင်လယ်နို့တိုက်သတ္တဝါများနှင့် ပင်လယ်လိပ်များ (အရေးမကြီးသောအဆင့်)

ဖြစ်နိုင်ချေရှိသော သက်ရောက်မှုများနှင့် ကြွင်းကျန်ရစ်သော သက်ရောက်မှုများ၏ အသေးစိတ်ဆန်းစစ်မှုများ နှင့် လမ်းညွှန်မှုများကို အစီရင်ခံစာ၏ အခန်း (၆) နှင့် အခန်း (၈.၁၃) တို့တွင် ဖော်ပြထားပါသည်။

## 1.8. အများပြည်သူနှင့် တိုင်ပင်ဆွေးနွေးခြင်းနှင့် သတင်းအချက်အလက်များ ထုတ်ဖော်တင်ပြခြင်း

### 1.8.1. ဆွေးနွေးညှိနှိုင်းမှုများ၏ရလဒ်များ

နယ်ပယ်အတိုင်းအတာသတ်မှတ်ခြင်းကာလနှင့် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အဆင့်များတွင် အများပြည်သူ နှင့်တိုင်ပင်ဆွေးနွေးခြင်း လုပ်ငန်းများကို ပြုလုပ်ခဲ့ပြီး အများပြည်သူတို့မှ စီမံကိန်းနှင့်ပတ်သတ်သည့် စိုးရိမ်ပူပန်မှု၊ ထင်မြင်ချက်များမေးမြန်းဆွေးနွေးခဲ့ပြီး PTTEPI မှပြန်လည်ဖြေကြားခဲ့ပါသည်။ အဓိကဆွေးနွေးသည့်အကြောင်း အရာများကို အောက်ပါအတိုင်းအကျဉ်းချုပ်ဖော်ပြအပ်ပါသည်။

- ထိခိုက်ပျက်စီးပျောက်ဆုံးလွယ်သော မြန်မာသန္တာကျောက်တန်းများနှင့်ပတ်သတ်၍ PTTEPI သည် ရေနံ အကဲဖြတ်တူးဖော်ရေး စီမံကိန်းများကို မလုပ်ကိုင်ရာတွင် ချမှတ်ထားသော ဥပဒေများ (PTTEPI ၏ Oil Spill Response Plan နှင့် အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ (ထုတ်လွှတ်မှု) အရည်အသွေးများ NEQG ) ကိုလိုက်နာ၍ ပတ်ဝန်းကျင်ညစ်ညမ်းမှုများကို လျော့ချလုပ်ဆောင်မည်ဖြစ်ပါသည်။
- ကမ်းလွန်ငါးဖမ်းလုပ်ငန်းများအပေါ်သို့ ဖြစ်နိုင်ချေရှိသော သက်ရောက်မှုများနှင့် ရေလုပ်ငန်း လုပ်ကိုင်သူများနှင့် အငြင်းပွားဖွယ် ကိစ္စရပ်များနှင့်ပတ်သတ်၍ သက်ရောက်မှုများလျော့ချနိုင်ရန် ရေကြောင်းသတိပေးစာ ထုတ်ပြန်ခြင်း၊ သတင်းစာ၊ ဂျာနယ်များတွင် စီမံကိန်းလုပ်ငန်းဆောင်ရွက်မည့် အကြောင်းကြေညာခြင်း နှင့် ရေကြောင်းပြသဘောများ ဖြင့် ကင်းလှည့်စောင့်ကြည့်ခြင်းဖြင့် ရေကြောင်း အန္တရာယ်များကို ရှောင်ရှားသွားမည်ဖြစ်ပါသည်။
- CSR လုပ်ငန်းများနှင့် ပတ်သတ်၍ PTTEP သည် ၎င်းတို့၏ ဒေသတွင်းဖွံ့ဖြိုးရေး CSR လုပ်ငန်းများကို ၂၀၀၈ ခုနှစ်တည်းကပင် စတင်အကောင်အထည်ဖော်ဆောင်ရွက်ခဲ့ပြီး နှစ်စဉ် CSR အစီအစဉ်များ ကိုလည်း သက်ဆိုင်ရာအစိုးရဌာနများနှင့် မြန်မာ့ရေနံနှင့်သဘာဝဓါတ်ငွေ့လုပ်ငန်း MOGE သို့ တင်ပြလျက်ရှိပါသည်။
- လုံလောက်သော ဟိုက်ဒြိုကာဗွန်များ ရှာဖွေတွေ့ရှိပါက ဒေသတိုးတတ်ရေး (လျှပ်စစ်လိုအပ်ချက် ဖြည့်စည်းပေးနိုင်ခြင်းကဲ့သို့သော) လုပ်ငန်းများကိုလုပ်ဆောင်ပေးရန် စသော အကြံပြုဆွေးနွေးချက်များ အား ရရှိခဲ့ပါသည်။

### 1.8.2. သတင်းအချက်အလက်များထုတ်ဖော်တင်ပြခြင်း

ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာလုပ်ထုံးလုပ်နည်းအရ မီဒီယာ၊ သတင်းစာ၊ ဂျာနယ်နှင့် PTTEPI ဝက်ဘ်ဆိုဒ်များ မှတစ်ဆင့် စီမံကိန်းအကြောင်းထုတ်ဖော်ကြေညာရာတွင် -

၁။ နယ်ပယ်အတိုင်းအတာသတ်မှတ်ရေးကာလ

၂။ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းလေ့လာနေချိန်ကာလ

၃။ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာ တင်သွင်းပြီးသည့် ကာလ

စသည်ဖြင့် သုံးကြိမ် ကြေညာထုတ်ပြန်သွားရမည် ဖြစ်ပါသည်။



နယ်ပယ်အတိုင်းအတာသတ်မှတ်ရေးကာလ နှင့် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းလေ့လာရေးကာလအပြီးတွင် အများပြည်သူသို့သတင်းထုတ်ဖော်တင်ပြချက် အဖြစ် ဖော်ပြပါကြေငြာချက်အတိုင်း PTTEPI ၏ website စာမျက်နှာ အများပြည်သူပိုင်သတင်းစာ၊ မီဒီယာများမှ တဆင့်ထည့်သွင်း ထုတ်ဖော် တင်ပြခဲ့ပါသည်။

## 2. INTRODUCTION

*This section presents the context and area of the study as well as its authors. It also describes the objectives and limits of the Environmental Impact Assessment (EIA).*

### 2.1. CONTEXT

PTTEP International Limited (PTTEPI) was granted the petroleum Production Sharing Contract (PSC) for offshore Block M9, owned by Myanmar Oil & Gas Enterprise (MOGE). PTTEPI is the Operator of Production Sharing Contract (PSC) of Block M9, which is located in the Gulf of Martaban. The area of Block M9 encompasses 11,962 km<sup>2</sup>, and it is approximately 260 km south of Yangon and 178 km west of Dawei. The water depth in the block ranges from approximately 50 to 800 m. The project location is indicated on Fig. 2 below.

Regarding the successful of Zawtika Gas Field project, PTTEPI plans to develop appraisal drilling campaign in the eastern part of Block M9. In general, drilling operations includes the following phases:

- Mobilization and installation phase
- Drilling phase
- Well plug and abandon /Demobilization of the rig



**Fig. 2. Geographical location of Block M9**

According to the Environmental Impact Assessment Procedure (EIA) issued by MOECAP (now MONREC) – Notification No. 616/2015, the project is classified as an EIA type economic activity (classified at line 16 of the table present in appendix I of the EIA procedure). With this aim in mind, PTTEPI is preparing an EIA Report in compliance with the EIA Procedure. According to the EIA Procedure (Article 63 – Chapter V), the report shall include the following content:

- Chapter 1: Executive summary (English language) / Executive summary (Burmese language)
- Chapter 2: Introduction
- Chapter 3: Policy, Legal and Institutional Framework
- Chapter 4: Project description and alternative selection
- Chapter 5: Description of the surrounding environment
- Chapter 6: Impact and risk assessment and mitigation measures
- Chapter 7: Cumulative impact assessment
- Chapter 8: Environmental management plan
- Chapter 9: Public consultation and disclosure
- Chapter 10: Conclusion and Recommendation
- Chapter 11: References

The impact study will consider these three phases and will include a timetable of the operations. After approval by the local authorities, drilling could begin in Q3-Q4 of 2018.

## 2.2. PRESENTATION OF THE PROJECT PROPONENT

PTTEPI, a subsidiary of PTTEP, is the operator for the project to carry out petroleum exploration and production activities and related business in Myanmar.

PTTEP and its subsidiary (PTTEPI and PTTEP SA) hold five exploration and production projects in Myanmar. The company is the operator in the following Blocks:

### Offshore

Zawtika project in Block M9  
Block M3  
Block M11  
Block MD-7

### Onshore

Block MOGE-3

Contact details of PTTEPI are provided in Tabl. 1 - Contact details of PTTEPI.

**Tabl. 1 - Contact details of PTTEPI**

Company name	PTTEP International Limited (Yangon Branch)
Address	Vantage Tower, 623 Pyay Road, Kamayut Township , Yangon Republic of Myanmar
Phone number	+95(1) 652700
Project Responsible Person	<b>Mr. Piya Sukhumpanumet</b> General Manager, PTTEPI
Principal contact person	<b>Yu San Khaing</b> Email: YuSanK@pttep.com <b>Thiri Aung</b> Email: ThiriAung@pttep.com

Tabl. 2 - PTTEPI's key person for the EIA preparation of proposed project

Name	Responsibility
Wichean Kaewkong	<b>Senior Engineer, Environment</b>
Zar Chi Saint	Engineer, Environment
Sutus Preuksjamas	Safety, Security, Health and Environmental Manager
Yu San Khaing	Coordinator, Social Development Project (Offshore) (MOGE Representative)
Suphachitra Thongchavee	Manager, Public Affairs and Communications Section
San Htet Aung Win	Head of Social Development Projects
Wunna Win	Drilling Engineer
Kamolchai Pattanapong	Vice President, Myanmar Well Operations Department
Khun Hline Myint	Geologist
Kanchit Jantarangsi	Exploration Project Manager, Myanmar Onshore Exploration Project

### 2.3. PRESENTATION OF ENVIRONMENTAL AND SOCIAL EXPERTS (INCLUDING HEALTH EXPERT)

The EIA was undertaken by a team based locally in Myanmar and remotely in France. All of our team has recent experience on projects in Myanmar, in particular in offshore Oil & Gas projects. This team has experience working together and functions supportively and efficiently.

Tabl. 3 - Presentation of the environmental and social experts

Name	Qualifications	Current position / Specialization	Years of experiences and responsibility
<b>ARTELIA Eau &amp; Environment</b>			
Christophe DERRIEN	<ul style="list-style-type: none"> <li>MSC in Industrial Risks &amp; Environment at the University of Lyon (France)</li> <li>BSC in Environmental Engineering at the University of Lyon (with Honours)</li> </ul>	<u>Project director</u> Specialized in HSE management of oil & gas project.	Taking responsibility as project director for this EIA.
Philip BUTLER	<ul style="list-style-type: none"> <li>“Ecole Nationale Supérieure de Géologie Appliquée et de Prospection Minière”, Specialties: Exploration and Environment ; Engineering geologist degree (1984-1987, Nancy, France)</li> <li>University of Nancy I, ‘Biologie des Organismes et des Populations’ (1985-1987, France)</li> <li>University of College Swansea, United Kingdom (1988-1991), Marine, environmental and Evolutionary Research Group. Study of the fouling of oil &amp; Gas platforms by coral in the Gulf of Guinera: designing an information system for handling ecological data / Fieldwork at Carmabi Marine Biology station in Curaçao.</li> </ul>	<u>Project manager</u> Specialised in environment, sustainable development and health and safety. His main recent achievements concern managing and doing environmental and social impact assessment in France and worldwide and in particular for the energy sector – Oil & Gas, solar and wind energy) as well as for industrial.	Main supervisor of proposed team and taking responsibility to review and advise the requirements while developing the EIA.
Maud DELON	<ul style="list-style-type: none"> <li>Master of Science in ‘Environmental Pollution and Protection’ (2007,</li> </ul>	<u>Environmental Impact Assessment Specialist</u>	With over 9 years of experiences in EIA sector in



**Offshore M9 East Appraisal/Exploration Drilling**

Report

**ENVIRONMENTAL IMPACT ASSESSMENT**

Name	Qualifications	Current position / Specialization	Years of experiences and responsibility
G	<p>United Kingdom)</p> <ul style="list-style-type: none"> <li>● Bachelor of Sciences (major in Environmental Sciences) (2005, United States of America)</li> <li>● Baccalaureate in ‘Science and Technology of Agronomy and Management’ (2000, France)</li> </ul>	9 years of experiences in the performance of EIA studies, environmental studies, environmental management and monitoring plans of numerous projects.	international projects. Taking the responsibility as first author of the report. Assessing the impacts and identifying the measures for the impacts
Coralie GRIELL	<ul style="list-style-type: none"> <li>● Master II in Sociology, Anthropology and Demography, Université Paris Descartes, (2014-2015, France)</li> <li>● Engineering Degree in Water and Environment, ‘Ecole Nationale Supérieure d’Ingénieurs de Limoges’ (ENSIL) (2005-2008, France)</li> </ul>	<p><u>Social Impact Assessment Specialist</u></p> <p>Societal consultant with 7 years of experience in the field of environmental and social impact assessment and project management.</p>	Taking responsibility to supervise and review on social issue of the report
Armeline DIMIER	<ul style="list-style-type: none"> <li>● Master II in Geopolitics and International Relations, International Trade, International Law, Humanitarian Rights, Development Issues, ‘Institut d’Etudes politiques’ of Toulouse (2008, France)</li> <li>● Political Sciences Diploma (equivalent to a Master level), Politics and International Relations, Geopolitics of Grenoble and Sussex University in Brighton (2007, England)</li> </ul>	<p><u>Stakeholder Relationship and Social Impact Consultant</u></p> <p>5-year experience in the field of corporate CSR strategy development in the oil &amp; gas world, covering stakeholder mapping, consultation and engagement; social impact assessment, social management plan implementation and follow-up, community grievance management, and tools development.</p>	Taking responsibility to supervise and review on social issue of the report
Christelle TARCHA LSKI	<ul style="list-style-type: none"> <li>● Master’s Degree in environmental diagnostics – Cranfield University, England (2004-2005; England)</li> <li>● Degree in biological engineering – Polytech, Clermont-Ferrand (2002-2005, France)</li> <li>● Life and Earth Sciences – Technolac University, Chambéry (2002-2002, France)</li> </ul>	<p><u>Health based risk assessment expert</u></p> <p>Environmental engineer with the Polluted Sites and Soils Unit of ARTELIA, applies her twelve year’s of experience in multidisciplinary project implementation and management. She acquired her experience in working in a variety of environmental sectors, such as health-based risk assessments.</p>	With twelve years of experiences in several environmental projects. Taking responsibility to supervise and review on health-based sector.
<b>Artelia International</b>			
Charles BOUHELIER	<ul style="list-style-type: none"> <li>● Master’s Degree – ‘Management and Environmental Services engineering – VEOLIA Campus’ (2012, France)</li> <li>● Engineer’s Degree – ‘Water &amp; Environment’ (2009, France)</li> <li>● Technical University Diploma ‘Physics measurements’ (2006, France)</li> </ul>	Based in Artelia’s branch office in Yangon, as a <u>local support</u> for data collection, local regulations and is used to taking part in public consultations.	Over 8 years of experience in working at Environmental field and around 5 years of working experiences in Myanmar. Taking the responsibility as project leader by supervising local consultants and participating in public/ stakeholder meetings.
DAW SHWUNN LAK YADANAR SOE	<ul style="list-style-type: none"> <li>● Bachelor’s Degree – Civil Engineering, Mandalay Technological University (2014, Myanmar)</li> <li>● Bachelor of Technology – Civil Engineering, West Yangon Technological University (2013, Myanmar)</li> </ul>	Local environmental engineer and project coordinator. Over 5 years of experiences in infrastructure and environmental fields. Well equipped experiences in worksite HSE, management and knowledge’s in waste control and environmental impact by urbanization.	With the current responsibilities to work together with the international experts as local support for bibliographic survey, secondary data collection, social surveyor and stakeholder facilitator

Name	Qualifications	Current position / Specialization	Years of experiences and responsibility
DAW THU YIN HTUN	<ul style="list-style-type: none"> <li>Bachelor of Engineering (chemical) (Myanmar)</li> </ul>	Local environmental engineer. Over 6 years of experiences with strong background in wastewater treatment, chemical laboratories and environmental fields.	With the current responsibilities to work together with the international experts as local support for bibliographic survey, secondary data collection, social surveyor and stakeholder facilitator
U Aung Soe Linn	<ul style="list-style-type: none"> <li>Bachelor of Science (Geology)</li> <li>Diploma in Political Law</li> </ul>	Over 4 years of experiences in environmental and law sector, Myanmar	Taking responsibility to review and revise the legal section in compliance with EIA procedures and requirement from review team members.

## 2.4. OBJECTIVES OF THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA) STUDY

This Environmental Impact Assessment (EIA) is now a regulatory requirement from Myanmar authorities to obtain the approval of project. The EIA provides information on environmental issues and mitigation measures that will be implemented during the operations to mitigate and/or minimize environmental impacts. The EIA will be submitted to the Ministry of Natural Resources and Environmental Conservation, the Myanmar Oil and Gas Enterprise (MOGE) and the Environmental Conservation Department (ECD), and then disclosed in accordance with relevant legislation.

The EIA was prepared in compliance with the new EIA regulation and procedure (Notification No°616 of 29 December 2015) of the Myanmar and International legislation addressing offshore petroleum industry and PTTEPI standards and specifications.

The EIA aims are:

- Explaining this offshore exploration project, on the basis of information provided by PTTEPI;
- Ensuring that environmental and social considerations are clearly quoted and integrated in the decision-making process of the project;
- Recommending procedures and practices to be followed during the project to ensure that environmental and social effects are avoided, minimized or mitigated.
- Providing guidance on environmental management programs, including auditing and contingency planning.

## 2.5. EIA METHODOLOGY

The proposed drilling EIA methodology involves a project description, a description of the existing environment, impact identification and evaluation, development of mitigation measures, and elaboration of guidelines for an Environmental Management Plan, in compliance with PTTEPI standards.

The description of the existing environment of the M9 Block was based on the Marine Baseline Survey in Offshore Block M9 performed by ERM company in February 2018 and literature review, allowing defining the initial state of the site which will serve as a reference state for the Environmental Management Plan.

A cutting dispersion study is performed in order to identify the impact level and diffusion range of cuttings and fluids due to tidal and current effects. The cutting dispersion study report is provided in the appendices of the present report. Then, analysis of this study is included in the impact assessment of the present EIA report.

## 3. POLICY LEGAL AND INSTITUTIONAL FRAMEWORK

*This chapter provides a description of applicable environmental legislative framework existing in International, Myanmar and PTTEPI' corporate requirements for performing an EIA.*

### 3.1. CORPORATE ENVIRONMENTAL AND SOCIAL POLICY

PTTEPI management is fully committed in providing a safe, secure and healthy workplace and conducting its operations in a manner that protects the environment. These commitments are in accordance with the PTTEP Vision, Missions and 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 stakeholder efforts to enable attainment of these principles.

PTTEPI line management at all levels are responsible for implementing and maintaining SSHE policy and SSHE MS. This SSHE policy shall be reviewed and revised at regular intervals.

#### 3.1.1. PTTEPI's SSHE Policy

##### 3.1.1.1. PTTEPI CORPORATE VISION

PTTEP will be an organisation that strives to achieve excellence and a position of leadership by being an injury-free workplace, a leader in security and health management whilst committed to demonstrate environmental responsibility.

##### 3.1.1.2. PTTEPI CORPORATE MISSION

- Eliminate all incidents and injuries through hazard management and behaviour-based safety.
- Deliver reliable and secure supply of energy using the latest technology and in parallel with responsibility in sustainable development.
- Create a SSHE culture grounded in leadership at every level of the organization, including contractors where everybody understands and uncompromisingly manages the SSHE risks in their working environment.
- Achieve the best in class SSHE performance in the exploration and production industry.

##### 3.1.1.3. PTTEPI'S SSHE POLICY

PTTEPI's SSHE Policy is as follows:

*"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 and (3) Zero Spill or External Complaint (e.g., zero complaint by authorities/communities/sea users)".*

*To meet these commitments, PTTEP has in place SSHE Management System (SSHE MS) that outlines our main principles and accountabilities to drive continual improvement.*

*PTTEP shall:*

- 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 Behaviour-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 all 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.*

PTTEP requires its contractors to comply with its “SSHE Contractor Management Standard”. The contractors are also required to carry out an SSHE Risk Assessment of their work and present a specific SSHE work plan. Workers must be formally trained in the general and specific SSHE issues at the site.

**Tabl. 4 - PTTEPI SSHE Management System Standards**

Item	Document	Document Number
1	Myanmar Asset SSHE Management System	11027-PDR-SSHE-000-001-R01
2	SSHE Training and Competency Procedure	11027-PDR-SSHE-340-003-R01
3	SSHE Compliance Obligation Procedure	11027-PDR-SSHE-306/01-R03
4	SSHE Requirement for Contractor	Myanmar-SSHE-11027-PDR-305
5	PTTEPI Myanmar Asset Loss of Primary Containment (LOPC) Reduction Plan	Myanmar- 13253-PLN-010
6	Working in Adverse Weather Procedure (Offshore)	11027-PDR-SSHE-401-R02
7	Myanmar Asset Crisis Management Plan	11027-PDR-SSHE-501-005-R00
8	Myanmar Asset Emergency Management Plan	11027-PDR-SSHE-006-R01
9	PTTEPI Crisis Communication Plan	Myanmar-0550-PDR-008
10	Blowout Contingency Plan	Myanmar-055-MNL-004
11	Myanmar Asset Waste Management Procedure	11027-PDR-SSHE-503/01-R02
12	Offshore Medical Emergency Response Plan (MERP)	Myanmar-SSHE-11027-PDR-506
13	Fitness to Work Procedure	Myanmar-SSHE-11027-PDR-508
14	Myanmar Asset Spill Contingency Plan	11027-PDR-SSHE-501/03-R02
15	Chemical Management Standard	11003-STD-590-005-R02
16	Grievance Handling Guideline	12140-GDL-009-R00

A copy of the PTTEPI environmental and social policy is provided as an appendix in the present EIA (see **Error! Reference source not found.**).

### 3.1.2. PTTEPI's Corporate Social Responsibility Policy

There are currently a number of Corporate Social Responsibility activities taking place by PTTEPI under the Zawtika project, which are conducted in compliance with MOGE's "*Guidelines for Implementation of CSR Programmes*". Additional details on these CSR activities are provided in Chapter 8 - Environmental and Social Management Plan.

### 3.1.3. Environmental Management in PTTEPI

PTTEPI is committed in operating the business conscientiously and responsibly towards society and environment through adhering to the Safety, Security, Health, and Environmental (SSHE) Policy, which includes the commitment to environmental protection. Company personnel, business partners as well as contractors working for or on behalf of the company must implement this SSHE Policy. Implementation of the Environmental Management System (EMS) is integrated in the SSHE Management System and is aligned with the ISO 14001 international standard.

To reinforce the implementation of the EMS, the company concentrates on the management of the environmental aspects and impacts for all the activities including product transportation, waste management, other logistics activities and supply chain management. For an effective management of environmental impact, PTTEPI has continued the certification and implementation of ISO 14001 for all his domestic operating assets.

PTTEPI has developed an environmental information database, and has continuously reviewed and updated the data collection method and database itself. The data reported since 2010 has continuously been assured by an independent external party as well as publicly disclosed in PTTEPI Sustainability Report. In addition, PTTEPI also benchmark its performance against peers in the International Association of Oil and Gas Producer (IOGP).

## 3.2. POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

### 3.2.1. Myanmar EIA Procedure

The Ministry of Natural Resources and Environmental Conservation (MONREC), formerly called the Ministry of Environmental Conservation and forestry (MOECAAF), issued a new procedure for evaluating the environmental impact of local projects, as well as guidelines on emissions. This Procedure, called the Environmental Impact assessment (EIA) Procedure (Ministry of Environmental Conservation and Forestry - Notification No. 616 / 2015), was drafted with support from Asian Development Bank and based on guidelines from the International Finance Corporation. For this project, PTTEPI was required to submit a Project Proposal Report<sup>3</sup> to the Environmental Conservation Department (ECD) of MONREC for screening. This report was submitted by PTTEPI in June 2017. Considering the item 16 of the annex 1 of the EIA Procedure, "Offshore Oil and Gas Exploration Drillings", the Ministry has categorized the project as an "EIA type activity or project". Therefore, PTTEPI has followed the EIA Type Project requirements of the EIA procedure.

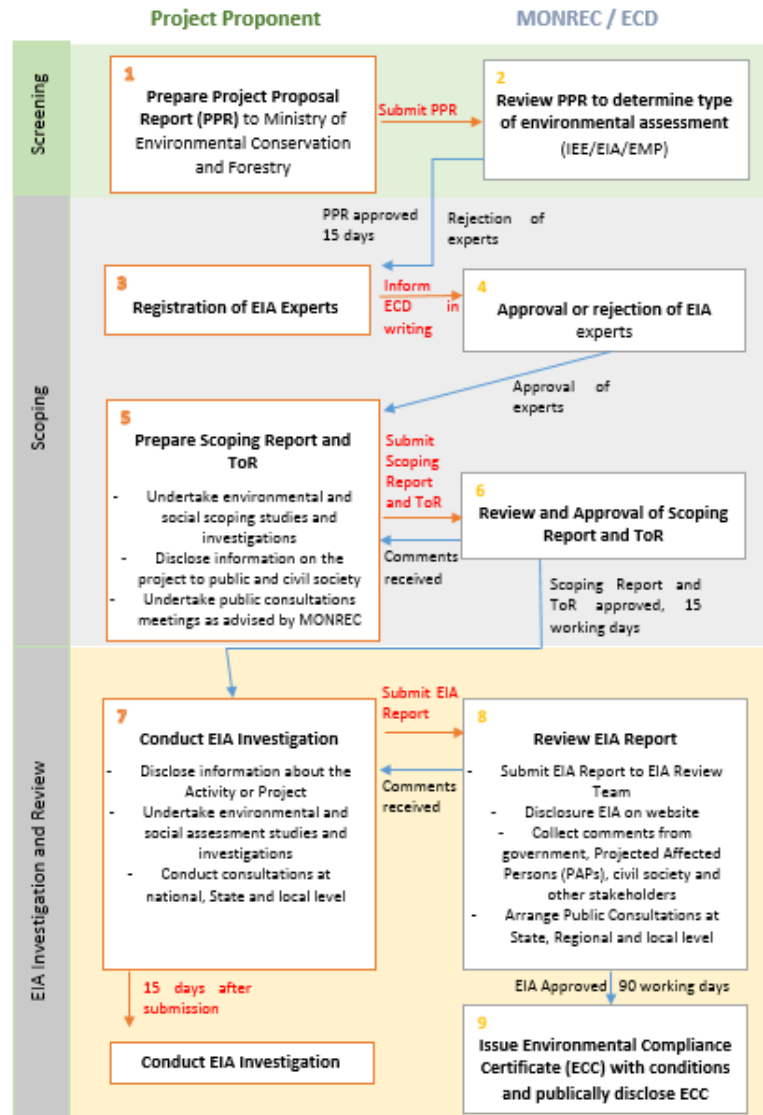
After screening, a scoping phase was conducted to further identify the potential impacts off the project and to identify potential mitigation measures. Stakeholder engagement was undertaken during this process to collect baseline data and allow stakeholders to express views and concerns which could be considered during the EIA Phase. The Scoping Report contained the Terms and Reference for the EIA report, which outline the scope and studies necessary as part of the EIA phase. The Scoping and Terms of Reference were also

<sup>3</sup> *Artelia (2017) Project Proposal Report for the Offshore M9 East Appraisal/Exploration Drilling in Block M9*

submitted to the ECD of MONREC. After submission to MONREC, the EIA report shall be disclosed to civil society, Project Affected Populations (PAPs), concerned government organizations and other interested stakeholders. All comments and recommendations received should be collected and reviewed by the MONREC prior their final decision on approval of the EIA Report.

The flowchart below provides a brief schematic overview of the procedure.

The relevant EIA has been developed according to the new Environmental Law and PTTEPI's requirements.



**Fig. 3.** New EIA Procedure : Ministry of the Environmental Conservation and Forestry (now MONREC), Notification N°616 of 29 December 2015

### 3.2.2. Myanmar Legislation relevant to the Proposed Project

Whilst environmental legislation in Myanmar is under active development, some legislation has been passed; the table on the next page summarizes the national environmental legislation that is relevant to the project.

**Tabl. 5 - Main Myanmar environmental legislation applicable to the Project**

<i>LEGISLATION</i>	<i>COMMITMENT</i>
<b>EIA-IEE-Environmental standards</b>	
Environmental Impact Assessment Procedure (MOECAP (now MONREC) – Notification No. 616/2015)	<p>This Environmental Impact Assessment (EIA) Procedure specifies the type and scope of environmental assessment required for all investment projects that could cause environmental and social harm. This procedure gives the methodology and requirements to undertake an EIA, according to the project. The project proponent has to fully comply the procedure and have to</p> <ul style="list-style-type: none"> <li>● take responsibility for all adverse impacts are including from Chapter 8, Section 102 to 110;</li> <li>● to comply full legal and financial responsibility, also PTTEPI’s contractor, subcontractors, officers, employees, agents, representatives, and consultant employed, hired or authorized.</li> <li>● to support programs for livelihood restoration and resettlement by consultation with relevant stakeholders (government agencies, organizations and other concerned persons, etc.);</li> <li>● to fully implement the EMP</li> <li>● to take responsibility and fully implement for all requirements set forth in the ECC, applicable laws, rules, procedure and standards;</li> <li>● to inform timely to Ministry by writing the detail information of the proposed project’s potential adverse impacts.</li> <li>● to perform the monitoing as defined in Chapter 9, Section 106 to 110;</li> <li>● to proactive and comprehensive self-monitoring of the project and activities related to all adverse impacts during all phases of project (pre-construction, construction, operation, decommissioning, closure and post-closure) by complying with applicable laws, rules, procedures, standards, ECC and EMP.</li> <li>● to notify in writing to the Ministry any breaches of its performance failures of the ECC and the EMP as soon as reasonably possible and the serious impact or the urgent attention of the Ministry may be required to inform within not later than 24 hours and in all other cases within 7 days.</li> <li>● to notify and identify in writing to the Ministry any breaches of its obligations or other performance failures or violations of</li> </ul>

<i>LEGISLATION</i>	<i>COMMITMENT</i>
	<p>the ECC and the EMP as soon as reasonably possible and in any event, in respect of any breach.</p> <ul style="list-style-type: none"> <li>● to submit the monitoring reports to the Ministry not less frequently than every six (6) months, as provided in a schedule in the EMP.</li> <li>● to provide the description of the requirement of the monitoring report such as documentation of compliance, the progress of the implementation of EMP, recommendations of the prevention of future difficulties, number and type of non-compliance with the EMP, remedial measures and timelines for completion of remediation, accidents related to the environmental health and safety, monitoring data of environmental parameter and conditions.</li> </ul> <p>And the project proponent has to allow the Ministry, Relevant Government Departments and Organization to conduct inspection as described in Chapter 9, Section 113,115,117 of the procedure.</p>
National Environmental Quality (Emission) Guidelines (2015)	The project proponent commits to fully comply with the National Emission Quality Guideline, which is the basis for regulation and control of noise and vibration, air emissions, and liquid discharges from various sources in order to prevent pollution for purposes or protection of human and ecosystem health.
<b>Environmental framework</b>	
Myanmar Environmental Conservation Rules (5th June 2014)	<p>The project proponent commits to fully comply with the Myanmar Environmental Conservation Rules.</p> <ul style="list-style-type: none"> <li>● As stated, “These place responsibility on the Government to establish and adopt the necessary programmes for the conservation and enhancement of environment, protection, control and reduction of pollution in environment, and conservation. An environment management fund has been created. Apart from state budget and other donations, polluters and people which obtain benefit from the natural environment service system will have to compensate their action through the fund.”, PTTEPI commits to compensate through the fund if their actions generate negative impacts to the natural environment and commits to be prosecuted according to Environmental Conservation Law, Section 31.</li> <li>● PTTEPI has to fully commit to follow the Ministry’s determination on the conditions for hazardous waste treatment, treatment of effluent, storage and transport of hazardous products, constraint of production to protect the environment.</li> <li>● PTTEPI has to submit an EIA or an IEE which has to be conducted by a qualified third person or organization accepted by the Ministry.</li> <li>● As described in Chapter (13), Section 69, PTTEPI shall not emit, ask to emit, ask to dispose, pile and ask to pile, by any means, hazardous waste or hazardous substances stipulated by notification according to any rules in this rules at any place which may affect the public directly or indirectly.</li> <li>● And PTTEPI has to comply the statement “Nobody shall carryout any activity which can damage the ecosystem and the natural environment which is affected due to such system, except for the permission of the Ministry for the interests of the people.”</li> </ul>
Prevention of Hazard from Chemicals and	The project proponent commits to fully comply with national regulation of chemicals, which regulates import, storage, usage and



<i>LEGISLATION</i>	<i>COMMITMENT</i>
<p>Related Substances Law (Pyidaungsu Hluttaw Law No., 28/2013)</p>	<p>disposal of chemicals and is responsible for chemical safety inspection. Permit requirement for “chemical related businesses”. Mitigation of chemical hazards to the environment and human beings and compliance monitoring of chemicals.</p> <p>As described in Section 15, the project proponent has to abide the license regulation and as in Section 16, the project proponent has</p> <ul style="list-style-type: none"> <li>● to perform to abide strictly the instructions for being safety in using the chemical and related substances by himself and also the persons who serve the work;</li> <li>● to keep the required safety equipment enough in the chemical and related substances businesses, furthermore has to grant the personal protection equipment and</li> <li>● to provide personal protective equipment, free of charge to the employees, concerned persons;</li> <li>● to practice trainings and exercises if necessary to the employees, concerned persons for using the occupational safety equipment and personal protection.</li> <li>● to allow the inspection performed by respective supervisors, inspectors whether or not the hazard may impact on the human being and animals</li> <li>● to complete medical check up for the employees, concerned persons who has to contact with chemical and related substances</li> <li>● to give recommendation whether the employee’s health is suitable to work or not and to keep the medical check up records</li> <li>● to inform the respective Township Administration Department with a copy of informative letter for the permission on storage of chemical or related substances</li> <li>● to acquire the guidance and agreement of the respective Department of Fire Brigade in advance, if the project has a risk of fire hazard</li> <li>● to transport only the permitted amount of the chemical and related substances in accordance with the prescriptive stipulations, if they are transported in local.</li> <li>● to take the permission from the Central Supervisory Board if the chemical and related substance are transferred from licensed place to any other place</li> <li>● to abide and perform in accordance with the related environmental laws, not to impact and damage to the environment</li> </ul> <p>As described in Section 17, the project proponent who has license must also have insurance which is able to pay the compensation, if human or animal had injured due to the project activities</p> <p>As described in Section 27, the project proponent must comply</p> <ul style="list-style-type: none"> <li>● classifying the hazard level according to the properties of chemical and related substances</li> <li>● establishing the Material Safety Data Sheet, labels, signs and pictograms</li> <li>● practicing trainings which must cover the proper wearing and using of PPE, safety equipment</li> <li>● performing in accordance with the prescriptive stipulations while transporting, handling, storing, using, discharging the</li> </ul>

<i>LEGISLATION</i>	<i>COMMITMENT</i>
	<p>chemical and related substances</p> <ul style="list-style-type: none"> <li>● to not import or export the chemical, related substances and the containers banned by the Central Supervisory Board</li> </ul>
<p>The Environmental Conservation Law (30<sup>th</sup> March, 2012)</p>	<p>The Environmental Conservation Law, whose objective is to implement Myanmar National Environmental Policy, enabling the basic principles and to give guidance for systematic integration of environmental conservation matters in the sustainable development process.</p> <ul style="list-style-type: none"> <li>● As described in Section 7, Subsection (o), project proponent commits to will pay compensation if there is any environmental impacts due to the project activity</li> <li>● As stated in Section 14, when causing a point source of pollution, the project proponent must treat, emit, discharge and deposit the substances which cause pollution in the environment in accord with stipulated environmental quality standards.</li> <li>● As stated in Section 15, when causing a point source of pollution, the project proponent must install or use an on-site facility or controlling equipment in order to monitor, control, manage, reduce or eliminate environmental pollution. If it is impracticable, it has to be arranged to dispose the wastes in accord with environmentally sound methods.</li> <li>● As in Section 24, the project proponent has to allow the Ministry to conduct inspection whether or not it is performed in conformity with such terms and conditions or inform the relevant Government departments, Government organizations to carry out inspections.</li> <li>● And as in Section 29, Project proponent must not violate any prohibition contained in the rules, notifications, orders, directives and procedures issued under this Law.</li> </ul>
<p>Constitution of the Republic of the Union of Myanmar, 2008</p>	<p>The Constitution of the Union of Myanmar, which is considered as the supreme law of the country and has provisions regarding the protection of the environment in Myanmar. Articles in the Constitution relevant to environmental protection and relevant to take the commitment from project proponent are as follows</p> <ul style="list-style-type: none"> <li>● As stated in article 37 of the Constitution, 2008: <ul style="list-style-type: none"> <li>○ The project proponent must commit the following statement that ‘<i>The Union is the ultimate owner of all lands and all natural resources above and below the ground, above and beneath the water and in the atmosphere in the Union</i>’;</li> <li>○ The project proponent must commit the following statement that ‘<i>The Union shall enact necessary law to supervise extraction and utilization of the State owned natural resources by economics forces.</i>’</li> </ul> </li> <li>● The project proponent must obey as stated in Article 390, “<i>Every citizen has the duty to assist the Union in carrying out the following matters:</i> <ul style="list-style-type: none"> <li>○ <i>Preservation and safeguarding of cultural heritage,</i></li> <li>○ <i>Environmental conservation;</i></li> </ul> </li> </ul>

<i>LEGISLATION</i>	<i>COMMITMENT</i>
	<ul style="list-style-type: none"> <li>○ <i>Striving for development of human resources;</i></li> <li>○ <i>Protection and preservation of public property.”</i></li> </ul> <p>These three articles in the Constitution provide a basis for legalizing and institutionalizing environmental health impact assessment and social impact assessment. And, the project proponent must show its respect by commitment.</p>
Myanmar Agenda 21 (1997)	<p>Myanmar Agenda 21 provides recommendations for the drafting and promulgation of a framework law which can further promote the integration of environmental and developmental concerns in the decision-making processes of the country.</p> <p>The Myanmar Agenda 21 contains guidelines to address the following issues:</p> <ul style="list-style-type: none"> <li>● increasing energy and material efficiency in production processes;</li> <li>● reducing wastes from production and promoting recycling;</li> <li>● promoting use of new and renewable sources of energy;</li> <li>● using environmentally sound technologies for sustainable production;</li> <li>● reducing wasteful consumption;</li> <li>● increasing awareness for sustainable consumption</li> </ul> <p>The project proponent must obey the guidelines during its project implementation.</p>
National Environment Policy (2019)	<p>The project proponent must obey the 23 principles as stated in National Environmental Policy.</p> <ul style="list-style-type: none"> <li>● The project proponent must commit to take the duty to protect the environment and to respect the right of every person and citizen living in Myanmar has their right to access clean and healthy environment</li> <li>● To recognize and consider the value of Myanmar’s environment including its significant spiritual values, ecological assets and cultural heritage, in addition to its direct benefits for humanity.</li> <li>● Establishment of environment and natural resource management, and to include environmental service provision, to minimize and avoid pollution and waste, to comply polluter pay principle</li> </ul>
<b>Air quality</b>	
The Operation of Business Relating to Ozone Depleting Substances: Notification No. 37/2014	<ul style="list-style-type: none"> <li>● The project proponents commits to apply for the Ministry with forms for import and export of the ozone depleting substance or designed product for use of ozone depleting substance, stating facts completely in accord with stipulations for the necessary endorsement. And the project proponent commit to operate the relevant business only after receiving an import license or an export license or a permit issued by the Ministry of Commerce after receiving the endorsement issued by the Ministry.</li> <li>● The project proponent must commit to be inspected by the Ministry or the Department or the Organization assigned by the Ministry relating to his business and to accept the legal action if violated any provision.</li> </ul>

<i>LEGISLATION</i>	<i>COMMITMENT</i>
Kyoto Protocol to the Convention on Climate Change, Kyoto (1997), 13/8/2003 (Accession)	<ul style="list-style-type: none"> <li>The project proponent commits to fully comply with the Kyoto Protocol; an international agreement linked to the United Nations Framework Convention on Climate Change, which commits its Parties by setting internationally bundling emission reduction targets.</li> </ul>
<b>Water environment</b>	
Conservation of Water Resources and Rivers Rules (2012)	<ul style="list-style-type: none"> <li>As described in Chapter 3, Section(7-c), the project proponent must commit that the wastewater produced from any factories and industries nearby the rivers, channels and ports should be treated before discharge and monitoring is required.</li> <li>Section (8-e), the project proponent must take preventive measures in accordance with international standards in order to prevent the leakage/discharge of wastewater and sewage into the rivers.</li> <li>The project proponent has to commit as stated in Section (9) that cost for pollution must be paid by the polluter.</li> </ul>
Law Amending the Port Act (2008)	<ul style="list-style-type: none"> <li>The project proponent has to commit as stated in Chapter 4, Section 21, Sub-section 2 of the Ports Act “<i>Any person who by himself or another so casts or throws any ballast or rubbish or any such other thing or so discharges any oil or water mixed with oil, or the master of any vessel from which the same is so cast, thrown or discharged, shall be punishable with fine not exceeding fifty thousand kyats, and shall pay any reasonable expenses which may be incurred in removing the same</i>”.</li> </ul>
Conservation of Water Resources and Rivers Law (2006)	<p>The section 6 of Conservation of Water Resources and Rivers Law outlines following prohibitions</p> <ul style="list-style-type: none"> <li>The project proponent shall not anchor the vessels where vessels are prohibited from anchoring in the rivers and creeks.</li> <li>The project proponent shall not dispose of engine oil, chemical, poisonous material and other materials, which may cause environmental damage, or dispose of explosives from the bank or from a vessel, which is plying, vessel which has berthed, anchored, stranded or sunk.</li> <li>The project proponent shall not dispose of any substance into the river-creek that may cause damage to waterway or change of watercourse from the bank or vessel.”</li> </ul> <p>The aims of this Law are as follows:</p> <ul style="list-style-type: none"> <li>to conserve and protect the water resources and river systems for beneficial utilization by the public;</li> <li>to smooth and enhance safety of waterways navigation along rivers and creeks;</li> <li>to contribute to the development of State economy through improving water resources and river systems;</li> <li>to protect environmental impact.</li> </ul> <p>The empowerment of this Law is provided to the Ministry of Transport for controlling navigation of vessels in the rivers and creeks as well as communicating with local and foreign government and organizations for conservation of water resources, rivers and creeks. Also, to carry out conservation works for water resources, rivers and creeks, in accordance with the relevant international</p>

<i>LEGISLATION</i>	<i>COMMITMENT</i>
	conventions, regional agreements and bilateral agreements for environmental conservation.
Myanmar Territorial Sea and Maritime Zone Law 2017	<ul style="list-style-type: none"> <li>● As stated in Section 31 of Myanmar Territorial and Maritime Zone Law, the project proponent commits to fully comply that the project proponent shall not, without the prior express permission of the government, carry out in the exclusive economic zone, any of the following:               <ul style="list-style-type: none"> <li>(a) exploration</li> <li>(b) exploitation, excavation and drilling of natural resources</li> <li>(c) research</li> <li>(d) excavation and drilling in any reason</li> <li>(e) construction, maintenance or operation of any artificial island, off-shore terminal, installation or other structure or device</li> </ul> </li> </ul>
<b>Biodiversity</b>	
Protection of Biodiversity and Protected Areas Law (May/2018)	<p>As stated in Section 39, the propjet proponent commits to be punished with imprisonment for maximum punishment or with fine 200,000 mmk or 500,000 mmk or both as minimum punishment.</p> <ul style="list-style-type: none"> <li>● The project proponent must not cause water and air pollution, causing damage to a watercourse or putting poison in the water in a natural area, passing through the electric current, and using chemicals and explosive substances.</li> <li>● The project proponent must not possessing or disposing of pollutants or mineral pollutants in a natural area.</li> </ul> <p>As stated in Section 41, the propjet proponent commits to be punished imprisonment for minimum 3 years to maximum 10 years or with fine.</p> <ul style="list-style-type: none"> <li>● The project proponent must not kill, hunt or wound, collect, sell a completely protected wild animal or animals controlled in national trade without permission, possessing or transporting or transferring such wild animal or any part thereof or blood of such animals or product deriving from the parts of such animals without permission;</li> <li>● The project proponent must not extract, collect a completely protected natural plants or plants controlled in national trade or destroying, collecting, possessing, selling, transferring and transporting such plant or any parts thereof or product deriving from the parts of such plant without permission</li> </ul>
The Protection of Wildlife and Wild plant and Conservation of Natural Area Rule (2002)	<ul style="list-style-type: none"> <li>● As stated in Section 4, the project proponent must not 1. building new infrastructure, 2. kill, hunt, wound or collect wild animals, possess, sell or transport or transfer such wild animal or any part thereof, and damaging, cutting, extracting and collecting natural plants or forest product, 3. digging, clearing the land, 4. crop growing, 5. using as pasture land, 6. Burning, 7. Fishing, 8. Hunting and 9. polluting water and air, damaging the drainage or poisoning the water, possessing or disposal of any poisonous material and waste metal, without permission</li> </ul>

<i>LEGISLATION</i>	<i>COMMITMENT</i>
Myanmar Agenda 21 (1997)	<p>Myanmar Agenda 21, which makes recommendations for the drafting and promulgation of a framework law which can further promote the integration of environmental and developmental concerns in the decision-making processes of the country.</p> <p>The project proponent commits to fully comply with the guidelines which address the following issues:</p> <ul style="list-style-type: none"> <li>● increasing energy and material efficiency in production processes;</li> <li>● reducing wastes from production and promoting recycling;</li> <li>● promoting use of new and renewable sources of energy;</li> <li>● using environmentally sound technologies for sustainable production;</li> <li>● reducing wasteful consumption;</li> <li>● Increasing awareness for sustainable consumption.</li> </ul>
The Burma Wildlife Protection Act (1936) and the Burma Wildlife Protection Rules (1941) (Burma Act No. Vii of 1936)	<ul style="list-style-type: none"> <li>● This project proponent commits to comply with the Burma Wildlife Protection Act and the Burma Wildlife Protection Rules, which makes provision for the establishment of sanctuaries (game sanctuaries) on any land at the disposal of the government or, subject to the consent of the owner, any land which is private property. It also provides for the protection of a number of named species outside sanctuaries and reserved forests.</li> </ul>
Thamihla Island (Notification no. 289/1970)	Gives information on the Marine Protected Areas
Meinmahla Kyun Wildlife Sanctuary (Notification no. 91/1993)	
Longlone Bok Island (Moscos Island) (Notification no. 243/1927)	
<b>Fishing/Aquaculture activities</b>	
Union of Myanmar Marine Fisheries Law (25 April 1990, amended 1993)	<ul style="list-style-type: none"> <li>● There are several restrictions relating to marine fisheries contained within the Fisheries Law. If the project proponent violated any of the prohibitions shall be punished with heavy fines and/or imprisonment. The relevance of this law to the project is that the project proponent must commit not to dispose of living aquatic creatures or any polluting material into the Union of Myanmar Marine Fisheries to cause pollution of water or to harass fishes and other marine organisms.</li> <li>● Project proponent must also comply with relevant articles 39 and 40.</li> </ul>
The Law Relating to the Fishing Rights of	<ul style="list-style-type: none"> <li>● Project proponent must comply and obey the Law and accept to be seized and taken action, in accordance with the</li> </ul>

<i>LEGISLATION</i>	<i>COMMITMENT</i>
Foreign Fishing Vessels (1989) & Law Amending the Law Relating to the Fishing Rights of Foreign Fishing Vessels – 1993	procedure of any fishing vessel and materials found therein for contravening any provisions of this Law
The Law on Aquaculture (1989)	<p>The project proponent must comply with the rules which gives the regulatory settings concerning Aquaculture: Lease or Licence, Duties and Fees</p> <ul style="list-style-type: none"> <li>● The project proponent must commit not to breed fish without licence;</li> <li>● The project proponent must commit not to obstruct navigation and flowing of water or polluting the water within the fisheries water or abetting such acts;</li> <li>● The project proponent must commit not to import live fish into the country and exporting live fish out of the country, without the prior permission of the Department;</li> <li>● The project proponent must commit not to breed fish prohibited by the Department</li> </ul>
<b>Heritage</b>	
The Protection and Preservation of Antique Objects Law (2015)	<ul style="list-style-type: none"> <li>● As stated in Section 12, the project proponent commits to promptly inform the relevant Ward or Village-Tract Administration office if they found any object which has no owner or custodian and if it seemed reasonable to assume that the said object is an antique object.</li> </ul>
The Protection and Preservation of Ancient Monument Law (2015)	<ul style="list-style-type: none"> <li>● As stated in Section 12, the project proponent commits to promptly inform the relevant Ward or Village-Tract Administration office if they found an ancient monument of over one hundred years old and above or under the ground or above or under the water which has no owner and it is assumed as ancient monument</li> <li>● As described in Section 15, the project proponent commits to apply prior permission to the Department if they have desire to extend towns, wards and villages, constructing or extending or repairing new buildings which include hotels, factories and residential buildings and so forth, digging to search petroleum, natural gas, gem or mineral, piping petroleum, constructing factories, connecting national grid, constructing communication tower, constructing or extending infrastructures, connecting underground electric and communication cable and other undergrounds, digging or extending wells, lakes and ponds, gold sieving, mining, quarry, placing and fencing ancient monuments in a private compound and are and constructing a building which does not meet terms and conditions in accordance with the region by the Ministry near and at the surrounding of an ancient monument.</li> <li>● And as stated in Section Section (20), the project proponent commits not to take photos, videos, films or copy and model an ancient monument for commercial purposes, using machines, which cause vibration within the specified place of an ancient monument. Likewise, the project proponent commits not to cultivate, garden, breed livestock, fence or block access near an ancient monument, emit gasses such as with a hot-air balloon, land, take off and fly airplanes and helicopters, and discard chemical substances and rubbish.</li> </ul>
The Protection and Preservation of Cultural	The project proponent commits to fully comply with the protection and preservation of cultural heritage regions law, whose the

<i>LEGISLATION</i>	<i>COMMITMENT</i>
Heritage Regions Law (2019)	<p>main objective is to implement the protection and preservation policy with respect to perpetuation of cultural heritage that has existed for any years and protect and preserve cultural heritage.</p> <ul style="list-style-type: none"> <li>● The project proponent commit not to carry out any of the following in the cultural heritage region:               <ul style="list-style-type: none"> <li>(a) Destroying an ancient monument;</li> <li>(b) Wilfully altering the original ancient form and structure or original ancient workmanship of an ancient monument;</li> </ul> </li> </ul>
<b>Public health</b>	
The protection of rights of National Races Law (2015)	<p>This law has provisions for equal treatment and considerations, developing united and respect between the races, and to achieve full opportunities for national races within Myanmar.</p> <ul style="list-style-type: none"> <li>● As described in Section 5, the project proponent commits to solve the matters of projects shall completely be informed, coordinated and performed with the relevant local ethnic groups in the case of development works, major projects, businesses and extraction of natural resources will be implemented within the area of ethnic groups.</li> </ul>
The Myanmar Fire Force Law (2015)	<p>Myanmar Fire Force Law has objectives to protect state-owned property, private property, cultural heritages and lives and properties of people from natural disaster and to help for country's security, law and order, peaceful lives of people.</p> <ul style="list-style-type: none"> <li>● The project proponent commit to comply as stated in Chapter 11, Section 25, "<i>The owner or manager of the factory, workshop, bus terminal, airport, port, hotel, motel, lodgings, condominium, market, department, organization or business exposed to fire hazard shall, in accord with the directive of the Department of Fire Service</i>"               <ul style="list-style-type: none"> <li>(a) not fail to form the Reserve Fire Brigade</li> <li>(b) not fail to provide fire safety equipment.</li> </ul> </li> </ul>
Social security Law (2012)	<p>The Social Security Law provides protection to individuals and households against sudden drops in income and welfare due to a range of shocks such as illness, disability, unemployment, illness or death of the main income earner, and old age.</p> <ul style="list-style-type: none"> <li>● As stated in Section 11, the project proponent commits to that the government departments/ companies/ associations/ organizations which have the minimum number of workers and above determined by the Ministry of Labour in co-ordination with the Social Security Board, they shall be applied with the provisions for compulsory registration for social security system and benefits.</li> <li>● As stated in Section 15, the project proponent has to ensure it meets the requirements of the social security funds</li> <li>● As mentioned in Section 18 (b), the project proponent commits to pay the social security fund for the worker and itself</li> <li>● As mentioned in Section 48 and 49, the project proponent must commit to ensure thier employers may benefit insurance by registering voluntarily for insurance of the workers who are not apply for the registration of employment injury benefit insurance system,</li> <li>● Section 75, the project proponent commit</li> </ul>



<i>LEGISLATION</i>	<i>COMMITMENT</i>
	<p>(a) to prepare and keep the work records and lists correctly</p> <p>(b) to inform the relevant township social security office if change of employer, business, number of workers, address of establishment, employment injury, etc.</p> <p>(c) to issue these lists on requirement of inspection team or official assigned duty under this law by the Social Security Head Office and various regional Social Security Offices.</p>
Prevention and Control of Communicable Diseases Law (1995, amended in 2011)	<p>Prevention and control of Communicable diseases Law, which describes functions and responsibilities of health personnel and citizens in relation to prevention and control of communicable diseases. It also describes measures to be taken in relation to environmental sanitation, reporting and control of outbreaks of epidemics and penalties for those failing to comply. The law also authorizes the Ministry of Health to issue rules and procedures when necessary with approval of the government.</p> <ul style="list-style-type: none"> <li>● According to Section 3, the project proponent commits to work with the Department of Health In order to prevent the outbreak of communicable diseases.</li> <li>● As stated in Section 4, the project proponent commits to comply with the measures undertaken by the Ministry of Health and the Department of Health in order to prevent the occurrence and spread of communicable disease</li> <li>● As mentioned in Section 9 and 11, the project proponent has to report immediately to the nearest health department or hospital, if any of the following are found <ul style="list-style-type: none"> <li>(a) massive death of animals including chicken and birds</li> <li>(b) rat fall</li> <li>(c) suspicion or occurrence of epidemic disease; occurrence of notifiable disease, the project proponent must allow the health officer for treatment</li> </ul> </li> </ul>
The Control of Smoking and Consumption of Tobacco Product Law (Law No. 5/2006)	<ul style="list-style-type: none"> <li>● As mentioned in Section 9, The project proponent has to define a smoking area and display notice boards for non-smoking area, and to accept the inspection of Ministry of Health as follows: <ul style="list-style-type: none"> <li>(a) keep the caption and mark referring that it is a non-smoking area at the place mentioned in section 6 in accordance with the stipulations.</li> <li>(b) arrange the specific place where smoking is allowed as mentioned in section 7, and keep the caption and mark also referring that it is a specific place where smoking is allowed, in accordance with the stipulations.</li> <li>(c) supervise and carry out measures so that no one can smoke at the non-smoking area.</li> <li>(d) accept the inspection when the supervisory body come for inspection</li> </ul> </li> </ul>
Penal Code (1 May 1961, and extended to	<ul style="list-style-type: none"> <li>● The project proponent commits to fully comply with the penal code of which applicable guideline is mainly concerned with public health; it is considered an offence to “voluntarily corrupt or foul the water of any public spring or reservoir so as to</li> </ul>

<i>LEGISLATION</i>	<i>COMMITMENT</i>
public health law in 1972)	<p>render it less fit for the purpose for which it is ordinarily used”, or to pollute the atmosphere arising from smoke, fumes, noxious odours, dust particles, noise and radioactive substances.</p> <ul style="list-style-type: none"> <li>● The only control of water pollution in the country is through guidelines issued in June 1994 by the Myanmar Investment Commission. These guidelines require that new projects, from both foreign and private investments, have wastewater treatment plants or systems.</li> </ul>
Public Health Law (1972)	<ul style="list-style-type: none"> <li>● Chapter 2, Section 3 and Section 5 describes that the project proponent has to allow to carry out the inspection, supervision, counselling, prohibition, repairing for Environmental Health Services, Food, Home products and cosmetics, infection, self-treatment medical centre, drugs. Legally constituted organization, assigned groups and government agencies are permitted to inspect of these issues.</li> <li>● The project proponent commits to fully comply with the Section 9 of this law, which empowers the Government to carry out measures relating to environmental health, such as garbage disposal, use of water for drinking and other purposes, radioactivity, protection of air from pollution, sanitation works and food and drug safety. However, detailed provisions do not exist to ensure more effective and comprehensive regulation of these areas.</li> </ul>
<b>Industrial law</b>	
The Petroleum and Petroleum Products Law (2017)	<p>The Petroleum and Petroleum Products Law (the “PPPL”) 2017, which was enacted by Pyaydaungsu Htuttaw as Pyaydaungsu Htuttaw Law No. 20/2017 on 1st August 2017 to repeal the Petroleum Act 1934.</p> <p>The project owner will abide the provisions of Section 9 (a,c,d), 10 (a,b,e) and 11 of said law.</p> <p>And the PPPL contains the provisions on import and export, transportation, storage, refinery, distribution, inspection and testing of petroleum and petroleum products and issuance of relevant licenses.</p> <ul style="list-style-type: none"> <li>● As mentioned in Section 9 (a,c,d) and Section 10(a,b,e) provides that the project proponent has to receive permission and licenses from the Ministry of Natural Resources and Environmental Conservation to carry out licence for the right to store for the storage tanks and warehouses, and to be taken action in accordance with existing laws if there is impact on environment while carrying out import, export, transport, and sale and distribution of petroleum and petroleum product</li> <li>● Also stated in Section 11, the project proponent commit to use sign, labels and pictograms on the containers containing any dangerous petroleum and petroleum products.</li> </ul>
Prevention from Danger of Hazardous Chemical and Associated Material Law (Pyidaungsu Htuttaw Law No 28/2013)	<p>The project proponent commits to fully comply with this Law, whose objectives are:</p> <ul style="list-style-type: none"> <li>● to prevent damage to environmental resources and living organisms due to chemicals and associated materials</li> <li>● to provide for the systematic control of businesses using chemicals and associated materials in accordance with government approvals</li> <li>● to carry out data gathering and to undertake education and research regarding the safe and systematic utilization of chemicals and associated materials</li> </ul>

<i>LEGISLATION</i>	<i>COMMITMENT</i>
	<ul style="list-style-type: none"> <li>● to achieve continuous improvements in worksite safety, health and environmental conservation</li> <li>● As stated in Section 7, the project proponent commits to apply to the central body for the acquisition of the license, attached with the management plan for the environmental conservation in accord with the stipulations, if they want to do the business of chemical and associated materials.</li> <li>● And as in Section 20, license holder has to apply to the central supervising body in accord with the stipulation for the relevant chemicals and associated materials using for his chemicals and associated materials business for a certificate.</li> <li>● And as detailed in Section 22, the registered certificate holder shall abide by the regulations contained in the registered certificate and shall follow the order and directives issued from time to time by the central supervising body</li> </ul>
Prevention of Hazard from Chemical and Related Substances Law (26 <sup>th</sup> August 2013)	<ul style="list-style-type: none"> <li>● The project owner will abide the provisions of section 16, 17, 23 and 27 of said law, stating obligations related to chemicals and related substances: registration, training, instructions to abide by, mitigation measures, compensation for damages</li> </ul>
The Law Amending the Oilfield Act (SPDCI Law No. 34/2010)	<ul style="list-style-type: none"> <li>● Oilfield Act provide the prevention of waste of oil or gas and also the prevention of environmental pollution by petroleum operations.</li> <li>● This act prescribes a wide range of protection measures for oil and gas workers, covering health, safety and occupational welfare issues. It also covers working hours, holidays and extensive prescriptions on employing children as well as setting up an inspection service, complemented by a range of penalties actions but it is unclear whether there has been inspection and enforcement of these basic provisions</li> </ul>
Explosive Substance Act (1908)	<p>According to Explosive Substance Act.</p> <ul style="list-style-type: none"> <li>● Any person, including the project proponent, who unlawfully and maliciously causes, by any explosive substance, an explosion of a nature likely to endanger life or to cause serious injury to property shall, whether any injury to person or property has been actually caused or not, be punished with imprisonment for a term not less than one year which may extend for five years, to which a fine not more than thirty lakh Kyats be added.</li> <li>● And as described in Chapter 7, Section 19, the project proponent commits relevant this law which stipulates the prohibitions on production, possession and use of explosives without permission.</li> </ul>
The Petroleum Act (1939) and Rules (1937)	<p>The Petroleum Act, which refers to the import, transport or store of any petroleum cannot be made save in accordance to the rules that may be defined by the President of the Union.</p> <ul style="list-style-type: none"> <li>● The project proponent has to commit as stated in Section 6, “All receptacles containing dangerous petroleum shall have a stamped, embossed, painted or printed warning, either on the receptacle itself or, where that is impracticable, displayed near the receptacle, exhibiting in conspicuous characters the words “Petrol” or “Motor Spirit”, or an equivalent warning of the dangerous nature of the petroleum”.</li> </ul>

<i>LEGISLATION</i>	<i>COMMITMENT</i>
The Myanmar Oilfields Act (1918)	<p>Myanmar Oilfields Act, which provides clarification on activities within the oil and gas industry and provides the Government with the power to define and alter limits of any notified oilfield. In addition, the Government can make rules for regulating all matters connected with many operations related to the extraction of oil and/or gas.</p> <ul style="list-style-type: none"> <li>The project proponent commits to fully comply the guidance and issues, as mentioned in Myanmar Oilfield Act, such as preventing oil and gas wastes, reporting of fires, accidents and other occurrences and regulating the collection and disposal of both oil and gas.</li> </ul>
<b>Transportation</b>	
Myanmar Aviation Act Pyidaungsu Hluttaw Law No. 33/2013	<ul style="list-style-type: none"> <li>The project proponent has to commit to comply the rules generally provide for the prohibition and regulation of the carriage in aircraft of any specified article or substance; the measures to be taken and the equipment to be carried for the purpose of ensuring the safety of life.</li> </ul>
<b>Infrastructure/economic development</b>	
Myanmar Investment Law (2016)	<p>As mentioned in Section 51, the project proponent has to commit</p> <ul style="list-style-type: none"> <li>to replace Myanmar citizens in various management field after providing for capacity building programs in order to be able to appoint citizens to different level positions of management, technical and operational experts, and advisors.</li> <li>to appoint only Myanmar citizens for works which does not require skill</li> <li>to appoint skilled citizen and foreign workers, technicians, and staff by signing an employment contract between employer and employee in accordance with the labour laws and rules</li> <li>to ensure to obtain the entitlements and rights in the labour laws and rules, including minimum wages and salary, leave, holiday, overtime fee, damages, compensation of the workman, social welfare, and other insurance relating to workers in stipulating the rights and duties of employers and employees and occupational terms and conditions in the employment contract</li> <li>to settle disputes arising among employers, among workers, between employers and workers, and technicians or staff in the investment in accordance with the applicable laws.</li> </ul> <p>As described in Section 65 (from b to p), the project proponent has to commit</p> <ul style="list-style-type: none"> <li>to establish and register a company or sole proprietorship or legal entities or branches of such entities under the Laws in order to invest;</li> <li>to abide by the terms and conditions, stipulations of special licenses, permits, and business operation certificates issued to them, including the rules, notifications, orders, and directives and procedures issued by this Law and the applicable laws, terms and conditions of contract and tax obligations</li> </ul>

<i>LEGISLATION</i>	<i>COMMITMENT</i>
	<ul style="list-style-type: none"> <li>● to carry out in accordance with the stipulations of the relevant department if it is, by the nature of business or by other need, required to obtain any license or permit from the relevant Union Ministries, government departments and government organizations, or to carry out registration</li> <li>● to immediately, inform to the Commission if it is found that natural mineral resources or antique objects and treasure trove are not related to the investment permitted above and under the land on which the investor is entitled to lease or use and not included in the original contracts. If the Commission allows, the investor shall continue to carry out the investment in such land, and if not allowed, the investor shall transfer and carry out, by obtaining the permission, at the substituted place which is selected and submitted by him</li> <li>● to not make any significant alteration of topography or elevation of the land on which he is entitled to lease or to use, without the approval of the Commission</li> <li>● to abide by applicable laws, rules, procedures and best standards practiced internationally for this investment so as not to cause damage, pollution, and loss to the natural and social environment and not to cause damage to cultural heritage</li> <li>● to list and keep proper records of books of account and annual financial statement, and necessary financial matters relating to the investments performed by permit or endorsement in accordance with internationally and locally recognized accounting standards</li> <li>● to close and discontinue the investment only after payment of compensation to employees in accordance with applicable laws for any breach of employment contracts, closure of investment, sale and transfer of investment, discontinuation of investment, or reduction of workforce</li> <li>● to pay wages and salaries to employees in accordance with applicable laws, rules, procedures, directives and so forth during the period of suspension of investment for a credible reason</li> <li>● to pay compensation and indemnification in accordance with applicable laws to the relevant employee or his successor for injury, disability, disease and death due to the work</li> <li>● to supervise foreign experts, supervisors and their families, who employ in their investment, to abide by the applicable laws, rules, orders and directives, and the culture and traditions of Myanmar</li> <li>● to respect and comply with the labour laws</li> <li>● to have the right to sue and to be sued in accordance with the laws</li> <li>● to pay effective compensation for loss incurred to the victim, if there are damage to the natural environment and socioeconomic losses caused by logging or extraction of natural resources which are not related to the scope of the permissible investment, except from carrying out the activities required to conduct investment in a permit or an endorsement</li> <li>● to allow the Commission to inspect in any places, when the Commission informs the prior notice to inspect the investment</li> <li>● to take in advance permit or endorsement of the Commission for the investments which need to obtain prior approval under the Environmental Conservation Law and the procedures of environmental impact assessment, before undertaking the assessment, and shall submit the situation of environmental and social impact assessment to the Commission along the</li> </ul>

<i>LEGISLATION</i>	<i>COMMITMENT</i>
	period of activities of the investments which obtained permit or endorsement of the Commission
Myanmar Investment Rules, 2017	<ul style="list-style-type: none"> <li>As in Section 64, the project proponent commits to carry out the investment in a responsible and sustainable manner by reducing and avoiding any adverse environmental and social impacts by the investor; such commitment without limiting environmental conservation actions, compliance with environmental conservation policies and human right, and application of effective technology for natural resource and practices of waste management strategy being included</li> <li>Myanmar Investment Rules, which lines up the requirements for carrying out an ESIA, as stated in Section 189 of the rules, the project proponent has to comply the following statement “after obtaining the permit, the investor who requires environmental and social impact assessments shall submit the required performances on environmental and social impact assessments to the Commission along the course of operating business”</li> <li>The project proponent commits to submit the confirmation of implementation of initial environmental impact assessment, reporting of the environmental impact assessment, taking the applicable certification of environmental conservation, and carrying out environmental management programme in accordance with Environmental Conservation Law, rules and procedures of environmental impact assessment. In addition, to take the decision from related Commission whether or not to continue the investment based on its compliance</li> </ul> <p>As described in Section 202, the project proponent commits to comply with all terms and conditions in the permit and other applicable laws when the investment is carried out</p>
Payments of Wages Law (2016)	<ul style="list-style-type: none"> <li>As mentioned in Section 3, the project proponent commits to pay the employee in local currency or foreign currency recognized by the Central Bank of Myanmar. This may be in cash, check or deposit into the bank account of employee to receive the payment for 60 days when he/she is in Alternative Civil Service.</li> <li>As mentioned in Section 4, the project proponent commits to pay for (a) Part-time, daily, weekly or other part-time job, temporary or piecework when the work is done or at the agreed time.</li> <li>If the project proponent encounters difficulty to pay the wages according to Section 4 sub-section (c) because of significant happenings, including natural disaster, the employer must report to the Department with solid evidence that wages will be paid at the mentioned day upon the workers’ agreement.</li> <li>The project proponent must abide that if an Employee carries out overtime work, he/she must be allowed the presiding overtime rate as set by the Law.</li> </ul>
The Myanmar Port Authority Law (2015)	<p>As stated in Myanmar Port Authority Law, relating to environmental conservation, the project proponent commits</p> <ul style="list-style-type: none"> <li>to carry out the distribution of information and technology, taking precautionary measures not to cause oil spills from vessels which carry petroleum, oil and chemical navigating within a port limit, or from oil test wells, oil wells and oil pipelines, or from collision and grounding of vessels</li> <li>if oil and chemical spill occurs, the project proponent commits to arrange in coordination with the experts, not for causing water pollution, clearing and sanitation. In doing so, the cost may be claimed from the responsible person in accord with the stipulations.</li> </ul>

<i>LEGISLATION</i>	<i>COMMITMENT</i>
	<ul style="list-style-type: none"> <li>● as stated in Section 19 (b, c), the project proponent must abide that Myanmar Port Authority               <ul style="list-style-type: none"> <li>(a) may claim damages from the relevant organization and person if the water pollutions, destructions and losses to environmental resources occur within a port limit, because of leakage of petroleum, oil or chemical from the tanker of petroleum, oil or chemical navigated within a port limit or from oil test wells ,oil wells and oil pipelines; or from collision or grounding of vessels, or for any other causes; because of discharge and disposal of pollutants and wastes from vessels and natural resource exploration rigs and structures from above and under water.</li> <li>(b) has the right, relating to the destructions and losses contained in subsection (a), to retain the relevant vessels, from above and under water natural resource exploration rigs and structures before obtaining the compensations.</li> </ul> </li> </ul> <p>As mentioned in Section 80, the project proponent must</p> <ul style="list-style-type: none"> <li>(a) not cause oil spill or discharge of sludge from the petroleum tanker, oil tanker and chemical tanker navigated within a port limit, or from oil test wells, oil wells and oil pipelines or from collision or grounding of vessels</li> <li>(b) not discharge, dispose or cause to fall dangerous materials, toxic materials, garbage, sludge and waste from the vessels, above and underwater natural resource exploration rigs and structures within a port limit</li> </ul>
Myanmar Engineering Council Law (2013)	<p>As stated in Myanmar Engineering Council law, the project proponent must abide the following guidance:</p> <ul style="list-style-type: none"> <li>● In Section 30,               <ul style="list-style-type: none"> <li>(c) If a foreign engineer who meets the requirements applies to the council for issuance of a registered limited engineer certificate, the executive committee shall, on behalf of the council, fix the permitted engineering subjects, the permitted status, the permitted region, the permitted time and other terms and conditions and issue, upon payment of the registration fee and the annual fees, the registered limited engineer certificate.</li> <li>(d) If a foreign registered professional engineer who meets the requirements in accordance with the ASEAN Mutual Recognition Arrangement on Engineering Services applies to the council for issuance of a registered limited professional engineer certificate, the executive committee shall, on behalf of the council, fix the permitted engineering subjects, the permitted status, the permitted region, the permitted time and other terms and conditions and issue, upon payment of the registration fee and the annual fees, a registered limited professional engineer certificate</li> </ul> </li> <li>● And the project proponent must comply the statement in Section 34, which said “if whoever has received a registration certificate, is found to have breached any rules contained in the registration certificate or violated any prohibition contained in a rule, order or directive enacted under this law or in any stipulation of this law, the executive committee may take the following administrative actions- (a) giving a warning; (b) assessing a suitable fine; (c) suspending the registration certificate; (d) cancelling the registration certificate.”</li> </ul>
Myanmar Foreign Investment Rules (2013)	<p>Myanmar foreign investment rules, which contain several elements dealing with environmental protection:</p> <ul style="list-style-type: none"> <li>● As stated in Section 33, the project proponent must submit proposals for economic activities that are considered capital intensive by the Commission, and that are prescribed to undergo environmental impact assessment by the Ministry of</li> </ul>

<i>LEGISLATION</i>	<i>COMMITMENT</i>
	<p>Environmental Protection and Forestry have to be submitted along with Environmental and Social Impact Assessment.</p> <ul style="list-style-type: none"> <li>● As described in Section 54, the project proponent must comply with Environmental Protection Law in dealing with environmental protection matters related to the business.</li> <li>● As in Se123, if it is scrutinized and found out that the project proponent has carried out business that causes environmental pollution or has not taken action to minimize environmental pollution at the land for which he is entitled to lease or use, or if it is scrutinized and found that the work carries out causes nuisance to the persons who reside around such place due to noise or by culture and if relevant persons officially object, the Commission may terminate the lease or tendering right to use after making necessary inquiry.</li> <li>● As described in Section 125, , the project proponent do not have the right to lease and develop the following lands: <ul style="list-style-type: none"> <li>(a) religious lands;</li> <li>(b) cultural heritage and natural heritage regions designated by relevant Ministries;</li> <li>(c) lands restricted for Union defence and security;</li> <li>(d) lands under litigation;</li> <li>(e) lands restricted by the State from time to time;</li> <li>(f) lands where exists place or building which may cause situations such as impact on public environment noise, pollution, impact on culture within urban residential area due to the business of the investor</li> </ul> </li> </ul>
Myanmar Foreign Investment Law (2012)	<p>As stated in Myanmar Foreign Investment law 2012, the duties and right of the project proponent are</p> <ul style="list-style-type: none"> <li>● to abide by the existing law of the Republic of the Union of Myanmar</li> <li>● no alteration of topography or elevation of the land obviously on which he is entitled to lease or use without the approval of the Commission;</li> <li>● As stated in Section 17, the project proponent commits <ul style="list-style-type: none"> <li>(a) not to cause environmental pollution or damage in accord with existing laws in respect of investment business.</li> <li>(b) report to the commission at once when the mineral resources or antique material or treasure trove not permitted in the contract on and the underground of the land permitted to utilize,</li> <li>(c) to perform not to affect environmental pollution and spoilage as per existing law in connection with the investment activities.</li> <li>(d) to take prior permit from the commission and share transfer shall be registered as per existing law if all share of foreign investment company is transferred to citizen or a foreigner outright</li> <li>(e) to transfer the high-tech competency technology functioned by him to the concerning works department or organization systematically as per the provision of the contract.</li> </ul> </li> </ul>



<i>LEGISLATION</i>	<i>COMMITMENT</i>
Minimum Wages Law (2013)	<p>Minimum Wages Law; which meets with the essential needs of the workers and their families , who are working at the commercial, production and service, agricultural and livestock breeding businesses, along with the purpose of increasing the capacity of the workers and for the development of competitiveness.</p> <ul style="list-style-type: none"> <li>● As stated in Section 12, the project proponent:               <ol style="list-style-type: none"> <li>(a) has to not pay wage to the worker less than the minimum wage stipulated under this Law;</li> <li>(b) may pay more than the minimum wage stipulated under this Law;</li> <li>(c) has to not have the right to deduct any other wage except the wage for which it has the right to deduct as stipulated in the notification issued under this Law;</li> <li>(d) has to pay the minimum wage to the workers working in the commercial, production and service business in cash. Moreover, if the specific benefits, interests or opportunities are to be paid, it may be paid in cash or partly in cash and partly in property, with prevailing regional price, jointly according to the desire of the worker</li> </ol> </li> <li>● As stated in Section 13, the project proponent:               <ol style="list-style-type: none"> <li>(a) has to prepare and maintain the lists, schedules, documents and wages of the workers correctly;</li> <li>(b) has to report the lists, schedules and documents prepared and maintained under sub- section(b) to the relevant department in accord with the stipulations;</li> <li>(c) has to accept the inspection when summoned by the inspection officer. Moreover, he has to produce the said lists and documents upon asking to submit</li> </ol> </li> <li>● As mentioned in Section 43, under the power and obligation of the project proponent:               <ol style="list-style-type: none"> <li>(a) before fixing of the minimum wage by the National Committee under this rule, if his remuneration is less than the prescribed amount, he should be paid up to the full amount;</li> <li>(b) part time, hourly job employees has to be paid the prescribed minimum wage for the working hours;</li> <li>(c) for the salary employees one day day-off has to be allowed in a week. If he has to work on the off day, overtime wage has to be paid in accord with the existing law;</li> </ol> </li> </ul>
Employment and Skill Development Law (2013)	<p>According to Employment and Skill Development Law, the project proponent must commit the following specific guidance:</p> <ul style="list-style-type: none"> <li>● In Section 5, the project proponent must sign a Contract of Employment with the worker who is within 30 days of working and the project proponent must consider to provide any necessary pre-employment trainings before the employment.</li> <li>● In Section 14, the project proponent commits to conduct occupational training to enhance the skills of workers who are to be employed as well as workers who are presently employed in accordance with the requirements of the enterprise and the</li> </ul>

<i>LEGISLATION</i>	<i>COMMITMENT</i>
	<p>policy of the Skills Development Agency</p> <ul style="list-style-type: none"> <li>● As in Section 30,               <ol style="list-style-type: none"> <li>(a) the project proponent of Industrial and Service Enterprises commits to pay contribution to the fund every month without fail amounting to not less than below 0.5% of the payroll of his workers up to the level of supervisors of the workers.</li> <li>(b) the project proponent must not deduct the contribution paid under sub- section (a) to the fund from the wages of the workers</li> </ol> </li> </ul>
Settlement of Labour Dispute Law (2012)	<p>Settlement of Labour Dispute Law is enacted for safeguarding the right of workers or having good relationship between employer and workers and making peaceful workplace or obtaining the rights fairly, rightfully and quickly by settling the dispute of employer and worker justly.</p> <ul style="list-style-type: none"> <li>● As in Section 38, the project proponent commits not to fail to negotiate and coordinate in respect of the complaint within the prescribed period without sufficient cause</li> <li>● As in Section 39, the project proponent not to alter the conditions of service relating to workers concerned in such dispute at the consecutive period before commencing the dispute within the period under investigation of the dispute before the Arbitration Body or Tribunal, to affect the interest of such workers immediately</li> <li>● As in Section 40, the project proponent has to commit to proceed to lock-out or strike without accepting negotiation, conciliation and arbitration by Arbitration Body in accord with this law in respect of a dispute</li> <li>● In Section 51, the project proponent commits any act or omission, without sufficient cause, which by causing a reduction in production resulting so as to reduce the workers' benefits shall be liable to pay full compensation in the amount determined by the Arbitration Body or Tribunal. Such money shall be recovered as the arrear of land revenue</li> </ul>
Labour Organisation Law (2012)	<p>According to this law, which took effect on 1<sup>st</sup> April 2014, foreign-owned, as well as citizen-owned investment is subject to compulsory registration with the Social Security Board it is employs a minimum number of employees determined by the Ministry of Labour in coordination with the Social Security Board. It has to be noted that this threshold currently stands at 5 employees.</p> <p>As of 1st April 2014, social security contributions paid to the Health and Social Care Fund by the employer and the employee amount respectively to 2% of the employee's monthly salary and the employer is also liable to contribute 1% of the employee's payroll earnings to the Employment Injury Benefit Fund (5% contribution total).</p> <ul style="list-style-type: none"> <li>● According to the statement from Section 17 to 22, The project proponent has to:               <ol style="list-style-type: none"> <li>(a) recognize the labour organizations</li> <li>(b) allow the member of executive committee assigned by the labour organization to perform their duty not exceeding two days per month</li> <li>(c) assist as much as possible if the labour organizations requests help which is in the interest of the factory's workers</li> </ol> </li> </ul>

<i>LEGISLATION</i>	<i>COMMITMENT</i>
The Myanmar Insurance Law (July, 1993)	<ul style="list-style-type: none"> <li>● As stated in Section 15, the project proponent has to ensure all motor vehicles effect compulsory Third Party Liability Insurance with the Myanmar Insurance</li> <li>● As stated in Section 16, the project proponent operating an enterprise which may cause loss to State-owned property or which may cause damage to the life and property of the public or which may cause pollution to the environment has to effect compulsory General Liability Insurance with the Myanmar Insurance</li> </ul>
The Workmen Compensation Act (1923, amended in 2005)	<ul style="list-style-type: none"> <li>● Section 10 (a, b) and 11, the project proponent has to compensate for death and injury during the working hours according to Workman's Compensation Act (1923) Amended by Law No 4/2005</li> <li>● the project proponent establish and maintain an injury management program; <ul style="list-style-type: none"> <li>(a) to review the effectiveness of its injury management program at least once every 2 years and revise the program in accordance with the results of the review;</li> <li>(b) to give a copy of its injury management program, and any revised injury management program, to the Minister.</li> </ul> </li> </ul>
Occupational Health and Safety Law, 2019	<p>The project proponent commits to comply the following statements as mention in Section 12, 16, 17, 18, 19, 20 (b), 21, 22, 23, 26, 27, 34 and 36. The abstract of above statements are that, the project proponent has</p> <ul style="list-style-type: none"> <li>● To appoint the Person In-charge for Occupational Safety and Health to closely supervise safety and health of workers (including female workers) in line with the type of Industry/Business</li> <li>● to allow Inspection Officers to enter the Workplaces to which this Law applies and inspect Occupational Safety and Health conditions and direct Employers for their compliance and report the findings to the Chief Inspection Officer</li> <li>● not to dismiss or demote a worker: - <ul style="list-style-type: none"> <li>(a) during any period before a medical certificate is issued by the Registered Doctor for occupational injury or by the Recognized Doctor for contact with Occupational Disease;</li> <li>(b) because the said Worker has addressed a complaint for hazardous or health detrimental condition;</li> </ul> </li> <li>● the project proponent to undertake the following in accordance with the stipulations: <ul style="list-style-type: none"> <li>(c) informing the Department in case of an Occupational Accident, Hazardous Event or Major and Serious Occupational Accident</li> <li>(a) (b) if a Worker is in contact with a stipulated Occupational Disease or contaminated or likely to be contaminated due to materials or Process used, sending a report to the Department together with a medical report prepared by the Recognized Doctor.</li> </ul> </li> </ul>

### **3.2.3. International Arrangements**

Myanmar is a member of:

- World Trade Organization (WTO)
- Association of Southeast Asian Nations (ASEAN)
- Network of Aquaculture Centres in Asia and the Pacific (NACA)
- Southeast Asian Fisheries Development Centre (SEAFDEC)

Myanmar is a party to the Convention on Biological Diversity (CBD). It has signed the Biosafety Protocol on May 11<sup>th</sup>, 2001, but is not yet a party to the Protocol. Myanmar is also a party to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

**3.2.4. International Practice Guidelines and International Convention relevant to the Project**

The table below provides a summary of the international practice guidelines and international conventions that are considered relevant to the project, and whom the project proponent commits to fully comply with in his future project.

**Tabl. 6 - Relevant International Guidelines and International Conventions**

<i>Standards/Guidelines</i>	<i>Description</i>
<b>International practice guidelines</b>	
World Health Organization (WHO) standards and guidelines	Presents guideline values for ambient air quality regarding emission of SO <sub>2</sub> , NO <sub>2</sub> , particulate matter (PM10 and PM2.5), and O <sub>3</sub> .
International Association of Oil and Gas Producers (OGP) Environmental Fates and Effects of Ocean Discharge of Drill Cuttings and Associated Drilling Fluids from Offshore Oil and Gas operations (2016)	Provides information on the environmental fate and effects of offshore discharge of these processed drill cuttings. Then, cuttings processing and waste disposal options are discussed.

<i>Standards/Guidelines</i>	<i>Description</i>
<p>IFC Environmental Health and Safety Guidelines (2007, updated 2012) and IFC Environmental Health and Safety Guidelines for Offshore Oil and Gas Developments (2015)</p>	<p><u>Air emissions:</u></p> <ul style="list-style-type: none"> <li>● Significant (&gt;100,000 tones CO<sub>2</sub> equivalent per year) greenhouse gas (GHG) emissions from all facilities and offshore support activities should be quantified annually.</li> <li>● All reasonable attempts should be made to maximize energy efficiency and operation of vessels for lowest energy use. During equipment selection, air emission specifications should be considered.</li> <li>● Measures consistent with the Global Gas Flaring and Venting Reduction Voluntary Standard (part of the World Bank Group's Global Gas Flaring Reduction Public-Private Partnership (GGFR program) should be adopted when considering venting and flaring options for offshore activities.</li> <li>● Continuous venting of associated gas is not considered current good practice and should be avoided. The associated gas stream should be routed to an efficient flare system, although continuous flaring of gas should be avoided if alternatives are available. If flaring is necessary, continuous improvement of flaring through implementation of best practices and new technologies should be demonstrated.</li> <li>● Methods for controlling and reducing fugitive emissions should be considered and implemented in the design, operation, and maintenance of offshore vessels. Leak detection and repair programs should be implemented.</li> <li>● Emission guidelines for small combustion facilities with a capacity of between 3 and 50 Megawatt thermal (MWth), such as those to be used for electricity generation and combustion on the semi-submersible rig or vessels.</li> </ul>

<i>Standards/Guidelines</i>	<i>Description</i>
	<p><u>Wastewater discharges:</u></p> <ul style="list-style-type: none"> <li>● Anti-foulant chemical dosing to prevent marine fouling of offshore facility cooling water systems should be carefully considered. Available alternatives should be evaluated.</li> <li>● The cooling water discharge depth should be selected to maximize mixing and cooling of the thermal plume to ensure that the temperature is within 3 degrees Celsius of ambient seawater temperature at the edge of the defined mixing zone or within 100 meters of the discharge point.</li> <li>● Sewage: Grey and black water from showers, toilets, and kitchen facilities should be treated in an appropriate on-site marine sanitary treatment unit in compliance with MARPOL 73/78 requirements.</li> <li>● Food waste: Organic (food) waste from the kitchen should, at a minimum, be macerated to acceptable levels and discharged to sea, in compliance with MARPOL 73/78 requirements.</li> <li>● Storage displacement water: Water pumped into and out of storage during loading and off-loading operations should be contained and treated before discharge.</li> <li>● Bilge waters: Bilge waters from machinery spaces in offshore facilities and support vessels should be routed to the facility closed drainage system, or contained and treated before discharge, in compliance with MARPOL 73/78 requirements. If treatment to this standard is not possible, these waters should be contained and shipped to shore for disposal.</li> <li>● Deck drainage water: Drainage water should be routed to separate drainage systems on offshore facilities. All process areas should be bounded to ensure drainage water flows into the closed drainage system. Contaminated drainage waters should be treated before discharge, in compliance with MARPOL 73/78 requirements.</li> <li>● Storm water should be separated from process and sanitary wastewater streams in order to reduce the volume of wastewater to be treated prior to discharge.</li> <li>● Surface runoff from process areas or potential sources of contamination should be prevented.</li> <li>● Oil water separators and grease traps should be installed and maintained as appropriate at refuelling facilities, workshops, parking areas, fuel storage and containment areas.</li> <li>● Indicative sanitary sewage discharge values include: pH (6-9); BOD (30mg/l); COD (125mg/l); Total nitrogen (10mg/l); Total phosphorus (2mg/l); Oil and grease (10mg/l); Total suspended solids (50mg/l); Total coliform bacteria (400 MPN<sup>1</sup>/100 ml).</li> </ul> <p><u>Solid and Liquid Management:</u></p> <ul style="list-style-type: none"> <li>● The waste materials should be segregated offshore into non-hazardous and hazardous wastes at a minimum, and shipped to shore for re-use, recycling, or disposal.</li> </ul>

<i>Standards/Guidelines</i>	<i>Description</i>
	<p><u>Noise:</u></p> <ul style="list-style-type: none"> <li>● Planning offshore construction activities to avoid sensitive times of the year.</li> <li>● Identifying fishing areas and reducing disturbance by planning construction activities at less productive times of the year, where possible.</li> <li>● If sensitive species are anticipated in the area, monitor their presence before the onset of noise creating activities, and throughout the construction.</li> </ul> <p><u>Emergency Preparedness and Response Plan</u></p> <ul style="list-style-type: none"> <li>● Spill prevention and control plan as part of the Emergency Preparedness and Response Plan</li> <li>● The company must have the funds available to implement the spill control plan, including equipment, budget and insurance. This plan should include details of response procedures in case of emergencies such as spills and leaks, including: <ul style="list-style-type: none"> <li>○ Inspection program implementation to ensure infrastructure integrity</li> <li>○ Preparation of standard operating procedures for appropriate containers and transfer operations</li> <li>○ Hazardous material location</li> <li>○ Documentation of specific PPE needs and operator training</li> <li>○ Documentation of availability of spill response equipment and lists of external resources</li> <li>○ Description of response activities including notification procedures (internal and external)</li> <li>○ Decision process for severity and action assessment.</li> </ul> </li> </ul> <p>The results of this plan will be reported annually and the plan updated regularly in response to the outcomes reported</p>
International Maritime Organisation (IMO)	<ul style="list-style-type: none"> <li>● No installation or structure should be installed after 1998 unless the facility is designed to be entirely removed.</li> <li>● Require the complete removal of all structures in water depths less than 100m and weighting less than 4000 tonnes. Those in deeper waters can be partially removed, leaving a minimum 55m of clear water for the safety of navigation.</li> <li>● Any disused installation, structure or part thereof, which projects above the sea (i.e. the topsides) should be adequately maintained;</li> <li>● The position, surveyed depth and dimensions of any installation not entirely removed should be indicated on nautical charts and any remains, where necessary, properly marked with aids to navigation;</li> <li>● The person responsible for maintaining the aids to navigation and for monitoring the condition of any remaining material should be identified;</li> <li>● It should be clear where liability lies for meeting any future claims for damages.</li> </ul>



<i>Standards/Guidelines</i>	<i>Description</i>
The American Petroleum Institute (API) <i>Compendium of Greenhouse Gas Emissions Estimation Methodologies for the Oil and Natural Gas Industry</i> (2009)	The overall objective is to promote the use of consistent, standardized methodologies for estimating GHG emissions from oil and natural gas industry operations. The API <i>Compendium</i> recognizes calculation techniques and emission factors for estimating GHG emissions for oil and natural gas industry operations.
International Petroleum Industry Environment and Conservation Association (IPIECA) <i>The Oil and Gas Industry: Operating In Sensitive Environments</i> (2003)	IPIECA is a voluntary non-profit organization whose membership includes both petroleum companies and associations at the national, regional or international levels. It addresses global environmental and social issues related to the petroleum industry: oil spill preparedness and response, global climate change, biodiversity, social responsibility, fuel quality and vehicle emissions, and human health. IPIECA also helps members identify new global issues and assesses their potential impact on the oil industry. The Association represents the views of its members in public forums and provides an interface between the petroleum industry and the United Nations Agencies.  IPIECA's goals are to promote good practices and industry consensus through arranging international workshops, publishing authoritative reports, providing a channel of communication with the UN, providing a forum for open dialogue, facilitating stakeholder engagement, promoting partnerships.
International Association of Oil and Gas Producers (OGP) <i>Environmental management in oil and gas exploration and production</i> (1997)	The OGP is the worldwide association of Oil and Gas Companies involved in exploration and production. The members include private and state-owned oil and gas companies, national associations and petroleum institutes. OGP represent their members before international regulatory bodies, and has observer status as a non-governmental organisation, with global and regional regulatory bodies that have an interest in marine environment protection.
United Nations Environment Program (UNEP) <i>Guidelines on Environmental Management for Oil and Gas Exploration and Production</i> (1997)	Provides guidelines on environmental management in oil and gas exploration and production. These guidelines should help to meet the challenge of fully integrating protection of the environment in the regulatory and business processes that control the exploration and production of oil and gas.
OGP Waste Management Guidelines (1993)	Provides an insight to the oil exploration and production processes and to waste management methods.
<b>International Conventions</b>	
Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal (Entered into force on the 6 <sup>th</sup> April 2015)	The Convention regulates the transboundary movements of hazardous wastes and provides obligations to its parties to ensure that such wastes are managed and disposed of in an environmentally sound manner.

<i>Standards/Guidelines</i>	<i>Description</i>
MARPOL (Annex I, IV, V and VI)	<p>MARPOL is an international convention with the main aim to prevent the pollution of marine environment by ships from operational and accidental causes. It is also a recommended practices which applicable to the management of environmental impacts from offshore oil and gas activities. It functions through six technical annexes and the relevant annexes are selected to fully comply in the proposed project.</p> <ul style="list-style-type: none"> <li>● MARPOL stipulates that any discharge into the sea of oil or oily mixtures from ships is prohibited except if: <ul style="list-style-type: none"> <li>○ For <math>4000 \leq \text{gross tonnage} \leq 10000</math>: the ship is proceeding on route; the oily mixture is processed through an oil filtering equipment and the oily mixture discharged to sea after filtration has an oil content not exceeding 15 parts per million (ppm); the oil content of the effluent without dilution does not exceed 15 ppm; the oily mixture does not originate from cargo pump room bilges on oil tankers; and the oily mixture, in case of oil tankers, is not mixed with oil cargo residues</li> <li>○ <math>&gt;10000</math> gross tonnage: as above, additionally must be fitted with alarm to indicate when this level cannot be maintained. Fitted with safety mechanism to ensure discharge of oily mixture automatically stopped when oil content of effluent exceeds 15ppm.</li> </ul> </li> <li>● Grinded food waste can be discharged to the sea at 4 nautical miles of the nearest coast</li> <li>● Annex I includes information for the prevention of pollution by oil</li> <li>● Annex IV gives information concerning the management of liquid discharges</li> <li>● Annex V gives information for management of wastes</li> <li>● Annex VI gives information for prevention of air pollution from ships, first adopted in 1997, limits the main air pollutants contained in ships exhaust gas, including sulphur oxides (SO<sub>x</sub>) and nitrous oxides (NO<sub>x</sub>), and prohibits deliberate emissions of ozone depleting substances (ODS). MARPOL Annex VI also regulates shipboard incineration, and the emissions of volatile organic compounds (VOC) from tankers)</li> <li>● Annex VI Chapter 4: Regulations on energy efficiency for ships to MARPOL Annex VI, to make mandatory the Energy Efficiency Design Index (EEDI), for new ships, and the Ship Energy Efficiency Management Plan (SEEMP) for all ships.</li> <li>● MARPOL requires the development of a Shipboard oil pollution emergency plan for every oil tanker of 150 gross tonnage and above and all other ships of 400 gross tonnages and above. The plan shall be developed based on the Guidelines for the development of shipboard oil pollution emergency plans adopted by the Organization by resolution MEPC.54 (32) as amended by resolution MEPC.86 (44).</li> </ul>
United Nation Framework Convention on Climate Change 1992 (UNFCCC) and Kyoto Protocol (1997)	Provide a framework for intergovernmental efforts to tackle climate change. Recognises that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases.

United Nations Convention on the Law of the Sea (UNCLOS), 1982 superseded the 1958 Geneva Convention	<ul style="list-style-type: none"><li>● Permits the partial removal of structures provided that IMO criteria are met</li></ul>
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### **3.3. CONTRACTUAL AND OTHER COMMITMENTS**

#### **3.3.1. Statement of Commitments**

PTTEPI will act in accordance with the commitments, mitigation measures, and plans that have been included in this EIA Report.

PTTEPI shall execute the EMP, all commitments, and conditions, and is liable to ensure that all contractors and subcontractors of the project follow with all applicable Laws, including the Environmental Conservation Law (2012), Environmental Conservation Rules and Environmental Impact Assessment Procedure (2015), as well as the EMP, project commitments and conditions.

PTTEPI and ARTELIA hereby confirm that:

- The EIA Report is accurate, consolidated and complete;
- The EIA has been conducted in accordance with relevant laws, including the EIA Procedure (2015).
- The project will fully comply the commitments, mitigation measures and plans set out in this EIA Report.

#### **3.3.2. Other Commitments**

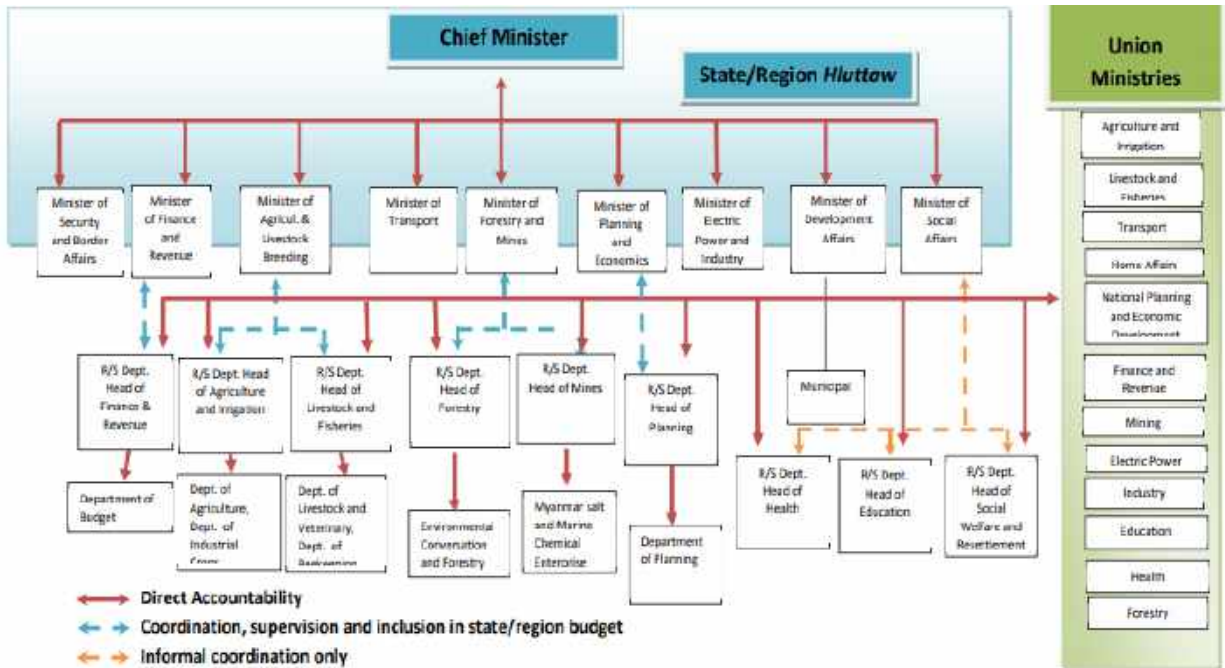
Myanmar has been a signatory related to the environment, which may have implication for the project. These include:

- United Nations Convention on the Law of the Sea
- United Nations Convention against Transnational Organized Crime
- London Amendment to the Montreal Protocol on Substance that Deplete the Ozone Layer; United Nations Framework Convention on
- Climate Change (UNFCCC); United Nations Convention to Combat Desertification;
- Vienna Convention for the Protection of Ozone Layer;
- Copenhagen Amendment to Montreal Protocol on Substance that deplete the Ozone Layer.
- Convention concerning the Protection of the World Culture and Natural Heritage;
- Convention on Biological Diversity (CBD); CARTAGENA Protocol on Biosafety to the Convention on Biological Diversity
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES);
- ASEAN Agreement on the Conservation of Nature Resources
- Kyoto Protocol to the United Nations Framework Convention on Climate Change;
- Ramsar Convention on Wetlands; and Stockholm Convention on Persistent Organic Pollutants (POPs)

### 3.4. MYANMAR LEGAL AND INSTITUTIONAL FRAMEWORK

#### 3.4.1. Myanmar Legal Framework

The laws and regulations of Myanmar have been authorized by the Republic of the Union of Myanmar. The organization structure of state and region governments in Myanmar is presented in the following figure.



**Fig. 4.** The organization structure of state and region governments in Myanmar (Source: Myanmar Information Management Unit (MIMU))

According to the 2008 constitution, the government institution of Myanmar is composed with twenty-four ministries:

1. Ministry of Agriculture, Livestock and Irrigation
2. Ministry of Border Affairs
3. Ministry of Commerce
4. Ministry of Construction
5. Ministry of Defence
6. Ministry of Education
7. Ministry of Electricity and Energy
8. Ministry of Ethnic Affairs
9. Ministry of Foreign Affairs
10. Ministry of Health and Sports
11. Ministry of Home Affairs
12. Ministry of Hotel and Tourism
13. Ministry of Industry
14. Ministry of Information
15. Ministry of Labour, Population and Immigration
16. Ministry of Natural Resources and Environmental Conservation
17. Ministry of Planning and Finance
18. Ministry of President's Office
19. Ministry of Religious Affairs

20. Ministry of Social Welfare, Relief and Resettlement

22. Ministry of Office of State Counsellor

21. Ministry of Transportation and Communication

23. Ministry of Office of the Union Government,

24. Ministry of International Cooperation.

The matters pertaining in laws and regulation of Myanmar are generally under the jurisdiction of the ministries, agencies and state-owned enterprises.

### 3.4.2. Myanmar Institutional Framework

Key ministries, agencies and state-owned enterprises that have jurisdiction over SSHE matters in oil and gas operations are presented below.

- **Ministry of Natural Resources and Environmental Conservation (MONREC):** MONREC is in charge of developing the country environmental policy, in particular in the fields of water and marine resources conservation. It is also responsible for introducing a new environmental permitting system, which is in process of implementation.
- **Environmental Conservation Department (ECD) of Ministry of Natural Resources and Environmental Conservation (MONREC):** the ECD of MONREC has ultimate responsibility in the review and approval, or otherwise, of submissions under the IEE/EIA process.
- **Myanma Oil and Gas Enterprise (MOGE):** MOGE is a Myanmar oil and gas state-owned enterprise responsible to work closely with oil and gas companies (local and international) in Myanmar and oversees the PSCs in cooperation with foreign oil companies. MOGE involves in direct communication and coordination with various levels of different government agencies for SSHE related issues.
- **Ministry of Electricity and Energy (MOEE):** MOEE jointly works with MOGE in managing SSHE issues of oil and gas operators in Myanmar, in which MOEE encourages operators to establish a SSHE Management System and prepare their own EIA/SIA for their project.
- **Myanmar Investment Commission (MIC):** MIC is a government agency responsible for coordinating with ministries (such as the MOEE) and other state entities to facilitate foreign investment in Myanmar. The MIC is also responsible for granting MIC permits, which enables foreign investors to carry out business activities under the Myanmar Investment Law (2016). The Law specifies MIC shall “*take consideration on the facts* such as financial credibility, economic justification of the business, appropriateness of technology and protection and conservation of environment in scrutinizing the proposals of investment”.
- **Ministry of Transport (MOT):** MOT is responsible for the organization of the country’s transport infrastructures, from air to marine transportation.
- **Ministry of Livestock, Fisheries and Rural Development (MLFRD):** MLFRD is in charge of developing, implementing and monitoring the country policies in the field of livestock, fishery and rural development, to ensure food security is achieved in the country, and prevent infectious diseases development that could endanger the national production.
- **Department of Fisheries (DoF):** Under the MLFRD, the DoF main mission is to guarantee the preservation of fish resources in order to ensure the sustainability of the fishery sector. The DoF develops conservation efforts, promotes research and surveys on the current condition of marine resources in partnership with intergovernmental agencies, maintains statistics on fisheries, and supervises the fishery sector through the delivery of licenses to fishing vessels.
- DoF has regional offices at the township level: these offices are responsible for handling the licensing system and taxes collection at the local level.
- **Myanmar Port Authority (MPA):** MPA is a government agency under the Ministry of Transport, founded in 1989 and located in Yangon. It is responsible for the regulation and administration of 8

coastal ports. It is also in charge of developing and improving the port infrastructures, notably through the development of Special Economic Zones and their associated ports.

- **Department of Marine Administration (DMA):** DMA is placed under the management of the Ministry of Transport. It is responsible for marine traffic safety (conformity of ships to national safety standards, improvement of rescue operations at sea) and human resources development in the maritime sector. It is in charge of the offshore fishing vessels inspection to determine if they meet safety standards, prior to the delivery of fishing licenses by the DoF.
- **Department of Marine Science – Myeik University**
- **Regional Authorities:** The Chief Minister; district and township administrators represent the highest levels of authority in the region of Tanintharyi.
- **Municipal Authorities:** government authorities at town and village level.

### **3.5. ENVIRONMENTAL STANDARDS AND VALUES TO BE USED FOR THE PROJECT**

The National Environmental Quality (Emissions) Guidelines (NEQG) were also enacted in 2015. These Guidelines provide the basis for regulation and control of noise and air emissions and effluent discharges from projects in order to prevent pollution and protect the environment and public health. These standards are noted to be the same as that recommended by the IFC General EHS Guidelines (2007, updated in 2015) and the IFC sector specific guidelines.

A summary of Myanmar national environmental standards referencing 2007 IFC offshore oil and gas guidelines and the 2015 IFC offshore oil and gas guidelines that are relevant to the project (drilling) for effluent discharges are shown in the table below.

Tabl. 7 - Summary of main emissions standards and values used for the project

Themes	Values selected for the project
<b>Liquid discharges (all operations)</b>	
Drainage and bilge water (limit of effluents)	< 15 ppm for bilge water and engine room (Annex I of MARPOL 73/78) <sup>4</sup>
Cooling water (Temperature)	The effluent should result in a temperature increase of no more than 3°C at edge of the zone, where initial mixing and dilution take place; where the zone is not defined, use 100 meters from point of discharge.
Wastewaters All vessels	Comply with MARPOL 73/78
<b>Cuttings</b>	
Cuttings of the sections using NABM (Non-Aqueous Base Mud)	<p>Comply with National Environmental Quality (Emission) Guideline.</p> <ul style="list-style-type: none"> <li>- Non-Aqueous drilling fluids: re-inject or ship-to-shore, no discharge.</li> <li>- Drilled cuttings, re-inject or ship-to-shore; no discharge except: <ul style="list-style-type: none"> <li>o Oil concentration lower than 1% by weight on dry cuttings;</li> <li>o Mercury maximum 1 mg/kg dry weight in stock barite;</li> <li>o Cadmium maximum 3 mg/kg dry weight in stock barite;</li> <li>o Discharge via a caisson at least 15 metres below sea surface.</li> </ul> </li> </ul> <p><u>2015 change</u></p> <ul style="list-style-type: none"> <li>- Non-Aqueous drilling fluid: re-inject or ship to shore, no discharge.</li> <li>- Drilled cuttings: Reinject or ship-to-shore, no discharge to sea except: <ul style="list-style-type: none"> <li>o Facilities located beyond 3 miles (4.8 km) from shore;</li> <li>o For new facilities: Organic Phase Drilling Fluid a, concentration lower than 1% by weight on dry cuttings;</li> <li>o For existing facilities c: Use of Group III non-aqueous base fluids and treatment in cutting dryers. Maximum residual Non Aqueous Phase Drilling Fluid d (NAF) 6.9% (C16-C18 internal olefins) or 9.4% (C12-C14 ester or C8 esters) on wet cuttings;</li> <li>o Discharge via a caisson (at least 15 m below surface is recommended whenever applicable; in any case, a good dispersion of the solids on the seabed should be demonstrated).</li> </ul> </li> </ul>

<sup>4</sup> European Maritime Safety Agency. 01/2017. The Management of Ship-Generated Waste On-board Ships. EMSA/OP/02/2016



Themes	Values selected for the project
Cuttings of the sections using WBM (Water Base Mud)	<ul style="list-style-type: none"> <li>- Water-based drilling fluid, re-inject or ship-to- shore; no discharge to sea</li> <li>- Water-based drilling fluids and cuttings, re-inject or ship-to-shore; no discharge to sea except: <ul style="list-style-type: none"> <li>o Mercury 1 mg/kg dry weight in stock barite;</li> <li>o Cadmium 3 mg/kg dry weight in stock barite;</li> <li>o Maximum chloride concentration must be less than four time's ambient concentration of fresh or brackish receiving water;</li> <li>o Discharge via a caisson at least 15 meters below sea surface</li> </ul> </li> </ul> <p><u>2015 change</u></p> <ul style="list-style-type: none"> <li>- WBDF: Reinject or ship-to-shore, no discharge to sea except: <ul style="list-style-type: none"> <li>o In compliance with 96 hr. LC-50 of Suspended Particulate Phase (SPP)-3% vol. toxicity test first for drilling fluids or alternatively testing based on standard toxicity assessment species (preferably site-specific species);</li> </ul> </li> <li>- WBDF cuttings: Reinject or ship-to-shore, no discharge to sea except: <ul style="list-style-type: none"> <li>o Facilities located beyond 3 miles (4.8 km) from shore;</li> </ul> </li> <li>- Discharge via a caisson (at least 15 m below sea surface is recommended whenever applicable);</li> <li>- in any case, a good dispersion of the solids on the seabed should be demonstrated)</li> </ul>
Completion and well work-over fluids	<ul style="list-style-type: none"> <li>- Ship-to-shore or re-inject, no discharge to sea except: <ul style="list-style-type: none"> <li>o Maximum one day oil and grease discharge should not exceed 42 mg/l; 30 day average should not exceed 29 mg/l</li> <li>o Neutralize to attain a pH of 5f or more</li> </ul> </li> </ul> <p><u>2015 Change</u></p> <ul style="list-style-type: none"> <li>- Oil and grease content does not exceed 42 mg/L daily maximum; 29 mg/L monthly average</li> </ul>
<b>Waste management</b>	
Food waste and hazardous waste	Grinding of food waste (diameter < 25 mm) before being discharged at sea. Other wastes are sent back onshore for appropriate treatment. (Annex V of MARPOL 73/78)
Sewage	Compliance with MARPOL 73/78 (in nearshore waters, carefully select discharge location based on environmental sensitivities and assimilative capacity of receiving waters)

### 3.6. HEALTH STANDARDS FOR PROJECTS WITH HEALTH IMPACTS

Myanmar is now a signatory to a number of international agreements related to environment and environmental health. The guidelines for health standards related to the offshore project are the EHS Guidelines by IFC under World Bank group. The EHS Guidelines contain the performance levels and measures that are normally acceptable to IFC and are generally considered to be achievable in new facilities at reasonable costs by existing technology.

The IFC, EHS Guidelines for Offshore Oil and Gas Development include information relevant to seismic exploration, exploratory and production drilling, development and production activities, offshore pipeline operations, offshore transportation, tanker loading and unloading, ancillary and support operations, and decommissioning. These guidelines also address potential onshore impacts that may result from offshore oil and gas activities.

**Tabl. 8 - Relevant general EHS guidelines for occupational health and safety**

Contents	Description
Management of Physical Hazards and Provision of first-aid equipment	<p>The <b>General EHS Guidelines</b> provide guidance for the management of physical hazards common to all industries and specifically relating to hazards from rotating and moving equipment, exposure to noise and vibration, electrical hazards, hot work, working with heavy equipment, confined space entry, working at heights, and the general working environment. The guidelines also provide guidance on Personal Protective Equipment (PPE) for workers</p> <p>Offshore facilities should be equipped, at a minimum, with specialized first-aid providers (industrial prehospital care personnel) and the means to provide short-term remote patient care. Depending on the number of personnel present and the complexity of the facility, provision of an on-site medical unit and a doctor may need to be considered</p>
Structural Safety of Offshore Facility	<p>Offshore facilities should be designed to eliminate or reduce the potential for injury or risk of an accident. The followings general measures which should be considered in the design of offshore facility :</p> <ul style="list-style-type: none"> <li>- Environmental conditions at the offshore location (e.g., seismicity, extreme wind and wave events, currents, ice formations)</li> <li>- Proper selection of materials and development of a monitoring plan to ensure the protection of equipment and structures from corrosion.</li> <li>- Adequate living accommodations appropriate to outside environmental conditions, plus related policies that consider the physical and mental strain on personnel living on production or drilling facilities; space for recreation and social activities and/or consideration of a limit to the number of consecutive days permitted on the offshore facility.</li> <li>- Limited accommodations in production and drilling facilities for staff related to asset operation only.</li> <li>- Temporary refuges or safe havens located in a protected area at the facility for use by personnel in the event of an emergency.</li> <li>- A sufficient number of escape routes leading to designated personnel muster points and escape from the facility.</li> <li>- Handrails, toeboards, and nonslip surfaces on elevated platforms and walkways, stairways, and ramps to prevent person overboard incidents.</li> <li>- Crane and equipment laydown area positioning to avoid moving loads over critical areas and reducing the impacts from dropped objects. (Alternatively, structural protection measures should be provided.)</li> </ul>
Additional occupational health and safety issues in offshore oil and gas operations	<ul style="list-style-type: none"> <li>- Fire and explosion prevention and control</li> <li>- Air quality</li> <li>- Hazardous materials</li> <li>- Personnel transfer and vessels</li> <li>- Well blowouts</li> <li>- Ship collision</li> <li>- Dropped objects and material handling issues</li> <li>- Emergency preparedness and response</li> </ul>

## 4. PROJECT DESCRIPTION AND ALTERNATIVES SELECTION

*This chapter provides a description of PTTEPI's projected activities in compliance with the new Environmental Impact Assessment Procedure. All information used in this section is based on data provided by PTTEPI, available at the time of the EIA elaboration.*

### 4.1. PROJECT BACKGROUND

PTTEPI is planning to undertake an appraisal drilling campaign in the eastern part of Block M9 in Q3-Q4 of 2018. The Project includes the drilling of a maximum of twelve appraisal wells.

The first screening stage of the project is the submission of the project proposal to MOGE and onward submission to MONREC. Regarding to this, the Environmental Conservative Department (ECD) responded to the project proposal with the instruction to perform an EIA for the proposed project. PTTEPI then prepared and submitted a Scoping Report which included the Terms of Reference for the EIA Study on the 16<sup>th</sup> November of 2017. The comments for scoping report were received from ECD via MOGE on 12<sup>th</sup> April of 2018 and the revised scoping report was submitted and approved by ECD on the 28<sup>th</sup> of June 2018. This EIA report is prepared in accordance with the EIA procedures.

### 4.2. DESCRIPTION OF THE LOCATION AND THE SITE

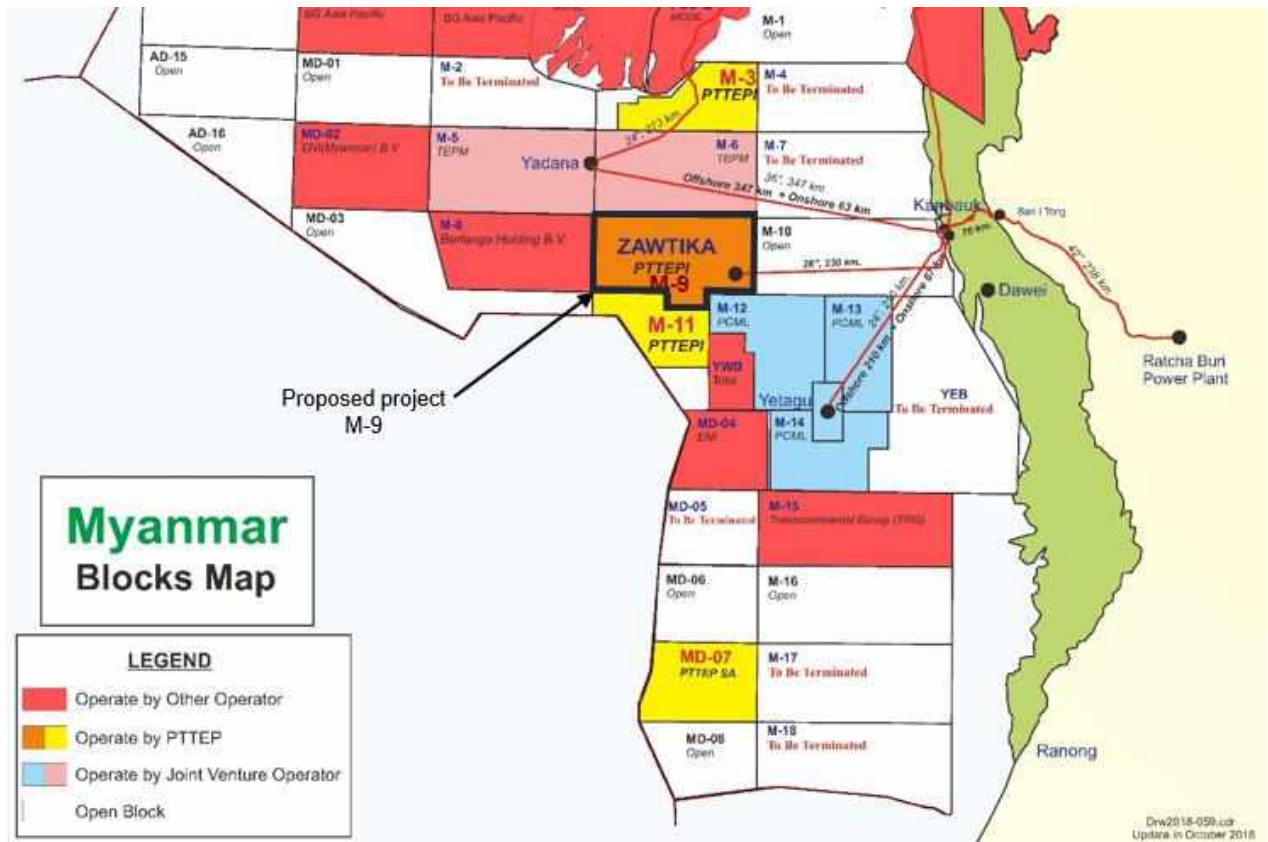
#### 4.2.1. Concession Area

As shown in the paragraph 2.1, Block M9 is located in the Gulf of Martaban, Andaman Sea, at approximately 260 km from the south coast of Yangon and 178 km west of Dawei. The water depth in the block ranges from approximately 50 to 800 m. Fig. 5 presents the location of the block. Its coordinates are presented in the following table.

**Tabl. 9 - Coordinates of Block M9**

Corner point	X	Y
A	372579.95	1621791.57
B	526918.12	1621473.25
C	526997.77	1547740.56
D	483801.37	1547731.44
E	483792.28	1533323.39
F	445688.58	1533375.42
G	445719.02	1547783.91
H	372202.84	1548045.60

Datum: WGS 1984 / Projection TM 96 E



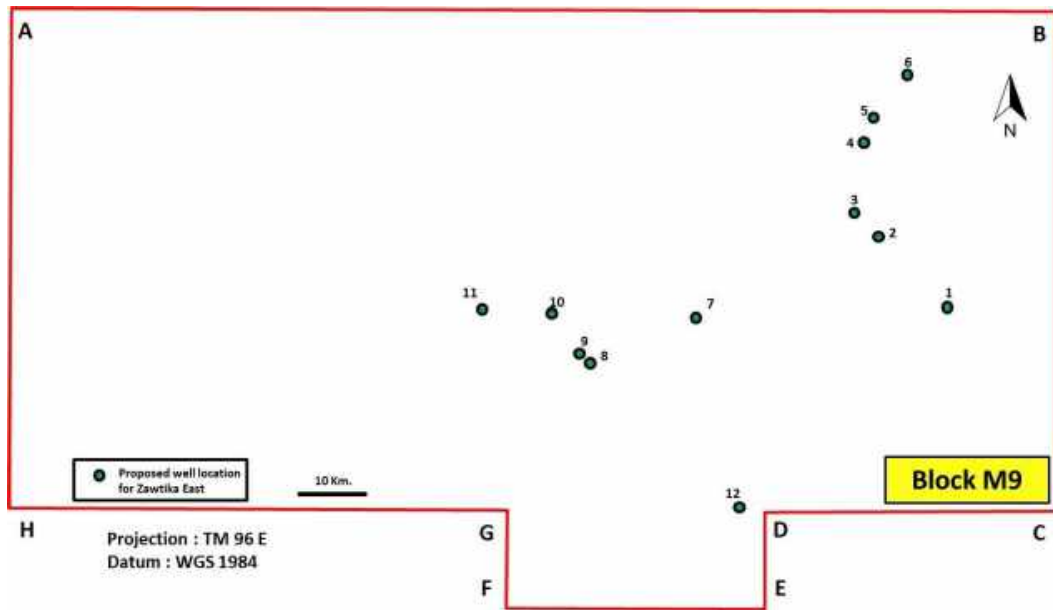
**Fig. 5. Geographical situation of Block M9**

**4.2.2. Drilling Activity Area**

The proposed project concerns the drilling of a maximum of twelve appraisal wells with as an objective to confirm (or deny) and indicate the presence of hydrocarbon reservoirs. This would serve the development of the existing Zawtika field. Below figure, presents the potential location of the twelve appraisal wells within the Block M9. Their coordinates are presented in the following table.

**Tabl. 10 - Types and Coordinates of the twelve potential wells**

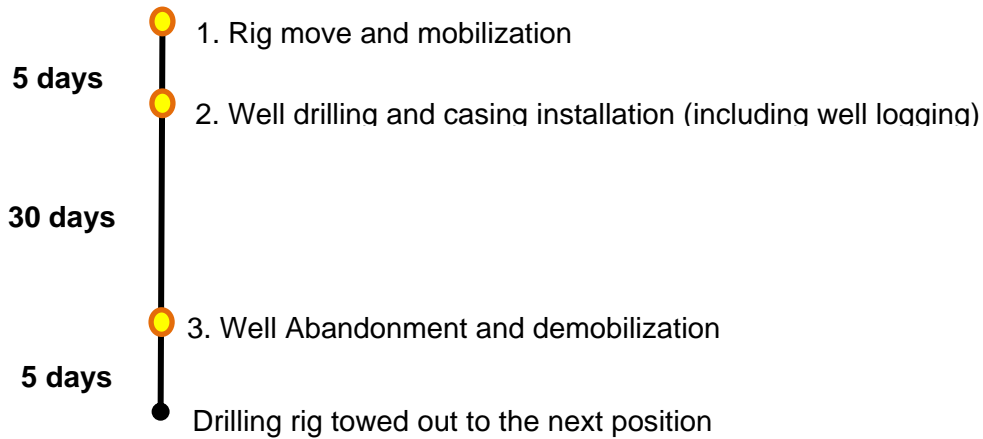
Well name	Tentative Proposed location				Estimated Water Depth (m)	Type of well
	X	Y	Latitude	Longitude		
1	509366.00	1578263.00	14°16'33.93"	96°05'12.60"	147	Appraisal
2	499796.00	1587761.00	14°21'43.16"	95°59'53.19"	130	Appraisal
3	496834.00	1592008.00	14°24'01.39"	95°58'14.27"	120	Appraisal
4	498533.00	1601590.00	14°29'13.29"	95°59'10.99"	110	Appraisal
5	500630.00	1605130.00	14°31'08.51"	96°00'21.04"	110	Appraisal
6	504591.00	1612173.00	14°34'57.75"	96°02'33.44"	115	Appraisal
7	473470.00	1577580.00	14°16'11.31"	95°45'14.55"	150	Appraisal
8	457844.00	1569790.00	14°11'57.04"	95°36'33.46"	132	Appraisal
9	455506.00	1571085.00	14°12'39.06"	95°35'15.38"	130	Appraisal
10	451970.00	1575600.00	14°15'05.81"	95°33'17.11"	120	Appraisal
11	441258.30	1576796.40	14°15'44.01"	95°27'19.55"	100	Appraisal
12	478200.00	1547510.00	13°59'52.65"	95°47'53.27"	152	Appraisal



**Fig. 6.** Proposed well location

### 4.3. TIME BOUNDARIES

The tentative commencement of appraisal drilling project is in 2019. The drilling of one appraisal well takes approximately 40 days. Therefore, for drilling twelve wells in this campaign, the duration will take approximately 540 days and thus, the completion of drilling for twelve wells will enter into 2021. The project schedule is presented in the table below.



**Tabl. 11 - Tentative schedule for project activities for twelve wells**

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Well-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Well-2																		
Well-3																		
Well-4																		
Well-5																		
Well-6																		
Well-7																		
Well-8																		
Well-9																		
Well-10																		
Well-11																		
Well-12																		

#### **4.4. DESCRIPTION OF THE PROPOSED PROJECT AND ASSOCIATED FACILITIES**

Before beginning of drilling operations, PTTEPI will coordinate with relevant government authorities and stakeholders via a “Notice to Mariners”, sent to the Myanmar Oil and Gas Enterprise (MOGE), at least four weeks prior to the campaign. This is to inform stakeholders of the schedule of the project in order to allow time for them to remove their fishing gears (if any) from the drilling area as well as to avoid fishing in these locations.

##### **4.4.1. Mobilization and Installation Phase**

###### **4.4.1.1. MOBILIZATION OF THE EQUIPMENT – DRILLING UNIT**

The wells will be drilled using a semi-submersible rig, which is capable of operating in seawater depths up to 500 to 3,000 m (see Fig. 7). This type of rig is easily transported from one location to another as they float high on the water with little drag when they are deballasted. The drilling rig will be transported from the rig’s previous location by two towing vessels. The speed of tow-out is approximately 3-5 knots and the expected duration of drilling rig transportation to the project’s location will take a maximum of 5 days and mobilization of the rig from one well to another will take approximately 5 days.



**Fig. 7.** Example of semi-submersible rig (left picture: ballasted; right picture: deballasted)

Upon arrival, the rig is fixed to its operational position by mooring using 8 to 12 anchors. The operating deck can be located high above the sea level owing to the good stability of the design, and therefore is kept well away from the waves. After positioning is completed, the rig will be ballasted to the drilling draft position prior to operation.

The drilling rig is on process of selection for the Block M9 appraisal drilling, and it should contain among other things: a drilling derrick and associated equipment, a pipe rack area, a shale shaker, a degasser, living quarters, two cranes, a helicopter landing deck, mud pits, mud pumps, main engines, AC sets, air compressors and stores. The moon pool area is an opening in the floor or base of the hull, platform, or chamber giving access to the water below. The rig consists of various areas, each with a particular purpose.

In order to drill, a marine riser is lowered from the working platform to the seabed with a blowout preventer (BOP) at the bottom that connects to the wellhead. The rig will have a Waste Management Plan (WMP) and an on-board oil pollution emergency plan which should comply with PTTEPI requirements.

#### 4.4.1.2. MOBILIZATION OF THE EQUIPMENT - SUPPLY VESSELS

Two material and equipment support vessels will make round-trips between onshore logistic bases and the drilling rig. Each supply vessel will transport catering provisions, supplies, casing/tubing, fuel, drilling water, fresh water, mud and cementing materials to the drilling rig. An example of a supply vessel that was used in the Zawtika field is presented in Fig. 8.

PTTEPI will use Thaketa Supply Base (TKA) in Yangon and Ranong Supply Base (RSB) in the port of Ranong Province (Thailand) as logistic bases. Both of them are currently supporting PTTEPI's offshore operations. Each shore base is equipped with an office building, warehouse, material yard, temporary waste and chemical storage, etc.

A helicopter will be used to transfer staff, with a capacity of 12 staff per flight. Staff transfers to the project area by helicopter takes 1 hour 10 minutes.

When the drilling unit will be operational at a well location, a temporary 500 m statutory safety zone around the drilling unit will be in force, i.e. no other vessels (except the drilling unit's support vessels) may enter this area.



**Fig. 8.** Example of a supply vessel (Source: PTTEPI, 2017)

#### 4.4.1.3. WORK FORCE

Rig mobilization and exploration drilling in Block M9 will be conducted by an expert contractor for offshore operations. The contractor has the skilled manpower and specialized equipment required for offshore work. Manpower having skills and experience with offshore exploration will be employed for the appraisal drilling program. It is expected that 156 employees will be working on the rig with 12 hour shifts typically on a 28 days crew change rotation during all phases; installation, drilling and abandonment.

The workers may come from both national and international and also depending on the origin of rig, nationality of employee can be different. However, there will be around 30 to 40 people from MOGE and some Myanmar contractors will be onboard. Accommodation on the drilling unit can support a workforce of 156 people.

Therefore, the rig has adequate accommodation for all drilling workers. From the two material support vessels (~14 workers per vessel), both of them will be used to support the drilling activities and patrol around the safety zone to prevent other boats entering the project area during drilling. All workers, both on the rig and vessels, will be accommodated offshore; therefore, it will not be necessary to provide them with onshore worker accommodation.



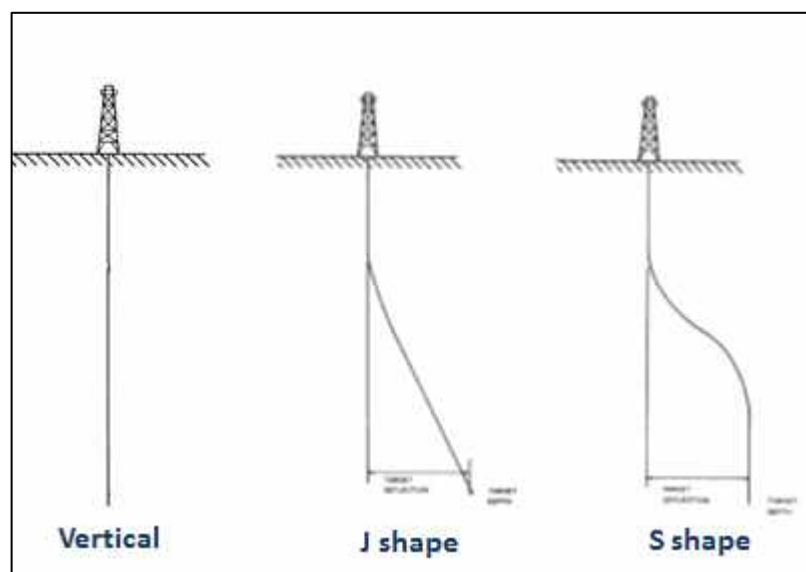
#### 4.4.2. Drilling Phase

##### 4.4.2.1. WELL AND CASING DESIGN

Most of the wells will target multiple reservoirs. There are a number of different types of wells that can be drilled, and these are described below. A particular well type may be best suited or most economical in the efforts to drain a specific configuration of hydrocarbons. Various drilling strategies can be adopted to place wells in specific patterns with the aim of optimizing production from a field.

- Vertical well: this type of well will drill vertically to the reservoir section. A 17-1/2" hole will be spud and a 13-3/8" surface casing will be set up to prevent bore hole collapse. Then a 12-1/4" hole will be drilled with well control equipment (e.g. diverter, BOP) and a 9-5/8" casing will be set up and cemented to isolate non-productive (for that particular well) gas sand. The main reservoirs section will be vertically penetrated with a 8-1/2" hole size.
- S-shape deviated well: this type of well will be kicked off as shallow as possible to get maximum reach distance and/or lower maximum inclination. In preliminary design, the kick off point is in a range of 500-600 mTVDSS (True Vertical Depth subsea), maximum inclination is under 60 deg, and build up rate is under 1.2 deg per 10 m. Then, the well will be dropped off at a vertical prior to penetrating the targeted reservoir. Drop off rate is under 1.2 deg per 10 m, similarly to the build-up rate. The reservoirs section will be vertically penetrated with a 8-1/2" hole size. A casing program of this well type will be similar to a vertical well, a 13-3/8" casing shoe at approximately 500 mTVDSS and 9-5/8" casing shoe just above the main targeted reservoir.
- J-shape deviated well: this type of well is similar to the S-shape deviated well type, the well will be kicked off as shallow as possible to get the maximum reach distance and/or low maximum inclination. In preliminary design, the kick off point is in range of 500-600 mTVDSS, maximum inclination is under 60 deg, except in some extended reach targets. Build up rate is under 1.2 deg per 10 m. Then, the well will be built up again to reach 60 deg inclination prior to penetrating the targeted reservoirs. The reservoirs section will be penetrated with a 8-1/2" hole size. A casing program of this well type will be similar to the vertical well, a 13-3/8" casing shoe at approximately 500 mTVDSS and a 9-5/8" casing shoe just above main targeted reservoir.

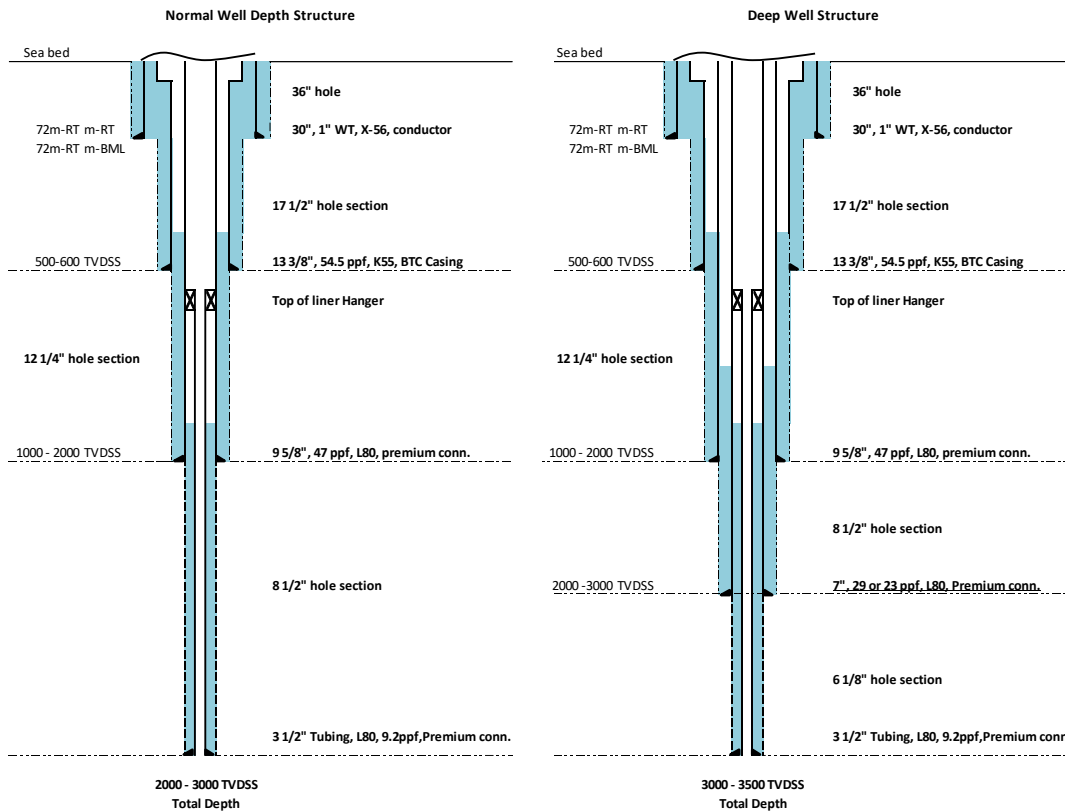
Fig. 9 shows general well profile.



**Fig. 9.** General well profile

#### 4.4.2.2. GENERAL CASING PROGRAM

The appraisal wells will start at 72 m TVD/MSL (True Vertical Depth below Mean Sea Level). It is expected to drill down to 3,000 – 3,500 m TVD/MSL (i.e., under the seabed). Tabl. 12 - and Fig. 10 show typical hole and casing dimensions and casing program respectively.



**Fig. 10.** Appraisal/ Exploration well profile (Source: PTTEPI, 2017)

Details on depths of sections and casing design for each well are summarized in the following table.

**Tabl. 12 -** Size and depth of appraisal wells

Well type	Well section	Well diameter (inch)	Casing diameter (inch)	True vertical depth (mTVDSS)	Measured depth (mMD)
Appraisal	Jet conductor / Surface section	36''	30'' conductor	72 m below the seabed	72 m below the seabed
		17 1/2''	13 3/8''	500-600	500-600
	Intermediate section	12 1/4	9 5/8	1,000-2,000	1,200-2,500
	Main reservoir section	8 1/2''	7'' if drilled 6 1/8'' section	2,500-3,000	3,000-4,000
	Main reservoir section (for deep well)	6 1/8''	3 1/2''	3,000-3,500	4,000-5,000

#### 4.4.2.3. DRILLING PROCEDURES

##### 4.4.2.3.1. Drilling and casing

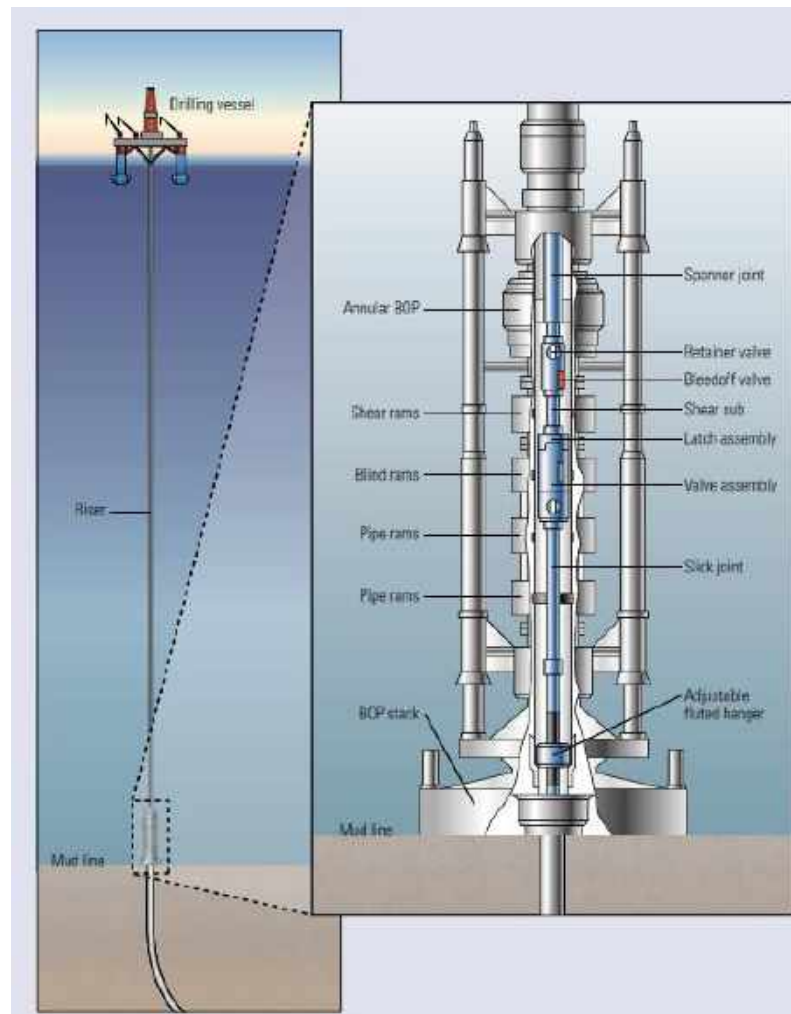
Once in position at the designated well-site, drilling will start. Drilling procedure for each section are detailed as follows:

- **36 x 17 ½-inch hole (surface section):** this section will be drilled to a depth of 500-600 m. The section is drilled using a 17 ½-inch bit, 36-inch hole opener, with seawater with bentonite and water-based mud (WBM) using for drilling the surface interval. Drilling depth of 17 ½-inch hole will be around 500-600 m from the drilling floor for 13 3/8-inch casing and 36-inch hole will be opened about 72 m from seabed for 30-inch conductor.

A subsea wellhead is installed with 13 3/8-inch casing and 30-inch conductor, which is attached by cement. Casing is installed to prevent collapse of loose soil near the surface, to prevent cuttings from draining back into wells, to prevent the discharge of drilling mud, and to isolate the well from the formation. Seawater with bentonite mud and WBM will be used as drilling fluid in this section. As drilling starts at the seabed without casing installed, drill cuttings are therefore discharged to the seabed. A blowout preventer (BOP) is installed above the subsea wellhead (see Fig. 11).

- **12 ¼-inch hole (Intermediate section):** after the cement to attach the casing has hardened, the second well drilling operation for intermediate hole will be conducted by a 12 ¼-inch drilling bit, which will drill to a TVDSS of 1000-2,000 m. 9 5/8-inch casing will then be installed and attached with cement. Water-based mud will be used as drilling fluid in this section.
- **8 ½-inch hole and 6 1/8-inch hole (reservoir section/bottom hole interval):**
  - **Option 1:** The bottom hole (or reservoir hole) is the last interval of the well, drilled by 8-1/2-inch hole to a TVDSS of 2,500-3000 m. Water-based mud (WBM) of synthetic based mud (SBM) will be used as the drilling fluids. Mud and cuttings will pass through shale shaker and centrifuge. No direct discharge to the sea is planned. On the other hand, cuttings will be discharged overboard at depth below 15 m from sea surface.
  - **Option 2 (for deep well):** in case that 8-1/2-inch hole cannot be drilled to a final well depth: the 8-1/2" section will be drilled to a TVDSS of 3,000-3,500 m and covered by 7-inch casing, which attached by cement. The next section is drilled by a 6-1/8-inch drill bit to a final depth at a TVDSS of 3,000-3,500 m. Water-based mud (WBM) or synthetic based mud (SBM) will be used as the drilling fluid. Mud and cuttings will pass through shale shaker and centrifuge. No direct discharge to the sea is planned. On the other hand, cuttings will be discharged overboard at depth below 15 m from sea surface.

At the end of drilling, if gas has been discovered, wells will be evaluated by wireline logging. At the end of the project, the well will be sealed. This consists in placing mechanical and cement plugs at strategic depths in the wellbore to separate and to permanently seal off the various zones. Then, the drilling unit will be demobilized and sent to its next assignment.



**Fig. 11.** Blowout preventer (BOP) stack linked to the rig

4.4.2.3.2. Cementing

After a casing string is set in a well, specially designed cement slurry is pumped into the annular space between the outside of the casing and the borehole. This cement slurry is used as an adhesive filler to prevent contamination or communication between subsurface formations and to provide structural support to the casing strings. To ensure effective cementing, an excess of cement is often used. Until the marine riser is set, this excess emerges out of the top of the well onto the seafloor. This cement does not set and slowly dissolves into the seawater.

Offshore drilling operations typically use Portland cements, defined as pulverized clinkers consisting of hydrated calcium silicates and usually containing one or more forms of calcium sulphate as an interground addition. The raw materials used are lime, silica, alumina and ferric oxide. The cement slurry used is specially designed for the exact well conditions encountered.

Additives can be used to adjust various properties in order to achieve the appropriate consistence of the material. There are over 150 cementing additives available on the market. The amount (concentrations) of these additives generally make up only a small portion (<10%) of the overall amount of cement used for a typical well. Examples of typical cement additives include: CaCl (accelerator); NaCl (accelerator); hematite (weighting agent); barite (weighting agent); calcium carbonate; silica flour; gel (bentonite); several types of polymers and specific additives to address unique conditions to the well. These additives are polymers generally made of organic material and are considered non-toxic.

Once the cement has set, a high-pressure leak-off test is performed to ensure that the cement filler seals as well as the enclosing rock is able to withstand the high pressures of fluids that might enter the well bore from deeper formations

#### 4.4.2.4. DRILLING FLUIDS (MUD) AND CUTTINGS

##### 4.4.2.4.1. Type of drilling fluids

Drilling fluids or drilling mud is used for lubrication of the bit and drill pipe, extraction of cuttings, control of subsurface pressures, prevention of well collapse and clogging of the penetrated formation.

Expected formulations for drilling mud consist in intercalations of sands with silts and clay stone. The objectives of the mud are mainly:

- Hydration and swelling of cuttings and adding stability to the bore hole;
- Effectively seal porous zones, minimising fluid loss to the formation and providing integrity to the bore hole wall;
- Reduce risk of losses or seepage losses;
- Avoid pipe getting stuck in permeable sections;
- Control specific gravity and solid content and optimise flow rate; and
- Provide efficient hole cleaning and improve deviation.

Three types of drilling mud will be used as follows:

- **Water-based mud (WBM)** will be used for surface section. The main components are biodegradable and include: barite, shale inhibitor additive and seawater. PTTEPI will use WBM as main drilling fluid for all well sections.
- **High Performance Water based mud (HPWBM)** will be used for the intermediate and deeper hole sections. HPWBM is the improved version of WBM with different kind of inhibited water based mud system to control the adverse effects of shaly formations, provide suitable lubricity and temperature salinity.
- **Synthetic based mud (SBM)** will be used as contingency for intermediate section and the reservoir section where WBM is not applicable. The main components are biodegradable and include: barite, base oil and fresh water. Drilling with SBM, oil on cuttings would be brought down below 6.9% by using a cutting dryer.

The drilling mud concentration and consumption are presented in the table below.

Tabl. 13 - Drilling mud concentrations and consumption

Section	Mud type	Chemical	Chemicals Concentration and Consumption			
			Hivis pill		Mud	
			Concentration	Consumption	Concentration	Consumption
			(kg/m <sup>3</sup> )	(kg)	(kg/m <sup>3</sup> )	(kg)
36" x 17-1/2"	WBM	Barium Sulphate			222.3	133380.00
		Bentonite	42.75	2565	70	42000.00
		Starch			21	2419.22
		Caustic Soda	0.3	18	0.3	180.00
		Sodium Bicarbonate	0.3	18	0.3	180.00
		Xanthan Gum	3	180	3	1800.00
		Biocide	0.3	18	0.3	180.00
12 1/4" – Option 1	WBM	Barium Sulphate			222.3	27787.5
		Bentonite	42.75	6412.5	70	8750.0
		Starch		0	21	2625.0
		Caustic Soda	0.3	45	0.3	37.5
		Sodium Bicarbonate	0.3	45	0.3	37.5
		Xanthan Gum	3	450	3	375.0
		Biocide	0.3	45	0.3	37.5
12 1/4" – Option2	SBM	Base Fluid			530.4	117748.8
		Water			140	31080
		Barium Sulphate			15	3330
		Calcium Chloride			38	8436
		Kerosine			9	1998
		Kerosine			16	3552
		Gilsonite			20	4440
		Calcium Hydroxide			25	5550
		Hectorite clay			3	666
		Organophilic clay			18	3996
		Methyl Styrene/Acrylate Copolymer			3	666
		Di-Propylene Glycol Monomethyl Ether			3	666
		Calcium Carbonate			45	9990
		Viscosifier			3	666
8 1/2" – Option 1	WBM	Sea Water			900	900
		KCL			51.48	16370.64
		NaCl			51.48	16370.64

Section	Mud type	Chemical	Chemicals Concentration and Consumption			
			Hivis pill		Mud	
			Concentration	Consumption	Concentration	Consumption
			(kg/m <sup>3</sup> )	(kg)	(kg/m <sup>3</sup> )	(kg)
		Soda Ash			1.43	454.74
		Caustic Soda			1.43	454.74
		XCD-XANVIS			5.72	1818.96
		Starch-Fluid loss additive			17.16	5456.88
		Polyamine			34.32	10913.76
		Encapsulating agent-HyPr cap			1.43	454.74
		Clouding Glycol-Cummulus CPG			34.32	10913.76
		CaCO3-25 microns			14.3	4547.4
		CaCO3 50microns			28.6	9094.8
		ROP Enhancer			34.32	10913.76
		Barite			14.3	4547.4
		FLC-2000			14.3	4547.4
8 ½" – Option 2	SBM	Base Fluid (Saraline)			530.4	117748.8
		Water			140	31080
		Barium Sulphate			15	3330
		Calcium Chloride			38	8436
		Kerosine			9	1998
		Kerosine			16	3552
		Gilsonite			20	4440
		Calcium Hydroxide			25	5550
		Hectorite clay			3	666
		Organophilic clay			18	3996
		Methyl Styrene/Acrylate Copolymer			3	666
		Di-Propylene Glycol Monomethyl Ether			3	666
		Calcium Carbonate			45	9990
		Viscosifier			3	666
6 1/8" – Option 1	WBM	Sea Water			900	900
		KCL			51.48	16370.64
		NaCl			51.48	16370.64

**Offshore M9 East Appraisal/Exploration Drilling**

Report

**ENVIRONMENTAL IMPACT ASSESSMENT**

Section	Mud type	Chemical	Chemicals Concentration and Consumption			
			Hivis pill		Mud	
			Concentration	Consumption	Concentration	Consumption
			(kg/m <sup>3</sup> )	(kg)	(kg/m <sup>3</sup> )	(kg)
		Soda Ash			1.43	454.74
		Caustic Soda			1.43	454.74
		XCD-XANVIS			5.72	1818.96
		Starch-Fluid loss additive			17.16	5456.88
		Polyamine			34.32	10913.76
		Encapsulating agent-HyPr cap			1.43	454.74
		Clouding Glycol-Cummulus CPG			34.32	10913.76
		CaCO3-25 microns			14.3	4547.4
		CaCO3 50microns			28.6	9094.8
		ROP Enhancer			34.32	10913.76
		Barite			14.3	4547.4
		FLC-2000			14.3	4547.4
6 1/8" – Option 2	SBM	Base Fluid (Saraline)			530.4	117748.8
		Water			140	31080
		Barium Sulphate			15	3330
		Calcium Chloride			38	8436
		Kerosine			9	1998
		Kerosine			16	3552
		Gilsonite			20	4440
		Calcium Hydroxide			25	5550
		Hectorite clay			3	666
		Organophilic clay			18	3996
Methyl Styrene/Acrylate			3	666		



**Offshore M9 East Appraisal/Exploration Drilling**

Report

**ENVIRONMENTAL IMPACT ASSESSMENT**

Section	Mud type	Chemical	Chemicals Concentration and Consumption			
			Hivis pill		Mud	
			Concentration	Consumption	Concentration	Consumption
			(kg/m <sup>3</sup> )	(kg)	(kg/m <sup>3</sup> )	(kg)
		Copolymer				
		Di-Propylene Glycol Monomethyl Ether			3	666
		Calcium Carbonate			45	9990
		Viscosifier			3	666
<b>Completion</b>	Base oil	Saraline				15922

4.4.2.4.2. Drilling Mud Quantities

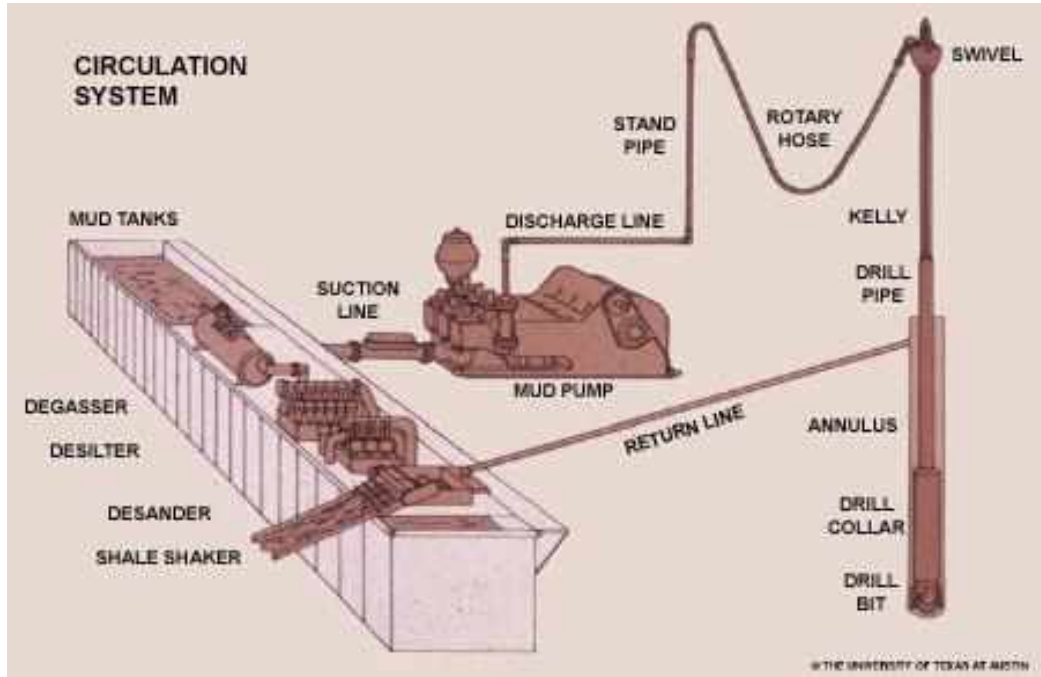
Expected volumes of mud to be used for each hole section are provided in below table.

**Tabl. 14 - Type and expected volumes of drilling mud (Source: PTTEPI, 2017)**

Section (Inch)	Casing Size (Inch)	Mud Type	Volume (m <sup>3</sup> )						
			Open hole	Previous Casing	Active	Mud losses	Total built	Return	Total transfer
Normal well									
36"x 17-1/2"	13-3/8"	WBM	78	0	60	360	498		60
12-1/4" option 1	9-5/8"	WBM	99	45	60	296	500	45	204
12-1/4" option 2	9-5/8"	SBM	99	45	60	150	354	45	204
8-1/2" – Option 1	-	WBM	62	85	60	400	650	85	250
8-1/2" – Option 2		SBM	62	85	60	128	335	85	207
Deep well									
36"x 17-1/2"	13-3/8"	WBM	78	0	60	360	498		60
12-1/4" option 1	9-5/8"	WBM	99	45	60	296	500	45	204
12-1/4" option 2	9-5/8"	SBM	99	45	60	150	354	45	204
8-1/2" – Option 1	7"	WBM	62	85	60	400	650	85	250
8-1/2" – Option 2	7"	SBM	62	85	60	128	335	85	207
6-1/8" – Option 1		WBM	29	69	60	100	258	69	158
6-1/8" – Option 2		SBM	29	69	60	60	218	69	158

4.4.2.4.3. Drilling mud circulation and treatment cuttings

Mud will be formulated in a mix tank prior to entering the drilling system. In a closed-loop system, the mud is pumped from mud holding tanks on the drilling unit down the inside of the drill string and through the drill bit. The mud carries the drill cuttings from the bit up the annulus between the drill string and the well bore to the surface and into the drilling mud handling system on the drilling unit. The drill cuttings are removed from the drilling mud by a solids control system. The mud is then reconditioned before returning to the drilling mud circulation system. The mud circulation system is showing in Fig. 12.



**Fig. 12.** Schematic of the mud circulation system (Source: Oil and Gas Well Drilling and Servicing eTool, [https://www.osha.gov/SLTC/etools/oilandgas/drilling/mud\\_system.html](https://www.osha.gov/SLTC/etools/oilandgas/drilling/mud_system.html), retrieved on August 22, 2017)

The mud circulation system includes several pieces of equipment to remove progressively smaller rock particles. General mud circulating equipment includes shale shakers, desanders, mud cleaner/silt separator, trip tankers and degasser. Each of these pieces of equipment is described in the following sections.

**A.** Shale shakers

Shale shakers are a set of vibrating mesh screens that filter out large rock particles and allow the liquid mud to fall through the screens to a tank below (see opposite figure). The screens operate at an angle so solids can move along the screen to the edge, where they fall down a chute and are discharged to the sea via a drop tube. The outlet of the drop tube is lowered approximately 15 m below the sea surface.

Smaller openings in the screen clean more solids from the whole mud, but there is a corresponding decrease in flow rate per unit area of screen. Hence, it is normal to run the screens in series with progressively finer screens (typically around 70 x 10-6 m), without discarding whole mud off the back of the shaker.



**B. Desanders and silt separator**

The mud skimmed off the shale shaker is then directed to the desanders and silt separators respectively. Desanders and silt separators function by means of a hydrocyclone. A hydrocyclone is a cone with a small hole at the narrow bottom end. The inlet pipe at the broad top of the cone is positioned so that the mud entering the cone swirls around the inside diameter. While the bottom of the cone is open, the main outlet pipe exits the top.

As mud enters the inside of the cone, it is forced to spiral down the cone by the following mud entering. As the cone gets narrower, the fluid speed has to increase to accommodate the flow rate, which results in very high centrifugal forces being applied. This means that the heavier solids particles are forced towards the cone walls.

As the mud stream reaches the bottom of the cone, pressure builds up to a point where the mud changes direction and begins spiralling back up the inside of the descending mud on the outside of the cone. Being heavier, the solids cannot change direction so readily and are ejected at the bottom of the cone, while the cleaned mud exits at the top. This process happens quickly with high flow speeds. Typically, it is around one sixth of a second between the mud entering and exiting the cone.

**C. Trip tank**

A trip tank will be provided, which by using a rotating barrel, removes the finest particles. The main role of the trip tank is to easily monitor any changes in the mud volume during drilling.

**D. Degasser**

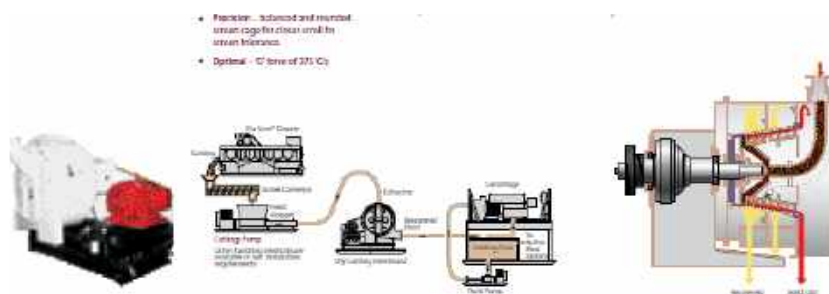
Mud will be transferred to the degasser, which removes the gas from mud by means of a vacuum. The gas is then flared.

**E. Centrifuge**

Fine solids, which could not be separated at shale shakers, are removed from the mud system using centrifuges. These can remove particle as low as 30 microns.

**F. Extractor cutting dryer**

The Extractor Cuttings Dryer can be utilized to reduce the liquid content of drill cuttings to a level that allows discharge to the environment. Discharge criteria are governed by local legislative requirements. This will typically be expressed as Oil on Cuttings (OOC) discharge criteria. The Extractor also functions insurance against whole mud losses from the shakers. It is able to capture and return valuable drilling mud to the active system should the situation arise. Typical cutting dryer is showing in the figure below.



**Fig. 13.** Typical cutting dryer

4.4.2.4.4. Muds and cuttings quantities

Drill cuttings are formation particles generated by the bit during the drilling process and vary in size from small slivers (less than 10 mm in length) to dispersed clays and ultra-fine particulates (less than 0.002 mm). The exact nature of the cuttings will depend on the geological formations drilled through.

Since the proposed project will not operate the drilling of 12 wells at the same time, it is relevant to estimate the amount of drill cuttings discharged by calculating the volume of each section (i.e., from hole interval height and hole diameter). Only measured depth is used for the calculation. It is estimated that approximately 250 m<sup>3</sup> for normal well and 383 m<sup>3</sup> for deep well of cuttings for each of the option will be generated per well.

Estimated quantities of cuttings for each well are presented in the table below.

**Tabl. 15 - Estimation of cuttings volumes for each well (Source: PTTEPI, 2017)**

Hole Interval	Hole Size (in.)	Open Hole Depth (m) <sup>(1)</sup>	Interval Length	Estimated Cuttings Volume	Quantity of Drilling Mud
Section 1 - Surface Hole	36"	72 m	72 m	160 m <sup>3</sup> (including 100% washout)	WBM 500 m <sup>3</sup>
	17-1/2"	500 m	500 m		
Section 2 - Intermediate Hole (Option 1, WBM)	12 ¼ "	1,800 m	1,300 m	120 m <sup>3</sup> (including 20% washout)	WBM 300 m <sup>3</sup>
Section 2 – Intermediate hole (Option 2, SBM)	12 ¼"	1,800 m	1,300 m	120 m <sup>3</sup> (including 20% washout)	WBM 300 m <sup>3</sup>
Section 3 – Bottom Hole – (Option 1, WBM)	8 ½ "	3,500 m	1,700 m	70 m <sup>3</sup> including 10% wash out	WBM 650 m <sup>3</sup> (recyclable 250 m <sup>3</sup> ) Mud lost on cuttings 400 m <sup>3</sup>
Section 3 – Bottom hole (Option 2, SBM)	8 ½"	3,500 m	1,700 m	70 m <sup>3</sup> Including 10% wash out	SBM 335 m <sup>3</sup> (recyclable 207 m <sup>3</sup> ) Mud lost on cuttings 128 m <sup>3</sup> OCC < 6.9%
Section 4 – Bottom Hole – (Option 1, WBM) (For deep well)	6-1/8"	5,000 m	1,500 m	33 m <sup>3</sup> including 10% wash out	WBM 218 m <sup>3</sup> (recyclable 158 m <sup>3</sup> ) Mud lost on cuttings 100 m <sup>3</sup>
Section 4 – Bottom Hole (option 2, SBM) (for deep well)	6-1/8"	5,000 m	1,500 m	33 m <sup>3</sup> including 10% wash out	SBM 218 m <sup>3</sup> (recyclable 158 m <sup>3</sup> ) Mud lost on cuttings 100 m <sup>3</sup>

1) Depth measured from platform along the wellbore's path to the final depth.

A summary of cuttings and mud management is presenting in the table below.

**Tabl. 16 - Summary of cuttings and mud management (Source: PTTEPI, 2017)**

Interval	Drilling Fluid	Management
Surface hole (36" x 17-1/2")	Seawater with bentonite and WBM	<ul style="list-style-type: none"> <li>WBM and cuttings flow from the well at the seabed level (as drilling starts at the seabed without casing installed, cuttings are therefore discharged to the seabed).</li> </ul>
Intermediate hole (12-1/4") and Bottom hole ((8-1/2" and 6-1/8") – Option 1)	WBM	<ul style="list-style-type: none"> <li>WBM and cuttings are passed through shale shaker and centrifuge.</li> <li>No direct discharge of WBM to the sea.</li> <li>Cuttings from shaker and centrifuge will be discharged overboard at depth below 15 m from sea surface.</li> </ul>
Intermediate hole (12-1/4") and Bottom hole (8-1/2" and 6-1/8") – option 2	SBM	<ul style="list-style-type: none"> <li>SBM and cuttings are passed through shale shaker centrifuge and dryer, to bring OCC below 6.9% on wet cuttings.</li> <li>Separated SBM will be stored in mud pit and recycled for the next drilling. No direct discharge to the sea.</li> <li>Cuttings from dryer will be discharged overboard at depth below 15 meter from sea surface.</li> </ul>

#### 4.4.2.5. WELL EVALUATION

##### 4.4.2.5.1. Mud logging

Evaluation of the petro-physical properties of the penetrated formations is carried out routinely during the drilling operation. Mud logging involves the examination of the drill cuttings brought to the surface by the drilling fluid. It also monitors the hydrocarbon gases that relate to changes in formation pressure, which can aid in controlling the well, and to the intersection of reservoir rocks.

##### 4.4.2.5.2. Wireline logging

Electrical logging and gamma ray measurement while drilling logging will be used for evaluating the geology encountered down the hole.

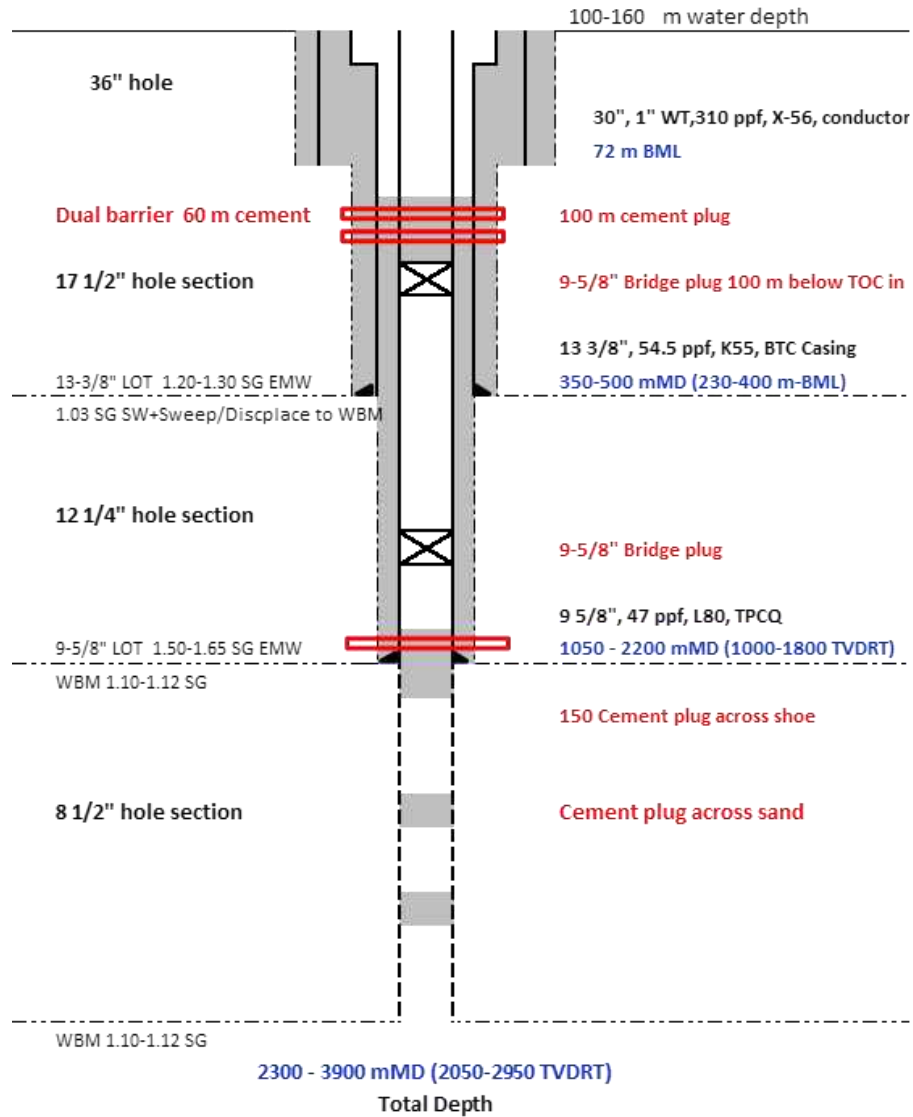
A radioactive source will be required for the gamma ray measurements, which will be recovered at the end of the logging. The radioactive devices will be transported from the contractor's base to a drilling unit in specially designed secured (locked) storage containers. The tools are inventoried upon arrival and tested for leaks. A detailed log is kept of any access to the storage container and tools.

Drilling units have special storage locations designated for radioactive containers and only certified logging engineers are allowed to handle the radioactive devices. They also wear personal monitoring devices to measure any unusual exposure. The equipment is handled as little as possible by the engineers and is immediately returned to the storage containers upon completion of the logging run.

#### 4.4.3. Well Plug and Abandonment / Demobilization of the Equipment

##### 4.4.3.1. WELL PLUG AND ABANDONMENT PHASE

The well will be abandoned at the end of the project. Well abandonment for the project will follow PTTEPI internal procedures in line with international standards for O&G industry. In general, it consists in placing mechanical and cement plugs at strategic depths in the wellbore to separate and to permanently seal off various zones (see Fig. 14). This process isolates these zones from each other and prevents the wellbore from releasing any fluids (including oil, natural gas and brine). No artefact will be left on the seabed.



**Fig. 14.** Schematic of typical P&A process

#### 4.4.3.2. DEMOBILIZATION OF THE EQUIPMENT

At the end of the drilling program, the equipment will be rig down and rig will move out and be towed using two towing vessels to the next project's proposed drilling positions.

## 4.5. FACILITIES AND UTILITIES

### 4.5.1. List of Heavy Machineries on Rig

Oil field drilling operation use different machines based on the type of the project, the presented table below shows general required heavy machineries lists which will be used in proposed project.

**Tabl. 17 - List of Heavy Machineries on Rig (Source: PTTEPI)**

Type of Machinery	Type of Machinery
Port crane To load and off-load materials and supplies form vessels. NOV Model: 96DNS180AE-2.5 Serial: H-DHM11873-67-02 Year Build 10/03/02	Riser Gantry Crane The main function of the riser gantry crane is to move and place the riser from its storage position to well centre. Crane Man Serial: C1063/A410574
Stbd Crane NOV Model: 96DNS180AE-2.5 Serial: H-DHM11873-66-02 Year Build 10/03/02	Sack room forklift Caterpillar Model: EP30CA1 Serial: 251AC2363 Year Build 2017
Knuckle Boom Crane NOV Model: 13708-0104 Serial: T-3708-C1891P-G0001 Year Build 2003	Subsea Area Caterpillar Model: EP25CA1 Serial: 257C01738

### 4.5.2. Accommodation

During drilling activities, accommodation for drilling workers will be provided on the drilling rig. Workers working on support vessels will be accommodated in the allocated accommodation on the vessels.

### 4.5.3. Water Supply and Usage

The project's activities in each phase utilize water for various purposes as summarized in the table below.

**Tabl. 18 - Type of water and volume of water use in the project activities (Source: PTTEPI, 2017)**

Project Activities	Type of Potable Water	Water Source	Quantity of Potable Water/Day (m <sup>3</sup> )
Production well drilling, well logging and production well preparation	Potable water for staff on drilling rig	Bottled water/ water producing unit on drilling rig	31.2
	Daily use water for staff on vessels	Water storage tanks in operational vessels	12.4

The water supply system on the drilling unit typically comprises an on-board water maker unit with a capacity equal to 200% of the daily consumption. The volume generated is in the range of 43.6 m<sup>3</sup>/day. Water is pumped from the sea, filtered, desalinated and sterilized.



The water based drilling fluids will be prepared with seawater.

#### **4.5.4. Power Supply**

Power to the rig for supporting drilling activities will be supplied by 6 generators driven by diesel engines. One spare generator will be used in case of an emergency situation or during service or repair of one of the main generators. Estimated fuel consumption, based on previous projects using rigs with similar power requirements, is 35 m<sup>3</sup>/day. Since the duration for drilling one well is approximately 40 days and the estimated fuel consumption for maximum 45 days is 1575 m<sup>3</sup>. The full storage capacity (100%) of fuel on rig is 12,564 BBLs or 1997.53 m<sup>3</sup>, and 80% of storage capacity (according to rig policy) is 10,006 BBLs or 1590.83 m<sup>3</sup>.

#### **4.5.5. Transportation**

Transportation of materials and equipment, chemicals and waste from drilling rig to the Onshore Support Base will be conducted mainly by material support vessels and barges. A helicopter will be used to transfer staff, with capacity of 12 staff per flight. Staff transfer to the project area by helicopter takes 1 hour 10 minutes.

#### **4.5.6. Primary Health Care Facility**

Since the project operation is based in offshore and the possibility of health management is mainly focus for employees. In some locations it may be sufficient to appoint a local doctor as a general practitioner to provide for the workforce. In other locations it may be necessary to develop a company clinic, which could include bringing in expatriate medical staff to provide care or work alongside local medical staff. The decision whether a company clinic is necessary depending on the standard of local health care and the ability to respond to medical emergency as per company's requirement.

#### **4.5.7. Well Control and Safety Equipment**

The typical facilities for well control and safety equipment on-board the drilling rig include the following:

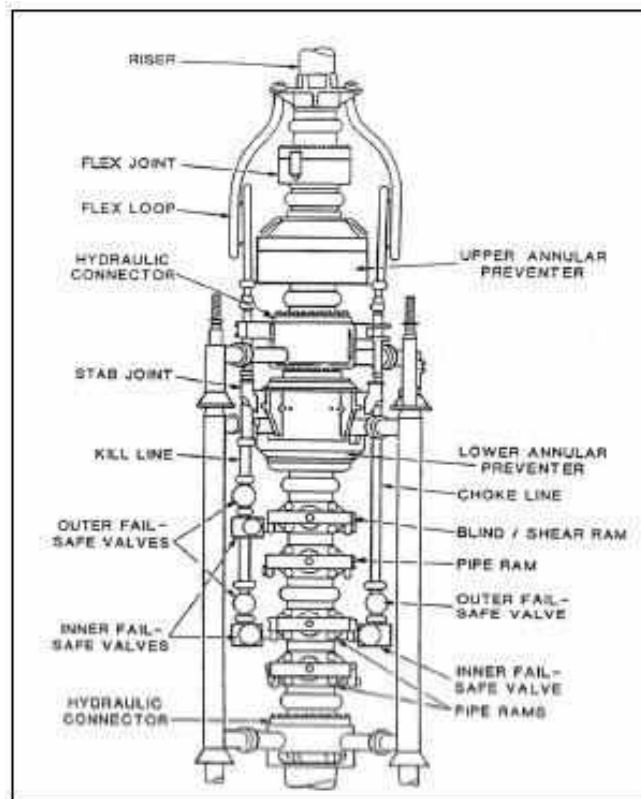
- gas detection system with sensors for hydrogen sulphide and combustible gas, a general warning system including navigational lights and horns;
- continuous monitoring of the well-bore pressures and fluids by the drilling and mud logging crews;
- regular monitoring of the specific gravity of the mud;
- alarms to warn the drilling and mud logging crews of any fluid level changes in the pits, indicating well kick;
- use of blow-out preventers to protect against excess pressures imposed by the formation that may damage drilling equipment and cause unrestrained flow of crude oil from the reservoir.;
- flotation devices such as lifeboats, life rafts, buoys and life vests.

The drilling rig is equipped with the necessary equipment to allow emergency disconnection for example during extreme weather conditions or in the case of mechanical/electrical problems on the rig resulting in drift off.

Although the probability of a well blow-out is extremely low, it nonetheless provides the greatest environmental concern during drilling operations. The primary safeguard to prevent a blow-out is to control the pore pressure by hydrostatic means, thereby maintaining a column of fluid to overbalance the formation pressure. This would include ensuring that the correct fluid density is used, operating in a prudent manner to avoid under balancing the well and designing the well to take all the risk (both mechanical and operational) into consideration. This approach is supported by correctly monitoring the well by such means as pit level

indicators, return mud-flow indicators, pump pressures, shaker returns and gas detection. Geologically the well would also be monitored for signs of abnormal (high or low) pressure to correctly identify any variations from the projected pressures and hole conditions.

The likelihood of a blow-out is further minimized by employing a blow-out preventer, which is a secondary control system. A typical BOP stack is shown in Fig. 15. When installed on top of the wellbore, a BOP is designed to close inside the well if flow from the wellbore is detected. The BOP allows the influx to be safely circulated out of the well in order to regain primary well control.



**Fig. 15.** Schematic of a typical subsea BOP stack

#### 4.5.7.1. POLLUTION PREVENTION EQUIPMENT

A typical drilling unit comprises the following pollution prevention equipment:

- Sewage treatment systems;
- One air operated garbage compaction system;
- Garbage grinders;
- One skimmer tank typically of 25 bbls;
- One oily water separator typically of 5 m<sup>3</sup>/h.

Apart from the above equipment, several devices will be available on the rig or on its support vessels for emergency interventions (e.g. oil spill, blowout, etc.). The following means of intervention are anticipated:

- Fire hydrant and water cannon;
- IMO/SOPEP spill kits;
- Containment floating boom and trawling floating boom;

- Sprayer boom associated with a stock of dispersant agent;
- Oleophilic skimming or mechanical skimming.

An “On-board Oil Pollution Emergency Plan” and an Emergency Response Plan will be applied during the appraisal drilling campaign.

#### **4.5.7.2. HAZARDOUS MATERIALS**

Hazardous materials comprise the mud and cementing chemicals, which are typically stored in tote tanks in a dedicated closed area. Hazardous materials will not be discharged into the environment.

#### **4.5.7.3. BALLAST SYSTEM**

The drilling unit shall be equipped with fully segregated ballast tanks that will be filled and emptied with seawater as necessary to maintain trim. This system avoids hydrocarbons pollution of ballast water.

In the context of offshore oil & gas operations, ballast water is of great importance for the safety of both crew and ship. However, there are globally environmental issues related to ballast water. This is because in shipping, ballast water primarily consists of water collected from the point of take-off which contains thousands of living species (and to a lesser extent sediment). The species carried in ballast water may be invasive and are particularly responsible for a number of very destructive incidents towards marine biodiversity.

These invasive species are not indigenous and so could be described as alien, exotic species which implies that they are members of a population that enters an ecosystem other than their historic or native range. Such species have the potential to cause direct environmental consequences to the biota of the recipient environment with its concomitant socio-economic consequences. Most of them are opportunistic species.

Because the Andaman Sea is an important biodiversity area (see 5.3 - Biological Environment), contamination risk with ballast waters is significant. Therefore, ballast waters are usually treated before being released. Treatment options are: UV radiation or adding chlorine.

The International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention) was adopted on 13 February 2004. It seeks to prevent the spread of harmful aquatic organisms from one region to another by establishing Standards and procedures for the control and management of ships' ballast water and sediments. All ships engaged on international voyages are required to manage their ballast water and sediment according to certain rules, in accordance with their own ballast water management plan. All vessels must also carry a ballast water register and an international ballast water certificate.

The provisions for each support vessel include the following:

- Vessels must have on-board and implement an approved ballast water management plan.
- Vessels must have a Ballast Water Register
- Where the ship is unable to renew the ballast water in the manner described in the convention, such ballast renewal should be carried out as far as possible from the nearest land and, in any event, at a distance of at least 50 nautical miles from the nearest land and at least 200 meters from the bottom.

## **4.6. IMPLEMENTATION COSTS**

Since the costs for implementation of mitigation measures are therefore not possible to individually specify, PTTEPI has estimated amount of over 1 million USD per year for all mitigation measures. And anticipated budget for implementing Environmental management Plan is 1,050,000 USD for total.

The estimated costs for implementation of the monitoring program are 50,000 USD.

## 4.7. INVENTORY OF WASTE DISCHARGES AND EMISSIONS

The following section is a brief description of the types of emissions and discharges that normally result from a typical well drilling operation.

- Normal emissions and discharges from the drilling unit are emissions to air, discharges to sea and wastes returning to shore;
- Abnormal discharges such as spills or losses of oil and/or chemicals are possible, but unlikely. In the event of an abnormal discharge, PTTEP's Oil Spill Response Plan would be implemented.

### 4.7.1. Atmospheric Emissions

Atmospheric emissions from a drilling campaign are primarily due to routine operations of the drilling program.

Estimations of atmospheric emissions were undertaken by multiplying diesel consumption and emission factors for relevant atmospheric components. Since the duration of the whole campaign is scheduled to last approximately 540 days for twelve wells, we estimated 40 days for each one of the 12 wells.

Estimations of the diesel consumption for supply boat and the drilling unit are based on the following:

- **15 m<sup>3</sup>/day/material supply vessel** (2 supply boats are expected);
- **Drillship's consumption: 40 m<sup>3</sup>/day;**

The emission factors (EM) are specified by the International Organization of Oil & Gas Producer (OGP) to express the emissions for each gas in tonnes of equivalent CO<sub>2</sub><sup>5</sup>. The greenhouse gas production was then calculated as the sum of CO<sub>2</sub> and NO<sub>2</sub>. A summary table of emissions calculations for each gas is presented in the table below.

**Tabl. 19 - Air emission evaluation estimated for one well**

Gas produced	OGP Emission Factor (t/t)	Estimated emissions (tonnes of equivalent CO <sub>2</sub> )
		Main vessel
<b>Diesel engine combustion (drilling rig, vessels and helicopter)</b>		
CO <sub>2</sub>	3.2	7615
CO	0.0021	5
NO <sub>x</sub>	0.0094	22
N <sub>2</sub> O	0.00022	0.5
SO <sub>2</sub>	0.008	19
CH <sub>4</sub>	0.00008	0.2
VOC	0.0019	4.5
<b>TOTAL emission for one well</b>		
/	/	<b>7666.2</b>
<b>TOTAL emissions for 12 wells</b>		
/	/	<b>91,994.4</b>

The greenhouse gases (GHG) emissions correspond to the sum of CO<sub>2</sub>, N<sub>2</sub>O and CH<sub>4</sub> emission each multiplied by the corresponding Global Warming Potential factor GHG (eq. CO<sub>2</sub>) = CO<sub>2</sub> + 298 \* N<sub>2</sub>O + 25 \* CH<sub>4</sub>.

<sup>5</sup> Compendium of Greenhouse Gas Emissions Estimation Methodologies for the Oil and Gas Industry (OGP Guidelines Petroleum industry guidelines for reporting greenhouse gas emissions (2nd Edition, May 2011))

Therefore, it is expected total emission of **7,769 ktms of CO<sub>2</sub> equivalent for 40 days to drill one well**. 93,228 ktms of CO<sub>2</sub> equivalent is estimated for the whole period of the 12 drilled wells (540 days).

Additional air emissions will be generated by positioning and operating the supply boats and during refuelling operations. Levels of pollution from these sources are expected to be insignificant.

## **4.7.2. Drilling Discharges to the Sea**

### **4.7.2.1. DRILLING WASTE**

#### 4.7.2.1.1. Drilling cuttings

Amount of cuttings generated from wells are estimated in Tabl. 15 - Estimation of cuttings volumes for each well (Source: PTTEPI, 2017). Per one well, a total of 350 m<sup>3</sup> for normal well and 383 m<sup>3</sup> for deep well drilling cuttings are expected to be generated from the appraisal drilling program, which will be eventually discharged at sea after being treated overboard if NEQG standards and IFC standards are met (see Table: Main Myanmar Legislation applicable to The Project). Drilling cuttings management is described in Table: Summary of Mud and Cuttings Management.

#### 4.7.2.1.2. Drilling mud

Mud will be removed from the cuttings to the extent possible. As the bottom section of the drilling system that utilizes SBM / WBM is within a closed-loop system, SBM/WBM mud loss would be limited to only two factors: 1) lost into formation and 2) lost on cuttings. The amount of mud lost into formation cannot be determined until it actually occurs, because it is an operational uncertainty. As soon as mud loss into formation occurs, engineers will pump the pre-mixed Loss Circulation Materials (LCM) into the well to seal the cracks and continue the drilling operation. Response to loss into formation is usually very quick. Immediately pump rates are reduced and drilling of new formation is completely stopped until major losses are cured. Minor seepage losses are sometimes tolerated and controlled drilling is exercised. Mud that is lost into formation will not cause harm to the environment and will not be returned. Oil on cutting would be controlled to below 6.9% using Cutting dryer.

### **4.7.2.2. CEMENT AND CEMENT ADDITIVES**

Although small volumes of spacer and of excess cement slurry are pumped to allow for overgauge hole volumes, the majority of the cement used for securing the casing remains in the well. Spacer and excess lead slurry from the cementing of the first casing string (36") will be discharged close to the seabed. This cement does not settle but slowly dissolves into seawater.

## **4.7.3. Wastewater**

Wastewaters are generally associated with domestic and sanitary wastewater (black and grey water) and oil contaminated wastewater (bilge and deck water). However, modern support vessels and the rig have well optimized wastewater management, with plenty of recycling, use of vacuum systems etc. Additionally, grey water is often used for flushing toilets after a small treatment. These water streams will be managed by the water storage and treatment devices on-board:

- Domestic and sanitary wastewater will be generated as a result of the human presence on the rig and support vessels. The maximum amount of black and grey water generated per day during the project in each phase can be estimated from the number of operational staff, and the rate of produced black water at 80 l/person/day<sup>6</sup> and grey water at 160 l/person/day (calculated from 80% of water for use

<sup>6</sup> Sewage generation rate is 0.08 m<sup>3</sup>/person/day.

at 200 l/person/day<sup>7</sup>). The estimated total generation for one well is of ~0.64 m<sup>3</sup>/day of black water and 1.28 m<sup>3</sup> of grey water. In terms of the whole campaign, such as 540 days for 12 wells, the estimated total generation is approximately 138.24 m<sup>3</sup>/day of black water and 276.48 m<sup>3</sup> of grey water.

- The bilge water means accumulated water in the ship holds and containing infiltration water, oil residues or any other product that would have been stored. Based on 0.23 m<sup>3</sup>/d typical output (0.15 m<sup>3</sup>/d typical values for the rig and 0.08 m<sup>3</sup>/d typical values for each vessel), total volume of bilge water for the drilling of one well during 40 days is estimated around 9.6 m<sup>3</sup>. 2,075.76 m<sup>3</sup> of bilge waters are estimated for the drilling of 12 wells during 540 days.
- The deck water comprises rainwater and deck washing water of the vessel. The run-off water is collected by an open drain system. Considering a typical drilling rig and typical vessels' deck dimensions (Rig 50x100 and vessel 2x10x30, sum: 5 600 m<sup>2</sup>) as well as the typical annual rainfall values during the rainy season (from May to October) in Myanmar (~100 mm/month in average), a rough estimation of the total deck water to be produced during the drilling campaign is 620 m<sup>3</sup>.
- Ballast water is stored in specially designated ballast tanks and cannot be mixed with any other contaminants. No discharge of ballast water is expected to occur during the project, the rig will normally arrive on-site and leave the site de-ballasted and ballast supply vessels will perform rotations within the same marine eco-zone.
- As part of routine operation and closing operations, the subsea BOP stack elements would vent hydraulic fluid onto the ocean at the seafloor. It is anticipated that approximately 20 m<sup>3</sup> of less toxic hydraulic fluid would be vented during the drilling of a well.

In order to minimize the waste associated with oil in bilge and deck water, no water will be discharged without prior on-board treatment. These wastewater releases comply with MARPOL. The table below summarizes the deck and bilge water production assumptions.

**Tabl. 20 - Estimated wastewater production from projected activities (rounded)**

Waste stream	Quantity (m <sup>3</sup> )		Assumption for estimation
	1 well in 40 days	12 wells in 540 days	
Black water	0.64	138.24	Based on the number of operational staff and the rate of produced sewage at 80 l/person/day and grey water at 160 l/person/day (calculated from 80% of water for use at 200 l/person/day).
Grey water	1.28	276.48	
Deck water	620		Based on typical drilling rig and typical vessels' deck dimension (Rig: 50x100 and vessel 2x10x30, sum: 5600 m <sup>2</sup> ), and typical annual rainfall values during the rainy season (May to October) in Myanmar (~100 mm/month in average).
Bilge water	9.6	2,075.76	Based on 0.23 m <sup>3</sup> /d typical output.

#### 4.7.4. Solid Waste

Ship activities produce waste which can be different:

- A variety of non-hazardous solid waste will be generated such as glass, paper, plastic and wood. Much of this is associated with galley and food services operations and with operational supplies such as shipping pallets, containers and protective coverings. No solid waste is intentionally disposed of into the marine environment as per MARPOL specification.

<sup>7</sup> Domestic polluted water generation rate is 80% of the amount of water use (200 l) or equal to 0.16 m<sup>3</sup>/person/day.

- Food wastes will be milled (<25 mm diameter) and discharged into the sea more than 12 miles offshore as per practices of MARPOL Convention. All non-food wastes will be collected for compaction and transport to the Thaketa Support Base and delivered to either MOGE or Yangon City Development Committee for final disposal. No incinerator is forecasted on-board 100% of garbage collection recovery will be treated onshore.

Typical hazardous wastes include drilling muds and cuttings, cementing wastes, well completion, excess drilling chemicals and containers, empty chemical drums, used lubricants, filters, paints, solvents, contaminated soil, batteries, medical waste, oily sludge, absorbents from spill clean-up. The estimated quantities of non-hazardous and hazardous wastes generated during the Block M9 appraisal activities are presented in the table below.

**Tabl. 21 - Estimated waste production from projected activities (Source: PTTEPI, 2018)**

Waste Type	Quantity of generated waste per 1 drilling well (kg)
1. General waste	2,526
2. Non-hazardous waste	184
3. Recycled waste	5 containers
4. Chemical container	70
5. Hazardous waste	470
<b>Total</b>	<b>3,240</b>
<b>Total estimated quantity of waste generated from 12 wells is 38,880 kg</b>	

Solid and liquid wastes will be managed in accordance with the provisions of the waste management systems and procedures outlines in the Environmental Management Plan (EMP) of the rig operator. In particular, the waste streams will be categorized on-board at source for the purpose of segregation and temporary storage prior to shipping to shore by the barge for treatment or disposal in an approved facility.

#### 4.7.5. Odour, Noise and Light

The potential for venting and fugitive releases exists; however, volumes will be small and unlikely to raise an odour problem. Ambient noise impacts may occur during drilling activities, however, these will be short term and at a small scale. A key factor for noise impact is the remote location of the project, which is located 260 km offshore away from people and any environmentally sensitive areas. Added to this, potential impact from extraneous light is expected to be minor, with the main sources arising from lighting and the flare (which will be performed in case of success and during limited time only).

#### 4.7.6. Accidental Releases

Accidental releases such as fuel leaks or blowout cases are possible but with low probability of occurrence. The use of blowout preventer is a systematic process to manage the potential accidents which could occur during the project operation. Project will operate under a number of specific contingency plans for responding to specific emergency events, including potential spill or well control events and so forth. Historical data indicates that among the accidental release, the probability of a blowout incident is extremely low and the spills are mostly caused by equipment failure and followed by the weakness of monitoring. Extreme weather events also act a substantial contributing role, accounting for nearly 25% of all spill events. Additionally, the environmental management plan for the accidental release is presented in Chapter 8 of this EIA.

#### 4.7.7. Project Emissions Target

The following table synthesizes project emission targets mentioned in the previous chapters (see section 3.5).

**Tabl. 22 - Project emission targets**

Themes	Values selected for the project
<b>Liquid discharges (all operations)</b>	
Drainage and bilge water (limit of effluents)	< 15 ppm for bilge water and engine room (Annex I of MARPOL 73/78) <sup>8</sup>
Cooling water (Temperature)	The effluent should result in a temperature increase of no more than 3°C at edge of the zone, where initial mixing and dilution take place; where the zone is not defined, use 100 meters from point of discharge.
Wastewaters All vessels	Comply with MARPOL 73/78
<b>Cuttings</b>	
Cuttings of the sections using NABM (Non-Aqueous Base Mud)	<p>Comply with National Environmental Quality (Emission) Guideline.</p> <ul style="list-style-type: none"> <li>- Non-Aqueous drilling fluids: re-inject or ship-to-shore, no discharge.</li> <li>- Drilled cuttings, re-inject or ship-to-shore; no discharge except:               <ul style="list-style-type: none"> <li>o Oil concentration lower than 1% by weight on dry cuttings;</li> <li>o Mercury maximum 1 mg/kg dry weight in stock barite;</li> <li>o Cadmium maximum 3 mg/kg dry weight in stock barite;</li> <li>o Discharge via a caisson at least 15 metres below sea surface.</li> </ul> </li> </ul> <p><u>2015 change</u></p> <ul style="list-style-type: none"> <li>- Non-Aqueous drilling fluid: re-inject or ship to shore, no discharge.</li> <li>- Drilled cuttings: Reinject or ship-to-shore, no discharge to sea except:               <ul style="list-style-type: none"> <li>o Facilities located beyond 3 miles (4.8 km) from shore;</li> <li>o For new facilities: Organic Phase Drilling Fluid a, concentration lower than 1% by weight on dry cuttings;</li> <li>o For existing facilities c: Use of Group III non-aqueous base fluids and treatment in cutting dryers. Maximum residual Non Aqueous Phase Drilling Fluid d (NAF) 6.9% (C16-C18 internal olefins) or 9.4% (C12-C14 ester or C8 esters) on wet cuttings;</li> </ul> </li> </ul> <p>Discharge via a caisson (at least 15 m below surface is recommended whenever applicable; in any case, a good dispersion of the solids on the seabed should be demonstrated).</p>

<sup>8</sup> European Maritime Safety Agency. 01/2017. The Management of Ship-Generated Waste On-board Ships. EMSA/OP/02/2016



Themes	Values selected for the project
<b>Cuttings</b>	
Cuttings of the sections using WBM (Water Base Mud)	<ul style="list-style-type: none"> <li>- Water-based drilling fluid, re-inject or ship-to- shore; no discharge to sea</li> <li>- Water-based drilling fluids and cuttings, re-inject or ship-to-shore; no discharge to sea except: <ul style="list-style-type: none"> <li>o Mercury 1 mg/kg dry weight in stock barite;</li> <li>o Cadmium 3 mg/kg dry weight in stock barite;</li> <li>o Maximum chloride concentration must be less than four time's ambient concentration of fresh or brackish receiving water;</li> <li>o Discharge via a caisson at least 15 meters below sea surface</li> </ul> </li> </ul> <p><u>2015 change</u></p> <ul style="list-style-type: none"> <li>- WBDF: Reinject or ship-to-shore, no discharge to sea except: <ul style="list-style-type: none"> <li>o In compliance with 96 hr. LC-50 of Suspended Particulate Phase (SPP)-3% vol. toxicity test first for drilling fluids or alternatively testing based on standard toxicity assessment species (preferably site-specific species);</li> </ul> </li> <li>- WBDF cuttings: Reinject or ship-to-shore, no discharge to sea except: <ul style="list-style-type: none"> <li>o Facilities located beyond 3 miles (4.8 km) from shore;</li> </ul> </li> <li>- Discharge via a caisson (at least 15 m below sea surface is recommended whenever applicable;</li> <li>- in any case, a good dispersion of the solids on the seabed should be demonstrated)</li> </ul>
Completion and well work-over fluids	<ul style="list-style-type: none"> <li>- Ship-to-shore or re-inject, no discharge to sea except: <ul style="list-style-type: none"> <li>o Maximum one day oil and grease discharge should not exceed 42 mg/l; 30 day average should not exceed 29 mg/l</li> <li>o Neutralize to attain a pH of 5f or more</li> </ul> </li> </ul> <p><u>2015 Change</u></p> <ul style="list-style-type: none"> <li>- Oil and grease content does not exceed 42 mg/L daily maximum; 29 mg/L monthly average</li> </ul>
<b>Waste management</b>	
Food waste and hazardous waste	Grinding of food waste (diameter < 25 mm) before being discharged at sea. Other wastes are sent back onshore for appropriate treatment. (Annex V of MARPOL 73/78)
Sewage	Compliance with MARPOL 73/78 (in nearshore waters, carefully select discharge location based on environmental sensitivities and assimilative capacity of receiving waters)

## **4.8. DESCRIPTION OF THE ALTERNATIVE SELECTION**

### **4.8.1. Project Selection Criteria**

PTTEPI has gained extensive experience worldwide in developing drilling programs for operations in environmentally sensitive environments and in operationally challenging geologic basins.

Overall, the drilling unit, cuttings handling and mud program options selected are considered to represent the optimal design solution with regard to the combination of environmental, commercial, and operational concerns and give PTTEPI and its partners the best chance of achieving the exploration program in a safe and environmentally sound manner.

The selected options minimize the impact of exploratory drilling within:

- The technical constraints of the drilling program, and
- Health, safety and environmental aspects of the alternatives available.

### **4.8.2. « No project » Alternative**

The alternative of no project is commonly considered in the analysis of alternatives to question the potential impacts and benefits of the project at a fundamental level. In the case of PTTEPI's project, the 'no project alternative' fits in loss of opportunity for two main reasons:

- The appraisal drilling is a necessary precursor to production drilling that would occur in the event of a commercial find of hydrocarbon reserves. The project occurs in the field of Zawtika field development and aims at extending the field production. Putting aside the interests of the project promoter, it may be considered that discovery of new petroleum reserves in Myanmar territory could be of benefit to the country economy and development. Therefore establishing the existence and degree of such potential is an important first step and the decision as to whether to exploit such reserves would be made at a later stage.
- As mentioned in the analysis of impacts under normal operations, the potential impacts from the project on the natural and human environments can be considered 'acceptable'. The main potential impacts of concern are related to interference with shipping and a highly unlikely accidental event causing the release of hydrocarbons to the marine environment.

### **4.8.3. Alternative Well Locations**

The location of the wells to be drilled depends on the geology and requirements for information on the targets. The well locations will be checked against any available bathymetry data collected during the seismic and marine baseline surveys to ensure that no noteworthy feature of importance is impacted; should this be the case, then the well locations will be slightly readjusted to avoid them.

### **4.8.4. Location of the Logistics Base**

There will be two supply bases for the project. The Thaketa Supply Base (TKA) in Myanmar and Ranong Supply Base (RSB) in Ranong Province, Thailand.

### **4.8.5. Selection of Drilling Unit**

There are many different types of offshore drilling facilities from which the operations take place. And they also have two structure types which are fixed structure type and floating structure type. Drilling rigs are

selected depends on the specific requirements of each drill site whereas the following drilling facilities are used for offshore operations: 1) Fixed platforms, 2) Compliant towers, 3) Semi-submersible platform, 4) Jack-up drilling rigs, 5) Drillship, 6) Floating production systems, 7) Tension-leg platform, 8) Gravity-based structure, 9) Spar platforms, 10) Normally unmanned installations (NUI) and 11) Conductor support systems.

The drilling operations will be contracted to a specialist drilling contractor who will provide and operate the drilling rig, which will be a semi-submersible drilling unit. The choice of the type of rig is constrained by water depth.

The seaworthiness certification, as well as PTTEPI Safety, Security, Health and Environment (SSHE) standards require that safety precautions will be taken to minimize the possibility of an accident during drilling operations. Availability of the rig within the wider region also comes into account, because rigs are difficult to move from one sea region to another.

#### **4.8.6. Choice of Drilling Fluid**

Different types of drilling fluids are used in various drilling operations. The numerous types of fluid are generally described into the following categories: 1) Water-based fluids, 2) Drill-in fluids, 3) Oil-based fluids, 4) Synthetic-based drilling fluids, 5) All-oil fluids, 6) Pneumatic-drilling fluids and 7) Specialty products.

The more environmentally friendly WBM is used where feasible; the synthetic based mud (SBM) is only used where essential – note that SBM tends to be more expensive, so there is an economic incentive to use the environmentally preferable option. For practical reasons, only one type of drilling fluid will be used for each section with a similar diameter.

When drilling the surface and intermediate sections of the well (first 3 casings, down to ca. 1000-2000 m below the seabed), rock pressure is not yet very high: it is then possible to use drilling fluids that have a relatively low lubrication potential. For this section, a water-based mud (WBM) is preferred due to lower toxicity; this is particularly important for the initial drilling, which is performed without a riser and therefore involves releasing some mud and cuttings on the seabed.

As the drilling reaches greater depths, rock pressure and temperatures increase. The performance of WBM then becomes insufficient: a non-aqueous drilling fluid will probably be required in order to provide sufficient lubrication for the smaller diameter deep sections, i.e. about one third to two thirds of the drilling depths, but these depths have the smallest diameter and thus require less mud. To minimize potential impacts, the mud formulation is synthetic based mud (SBM), which uses synthetic oil with a low toxicity as the base component.

Finally, the additives in the formulation are chosen insofar as possible so as to be relatively harmless for the environment, e.g. the biocide for WBM and completion fluid is triethanol, no organohalogen are used. The SBM will use the components indicated in the following table.

Tabl. 23 - Components of the SBM

Chemical	Function	Hazard information
Synthetic drilling base fluid	Synthetic drilling base fluid	Not regarded as dangerous for the environment; readily biodegradable; harmful if swallowed.
Water	Internal water	Not regarded as a health hazard; Not regarded as dangerous for the environment.
Barium Sulphate	Weighting agent	Inhaled quartz or crystobalite causes cancer in humans; Nuisance dust; Not regarded as dangerous for the environment.
Calcium Chloride	Shale stabilizer	May cause irritation to the respiratory system; May cause discomfort if swallowed; Dust has an irritating effect on moist skin; Not regarded as dangerous for the environment.
Kerosine	Emulsifier	May cause irritation to the respiratory system; May cause gastric distress, nausea and vomiting if ingested; May be irritating to the skin; May be irritating to the eyes; Not regarded as dangerous for the environment.
Kerosine	Emulsifier	Gas or vapour in high concentration may irritate respiratory system; Gastrointestinal symptoms; May cause irritation after repeated contact; Irritating to eyes.
Gilsonite	Fluid loss reducer	May cause irritation to the respiratory system; May cause discomfort if swallowed; May be irritating to the skin; May be irritating to the eyes; Not regarded as dangerous for the environment.
Calcium Hydroxide	pH modifier	Corrosive; Irritant (inhalation, eyes, skin); May have a harmful effect on aquatic organisms due to pH shift.
Hectorite clay	Visosifier	May cause irritation to the respiratory system; May cause discomfort if swallowed; May be irritating to the skin; May be irritating to the eyes; Not regarded as dangerous for the environment.
Organophilic clay	Visosifier	May cause irritation to the respiratory system; May cause discomfort if swallowed; May be irritating to the skin; May be irritating to the eyes; Not regarded as dangerous for the environment.
Methyl Styrene/Acrylate Copolymer	Fluid loss reducer	May cause irritation to the respiratory system; May cause discomfort if swallowed; May be irritating to the skin; May be irritating to the eyes; Not regarded as dangerous for the environment.
Poly Glycol	Enhances the rate of penetration/anti-acretion	May cause irritation to the respiratory system; May cause discomfort if swallowed; May be irritating to the skin; May be irritating to the eyes; Not regarded as dangerous for the environment

The SBM will normally be prepared on board the drilling rig. However, if mud has to be carried over from one drilling campaign to another, then issues relating to the transportation of the mud will be addressed in the EIA.

#### 4.8.7. Cuttings and Drilling Fluids Handling

Although it is preferable to use WBM and SBM shall be considered for contingency case, the dispersion study (see chapter 6.5 for a synthesis of results from the modelling report who's the complete report is provided in the **Error! Reference source not found.** of the present document) will confirm the choice of the drilling fluids.

PTTEPI' strategy for handling the cuttings from the exploration drilling considers the following factors:

- The Myanmar regulations;
- PTTEPI's worldwide drilling experience;
- International petroleum industry practice;
- The technical capabilities of the drilling unit;
- The availability of suitable local sites for onshore disposal or treatment of waste materials, and
- Evaluation of the costs and benefits for offshore/onshore disposal.

The options that are theoretically possible for the disposal of drill cuttings include:

- Offshore discharge;
- Re-injection.

The option of re-injection is not technically practical or economically feasible in connection with appraisal wells drilled from mobile units. A dedicated re-injection well would need to be drilled for cuttings re-injection, as the drilling unit affords too little space to store cuttings and to accommodate clarification equipment required to turn the cuttings into a re-injectable medium. This option is mainly useful for multiple wells in a production context.

In case of technical problem, a second option would be ship to shore transfer of the cuttings. This creates its own impacts due to further marine traffic and requirements for the disposal of the cuttings onshore.

Considering all factors, the offshore discharge of cuttings has been identified as being the preferred option for the Block M9 exploration drillings. Modelling of the dispersal of cuttings will be performed to check that related impacts are acceptable, and a comparative analysis of the various cutting disposal methods will be included in the EIA.

Environmental assessments have found that the impacts from the discharge of sea water based mud to be localized and limited in duration. PTTEPI plans to use water based mud in the first well sections.

For technical reasons, SBM has to be used; nevertheless, PTTEPI will utilize low toxicity, biodegradable and non-persistent Synthetic Based Mud (SBM). PTTEPI also plans to use a cuttings treatment unit to reduce to recover and reuse of mud.

PTTEPI considers the offshore discharge of cuttings generated from drilling is the preferred option for the Block M9, based on overall environmental, safety, technical and logistic considerations.

#### 4.8.8. Choice of Cement Additives

PTTEPI is planning another drilling project on the adjacent block, M11, and it is assumed the company will use the same liquid cement chemicals used on M11 for M9. The composition and volume of liquid cement chemicals are listed as follow:

**Tabl. 24 - Composition and volume of Cement Chemicals used for M9**

Section (inch)	Casing size (inch)	Cement chemical	Function	Volume (m <sup>3</sup> /well)
<b>Normal well</b>				
36"x 17-1/2"	13-3/8"	PC-X60L	Defoamer	0.4
		PC-A97L	Accelerator	4
		PC-P81L	Extender	5
12-1/4"	9-5/8"	PC-X60L	Defoamer	0.1
		PC-J62L	Anti-settling agent	0.5
		PC-G712L	Fluid loss agent	3
		PC-P81L	Extender	2.5
		PC-H21L	Retarder	0.15
			Gas Block Additive	1
8-1/2" Completion	3-1/2"	PC-X60L	Defoamer	0.12
		PC-G712L	Fluid loss agent	2.8
		PC-J62L	Anti settling agent	0.5
		PC-P81L	Extender	0.7
		PC-H21L	Retarder	0.3
			Gas Block Additive	1
			PC-H21L	Retarder
<b>Deep Well</b>				
36"x 17-1/2"	13-3/8"	PC-X60L	Defoamer	0.4
		PC-A97L	Accelerator	4
		PC-P81L	Extender	5
12-1/4"	9-5/8"	PC-X60L	Defoamer	0.1
		PC-J62L	Anti-settling agent	0.5
		PC-G712L	Fluid loss agent	3
		PC-P81L	Extender	2.5
		PC-H21L	Retarder	0.15
			Gas Block Additive	1
8-1/2"	7"	PC-X60L	Defoamer	0.12
		PC-J62L	Anti-settling agent	2.8
		PC-G712L	Fluid loss agent	0.5
		PC-P81L	Extender	0.7
		PC-H21L	Retarder	0.3
			Gas Block Additive	1
6-1/8" Completion	3-1/2"	PC-X60L	Defoamer	0.05
		PC-J62L	Anti-settling agent	1.2
		PC-G712L	Fluid loss agent	0.2
		PC-P81L	Extender	0.3
		PC-H21L	Retarder	1
			Gas Block Additive	0.5

#### 4.8.9. Summary of Project Alternatives

A synthesis of the alternatives and rationale for the selected alternative is presented in the table below.

**Tabl. 25 - Summary of project alternatives**

Option	Alternatives	Selected alternative	Rationale for selection of alternative
Project	<ul style="list-style-type: none"> <li>● Proceed with project</li> <li>● No project</li> </ul>	Proceed with project	The “No project” alternative would result in the loss of opportunity for oil and gas development in Block M9. The exploration drilling is a necessary precursor to production drilling that would occur in the event of a commercial find of hydrocarbon reserves.
Drilling unit	<ul style="list-style-type: none"> <li>● Fixed platforms</li> <li>● Compliant towers</li> <li>● Anchored semi-submersible platform</li> <li>● Jack-up drilling rigs</li> <li>● Drillship</li> </ul>	Anchored semi-submersible rig	The choice of the type of rig is constrained by water depth. Availability of the rig within the wider region also comes into account, because rigs are difficult to move from one sea region to another.
Drilling fluid	<ul style="list-style-type: none"> <li>● Water-based fluids</li> <li>● Drill-in fluids</li> <li>● Oil-based fluids</li> <li>● Synthetic based drilling fluids</li> <li>● All oil fluids</li> <li>● Pneumatic drilling fluids</li> <li>● Specialty products</li> </ul>	Water based fluids and Synthetic based drilling fluids	The more environmentally friendly WBM is used where feasible; the synthetic based mud (SBM) is only used where essential. It is important to note that SBM tends to be more expensive, so there is an economic incentive to use the environmentally preferable option. For practical reason, only one type of drilling fluid will be used for each section with a similar diameter. Moreover, to minimize potential impacts, the mud formulation is synthetic based mud, which used synthetic oil with a low toxicity as the base component.
Cuttings handling	<ul style="list-style-type: none"> <li>● Cuttings re-injection</li> <li>● Offshore disposal of treated cuttings</li> <li>● Ship to shore</li> </ul>	Offshore disposal of treated cuttings	<p>Re-injection is not technically practical or economically feasible for this project as this would require the drilling of another well and additional infrastructure.</p> <p>Although onshore disposal would have less environmental effects on the marine environment, the transport of drill wastes to shore will create more marine traffic and requirements for the disposal of the cuttings onshore.</p> <p>The anticipated volume of bottom-hole cuttings for each well is small (350 m<sup>3</sup> for normal well and 383 m<sup>3</sup> for deep well). Given the dispersive open water characteristics of Block M9, the discharge of treated cuttings near the sea surface are expected to disperse over a broad area and impacts to the marine environment are expected to be localized and temporary. Disposal on location also decreases transit emissions and vessel traffic. The selected offshore cuttings disposal option presents the most technically and economically viable option and the option that represents the least adverse overall environmental effects.</p>

## 5. DESCRIPTION OF THE SURROUNDING ENVIRONMENT

*This section provides a description of the environmental conditions of Block M9 within Myanmar jurisdiction and its surroundings including the coastal areas.*

*The main environmental and social information within the project area have been taken from bibliographical research, previous studies performed within the project area. and a Marine Baseline Survey which conducted by ERM-Siam Co, Ltd in February 2018 near the potential well sites (attached as **Error! Reference source not found.**) . Primary data were collected and gave a better understanding about the baseline condition of physical and biological components of the marine environment at the sampling locations for this block covering:*

- Seabed sediment quality;
- Macrobenthos communities;
- Water quality; and,
- Plankton communities.

*With no Myanmar national guidelines, interpretation of results were based on the selected Association of Southeast Asia Nations (ASEAN) and Australian water and sediment quality guidelines, where appropriate.*

*In addition, a dedicated marine mammal observer was also conducted during the survey in order to record any marine mammal and turtle sightings.*

*The performance of this environmental description is a reference initial state leading to identify environmental sensitivity that concludes this section and which is presented in §6.1.2.*

*The results of **sediment quality, macrobenthos communities, water quality and plankton communities** during Marine Baseline Survey support separate information of block M9 from block M11.*

The main environmental and social information within the project area have been taken from bibliographical research and previous studies performed within the project area. The literature review identified include:

- STS GREEN.2016.*Marine Environmental Survey (monitoring) for Zawtika Processing and Living Quarter Platform (ZPQ) and Zawtika Wellhead Platform 2 (ZWP-2). Final Report PTTEPI. July 2016.*
- AEE RSE.2016.*Block M5-M6 Carbonate exploration drilling campaign: Update of the Environmental and Social Impact Assessment process in compliance with the new Myanmar regulation. Final Report PTTEPI. October 2016.*
- ERM.2016.*Initial Environment Examination (IEE) Report of 3D Seismic Survey in Myanmar Offshore Block M9. Final Report PTTEPI. December 2016.*
- Pro-En Technologies, Limited.2010.*Environmental, Social and Health Impact Assessment (ESHIA) Zawtika Production Development and Offshore Gas Transportation System. Final Report PTTEPI. August 2010.*

In addition, an Environmental Baseline Survey was performed for the Block M9 in February 2018; this part of the study was compiled from the Marine Baseline Survey in Offshore Block M9 and desk-based research.

### 5.1. STUDY AREA AND AREA OF INFLUENCE

The study area covers all potential zones that can be sensitive to the project. It includes areas of direct and indirect impact. The Area of Direct and Indirect Impact include:

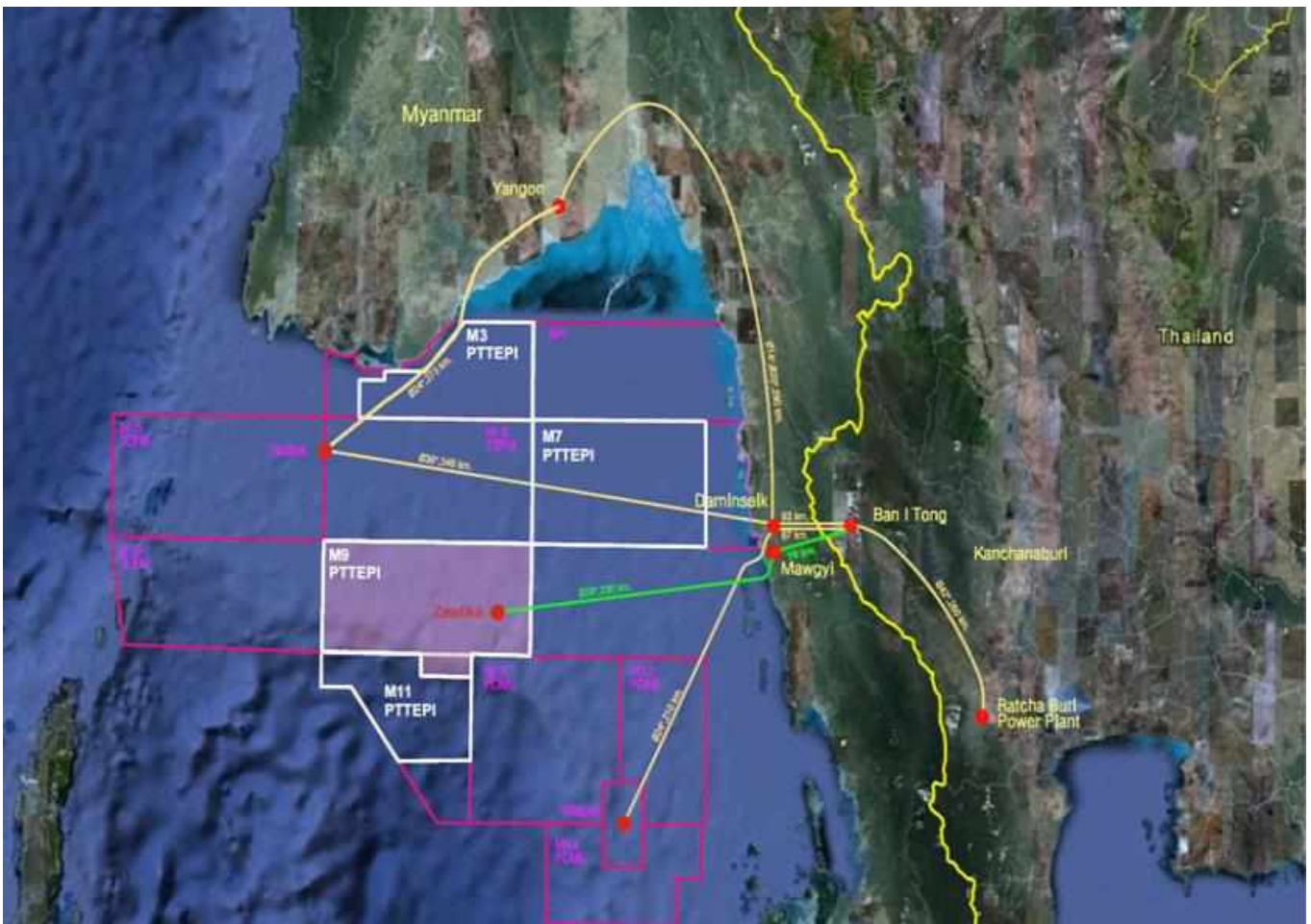
- Area of direct impact:
  - Wells drilling sites (based on this assumption, Block M9 is taken into consideration);



- Transportation zones that can be used during the project.
- Area of indirect impact:
  - The two onshore support bases, such as the Ranong Supply Base (RSB) in the port of Ranong (Thailand) and Thaketa Supply Base (RSB).

In addition, the study area considered also depends on the specific environment studied. Considering all these points, in the framework of this project, the considered study areas are:

- For the physical environment, the study area is Block M9;
- For biological and socio-economic environment, the study area is comprised between the offshore environment and the coastal area.

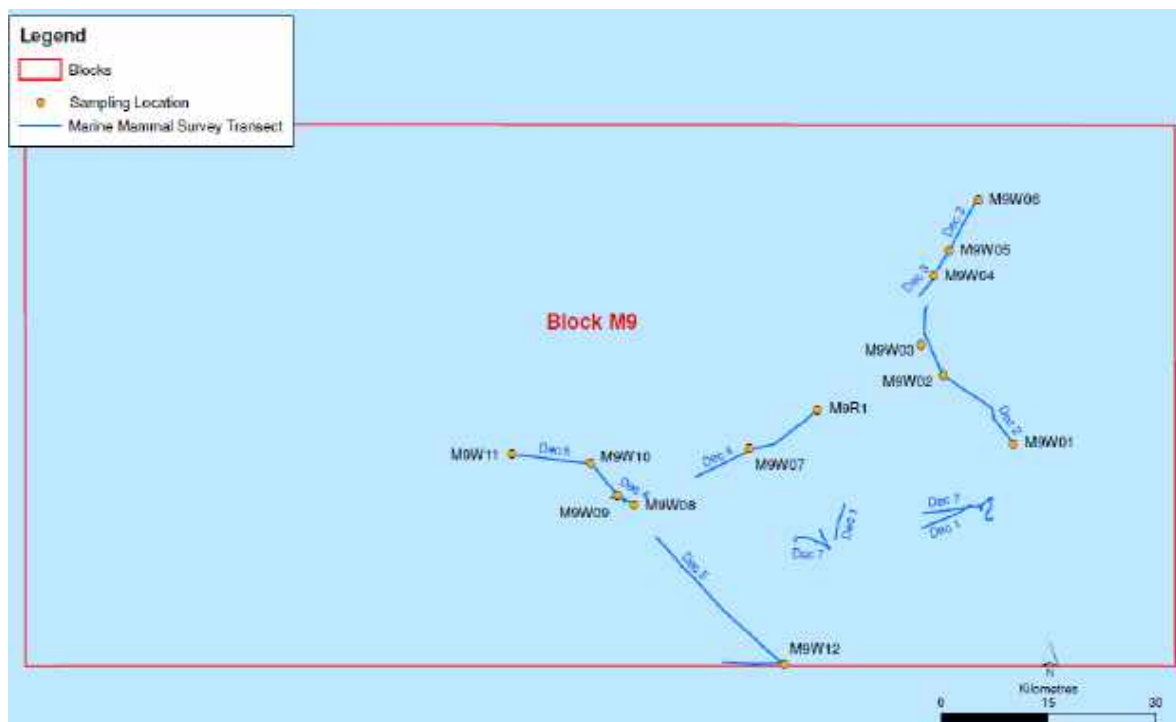


**Fig. 16.** Location of the project area

### 5.1.1. Marine Baseline Survey

The Marine Baseline Survey performed by ERM-Siam Co., Ltd in February 2018, provide a reference dataset for this EIA study on water quality, sediment quality, macrobenthos and plankton assemblages and marine mammal sightings at Block M9 and inform the assessment of impacts due to drilling operations as well as a dataset for use in future monitoring.

The location point of study areas identified and performed for Marine Baseline Survey sampling and marine mammal survey within the project area is presented in below figure. As shown in figure, total of 13 sampling locations were selected for water, sediment, benthos and plankton sampling at Block M9. The results of the baseline survey of reference sites within Block M9 are presented along with an interpretation of selected guideline values and presented as an appendix in **Error! Reference source not found.**



**Fig. 17.** Survey location for marine baseline samplings and marine mammal survey

## 5.2. PHYSICAL ENVIRONMENT

### 5.2.1. Climate

The climate can be described as a tropical monsoon climate. It is characterized by strong monsoon influences, has a considerable amount of sun, a high rate of rainfall, and high humidity. The climate of the Andaman Sea is mostly determined by the monsoons of Southeast Asia. The short winter dry season starts from December to January and a long wet season extends from February to November, with particularly heavy rain falling from May to September. The Andaman monsoon can be divided into four seasons:

- Winter – From December to April, the northeast monsoon brings infrequent rainfall, mild temperatures, and lower humidity during winter.
- Spring - The spring transition period between the monsoons (April and May) is hot with very variable weather and thundery squalls.

- Summer – From June to September, the southwest monsoon is characterized by cloudiness, overcast skies, and frequent light rain, interspersed with rain squalls or thunderstorms.
- Autumn - Post-monsoon transition from October and November.

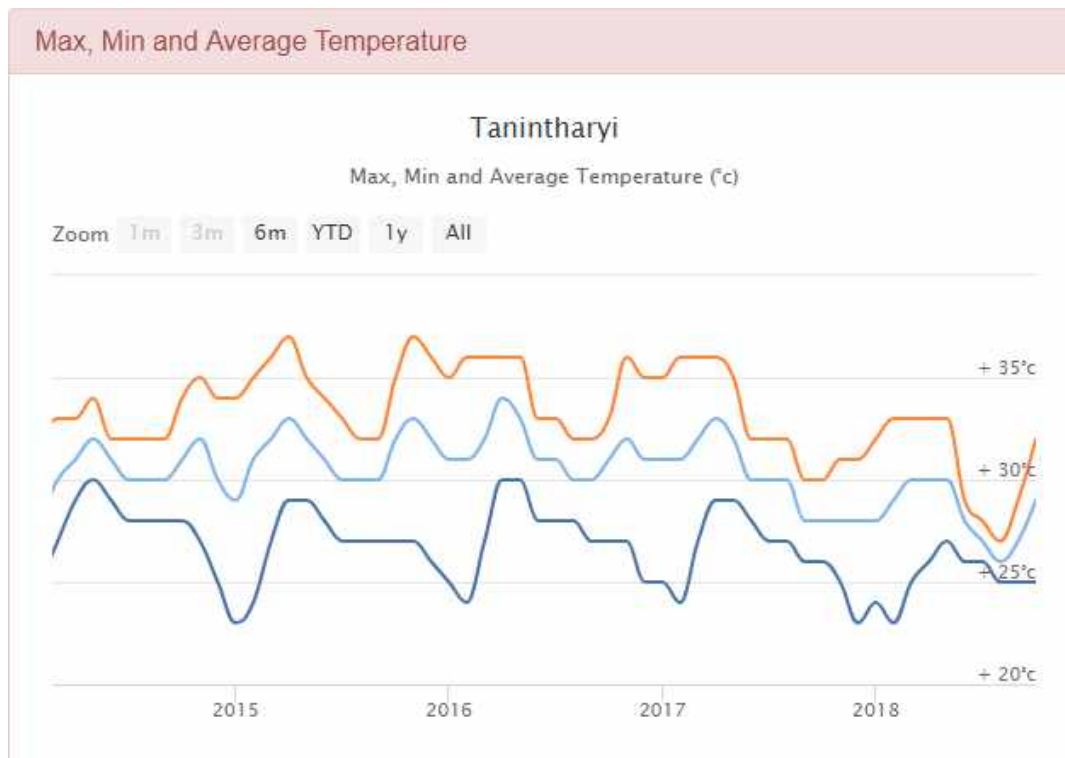
Block M9 is located in the southwestern portion of the Gulf of Martaban, in the Andaman Sea, 260 km south of Yangon and 178 km west of Dawei, in the Tanintharyi Coastal Zone. The weather in the Block M9 area is primarily influenced by the Northeast (NE) Monsoon and the Southwest (SW) Monsoon, and the short transitional periods between them (Michael Arthur Aung Thwin et al., Encyclopedia Britannica, 2017).

### 5.2.1.1. TEMPERATURE & PRECIPITATION

In Tanintharyi Division, air temperature is steady over the years from 2015 to 2018 with an average of 26.25°C. The average hottest temperature is around 36°C, and the average lowest temperature is approximately 22°C according to the following graphical data.

Where Dawei has a tropical climate with significant rainfall in most months of the year, the short dry season has little effect on the overall climate. The warmest month of the year in Tanintharyi is April, with an average temperature of 33°C. January has the lowest average temperature of the year. It is 22°C.

The following figures show the temperature fluctuation of Tanintharyi region during the year from 2015 to 2018



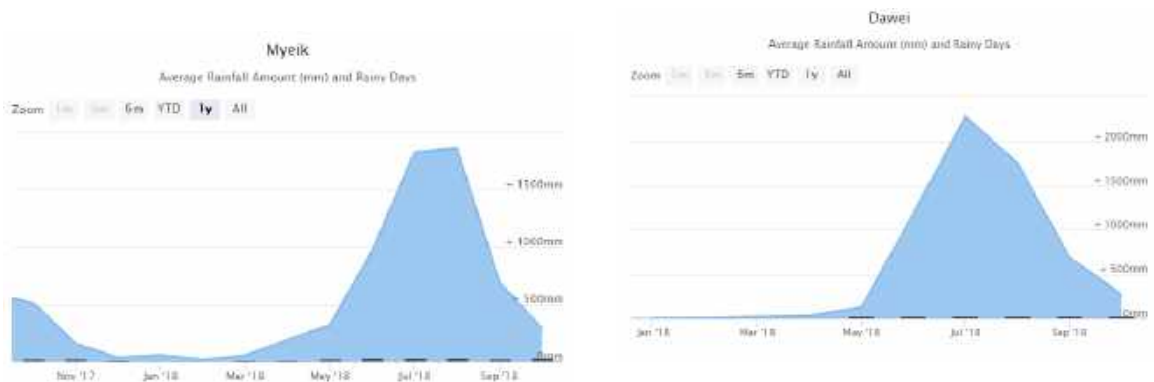
**Fig. 18.** Graphical data of temperature changes in Tanintharyi region (Source: world weather)

The project area is impacted by abundant rainfall during the wet season, with frequent thunderstorms. However, during the start of the drilling campaign (late 2018), which shall happen fine cool weather with very little rainfall is expected.

### 5.2.1.2. PARTICIPATION AND RELATIVE HUMIDITY

The northeast monsoon might also generates high moisture levels over the south and south-west part of the area. Relative humidity at Mergui (Myeik) is highest during the period from July – September while the peak rainfall in both Dawei and Myeik region is also from July to September. According to the following data, the average annual rainfall during 2018 is around 3000 mm. The below figures show the participation data of 2018 for Myeik and Dawei region.

**Fig. 19.** Participation data for Dawei and, Tanintharyi (Source: world weather)



### 5.2.1.3. WIND

The winds in the Northern Andaman Sea are generally gentle to moderate, with mean monthly wind speeds ranging from 3.5 m/s to 7.5 m/s. Strong winds (>11.0 m/s) occur less than 2% of the time during the year and are generally limited to the monsoonal seasons. Mean winds are stronger during the summer Southwest Monsoon (~6.5 m/s, from the south-west to west sector) than during the winter Northeast Monsoon (~4.5 m/s). Winds in excess of 14 m/s can occur during any season but are most common during the monsoonal seasons. Strong surges of the Northeast Monsoon, squalls associated with the Southwest monsoon and the occasional tropical cyclones can occasionally cause gale force winds (> 17.5 m/s) in the Northern Andaman Sea.

The least windy season is the spring (Pre-monsoon) transition period with a mean wind speed of 4.2 m/s, when land/sea breezes (i.e. onshore – offshore wind flow) dominate. The autumn transition season is windier than the Northeast Monsoon, with a mean wind speed of 4.8 m/s.

Predominant wind direction within the project area blows from North-Northeast from November to April. From May to October, the predominant wind direction is southwest. The wind regime in the vicinity of the project area is gentle to moderate, with 50% of the winds throughout the year exceeding 4.5 m/s and 10% exceeding 8.4 m/s.

Tornadoes recorded in the area are considered small scale and while very destructive, they are rare in the study area during the expected period of drilling campaign. Waterspouts are more common, and their destructive path is more limited. They occur throughout the wider region, mainly in the south.

### 5.2.1.4. AIR QUALITY

Air quality in the prospected area is projected to be good due to its offshore location (260 km south of Yangon and 178 km west of Dawei). In regards of the duration of drilling activity, well type condition and emission data presented in this report, the air quality within the project area is not identified as a specific issue.

### 5.2.1.5. SEISMIC ACTIVITY AND NATURAL TECTONICS

Myanmar is located on a long active tectonic belt extending from the Himalayas to the Sunda Trench. Myanmar borders the Bay of Bengal to the southwest and the Gulf of Martaban and the Andaman Sea along its southern periphery. The country's extensive coastline of about 1,930 km (1,199 mi) and its extensive lowland areas make it particularly vulnerable to all types of marine and terrestrial disasters. Myanmar's vulnerability to natural disasters result from its unique geographic location and geology. Historically, Myanmar has experienced many earthquakes and historic records show that at least 15 major earthquakes with magnitudes  $M \geq 7.0$  RS have occurred in Myanmar during the last hundred years. The Moattama Basin lies in a back-arc setting relative to the Nicobar/Andaman ridge and the Sunda trench, which are interpreted as remnants of Palaeocene subduction.

Geologically, the Moattama Basin lies in the northern part of the Andaman Sea. In the Gulf of Martaban during the Middle Miocene to Late Miocene, sedimentation was accompanied by the occurrence of growth faults. This replaced the older rift style of extension. Much of the sediment input into the Gulf of Martaban during Miocene time would have been from the Salween River (C.K. Morley, 2005 - 2016).

The major normal faults in the study area dip south and trend east, northeast-west and southwest. Some small north-dipping normal faults occur in the eastern and western parts of the study area.

### 5.2.2. Geology

The prospected area is located on the Tanintharyi continental shelf in the Andaman Sea in the west and Thailand to the east. This coastal zone covers south of the Gulf of Martaban up to the mouth of Packchan River, and includes Myeik Archipelago and the Andaman Sea. The Sittaung River also flows into the head of the gulf, about 75 miles north of the entrance. The Rangoon River and the Moulmein River enter the sea on the NW and E sides, respectively, of the gulf.

The geology of the project area is known to be characterized by silts and clays for upper layers, with high nutrients and organics. This indicates a soil environment in generally good condition, with chemical and physical characteristics which would be reasonably sensitive to changes in physical composition as a result of seabed disturbance.

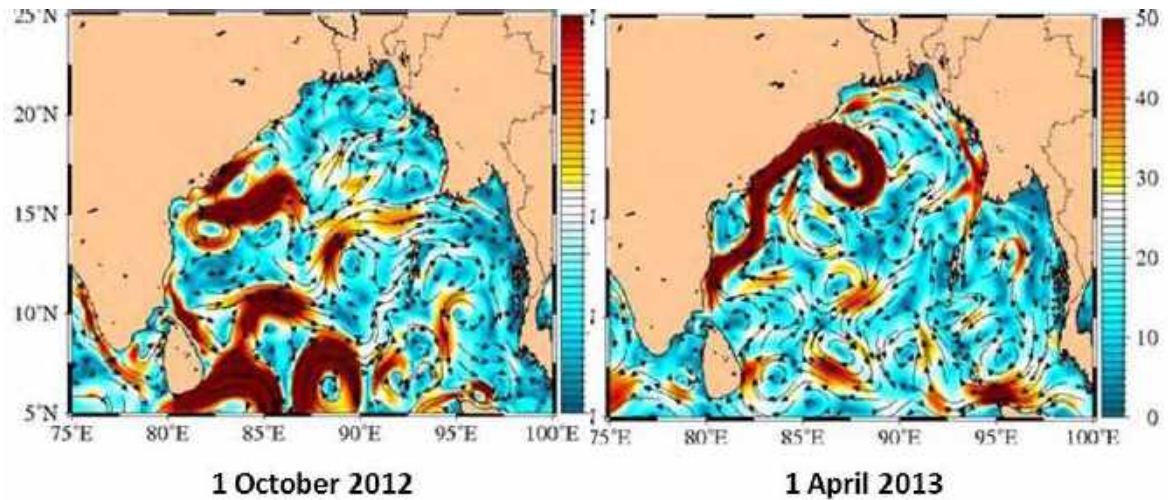
### 5.2.3. Bathymetry – Oceanography

Bathymetry within the project area ranges from 50 to 800 m, which means a particular environmental sensitivity regarding water column as well as seabed. During surveys for previous PTTEPI Block M9 projects, general seabed features were found to consist of carbonate build-up, minor seabed depressions, sand ripples, sonar contacts, possible gas seepage, high sonar reflective seabed, and existing pipeline and trawl scars. The northern portions of the Gulf of Martaban are relatively shallow within its limits, reaching maximum depths of about 20 m at the imaginary line between Baragua Point and Kalegauk Island<sup>9</sup>.

#### 5.2.3.1. VELOCITY AND DIRECTION OF CURRENTS

Ocean currents around the prospected area are strongly dominated by the monsoon winds. Mean speed are 0.4 m/s with possible peaks approaching 2.0 m/s due to relatively steady monsoon winds. These currents decrease rapidly with depth below the surface (mean speeds 0.15 m/s near the bottom). The following figure presents a schematic of circulation pattern in the Bay of Bengal.

<sup>9</sup> National Geospatial-Intelligence Agency, 2005



**Fig. 20.** Schematic of seasonal oceanic currents in the Bay of Bengal (Source: IEE report of 3D seismic survey in Myanmar Offshore Block M9, PTTEPI, December 2016)

#### 5.2.3.2. TIDES AND WAVES

The Gulf of Martaban has a tide-dominated coastline, semidiurnal with a tidal range of four to seven meters. The tidal range is around 6.6 m during spring tides, the turbid zone covers an area of more than 45,000 km<sup>2</sup> making it one of the largest perennially turbid zones of the world's oceans. During neap tides, with a tidal range of 2.98 m, the highly turbid zone coverage drops to 15,000 km<sup>2</sup>. The edge of the highly turbid zone migrates back-and-forth in-sync with every tidal cycle by nearly 150 km<sup>10</sup>.

The tides along the Tenasserim coast and along the west coast of Thailand are semi-diurnal, with a small diurnal inequality in both time and height. The tides approach these coasts from the SSW and progress north. The mean spring ranges increase from about 3 m at the Myanmar-Thailand border to over 5.2 m at Mergui (National Geospatial-Intelligence Agency, 2005). The currents flow at an average rate of 0.4 knots, with a maximum of about 0.7 knots. Near the coast, the tidal currents will also exert great influence and will either augment or deter the non-tidal currents.

The movement of swell in the region is related to the dominant monsoon wind. The area from the Ganga (Ganges) estuary to the Gulf of Martaban, including the Andaman Islands, has a generally moderate swell from the south-west though this becomes heavy during the Southwest monsoon. Turbulent seas are encountered from time to time, associated with squalls.

#### 5.2.4. Marine Sediments

Receiving large masses of sediments from Ayeyarwady, Sittaung and Thanlwin Rivers, consisting of silty clay, discharge into the Andaman Basin, with an annual load of about 265 x 10<sup>6</sup> metric tons. The eastern and inner Ayeyarwady delta-shelf accumulates 90% of this sediment at a rate of 200 cm /100 years.

The Gulf of Mottama is recognized as the most extensive and most significant intertidal mudflat system in Southeast Asia. It provides ecosystem goods and services to communities living in Mon State, Bago Region and Yangon Region, and supports a variety of aquatic species and wintering shorebirds. Due to difficult access to the area, the Gulf of Mottama (or the Gulf of Martaban) is one of the least studied coasts in the country.

<sup>10</sup> EOSnap, 2012

More specific to the project area, sediments from the Salween Sittaung and Yangon rivers empty into the Gulf of Martaban. According to the National Institute of Oceanography, studies of the sediment texture, depth of the water, etc., indicate that the sea floor in the Gulf of Martaban, the surrounding coastal areas and estuaries are covered with silty clays and subject to constant settling and re-suspension due to tidal forces. The shallowness (less than 30 meters deep) of the gulf allows the tidal currents mix the waters and bring the re-suspended material to the surface (Earth Snapshot (EOSnap), 2012). Results from the survey reported that the sediments mainly consisted of grey sediments composed of sandy silt and clay fractions. Total Organic Carbon (TOC) content of the sediment recorded from all sample stations are within the range of 0.08% to 2.66%, which was similar to the previous studies in Andaman Sea. All sediments samples collected at Block M9 were considered as undisturbed marine environments, uncontaminated with no parameter occurring at concentrations of environmental concern (ERM, 2018).

### 5.2.5. Seawater Quality

Marine water physical and chemical parameters were analysed for water samples collected from 1.5 m, ~50 m and ~100 m below the water surface in all potential wells (ERM, 2018). The parameters included the following:

- Physical parameters (included seawater temperature, salinity, pH, Dissolved Oxygen, transparency, Total Suspended Solids (TSS) and turbidity) were at similar levels at all sampling stations and found to comply with the ASEAN water quality guidelines. High water transparency, low TSS concentrations and low turbidity at the sampling stations were all indicative of high water clarity conditions.
- Chemical parameters (included Total Organic Carbon (TOC), Total Nitrogen, Total Phosphorus, Total Petroleum Hydrocarbons (TPH), oil and grease, metals, cyanide and phenol) were recorded below detection limits. All of these parameters complied with the ASEAN water quality guideline values since there is no national marine water quality guidelines in Myanmar.

Water quality in the region of the project area is considered to be good, with acceptable chemical water quality characteristics. It was found to be typical of offshore open water environment exhibiting high water clarity and low nutrient levels.

### 5.2.6. Vulnerability to Natural Disaster

The Union of Myanmar is exposed to multiple natural hazards including cyclones, earthquakes, floods and fire and it has been periodically hit by natural disasters. According to the United Nations Office for the Coordination of Humanitarian Affairs (OCHA), the tropical storm season in Myanmar occurs from May to November, with a peak of risk in October.

The Block M9 area is considered to be potentially exposed to multiple natural hazards; tropical storms being the most relevant (OCHA, 2013). The most risky season occurs from May to November, with a higher risk in October.

Since the exploration drilling will start Q3-Q4 of the year, it is not likely that the project will be at risk of tropical storms or cyclones during this period. However, if drilling activities will last approximately 540 days, the project will be vulnerable to natural disaster. Preventive measures will have to be taken.

The following is the recorded list of tropical cyclones that affected Myanmar in recent years.

1. Pabuk (2019) : A tropical cyclone that struck in May 2019, head to malat Peninsula and had impact on Myanmar coastal region.
2. Mora (2017) : A tropical cyclone which was categorized as “Severe Cyclonic Storm”, caused widespread devastation and severe flooding in Sri Lanka, Angaman and Nicobar island, Bangladesh, Myanmar and Northeast India in May 2017.

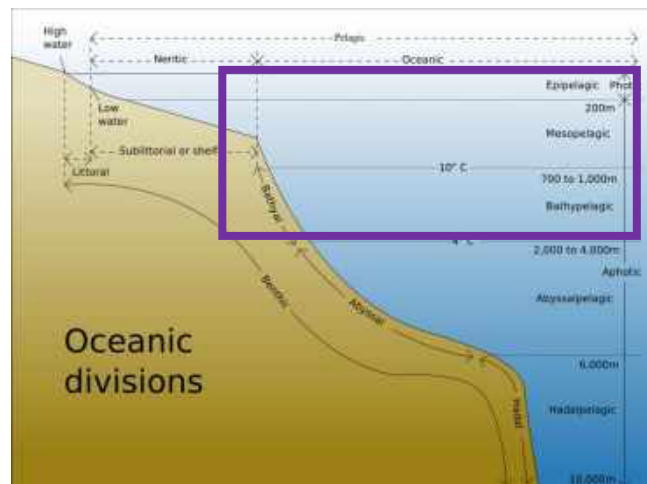
3. Maarutha (2017) : Categorized as tropical storm with lowest pressure of 996 hPa
4. Kyant (2016) : Categorized as tropical storm with lowest pressure of 998 hPa

### 5.3. BIOLOGICAL ENVIRONMENT

#### 5.3.1. Marine Biological Environment

The drilling exploration will take place offshore the coast of Myanmar on the Ayeyarwady delta continental shelf between the epipelagic zone and the mesopelagic zone, as the depth within the surveyed area is between 50 to 800 m (see opposite figure). They contain both phytoplankton and zooplankton communities that can support larger organisms like marine mammals and some types of fish, as well as local fauna typical of shallow tropical waters.

The following section identifies the main group of marine species that may potentially occur within the project area and their main characteristics (IUCN Red List category, population trend, habitat, habits, feeding regime, sensitivity, etc.).



##### 5.3.1.1. PLANKTONIC AND ZOOPLANKTONIC COMMUNITIES

The Andaman Sea is very productive with high phytoplankton densities during the Northeast Monsoon (November). Results from the phytoplankton and zooplankton survey showed that species composition and abundance were similar among sampling. Although rich abundance of zooplankton groups occur in the Andaman Sea, lower abundance for crab larvae, planktonic shrimps and larvaceans are observed. The density of phytoplankton was recorded to be 1,000 – 3,000 cell/L with 6 species identified; while the density of zooplankton was reported to be 1,000 -3,000 individuals/L with at least 4 species (ERM, 2018). Results of low abundance and diversity was considered consistent with low nutrients content of the offshore waters. That is, the oligotrophic conditions (low nutrients) of the survey area was though to have limited the growth of the phytoplankton, which may also account for the low population of their predators, such as zooplanktons.

The results of low nutrient and plankton population indicated that the study area is unpolluted and exhibiting oligotrophic conditions that may be typical of open ocean environments.

##### 5.3.1.2. BENTHIC COMMUNITIES

Benthic communities are likely to be well presented in terms of species and abundance within the project area. Sediment granulometry is closely related to the distribution and abundance of benthos. High meiofaunal abundance in silty clay and impoverishment in sand silt clay type sediment has been reported from the Andaman Sea. The Ayeyarwady River discharges large amounts of sediment loaded with nutrients in the Martaban gulf, which may provide the additional source of food for high populations of metazoan meiofauna in the area. Abundance of benthic fauna supports the food chain in the marine ecosystem. The information has been given that the total density of macro-fauna in Andaman Sea is 68-438 (unit: No/10 cm<sup>2</sup>) in the depth of 30-2150 m, this data being based on Ansari et al., 2012. It is possible that the meiobenthic population of Myanmar coast is influenced independently by a complex suit of environmental parameters such as sediment characteristics, depth, latitude and biological parameters. It is also suggested that more studies in the present












area are required for a better understanding of the spatial and temporal distribution of meiobenthos and its critical role in the benthic system and local environment.
















Results from the marine environmental survey collected a total of 43 individuals' organisms with 7.17 g. The specimens belong to five Phyla (Annelida, Arthropoda, Chordata and Nemertea). At each of the sampling stations, macrobenthos were found to occur in low abundance and low biomass of common benthic species. Infaunal assemblage structure was generally similar between stations and dominated by Annelida and arthropoda species (typical feature of macrobenthos communities' soft sediment marine benthic habitat).
















### 5.3.1.3. FISH (SEA AND COASTAL ZONE)





In open areas, pelagic species inhabit and generally undertake large migrations between feeding grounds and spawning areas throughout the year. They are economically important to Myanmar and are widespread in their distribution. A wide variety of jacks, tunas, barracudas, flying fish, sharks and rays are included in this community that extends across the entire Indian Ocean. A total of 37 species were identified by the IUCN as threatened with different levels of vulnerability in Andaman Sea and Bay of Bengal. The family Clupeidae (herring and anchovies) and Scombridae (mackerel and tuna) are likely to be present in portions of Block M9. This family is known to be sensitive to underwater sound generation as they are classified as "hearing specialists".

According to monthly reports from One Stop Service (OSS) Centre for Customs in Myeik, the following fishes are mostly caught in Tanintharyi fishing ground during November and December.

		
<i>Tenulosa ilisha</i> (Hilsa Shed) Ngar Thalout	<i>Pomadasys argenteus</i> (Javelin) Ngar Kote	<i>Lethrinus spp</i> (Snapper) Par Ni / Pa Htwet
		
<i>Psettodes erumei</i> (Indian Hallbut) Khway Shar Gyi	<i>Lutjanus malabaricus</i> (Malaba Red Snapper) Ngar Bayin / Par Ni	<i>Trichiurus lepturus</i> (Large heah Air Tail) Ngar Takon / Sit touk
		
<i>Parupeneus pleurospilus</i> (Spotted Golden Goat Fish) Kyoe Wah	<i>Thryssa hamiltonii</i> Ngar Parsha / Ngar Pyar	<i>Lutjanus russelli</i> (Snapper) Par Ni

		
<i>Sillago sihama</i> (Silver Sillago) Ngar Thae Toe	<i>Priacanthus tayenus</i> (Purple Spotted Bigeye) Ngar Ni / Myat Lone Gyi	<i>Caranx Ignobilis</i> (Giant Trevally) Phar Kyan
		
<i>Gerres filamentosus</i> (Whipfin Silvery Biddy) Ngar C Oe	<i>Pampus chinensis</i> (Chinese Pomfret) Ohn Nga Mote	<i>Pterocaesio spp</i> (Fusilier) Kyat Tu Yway Ngar
		
<i>Scarus spp</i> (Enber Parrotfish) Kyat Tu Yawy Ngar Mae	<i>Scarus spp</i> (Enber Parrotfish) Kyat Tu Yawy Ngar Shwe Asinn	<i>Lates calcarifer</i> (Seabass) Ka Baung / Ka Ka tit
		
<i>Epinephelus bleekeri</i> (Duskytail Grouper) Kyauk Ngar	<i>Selarboops</i> (Oxeye Scad) Pann Zinn	<i>Scarus spp</i> (Enber Parrotfish) Kyat Tu Yawy Ngar
		
<i>Caesio cuning</i> (Yellowtail Fusilier) Shwe Wan Ni	<i>Penaeus merguensis</i> (banana) Pazun Phyu	<i>Scolopsis taenioptera</i> (Latticemonocle Bream) Ngar Swe Kyin

		
<i>Portunus sanguinolentus</i> (Sand crab) Thae Ganan	<i>Aluterus Monoceros</i> (Lather jacket) Ngar Satku	<i>Sphyraena obtusata</i> (Barracuda) Kyein Mwyae Taung
		
<i>Selaroides leptolepis</i> (Yellow strip scad) Myat San Kyal	<i>Upeneus vittatus</i> (Yellowstried Goat Fish) Kyoeh Wah / Tar Lu C	<i>Leiognathus splendens</i> (pony fish) Nga Wine
		
<i>Lethrinus spp</i> (Starry Emperor) Ngar Phat Sat	<i>Megalaspis cordyla</i> (Hardtail scad) Ngar Chin Baung	<i>Pterocaesio chrysozona</i> (Goldenband Fusilier) Shwe Asinn
		
<i>Pentaptrion longimanus</i> Nga Bare Phyu	<i>Abalistes stellaris</i> (Starry Triggerfish) Nga Than	<i>Epinephelus areolatus</i> (Areolatus-Grouper) Kyauk Ngar
		
<i>Nemipterus japonicas</i> (Threadfin Bream) Shwe Ngar	<i>Plotosus canius</i> (Grey Eel-catfish) Pinlae Ngakhu	<i>Rachycentron canadum</i> (Cobia) Pinlae Ngayant

		
<i>Tenualosa ilisha</i> (Hilsa Shed) Ngar Thalout	<i>Sardinella gibboza</i> (Gold strips-Sardine) Nga Kone Nyo	<i>Pomadasys maculatus</i> (SaddleGrunt) Kala Kote
		
	<i>Parastromateus niger</i> (Black Pomfrat) Ngar Mote Mae	

**Fig. 21.** Fishes caught in Tanintharyi fishing ground between November and December

Demersal species such as snapper and croaker are known to be caught in Mon State and could be present in Block M9.

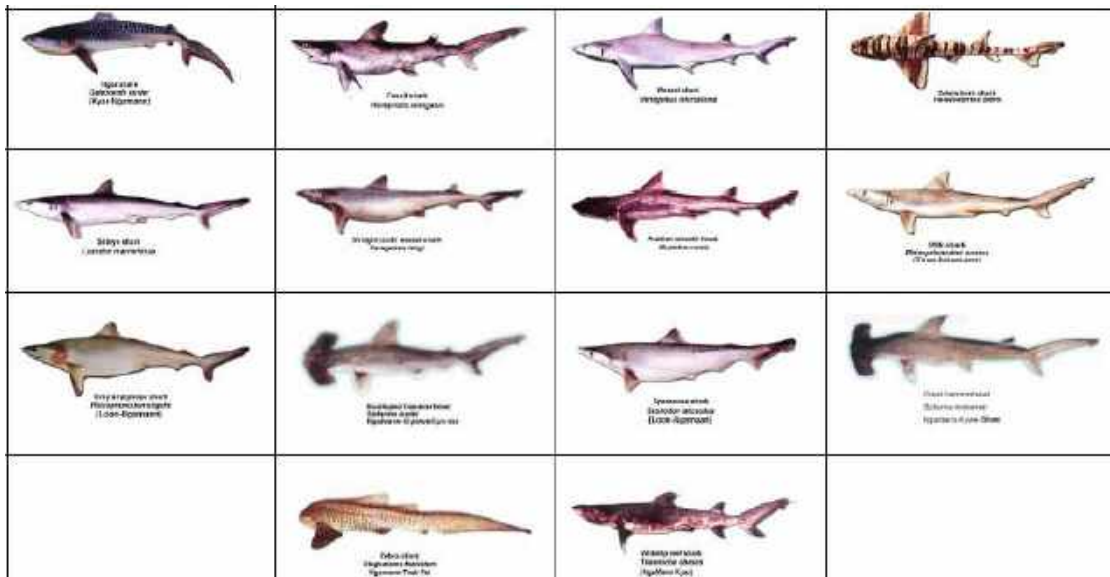
In coastal areas, seagrass and mangrove habitats serve as areas of enhanced biological productivity and nursery areas for juvenile fishes. Rocky shores and coral reefs are also expected to be areas supporting fish aggregations, site-attached species and serve as nursery areas. These nursery areas are located far from the project area.

#### 5.3.1.4. SHARKS AND RAYS

Shark fisheries are considered as one of the unregulated fisheries in the region. In some locations, sharks are considered as secondary target catch in the fishing activities using long line, gillnet, fish trawl, purse seine, and other fishing gears.

A total of 20 species were recorded in the Myeik landing site; this include 6-Carcharhinus, 1-Tiger, 1-Blacktip, 1-Zebra and 1-Bullshark. No record of Hammerhead shark occur in this landing site.

The following figures shows species of shark and ray found in Myanmar, some of which are listed as species of concern on the IUCN Red List.



**Fig. 22.** Various species of sharks and rays identified in Myanmar

According to the order number 2/2004 issued by the Department of Fisheries on May 2<sup>nd</sup>, 2004, it is not permitted to conduct shark fishing operations in the protected areas starting from Ross Island (12° 13' N, 98° 05.2' E) to Lampi Island (10° 48' N, 98° 16.1' E).

Based on Tourism trip records to Myeik in 2013, thirty-seven people reported seeing approximately 113 rays, including the Blue-spotted Stingray (*Neotrygon kuhlii*), Eagle rays (*Aetobatus ocellatus*) and Black spotted stingrays.

### 5.3.1.5. MARINE MAMMALS

Myanmar’s coastal and offshore waters support marine mammals within the order of Cetaceans (whales, dolphins and porpoises), Sirenian (sea cows) and a small number of freshwater otters that sometimes occur in coastal marine habitats. Moreover, Lampi Island and the larger Shark Protected Area, which is 413 km from the project, are likely to be the home to marine mammals, sharks and giant clams on the near shore reefs.

A total of 29 cetaceans and one sirenian species have been reported by the IUCN with different levels of vulnerability:

- 2 species are endangered (EN) facing very high risk of extinction in the wild: the Blue Whale (*Balaenoptera musculus*) and the Fin Whale (*Balaenoptera physalus*);
- 4 species are classified as vulnerable (VU) facing high risk of extinction in the wild: the Irrawaddy Dolphin (*Orcaella brevirostris*), the Sperm Whale (*Physeter macrocephalus*), the Finless Propoise (*Neophocaena phocaenoides*) and the Dugong (*Dugong dugon*). The Dugongs are rare and mostly found west of the Ayeyarwady Delta and further north of the main coastline.
- 1 species is near-threatened (NT): the Indo-pacific Humpbacked Dolphin (*Sousa chinensis*).

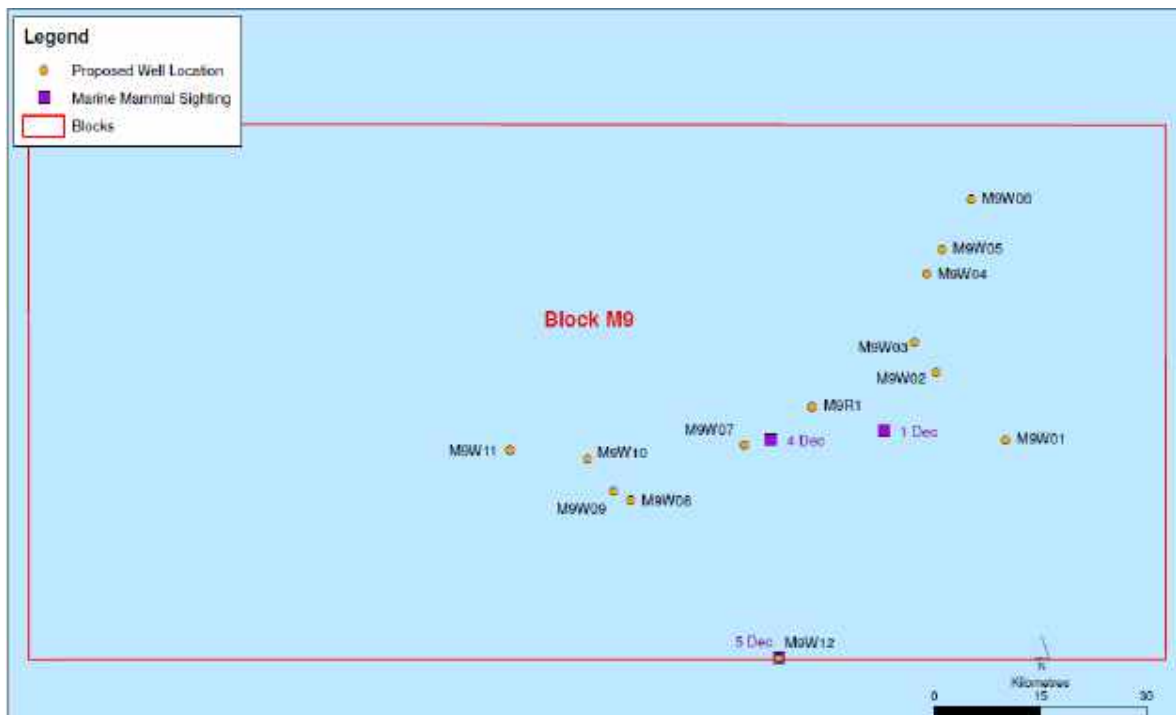
Larger cetacean species have been recorded in offshore deeper waters, which would be in line with their typical histories. That is, based on experiences and messages from local fishermen, whales are likely to encounter in the project area.

Conducted over a period of six days, a total of three groups of Pantropical Spotted Dolphin (*Stenella attenuate*) were observed in Block M9 during the marine environmental survey (ERM, 2018). This species is reported to be among the most commonly sighted marine mammal species in Myanmar marine waters and is being listed as ‘Least Concern’ on the IUCN 2018 Red List of Threatened Species. The pictures below show

some individuals observed during the marine environmental survey and the representative locations of the dolphin sighted.



**Fig. 23.** Photos of Pantropical Spotted Dolphin (*Stenella attenuate*) observed during the marine environmental survey (Source: ERM, 2018)

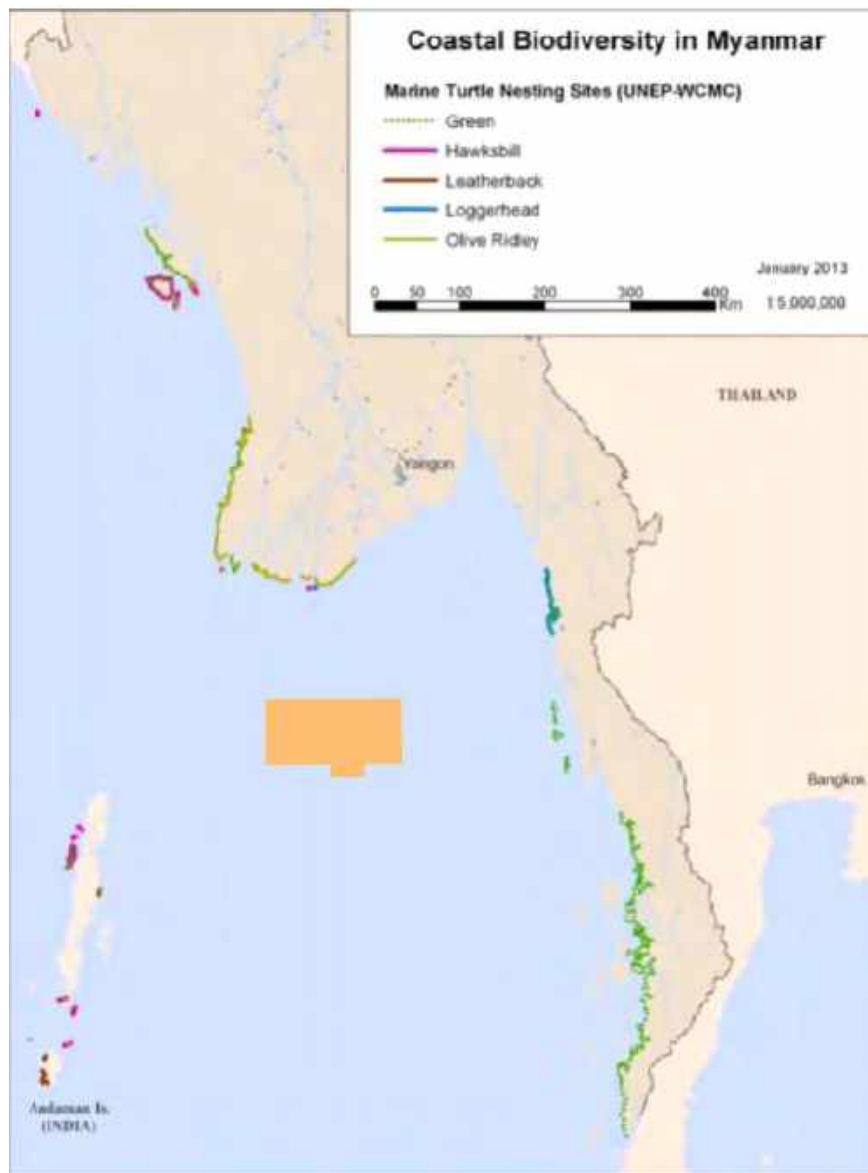


**Fig. 24.** Locations of the dolphin sighted (Source: ERM, 2018)

### 5.3.1.6. SEA TURTLES

Five marine turtle species are regularly seen nesting and foraging on Myanmar’s beaches, including the Olive Ridley Turtle (*Lepidochelys olivacea*) (*vulnerable*), the Loggerhead Turtle (*Caretta caretta*) (*endangered*), the Green Turtle (*Chelonia mydas*) (*endangered*), the Hawksbill Turtle (*Eretmochelys imbricata*) (*critically endangered*) and Leather Back Turtle (*Dermochelys coriacea*) (*critically endangered*). However, the Loggerhead and Leatherback turtles are assumed to be almost extinct in Myanmar waters. DoF has signed at least 35 nesting sites along the country’s coastal region, of which seven of them are closely conserved by undertaking monitoring and surveillance of turtle landing sites, clutches and magnitude of hatchlings that are able to return to the sea.

Turtles’ distribution in Myanmar is shown in the following figure.



**Fig. 25.** Turtle distribution in Myanmar according to UNEP WCMC Database (Source: IEE report of 3D seismic survey in Myanmar Offshore Block M9, PTTEPI, December 2016)

The project area may be on a migration path for turtles that reach Myanmar beaches during the nesting period from the end of September to March, with a peak in January-February. Most observations of turtles are

typically within 15 km of mainland shores in protected, relatively shallow marine waters (22-25 m), far away from the project area. Nevertheless, some species may be encountered in the area to be explored as they are migratory species.

Since 2011, the country has been conducting turtle conservation activities in collaboration with international agencies and organizations. Today, Myanmar cooperates and collaborates with ASEAN-SEADEC, IOSEA and Indian Ocean Turtle Newsletter (IOTN) for the conservation and management of sea turtles.

#### **5.3.1.7. MARINE BIRDS**

A total of 63,298 shorebirds, comprising 33 species and 7,027 waterbirds, consisting of 45 species, were identified between the mouth of Yangon River and Ayeyarwady Delta. Among these species, eighty-four individuals of Spoon-billed Sandpiper at five sites and one Nordmann's Greenshank, which are globally endangered species, were recorded (Wetlands International, 2008).

The most abundant groups of seabirds is the terns. Other seabirds, which may use these waters include gulls, storm petrels, Jaegers (also known as Skuas), tropicbirds, boobies, noddies and frigatebirds. Seabird species tend to be highly migratory, far ranging and widely distributed away from breeding areas. According to the BirdLife association, three migratory flyways cross Asia: the West Pacific Flyway, East-Asian Australasian and the Central Asian Flyway. PTTEPI's project is mostly concerned with the East Asian Australasian Flyway. More than 50 million migratory waterbirds, including 8 million waders, are using this route annually. In addition, 21 species of migratory birds have more than 95% of their entire global population within the East Asian Australasian Flyway (which covers the majority of the Asian Central Flyway) including the Spoon-billed Sandpiper (*Eurynorhynchus pygmeus*) and Chinese Crested Tern (*Sterna bernsteini*) (both Critically Endangered).

According to the BirdLife association, the closest Important Bird Areas are the Ayeyarwady Delta and the Lampi Island National Park; both at more than 200 km from the project area. Taking into account the typical habitat of these seabirds, offshore Myanmar waters, including Block M9, are used by seabirds for foraging and loafing (resting).

### **5.3.2. Coastal Biological Environment**

#### **5.3.2.1. GEOGRAPHICAL AND ECOLOGICAL DESCRIPTION**

The prospected area is located on the Tanintharyi continental shelf in the Andaman Sea in the west and Thailand to the east. This coastal zone covers south of the Gulf of Martaban up to the mouth of Pakchan River, and includes Myeik Archipelago and the Andaman Sea.

Block M9 is located offshore, approximately 200 km south of the coast of the Ayeyarwady Delta, one of the most important coastal ecosystems in the country. And the nearest Narcodam island is located approximately 96 km from the adjacent corner of the block. Given the distance between habitats and project activities, there will be any impact on these coastal receptors and the biodiversity value of the India's island due to the project activities.

#### **5.3.2.2. CORAL REEFS**

A total of 51 coral species have been identified in Myanmar by the DOF but systematic assessment is still needed to map out the status of coral reef diversity and their trend in the seascape (UNEP; MOECAP; GEF, 2011): among anthozoan coral polyps, 51 species belonging to 20 families and 30 genera along Rakhine coast, 3 species belonging to 2 families and 2 genera from Delta areas and 93 species belonging to 21 families and 47 genera from Tanintharyi coast have been recorded by Aung Kyi (1982), San Win (1993), Mya Than Tun (2000) and Mya Than Tun and Tint Tun (2002). (Bay of Bengal Large Marine Ecosystem Project, 2012).



Coral Reef formation in the Irrawaddy coastal zone is restricted to the Coco, Prepara and Narcondam islands, which lie far outside the zone of influence of river runoff. Block M9 is located at about 153, 122 and 83 km from the three islands.

### 5.3.2.3. MANGROVES

Mangroves along the Myanmar's coast are particularly used as a source of firewood and charcoal for cooking, wood for construction and fisheries. There are no mangroves in the vicinity of Block M9, due to its location far offshore from coastal mainland or islands. That is, mangroves will not be affected by the Block M9 project.

### 5.3.2.4. SEAGRASS

Seagrass is normally absent from the Ayeyarwady Delta and the Gulf of Martaban coastal regions, where water turbidity is very high because of the enormous sediment discharges from upstream watersheds. These species are found mainly in the Rakhine and Tanintharyi coastal areas.

There is no seagrass in the vicinity of Block M9, due to its location far offshore from coastal mainland or islands. Seagrass will therefore not be affected by the Block M9 project.

### 5.3.2.5. SEAWEED

According to the National Report of Myanmar on Sustainable Management of the Bay of Bengal Large Marine Ecosystem, some 122 genera and 307 species of seaweeds from Myanmar have been reported (Department of Fisheries Myanmar, 2003).

Among the species observed in Myanmar, Sargassum and Hypnea are the most abundant. The standing stock of Sargassum is estimated at 2,500 tonnes dry weight and 1,500 mt dry weight for Hypnea. Sargassum beds formed along the Tanintharyi coastal region provide good habitats, refuges and spawning grounds for commercially important fishery resources.

### 5.3.2.6. MARINE REPTILES

A total of 16 marine reptiles have been recorded by the IUCN in Myanmar coastal waters from which turtles represent the most threatened group.

Regarding sea snakes, all the species identified by the IUCN in Myanmar coastal waters have been identified as being of 'least concern'.

The saltwater crocodile (*Crocodilus porosus*) has been recorded in swampy coastal areas throughout the region, as well as occasionally being observed in the open sea. This species is listed by the IUCN as least concern, and is not considered significant in the context of the exploration drilling project.

### 5.3.2.7. MARINE MAMMALS

Two species of marine mammals typical of coastal areas (shallow water, delta, rivers) in the Andaman Sea can possibly be found within the project area. These include:

- Irrawaddy dolphin (*Orcaella brevirostris*) (Vulnerable);
- Striped dolphin (*Stenella coeruleoalba*) (Least Concern).

Groups of Pantropical Spotted Dolphin (*Stenella attenuate*) which are reported as most commonly sighted species, were observed in Block M9 during the Marine Baseline Survey (ERM, 2018).

## 5.4. SENSITIVE AND PROTECTED AREAS

### 5.4.1. The IUCN Red List

The International Union for the Conservation of Nature (IUCN) helps to find practical solutions to the most pressing environmental and development problems. It develops and supports science from the point of view of conservation, particularly concerning species, ecosystems, biological diversity and their impact on human livelihoods. This organization runs thousands of projects everywhere in the world to better manage natural environments. The IUCN also support governments, NGOs, international conventions, UN organizations, companies and communities, to develop laws, policies and best-practices.

The IUCN Red List is an accurate indicator of the state of biodiversity in the world. Based on this analysis, we now know that one in four species of mammal, one in eight birds, one in three amphibians and almost a third of conifer species are threatened by global extinction. The Red List relies on a series of five precise criteria to evaluate the risk of extinction of all species and sub-species in all parts of the world. This classification in categories is done using five quantitative criteria of biological factors associated with the risk of extinction: size of the population, rate of decline, area of geographical distribution, population level and fragmentation of the distribution. With the IUCN Red List system, each species or sub-species can be classed in one of the following nine categories:

- **EXTINCT (EX):** a taxon is said to be extinct when there is no doubt that the last individual is dead.
- **EXTINCT IN THE WILD (EW):** a taxon is said to be Extinct in the Wild when it only survives in cultivation, captivity or as a naturalized population(s), well outside its original distribution area.
- **ENDANGERED SPECIES: CR + EN + VU**
- **CRITICALLY ENDANGERED (CR):** a taxon is said to be Critically Endangered when it is confronted by an extremely high risk of extinction in the wild.
- **ENDANGERED (EN):** a taxon is said to be endangered when the best data available indicate that it is confronted by a very high risk of extinction in the wild.
- **VULNERABLE (VU):** a taxon is said to be Vulnerable when the best data available indicate that it is confronted by a high risk of extinction in the wild.
- **NEAR THREATENED (NT):** a taxon is said to be Near Threatened when it is about to fulfil the criteria corresponding to the categories of threatened groups or that these criteria will probably be fulfilled in the near future.
- **LEAST CONCERN (LC):** a taxon is said to be of Least Concern when it has been evaluated according to the criteria and does not fulfil any of them i.e. none of the Critically Endangered, Endangered, Vulnerable or Near Threatened categories. The LC category includes widespread and abundant taxon.
- **DATA DEFICIENT (DD):** a taxon enters the category of data deficient when there is insufficient data to directly or indirectly evaluate the risk of extinction as a function of its distribution and/ state of its population.
- **NOT EVALUATED (NE):** a taxon is said to be Not Evaluated when it has not yet been evaluated against the criteria.

The IUCN identified 77 threatened marine species in the western Indian Ocean waters. In this list, 6 species are considered as CR, 19 EN and 52 VU.


The Endangered species in the study zone are, for example:

- Marine mammals: Blue Whale, Irrawaddy Dolphin, and the Dugong;
- Fish: Queen triggerfish, hogfish, grouper, swordfish, wrasse, sawfish, guitarfish, tuna;
- Sharks: silvertip shark, sand tiger shark, Bullshark, mackerel and tuna

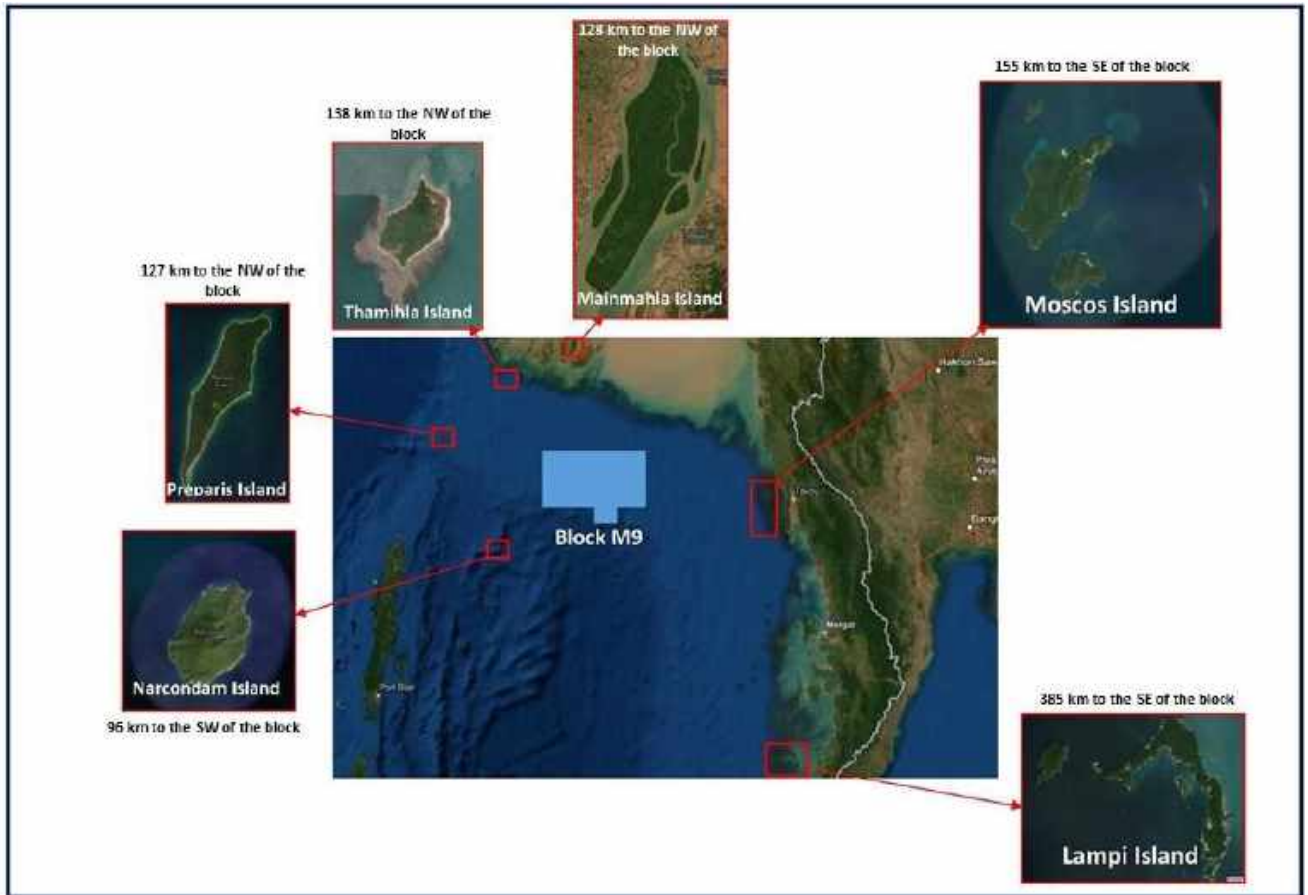
- Turtles: loggerhead, green, leatherback, Hawksbill, and Olive Ridley turtles.
- Rays: eagle rays, blue spotted stingray and black spotted stingrays

#### 5.4.2. Protected Areas

A total of 45 protected areas have been established in Myanmar, which include four marine protected areas (MPA):

- **The Lampi Marine National Park** (see opposite picture) was declared ASEAN Heritage Park in 2003. It protects evergreen and mangrove forests, beaches and dunes, coral reefs, sea grass and a rich biodiversity, with over 1,000 recorded species. The Lampi Island is the biggest island within the park and the core of the marine national park. It has a rocky coastline and beautiful sandy beaches, bays and inlets.
- 
- **The Mainmahla Kyun Wildlife Sanctuary** is a wetland reserve, located in Bogale Township, and classified as a mangrove ecosystem reserve. The reserve occupies an area of 137 km<sup>2</sup> and was established in 1986. The protected area has a total of 29 mangrove tree species and saltwater crocodiles.
  - **The Moscos Islands Wildlife Sanctuary** is a demarcated wildlife reserve located in the Moscos Islands. It is governed by the Burma Forest Department and the level of protection is total. The main purpose of the reserve are habitat conservation and natural resources maintenance. The typical habitat is tropical evergreen forest.
  - **The Thamihla Kyun** is a small offshore island to the west of the Irrawaddy Delta, measuring about 1,100 m by 730 m. Designed in 1970, this wildlife sanctuary encompassing marine areas and coastal reefs that are sensitive.

The nearest protected areas from Block M9 are the Mainmahla Kyun Wildlife Sanctuary, Thamihla Kyun Wildlife Sanctuary, and Moscos Island Wildlife Sanctuary. As shown in the figure below, all of these protected areas are located from project with shown distances in the below figure and are not expected to experience any impact or influence from project operation. The proximity of these protected areas to Block M9 are presented in the following figure.



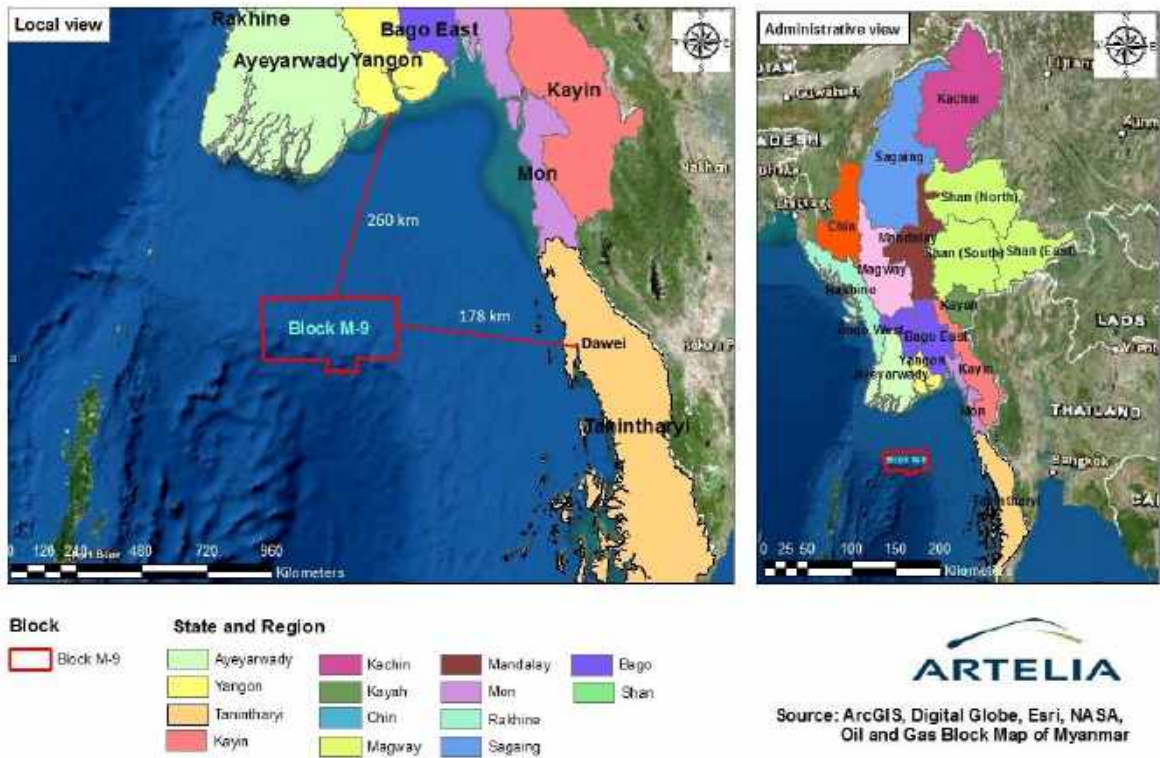
**Fig. 26.** Marine protected areas near Block M9 (source: ArcGIS)

## 5.5. SOCIO-ECONOMIC ENVIRONMENT

As shown on the figure below, the project area is located at ~260 km south of Yangon and 178 km west of Dawei, close in an offshore zone, with water depths comprised between 50 and 800 m. The project is not expected to have significant interactions with the on-shore human environment in Myanmar, apart from offshore marine activities such as fishing and goods transportation. Likelihoods that coastal human activities (small-scale fishing, aquaculture or tourism) are impacted by the project are limited, except in case of accidents or emergencies.

The context for administrative profile, economy and livelihood presented in this report of the block M9 is mostly identical with block M11 as these two proposed projects are mainly interconnected with Tanintharyi region's Dawei, Yebyu, Myeik townships.

Therefore, emphasis is made here on marine economic activities (for example, commercial sea navigation and fishing) and of the socio-economic conditions of coastal communities living in the Tanintharyi Coastal Zone, which is the closest to the project area.



**Fig. 27.** Distances between Block M9 and locations of Yangon & Dawei

**5.5.1. Administrative Organization and Governance**

**5.5.1.1. ADMINISTRATIVE ORGANIZATION AND TERRITORIAL UNITS**

Previously known as Tenasserim Division before being reclassified as a Region, Tanintharyi is a long and narrow strip of land which covers over 43,328 km<sup>2</sup> of territory. The mainly concern area, which are likely of being impacted from the project activities are Dawei township, Myeik township and Yebuy Township.

Dawei Township is the capital of Tanintharyi division and located in the south of Yangon, also a coastal region bounded by the Andaman Sea in the east. Thayet Chaung, Lounglon, Yebyu and Dawei townships are under the governance of Dawei district. The area has over 125,600 population and rubber, oil palm, cashew nut and areca nut are the main product of the region.

Yebyu Township is considered to organize the consultation meeting regarding to the suggestions from Tanintharyi region authorities. Main products are rubber, betel leaf, cashew nut and import foods and clothes from Dawei.

Dawei Township is on the coast of an island on the Andaman Sea which is also famous for its products such as pearl, rubber, edible bird's nest, dried fish, dried prawn and ngapi (shrimp paste). The capital of coastal reion, Myeik, is a gateway to the 800 offshore islands of the Mergui Archipelago, which are developing a tourist trade.

The general administration data is summarized in the following table.

Tabl. 26 - General administration data

Sr.	Article	Dawei	Yebyu	Myeik	
1.	Area	4,268.3	2,447	1,417.9	
2.	Total population	125,605	100,768	284,489	
3.	Productive working population (approximate percentage)	66%	63.2%	63.5%	
4.	Religion (approximate percentage)	Buddhist	88%	88%	86%
		Christian	7%	7%	3.2%
		Islam	5%	5%	9.8%
		Hindu	0.5%	0.5%	0.45%
5.	Literacy rate (approximate percentage)	95% (only 12.4 % has completed university/college education)	84.4% (only 4.6 % has completed university/college education)	96.4% (only 9.4 % has completed university/college education)	
6.	Health Profile	Hospital	7	4	1
		Clinic	12	1	9
		Village health care	4	7	32
7.	Educational Buidling	University/college	5	-	4
		B.E.H.S	12	11	21
		B.E.M.S	12	19	17
		B.E.P.S	17	146	2
8.	Land use (Acre)	Agricultural	89,748	109,404	89,228
		Industrial	46	879	172
		Reserved forest	270,118	526,748	75,111
		Total Acre	1,687,131	1,011,232	350,367
9.	Livelihood (number)	Government servant	6,071	1,040	4,614
		Agricultural	1,219	17,600	689
		Animal husbandry	65	6,500	266
		Fishery	320	560	9,739
		Random	30,653	8,320	30,209
10.	GDP (2014-2015)	1,445,499 MMK	12,357,626 MMK	2,077,592 MMK	

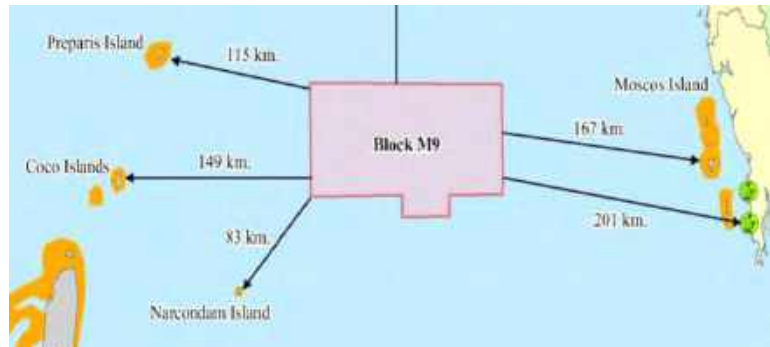
### 5.5.1.2. GOVERNANCE

The Union of Myanmar is administratively divided into 7 States and 7 Regions. These States and Regions are divided into 63 Districts and a total of 324 Townships, further divided into wards and village tracts. The closest states to the project location are Tanintharyi, followed by Ayeyarwady, Mon and Yangon.

The DoF has established a legal framework with strategies and policies for sustainable development and management of marine fisheries. These include licensing, prescription of exploitable species, designation of environmental friendly fishing gears and methods and the imposition of closed areas and seasons.

### 5.5.2. Demography

Non-resident population has been recorded in the project area, which is 113 km from the nearest mainland coast (Ahmar town, Pyapon Sub-township, Pyapon district, Ayeyarwady State), and 83 km from the nearest island, which is uninhabited (Narcondam Island). Although this island, along with Coco Island, are uninhabited, they are visited by tourists.



The quality of life issues addressed can pertain only to populations in nearby coastal communities and the general population of Myanmar. People along the coast generally live in small villages.

### 5.5.3. Economy

Tanintharyi Region has seen 5.1% progress in the economic sector in comparison with the same period in previous fiscal year.

#### 5.5.3.1. MAIN ECONOMIC INDICATORS

The population is engaged in fishing, production of natural rubber and coconuts, manufacture of fermented shrimp paste, the collection of edible bird's nests and pearl farming. Mergui is a gateway to the 800 offshore islands of the Mergui Archipelago, which are developing a tourist trade. Tourism in the area is restricted to cruises as land based accommodations are currently non-existent on the islands.

#### 5.5.3.2. OFFSHORE OIL & GAS ACTIVITIES

Myanmar promising offshore oil and gas resources represent an important potential of growth for the country's economy, attracting interest from the national and international oil and gas industry. In 2012, 34% of the Foreign Direct Investments in the country were directed at oil and gas exploration and production.

In a move to boost the increase of oil and gas activity in the country, the Ministry of Energy recently concluded the Myanmar Offshore Blocks Bidding Round 2013, attributing 20 offshore blocks to international companies. Ten deep-water blocks and ten shallow-water blocks were attributed to oil majors and independent companies, such as Statoil, Eni, Shell, Total, ConocoPhillips, BG Group, and Woodside Energy.

YWB Block was awarded to Total E&P Myanmar, and other blocks neighbouring YWB were attributed to various companies, such as to Eni (Block MD4). They can be localized in the Fig. 28 and are for most of them in production:

- The Yetagun field in M12, M13 and M14 produces since 2000 and is operated by a local subsidiary of Malaysian company Petronas.
- The Zawtika, Kakonna and Gawthaka fields started to produce in March 2014, and are operated by the Thai company Petroleum Authority of Thailand Exploration and Production International (PTTEP International).
- Several other blocks are at the stage of 2D or 3D seismic campaigns.

This surge in offshore exploitation of oil and gas resources causes an increase in operational activities in the Andaman Sea, which could lead to negative cumulative impacts on the fishery sector and global marine traffic in the region.



**Fig. 28.** Myanmar deep water block 2014 (Source: Total IEE report for YWB Block & Myanmar deepwater E&P operations outlook by Dr. ZawMinThan)

#### 5.5.4. Public Health Components

According to Administrative Profiles (2017), the local people mainly suffer diarrhea, dysentery. And malaria, tuberculosis (TB), hepatitis and HIV are second most popular diseases in the region. The following table presents the list of common diseases and number of people who suffer from those diseases.

**Tabl. 27 - Mortality of Diseases in Dawei, Yebyu and Myeik**

Types of Diseases	Dawei		Yebyu		Myeik	
	Morbidity	Mortality	Morbidity	Mortality	Morbidity	Mortality
Malaria	84		575		68	
Diarrhea	1466		2216		2381	
Tuberculosis (TB)	467		199	1	949	2
Dysentery	606		521		826	
Hepatitis	649		19		2	
HIV (2015-2016)	165	13	2		162	9
HIV (2016-2017)	58	4	6	1	46	



### **5.5.5. Fishery and Aquaculture Activities**

#### **5.5.5.1. FISHERY SECTOR REGULATION**

Six laws are the basis for inland and marine fishery organization, management and control by the different government agencies in charge of this sector. They are listed below:

- Law Relating to the Fishing Rights of Foreign Fishing Vessels – 1989;
- Law relating to Aquaculture – 1989;
- Myanmar Marine Fisheries Law – 1990;
- Freshwater Fisheries Law – 1991;
- Law Amending the Myanmar Marine Fisheries Law – 1993; and
- Law Amending the Law Relating to the Fishing Rights of Foreign Fishing Vessels – 1993.

In addition to these national laws, the following international laws are also taken into account by the fishery sector.

- Code of Conduct for Responsible Fisheries
- International Plan of Action – IPOA – IUU
- EU regulation No. 1005/2008 and 1010/2009
- Regional Plan of Action – IUU (RPOA – IEE)
- ASEAN Regional Plan of Action for Managing Fishing Capacity – RSPOA Capacity (2017)
- ASEAN Guidelines for Preventing the Entry of Fish and Fisheries Products from IUU Fishing Activities into Supply Chain

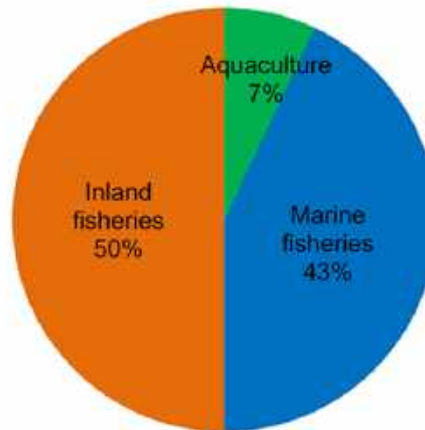
According to TIQC, DOF is committed to comply with WTO-SPS Agreement Obligation, EC Regulation and ASEAN common principles of food hygiene, control system and labelling (DoF, Myanmar).

The Myanmar fisheries sector is managed by the Ministry of Livestock, Fisheries and Rural Development, and more particularly by the Department of Fisheries (DoF), which takes care of both inland and marine fisheries. The main mission of the DoF is to develop and implement sectorial policies aiming at promoting sustainable fishing practices and ensuring the preservation of marine resources. The DoF develops conservation efforts, promotes research and surveys on the current condition of marine resources in partnership with intergovernmental agencies, maintains statistics on fisheries, and supervises the fishery sector through delivery of licenses to national fishing vessels.

#### **5.5.5.2. FISHING INDUSTRY**

The fishery sector is one of the major components of the country's economy supporting thousands of households. Fish serves as major source of animal protein of local people who largely consume rice and fish in their daily meals. With a population of about 51.5 million in 2016, the country's average fish consumption was 68 kg/person/year (Regional fishery Policy Network Member for Myanmar, 2017).

A total of 3,220,000 of the country's population are employed as full time and part time fishers, where 57% are engaged in freshwater fisheries and 43% in marine fisheries (see figure below).



**Fig. 29.** Ratio of fishers engaged in fisheries sub-sectors in Myanmar in 2016 (Source: DoF, 2016<sup>11</sup>)

In 2016, the country's total production of fish was estimated around 5.59 million MT, comprising the production of marine fish at 3 million MT (54% of total fish production) and production of freshwater fish at 2.59 million MT (46% of total fish production).

### 5.5.5.3. MARINE FISHERY

Marine fisheries are organized under the Marine Fisheries Law, which classifies this sector into the inshore and offshore categories. Their main characteristics are detailed below:

- **Inshore (or coastal) fishery:** covers an area up to 10 nautical miles from the shore on the Ayeyarwady and Tanintharyi coasts. Boats entering this category should not be equipped with engine having more than 12 horsepower and length of the boat is limited to 30 feet.
- **Offshore fishery:** covers the outer area of the inshore fishery zone up to the EEZ border. Boats should have more than 12 horsepower engine, and can use bottom trawl, purse seine, surrounding nets, drift nets and long lines.

For licensing purposes, the Department of Fisheries divided the offshore zone into 140 fishing grounds of 30 x 30 nautical miles block, using latitude and longitude lines. It also designated four fishing areas, namely Rakhine (40 blocks), Ayeyarwady (44 blocks), Mon (14 blocks) and Taninthary (52 blocks).

In addition to offshore fisheries, although little documented information is available, there are likely fishing activities on the islands closest to Block M9 (Coco Islands, Narcondam Island and Preparis Island). According to discussion with local regional offices, only fishery groups from Tanintharyi Region are located within Block M9. There are also indications that November to April is the best season for fishing in terms of weather condition. Fishing occurs during this period in shallow water, across the continental slope but also in deep-water.

#### 5.5.5.3.1. Marine Fishery License System

The national fishing license system is divided into two categories based on the fishing zones:

- **Inshore fishery zone license:** the General Administration Department (GAD) is in charge of inshore fishing boats' inspection. The Department of Fisheries proceeds with the issuance of fishing licenses upon recommendation of the GAD.

<sup>11</sup> <http://www.seafdec.org/fisheries-country-profile-myanmar/>

- **Offshore fishery zone license:** the Department of Marine Administration (DMA) takes care of inspection and registration of the offshore fishing boats. Fishing licenses are delivered by the DoF only when the DMA has issued its approval.

The Myanmar Fisheries Law encourages foreign fishing activity with the granting of fishing rights to foreign companies, but limits their activity to the EEZ and forbids it in the territorial sea.

In April 2014, the Government of Myanmar suspended the granting of fishing rights and licensing for foreign vessels until further notice. This ban is justified by alleged fish resources depletion, due to overfishing and the use of destructive fishing gears by foreign companies whose activity has intensified over the last five years. It was welcomed by national fishing associations, as it was expected for a long time<sup>12</sup>.

#### 5.5.5.3.2. Illegal, unreported and unregulated fishing

Myanmar law is repressive against illegal, unreported and unregulated fishing. It bans all fishing gears that are destructive to the environment and fisheries resources, including pair trawl, electric fishing, fishing using poisons, chemicals, explosives, purse seine net less than 3,5 inches mesh size and trawl net cod-end mesh size less than 2 inches (KYA Kyaw, 2010). Trawl use is also forbidden in the inshore fishery zone. Several institutions are involved in fighting illegal fishing under the coordination of the Myanmar Navy: the Coast guards, the Department of Fisheries, the Myanmar Customs Department and the Myanmar Police Force.

Despite these measures, illegal fishing is commonly practiced in Myanmar waters, especially by neighbouring Thai vessels in the Andaman Sea.

#### 5.5.5.3.3. Artisanal fishing

Small scaled fishermen share their fishing grounds in the estuaries near shore while others travel up to 70 miles offshore. Fishermen with small boats use small (1.5-2 cm) mesh nets to catch fish in the river mouth during high tides.

Offshore fishermen were reportedly using about 3 inch mesh size purse seine as their main fishing gear. In the mudflat, tidal traps or set bag nets are widely practiced. Fish products are sold in mixed catch – small size to local buyers and large size to company buyers either in Yangon or Thailand. However, in the project area, which is far offshore, there are not expected to be any artisanal fishing craft.

#### 5.5.5.3.4. Industrial fishing activities

In 2010, fisheries production over all fishery products was 3.92 million tonnes of which 2.61 million tonnes (53%) were marine. Over 2009-2010, Thailand was the greatest importer of Myanmar's fishes, importing 108,511 tonnes of marine and freshwater fishes, followed by Kuwait, China and Singapore. Exported fishery products accounted for 10% of the total production in 2009-2010.

Industrial fishing activity in the offshore waters of Myanmar is most likely to occur outside of the rainy season due to the increased risk of being at sea during monsoon conditions. Therefore, fishing in the project area is most likely to occur between September and May.

#### 5.5.5.3.5. Marine fishery in Tanintharyi Region

The project is located within the Ayeyarwady and Tanintharyi Fishing Areas. In addition to offshore fisheries, although little documented information is available, there are likely fishing activities on the islands closest to Block M9 (Coco Islands, Narcondam Island and Preparis Island).

According to discussion with local regional offices, only fishery groups from Tanintharyi Region are located within Block M9. Tanintharyi Region produced approximately 650,000 tons of fish during 2009-2010 season, far higher than the yield of 150,000 tons in Mon State. Several local prawn and fish farms, as well as

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<sup>12</sup> *The Irrawady, Burma Bans Foreign Fishing Boats From Its Waters, April 3, 2014.*

processing plants, are also connected to this business as well. There are also indications that November to April is the best season for fishing in terms of weather condition. Fishing occurs during this period in shallow water, across the continental slope but also in deep-water.

#### **5.5.5.4. FRESHWATER FISHERIES**

With 1.5 millions tonnes of freshwater fish yielded in 2015, Myanmar's freshwater capture fisheries are the largest in Southeast Asia and represent 28% of the total national fish production (Myanmar Fisheries Partnership, 2016). This sector provides job opportunities to 1.5 million people and 27% of the fresh fish consumed.

Freshwater fisheries production covers approximately 6 million ha during 4-5 months of the year. Freshwater aquaculture is mainly operated by private sector rearing fish in pond-based culture system. In terms of leasable freshwater fisheries, the fishing rights are granted through a lease agreement with DoF subject to stipulations relating to the area, species, fishing implements, fishing period and methods used.

#### **5.5.5.5. MARINE AQUACULTURE**

Aquaculture has potential to be a significant source of income and employment for people living in Tanintharyi division. The Department of Fisheries introduced aquaculture with Tilapia, Common Carp species, and other freshwater finfish from the 1950s onward, succeeding mass production by artificial propagation.

The expansion of aquaculture undoubtedly increased fisheries production, but in many cases, it also resulted in damage to sensitive ecosystems such as mangroves and intertidal mudflats. There is a need, therefore, to carefully assess future aquaculture projects from the point of view of their environmental impacts.

#### **5.5.5.6. ORNAMENTAL FISH**

The ornamental fish industry is one of the country's main economic sectors that generate income through export. The production of ornamental fish was about 1.45 million fishes in 2014-2015, which was the same as that in 2015-2016. In terms of value, the ornamental fish production had increased to US\$ 0.20 million in 2015-2016 from US\$ 0.16 million in the previous fiscal year.

#### **5.5.5.7. INTERACTIONS BETWEEN THE PROJECT AND THE FISHERY SECTOR**

The project area is located in the offshore fishery zone of the Tanintharyi region. It is relatively close to the shoreline and at water depths comprised between 50 and 800 m. Given these parameters, there is a probability that large, industrial fishing fleets legally operate targeting mainly pelagic fish. It is also possible to find foreign fishing fleet (mostly Thai) operating illegally since the recent ban forbids legal foreign fishing. Besides, small-scale fishermen that occasionally venture far away from the coast could be encountered, although this likelihood is much more limited.

### **5.5.6. Coastal Tourism**

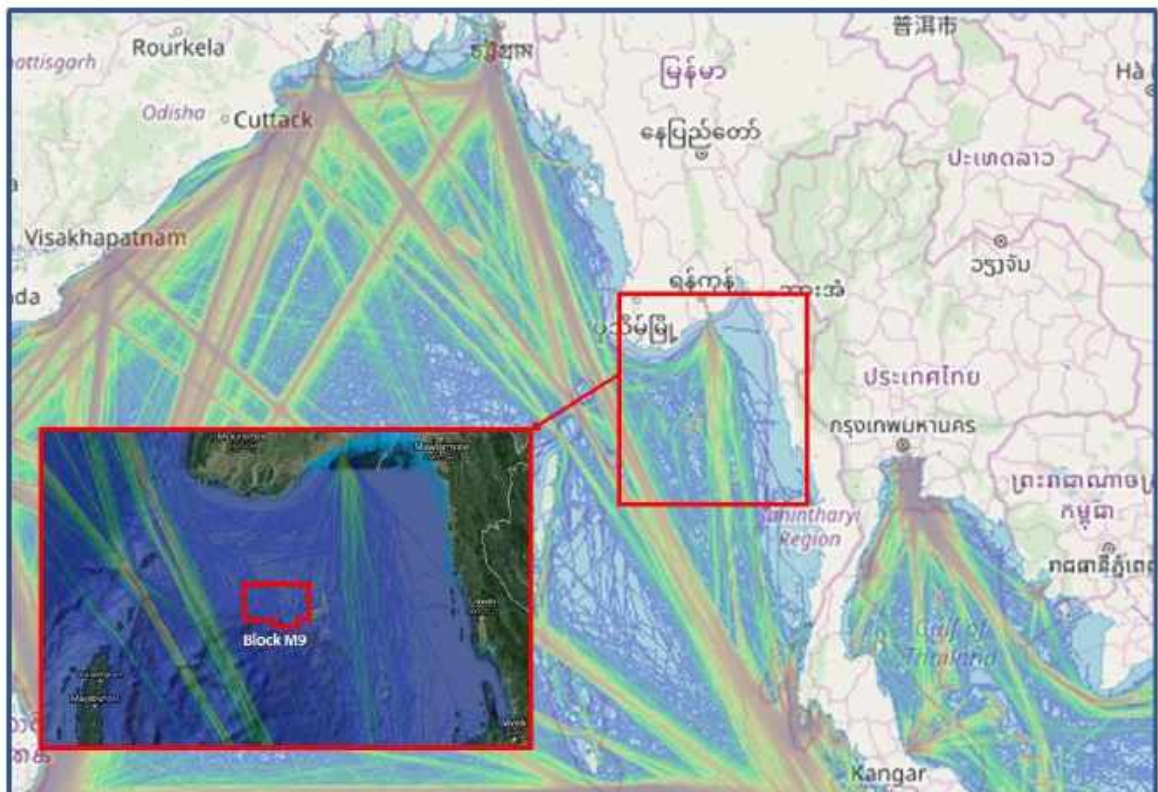
The Mergui Archipelago, which consists of more than 800 untouched islands, is part of the Tanintharyi Region. All islands lie in the Andaman Sea of the coast of southern Myanmar. Since 2016, the natural, unspoiled islands have become increasingly popular among international tourists. In 2017 fiscal year, earning more than K1.6 billion from tourism. Tourist attractive islands are Lampi Island, Jack Fruit Island and Myauk ni island. The traditional culture of Salone, also known as Sea gypsies or Moken is becoming a popular trend in tourism.

### 5.5.7. Marine Transportation

Marine traffic density offshore Ayeyarwady and Tanintharyi is limited to boats navigating between the Port of Yangon and a regional shipping lane connecting Bangladesh to Thailand. Although the project is located around the main shipping lane from Yangon heading to the Straits of Malacca in the south, Block M9 is far from international routes.

Besides commercial traffic, there is a strong contribution of oil and gas operations to regional marine traffic off Myanmar coasts. There exists the potential for tanker routes to be established near the project area. Thus, the exploration drilling campaign is likely to temporarily increase the marine traffic in the area, and operational ships may encounter commercial ships during the project implementation.

By taking into account that the project is not within the international shipping route and locating at a significant distance from protected islands and far from the margin of maritime boundary, the possible impact of transboundary passage is anticipated as negligible and the disturbance to commercial and naval marine traffic is as minor.



**Fig. 30.** Location of project Block M9 and international shipping lane

### 5.5.8. Main Ports Identified for the Installation of the Logistic Base

The project will use the Thaketa port and the foreign port of Ranong (Thailand) for supplies, crew transport and support for project operation.

## 6. IMPACT AND RISK ASSESSMENT AND MITIGATION MEASURES

*The first section of this chapter is a reminder of the impacts producing factors observed on the project description and the environmental sensitivities identified in the description of the environment. At first, project component that could have an impact on the environment are listed; in a second part, the environmental sensitivities are listed. All of this information will be used as input data for the impact analysis.*

*In this chapter, the project's negative and positive, direct and indirect, temporary, permanent, cumulative impacts on the site and its environment will be studied. The potential and residual impacts are assessed for each project phase (from the drilling phase to the decommissioning of the facilities) taking into account the environment components such as biodiversity, air, water and marine sediment quality, and socioeconomic components (employment, land and resources uses, life conditions, etc.).*

### 6.1. SUMMARY OF IMPACT PRODUCING FACTORS AND ENVIRONMENTAL SENSITIVITIES

#### 6.1.1. Summary of the Project Components likely to Impact the Environment

To better assess the impacts, the project is analysed to highlight the environmental aspects associated with the activities planned.

An environmental aspect is defined by the standard NF EN ISO 14001: 2004 as a "part of the activities, products or services of an organization that can interact with the environment", whose effects on the receiving environment will be evaluated to calculate the environmental (and social) impact.

The project consists in the mobilization and demobilization of one rig to complete the drilling campaign target recognition on the prospected survey area. The minimum sea depth in the proposal drilling area ranges between 50 to 800 m. It will be conducted in Q3-Q4 of 2018 for 540 days. So the elements that could have an impact on the environment are described as impact producing factors in the following table.

**Tabl. 28 - Block M9 operation impact producing factors**

Exploration drilling operation impact factors
<ul style="list-style-type: none"> <li>● <b>Physical presence of the drilling rig and support vessel:</b> the presence of the drilling rig and logistic vessel can cause important impact on the maritime environment of the project area.</li> </ul>
<ul style="list-style-type: none"> <li>● <b>Consumption of resources (diesel):</b> drilling activities required the consumption of natural resources along with the use of chemicals, all of this in order to operate the engines, machines and processes.</li> </ul>
<ul style="list-style-type: none"> <li>● <b>Discharges and waste production</b> (sanitary waste, runoff water, bilge water, ballast water).</li> </ul>
<ul style="list-style-type: none"> <li>● <b>Generation of air emissions, noise and light</b> (security, drilling): drilling and well installation generate underwater noise, air emission and light.</li> </ul>
<ul style="list-style-type: none"> <li>● <b>Generation of hazardous and non-hazardous wastes:</b> drilling activities (oil sludge) as well as the operation of living quarters on vessels lead to the production of wastes.</li> </ul>
<ul style="list-style-type: none"> <li>● <b>Chemical storage on rig and onshore:</b> to ensure optimal operation of the drilling process, chemical injection is required.</li> </ul>
<ul style="list-style-type: none"> <li>● <b>Labour, subcontractor and supply:</b> drilling operation require the recruitment of local &amp; expatriate personnel.</li> </ul>
<ul style="list-style-type: none"> <li>● <b>Accidental spills:</b> in case of unplanned event such as accident, drilling operation may cause oil spill of greater or lesser importance.</li> </ul>

#### 6.1.2. Summary of the Environment Sensitivity

The conclusion of the receiving environment sensitivity involves a semi-quantitative notation based on expert opinions scored on a scale of 0 to 4, where 0 represents "no sensitivity" and 4 "high sensitivity". The general

principles for establishing a sensitivity ranking for a component are described in Tabl. 29 - General principles for sensitivity scoring (Se). The notation of environment sensitivity is independent of any of the project's characteristics.

The notion of sensitivity takes into account various factors including population, biodiversity, presence of rare or threatened species, economic importance, capacity to recover populations or quality of the environment after impact, percentage of affected ecosystems or resources compared to regional, national or international level.

From a socio-economic point of view, the human environment sensitivity is assessed according to the level of resilience of the populations and stakeholders affected by the project. It is the capacity to adapt and response to the changes caused by the project's activities.

**Tabl. 29 - General principles for sensitivity scoring (Se)**

Guide	Score (S)
<p><b>High sensitivity:</b></p> <p>The affected species/ecosystems are rare, at risk or protected at the international level.</p> <p>The component (habitat, environment) presents a high preservation issue with the presence of permanent or regular threatened species.</p> <p>The local population and local socioeconomic environment stakeholders are highly vulnerable to the changes generated by the project: no or very low resilience.</p>	4
<p><b>Medium sensitivity:</b></p> <p>The affected species/ecosystems are rare or protected in the Myanmar waters and along the coasts of Myanmar but are common outside the Andaman Sea.</p> <p>The component (habitat, environment) presents a preservation issue with the presence of vulnerable established species or threatened species occasionally using the area.</p> <p>A great part of the local population and local socioeconomic environment stakeholders is vulnerable to the changes generated by the project.</p>	3
<p><b>Low sensitivity:</b></p> <p>The affected species/ecosystems are not widespread over the Myanmar waters and along the coasts of Myanmar but are common outside the Andaman Sea.</p> <p>The component (habitat, environment) has no special preservation issue.</p> <p>There is no species considered as rare, at risk or protected.</p> <p>A part of the population and local stakeholders have the capacity to respond to the changes generated by the project.</p>	2
<p><b>Very low sensitivity:</b></p> <p>Impacted species/Ecosystems are widespread over the Myanmar waters and along the coasts of Myanmar but also outside the Andaman Sea.</p> <p>The component (habitat, environment) has no special preservation issue.</p> <p>There is no species considered as rare, at risk or protected.</p> <p>The local populations and the local socioeconomic environment stakeholders have all the capacities and resources required to respond or adapt to the changes generated by the project (high resilience).</p>	1
<p><b>No sensitivity:</b></p> <p>The project area and potential zone to be affected does not include any inhabitants, animal, plant species, ecosystem or resources within the project area</p>	0

The receiving environment located in the vicinity of the project can be broken down into three major components: (i) physical environment, (ii) biological environment and (iii) human environment. Based on the data examined in the section 5 - Description of the Surrounding Environment, the outcomes of the coring survey receiving environment rating process are given in the following table.

Tabl. 30 - Sensitive components of the environment

Components			Sensitivity quotation	Se
Physical	Offshore ambient air	Air quality and greenhouse effect	The sensitivity of the atmospheric environment to changes in atmospheric emission concentrations in the magnitudes predicted as part of the exploration project is expected to be fairly low due to the other similar industrial activities currently undertaken in the adjacent areas.	1
	Offshore sediment	Quality and disruption	The sediment consists of high proportions of silt and clay, with high nutrient contents and organics. This indicates a soil environment in generally good condition, with chemical and physical characteristics which would be reasonably sensible to changes in physical composition as a result of seabed disturbance.	2
	Water column	Physical and chemical characteristics	Water quality in the region of the project area is considered to be good, with acceptable chemical water quality characteristics. Although anthropogenic pollution has been recorded in surrounding blocks, the presence of pollution on Block M9 was considered uncontaminated with no parameter occurring at concentrations of environmental concern.	2
Biological	Offshore environment	Phytoplankton and zooplankton	The Andaman sea is very productive with high phytoplankton densities during the Northeast monsoon (November). <i>Oscillatoria erythraea</i> and <i>Protoberidinium sp.</i> are dominant species. A rich abundance of zooplankton groups, including calanoid copepods, phylum arthropoda and phylum chordata is found present in the project area.	2
		Benthic communities	Benthic communities are likely to be well presented in terms of species and abundance within the project area.	1
		Fish	The pelagic fish community is widespread and relatively eclectic in its distribution. A wide variety of jacks, tunnys, barracudas, flying fish, sharks and rays are included in this community that extends across the entire Indian Ocean. A total of 37 pelagic fish species were identified by the IUCN as threatened with different levels of vulnerability in Andaman Sea and Bay of Bengal.	2
		Cetaceans	A total of 29 marine mammal species have been recorded by the IUCN with different levels of vulnerability: <ul style="list-style-type: none"> <li>2 species are endangered (EN) facing very high risk of extinction in the wild: the Blue Whale (<i>Balaenoptera musculus</i>) and the Fin Whale (<i>Balaenoptera physalus</i>);</li> <li>4 species are classified as vulnerable (VU) facing high risk of extinction in the wild: the Indo-Pacific Finless Porpoise (<i>Neophocaena phocaenoides</i>), the Irrawaddy Dolphin (<i>Orcaella brevirostris</i>), the Sperm Whale (<i>Physeter macrocephalus</i>) and the Dugong (<i>Dugong dugon</i>). The Dugongs are rare and are mostly found west of the Irrawaddy Delta and further north of the main coastline.</li> <li>1 species is near threatened (NT): the Indo-pacific Hump-backed Dolphin (<i>Sousa chinensis</i>).</li> </ul> Larger cetaceans' species have been recorded in offshore deeper waters which would be in line with their typical histories. Therefore, they are likely to be found within the project area.	4
		Turtles	Amongst the turtle species present in Myanmar, 5 species breed regularly on Myanmar's beaches, including the Olive Ridley Turtle <i>Lepidochelys olivacea</i> (vulnerable), the loggerhead <i>Caretta caretta</i> (endangered), the Green Turtle <i>Chelonia mydas</i> (endangered), the Hawksbill Turtle <i>Eretmochelys imbricata</i> (critically endangered), and Leather Back Turtle <i>Dermochelys coriacea</i> (critically endangered). Most observations of turtles are typically within 15 kilometres of mainland shores in protected, relatively shallow marine waters (22-55 m). However, all the marine turtles species recorded in Myanmar may occur in the M9 Block during migratory movements to and from nesting beaches along the coast with exception of the Loggerhead turtle.	4



**Offshore M9 East Appraisal/Exploration Drilling**

Report

**ENVIRONMENTAL IMPACT ASSESSMENT**

Components		Sensitivity quotation		Se
Coastal environment	Birds	A total of threatened 20 seabird species are currently identified by the IUCN in Myanmar waters. Amongst these species, 4 species are identified as near threatened and 16 species are recorded as least concern. Taking into account the typical habitat of these seabirds, seven species could potentially occur within the project area.	2	
	Seagrass and seaweed	Although seagrass are normally absent from the Ayeyarwady Delta and the Gulf of Martaban coastal region, these species are found mainly in the Rakhine and Tanintharyi coastal areas. Among the seaweed species observed in Myanmar, <i>Sargassum</i> and <i>Hypnea</i> are the most abundant.	1	
	Marine reptiles	Regarding sea snakes, all the species identified by the IUCN in Myanmar coastal waters have been identified as being of 'least concern'. The saltwater crocodile ( <i>Crocodylus porosus</i> ) has been recorded in swampy coastal areas throughout the region, as well as occasionally being observed in the open sea. This species is listed by the IUCN as least concern, and it is not considered significant in the context of the exploration drilling project.	1	
	Mangroves	Mangroves along the Myanmar's coast are of great importance. There are no mangroves in the vicinity of the Block M9, due to its location far offshore from coastal mainland or islands. That is, mangrove will not be affected by the Block M9.	0	
	Coral reefs	Coral Reef formation in the Ayeyarwady coastal zone is restricted to the Thamihla Kyun, Coco and Preparis islands which lie far outside the zone of influence of river runoff. Block M9 is located at ~153 km and 122 km and 83 km from the three Islands.	1	
	Sensitive and Protected areas	Sensitive areas	There are four marine protected areas located in the proximity of the Block M9: Lampi Island, Mainmahla Kyun, Moscos Islands and Thamihla Kyun. One of these areas is designed as a marine national park and three are wildlife sanctuary.	1
		International Protected areas	Myanmar has one identified Ramsar site which is not considered to be affected by the project and 1 Important Bird Area (the Irrawaddy Delta) that could be affected by the project activities.	1
Human	Offshore societal environment	Marine fishery	The project is located in the offshore fishery zone, where 2,000 fishermen are registered to operate and from where foreign fishing activities have been recently banned. According to discussion with local regional offices, only fishery groups from Tanintharyi Region are located within Block M9. There are also indications that November to April is the best season for fishing in terms of weather condition. Fishing occurs during this period in shallow water, across the continental slope but also in deep-water.	3
		Marine traffic & Port infrastructure	Although the eastern edge of the block is located adjacent to the main shipping lane from Yangon heading to the Straits of Malacca in the south, Block M9 does not include international routes. However, there exists the potential for tanker routes to be established near Block M9.	3
	Onshore societal environment	Local and regional economic fabric	No resident population has been recorded in the project area, which is 113 km from the nearest mainland coast (Ahmar town, Pyapon Sub-township, Pyapon district, Ayeyarwady State), and 83 km from the nearest island, which is uninhabited (Narcondam Island). Although this island, along with Coco Island, are uninhabited, they are visited by tourist.	1

## 6.2. METHODOLOGY TO ASSESS IMPACTS

The Environmental Assessment methodology is based on World Bank Guidelines and ISO 14000. The elements considered are the following:

- Positive and negative impacts (i.e., beneficial or detrimental);
- Direct and indirect impacts;
- Temporary and short-term (i.e., less than 3 years) and long-term impacts (i.e., longer than 3 years);
- Magnitude categories (negligible, minor, moderate, major and unknown) for local, regional, national and international scales; and
- Project actions which will cause an immediate impact and those which will have a future impact. Due to their permanence, irreversible impacts are to be identified and highlighted in the assessment.

The first steps consist in establishing the impact producing factors based on project description and the environmental sensitivity based on environmental description (see § 6.1). The estimations of emission, discharge and waste production presented in chapter 4.5 constitute also an important input data for the impact assessment.

The impact producing factors were identified for each stage of the project: (i) Mobilization and installation phase, (ii) Drilling phase and (iv) P&A phase (Plug and Abandon) and Demobilization of the equipment.

The environmental impact assessment process involves:

- A screening of potential impacts associated with each phase of the project is performed using a cause-effect matrix. This matrix presents the potential environmental consequences of untreated impacts in order to identify those resulting in a significant environmental impact requiring mitigation of significant residual risk;
- A detailed evaluation of the significant individual impact producing factors that comprise each aspect of the project phases is then performed. The potential impacts and proposed associated mitigation measures are quantified using the same rationale as for screening to assess the remaining impact and the effectiveness of proposed mitigation measures.

A **potential impact** is defined as the impact that could occur when no mitigation measure has been applied, where no management plan has been implemented (example: waste management plan) and where there is a potential for non-compliance against regulation if abatement systems malfunction. The potential impacts are presented in section 6.2.2.

A **residual impact** is defined as the impact that could occur after application of the mitigation measures. The relevant environmental consequences assessed as requiring mitigation or management measures, and the associated residual impacts, are presented in section 6.3.

### 6.2.1. Impact Assessment Parameters

#### 6.2.1.1. DEFINITION OF INTENSITY (I)

An environmental impact can be described as the change in an environmental parameter, which results from a particular activity or intervention. The intensity (I) of the environmental impact is integrated into the analysis by determining an intensity score for each impact. The notion of intensity takes into consideration the characteristics of the impact producing factor: nature, type of effect, duration, reversibility and scale/area affected.

The intensity is scored on a scale of 1 to 4, where 1 is for low intensity and 4 for high intensity. The scoring is established qualitatively.

General principles for scoring the intensity are provided in the below table.

Tabl. 31 - General principles for scoring intensity (I)

Intensity (I)	Level
<p style="text-align: center;"><b>MAJOR (Long-term impact with wide extent)</b></p> <ul style="list-style-type: none"> <li>• <b>Sediment, water column and air quality</b> The impact producing factor affects the zone extending from the project location to the coast. The change in the physical and chemical characteristics is greater than 5% compared to the baseline characteristics. Contamination of the receptors by products that are toxic, poorly biodegradable, and/or hazardous.</li> <li>• <b>Offshore flora and benthic fauna</b> The impact producing factor affects the populations located within the zone extending from the project location to the coast. The detectable change in population numbers or species biodiversity is greater than 5% compared to the baseline characteristics.</li> <li>• <b>Offshore fauna (turtles, marine mammals, fish)</b> The impact producing factor affects the marine life found within the zone extending from the project location to the coast. There is a detectable change in population numbers greater than 5% compared to the normal variations in baseline characteristics.</li> <li>• <b>Consumption of natural resources</b> Important consumption of natural resources, water or energy</li> <li>• <b>Waste production</b> Significant production of hazardous wastes, those are not taken in charge correctly</li> <li>• <b>Noise</b> Excessive noise level with impact on human health.</li> </ul>	4
<p style="text-align: center;"><b>MODERATE (Medium-term impact, middle to large extension)</b></p> <ul style="list-style-type: none"> <li>• <b>Sediment, water column and air quality</b> The impact producing factor affects the zone extending from the project location to the coast. The change in the physical and chemical characteristics is more or less 5% compared to the normal variations in baseline characteristics.</li> <li>• <b>Offshore flora and benthic fauna</b> The impact producing factor affects the populations located within the zone extending from the project location to the coast. The detectable change in population numbers or species biodiversity is more or less 5% compared to the normal variations in baseline characteristics.</li> <li>• <b>Offshore fauna (turtles, marine mammals, fish)</b> The impact producing factor affects the marine life found within the zone extending from the project location to the coast. The detectable change in population numbers or species biodiversity is equal to or less 5% compared to the normal variations in baseline characteristics.</li> <li>• <b>Consumption of natural resources</b> Important consumption of natural resources, water or energy</li> <li>• <b>Waste production</b> Significant production of hazardous wastes, those are addressed correctly</li> <li>• <b>Noise</b> Noise level slightly above the regulatory requirements.</li> </ul>	3
<p style="text-align: center;"><b>MINOR (Short-term impact, low to middle extension)</b></p> <ul style="list-style-type: none"> <li>• <b>Sediment, water column and air quality</b> The impact producing factor affects a localized area representing a zone with a radius of approximately 20 km. The change in the physical and chemical characteristics is more or less 5% compared to the normal variation of the baseline characteristics.</li> <li>• <b>Offshore flora and benthic fauna</b> The impact producing factor affects the populations with a localized area representing a zone with a radius of approximately 20 km. The change in population numbers and species biodiversity is more or less 5% compared to the normal variations of the baseline characteristics.</li> <li>• <b>Offshore fauna (turtles, marine mammals, fish)</b> The impact producing factor affects the marine life in the immediate vicinity of the project area within a zone with a radius of approximately 20 km. The change in population numbers and species biodiversity is more or less 5% compared to the normal variations of the baseline characteristics.</li> <li>• <b>Consumption of natural resources</b></li> </ul>	2

Intensity (I)	Level
Significant consumption of natural resources, water or energy <ul style="list-style-type: none"> <li>• <b>Waste production</b> Low production of hazardous wastes, those are addressed correctly</li> <li>• <b>Noise</b> Acceptable noise level, below threshold limit recognize for their impact on human health.</li> </ul>	
<p style="text-align: center;"><b>NEGLIGIBLE (Short-term impact, small extension)</b></p> <ul style="list-style-type: none"> <li>• <b>Sediment, water column and air quality</b> The impact producing factor affects a localized area representing a zone with a radius of approximately 2 km. The change in physical and chemical characteristics are known to occur but cannot be measured as they are within the normal variations of the parameter.</li> <li>• <b>Offshore flora and benthic fauna</b> The impact producing factor affects the populations within a localized area representing a zone with a radius of approximately 2 km. The change in populations number and species biodiversity are known to occur but cannot be measured as they are within the normal variations of the parameter.</li> <li>• <b>Offshore fauna (turtles, marine mammals, fish)</b> The impact producing factor affects the marine life in the immediate vicinity of the project area within a zone with a radius of approximately 2 km. There is no measurable effect on the population numbers, but it is thought that there could be some disruption to the species causing them to avoid the area.</li> <li>• <b>Human environment</b> Detectable interaction with marine traffic and fishing activities without hindrance or reduced fish catch.</li> <li>• <b>Consumption of natural resources</b> Small consumption of natural resources, water or energy</li> <li>• <b>Waste production</b> No production of hazardous wastes</li> <li>• <b>Noise</b> Noise level similar to the noise background.</li> </ul>	1
<ul style="list-style-type: none"> <li>• No impact.</li> </ul>	0
<p style="text-align: center;"><b>POSITIVE</b></p> <ul style="list-style-type: none"> <li>• All positive impacts no matter their scopes and size.</li> <li>• In practice most of the positive impacts concern the human environment (direct or indirect jobs for local population, etc.) during all the project phases.</li> </ul>	P

### 6.2.1.2. DEFINITION OF SEVERITY (S)

The severity of the impacts is further qualified by considering the following:

- Positive impact: impact favourable to developments or which may be of benefit to the environment;
- Negative impact: impact causing environmental nuisance or degradation;
- Direct impact: impact caused by the studied activity, which has a scale of effect in the same time and in the same place as the studied activity ;
- Indirect impact: the consequences of the impact are distant in space and in time from the studied activity ;
- Long-term Impact: the consequences of the impact last at least 10 years;
- Medium to long term: the consequences of the impact last between 5 and 10 years;
- Short-term Impact: the consequences of the impact are instantaneous or last less than 1 year.

The severity of an impact is scored by multiplying the score for intensity by the score for sensitivity:  $S=Se \times I$ .

The below table explains how to score the severity of the impact by crossing sensitivity with intensity.

Tabl. 32 - Rating impact severity

Severity $S = I \times Se$	Sensitivity of the affected environment (Se)			
	1	2	3	4
Intensity (I)	0	0	0	0
	1	1	2	3
	2	2	4	6
	3	3	6	9
	4	4	8	12

Positive impact	NO IMPACT	
P	NEGLIGIBLE	MODERATE
	MINOR	MAJOR

The impact intensity (I) is estimated by an expert based on the environment presented in the table below.

Tabl. 33 - Impact severity

Environment	Major	Moderate	Minor
Physical and natural environment	<p>Long-term (&gt;10 years) and general changes in characteristics of habitat/ecosystem and its ecological functions. The habitat/ecosystem cannot return to its original state.</p> <p>Sufficient disturbance of a bio-geographical portion of a species population to cause a decrease in its abundance, distribution or size of gene pool, such that the population of the species and other associated species cannot naturally return to the original level.</p> <p>Loss or major modification of an internationally designated site, for which the key characteristics will be fundamentally changed.</p> <p>Injury or death of a species (numerous individuals) classified as “critically endangered” by the IUCN, such that its regional and/or international population is threatened.</p> <p>Incident requiring mobilization of equipment and an international response team.</p>	<p>Changes in characteristics of habitat and ecosystem or its ecological functions, which can return to their initial state within 5-10 years.</p> <p>Sufficient disturbance of a bio-geographical portion of a species population to cause a decrease in its abundance, distribution or size of gene pool, such that the population of the species and other associated species will return to their original level only after several years.</p> <p>Loss or major modification of a locally designated site, for which the key characteristics will be fundamentally changed</p> <p>Injury or death of a species (one or several individuals) classified as “critically endangered” by the IUCN. The mortality rate remains negligible compared with the local population.</p> <p>Incident requiring mobilization of a national or company response resource.</p> <p>Major change in the appearance and sensitivity of a rare or unique landscape recognised locally.</p>	<p>Reduction of the integrity of a habitat and ecosystem, which will nevertheless return to its initial state in 2-5 years with minimum intervention.</p> <p>Disturbance of a bio-geographical population or species individuals resulting in a decline in abundance or distribution of one or several generations, but which does not adversely affect the integrity of other associated species.</p> <p>Injury or death of a species (one or several individuals) classified as “vulnerable” by the IUCN.</p> <p>Mortality rate remains negligible compared with the local population.</p> <p>Incident on site requiring mobilization of equipment and a response team.</p> <p>Development will not affect the key characteristics contributing to the distinctive nature and/or value of the landscape.</p>

Environment	Major	Moderate	Minor
Human environment	<p>Increase in public exposure to substances, which threaten health and could increase mortality rate.</p> <p>Changes affecting chances of life in different ways (access to healthcare/medication) of vulnerable groups (handicapped, elderly people, heads of families, women and people living below the official poverty line or subsistence levels).</p> <p>Damage on a site of national or international cultural importance which could lead to protests/unrest.</p> <p>Sufficient unplanned migration flow (inflow) to overwhelm capacity of physical and social infrastructures.</p> <p>Major change in visual quality and sensitivity of a rare, or unique, (inter)nationally designated landscape.</p>	<p>Reduction in goods and access to goods, where variation in the economy affects more than 5 individuals, households or enterprises.</p> <p>Loss of jobs in small communities having very few short- or medium-term alternatives (less than one year after losing employment).</p> <p>Changes likely to adversely affect the success of a policy or existing plan.</p> <p>Changes affecting differently the livelihoods of vulnerable groups (handicapped, elderly people, heads of families, women and people living below the official poverty line or subsistence levels).</p> <p>Minor damage on a site of national cultural importance, which could lead to protests/unrest.</p> <p>Financial loss to enterprises in the medium to long term (&gt;1 year), where recovery could be difficult.</p> <p>Sufficient unplanned migration flow (inflow) to overwhelm capacity of at least one infrastructure.</p> <p>Increase in cultural conflicts which may not be contained using existing social control norms.</p> <p>Increase/change in maritime traffic through sensitive areas (e.g. international traffic lanes).</p>	<p>Decrease in goods and access to goods, where economic variation affects 1 to 4 individuals, households or enterprises.</p> <p>Loss of jobs in small communities capable of adapting and offering job opportunities in the short or medium term (less than one year losing employment).</p> <p>Damage on a site of regional or local cultural importance (e.g. antique wrecks, etc.).</p> <p>Financial loss to enterprises in the short term (&lt;1 year), where recovery is possible.</p> <p>Unplanned migration flow (inflow), which should not overwhelm infrastructure capacity.</p> <p>Increases in cultural conflicts and changes in attitude, but these should be contained by the existing social control norms.</p> <p>Increase in public exposure to health hazards, which could increase mortality rate.</p> <p>Reduced access to healthcare facilities and treatment.</p> <p>Increase/change in maritime traffic through sensitive areas (e.g. national traffic lanes).</p>

**When impact is considered as negligible, no impacts details (duration, short-term, long term, direct indirect, etc.) is given as it is not considered necessary.**

### 6.2.2. Assessment of potential impact cause effect matrix

A screening matrix has been developed to summarize the outcomes of the qualitative assessment of activity / receiver interactions for each activity performed during each phase of the project. Those are presented in the chapters below.

The impact producing categories are presented on the horizontal axis and the environmental components along the vertical axis.

Each matrix cell indicates the impact severity (major, moderate, minor or negligible) based on the consideration of the intensity of the impact producing factor and the sensitivity of the receiving environment.

The presented impacts are the untreated impacts related to all environmental components without the implementation of appropriate mitigation factors.

These tables present the potential impacts in a worst case scenario, in order to identify the risks identified as MODERATE or MAJOR.

For activities identified as having minor to major risks (i.e. risk greater than 3), appropriate mitigation factors were identified. The potential mitigation measures consist of either design measures or 'soft' operational and procedural controls to minimize the impacts of the identified activities.

The potential for accidental events to occur has also been assessed in terms of probability of occurrence and consequence. These events are considered to constitute non-planned / unforeseen events.

6.2.2.1. POTENTIAL IMPACTS MATRIX

Tabl. 34 - Potential impact matrix

ENVIRONMENTAL RECEPTORS		POTENTIAL IMPACTS																																															
		P0		P1		P2		P3		P4			P5		P6			P7		P8		P9																											
		Consumption of Natural Resources		Atmospheric emissions		Generation of noise		Generation of light		Discharges to the sea			Generation of solid hazardous and non hazardous wastes		Disturbance of seabed			Physical presence of structures and vessels		Introduction of Invasive Species		Accidental releases and other emergency situations																											
Matrix Severity (S) = Intensity (I) * Sensitivity (Se) No Impact 1-2 : Negligible 3-4 : Minor 5-9 : Moderate >9 : Major P: Positive		Use of freshwater	Use of fuel oil	Use of chemical products	Use of drilling mud and additives	Combustion of fuel oil rig	Combustion of fuel oil for vessel and helicopter	Drilling operations	Vessels and Helicopter	Underwater noise from traffic	Drilling rig	Vessels and Helicopter	Blige, ballast and deck water	Sanitary wastewater	Cement discharge	Discharge of drilling cuttingd and mud	Non-Hazardous waste	Hazardous waste	Installation of rig	Positioning of the rig	Drilling operation	Presence of vessels and rig	Ballast water	Biofouling	Blowout	Fuel and Oil Spills	Hazardous materials	Fire and Explosions																					
Physical components	Natural resources	2	2	1																																													
	Non renewable resources		3	6	2	3	6	2	3	6	2																																						
Physical components	Sediment Quality															1	2	2																															
Physical components	Water Quality												3	6	2	3	6	2	1	3	3	2	1	2	4	2			2	4	2																		
Physical components	Atmospheric environment					1	2	2	1	2	2															2	6	3		2	4	2																	
Biological environment Offshore	Plankton							2	2	1	2	2	1	2	4	2	2	4	2		2	4	2				2	6	3	2	4	2	2	4	2														
	Bentic community							2	2	1	2	2	1	2	2	1	2	2		1	2	2	2			1	1	1	1	2	4	2		2	6	3	2	4	2	2	4	2							
	Pelagic Fish							1	1	1	2	2	1	2	2	1	2	4	2	2	4	2	2	2	1	2	4	2		2	4	2		2	6	3	2	4	2	2	4	2							
	Marine mammals							3	3	1	3	3	1	3	3	1	3	6	2	3	6	2		2	4	2	3	3	1	3	6	2		3	6	2		3	9	3	6	2	3	6	2				
	Marine turtles							3	3	1	3	3	1	3	3	1	3	6	2	3	6	2		2	4	2	3	3	1	3	6	2		3	6	2		3	9	3	6	2	3	6	2				
	Seabirds							2	2	1	2	2	1	2	2	1	2	2	1	2	4	2		2	4	2				2	4	2		2	6	3	2	4	2	2	4	2	2	4	2				
Biological Environment Coastal	Mangroves																																																
	Seagrass																																																
	Seaweed																																																
	Coral reefs																																																
	Marine reptiles																																																
	Marine mammals																																																
Sensitive areas	Sensitive areas																																																
	Societal Offshore environment																																																
Social Environment	Port infrastrucure																																																
	Industrial fishing																																																
	Marine Traffic																																																

Sensitivity of receiving environment

Sensitivity (Se) Significance

Sensitivity of 4, significance is considered as MAJOR  
 Intensity is scored on a scale of 1 to 4 (1=low intensity, 4=high intensity)  
 Sensitivity is scored on a scale of 1 to 4 (1=low sensitivity, 4=high sensitivity)

### 6.3. IMPACTS ASSESSMENT OF RESIDUAL EFFECTS

The section below is composed by tables which synthesize for each impact producing factor, the level of potential impact, the associated measures proposed to reduce, remove or compensate this potential impact, and the level of residual impact after implementation of proposed measures.

#### 6.3.1. Physical Presence of the Drilling Rig and Support Vessels

Marine equipment (vessels, rigs) and means of transportation for logistics activities (helicopters, vessels) may interfere with commercial shipping routes or fishing activities. Moreover collisions with marine mammals may occur. The main impacts are detailed in the table below.

Tabl. 35 - Impacts from project physical presence

Impact producing factor	Potential impact ranking	Control and mitigation measures	Environmental consequences	Residual impact ranking	Monitoring
Presence of vessels and drilling rig	MODERATE to MINOR <i>Negative, direct, short-term impact on sediment and benthic communities, marine mammals and industrial fishing</i>	<ul style="list-style-type: none"> <li>Before the drilling starts, PTTEPI will coordinate with MOGE, who will then issue “Notice to Mariner” regarding project activities to concerned parties (i.e., Department of Fisheries, Ministry of Livestock, Fisheries and Rural Development, Myanmar Navy and Myanmar Fisheries Federation).</li> <li>Implementing a grievance mechanism</li> </ul>	The impact of the exploration drilling works on the environment and on the economic activities within the area is very limited. However, the aspect “cumulative impact” with the other platforms may have a significant impact on the activities within the area (very strong presence of oil developments in the Myanmar offshore area).	MINOR	<ul style="list-style-type: none"> <li>A post-drilling seabed inspection will be scheduled for the next monitoring plan to evaluate the impact of smothering by sediment on the benthic communities.</li> </ul>

#### 6.3.2. Consumption of Natural Resources & Energy Use

Tabl. 36 - Impacts from resource consumption (raw materials, water, energy)

Impact producing factor	Potential impact ranking	Control and mitigation measures	Environmental consequences	Residual impact ranking	Monitoring
Use of fresh water	NEGLIGIBLE <i>Use of renewable resource</i>	<ul style="list-style-type: none"> <li>Reduce water needs by optimizing the operation with strong needs of water (mud recycling and production, cleaning).</li> <li>Use seawater wherever possible.</li> <li>Use equipment with the lowest consumption possible.</li> </ul>	Cumulative impacts may occur with other activities using waters in the region (potential diminution of the water source in port area)	NEGLIGIBLE	<ul style="list-style-type: none"> <li>No specific monitoring necessary</li> </ul>



Impact producing factor	Potential impact ranking	Control and mitigation measures	Environmental consequences	Residual impact ranking	Monitoring
Use of fuel oil <sup>13</sup>	MODERATE TO MINOR	<ul style="list-style-type: none"> <li>Control and reporting of fuel consumption through the preparation phase.</li> <li>Inspection and regular maintenance of engines and machines vessels and drilling rig as part of a Preventive Maintenance Plan to prevent excessive consumption.</li> </ul>		MINOR	
Use of chemical products	MODERATE	<ul style="list-style-type: none"> <li>Implementation of a Chemical Management Plan with instructions for adequate storage in accordance with SDS instructions, handling and reporting of consumption.</li> <li>Selection of the chemicals is based on technical requirements, with ecotoxicity / bioaccumulation included in the criteria where possible.</li> <li>Optimization on the use of chemicals.</li> <li>Reporting of chemical products consumption.</li> <li>The process of chemical selection will comply with PTTEPI policies.</li> <li>Safety Sheets must be provided with every chemical product for safety and environmental reasons in English and in any other relevant language on-board.</li> <li>Provide spill response equipment on-site.</li> <li>Adequate storage will be proved for each chemical in accordance with safety instructions (storage conditions, etc.).</li> </ul>	The used quantities will not deprive the others users of this resource.	MINOR	<ul style="list-style-type: none"> <li>Recording of incidents related to chemicals.</li> </ul>
Use of drilling mud and additives	MODERATE	<ul style="list-style-type: none"> <li>Opportunities to achieve significant waste volume reduction on drilling mud generated are limited as it is a function of the number of wells and their depth. However, opportunities exist for source reduction for example by using of proper solids' control equipment that can reduce the amount of mud discharged or use of more efficient drill bits rather than chemical additions.</li> </ul>		MINOR	<ul style="list-style-type: none"> <li>Consumption of chemical via the Chemical Management plan</li> </ul>

<sup>13</sup> Only consumption of oil is included here, spills are addressed in the table section on accidental releases.

### 6.3.3. Impact from Discharges to Sea

#### 6.3.3.1. DISCHARGES FROM MARINE VESSELS AND DRILING RIG

The drilling, equipment installation and decommissioning activities require the utilization of various ships and marine vessels. The potential discharges at sea include:

- Ballast water,
- Bilge water,
- Deck run-off water, and
- Sewage waters (domestic and sanitary waters).

Assuming there is no mitigation in place, the main concern associated with the discharges is with respect to discharge of untreated wastewater containing hydrocarbons (diesel and oil) or untreated sewage. Untreated discharges could potentially degrade seawater quality and affect marine life.

Another concern is the incidence of ballast water on the environment. It may have the following impact on biodiversity if a proper management plan is not implemented: invasive species, deleting species, changes in relative abundance of species and introduction of foreign species.

The impact producing factors means of control & mitigation and environmental consequences that are identical for all these marine vessels are addressed together and referred to as ship systems.

**Tabl. 37 - Impacts from ship system discharge**

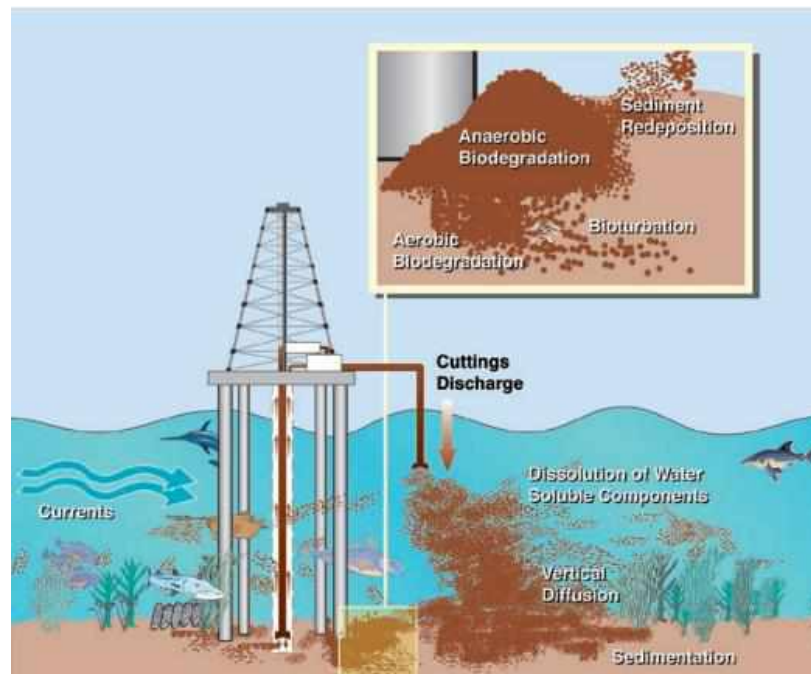
Impact producing factor	Potential impact ranking	Control and mitigation measures	Environmental consequences	Residual impact ranking	Monitoring
Ballast water discharge	MODERATE <i>Permanent, direct, negative impact on water quality</i>	<ul style="list-style-type: none"> <li>● Vessels have designs whereby ballast tanks are separated from systems containing hydrocarbons.</li> <li>● Ballast water will not be discharged into the environment without prior treatment.</li> <li>● Ballast water discharges, if any, will comply with the international Convention for the Control and Management of Ships' Ballast Water and Sediment (IMO, 2004).</li> </ul>	Ballast water will be treated in compliance with MARPOL convention prior to being discharged into the sea. Water from the MODU ballasting will not need any processing if it is discharged at the location where it was taken.	NEGLIGIBLE	<ul style="list-style-type: none"> <li>● Application of the chemical management plan</li> </ul>
Bilge water discharge	MODERATE <i>Temporary, direct, negative impact on water quality</i>	<ul style="list-style-type: none"> <li>● The bilge water will be separately collected and treated.</li> <li>● The development of a system to treat bilge water with a hydrocarbon concentration in the water below 15 ppm.</li> <li>● Vessel not to be stationary when undertaking discharge.</li> </ul>	The treatment of bilge water in compliance with MARPOL Convention will ensure negligible impact on water quality.	NEGLIGIBLE	
Run-off water	MODERATE <i>Temporary,</i>	<ul style="list-style-type: none"> <li>● Vessels have separate drainage and treatment system for</li> </ul>	Run-off water will not contain hydrocarbons and	NEGLIGIBLE	

Impact producing factor	Potential impact ranking	Control and mitigation measures	Environmental consequences	Residual impact ranking	Monitoring
	<i>direct, negative impact on water quality</i>	<ul style="list-style-type: none"> <li>contaminated run-off water.</li> <li>The marine vessels have open drain system which collects and treats run-off water potentially contaminated with hydrocarbons and/or chemicals.</li> </ul>	no detectable effects on water quality are anticipated.		
Sewage waters discharge (domestic and sanitary waters)	<b>MODERATE</b> <i>Temporary, direct, negative impact on water quality</i>	<ul style="list-style-type: none"> <li>Suitable sewage water treatment units shall be available on the vessels and adequately sized according to the number of people working on-board.</li> <li>Implementation of an Operational Discharge Management Plan.</li> </ul>	Routine discharge of wastewater to the ocean will cause a negligible and localized increase in nutrient concentrations, suspended matter, BOD, COD, phosphates and nitrates and bacteriological matter into the water column.	<b>NEGLECTIBLE</b>	<ul style="list-style-type: none"> <li>Proper functioning of wastewater treatment system will be covered by the Preventive Maintenance Plan.</li> </ul>

### 6.3.3.2. DISCHARGES FROM DRILLING

#### 6.3.3.2.1. Drilling cuttings

The discharge of drilling cuttings is an environmental concern since they are deposited on the seabed and cause an impact on benthic communities because of physical burial.



**Fig. 31.** Example of the effect of drill cuttings discharges

The International Association of Oil and Gas producers (OGP) performed a study on the environmental aspects of cutting discharge of Water based Mud in 2003 and concluded that the main effect of the discharged cuttings is that of physical smothering of the benthos whilst there is negligible impact on the

water column (Cf. Fig. 31). The magnitude of the impact is related to the thickness and the effects are considered as short term.

#### 6.3.3.2.2. Cement

The discharge of cement is of concern because of the burial of benthic communities. The effect will be localized. The quantities are expected to be very small.

#### 6.3.3.2.3. Chemical additives in the drilling fluid

The discharge of the chemical additives contained in the drilling mud, which is discharged with the cuttings is an environmental concern because of the potential toxic nature of some of the chemicals (e.g. the biocides) or because they can disturb the conditions (e.g. oxygen scavengers):

- Direct impact on water quality from chemicals and heavy metals in the drilling mud which dissolve in the water column as the cuttings sink to the seabed, and
- Indirect impact on marine life from the degraded seawater quality.

During the first drilling stage (riserless stage), all cuttings and mud will be deposited into the seabed. Only seawater with bentonite and water-based mud will be used for these sections. For the following section, low toxicity, biodegradable and non-persistent non-aqueous based-mud will be used.

#### 6.3.3.2.4. Synthesis of the effects from drilling discharges

**Tabl. 38 - Impacts on benthic communities from drilling discharges**

Impact producing factor	Potential impact ranking	Control and mitigation measures	Environmental consequences	Residual impact ranking	Monitoring
Discharge of drilling cuttings and drilling mud (see Box 1 below)	NEGLIGIBLE	<ul style="list-style-type: none"> <li>● Use of WBM with high biodegradability and low toxicity additives as main drilling fluid for all well sections.</li> <li>● For contingency and technical reason, SBM will be used with low toxicity biodegradable and non-persistent.</li> <li>● The following condition will be effective:               <ul style="list-style-type: none"> <li>○ The discharge of cuttings shall be complied with NEQG, Environmental, Health and Safety guidelines for Offshore Oil and Gas Development (IFC, 2015).</li> <li>○ Discharge of cuttings will be 15 m below sea surface.</li> </ul> </li> <li>● Use of centrifuges, shale shakers and mud cleaners to separate out the cuttings from the mud.</li> <li>● Drilling mud will be treated and then sent back to the cycle in a continual circulation through the well and</li> </ul>	<p>Benthic populations in the project area are sparse and irregular.</p> <p>The <i>International Association of Oil and Gas producers</i> (OGP) performed a study on the environmental aspects of cutting discharge in 2003 and concluded that the main effect of the discharged cuttings is that of physical smothering of the benthos and that there is negligible impact on the water column. The magnitude of the impact is related to the thickness and the effects are considered short term.</p> <p>The WBM comprises seawater small quantities of viscosity modifiers and some chemical additives such as potassium chloride, sodium chloride, calcium chloride, sodium bromide, potassium formate and potassium sulphate. These additives do not have an adverse effect on the marine environment.</p>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>● Post-drilling seabed inspection included in Monitoring Plan.</li> </ul>

## Offshore M9 East Appraisal/Exploration Drilling

Report

## ENVIRONMENTAL IMPACT ASSESSMENT

Impact producing factor	Potential impact ranking	Control and mitigation measures	Environmental consequences	Residual impact ranking	Monitoring
		through the rig's mud handling system: recycling of the mud to minimize the quantity discharge to sea.			
Discharge of cement	NEGLIGIBLE	<ul style="list-style-type: none"> <li>Optimization of the quantities of cement used.</li> </ul>	A small quantity of cement will be discharged at the drilling location. The impact will be low and localized.	NEGLIGIBLE	<ul style="list-style-type: none"> <li>Monitoring of fluid loss control parameters during cement injection.</li> </ul>
Chemical additives in the drilling fluid	NEGLIGIBLE	<ul style="list-style-type: none"> <li>Chemicals shall be selected according to their low toxicity.</li> <li>Used quantities of product shall be optimized.</li> </ul>	The trace quantities of the chemicals are not expected to have any measurable effect on the benthic communities.	NEGLIGIBLE	<ul style="list-style-type: none"> <li>Post-drilling seabed inspection included in Monitoring Plan.</li> </ul>

Tabl. 39 - Impacts on the water column and pelagic marine life from drilling discharge

Impact producing factor	Potential impact ranking	Control and mitigation measures	Environmental consequences	Residual impact ranking	Monitoring
Discharge of drilling cuttings and drilling mud (see Box 1 below)	MINOR Temporary, direct, negative impact	<ul style="list-style-type: none"> <li>Use of WBM with high biodegradability and low toxicity additives as main drilling fluid for all well sections.</li> <li>For contingency and technical reason, SBM will be used with low toxicity biodegradable and non-persistent.</li> <li>The discharge of cuttings shall be complied with NEQG, Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (IFC, 2015).</li> <li>Allow the discharge of drilling cuttings if only the oil on cuttings is less than 6.9% of wet cuttings by using Dryer Unit</li> </ul>	The WBM comprises seawater small quantities of viscosity modifiers and some chemical additives such as potassium chloride, sodium chloride, calcium chloride, sodium bromide, potassium formate and potassium Sulphate. These additives do not have an adverse effect on the marine environment.	MINOR Temporary, direct, negative impact	<ul style="list-style-type: none"> <li>Post-drilling water quality analysis included in Monitoring Plan.</li> </ul>
Drilling discharges	NEGLIGIBLE transboundary impacts	<ul style="list-style-type: none"> <li>No transboundary impacts identified in normal condition as the discharges are localized.</li> </ul>		NEGLIGIBLE	

**Box 1 – Synthesis on the cutting dispersion report (see also paragraph 6.5 and Error! Reference source not found.)**

As the cutting dispersion report has mentioned, impacts associated with suspended matter are low. Assessment of toxicity depends on the drilling option, which will be used effectively on using a cutting dryer. It is therefore anticipated a localized minor impact on the quality of the water column if SBM are used (or negligible impact if WBM is used).

### 6.3.4. Air Quality and Global Warming

#### 6.3.4.1. AIR EMISSION FROM MARINE VESSELS

##### A. Diesel combustion for marine engines

The drilling equipment installation and decommissioning activities require the use of various ships and the drilling rig.

- Logistics will require the use of 2 supply boats;

The marine engines will be fuelled with marine diesel oil most probably in one of the logistic bases chosen (Ranong Supply Base or Thaketa). The combustion of the diesel will result in the generation of exhaust gases comprising:

- Green House Gases (GHGs) comprising carbon dioxide, nitrous oxides and traces of methane. The GHG emissions will contribute to global warming.
- Air quality pollutants comprising sulphur dioxide, nitrogen oxides, volatile organic compounds, carbon monoxide.

The quantity of GHG and air pollutant emissions is considered as negligible with respect to the drilling operation (540 days). No measurable impact on air quality in the project area or onshore is anticipated.

**Tabl. 40 - Impacts of air emissions from marine vessel**

Impact producing factor	Potential impact ranking $S = Se \times I$	Control and mitigation measures	Environmental consequences	Residual impact ranking $S = Se \times I$	Monitoring
Diesel combustion for marine engines	NEGLIGIBLE <i>Impact on contribution to GHG and impact on air quality</i>	<ul style="list-style-type: none"> <li>● Maintaining marine engines, generators and compressors in good working order.</li> <li>● Compliance with MARPOL 73/78 Annex VI – prevention of air pollution from ships, and if applicable based on age of vessels (MARPOL Annex VI Chapter 4 – ship energy efficiency management)</li> </ul>	From evaluation of emissions from other offshore development projects, it is known that emissions from these sources contribute to only a small percentage of emission.	NEGLIGIBLE	<ul style="list-style-type: none"> <li>● No specific measurements will be performed.</li> </ul>

## B. Chloro-fluoro carbons

The drilling rig is commonly equipped with heating, ventilation and air-conditioning systems. These systems typically contain chloro-fluoro-carbons (CFCs). Normally there are no releases of CFCs, but they may be potential small fugitive leaks of CFCs if the equipment is poorly maintained, which would contribute to the impact on the ozone layer. Potential fugitive releases from poorly maintained material would not have a measurable contribution to Myanmar CFC emissions.

**Tabl. 41 - Impacts of air emissions from marine vessel**

Impact producing factor	Potential impact ranking $S = Se \times I$	Control and mitigation measures	Environmental consequences	Residual impact ranking $S = Se \times I$	Monitoring
Chloro-fluoro carbons present in heating ventilation and air conditioning systems, cold rooms and fridges.	<b>NEGLECTIBLE</b> <i>Impact on contribution to GHG and impact on air quality</i>	<ul style="list-style-type: none"> <li>Release of refrigerant gases will be minimized through maintenance procedures and records of refilling performed and kept on-board.</li> <li>Compliance with MARPOL 73/78 – Annex VI – prevention of air pollution from ships.</li> </ul>	The effective implementation of the mitigation measures shall ensure that the minimization of the CFC releases is optimized.	<b>NEGLECTIBLE</b>	<ul style="list-style-type: none"> <li>No specific measurements will be performed.</li> </ul>

### 6.3.4.2. AIR EMISSIONS GENERATED BY DRILLING OPERATION

The power for the drilling tool will be provided by diesel generators on the drilling rig.

The combustion of the diesel will result in the generation of exhaust gases comprising:

- Green House Gases (GHGs) comprising carbon dioxide, nitrous oxides and methane. The GHG emissions will contribute to global warming.
- Air quality pollutants comprising sulphur dioxide, nitrogen oxides, volatile organic compounds, carbon monoxide.

The quantity of GHG and air pollutant emissions is considered as negligible since drilling operations for twelve wells will not occur simultaneously. No measurable impact on air quality in the project area or onshore is anticipated.

**Tabl. 42 - Impacts of air emissions from drilling**

Impact producing factor	Potential impact ranking $S = Se \times I$	Control and mitigation measures	Environmental consequences	Residual impact ranking $S = Se \times I$	Monitoring
Exhaust gases from diesel combustion for power generation	<b>NEGLECTIBLE</b> <i>Impact on contribution to GHG and impact on air quality</i>	<ul style="list-style-type: none"> <li>Maintaining generators and compressors in good working order.</li> <li>Compliance with MARPOL 73/78 Annex VI – prevention of air pollution from ships.</li> <li>Implementation of a Ship Energy Efficiency Management Plan (SEEMP) for the vessels (MARPOL 73/78 Annex VI requirement from 1<sup>st</sup> January 2013).</li> </ul>	The project's offshore area is very far away from the Myanmar coasts; the effects are considered negligible.	<b>NEGLECTIBLE</b>	<ul style="list-style-type: none"> <li>No specific measurements will be performed.</li> </ul>

### 6.3.4.3. ADDITIONAL AIR EMISSION FROM LOGISTICS

In addition to the emissions from the vessels (see paragraph 6.3.4.1), there will also be emissions from the use of helicopters and onshore support facilities as described in the table below.

**Tabl. 43 - Impacts of air emissions from logistics**

Impact producing factor	Potential impact ranking <i>S = Sex I</i>	Control and mitigation measures	Environmental consequences	Residual impact ranking <i>S = Sex I</i>	Monitoring
Exhaust gases from helicopter jet fuel combustion	NEGLIGIBLE	<ul style="list-style-type: none"> <li>Only use helicopter for crew transportation and emergency cases</li> </ul>	No significant impacts expected.	NEGLIGIBLE	<ul style="list-style-type: none"> <li>No specific measurements will be performed.</li> </ul>

The emissions from helicopter use (estimation: 1 hour 10 minutes per flight) are expected to be negligible.

### 6.3.5. Impacts from Noise and Light

#### 6.3.5.1. EMISSIONS FROM MARINE VESSELS - OFFSHORE

The drilling activities require the utilization of 2 supply vessels, all of which will generate noise and light in addition to the drilling rig. The sources of noise are the marine engines and diverse warning sirens.

- Typical underwater noise levels associated with supply vessels in oil and gas exploration is 181 dB re 1  $\mu$ Pa@1 m and with helicopters ~100-160 dB re 1  $\mu$ Pa@1 m (Whale and Dolphin Conservation Society, 2004).
- Implementing the project will contribute to slightly augment the background noise level in the sea and consequently affect the marine species. The levels of underwater noise generated by the traffic of the vessels, especially when in and out of the ports, can affect some coastal sensitive species such as the dugong and the Irrawaddy dolphin (*Orcaella brevirostris*).

The sources of light is the navigation and warning lights and the source of odor is the exhaust gases from the marine engine diesel combustion. Vessels will be illuminated during navigation and working time for safety reasons. When seawater is directly illuminated, it can attract or change the behavior of marine fauna (plankton, fish and predators such as marine mammals).

The project location is situated ~260 km south of Yangon and 178 km west of Dawei and few round trips with marine vessels are forecasted, due to the duration of the project.



Tabl. 44 - Impacts from noise, light and odor generated by ship systems

Impact producing factor	Potential impact ranking	Control and mitigation measures	Environmental consequences	Residual impact ranking	Monitoring
<b>Noise</b>					
Marine engines	NEGLIGIBLE (plankton, benthic communities, pelagic fish and seabirds)	<ul style="list-style-type: none"> <li>Adoption of equipment designed to current engineering standards.</li> <li>Engines to be inspected in order to prevent excess of noise – Equipment Maintenance Plan.</li> </ul>	Emissions are not greater than other marine traffic of a similar size.	NEGLIGIBLE (plankton, benthic communities, pelagic fish and seabirds)	<ul style="list-style-type: none"> <li>No specific measurement considered.</li> <li>Verification that no spurious noises occur.</li> </ul>
	MINOR (marine mammals and turtles)			MINOR (marine mammals and turtles)	
Horns and warning sirens	NEGLIGIBLE (plankton, benthic communities, pelagic fish and seabirds)	<ul style="list-style-type: none"> <li>Adoption of equipment designed to current engineering standards.</li> </ul>	There will be discernible increase in noise in the immediate vicinity of the ships, but no noticeable effect on marine life is expected. The project is located ~170 km away from the coastline.	NEGLIGIBLE (plankton, benthic communities, pelagic fish and seabirds)	<ul style="list-style-type: none"> <li>No specific measurement considered.</li> </ul>
	MINOR (marine mammals and turtles)			MINOR (marine mammals and turtles)	
Disturbance to coastal port activities and marine organisms	NEGLIGIBLE	<ul style="list-style-type: none"> <li>The noise level of helicopter flights heading to the offshore facilities will be managed in the EMP.</li> </ul>		NEGLIGIBLE	
Underwater noise from vessel traffic	MODERATE (marine mammals and turtles)	<ul style="list-style-type: none"> <li>Vessels to use slow speed and adapt the routes to avoid sensitive areas to marine mammals (especially near the coast – Ayeyarwady delta – due to the possible presence of the dugong and the Irrawaddy dolphin (<i>Orcaella brevirostris</i>))</li> <li>Adoption of passive acoustic monitoring system to observe the presence of marine mammals</li> </ul>		MINOR (marine mammals and turtles)	<ul style="list-style-type: none"> <li>No specific monitoring.</li> </ul>
<b>Light</b>					
Navigation warning lights and spot lights	NEGLIGIBLE (plankton, benthic communities, pelagic fish and seabirds)	<ul style="list-style-type: none"> <li>Adoption of equipment designed to current engineering standards.</li> <li>Adoption of passive acoustic monitoring system to observe the presence of marine mammals</li> </ul>	The effect of light emission on fish are poorly known.	NEGLIGIBLE (plankton, benthic communities, pelagic fish and seabirds)	<ul style="list-style-type: none"> <li>This issue is to be verified as part of the Preventive Maintenance Plan.</li> </ul>
	MINOR (marine mammals and turtles)			MINOR (marine mammals and turtles)	

### 6.3.5.2. EMISSIONS FROM LOGISTICS BASES

The logistics base will be situated in industrial port zone of Ranong Supply Base or Thaketa without specific sensitivities. No specific construction will be made, and activities will pertain to handling and storage. However, storage and handling will not generate specific noise and light emission on-site. The duration of activities performed within the logistics base will last approximately 540 days. Work will be conducted during day light and avoided at night if possible.

### 6.3.5.3. EMISSIONS FROM DRILLING OPERATION

#### A. Noise

In addition to the noise generated by the rig, the drilling will generate subsea noise caused by the physical action of the well drilling.

- Intermittent elevated noise levels due to operation of engines and machines.
- Drilling operations will generate underwater noise and vibrations that can range from 72 dB re 1  $\mu$ Pa@1 m for submersible rigs to 185 dB re 1  $\mu$ Pa@1 m in certain drilling ships (American Institute, 1984, Whale and Dolphin Conservation Society, 2004).

The underwater noise will cause marine life to flee the immediate area. However, there is no source of high frequency noise that affect to marine mammal, therefore, only radio operator or other suitable person (passive acoustic monitoring operator) will be responsible for marine mammal observation during the drilling activity. The marine mammal sighting will be recorded.

The project location is located at approximately 170 km away from coastal areas. Additional ambient noise will have no impact within the coastal area.

#### B. Light

Potential impact from extraneous light is expected to be minor, with the main sources arising from lighting.

**Tabl. 45 - Impacts from noise, light and odor generated during drilling operation**

Impact producing factor	Potential impact ranking	Control and mitigation measures	Environmental consequences	Residual impact ranking	Monitoring
<b>Noise</b>					
Underwater noise from drilling	NEGLIGIBLE ( <i>plankton, benthic communities, pelagic fish and seabirds</i> )	<ul style="list-style-type: none"> <li>● Inspection and regular maintenance of engines and machines on vessels and drilling rig as part of a Preventive Maintenance Plan to reduce the generation of elevated noise from engines.</li> <li>● Adoption of passive acoustic monitoring system to observe the presence of marine mammals</li> </ul>	The noise emissions are not anticipated to have any noticeable permanent effect on marine life due to the duration of the project. Marine mammals potentially present around the study area will flee to a quieter area (see Ship Energy Efficiency Management Plan).	NEGLIGIBLE ( <i>plankton, benthic communities, pelagic fish and seabirds</i> )	<ul style="list-style-type: none"> <li>● No specific measurements considered.</li> <li>● Verification that no spurious noises occur, included in the Preventive Maintenance Plan.</li> </ul>
	MINOR ( <i>marine mammals and turtles</i> )			MINOR ( <i>marine mammals and turtles</i> )	

Impact producing factor	Potential impact ranking	Control and mitigation measures	Environmental consequences	Residual impact ranking	Monitoring
<b>Light</b>					
Light from drilling	NEGLIGIBLE ( <i>plankton, benthic communities, pelagic fish and seabirds</i> )	<ul style="list-style-type: none"> <li>External lighting will be minimized to levels for safe navigation, safety of deck operations, except in the case of an emergency</li> </ul>	The light emissions are not anticipated to have any noticeable permanent effect on marine life due to the duration of the project.	NEGLIGIBLE ( <i>plankton, benthic communities, pelagic fish and seabirds</i> )	<ul style="list-style-type: none"> <li>This issue will be verified as part of the Preventive Maintenance Plan.</li> </ul>
	MODERATE ( <i>marine mammals and turtles</i> )	<ul style="list-style-type: none"> <li>Adoption of passive acoustic monitoring system to observe the presence of marine mammals</li> </ul>		MINOR ( <i>marine mammals and turtles</i> )	

### 6.3.6. Impacts from Hazardous and Non-Hazardous waste

#### 6.3.6.1. POTENTIAL IMPACTS FROM HAZARDOUS AND NON-HAZARDOUS WASTE (OFFSHORE)

Hazardous waste is generated by all phases of the project. The environmental concern in relation to waste is that the waste should be effectively managed. If the waste is not effectively managed, the concern is that the waste could be discharged into the sea or dumped in inadequate onshore landfills. The use of unsuitable waste management practices could potentially result in impacts on marine protected areas, coastal ecosystems, bird species.

Typical waste streams are as follows:

- Liquid: deck drainage, drilling mud, sewage, ballast and wash water (Cf. the above paragraph).
- Solid: food waste, plastics, scrap metals, wood pallets, cardboard / paper, empty chemical drums, used /obsolete chemicals and paints, batteries, clinical wastes, electronic waste.

**Tabl. 46 - Impacts from hazardous and non-hazardous waste (offshore)**

Impact producing factor	Potential impact ranking	Control and mitigation measures	Environmental consequences	Residual impact ranking	Monitoring
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Impact producing factor	Potential impact ranking	Control and mitigation measures	Environmental consequences	Residual impact ranking	Monitoring
Hazardous and non-hazardous waste (drilling rig and marine vessels)	MODERATE <i>Negative, direct, short-term impact on environmental health when ineffective waste management</i>	<ul style="list-style-type: none"> <li>Waste will be collected, stored and eliminated according to a Waste Management Plan (WMP) developed for drilling operations.</li> <li>Hazardous and non-hazardous waste will be collected and stored in suitable containers.</li> <li>Food wastes will be ground to 25 mm prior to discharge to sea. All non-food wastes will be collected for compaction and transport to shore for landfill disposal. No incinerator is forecasted on-board. 100% of garbage collection recovery will be processed onshore.</li> <li>The hazardous waste containers will be equipped with means to contain any spills or leaks.</li> <li>The stored hazardous and non-hazardous wastes will be transported to a suitable authorized disposal facility onshore.</li> <li>Mitigation measures for liquid waste are similar than the ones proposed in the paragraph 6.3.3 of the present document.</li> </ul>	There is limited impact from solid wastes generated by the project. Solid waste generated from the drilling rig and from the surface facilities will be disposed onshore.	NEGLECTIBLE	<ul style="list-style-type: none"> <li>Inspection of waste management practices and waste management records.</li> </ul>

### 6.3.6.2. POTENTIAL IMPACTS FROM HAZARDOUS AND NON-HAZARDOUS WASTE (ONSHORE – LOGISTIC BASE)

Environmental concern in relation to waste is that the waste should be effectively managed. If the waste is not effectively managed, the concern is that the waste could be discharged into the environment or dumped in inadequate landfills onshore. The use of unsuitable waste management practices onshore could potentially affect public health and the company's reputation. Potentially ineffective waste management could incur MINOR impacts on the onshore environment and public health, taking into account the logistics base will be in industrial zone, and quantity of waste generated is anticipated to be low (the logistics base mainly serves as a storage and handling area).

Typical waste streams are as follows:

- Liquid: releases of chemical products (Cf. paragraph 6.3.6.3).
- Solid: food waste, scrap metals, wood pallets, cardboard / paper, empty chemical drums, used /obsolete chemicals and paints, batteries, clinical wastes, electronic waste.

Tabl. 47 - Impacts from hazardous and non-hazardous waste (onshore)

Impact producing factor	Potential impact ranking	Control and mitigation measures	Environmental consequences	Residual impact ranking	Monitoring
Hazardous and non-hazardous waste (logistic base)	MINOR <i>Negative, indirect, medium term</i>	<ul style="list-style-type: none"> <li>Waste will be collected, stored and eliminated according to a Waste Management Plan (WMP) developed for logistic base.</li> <li>Hazardous and non-hazardous waste will be collected and stored in suitable container.</li> <li>The hazardous waste containers will be equipped with means to contain any spills or leaks.</li> <li>The stored hazardous and non-hazardous wastes will be transported to a suitable authorized disposal facility onshore by a certified transporter.</li> </ul>	There is limited impact from solid wastes generated by the project. Solid waste generated from the drilling rig and from the surface facilities will be disposed onshore.	NEGLIGIBLE <i>Impact on environmental and public health when effective waste management implemented</i>	<ul style="list-style-type: none"> <li>Inspection of waste management practices and waste management records.</li> </ul>

### 6.3.6.3. STORAGE, HANDLING AND TREATMENT OF HAZARDOUS AND NON-HAZARDOUS WASTE (ONSHORE, OFFSHORE AND DURING TRANSPORTATION)

During the campaign, the estimated quantities of non-hazardous waste (glass, paper, plastic, wood and associated): 184 kg and hazardous wastes (muds and cuttings, cementing wastes, excess cementing chemicals, used lubricants, medical waste, oil sludge and etc.): 470 kg can be generated per well. Whereas, the total estimation of non-hazardous waste is 2,208 kg and that of hazardous waste is 5,640 kg. Those wastes will be categorized and stored on-board before shipping to certified onshore waste management facility for treatment or disposal.

The environmental concern regarding the storage and handling and treatment of hazardous and non-hazardous waste without any specific controls is that, the storage facilities could accidentally leak into the environment. The waste are transported in small drums, sealed containers and the storage facilities during logistics.

### 6.3.7. Impacts from Chemicals

#### 6.3.7.1. STORAGE AND HANDLING OF CHEMICALS ONSHORE (LOGISTICS BASE, INCLUDED OFFSHORE ENTRANCE AND EXIT)

Chemical additives for the drilling project will be stored within the logistics base prior to be transported to the drilling rig. These chemical products will mainly be used for the preparation of drilling mud. Products stored typically consist of bentonite, barite, cement, base oil, salts and diesel fuel. Products used for the preparation of non-aqueous based-mud will be chosen for their low toxicity; the product will be biodegradable, non-persistent in the environment.

The environmental concern regarding the storage and handling of chemicals is that without any specific controls, the storage facilities could have leaks, or could accidentally be rejected into the environment. The chemicals are transported in small drums and containers and the storage facilities on logistics base represent a small inventory. Relatively small quantity of products will be stored into both of the logistics bases.

Tabl. 48 - Impacts from storage and handling of chemicals onshore

Impact producing factor	Potential impact ranking $S = Se \times I$	Control and mitigation measures	Environmental consequences	Residual impact ranking $S = Se \times I$	Monitoring
Chemical storage	MINOR <i>Temporary indirect negative impact on soil quality in case of spill</i>	<ul style="list-style-type: none"> <li>Storage of the chemicals on dedicated zone equipped with retention and in designated tanks.</li> <li>Safety Data Sheets (SDS) will be available on the logistic base.</li> <li>Personnel will be trained in the safe handling of the chemicals.</li> <li>Provide all personnel with the necessary personnel protective equipment.</li> </ul>	The implementation of a Chemical Management Plan will ensure prevention spillage of chemicals into the natural environment and no adverse effects are anticipated.	NEGLIGIBLE <i>Impact when effective chemical management implemented</i>	<ul style="list-style-type: none"> <li>No specific measurement will be performed.</li> </ul>

### 6.3.7.2. STORING AND HANDLING OF CHEMICALS OFFSHORE

The different project activities require the use of chemicals and consequently the storage and handling of them. The main activity is drilling and will be performed with a drilling rig. Chemical additives for the drilling mud preparation will be transported to the rig and stored on-board.

The environmental concern regarding the storage and handling of chemicals is that without any specific controls, the storage facilities could be insufficient and/or poorly maintained which could result in the release of chemical into the sea. The chemicals are transported in small drums and containers and the storage facilities on vessels represent a small inventory.

Tabl. 49 - Impacts from storage and handling of chemicals offshore

Impact producing factor	Potential impact ranking	Control and mitigation measures	Environmental consequences	Residual impact ranking	Monitoring
Chemical storage	MINOR <i>Negative direct, medium-term impact on water quality in case of spill</i>	<ul style="list-style-type: none"> <li>Storage of the chemicals on dedicated zone equipped with retention and in designated tanks.</li> <li>Safety Data Sheets (SDS) will be available on the drilling rig.</li> <li>Personnel will be trained in the safe handling of the chemicals.</li> <li>Optimization on the use of chemicals.</li> <li>Provide all personnel with the necessary personnel protective equipment.</li> </ul>	The implementation of a Chemical Management Plan will ensure prevention spillage of chemicals into the natural environment and no adverse effects are anticipated.	NEGLIGIBLE	<ul style="list-style-type: none"> <li>No specific measurements will be required</li> </ul>
Handling of chemicals	MINOR <i>Temporary, indirect negative impact on water quality in case of spill</i>	<ul style="list-style-type: none"> <li>Safety Data Sheets (SDS) will be available on the drilling rig.</li> <li>Personnel will be trained in the safe handling of the chemicals.</li> <li>Provide all personnel with the necessary personnel protective safety equipment</li> </ul>			

### 6.3.7.3. CHEMICALS DISCHARGED DURING DRILLING

No chemicals will be released into the environment from the chemical storage and handling during normal operation.

The release of chemicals into the environment through the discharge of cuttings comprising a small amount of drilling mud containing traces of chemicals is discussed with discharges to the sea.

### 6.3.8. Impacts on the Socio-Economic Environment

#### 6.3.8.1. NEGATIVE SOCIO-ECONOMIC IMPACTS

Tabl. 50 - Negative socio-economic impacts

Impact producing factor	Potential impact ranking	Control and mitigation measures	Environmental consequences	Residual impact ranking	Monitoring
Disturbance to commercial and naval marine traffic	MINOR Temporary, direct and short-term impacts	<ul style="list-style-type: none"> <li>An exclusion zone (radius of 500 m) will be established surrounding the drilling rig.</li> <li>Radars will be used on the supply vessels to monitor the marine traffic</li> <li>Project vessels will be used as watchmen boats in the vicinity of the drilling rig. Their role will be to establish communication with vessels approaching too close from the exclusion zone and reroute them</li> <li>The supply vessels will follow international navigation standards (as set up by the IMO), adopt responsible practices of navigation and follow protocols towards the small local vessels (if any).</li> </ul>	The impact is considered reduced because very little marine traffic is expected.	NEGLIGIBLE	<ul style="list-style-type: none"> <li>Records of movement of vessels in the vicinity of the security zone.</li> <li>Log of contacts with fishing boats.</li> <li>Complaints register.</li> </ul>
Disturbance to artisanal and industrial fishing activities	MINOR Temporary, direct and short-term impacts	<ul style="list-style-type: none"> <li>The same mitigation measures are recommended than those for the commercial marine traffic.</li> </ul>		NEGLIGIBLE	
Disturbance to coastal port activities and surrounding communities	NEGLIGIBLE	<ul style="list-style-type: none"> <li>Before drilling starts, PTTEPI will coordinate with MOGE, who will then issue "Notice to Mariner" regarding project activities to concerned parties (i.e., Department of Fisheries, Ministry of Livestock, Fisheries and Rural</li> </ul>	The management of noise in the EMP should ensure minimized impact on the population living on the coast nearby the onshore base.	NEGLIGIBLE	

Impact producing factor	Potential impact ranking	Control and mitigation measures	Environmental consequences	Residual impact ranking	Monitoring
		Development, Myanmar Navy and Myanmar Fisheries Federation). <ul style="list-style-type: none"> <li>PTTEPI will establish a direct and regular coordination with Thaketa and Ranong Port Authority for the ship movement from these the logistic bases to the drilling site.</li> </ul>			

### 6.3.8.2. POSITIVE SOCIO-ECONOMIC IMPACTS

**Tabl. 51 - Positive socio-economic impacts**

Impact producing factor	Potential impact ranking	Control and mitigation measures	Environmental consequences	Residual impact ranking	Monitor
Direct and indirect employment	<b>POSITIVE</b> Temporary, regional, direct and short-term impacts	<ul style="list-style-type: none"> <li>A local content plan will be developed locally with the drilling contractors and other contractors if needed, and with both Myanmar and local relevant authorities.</li> </ul>	<p>It is estimated that the project will only lightly increase the number of local employees.</p> <p>Indirect employment resulting from the petroleum industry is difficult to estimate at that exploration stage.</p> <p>Indirect employment will be created primarily through the provision of food services, onshore support for equipment supplies and the logistics (road or marine transportation of goods, etc.).</p>	<b>POSITIVE</b> Temporary, regional, direct and short-term	<ul style="list-style-type: none"> <li>No specific mitigation measures required.</li> </ul>
Contribution to local economic development	<b>POSITIVE</b> Temporary, regional, direct and short-term impacts	<ul style="list-style-type: none"> <li>PTTEPI could measure the financial value of its contribution to local economic development through estimation of the taxes paid to local government and of the revenues generated for local sourcing companies.</li> </ul>	<p>It is estimated that the project (at this stage) will contribute in a very limited manner to the local economic development.</p>	<b>POSITIVE</b> Temporary, regional, direct and short-term	

### 6.3.9. Matrix of Residual Impacts

As a summary, the table below synthesizes residual impacts of the project taking into account the implementation of mitigation measures proposed in § 6.3.



Tabl. 52 - Residual impact matrix

ENVIRONMENTAL RECEPTORS		RESIDUAL IMPACTS																																					
		P0		P1		P2		P3		P4		P5		P6		P7		P8		P9																			
		Consumption of Natural Resources		Atmospheric emissions		Generation of noise		Generation of light		Generation of wastewater and liquid wastes		Generation of solid hazardous and non hazardous wastes		Disturbance of seabed		Physical presence of structures and vessels		Introduction of Invasive Species		Accidental releases and other emergency situations																			
Matrix		Use of freshwater	Use of fuel oil	Use of chemical products	Use of drilling mud and additives	Combustion of fuel oil for rig	Combustion of fuel oil for vessel and helicopter	Drilling operations	Vessels and Helicopter	Underwater noise from traffic	Underwater noise from anchoring	Drilling rig	Vessels and Helicopter	Blige, ballast and deck water	Sanitary wastewater	Cement discharge	Discharge of drilling cutting and mud	Non-Hazardous waste	Hazardous waste	Installation of rig	Positioning of the rig	Drilling operation	Presence of vessels and rig	Ballast water	Biofouling	Blowout	Fuel and Oil Spills	Hazardous materials	Fire and Explosions										
Physical components	Natural resources	2	1																																				
	Renewable resources																																						
	Non renewable resources		3	3	1	3	3	1	3	3	1																												
	Sediment Quality																2	2	1				3	3	1														
	Water Quality													2	2	1	2	2	1	2	2	1						2	4	2	2	2	1	2	2	1			
	Atmospheric environment					1	1	1	1	2	2																	2	4	2	2	2	1	2	2	1			
Biological environment Offshore	Plankton							2	2	1	2	2	1	2	2	1	2	2	1	2	2	1					2	4	2	2	2	1	2	2	1				
	Bentic community							2	2	1	2	2	1	2	2	1	2	2	1	2	2	1				2	2	1	2	2	1	2	2	1	2	2	1		
	Pelagic Fish							2	2	1	2	2	1	2	2	1	2	2	1	2	2	1	2	2	1			2	4	2	2	2	1	2	2	1			
	Marine mammals							3	3	1	3	3	1	3	3	1	3	3	1	3	3	1	3	3	1			3	6	2	3	3	1	3	3	1	3	3	1
	Marine turtles							3	3	1	3	3	1	3	3	1	3	3	1	3	3	1	3	3	1			3	6	2	3	3	1	3	3	1	3	3	1
	Seabirds							2	2	1	2	2	1	2	2	1	2	2	1	2	2	1	2	2	1			2	4	2	2	2	1	2	2	1	2	2	1
Biological Environment Coastal	Mangroves																																						
	Seagrass																																						
	Seaweed																																						
	Coral reefs																																						
	Marine reptiles													3	3	1																							
	Marine mammals													3	3	1																							
Sensitive areas	Sensitive areas																										3	3	1	3	3	1							
Social Environment	Societal Offshore environment	Port Infrastructure																																					
		Industrial fishing																																					
		Marine Traffic																																					

Sensitivity of receiving environment  
 Sensitivity  
 Se  
 Significance  
 Sensitivity of 4, significance is considered as MAJOR  
 Intensity is scored on a scale of 1 to 4 (1=low intensity, 4=high intensity)  
 Sensitivity is scored on a scale of 1 to 4 (1=low sensitivity, 4=high sensitivity)

## 6.4. ENVIRONMENTAL HAZARDS AND RISK ASSESSMENT

The unusual environmental impacts for an offshore oil and gas project are mainly related to accidental spills (risk of blowout, risk of gas, oil and toxic chemical elements leaks; risk of fire and explosion). They can be arbitrarily divided into two categories: (i) small spills during the life of the project (less than a few hundred barrels) and (ii) highly unlikely spills but with very large volumes (several tens of thousands of barrels).

In this section, mainly the environmental impacts related to accidental situations are addressed. Indeed, these spills in accidental situation can also generate consequences for the other offshore facilities located nearby, especially in terms of risk of fire of an oil slick drifting towards other facilities.

**Tabl. 53 - Impacts from accidental situations**

Potential impact	Mitigation, control, optimization measures	Environmental and social consequences Residual impact
<b>Major spills</b> Uncontrolled blow out leading to coastal pollution, Or gas leak Followed by fire or explosion <b>POTENTIAL AND TEMPORARY MAJOR</b>	<ul style="list-style-type: none"> <li>Use of international standards (API, ISO...) currently in force for facilities design and operation.</li> <li>Controlling the risk of accident is a major concern during a drilling operation, and this for each phase of the project (anticipation and risk management).</li> <li>Oil and chemicals spills reporting</li> <li>Risk management procedures (SSHE Management System)</li> <li>Oil Spill Contingency Planning (OSCP) will be prepared and address major spill from well blow out as one of the scenarios</li> </ul>	Important environmental consequences and on the long term (see box below following this table). Negative consequences on marine resources and people who depend on it for livelihood and employment. Loss of activities and income for fishermen and jobs induced onshore. <b>MAJOR</b> <b>in case of major spill</b> But considered as <b>ACCEPTABLE</b> given the low probability that a major spill occur, and, in that case, given the emergency management devices implemented to limit the impacts in case of critical accident.
<b>Minor spills</b> Drilling mud Cement Chemicals <b>POTENTIAL AND TEMPORARY MODERATE</b>	<ul style="list-style-type: none"> <li>Idem</li> </ul>	See box below. <b>MINOR</b>
<b>Potential socio-economic impacts related to accidental situations (blow-out, oil spill)</b> <b>POTENTIAL AND TEMPORARY MAJOR</b>	<ul style="list-style-type: none"> <li>Before drilling starts, PTTEPI will coordinate with MOGE, who will then issue "Notice to Mariner" regarding project activities to concerned parties (i.e., Department of Fisheries, Ministry of Livestock, Fisheries and Rural Development, Myanmar Navy and Myanmar Fisheries Federation).</li> <li>An OSCP should also be prepared in order to organize the response to the spill.</li> <li>A spill exercise is planned with relevant parties.</li> </ul>	Due to highly developed oil spill emergency response capacities, PTTEPI with its back-up, should be able to contain oil spill at its minimum and limit the oil spill consequences on environment and local communities. <b>MINOR</b>

**Box 2 - Environmental consequences of accidental spills and discharges**

The environmental consequences in case of oil spill depend on the size of the spill and on the sea weather conditions at the time of the event.

Minor spills: the oil slick can spread up to the coast, but because of the small discharged quantities, the expected impacts are negligible (Block M9 area is located approximately 260 km south of Yangon and 178 km west of Dawei).

Major accidents: they can be the cause of an important oil spill and have a substantial impact on the environment, including coastal ecosystems.

Indicative statistics for spills (source : Oil & Gas Producers Risk Assessment Data Directory, 2010) :

Operation	Probability of events			Unit
	Blow out (surface)	Blow out (underground)	Well release	
Deep drilling	3,5 10 <sup>-4</sup>	1,3 10 <sup>-4</sup>	2,2 10 <sup>-4</sup>	Per drilled well
Gas pocket drilling	9,6 10 <sup>-4</sup>	4,4 10 <sup>-5</sup>	7,0 10 <sup>-4</sup>	Per drilled well
Production	3,3 10 <sup>-5</sup>	4,7 10 <sup>-6</sup>	9,5 10 <sup>-6</sup>	Per well and per year
Reconditioning	1,0 10 <sup>-3</sup>	-	8,5 10 <sup>-4</sup>	Per reconditioning

Blow out: Incident when a leak of the well effluent flows out from the well (surface blow out) or between the geological formations (underground blow-out) without the implemented technical means being able to contain it.  
 Well release: incident when oil flows out from a well from a place where no flow is expected, and that the flow was contained thanks to the technical means implemented on the well at the time of the accident.  
 Deep drilling: drilling activities through geological strata to reach a deep reservoir  
 Gas pocket drilling: when a drilling passes through a gas pocket less deep than the prospected reservoir.  
 Production : oil extraction phase  
 Reconditioning of wells: Well maintenance process or well curative treatment process.

This table indicates for instance that the probability of a surface blow-out during the drilling phase is 3, 5 10<sup>-4</sup>.

**Statistic for spilled quantities** (Source : ITOPF Oil Tanker Spill statistics 2012)

The data come from a feedback and from follow-ups performed since the 1970's on over 10,000 spills from oil tankers, carrier and tankers all over the world.

Out of all the major spills (>700 t) that have occurred since the 1970's, 55% occurred in the 1970's and 7% in the 2000's. This drastic reduction is the result of the impacts of the resources deployed by oil companies and some governments.

In the 2000's (2000-2009), there was an average of 3.3 major spills per year and 14.9 moderate spills (between 7 and 700 t) compared to 24.6 and 28.2 respectively in the 1990's.

In 2012, there was no spill bigger than 700 t and 7 spills between 7 and 700 t. In all, in 2012, 1,000 t of oil were discharged, compared to 12,000 t in 2010, 43,000 t in 2003, 80,000 t in 1996 and 351,000 t in 1975.

Regarding minor spills (<7 t) between 1970 and 2012, 21% occurred because of equipment fault, 7% because of a hull breaking, 3% because of grounding, 2% in a collision and 2% during a fire or an explosion.

Regarding moderate spills (between 7 and 700 t) between 1974 and 2012: 26% were caused by collision, 20% by grounding, 15% by technical failures, 7% by hull breaking and 4% by fires or explosion.

Regarding major spills (>700 t) between 1970 and 2012, 33% were caused by grounding, 29% by collision, 13% by hull breaking, 12% by fire and 4% by equipment failures.

**Impacts from spills**

Overall, oil spills affect all environmental compartments:

- They damage water quality and sediment quality in case of deposits.
- They can poison living species, fish, and benthic populations.
- They can have consequences on animal species. Marine birds are the most vulnerable species since they are easily affected by floating oil slicks. Species that dive to feed and that gather on the surface are particularly vulnerable.

Moreover, oil swallowed by birds when they try to clean their feathers can be lethal. The most common causes of death are drowning, starvation and hypothermia. Whales, dolphins and seals are not particularly sensitive to oil spills.

- If the oil slick spreads over up to the coast, there can be important consequences on coastal habitats, on life quality (oil infiltrations in underground waters and thus in the water potentially used by the local population), on coastal activities such as boating, tourism and fishing activities.
- Coastal areas, more than any other environment, are sensitive to oil spills since oil piles up on the coasts. Mangroves are quite sensitive to oil that can stagnate around their roots and suffocate them. Sedimentary beds are less sensitive to direct contamination. However, they can have long-term impacts when oil settles in sediments and stays there through long years.
- Oil slicks can reach and damage Myanmar's protected marine areas or neighbouring countries and thus cause irreversible losses in the rich biodiversity of these zones.
- They can indirectly have a substantial impact on fishing activities because of the diminution of the resources related to the accident and thus have consequences on local populations such as loss of income, fewer jobs or decrease in food resources.

## 6.5. MODELLING STUDIES

The main purpose of this study is to set up a model that can lead to assess environmental impact of released cuttings due to a drilling operation. Cuttings from the drilling operation are brought up to the boat, sort out and cleaned before being released from the boat into the Sea. The environmental impact will be assessed by calculating cuttings suspensions concentrations and sediment deposits at the end of the drilling operation.

There is 12 locations on Block M9 are going to be drilled, the two representative points: Point KKN-82 and KKN-44 are chosen to be indicative for the rest points located at the East of M9.

All points are located on the continental shelf at a depth of about -130m and the nearest distance between points is more than 500 m. Therefore, the deposit thickness decreases fastly with the distance: the summary of the modelling studies is shown in following sections.

The complete report is provided in the **Error! Reference source not found.** of this EIA report.

### 6.5.1. The Andaman Sea

The Andaman Sea circulation is a complex system depending on meteorological conditions (winds, river flows, atmosphere exchange...), tides, Kelvin waves and complex topographic and bathymetric features like channels controlling exchanges with other Seas. The good set up of the currents is a key point in a dispersion study. Therefore a specific methodology was used to implement into the dispersion model currents from a global ocean model that realistically represent the general Andaman Sea circulation.

In the area of the drilling location M9, surface currents flow northward during the dry season and southward during the monsoon season. Maximum intensities are observed during the dry season.

### 6.5.2. Modelling Software Used

For this study, softwares of the TELEMAC-MASCARET system are used. The TELEMAC-MASCARET system ([www.opentelemac.org](http://www.opentelemac.org)) is dedicated to study environmental processes in free surface transient flows. It is developed by EDF (Electricité de France) and constantly updated to improve its performances and its capabilities to treat complex engineering situations.

More precisely, the hydrodynamics module applied is TELEMAC-3D, a true three-dimensional hydrodynamics model which solves the shallow/deep water equations by taking into account various processes like bathymetry effects on currents and hydro-meteorological forcing. It also simulates the

transport of suspended cohesive and non-cohesive sediment. To do so, it solves the suspended sediment transport and bed change equations. Exchanges with the bed are represented by the erosion and deposition flow terms. The hydrodynamics can be recalculated at each time step on the basis of changes in the bed and density (internal coupling between currentology and sedimentology).

### 6.5.3. Hydrodynamic Model Settings

#### 6.5.3.1. METHODOLOGY

The methodology follows three major steps:

- Built a mesh to represent accurately the bathymetric features in the area of the exploration drilling campaign,
- Extract from a global ocean model currents for different depths and use them as forcing conditions for the regional TELEMAC-3D numerical model,
- Run the TELEMAC-3D regional model to simulate the transport of suspended sediment and obtain results for the dispersion study.

##### 6.5.3.1.1. The mesh

The unstructured mesh of the model is built by prisms on the basis of horizontal triangular elements, feature offering the possibility to use large elements in general areas of the model (as offshore zones) and much smaller elements in the zones of interest, as around coast, harbour structures.

A mesh representing the Northern part of the Andaman Sea was build (see opposite figure). The mesh size ranges from 50 m on the exploration drilling point to represent accurately sediment dispersion. The mesh size can reach up to 10 km far away from the drilling point zone area. It was given specific care to build a refine mesh on the steep continental slope for those slopes are important for the general hydrodynamic.



Model geographical horizontal coordinates are in UTM 46 N. Vertical coordinates are in Mean Sea Level (MSL).

##### 6.5.3.1.2. Bathymetry

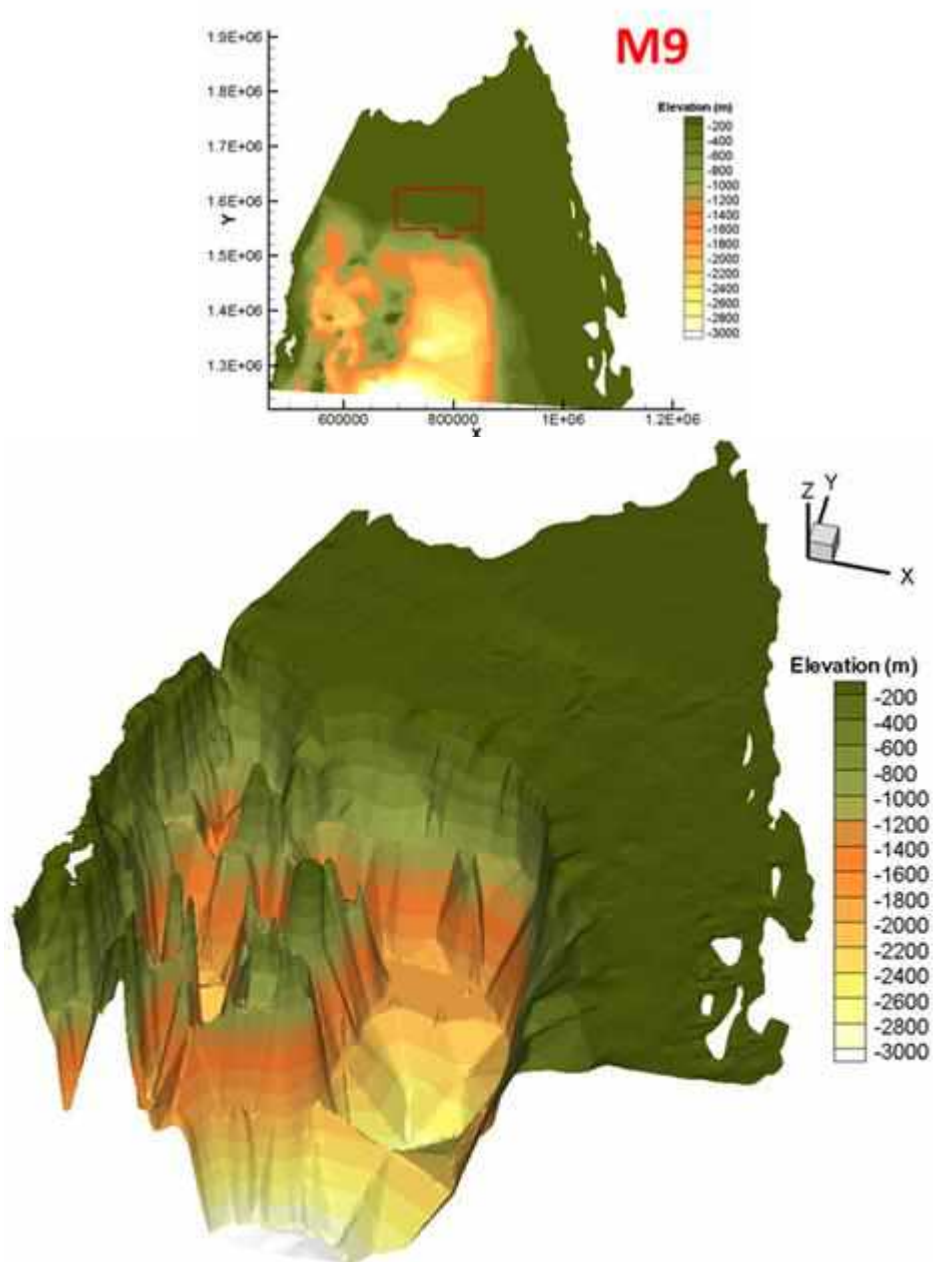
The model bathymetry is extracted from two main data sources:

- Numerical marine charts (Fig. 32);
- Local bathymetric surveys provided by PTTEP around each exploration drilling point on a square area of 5 km x 5 km around each point.



**Fig. 32.** Numerical marine Charts used in the model bathymetry

The model bathymetry is illustrated on Fig. 33. The M9 zone is located on the continental shelf at a depth of -100 m to -150 m.



**Fig. 33.** Model bathymetry

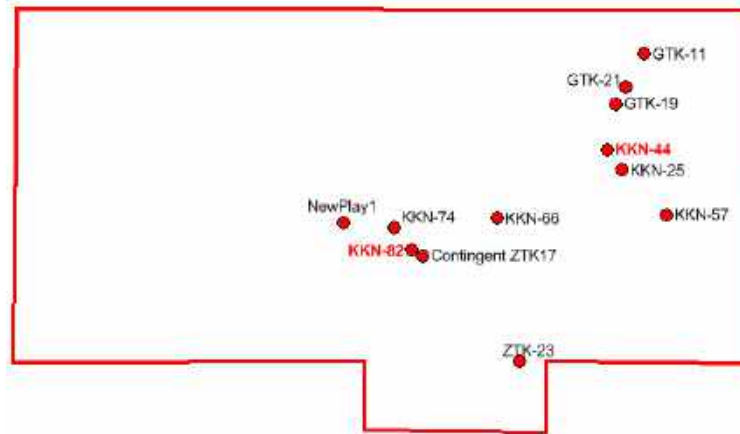
### 6.5.3.2. MODEL SETUP AND CONFIGURATION

The hydrodynamic currents are obtained from outputs of global ocean model PSY4V2R1 available from the Copernicus marine environment monitoring service (<http://marine.copernicus.eu/>),. The spatial resolution is  $1/12^\circ$ . The data can be extracted daily over 50 levels, from 0 to -5000m. The atmospheric fields forcing the ocean model are taken from the ECMWF (European Centre for Medium-Range Weather Forecasts) Integrated Forecast System, with a 3 hour resolution.

Current velocities are extracted and then used as forcing conditions by the TELEMAC-3D regional model to calculate the sediment dispersion.

- **Current analysis M9 Block**

12 locations on Block M9 are going to be drilled (see the figure below). Point KKN-82 is chosen to be representative of points located at the center of Block M9, and KKN-44 to be representative of points located at the East of M9. The elevation of the sea bottom is about -130 m depth for those 2 points.



**Fig. 34. Drilling locations – Block M9**

In the area of the drilling locations M9, surface currents flow northward during the dry season and southward during the monsoon season. Maximum intensities are observed during the dry season.

### 6.5.4. Environmental Impact of Drilling Operation

#### 6.5.4.1. INPUT DATA

The discharge plume includes drilling mud and drilling cuttings, both released at the surface.

- Drilling location: point D
- Mud: D50=0.0156mm, settling velocity=0.02cm/s, volume = 40% of the mixture, density = 550 kg/m<sup>3</sup>
- Contents of the drilling cuttings: sediments with particle distribution as follow: D50=0.25mm, settling velocity=3.4cm/s, volume = 60% of the mixture, density = 1500 kg/m<sup>3</sup>

The sediment is assumed as a non-cohesive sediment. The Krone and Partheniades formulation is used to simulate sediment deposition and resuspension after deposition.

- The total volume discharge is estimated of 383 m<sup>3</sup> for deep well. An average constant discharge to the sea is considered. This discharge point is set up to -15 m below sea surface.

#### 6.5.4.2. METHODOLOGY

Among 12 drilling locations (Fig. 34), two of them were selected for simulations. KKN82 is considered to be representative of the center of the block and KKN44 of the East of the block. All points are located on the continental shelf at a depth of about -130m. And it is found that the nearest distance between points is more than 500 m, the deposit will decrease with the distance. Therefore, results obtained for one point are relevant for neighbor points. Additionally, the distance between each well location is listed in table below:



Tabl. 54 - Well location distances from nearest point of the block

Distance between wells for Eastern part of the block		
KKN 57 - KKN 25	well 1 - well 2	13.5 km
KKN 25 - <b>KKN 44</b>	well 2 - well 3	6 km
<b>KKN 44</b> - GTK 19	well 3 - well 4	9.5 km
GTK 19 - GTK 21	well 4 - well 5	4.3 km
GTK 21 - GTK 11	well 5 - well 6	8.2 km
Distances between wells for center of the block		
KKN 66 - ZTK 17	well 7 - well 8	17.2 km
ZTK 17 - <b>KKN 82</b>	well 8 - well 9	3 km
<b>KKN 82</b> - KKN 74	well 9 - well 10	5.6 km
KKN 74 - NewPlay 1	well 10 - well 11	11 km
NewPlay 1 - ZTK 23	well 11 - well 12	47 km

The simulations are run over one month. The months are chosen to describe best the currents variability which are depending on the season as it was underlined in §6.5.3.2. It was taken care not to choose months where current intensity was identified over the 10 year average in §6.5.3.2, in order not to run simulations that favor dispersion.

Tabl. 55 - Scenarios for Block M9

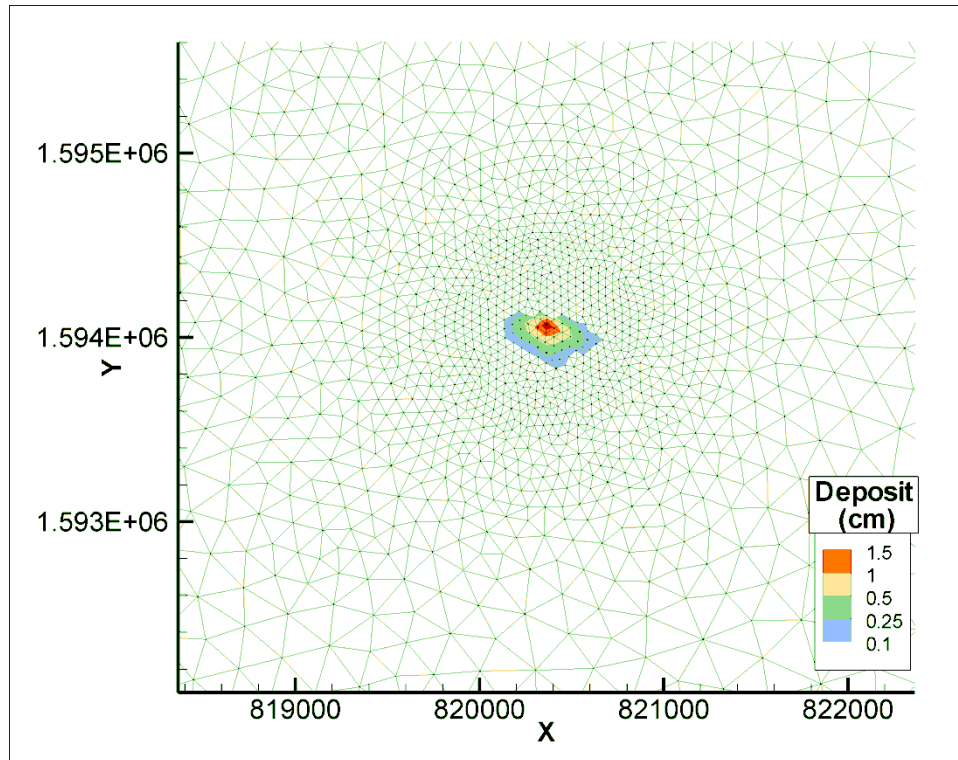
Injection point	Month to simulate	Season
KKN82	February	Dry season
KKN82	April	Warm season
KKN82	June	Monsoon
KKN44	January	Dry season
KKN44	October	End of monsoon

### 6.5.4.3. RESULTS

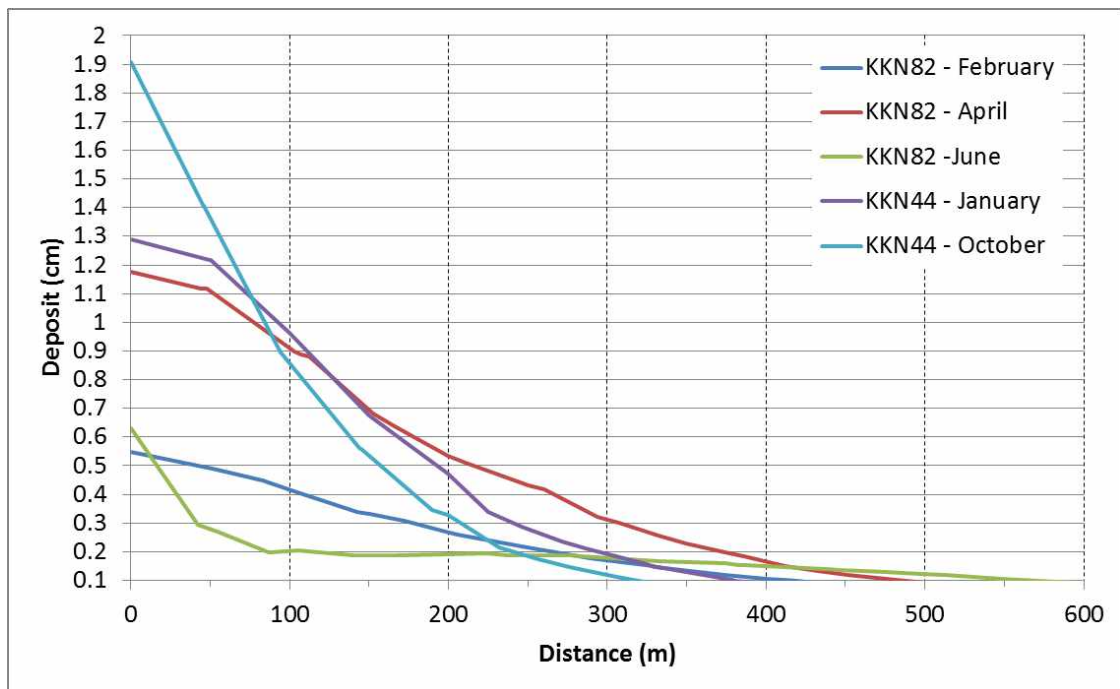
#### 6.5.4.3.1. Sediment deposit

For Block M9, the maximum deposit is observed for point KKN44 with the October run (Fig. 35). The maximum deposit calculated is 1.9 cm. Results obtained for all simulations are shown in the cutting dispersion report provided in the **Error! Reference source not found.** of the present report. Simulations for Block M9 exploration show that the impact is very low and limited to an area of about 50m to 100m around the maximum point deposit (area colored in orange on the figure).

Fig. 36 illustrates that the deposit thickness decreases fastly with the distance. Only three simulations show a deposit above 1cm. The area impacted by a threshold of 1cm does not extend further than 100 m from the outfall.



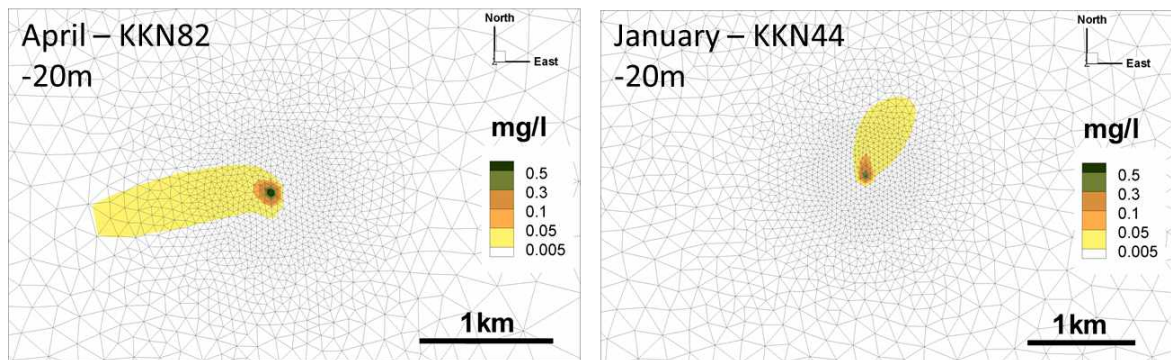
**Fig. 35.** Point KKN44 – October – Block M9



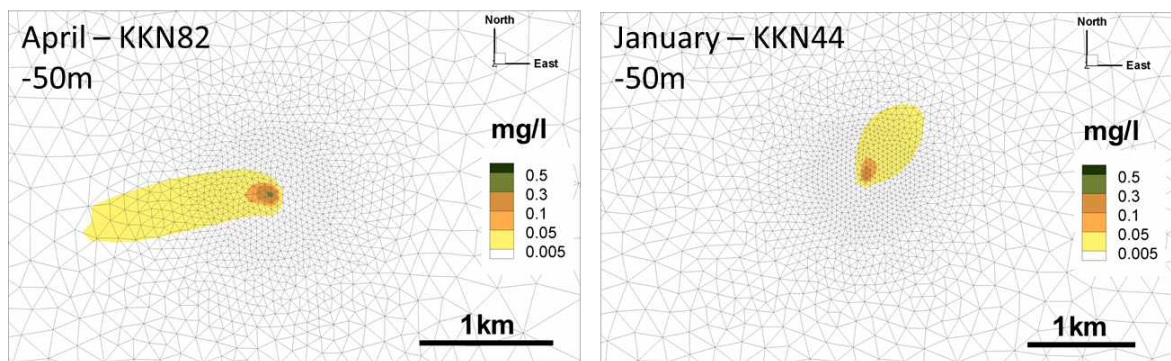
**Fig. 36.** Point KKN44 – October – Block M9

## 6.5.4.3.2. Suspended sediment

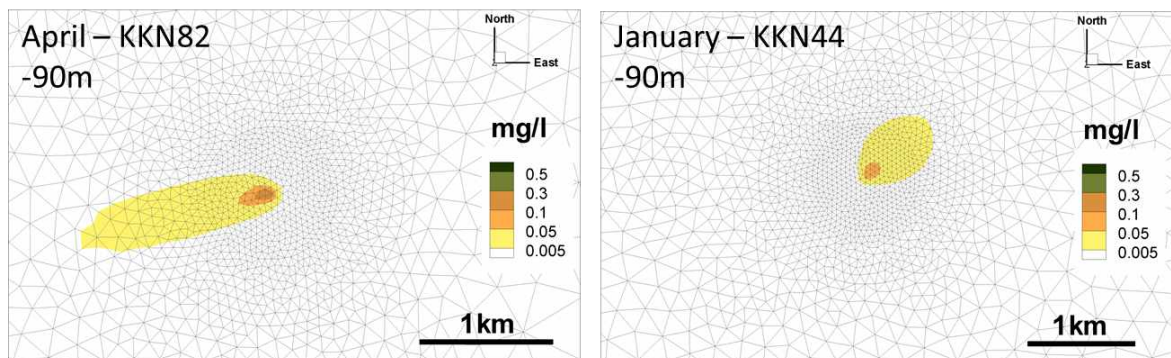
Suspended sediment concentrations calculated are low, always below 1mg/l. The maximum are observed at point KKN82 in April and at point KKN44 in January, respectively 0.95 mg/l and 0.7mg/l at -20m depth (Fig. 37). It would not be possible to measure such impact in the field because the value is too low, in the range of uncertainty of the measurement. The concentration more than 0.1mg/l (dark orange) is restricted to an area defined by a circle of 150m diameter at -20m. It can be seen on the whole water column for point KKN82 and it is diluted for point KKN44 between -50m depth and -90m depth (Fig. 387, Fig. 398). The cutting dispersion report provided in the **Error! Reference source not found.** of the present document illustrates the plume at different depths for all simulations.



**Fig. 37.** Suspended sediment concentration at -20m – Block M9



**Fig. 38.** Suspended sediment concentration at -50m – Block M9



**Fig. 39.** Suspended sediment concentration at -90m – Block M9

### 6.5.5. Discussion / Conclusion

For Block M9, the drilling points are located at a depth of -130m on the continental shelf. 12 drilling points are expected, two were selected and five simulations were run over 1 month (drilling duration). Months simulated were chosen to describe all seasons. Simulation results have shown that:

- For water column: the suspended sediment load in the water column is below 1 mg/l for all simulations. At -20 m depth, the area where the concentration is more than 0.1 mg/l corresponds to a circle of 150 m diameter and this 0.1 mg/l concentration is observed at -90 m for only one of the simulation; it would not be possible to measure such impact in the field because the value is too low, in the range of uncertainty of the measurement. Thus, impacts associated with suspended matter are low. Assessment of toxicity depends on the drilling option, which will be used effectively on the field (i.e., WBM or SBM). In case SBM are used, the residual oil on cuttings will be maintained below 6.9% by using a cutting dryer. It is therefore anticipated a localized minor impact on the quality of the water column if SBM are used (or negligible impact if WBM is used).
- For sediment: a sediment deposit of more than 1 cm is observed on January, April and October simulations. The area with thickness deposit above 1 cm corresponds to narrow circle with radius of 100 m. A commonly used threshold for burial of benthos is 6.5 mm for sensitive species like deepwater corals (Larson & Purser, 2011). It thus assumed that burial of 1 cm will affect sensitive and non sensitive species indistinctively. The area of direct impact is limited to a radius of 100 m around the drilling point which is very limited and thus the impact is considered as negligible. In case of use of SBM, toxicity of the used chemical will affect the benthos species in a limited radius around the drilling site. In this situation, the anticipated level of impact is minor on a middle term basis. It is therefore anticipated a localized minor impact on the changing in sediment structure (grain size change for example) near drilling well locations.

## 6.6. SUMMARY OF PROJECT'S IMPACTS AND MITIGATION MEASURES

### 6.6.1. Physical Environment

#### 6.6.1.1. IMPACT ON AIR

The potential pollution sources are identical to those presented for GHG (see paragraph 4.7.1).

Most of NO<sub>x</sub>, SO<sub>2</sub>, CO and VOC emissions occur out at sea in an unconfined and ventilated environment and will have no detectable impact on offshore air quality. Furthermore, the project's offshore area is very far away from the Myanmar coasts, the effects are considered negligible.

The impact is limited to the facilities vicinity. Only the cumulative aspects, i.e. the project's emissions added to the current emissions, could generate a significant impact. The residual impact of the project is **NEGLECTIBLE** (under the condition that further studies are implemented in order to understand better about the cumulative impacts and health risks relating to the project).

#### 6.6.1.2. IMPACT ON MARINE SEDIMENT

##### Physical disruptions

The project components that will disrupt the physical quality of marine sediments are mainly: (i) drilling activities with cutting deposits and (ii) re-suspension and movement of the sediments settled on the subsea facilities during the P&A phase. Only the first point can cause a significant impact which, in any case, will be limited to the immediate vicinity of the facilities. These various operations have a localized impact.

The main measures implemented by the project concern (i) the generalization of the vessel dynamic positioning devices for drilling and (ii) processing in place the cuttings from sections using WBM and SBM so that they are discharged via discharge line 15 m below sea surface.

Finally, the residual impact on the project area is **MINOR**.

### **Quality of sediments**

The physical and chemical contamination of the sediments will mainly come from the drilling phase when the cuttings from the sections using drilling mud will settle around the wells; these cuttings may be slightly contaminated by barium from the drilling mud (change in sediment structure, burial or organisms). Chemical additives and oil from the reservoirs could contaminate the sediment surface (toxicity of chemicals).

To limit the impact on sediment quality, the main implemented measures concern (i) the recycling system for WBM and SBM and treatment of cuttings before being discharged in order to obtain a total oil concentration limit as per Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (IFC, 2015), (ii) selection of chemicals added to drilling muds (according to criteria such as the lowest toxicity, the smallest bioaccumulation potential, the highest biodegradability) and (iv) the implementation of a waste management plan and an environment management plan.

Finally, the residual impact on the project area is **MINOR**.

A critical accidental situation, such as a spill related to a loss of containment of a well head, can have a major consequence on the physical and chemical quality of marine sediments. Several studies performed during design and operation phase (such as HAZID, Oil Spill Risk Assessment, OPERSAFE audit, Preventive Maintenance plan...) and oil spill emergency procedures should be implemented to minimize the risk and its consequences.

Finally, the residual impact of these accidental situations is considered as an **ACCEPTABLE RISK** given the low probability of occurrence and the most serious possible environmental consequence on sediments.

## **6.6.1.3. IMPACT ON THE WATER COLUMN**

### **Chemical characteristics and turbidity**

Discharges will disrupt the physical and chemical quality of the waters located near the discharges. This will mainly be an increase of the turbidity during the drilling phase that results in a reduction of the euphotic zone and, to a lesser extent, to a local increase the molecule concentrations at potentially toxic levels for some sensitive organisms (oil, heavy metals and other molecules).

The impact comes from (i) the release, after treatment, of the cuttings associated to the oil mud residue that will settle through the water column by temporarily increasing the turbidity in the environment, (ii) solution treatment of drilling mud additives and (iii) cementing grout near the drilling head.

Moreover, the production of waste can also disrupt the physical and chemical quality of sea water in the project vicinity. Variations in the ionic composition may also occur locally and temporarily and pH variations are very unlikely. However variations in the concentrations of potentially toxic organic and mineral molecules (biocide, metals, viscosity agent...) are likely to occur. The impacts regarding the physical and chemical variations on the biological environment are discussed in paragraph 6.3.3.2.

Another important measure concerns the management of drill cuttings that will only be discharged at sea if the oil on cuttings is less than 6.9% of wet cuttings by using Dryer Unit.

Other key measures allowing the reduction of impacts on water are: (i) the selection of chemicals based on the lowest toxicity, the lowest potential bioaccumulation and greater biodegradability, (ii) optimization on the use of chemicals, (iii) the development of a system to treat bilge water and drainage water, with a hydrocarbon concentration in the water below 15 ppm, (iv) a waste water treatment, (v) monitoring pH

before being discharged and (vi) development of waste management plan and an environmental management plan.

Finally, the residual impact on the project area is **NEGLIGIBLE**.

An accidental situation, leading to a major oil spill, will have major impacts on the physicochemical quality of the water column. A series of studies during the design and operation phases (e.g. HAZID, HAZOP, OPERSAFE audit, Preventive Maintenance Plan...) and emergency procedures in case of accident (Oil Spill Contingency Plan) shall be implemented to minimize the risk and its consequences.

Finally, the residual impact of accidental situations is considered as an **ACCEPTABLE RISK** given the low probability of occurrence and the most serious potential environmental impacts on the water column.

**6.6.2. Offshore biological environment**

**6.6.2.1. FLORA AND FAUNA PLANKTONIC COMMUNITIES**

Alterations of water and sediment quality (see previous sections) will have an impact on sensitive planktonic populations due to chemicals and wastes in the water column. The development of mitigation measures which shall help limit the impact on the water column and sediments (see 6.6.1.2 and 6.6.1.3) is also effective in limiting the impact on plankton communities.

The residual impact is **NEGLIGIBLE**.

**6.6.2.2. MARINE FAUNA**

**Benthic communities**

Like sediments (see previous sections), benthic communities will also be disrupted by the project activities. Benthic communities will directly be destroyed or disrupted, mainly, when the heights of drilling cuttings are too large (tens of centimeters).

Finally, compared to the total amount of area available on similar offshore locations, disrupted surfaces are limited to negligible surfaces. Mitigation measures that will limit the impacts on sediment (see 6.6.1.2) are also effective to protect benthic communities.

Critical accidental situations, such as a spill related to the containment breach of the well head, can have major consequences on sediments and benthic populations. A series of risk studies performed during the design and operation phase (see above) and emergency procedures in case of accident (Oil Spill Contingency Plan) are implemented to minimize the risk and its consequences.

Finally, the residual impact of accidental situations is considered as an **ACCEPTABLE RISK**, given the low probability of occurrence and the most serious potential environmental impacts on benthic populations.

**Ichthyological communities**

The ichthyological communities are composed of a varied biomass of secondary consumers and predators. Many species are harvested by fishing, which makes these populations relatively sensitive. Moreover, some species may be subject to special protection, such as certain species of sharks and rays.

All impacts on biotopes (water and sediment) and on the food web (phytoplankton, zooplankton and benthic population) have an effect on these particular communities, both on biodiversity and on biomass.

All of these mitigation measures, developed by the project to minimize the impact on biotope (water column, sediment) and biotic communities of the food web can limit the impact on the ichthyological population (see paragraphs 6.6.1.2, 6.6.1.3 and 6.6.2).

Finally, the residual impact is considered as **MINOR**.

Accidental situations can also have a significant impact on marine life. To conclude, the residual impact from accidental situations is considered as an **ACCEPTABLE RISK**, given the probability of occurrence and the most serious potential environmental effects on these communities.

**Box 3 - Food web**

1/Phytoplankton or primary producers (floating microscopic algae): produce biomass from (i) the mineral dissolved in water from mineralized organic matter and (ii) solar energy.

2/Zooplankton or primary consumers (juvenile stage of most marine species): live on phytoplankton biomass.

3/Small carnivores or secondary consumers: consumers of zooplankton biomass. Fish and planktonic feeders, including Mysticeti.

4/Large carnivores or predators: tuna, sharks, toothed whales, starfish and anemones living on small carnivore biomass.

Biomass type:

Phytoplankton: 1,000 tons

Zooplankton: 100 tons

Small carnivores: 10 tons

Large carnivores: 1 ton

Feces and corpses of these four groups are transformed by bacteria into minerals, which are then deposited on the seabed or re-suspended in the water column.

### **Sensitive species: turtles, marine mammals and offshore birds**

These taxa include the vast majority of marine species, protected by regulations or regarded as endangered species. This environmental component is highly sensitive.

The impacts of the project on (i) water and (ii) sediment quality as well as (iii) planktonic and benthic populations may indirectly affect these species by disrupting their habitats and food sources. Mitigation measures relating to them are also effective (see impact producing factors and mitigation measures presented in the previous sections).

Other activities from the project can cause direct impacts on these populations. The noise emitted during drilling and installation phases can cause temporary hearing loss and behavioral changes in sensitive species.

In addition to these main mitigation measures, developed to minimize impacts on habitat and food resources, additional measures are needed with: (i) a procedure involving a marine mammal observvation by radio operator or sutible person on-board in order to validate there is no marine mammal before starting drilling operations; (ii) the implementation of a lighting plan to limit emissions of stray light, while ensuring optimal safety conditions on sites ; (iii) Adoption of passive acoustic monitoring system to observe the presence of marine mammals

To conclude, due to the implementation of drilling activity from well by well and phase by phase and in combination with conduction of seafloor survey before drilling, the residual impact on the project area is **MINOR** for marine mammals and turtles. In terms of seabirds, as the activities mainly carried out offshore, 170 km offshore the Myanmar coasts, sea birds populations should be very limited. Residual impacts are considered **NEGLIGIBLE**.

Accidental situations, leading to large spill, can cause direct mortality (toxicity, sticking, choking) or indirect (temporary habitat destruction). Finally, by taking into account the measures implemented to mitigate risk and to manage accidental events, the residual impact from accidental situations is considered as an **ACCEPTABLE RISK**.

### **6.6.3. Coastal Environment**

The project is located approximately 260 km from the south coast of Yangon and 178 km west of Dawei. However, several aspects of the project may affect coastal habitats and biological communities especially as they are often sensitive to: (i) produced, managed and transported wastes to shore for treatment and/or storage and (iii) freshwater consumption water during drilling activities.

The remarkable coastal habitats are (i) the beaches that host specific species (dune and intertidal zones), especially sea turtle nesting areas and (ii) wetlands in relation to the sea, such as mangroves and estuaries. All of the identified protected areas are located far from the project, over 160 km from the project area.

The implementation of an appropriate waste management plan should reduce to the minimum the impact generated by hazardous and non-hazardous disposal (onshore by authorized contractor). Residual impact is considered **NEGLIGIBLE** (if a complete route for waste disposal is identified and approved).

Any accidental situations, leading to large spills, can cause destruction of coastal habitats and remarkable biological communities with rehabilitation time of several decades. Mangroves, beaches and estuaries are exposed to this risk throughout the Myanmar coast and neighboring countries. Finally, and taking into account the measures implemented to mitigate risk and to manage accidental events, the residual impact generated by accidental situations appears as an **ACCEPTABLE RISK**, even if the impact is significant in case of a major accident.

### **6.6.4. Human Environment**

The project will generate many positive social aspects which are summarized below:



- It is estimated that the project will only lightly increase the number of local employees. Indirect employment resulting from the E&P industry is difficult to estimate at that stage (exploration). Indirect employment will be created primarily through the provision of food services, onshore support for equipment supplies and the logistics (road or marine transportation of goods, etc.).
- It is estimated that the project will contribute in a very limited manner to the local economic development.

The main negative social impacts will be:

- Limiting the industrial and artisanal fisheries areas. These are mainly cumulative impacts to consider.
- Accidents or marine pollution can reduce the activities development of coastal tourism.

The main socioeconomic measures implemented before, during and after the exploration drilling project are:

- A local content plan will be developed locally with the drilling contractors and other contractors if needed, and with both Myanmar and local relevant authorities.
- An exclusion zone (radius of 500 m minimum) will be established surrounding the facilities.
- Radars will be used on the supply vessels to monitor the marine traffic.
- Project vessels will be used as watchmen boats in the vicinity of the drilling rig. Their role will be to establish communication with vessels approaching too close from the exclusion zone and reroute them.
- Facilities or support vessels should not anchor in areas used by other marine actors such as fishing areas.
- The supply vessels will follow international navigation standards (as set up by the IMO), adopt responsible practices of navigation and follow protocols towards the small local vessels (if any).
- Support to the project contractors (identification of potential local subcontracting) to facilitate their responses to tenders on the project.
- PTTEPI will establish a direct and regular coordination with Thaketa and Ranong Port Authority for the ship movement from this the logistic base to the drilling site.

See also mitigation measures on the cumulative aspects presented in the section 7 of the present document.

## 7. CUMULATIVE IMPACT ASSESSMENT

*This section describes our methodology and any other foreseeable activity in the area, which could combine with this development project to induce cumulative impacts, in order to assess these cumulative impacts.*

### 7.1. METHODOLOGY AND APPROACH

The environmental impacts associated with a project may be accumulated or intensified when considered in the context of existing operations in the area. The cumulative impacts on different environmental indicators may vary depending on the scale, intensity, and proximity of multiple operations, as well as the interactions of environmental ecosystems affected.

This assessment allows the consideration of deviations from baseline environmental conditions as a result of simultaneous marine activities, current and future, and accounts for the seeming insignificance of a single activity which may trigger, aggravate or in some other way worsen the impacts of a project when considered in collaboration with another.

The evaluation of cumulative impacts associated with exploration drilling activities is complex due to diverse operational and environmental interactions.

In order to account for the complexity of cumulative impacts, this assessment was conducted in four phases:

- Identification of environmental components which may be significantly adversely affected by the project;
- Identification of projects or activities (mainly future) which may have a negative impact on the environmental components identified above;
- Determination of the sensitivity of environmental components to cumulative impacts (be they over a short- or long-term period) when considered in parallel with other projects or activities identified in the area;
- Determination of significance of cumulative impacts on the environmental components after consideration of proposed mitigation measures.

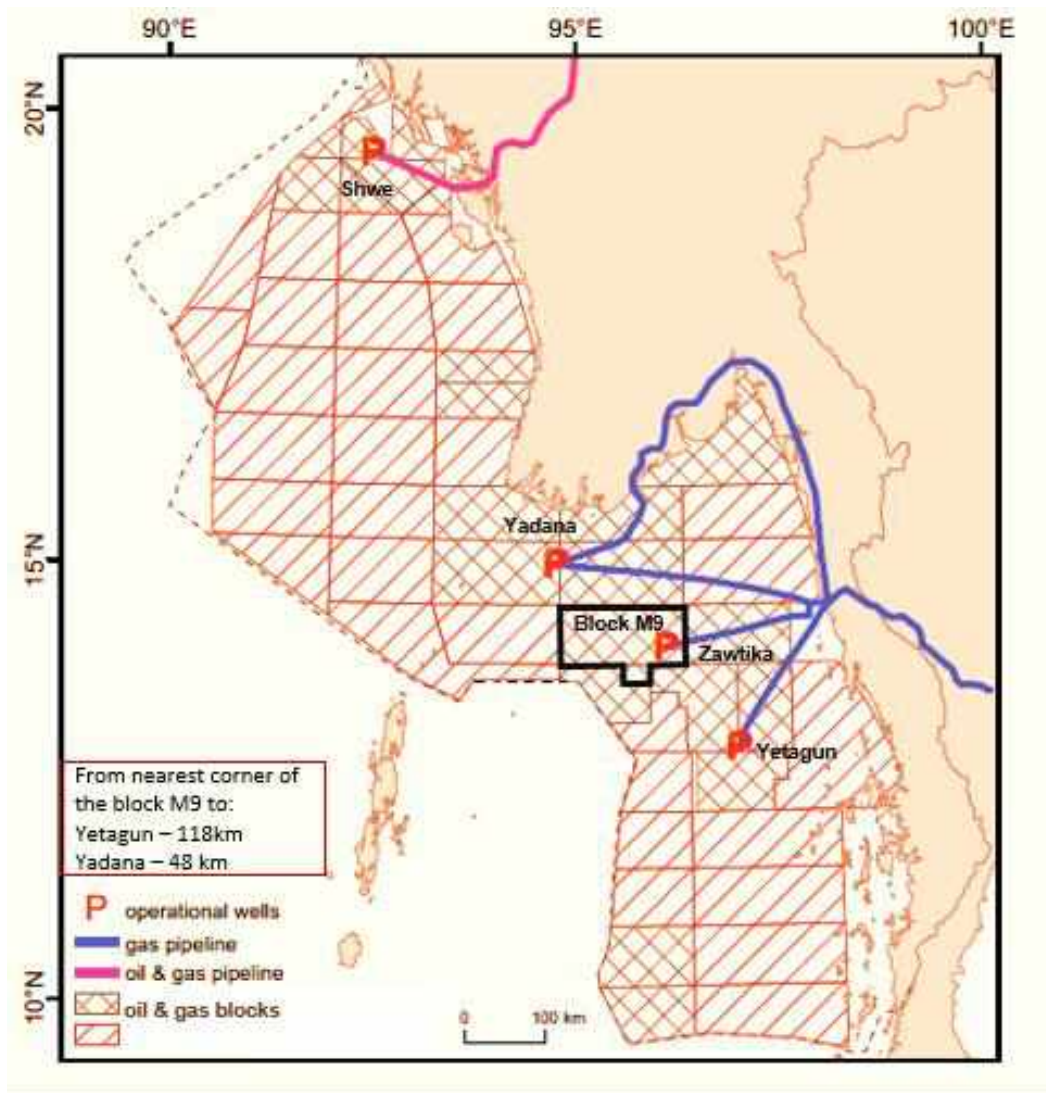
The potential impacts associated with the carbonate exploration drilling are considered in the context of other existing marine operations in the potentially affected area in the sections below.

### 7.2. CUMULATIVE IMPACT ON OTHER OIL & GAS EXPLORATION AND PRODUCTION ACTIVITIES

For most environmental components, the impacts generated by the M9 appraisal drilling project are negligible to minor. This result is mainly due to the localization of the project (far from the coast).

However, each environmental component undergoes the cumulative impacts of all oil & gas exploration and production activities. A great number of activities has cumulative impacts on the physical environment and indirectly affects the natural and human environment. The main cumulative activities of the project are as follows: (i) physical presence and annexation of the maritime domain, (ii) emissions and discharges that modify the physical environment and indirectly the natural environment and (iii) the production of waste that is advisable to reuse, process and/or bury with environmental consequence that are not always well controlled.

It is possible that an operator from nearby blocks may perform its activities simultaneously with PTTEPI in order to avoid the hurricane season.



**Fig. 40.** Location of existing oil and gas development fields, pipelines and the Block M9

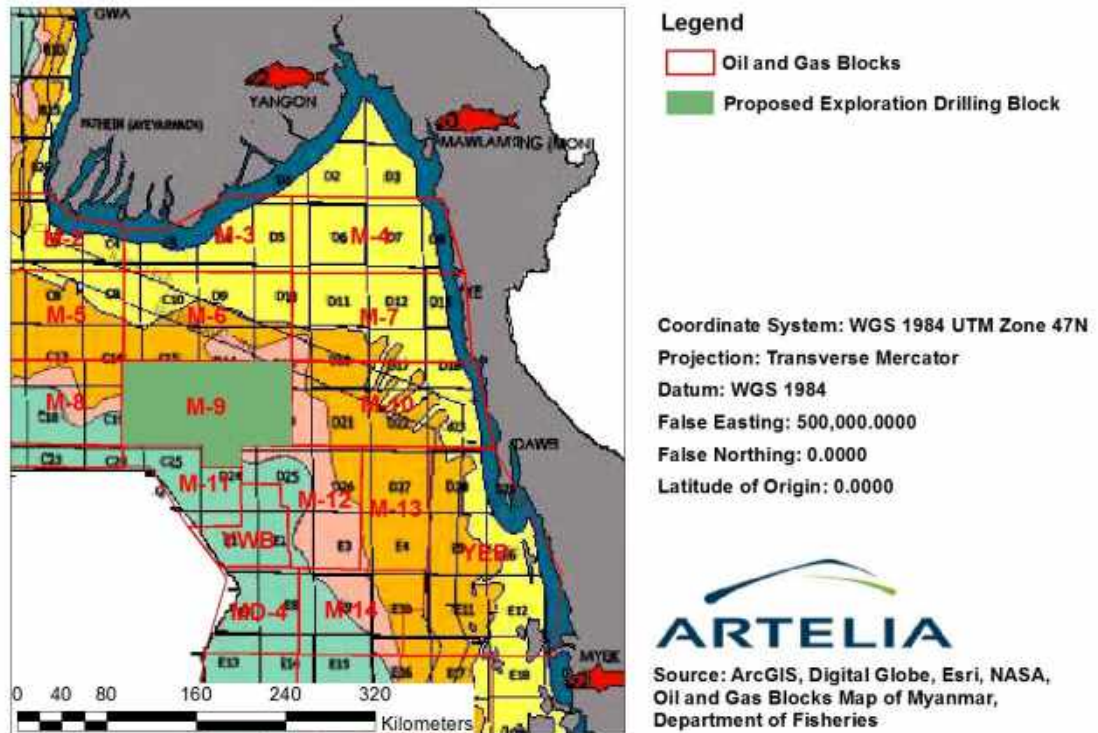
According to the possibility of simultaneous operation with other existing activities and the proposed project, there may have cumulative impacts on physical environment, marine traffic, commercial fishing and marine ecosystem. Nevertheless, the duration of each drilling 70 days with 15 days of less intensive drilling operation (for well abandonment and demobilization phase) is unlikely to be resulted as cumulative impact and the dispersion of emission and discharges to the physical environment is expected to be settled. While considering the cumulative impacts of emission and discharges into physical environment, a dispersion study presented and performed in this project can be taken as reference.

The complete dispersion study for this project is provided in the **Error! Reference source not found.** of this EIA report.

### 7.3. CUMULATIVE IMPACT ON TRADITIONAL FISHING

The impact on fishing activities first comes from the direct impacts that accumulate for each oil and gas activities: (i) increase in sea traffic, (ii) extension of restricted shipping areas, (iii) increase of the fish aggregating device impact on each offshore structure in the restricted areas attracting resources.

Indirect impacts eventually affecting fishing activities are numerous, and if, they seem negligible when taken individually, accumulating them can become worrying: (i) increase of anthropogenic pressure, (ii) primary increase of the fishing pressure, (iii) shrinkage of mangroves and other spawning grounds, (iv) cumulated impacts of the discharges on biotopes (water, sediments, and seagrass). (i) + (ii) + (iii) + (iv) lead to (v) secondary increase of the fishing pressure, (vi) reduction of juvenile fry and (vii) reduction of fish stocks. All these effects generate an increase of the effort and risk of single catches, subject of the complaint of the fishermen.



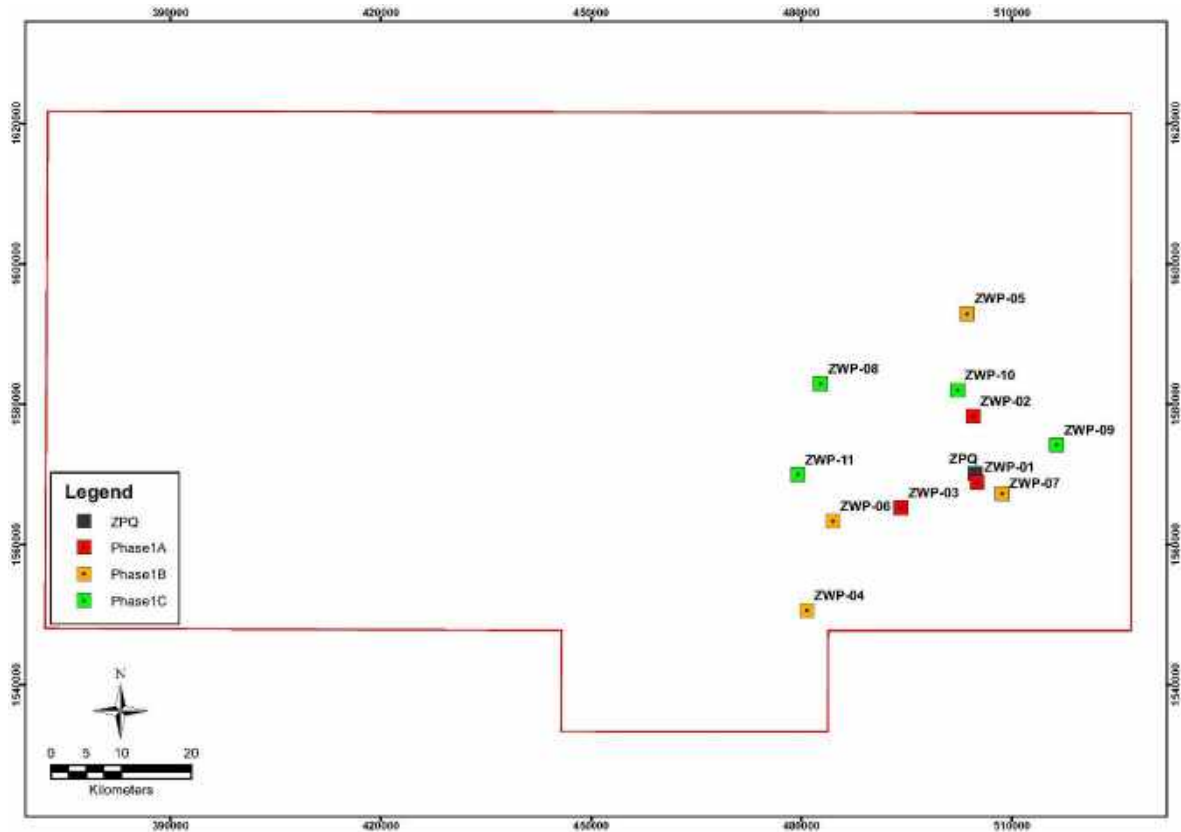
**Fig. 41.** Overlaying the Block M9 and fishing grounds

However, the proposed campaign is near the existing production gas fields, especially Zawtika and patrolling of vessel around the exclusion zone can also prevent the entering of illegal fishing boats into the nearby fishing grounds. According to the size of block and per well drilling schedule of the project, there will be a large percentage of area remains as fishing grounds for offshore fisheries. Refer to the responses from public consultation meetings, the opinion and sensitivity of fishermen ranked as medium sensitivity and thus, given our current knowledge, it is not reasonable to provide a conclusion regarding the cumulative impact of oil activities on fishing. Traditional fishermen, themselves, consider that the most important impact on their activity is caused by illegal fishing on their zone.

#### 7.4. CUMULATIVE IMPACT ON MARINE TRAFFIC

The main impacts is increase in marine traffic in the region due to the operation of proposed project, regional fishing activities and navigating of vessels through the main shipping lane. Since the proposed 12 appraisal wells will take approximately 540 days, the possibility in frequent occurrences of project's supply vessels and fishing boats and commercial ships during project implementation. The disturbance to commercial and naval marine traffic is expected as lower range due to the existing establishment of exclusion zone in Zawtika project. The below figure of Zawtika platform location map is presented to anticipate the possible cumulative

impacts of marine traffic due to the parallel operation of proposed project, in order to avoid Tropical cyclone season.



**Fig. 42. Zawtika Platform Location Map**

## 7.5. CUMULATIVE IMPACT ON BIODIVERSITY

The reduction of biodiversity comes from direct effects that accumulate for all exploration and production projects. In normal operation, direct effects are low and mainly related to noise generated by activities, to the discharged toxic substances and to the direct destruction of the biotope when installing equipment. The hazardous impacts on biodiversity come from critical accidental situations. Their probabilities add up project after project with also an accumulation of discharges that are smaller but with more important occurrences that generate the destruction of organisms and biotopes, and behavioral modifications.

Indirect impacts are caused by the increase of the anthropic pressure related to oil & gas activities and generate a decline in mangroves and other spawning grounds, reducing the coastal and marine biodiversity.

## 8. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

### 8.1. INTRODUCTION

The appraisal drilling campaign will be conducted by PTTEP International Limited (PTTEPI) in the eastern part of Block M9 where the water depth in the project area ranges from 50 to 800 m. The present study provides a recommended approach to developing an environmental management plan, which will deliver the agreed management and mitigation measures identified in the report. The final and issued EMP will need to be developed by PTTEPI and its selected drilling contractor before the start of the project.

The EMP aims to establish required and adequate tools to eliminate, mitigate and/or compensate environmental and social impacts identified in the EIA throughout exploration drilling activities in Block M9. Environmental Management Plan (EMP) presents for the whole project duration the procedures, resources, roles and responsibilities with regards to:

- The implementation of mitigation measures to prevent and/or minimize potential environmental impacts regarding project activities,
- The monitoring of any environmental impacts related to the Project.

PTTEPI has Safety Security Health and Environmental (SSHE) policy which is presented in Section **Error! Reference source not found. Error! Reference source not found.**

### 8.2. PROJECT DESCRIPTION

PTTEPI is planning to conduct the exploration drilling of a maximum of twelve appraisal wells with as an objective to confirm (or deny) and indicate the presence of hydrocarbon reservoirs. The drilling of one appraisal well takes approximately 40 days. Therefore, for drilling twelve wells in this campaign, the duration will take approximately 540 days and thus, the completion of drilling for twelve wells will enter into Q1 of 2020

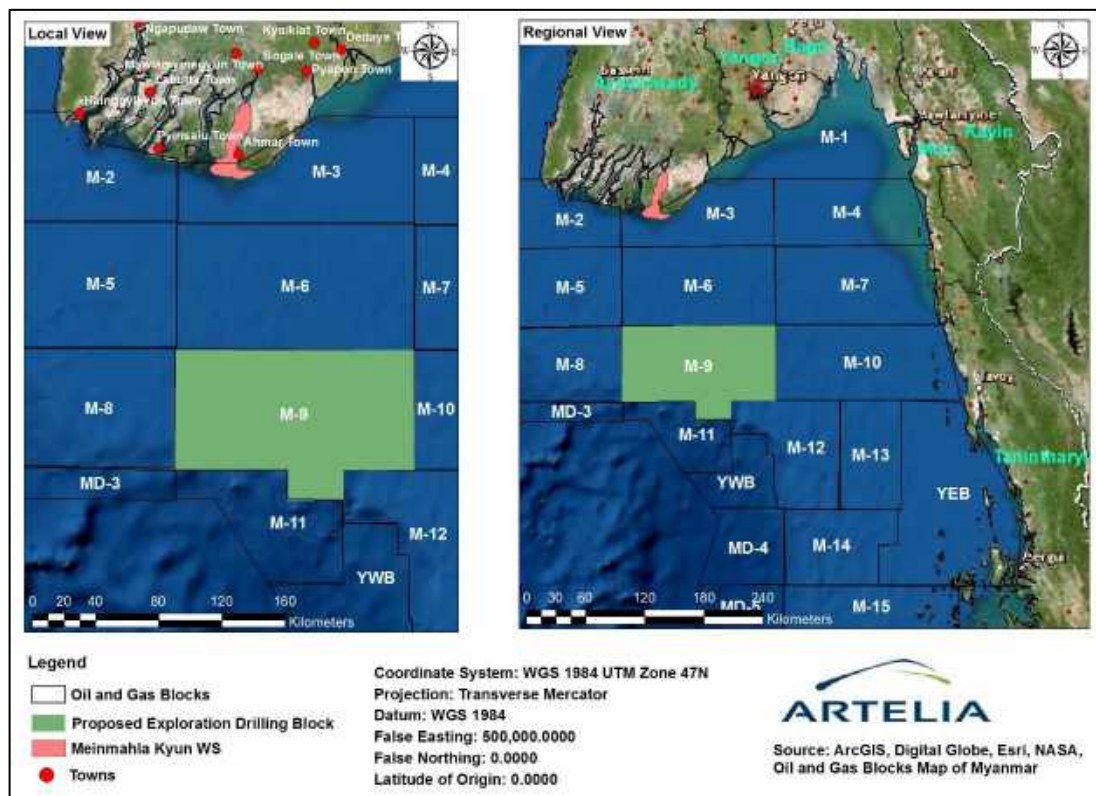
- **Mobilization and Installation Phase** – The wells will be drilled using a semi-submersible rig, which is capable of operating in sea water depths up to 500 to 3,000 m and which can be easily be transported as they float high on the water with little drag when they are deballasted. The drilling rig will be transported by two towing vessels and the duration of transporting the rig to the Project's location will take a maximum of 5 days. Upon arrival, the rig is fixed to its operational position by mooring using 8 to 12 anchors. There will also be supply vessels which will transport catering provisions, supplies, casing/tubing, fuel, drilling water, fresh water, mud and cementing materials to the drilling rig. A helicopter with a capacity of 12 staff per flight will also be used. It is expected that 156 employees will be working on the rig during all phases; installation, drilling and abandonment.
- **Drilling Phase** – Most of the wells will be drilled using best suitable drilling strategies and most economical in the efforts; **Vertical well, S-shape deviated well and J-shape deviated** can be adopted to draw out a specific configuration of hydrocarbons. The appraisal wells will start at 72 m TVD/MSL (True Vertical Depth below Mean Sea Level). It is expected to drill down to 3,000 – 3,500 m TVD/MSL (i.e., under the sea level). Once in position at the designated well-site, drilling will start. At the end of drilling, if gas has been discovered, wells will be evaluated by wireline logging. At the end of the project, the well will be sealed. Three types of drilling mud, **Water-based mud (WBM), High Performance Water based mud (HPWBM) and Synthetic based mud**

(SBM) will be used for lubrication of the bit and drill pipe, extraction of cuttings, control of subsurface pressures, prevention of well collapse and clogging of the penetrated formation. Mud will be formulated in a mix tank prior to entering the drilling system. Therefore, the mud circulation system will be utilized to remove progressively smaller rock particles. General mud circulating equipment includes shale shakers, desanders, mud cleaner/silt separator, trip tankers and degasser. During drilling operation, evaluation method of the petro-physical properties of the well will include **Mud logging**, which involves the examination of the drill cuttings brought to the surface by the drilling fluid and **Wireline logging** which is electrical logging and gamma ray measurement will be used to evaluate the geology encountered down the hole.

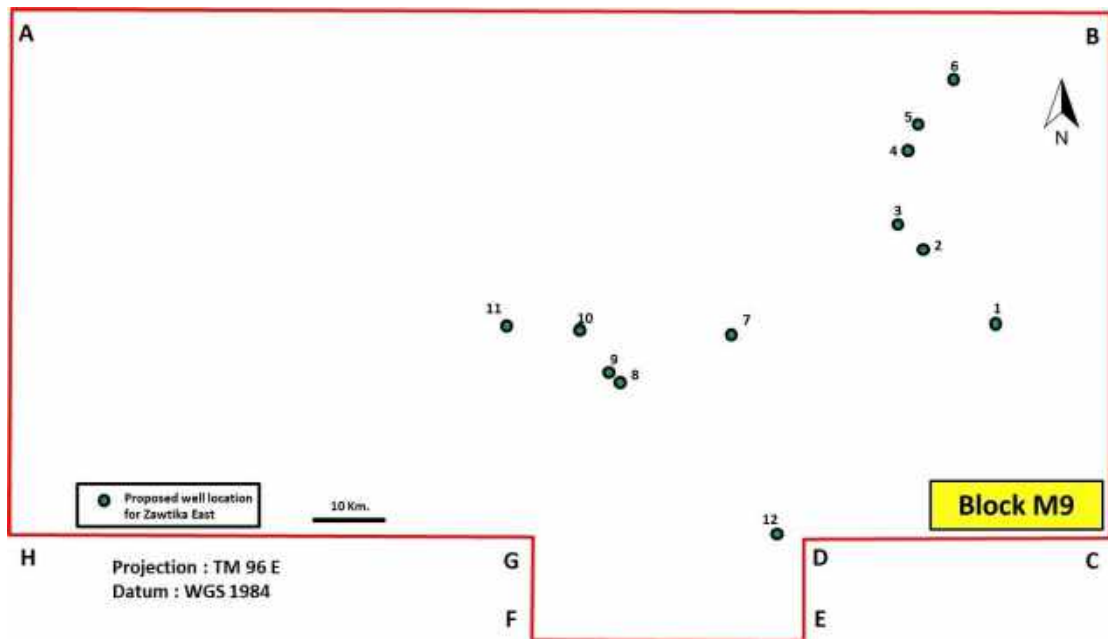
- **Decommissioning, Closure and Post-closure Phase-** At the end of the exploration drilling program, rig will be moved out and be towed using two towing vessels to the next Project's proposed drilling positions. The wells will also be abandoned at the end of the project. Well abandonment for the project will follow PTTEPI internal procedures in line with international standards for O&G industry. Generally, it consists in placing mechanical and cement plugs at strategic depths in the wellbore to separate and to permanently seal off various zones.

### 8.3. OVERVIEW MAP OF PROJECT AREA

Block M9 is located in the Gulf of Martaban, Andaman Sea, at approximately 260 km from the south coast of Yangon and 178 km west of Dawei. The following figures represent the location of the block and proposed well locations.



**Fig. 43.** Location of the Block M-9



**Fig. 44.** Proposed well locations in Block M9

#### **8.4. LEGAL REQUIREMENT, HEALTH POLICY AND COMMITMENTS OF THE PROJECT**

The policy and legal requirements of the project have been comprehensively described in Chapter **Error! Reference source not found.**

##### **8.4.1. PTTEPI's Commitment Letter**

The commitment letter of PTTEPI is attached in APPENDIX 6.

#### **8.5. SUMMARY OF IMPACTS AND MITIGATION MEASURES**

The assessment of the impacts are taken into all the project activities such as consumption on natural resources, atmospheric emissions, discharge of various effluents, waste, the disturbance to the seabed, physical presence of the rig and supporting vessels, introduction of invasive marine species, accidental release, use of labor, subcontractor and so forth.

The residual impact assessment also indicates that the M9 exploration drilling project will result in negligible or minor for residual impacts following the implementation of recommended mitigation measures due to low overall residual impact magnitude and short duration.



The summary of all impacts and mitigation measures are presented in the table below.

**Tabl. 56 - Summary of impacts and mitigation measures during mobilization and installation phases**

Environmental & Social aspects	Impact forming factors	Mitigation measures
1- Air quality / GHG emissions	Air emissions from combustion due to operation of machines and engines installed on support and supply vessels.	<ul style="list-style-type: none"> <li>● Regular maintenance of marine engines, generators and compressor.</li> <li>● Compliance with MARPOL 73/78 Annex VI – prevention of air pollution from ships, and if applicable based on age of vessels (MARPOL Annex VI Chapter 4 – ship energy efficiency management)</li> <li>● To warn vessels of any delays in required times of arrival so that they may reduce speed accordingly for energy efficiency if possible</li> </ul>
2- Seawater & sediment quality	Discharge of oil-containing wastewater (i.e., bilge water, oil-chemical containing wastewater from engine room and deck drain) containing hydrocarbons or untreated sewage from marine vessels could potentially degrade seawater quality.	<ul style="list-style-type: none"> <li>● Rig, support and supply vessels shall be equipped with sanitary wastewater treatment unit.</li> <li>● All vessel shall comply with MARPOL (discharged bilge water into the sea shall not exceed 15 mg/l) and PTTEPI’s Waste Management Plan.</li> <li>● Bilge water separately collected and treated prior to discharge into the sea. All discharges should be treated and has &lt;15 ppm of oil content.</li> <li>● Food waste is milled and ground to a size of &lt;25 mm in diameter prior to discharge.</li> <li>● Ballast water will not be discharged into the environment without prior treatment. Ballast water discharges, if any, will comply with the international convention for the control and management of ships’ ballast water and sediment (IMO, 2004).</li> </ul>
	Discharge of wastewater and sewage from drilling rig, support and supply vessels may impact seawater quality.	<ul style="list-style-type: none"> <li>● Marine vessels have open drain system, which collects and treats run-off water potentially contaminated with hydrocarbons and/or chemicals.</li> <li>● Vessels not to be stationary when undertaking discharge.</li> <li>● Suitable sewage water treatment units shall be available on the vessels and adequately sized according to the number of people working on-board.</li> <li>● Chemical additives on all marine vessels will be stored in drums or tote tanks located in area equipped with means to contain any leaks or spills.</li> </ul>
	The Project will generate various types of hazardous and non-hazardous wastes. Inappropriate management (including transportation, storage and disposal) of waste will impact seawater quality.	<p>Manage waste at offshore facilities in compliance with the requirements under MARPOL 73/78 and PTTEPI’s Waste Management Plan.</p> <p><b>Hazardous Waste</b></p> <ul style="list-style-type: none"> <li>● Waste storage areas shall be clearly defined.</li> <li>● Collected and stored in suitable containers that are protected from the environment (rain, wind, etc.).</li> <li>● The vessel deck shall be cleaned to minimize the impact from oil and chemical contamination into the sea during period of rain.</li> <li>● Containers equipped with means to contain any spills or leaks.</li> <li>● Transferred to a suitable authorized disposal facility onshore by a certified transporter.</li> <li>● Prohibit any discharge of hazardous waste into the sea.</li> </ul> <p><b>Non-hazardous waste</b></p> <ul style="list-style-type: none"> <li>● Segregate non-hazardous waste, including food</li> </ul>

Environmental & Social aspects	Impact forming factors	Mitigation measures
		<p>waste, paper, aluminum can, glass, rag and other wastes in separate containers or proper areas.</p> <ul style="list-style-type: none"> <li>● Waste storage areas shall be clearly defined.</li> <li>● Food wastes will be ground to 25 mm prior to discharge to sea. All non-food wastes will be collected and transported to shore for landfill or acceptable disposal.</li> <li>● Dispose non-hazardous waste at onshore treatment facilities in accordance with the law of Myanmar and PTTEPI's Waste Management Plan.</li> <li>● Transported to the onshore bases for collection and recycling by an authorized waste management contractor.</li> <li>● Keep the record of waste inventories, including type and quantities updated.</li> </ul>
	Drilling rig installation and anchoring of support vessels can disturb the seafloor and consequently cause a temporary suspension of the sediments, increasing turbidity.	<ul style="list-style-type: none"> <li>● Before the drilling starts, PTTEPI will coordinate with MOGE, who will then issue "Notice to Mariner" regarding project activities to concerned parties (i.e., Department of Fisheries, Ministry of Livestock, Fisheries and Rural Development, Myanmar Navy and Myanmar Fisheries Federation).</li> </ul>
3- Seabed characteristics	The pattern of seafloor sediment topography could be affected by rig and anchoring of support vessels.	<ul style="list-style-type: none"> <li>● Conduct seafloor surveys to identify seabed features that could impact on or be impacted by rig installation.</li> <li>● Prohibit anchor dragging.</li> <li>● Before the drilling starts, PTTEPI will coordinate with MOGE, who will then issue "Notice to Mariner" regarding project activities to concerned parties (i.e., Department of Fisheries, Ministry of Livestock, Fisheries and Rural Development, Myanmar Navy and Myanmar Fisheries Federation).</li> </ul>
4- Marine life and marine ecology	Offshore activities may disturb marine mammals.	<ul style="list-style-type: none"> <li>● Adoption of equipment designed to current engineering standards.</li> <li>● Regular maintenance of marine engines, generators and compressor.</li> <li>● Vessels to use slow speed and adapt the routes to avoid sensitive areas to marine mammals</li> <li>● Adoption of passive acoustic monitoring system to observe the presence of marine mammals</li> </ul>
	Waste, wastewater and discharges from drilling rig and vessels may cause an impact on seawater and sediments, which may indirectly affect the community of marine biota at the surface level and the seabed.	<ul style="list-style-type: none"> <li>● Implement all mitigation measures for Item 2 and 3.</li> </ul>
5- Fishing communities and fisheries	Reduced fishing area due to the presence of drilling rig and vessels, and 500 m exclusion zones.	<ul style="list-style-type: none"> <li>● Before drilling starts, PTTEPI will coordinate with MOGE, who will then issue "Notice to Mariner" regarding all the project activities to concerned parties (i.e. Department of Fisheries, Ministry of Livestock, Fisheries and Rural Development, Myanmar Navy, and Myanmar Fisheries Federation).</li> <li>● An exclusion zone (radius of 500 m) will be established surrounding the drilling rig.</li> <li>● Use support vessels to warn off traffic.</li> <li>● Provide appropriate lights and warning signals at offshore facilities to prevent accidental collision.</li> </ul>
	The quantity and quality of aquatic biota	<ul style="list-style-type: none"> <li>● Implement all mitigation measures for Item 2 and 3</li> </ul>

Environmental & Social aspects	Impact forming factors	Mitigation measures
	may decrease due to waste contamination in the sea. Contaminants may consist of non-hazardous and hazardous waste.	above.
6- Shipping and navigation	Marine vessels may obstruct marine navigation during transporting the rig and equipment from onshore.	<ul style="list-style-type: none"> <li>• Before drilling starts, PTTEPI will coordinate with MOGE, who will then issue “Notice to Mariner” regarding project activities to concerned parties (i.e. Department of Fisheries, Ministry of Livestock, Fisheries and Rural Development, Myanmar Navy, and Myanmar Fisheries Federation).</li> <li>• Use support vessels to warn off traffic.</li> <li>• Provide appropriate lights and warning signals at offshore facilities to prevent accidental collision.</li> <li>• An exclusion zone (radius of 500 m) will be established surrounding the drilling rig.</li> </ul>
	The presence of the offshore facilities may obstruct navigation.	
7- Socio-economy	Increase in industrial expenditure and income (positive impact)	<ul style="list-style-type: none"> <li>• Enhance utilization of local goods and services as much as possible.</li> </ul>
8- Occupational health and safety	Injuries or illness due to exposure to harmful substances or accident	<p>Implement relevant components of PTTEPI's SSHE Management System, including the following:</p> <ul style="list-style-type: none"> <li>• Implement PTTEPI's Occupational Health Management Standard. (attached in <b>Error! Reference source not found.</b>)</li> <li>• Ensure that all employees wear appropriate equipment, and implement PTTEPI's Personal Protective Equipment Standard.</li> <li>• Personnel will be provided with safety training to ensure that all workers practice under safety operation and regulation of work, as per PTTEPI's SSHE Training &amp; Competency Standard.</li> </ul>
		<ul style="list-style-type: none"> <li>• Cooperate with the nearest health center/hospital in order to immediately support response to emergency events, as per PTTEPI's MERP. Duty Manager and Emergency Management Team for Medevac response or Medical Referral in case of emergency events.</li> </ul>
	Injuries due to working in noisy areas.	<p>Implement following operational measures for prevention and control of accidents:</p> <ul style="list-style-type: none"> <li>• Safety Data Sheets must be provided with every chemical products.</li> <li>• Adequate storage will be provided for each chemical in accordance with safety instruction (storage conditions, etc.).</li> <li>• Provide spill kits on-site.</li> <li>• Provide first aid kits on-site.</li> <li>• Provide proper sanitary systems, including drinking water, potable water, toilet and waste management.</li> </ul>
9- Public health and Health service	Project activities could involve general public around shore bases that will be used for staff, materials and waste transportation.	<ul style="list-style-type: none"> <li>• Implement PTTEPI's Occupational Health Management Standard. (attached in <b>Error! Reference source not found.</b>)</li> </ul>
	In case of accident or illness during project activities, it may be required to use healthcare services around the shore bases.	<ul style="list-style-type: none"> <li>• Cooperate with the nearest health center/hospital in order to immediately support response to emergency events, as per PTTEPI's MERP. Duty Manager and Emergency Management Team for</li> </ul>

Environmental & Social aspects	Impact forming factors	Mitigation measures
		Medevac response or Medical Referral in case of emergency events.

**Tabl. 57 - Summary of impacts and mitigation measures during drilling**

Aspects	Potential impacts	Mitigation measures
1- Air quality / GHG emissions	Air emissions from combustion due to operation of machines and engines.	<ul style="list-style-type: none"> <li>● Maintaining generators and compressors in good working order.</li> </ul>
	Exhaust gases from helicopter jet fuel combustion.	<ul style="list-style-type: none"> <li>● Use the helicopter only for crew transportation and emergency case</li> </ul>
2- Seawater & sediment quality	Discharge of mud and cuttings into the sea could impact seawater and sediment quality.	<ul style="list-style-type: none"> <li>● Use of WBM with high biodegradability and low toxicity additives as main drilling fluid for all well sections.</li> <li>● For contingency and technical reason, SBM will be used with low toxicity biodegradable and non-persistent.</li> <li>● The discharge of cuttings shall be complied with Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (IFC, 2015).</li> <li>● Discharge of cuttings will be 15m below sea surface.</li> </ul>
	Discharge of cement could impact seawater quality.	<ul style="list-style-type: none"> <li>● Use of centrifuges, shale shakers and mud cleaners to separate out the cuttings from the mud.</li> <li>● Drilling mud will be treated and then send back to the cycle in a continual circulation through the rig's mud handling system: recycling of mud to minimize the quantity discharge to sea.</li> <li>● Optimization of the quantities of cement and the dosing of chemicals used.</li> <li>● SDS available on the drilling rig</li> </ul>
	Chemical additives in the drilling fluid may impact seawater and sediment quality.	<ul style="list-style-type: none"> <li>● Chemicals shall be selected according to their low toxicity.</li> </ul>

Aspects	Potential impacts	Mitigation measures
	The Project will generate various types of hazardous and non-hazardous wastes. Inappropriate management (including transportation, storage and disposal) of waste will impact seawater quality.	<p>Manage waste at offshore facilities in compliance with the requirements under MARPOL 73/78 and PTTEPI's Waste Management Plan.</p> <p><b>Hazardous Waste</b></p> <ul style="list-style-type: none"> <li>Waste storage areas shall be clearly defined.</li> <li>Collected and stored in suitable containers that are protected from the environment (rain, wind, etc.).</li> <li>The vessel deck shall be cleaned to minimize the impact from oil and chemical contamination into the sea during period of rain.</li> <li>Containers equipped with means to contain any spills or leaks.</li> <li>Transferred to an authorized disposal facility onshore by a certified transporter.</li> <li>Prohibit any discharge of hazardous waste into the sea.</li> </ul> <p><b>Non-hazardous waste</b></p> <ul style="list-style-type: none"> <li>Segregate non-hazardous waste, including food waste, paper, aluminum can, glass, rag and other wastes in separate containers or proper areas.</li> <li>Waste storage areas shall be clearly defined.</li> <li>Food wastes will be ground to 25 mm prior to discharge to sea. All non-food wastes will be collected for compaction and transport to shore for landfill or acceptable disposal.</li> <li>Dispose non-hazardous waste at onshore treatment facilities in accordance with the law of Myanmar and PTTEPI's Waste Management Plan.</li> <li>Transported to the onshore bases for collection and recycling by an authorized waste management contractor.</li> <li>Keep the record of waste inventories, including type and quantities updated.</li> </ul>
3- Seabed characteristics	The pattern of seafloor sediment topography could be affected by discharge of drilling mud and cuttings.	<ul style="list-style-type: none"> <li>Implement all mitigation measures in Item 2.</li> </ul>
4- Marine life and marine ecology	<p>Offshore activities may disturb marine species.</p> <p>send the person recommended by the DMS on an international Marine Mammal Observer training course for full training and provide the required equipment (optics) to DMS.</p> <p>Drilling discharge may cause an impact on seawater and sediments, which may indirectly affect the community of marine biota at the surface level and the seabed.</p>	<ul style="list-style-type: none"> <li>Implement all mitigation measures for Item 2.</li> </ul>

Aspects	Potential impacts	Mitigation measures
5- Fishing communities and fisheries	Reduced fishing area due to the presence of drilling rig and vessels, and 500 m exclusion zones.	<ul style="list-style-type: none"> <li>Before drilling starts, PTTEPI will coordinate with MOGE, who will then issue “Notice to Mariner” regarding project activities to concerned parties (i.e. Department of Fisheries, Ministry of Livestock, Fisheries and Rural Development, Myanmar Navy, and Myanmar Fisheries Federation).</li> <li>An exclusion zone (radius of 500 m) will be established surrounding the drilling rig.</li> <li>Use support vessels to warn off traffic.</li> <li>Provide appropriate lights and warning signals at offshore facilities to prevent accidental collision.</li> </ul>
	The quantity and quality of aquatic biota may decrease due to waste contamination in the sea. Contaminants may consist of non-hazardous and hazardous waste and mud and cuttings from drilling activities.	<ul style="list-style-type: none"> <li>Implement all mitigation measures for Item 2 and 3 above.</li> </ul>
6- Shipping and navigation	Marine vessels may obstruct marine navigation during transporting the rig and equipment from onshore.	<ul style="list-style-type: none"> <li>Before drilling starts, PTTEPI will coordinate with MOGE, who will then issue “Notice to Mariner” regarding project activities to concerned parties (i.e. Department of Fisheries, Ministry of Livestock, Fisheries and Rural Development, Myanmar Navy, and Myanmar Fisheries Federation).</li> <li>Use support vessels to warn off traffic.</li> <li>Provide appropriate lights and warning signals at offshore facilities to prevent accidental collision.</li> <li>An exclusion zone (radius of 500 m) will be established surrounding the drilling rig.</li> </ul>
	The presence of the offshore facilities may obstruct navigation.	
7- Socio-economy	Increase in industrial expenditure and income (positive impact)	<ul style="list-style-type: none"> <li>Enhance utilization of local goods and services as much as possible.</li> </ul>
8- Occupational health and safety	Injuries or illness due to exposure to harmful substances or accident	Implement relevant components of PTTEPI’s SSHE Management System, including the following: <ul style="list-style-type: none"> <li>Implement PTTEPI’s Occupational Health Management Standard. (attached in <b>Error! Reference source not found.</b>)</li> <li>Personnel will be trained with the safe handling of the chemicals</li> <li>Personnel will be provided with the necessary personnel protective safety equipment.</li> <li>Personnel will be provided with safety training to ensure that all workers practice under safety operation and regulation of work, as per PTTEPI’s SSHE Training &amp; Competency Standard.</li> </ul>
		<ul style="list-style-type: none"> <li>Cooperate with the nearest health center/hospital in order to immediately support response to emergency events, as per PTTEPI’s MERP. Duty Manager and Emergency Management Team for Medevac response or Medical Referral in case of emergency events.</li> </ul>
		Implement following operational measures for prevention and control of accidents: <ul style="list-style-type: none"> <li>Safety Data Sheets must be provided with every chemical product for safety and the environment.</li> <li>Adequate storage will be provided for each chemical in accordance with safety instruction (storage conditions, etc.).</li> <li>Provide spill kits on-site.</li> <li>Provide first aid kits on-site</li> </ul>

**Offshore M9 East Appraisal/Exploration Drilling**

Report

**ENVIRONMENTAL IMPACT ASSESSMENT**

Aspects	Potential impacts	Mitigation measures
		<ul style="list-style-type: none"> <li>Provide proper sanitary systems, including drinking water, potable water, toilet and waste management.</li> </ul>
	Injuries due to working in noisy areas.	<ul style="list-style-type: none"> <li>Maintaining generators and compressors in good working order.</li> <li>Provide personal protection equipment (ear plug for instance) to workers working on high level noise activities.</li> </ul>
9- Public health and Health service	Project activities could involve general public around shore bases that will be used for staff, materials and waste transportation.	<ul style="list-style-type: none"> <li>Implement PTTEPI's Occupational Health Management Standard.(attached in <b>Error! Reference source not found.</b>)</li> </ul>
	In case of accident or illness during project activities, it may be required to use healthcare services around the shore bases.	<ul style="list-style-type: none"> <li>Cooperate with the nearest health center/hospital in order to immediately support response to emergency events, as per PTTEPI's MERP. Duty Manager and Emergency Management Team for Medevac response or Medical Referral in case of emergency events.</li> </ul>

**Tabl. 58 - Summary of impacts and mitigation measures during P&A (Plug and Abandon) and Demobilization**

Aspects	Potential impacts	Mitigation measures
1- Air quality / GHG emissions	Air emissions from combustion due to operation of machines and engines installed on support and supply vessels.	<ul style="list-style-type: none"> <li>Regular maintenance of marine engines, generators and compressor.</li> <li>Compliance with MARPOL 73/78 Annex VI – prevention of air pollution from ships, and if applicable based on age of vessels (MARPOL Annex VI Chapter 4 – ship energy efficiency management)</li> <li>To warn vessels of any delays in required times of arrival so that they may reduce speed accordingly for energy efficiency if possible</li> </ul>
2- Marine life and marine ecology	Offshore activities may disturb marine mammals.	<ul style="list-style-type: none"> <li>Regular maintenance of marine engines, generators and compressor.</li> <li>Vessels to use slow speed and adapt the routes to avoid sensitive areas to marine mammals</li> <li>Adoption of passive acoustic monitoring system to observe the presence of marine mammals</li> </ul>
	Waste, wastewater and discharges from drilling rig and vessels may cause an impact on seawater and sediments, which may indirectly affect the community of marine biota at the surface level and the seabed.	<ul style="list-style-type: none"> <li>Implement all mitigation measures for Item 2 and 3.</li> </ul>
3- Fishing communities and fisheries	Reduced fishing area due to the presence of drilling rig and vessels, and 500 m exclusion zones.	<ul style="list-style-type: none"> <li>An exclusion zone (radius of 500 m) will be established surrounding the drilling rig.</li> <li>Use support vessels to warn off traffic.</li> <li>Provide appropriate lights and warning signals at offshore facilities to prevent accidental collision.</li> </ul>
	The quantity and quality of aquatic biota may decrease due to waste contamination in the sea. Contaminants may consist of non-hazardous and hazardous waste and mud and cuttings from drilling activities.	<ul style="list-style-type: none"> <li>Implement all mitigation measures for Item 2 and 3 above.</li> </ul>

Aspects	Potential impacts	Mitigation measures
4- Shipping and navigation	Marine vessels may obstruct marine navigation during transporting the rig and equipment from the drilling site to the next Project's proposed drilling position.	<ul style="list-style-type: none"> <li>• Use support vessels to warn off traffic.</li> <li>• Provide appropriate lights and warning signals at offshore facilities to prevent accidental collision.</li> <li>• An exclusion zone (radius of 500 m) will be established surrounding the drilling rig.</li> </ul>
5- Occupational health and safety	Injuries or illness due to exposure to harmful substances or accident	<p>Implement relevant components of PTTEPI's SSHE Management System, including the following:</p> <ul style="list-style-type: none"> <li>• Implement PTTEPI's Occupational Health Management Standard. (attached in <b>Error! Reference source not found.</b>)</li> <li>• Ensure that all employees wear appropriate equipment, and implement PTTEPI's Personal Protective Equipment Standard.</li> <li>• Personnel will be provided with safety training to ensure that all workers practice under safety operation and regulation of work, as per PTTEPI's SSHE Training &amp; Competency Standard.</li> </ul>
		<ul style="list-style-type: none"> <li>• Cooperate with the nearest health center/hospital in order to immediately support response to emergency events, as per PTTEPI's MERP. Duty Manager and Emergency Management Team for Medevac response or Medical Referral in case of emergency events.</li> </ul>
	Injuries due to working in noisy areas.	<p>Implement following operational measures for prevention and control of accidents:</p> <ul style="list-style-type: none"> <li>• Safety Data Sheets must be provided with every chemical product for safety and the environment.</li> <li>• Adequate storage will be provided for each chemical in accordance with safety instruction (storage conditions, etc.).</li> <li>• Provide spill kits on-site.</li> <li>• Provide first aid kits and first aid rooms</li> <li>• Provide proper sanitary systems, including drinking water, potable water, toilet and waste management.</li> </ul>
6- Public health and Health service	Project activities could involve general public around shore bases that will be used for staff, materials and waste transportation.	<ul style="list-style-type: none"> <li>• Implement PTTEPI's Occupational Health Management Standard. (attached in <b>Error! Reference source not found.</b>)</li> </ul>
	In case of accident or illness during project activities, it may be required to use healthcare services around the shore bases.	<ul style="list-style-type: none"> <li>• Cooperate with the nearest health center/hospital in order to immediately support response to emergency events, as per PTTEPI's MERP. Duty Manager and Emergency Management Team for Medevac response or Medical Referral in case of emergency events.</li> </ul>



## **8.6. OVERALL BUDGET FOR IMPLEMENTATION OF THE EMP**

Since the costs for implementation of mitigation measures are therefore not possible to individually specify, PTTEPI has estimated amount of **over 1 million USD** per year for all mitigation measures and 1,050,000 USD for implementing of EMP in total.

The estimated costs for implementation of the monitoring program are **50,000 USD**.

## **8.7. ENVIRONMENTAL AND SOCIAL ORGANISATION OF THE PROJECT**

### **8.7.1. Roles and Responsibilities for the ESMP prior to Exploration Drilling Activities**

The roles and responsibilities of the staff regarding the implementation of ESMP specification and requirement are described in the following sections; they are responsible for both environmental and social aspects:

#### **8.7.1.1. DRILLING MANAGER**

It is the responsibility of the Project Manager, in line with his/her overall responsibility for HSE on the Project, to perform the following:

- Provide adequate resources for the management of environmental aspects as outlined in this document.
- Direct the development, maintenance and improvement opportunities of the overall Project environmental protection objectives.
- Ensure that contractors comply with the Company environmental protection standards at project sites;
- Have the responsibility for implementing the recommendations contained in the Environmental Impact Assessment, and ensure that the strategies will be designed to meet PTTEPI overall goal of environmental impacts management (i.e. to reduce so far as is reasonably practicable the potential hazards to personnel, the environment, assets and the business);
- Ensure the implementation of Contractors' protection management aspects incorporated in the HSE Plan for the respective work packages;
- In liaison with HSE Manager of the affiliate, perform environmental audits of Contractors' facilities towards establishing compliance with standard environmental management practices and especially with the Contractor's HSE MS, approved by the Project management

#### **8.7.1.2. AFFILIATE HES MANAGER**

It is the responsibility of the Project HSE Manager to:

- Ensure the implementation of the ESMP in accordance with PTTEPI's SSHE and ensure that it will be ready when the operation starts;
- Manage the development of the detailed procedures for each environmental and safety aspect covered in the EIA i.e. operational discharges, hazardous and non-hazardous waste, spills...;
- Organize audits on the implementation of the ESMP;
- Ensure that the project environmental goals are being achieved in compliance with the applicable legislation.
- Update the ESMP as and when necessary;

- Facilitate the implementation of the ESMP;
- Develop the detailed procedures for each aspect of the ESMP;
- Maintain records of the various management programmes;
- Participate in the HSE audits in line with the agreed Project Audit schedule.

### 8.7.1.3. CONTRACTORS

The drilling Contractors must be able to demonstrate at all times that mechanisms are implemented to comply with international laws, as well as with PTTEPI's SSHE requirements. The Contractors will need to develop procedures in accordance with the PTTEPI's ESMP. Audits will be performed to assess compliance with regulation of Myanmar and PTTEPI standards.

Each Contractor and sub-contractor employee is responsible for carrying out their work in a manner which will not put at risk their personal health and safety or that of others and will not harm the environment.

### 8.7.2. Roles and Responsibilities for the ESMP during Exploration Drilling Activities

For each phase of activity (i.e. drilling, etc.), responsibilities will be reallocated, based on the presence of an HSE organization on-board the drilling rig and under the RSES (person Responsible for Safety, health and Environment on Site). The RSES is in charge of managing the risks on-site as well as ensuring the good implementation of the environmental management plan during the operational activities of the drilling rig in close collaboration with drilling contractor offshore installation manager.

In general, the RSES has the responsibility to:

- Ensure the implementation of the ESMP requirements, PTTEPI's requirements and the needs specified in the EIA;
- Review the Environmental Protection systems in place and propose, if necessary, potential improvements and communicate the results;
- Contribute to the HSE reporting and analysis of anomalies and incidents;
- Know the OSCP and ensure its implementation.

Moreover, on site, the RSES should check if the following requirements are respected:

- Take into account the toxicological data when choosing chemical products;
- Ensure a monitoring of discharges and control them;
- Take into account environmental risks: interventions, etc.;
- Ensure that the Contractors comply with the Company environmental protection standards at project sites

## 8.8. PURPOSE OF EMP

Environmental Management Plan (EMP) presents for the whole project duration the procedures, resources, roles and responsibilities with regards to:

- The implementation of mitigation measures to prevent and/or minimize potential environmental impacts regarding project activities,
- The monitoring of any environmental impacts related to the Project.

The list below is presenting PTTEPI’s safety, security, health and environmental (SSHE) procedures/plans, which covered all operational activities for Myanmar Asset.

**Tabl. 59 - PTTEPI SSHE Management System Standards**

Item	Document	Document Number
1	Myanmar Asset SSHE Management System	11027-PDR-SSHE-000-001-R01
2	SSHE Training and Competency Procedure	11027-PDR-SSHE-340-003-R01
3	SSHE Compliance Obligation Procedure	11027-PDR-SSHE-306/01-R03
4	SSHE Requirement for Contractor	Myanmar-SSHE-11027-PDR-305
5	PTTEPI Myanmar Asset Loss of Primary Containment (LOPC) Reduction Plan	Myanmar- 13253-PLN-010
6	Working in Adverse Weather Procedure (Offshore)	11027-PDR-SSHE-401-R02
7	Myanmar Asset Crisis Management Plan	11027-PDR-SSHE-501-005-R00
8	Myanmar Asset Emergency Management Plan	11027-PDR-SSHE-006-R01
9	PTTEPI Crisis Communication Plan	Myanmar-0550-PDR-008
10	Blowout Contingency Plan	Myanmar-055-MNL-004
11	Myanmar Asset Waste Management Procedure	11027-PDR-SSHE-503/01-R02
12	Offshore Medical Emergency Response Plan (MERP)	Myanmar-SSHE-11027-PDR-506
13	Fitness to Work Procedure	Myanmar-SSHE-11027-PDR-508
14	Myanmar Asset Spill Contingency Plan	11027-PDR-SSHE-501/03-R02
15	Chemical Management Standard	11003-STD-590-005-R02
16	Grievance Handling Guideline	12140-GDL-009-R00

EMP may need further adequate briefings, trainings and incorporated working documents, such as Standard Operating Procedures, Work Procedures, which are developed by PTTEPI and its selected contractors.

The following table present the recommendaed management plans for the project:

**Tabl. 60 - Management Sub-Plans include in the report**

Management Sub-Plans	Remark
Chemical Management Plan	The outlines of Chemical Management Plan is described in this document. However, the detail procedures shall be developed by the contractor and approved and supervised by PTTEPI representatives on Site and SSHE department.
Waste Management Plan	The overview of PTTEP Waste Management Proecedre is described in this document to support for Waste Management. However, the detail procedures shall be developed by the contractor on operation basis.
Blowout Contingency Plan	The outlines of Blowout Contingency Plan is described in this document. However, the contractor shall develop detail procedures with the supervision of PTTEPI representatives on site.
Spill Contingency Plan	The Spill Contingency Plan is described in this document in general. However, the contractor shall develop detail procedures with the supervision of PTTEPI representatives on site.
Emergency and Crisis Management Plan	Emergency and Crisis Management Plan is described in this document. However, the contractor shall develop detail procedures with the supervision of PTTEPI representatives on site.
Grievance Mechanism (for handling of complaints by project stakeholders and third parties)	The general context of Grievance Mechanism is presented in this document and PTTEPI will practice according to Grievance Handling Guidelines.
Training and Awareness Programme	This programme is generally described in present document. Nevertheless, practicing of training and exercises for employees and contractors will be developed for the project.
Environmental Audit Programme	The outlines of Environmental Audit Programme is described in this document. And the responsible party or appointed team leader will conduct the audit on given time schedule.
Occupational and Community Health Management Plan	The outlines of the plan is general description of health management to be practised by PTTEPI and embedded PTTEPI's Occupational Health Management Standard as an appendix for proper guidance..
Monitoring Plan (through which the efficacy of management and mitigation measures can be verified).	The monitoring programs are described in each sub-plans at the present document.

These plans and procedures will mostly be developed by the Contractor and approved and supervised by PTTEPI representatives on Site and SSHE department

## **8.9. MANAGEMENT AND MONITORING PLANS OF THE PROJECT**

The actions, detailed in the ESMP, will require that a number of procedures and plans are developed to cover the implementation of specific mitigation measures or to implement best environmental practices.

These specific plans and procedures are listed below:

- Chemical Management Plan
- Waste Management Plan
- Ballast Water Management Plan
- Blowout Contingency Plan
- Spill Contingency Plan
- Emergency & Crisis Management Plan
- Grievance Mechanism
- Training and Awareness Programme
- Environmental Audit Program

These plans and procedures will mostly be developed by the Contractor and approved & supervised by PTTEPI representatives on Site and SSHE department. The sub-monitoring plans are provided under each management plans.

### **8.9.1. Chemical Management Plan**

#### **8.9.1.1. OBJECTIVE**

A Chemical Management Plan will be prepared for the Project and will present the methodology adopted by the Company and how they will implement best practices.

#### **8.9.1.2. LEGAL REQUIREMENTS**

The applicable national legislations for chemical management are as follows:

- Environmental Impact Assessment Procedure (2015)
- Environmental Conservation Rules (2014)
- Prevention from Danger of Hazardous Chemicals and Related Substances Law (2013)
- Environmental Conservation Law (2012)

The applicable national and international guidelines are as follow;

- National Environmental Quality (Emission) Guidelines (2015)
- IFC Environmental Health and Safety Guidelines – Offshore Oil and Gas Developments (2015)
- IFC General Environmental Health and Safety Guidelines (2007)

The summarized description of above the laws and guidelines are presented in Chapter -**Error! Reference source not found.**

### **8.9.1.3. OVERVIEW MAPS AND SITE LAYOUT**

Although there are no applicable overview maps, satellite images or site layout concerning this Chemical Management Plan, the overview map of proposed drilling campaign is presented in figure 42

### **8.9.1.4. IMPLEMENTATION SCHEDULE**

Chemical Management Plan will be developed by the contractor before starting drilling operation and it will be conducted during the operation. The contractors and concerned person must also comply and practice the guidelines, standards and procedures of PTTEPI.

### **8.9.1.5. MANAGEMENT ACTIONS**

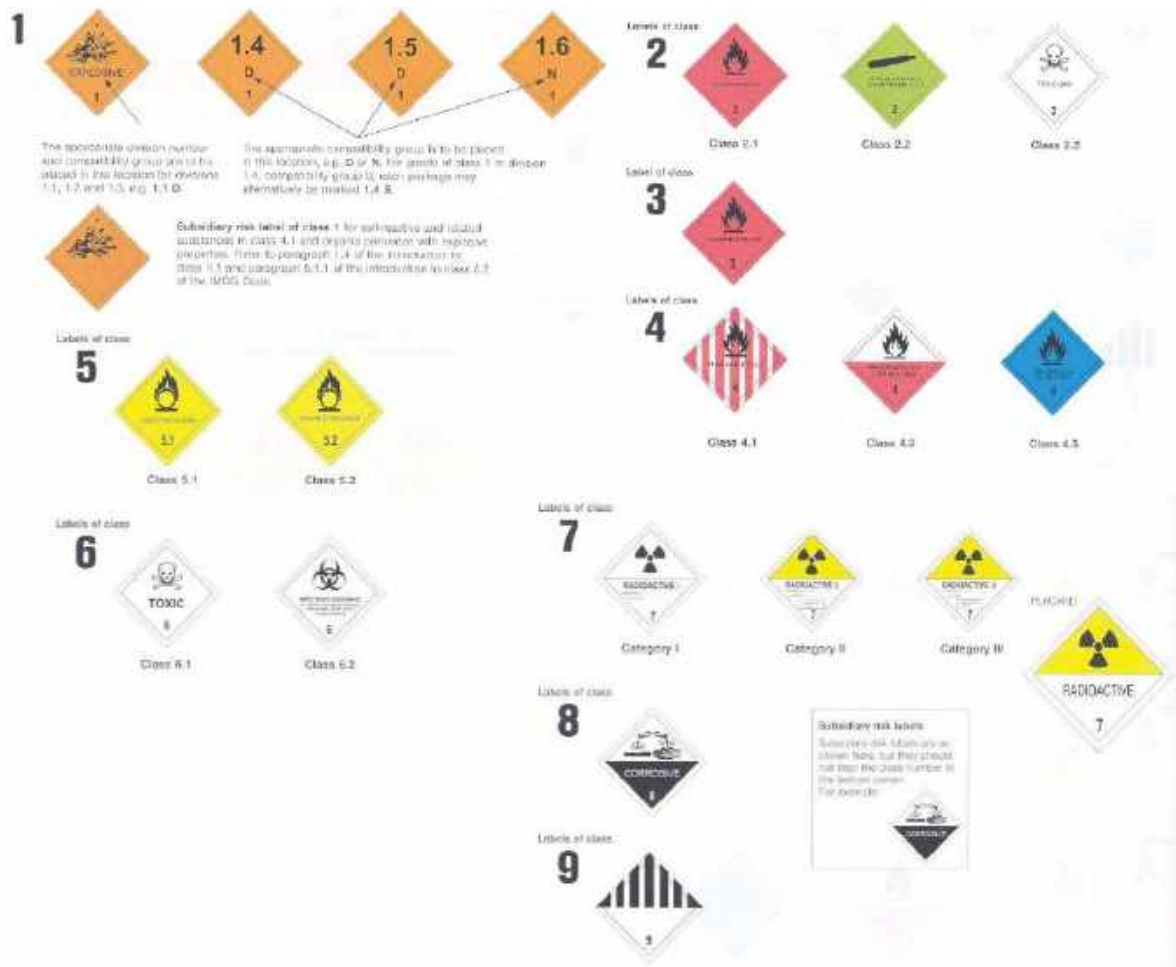
#### **8.9.1.5.1. Classification of chemicals**

The classification and labelling of chemicals is commonly accepted at international level under a system, which is called "Globally Harmonized System of Classification and Labelling of Chemicals (GHS)". This system addresses classification of chemicals by types of hazard and proposes harmonized hazard communication elements, including labels and safety data sheets. It aims at ensuring that information on physical hazards and toxicity from chemicals are available in order to enhance the protection of human health and the environment during the handling, transport and use of these chemicals. The GHS also provides a basis for harmonization of rules and regulations on chemicals at national, regional and worldwide level.

Myanmar is currently preparing to revise existing legislation and administrative procedures to implement the GHS.

GHS comes with its own library of pictograms for labelling hazardous chemicals. Two types of labels are defined: labels to be put on hazardous products and labels for transportation. Each pictogram describes a specific hazard characteristic and up to four standard GHS pictograms may appear on the label of a single product.

Transportation GHS pictograms vary in colour and alert workers of chemical hazards during transportation. Some of these pictograms provide carriers with greater chemical detail and bright colours improve legibility at a distance. GHS labels are presented below.



**Fig. 45. Chemical classes and colour symbols**

8.9.1.5.2. Basic regarding the storage of chemicals

During drilling, the mud and cementing chemicals are stored in a dedicated area. The following criteria will be considered for storage of chemical products:

- Proximity to equipment and facilities (e.g. fire water, appropriate drainage systems);
- Separate storage areas for incompatible products;
- Drainage systems for hazardous chemicals;
- Secured access, limited to authorized and appropriately trained personnel.

Within the storage areas, chemicals will be stored as follows:

- Drums will be preferentially stored vertically. Horizontal drums will be appropriately wedged;
- Storage racks with integral secondary containment or connection to the slop tank via open drain are recommended; and
- Stacking heights will be limited (3 drum layers maximum)
- Availability of fire protection equipment and system in storage area

The locations of emergency equipment will be indicated in storage areas and an inventory of chemicals will be kept. Material Safety Data Sheets (MSDS) and eco-toxicity data sheets will be available for each

chemical. Chemical containers will be inspected regularly for leaks, dents, bulging, corrosion or other mechanical deterioration and prompt corrective actions will be taken to mitigate the potential for a chemical spill or release.

#### 8.9.1.5.3. Transport/ Transfer of chemicals

Loading and unloading of chemicals should be done on a bonded area (i.e. a secondary containment). A specific procedure must be established in every area where chemicals are handled on a regular basis. The procedure will present the correct operation mode with visual information (e.g. picture and location of a safety valves) and will present the safety procedure to be adapted by the personnel in case of accident (spill, fire...).

The containment for transfer shall be in good condition. The integrity of any receptacle deemed compromised through rust, dents or as a result of leaking shall not be transported. The contents of the container shall be transferred to another one. Incompatible substances shall not be transported with each other unless appropriate precautions/measures are ensured (e.g. different compartments).

Ensuring of chemical transfer checklist and ensuring everyone involved in the job understands that they can halt the work at any point if something is found as incorrect. To comply with local international regulations for air transport, marine transport and inland transport, the respective work instructions, roles and responsibilities developed by PTTEPI and the contractors.

#### 8.9.1.5.4. Basis regarding the elimination of chemicals

The elimination of chemicals must be done in compliance with the provision of PTTEPI's Waste Management Plan. Wastes chemicals are considered hazardous wastes and will follow the hazardous wastes disposal guidance outlined in such procedure.

#### 8.9.1.5.5. Inspections and audits

Regular inspection shall be carried out by the Environmental Manager focusing on chemical handling, use, transportation and storage, availability of PPE and clean drums for emergency storage etc.

#### 8.9.1.5.6. Staff training

The personnel and subcontractors must follow training on operational risk on-site. The training programme will include at minimum:

- Dangerous chemicals identification methods;
- Good practices of transport, loading/unloading products, handling and procedures;
- Health and Environmental risk associated with chemicals used on-site;
- The place and format where the MSDS are made available;
- The PPE (Personal Protective Equipment) including instruction on storage, availability, maintenance, etc.;
- Emergency procedures and anti-pollution plan ;
- Fire prevention means, their location and anti-spill kit (absorbent, stopping, obturator...);
- Operating instructions of the incident reports.

In addition, information will be made available to the personnel and the subcontractors in order to explain the procedures regarding vehicles refueling and maintenance.



**8.9.1.6. MONITORING PLANS AND PERFORMANCE CRITERIA**

To keep good tracking of any spilled goods (in the warehouse, on deck etc.) with good records on the type of packaging etc. to ensure this does not occur again.

**8.9.1.7. PROJECTED BUDGETS AND RESPONSIBILITIES**

The budget for implementation of chemical management plan is included in overall budget of environmental management plan which is 1,050,000 USD in total.

**8.9.2. Waste Management Plan****8.9.2.1. OBJECTIVE**

A Waste Management Procedure will be prepared for the Project, to present the aim, methodologies and best practices adopted by PTTEPI to fulfil its obligations regarding specifications mentioned in the present EIA. This document will then be integrated into the Contractors' waste management plan as soon as possible, prior the beginning of exploration drilling activities.

Each Contractor at each stage of the project shall develop a waste management procedure to be approved by PTTEPI's SSHE department.

The WMP provides rules to collect, to sort, to classify according to the different categories of wastes produced, to store and to transport waste to a suitable disposal. The main objectives are to:

- Minimize the generation of waste material by judicious use of raw materials and reuse or recycling of materials, when feasible;
- Treat or dispose waste with a minimum impact on the surrounding environment, and
- Enhance awareness of the staff on-site about proper waste management procedures.

The WMP shall include the following, as a minimum:

- Waste sources (activity or place where the waste is generated),
- Classification: hazardous (specify if toxic / flammable / reactive / corrosive / radioactive / bio-hazardous) or non-hazardous.
- Waste handling and storage procedure at locations (description and layout of temporary storage, segregation and treatment facilities),
- Waste transportation procedure

Final disposal procedure and register (when outside locations, provide specifications on treatment and final disposal).

All contractors involved in the project, as well as PTTEPI will be responsible for implementing the WMP.

**8.9.2.2. LEGAL REQUIREMENTS**

The applicable national legislations for waste management are as follows:

- Environmental Impact Assessment Procedure (2015)
- Environmental Conservation Rules (2014)
- Environmental Conservation Law (2012)
- Myanmar Investment Law, 2016

- The Petroleum and Petroleum Products Law, 2017
- The Prevention of Danger of Hazardous Chemical and Related Substance Law, 2013

The applicable national and international guidelines are as follow;

- National Environmental Quality (Emission) Guidelines (2015)
- IFC Environmental Health and Safety Guidelines – Offshore Oil and Gas Developments (2015)
- IFC General Environmental Health and Safety Guidelines (2012)
  - MARPOL Annex V

The summarized description of above the laws and guidelines are presented in Chapter -3

### **8.9.2.3. OVERVIEW MAPS AND SITE LAYOUT**

Although there are no applicable overview maps, satellite images or site layout concerning this Waste Management Plan, the overview map of proposed drilling campaign is presented in figure 42.

### **8.9.2.4. IMPLEMENTATION SCHEDULE**

Waste Management Plan will likely be developed by the contractor before starting the drilling operation and it will be conducted during the operation. The contractors and concerned person must also comply and practice the guidelines, standards and procedures of PTTEPI.

### **8.9.2.5. MANAGEMENT ACTIONS**

#### **8.9.2.5.1. Waste identification**

Waste materials arise from a number of “activity and process” sources including exploration, project planning and implementation, domestic, catering, office, storage, maintenance, medical, etc. 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.

#### **A. Non-hazardous waste**

Non-Hazardous waste is the waste which, although not harmless, present a lower level of risk to human health and the environment. There are 2 types of non-hazardous waste as follows:

- General non-hazardous wastes from office, catering services, laundry, household, etc. from industrial activities, e.g.
  - General waste (e.g. scrap metal, non-biodegradable waste);
  - Recyclable or reusable waste (e.g. paper, wood, drinking plastic bottle, glass); and
  - Biodegradable waste (e.g. food waste, sewage).
- Waste containing or contaminated with hazardous substances in concentrations that, before or after treatment, are considered low enough to meet the specified national, international or regulatory discharge criteria which do not exceed the standard limit of the country, e.g. drilled cuttings.

#### **B. Hazardous waste**

Hazardous waste is defined as any waste which causes or is likely to cause danger to health or the environment by reason of their chemical activity or toxic, flammable, explosive, corrosive, or other

characteristics, whether alone or when coming into contact with other wastes. Forms of hazardous waste include solids, sludge, liquid and containerized gas and hydrocarbon waste.

Hazardous waste shall be categorized into 2 main types as follows:

- Wastes creating nuisance due to flammability, reactivity, corrosiveness, radioactive, infection, toxicity for humans & the environment or, e.g.
  - General hazardous wastes (e.g. chemical waste and residue, paint, spent and used oil, contaminated packing material, special maintenance waste, contaminated sludge, combustion residue, photocopy machine, PC printers polluting cartridge, medical waste, filter, fluorescent, bulb);
  - Heavy metal wastes (e.g. mercury, arsenic, cadmium); and
  - Batteries.

It is noted that, if there will be a presence of incoming heavy metals from reservoir, the incurred wastes in contact with the incoming gas or fluid shall be considered as being contaminated with the heavy metal (e.g. mercury, arsenic, cadmium), and therefore is classified as hazardous waste which will require specific additional handling and management procedures.

- Waste containing or contaminated with hazardous substances in concentrations which exceed the standard limit of country regulation or international hazardous waste standard, for example oil concentration or waste containing heavy metal.

#### 8.9.2.5.2. Waste storage and collection

The waste collection includes household-waste sorting in order to allow each waste to follow its specific field elimination.

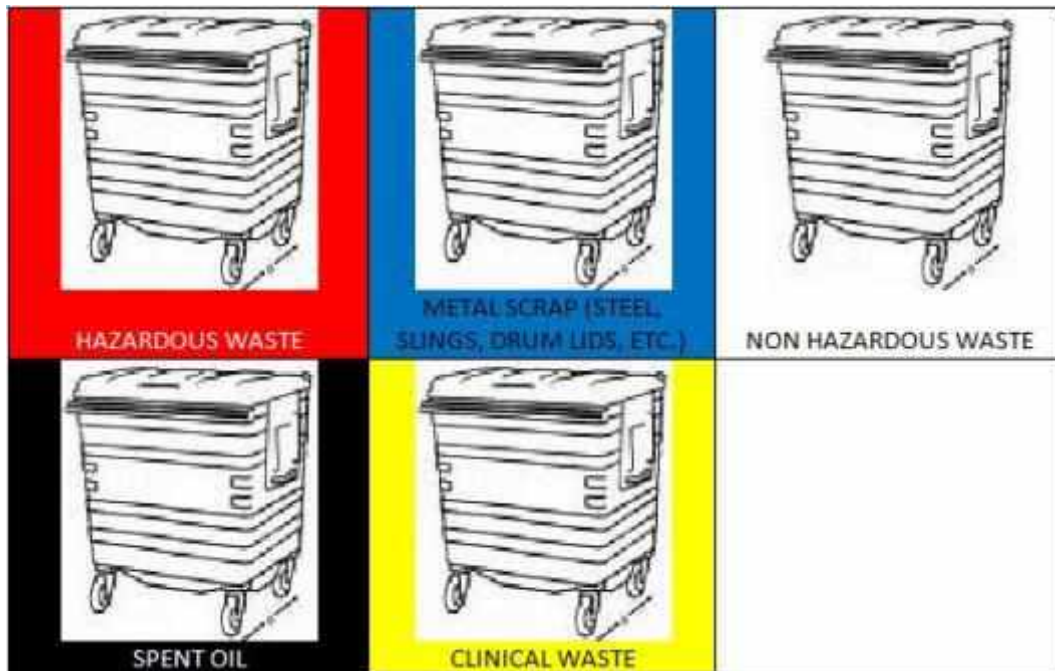
Regarding the project, waste will be sorted prior to collection. All waste will be separated according to different categories in order to ensure a suitable waste storage. It is recommended to have on site not only buckets of large capacity, but also smaller dustbins identified in several strategic points according to the activities. Organic waste and waste mainly resulting from the restoration will be stored in close bins within a netted surface in order to limit the access of wild fauna. Sealed containers on secondary containment and protected from rain waters are necessary for the storage of liquid waste.

The type of waste corresponding to each container will have to be labelled with coded representation colours, pictograms and text in the languages used on the project site (Burmese, Chinese, and English).

An inventory of waste generated shall be maintained. Weighing scales or measuring devices shall be provided to measure quantities of waste generated/discharged. Records of waste generated, treated and sent for disposal shall be maintained on site.

All wastes must be collected and disposed of in appropriate bins / skips / containers. The waste collection principles include:

- Incompatible / inter-reacting products should not be mixed (e.g. spent oil and waste paints) under any circumstances.
- Quantities of waste must be estimated.
- Personnel will be trained in waste sorting and collection (adapted to position and to wastes generated).



**Fig. 46.** Waste segregation colour code example

The waste collection recipients must have the following characteristics:

- Be leak-proof, and made from materials which have a low flammability,
- Prevent loose equipment dropping handling operations,
- Avoid flying particles or spillage of materials.
- Stand stable on the ground, easy to handle, without danger for users,
- Certain Hazardous wastes (liquids, medical waste, etc.) must be packaged in sealed containers adapted to their specific characteristics.

Wastes will be sorted then stored in areas arranged specifically before being sent to an accredited waste management company. The time of waste storage on site should normally extend from 2 to 3 days for organic waste and several weeks for inert waste. This time depends on the storage capacity arranged on the site and on the routing possibilities towards the treatment centre.

Waste will be stored in a secured area, away from any activities. Hazardous wastes such as empty drums of chemicals will be locked in a secured area.

#### 8.9.2.5.3. Waste disposal and treatment methods

Waste will be managed following the current waste management strategy described below (priority order):

- Reduce
- Reuse
- Recycle
- Recover

The ways to dispose of waste are multiple during the operations. The choice is given according to legislation, available local facilities and PTTEPI's requirements. The methods having less impact on population and the environment are to be privileged. It is prohibited to give up or put waste outside dedicated areas. In particular, burning of wastes is prohibited.

The training of the staff for waste sorting will be essential to manage the waste management. The methods are presented below:

- The oily remains, including the greasy rags and materials for example, will be put into containers to be treated in an approved subsidiary company (for e.g. incineration, authorized landfill...);
- The chemicals and painting residues will be stored in cans or drums in zones equipped with secondary containment before being evacuated by a specific waste handling company;
- Possible generated medical waste will be stored in suitable containers (for example, specific kits to recover the needles) and will be eliminated in an approved waste handling industry;
- The used metal containers can represent a danger to the environment according to their residual chemical contents. They will be eliminated out of the site by an approved waste handling industry. When that is possible, the drums will be returned to the suppliers. If a re-use is considered, a detailed attention will have to be paid to the drum residual contents compatibility with the new filling liquid in order to avoid any violent chemical reaction or explosion ;
- Scrap will be sorted. A storage area will be defined. It will be only for clean metals. Any unclean metal produced will be washed prior storage or eliminated as an hazardous material;
- The domestic waste and collective restoration waste will be collected and stored separately. The food waste management is a source of infection during the organic material degradation. Moreover, food waste, if they are not duly eliminated, can attract animals and insects. The catering services will thus have to be equipped with closed containers intended for the food waste collection.

The final disposal sites initially identified for non-hazardous wastes are;

- Yangon City Development Committee (YCDC) disposal yard
- DOWA waste management facility

#### 8.9.2.5.4. Waste transport

The means of transport must be adapted to the type of waste transported. All the transfers of dangerous waste and other waste must respect the national regulation and international best practices.

To ensure a traceability of the dangerous waste, a follow-up register will be set up by the PTTEPI describing waste nature, quantities, storage facilities and elimination process used for each type of waste. Waste manifest will be used for all typed of waste in order to install a waste tracking system.

The waste transport towards their elimination site can be ensured by the owner, a local operator or a specialized company. The person in charge of the waste management (i.e. SSHE responsible) will check the service quality and reliability for example references etc. If necessary, an audit on service providers could be carried out if there is any doubt on the quality of waste treatment.

It is strongly recommended that:

- The staff in charge of transport is conscious of the nature of waste and the dangers they can represent;
- Waste inventories forms and waste manifest are filled out;
- A sheet describing the waste indicating nature, dangerous characteristics of the waste and the provisions to be taken in the event of accident is provided to the driver in charge of transport ;
- The company specialized in the treatment or the waste disposal will have to provide an elimination certificate.

A report including the information mentioned above must be prepared by the SSHE department according to the frequency required (ex: quarterly) and presented to the general management. It contains the types of waste and the produced quantities, the treatment used by type of waste, the costs generated by the waste management.

#### 8.9.2.5.5. Staff training

The personnel and subcontractors must follow training on operational risk on-site. The training programme will include at minimum:

- Dangerous chemicals identification methods;
- Good practices of transport, loading/unloading products, handling and procedures;
- Health and Environmental risk associated with chemicals used on-site;
- The place and format where the MSDS are made available;
- The PPE (Personal Protective Equipment) including instruction on storage, availability, maintenance, etc.;
- Emergency procedures and anti-pollution plan ;
- Fire prevention means, their location and anti-spill kit (absorbent, stopping, obturator...);
- Operating instructions of the incident reports.

In addition, information will be made available to the personnel and the subcontractors in order to explain the procedures regarding vehicles refueling and maintenance.

#### 8.9.2.6. MONITORING PLANS AND PERFORMANCE CRITERIA

The following documentation and records will be kept:

- List of agreements with all waste contractors and short reports (with photographs) on their premises
- Waste traceability:
  - Raw records for each movement of waste, specifying quantity for each type-;
  - Weekly and whole project consolidation statistics;
  - Final disposal record

**Tabl. 61 - Monitoring program (source: PTTEPI, 2018)**

Discharge	Monitoring requirement			
	Parameter / effluent characteristics	Monitoring frequency	Location	Responsibility
Mud and cuttings (SBM)	Parameters required by NEQG to be analysed: - OOC % - Total Mercury (Total Hg) dry weight in stock barite. - Cadmium (Cd) dry weight in stock barite.	Once during drilling at each well	At each proposed well location	PTTEPI
Mud and cuttings (WBM)	Parameters required by NEQG to be analysed: - Total Mercury (Total Hg) dry weight in stock barite. - Cadmium (Cd) dry weight in stock barite. - Chloride (Cl)			
Sewage	Parameters required by NEQG to be analysed (as per MARPOL 73/78): - Thermotolerant Coliforms - Biochemical Oxygen Demand (BOD) - Chemical Oxygen Demand (COD) - pH	Once every 6 months and/ or at each well operation		

**8.9.2.7. PROJECTED BUDGETS AND RESPONSIBILITIES**

The budget for implementation of waste management plan is included in overall budget of environmental management plan which is 1,050,000 USD in total.

**8.9.3. Ballast Water Management Plan**

**8.9.3.1. OBJECTIVE**

Ballast water management plan aims to reduce the harmful effects on marine environment from ballasting operations of the ships.

**8.9.3.2. LEGAL REQUIREMENTS**

The applicable national laws related to water resources are as follow;

- Freshwater Fisheries Law (1991)
- Conservation of Water Resources and Rivers Law (2006)
- Law Amending the Port Act (2008)
- Conservation of Water Resources and Rivers Rules (2012)

- Environmental Conservation Law (2012)
- Environmental Conservation Rules (2014)
- Environmental Impact Assessment Procedure (2015)

The applicable national and international guidelines are as follow;

- National Environmental Quality (Emission) Guidelines (2015)
- IFC General Environmental Health and Safety Guidelines (2007) and
- IFC Environmental Health and Safety Guidelines – Onshore Oil and Gas Developments (2007)
- International Convention for the Control and Management of Ships’ Ballast Water and Sediment (IMO,2004)

The summary description of above the laws and guidelines are presented in Chapter **-Error! Reference source not found.**

#### **8.9.3.3. OVERVIEW MAPS AND SITE LAYOUT**

Although there are no applicable overview maps, satellite images or site layout concerning this Ballast Water Management Plan, the overview map of proposed drilling campaign is presented in figure 42.

#### **8.9.3.4. IMPLEMENTATION SCHEDULE**

Ballast Water Management Plan will be developed by the contractor before starting the drilling operation and it will be conducted during the operation. The contractors and concerned person must also comply and practice the guidelines, standards and procedures of PTTEPI.

#### **8.9.3.5. MANAGEMENT ACTIONS**

The purpose of managing ballast water is to prevent the introductions of nonindigenous species from water collecting point. The species carried along with ballast water may be invasive or destructive to the marine biodiversity environment. Thus, in order to prevent unintentional introduction nonindigenous aquatic organisms through the ballast operation, the following recommendations are outlined;

- Include of specially designed ballast tank in drilling unit.
- Actions and procedures to implement the Ballast Water Management.
- Safety procedures for the crews and all vessels with respect to the Ballast Water Management.
- Designation of the Officer to coordinate the shipboard Ballast Water Management.
- Provision of ballast water record book and reporting.
- Availability of Ballast Water treatment equipment all associated control equipment, monitoring equipment and sampling facilities.
- Practice the methods which have been evaluated and accepted by IMO for ballast water discharges
  - Sequential: A process by which a ballast tank intended for the carriage of ballast water is first emptied and then refilled with replacement ballast water to achieve at least a 95 per cent volumetric exchange.



- Flow-through: A process by which the replacement ballast water is pumped into a ballast tank intended for the carriage of ballast water, allowing water to flow through overflow or other arrangements.
- Dilution: A process by which replacement ballast water is filled through the top of the ballast tank intended for the carriage of ballast water with simultaneous discharge from the bottom at the same flow rate and maintaining a constant level in the tank throughout the ballast exchange system

The dedicate treatment techniques that aim for the project are: ultraviolet light (physical disinfection) or electrolytic chlorination (chemical treatment).

Ultraviolet light: the environmental friendly process where the UV radiation attack and breakdown the cell membranes and kill the organism. The effectiveness rely on the UV transmission through the water and some disadvantages such as operational cost and maintenance are needed to be taking account.

Electrolytic chlorination: the process which setting up the free chlorine sodium hypochlorite and hydroxyl radicals, to cause electrochemical oxidation through the creation of ozone and hydrogen peroxide. The considerable factors for this process are the storage of chemical (see Chemical management Plan) and neutralization of chemical before discharge.

Furthermore, the provisions for the vessels include that; all vessels must have approved ballast water management plan, ballast water register and international ballast water certificate. The contractors' vessels must comply with IMO Ballast Water requirements.

Although it is expected for no discharge of ballast water during the project operation, however, if there is any discharge of ballast water without treatment will not be allowed and the treated water must be in compliance with MARPOL 73/78 and also with the national guideline such as NEQG. Ballast Water Management will be monitored accordingly and included in the Monitoring Report which will be disclosed and submitted to the Ministry according to the EIA procedure.

#### **8.9.3.6. PROJECTED BUDGETS AND RESPONSIBILITIES**

The budget for implementation of ballast water management plan is included in overall budget of environmental management plan which is 1,050,000 USD in total.

#### **8.9.4. Blowout Contingency Plan**

##### **8.9.4.1. OBJECTIVE**

Blowout Contingency Plan is to be able to swift and effective mobilization of PTTEPI Operational and external resources to combat and minimize the effects of a blowout.

##### **8.9.4.2. LEGAL REQUIREMENTS**

The applicable national legislation are as follows:

- Environmental Impact Assessment Procedure (2015)
- National Environmental Quality (Emission) Guidelines (2015)
- Environmental Conservation Rules (2014)
- Environmental Conservation Law (2012)

The applicable national and international guidelines are as follow;

- IFC Environmental Health and Safety Guidelines – Offshore Oil and Gas Developments (2015)
- IFC General Environmental Health and Safety Guidelines (2012)

The summarized description of above the laws and guidelines are presented in Chapter -**Error! Reference source not found.**

#### 8.9.4.3. OVERVIEW MAP AND SITE LAYOUT

Although there are no applicable overview maps, satellite images or site layout concerning this Blowout Contingency Plan, the overview map of proposed drilling campaign is presented in figure 42.

#### 8.9.4.4. IMPLEMENTATION SCHEDULE

This programme will be developed by the PTTEPI before starting drilling operation in order to act quickly in the initial stage of the event.

#### 8.9.4.5. MANAGEMENT ACTIONS

This plan covers drilling and well intervention activity for PTTEPI Offshore Myanmar (Bay of Bengal, Gulf of Martaban). The plan addresses the requirements of an operational scheme with the evaluation of the situation and a mobilization scheme. PTTEPI's Blowout Contingency Plan, which defines all scope and processes of the plan in detail.

##### 8.9.4.5.1. Control of a drilling emergency

Blowout is mostly occurred during operations, which result in having difficulties to control the well. The following figure presents the level of blowout incident classification.



**Fig. 47.** Levels of Incident during blowout

##### 8.9.4.5.2. Multiple emergency potential

The emergency require the deployment of large numbers of personnel in various teams to deal with specific aspects of the situation. IMA Emergency and Crisis Management Organisation will have to deal with the protection of Personnel, Environment and Company Asset and Reputation.

##### 8.9.4.5.3. Coordination of Efforts

During an event of blowout, the coordination and cooperation must be established between drilling contractors and the company's drilling department to avoid redundancy of efforts and to optimize mutual assistance.

##### 8.9.4.5.4. Notification

Senior Drilling Supervisor (SDSV) will likely be the first responder on scene on board the rig. After doing investigation, SDSV will notify the drilling superintendent, IMA duty manager and the drilling manager

about the incident. After the level of incident is identified, the drilling superintendent will provide technical advice to SDSV in order to respond accordingly to the well control situation.

8.9.4.5.5. Tiered Response Principle

PTTEPI Emergency & Crisis Management framework consists of three levels of response designed to handle the planning and response to all emergency and crisis management situations including well control and blowout incidents specific to PTTEPI. These are the Emergency Response Team (ERT), the Emergency Management Team (EMT) and the Crisis Management Team (CMT).



**Fig. 48.** Tiered Response Framework

**8.9.4.6. PERFORMANCE CRITERIA**

Conduct seafloor surveys to identify seabed features that could impact on or be impacted by rig installation and find a suitable location for drilling in order to prevent blowout.

Install blowout preventer and shear ram appropriately to prevent hydrocarbons to environment.

Training of personnel and contractors for monitoring and prevention of any risk from blowouts, and training for using of oil field cleaning equipment.

Regular monitoring of well pressure, mud-circulating system and operation the project with skilled and experienced contractors with higher standards of safety and good practices.

Additionally, in compliance with the provision of PTTEPI’s Emergency and Crisis Management Plan.

**8.9.4.7. PROJECTED BUDGETS AND RESPONSIBILITIES**

The budget for this programme is included in the overall budget which is 1,050,000 USD in total for implementation of the EMP.

### **8.9.5. Spill Contingency Plan**

#### **8.9.5.1. OBJECTIVE**

Spill Contingency Plan is developed to provide detailed actions to be implemented in case of spill to minimize the impact on personnel and environment and mitigating its effect and coordinating with third party if necessary.

#### **8.9.5.2. LEGAL REQUIREMENTS**

The applicable national legislation are as follows:

- Environmental Impact Assessment Procedure (2015)
- National Environmental Quality (Emission) Guidelines (2015)
- Environmental Conservation Rules (2014)
- Environmental Conservation Law (2012)
- Conservation of Water Resources and Rivers Rules (2012)
- Conservation of Water Resources and Rivers Law (2006)
- Union of Myanmar Marine Fisheries Law (1993)

The applicable national and international guidelines are as follow;

- IFC Environmental Health and Safety Guidelines – Offshore Oil and Gas Developments (2015)
- IFC General Environmental Health and Safety Guidelines (2012)
- IPIECA: The Oil and Gas Industry: Operating In Sensitive Environments (2003)
- OGP: Environmental Management in Oil and Gas Exploration and Production (1997)
- UNEP: Guidelines on Environmental Management for Oil and Gas Exploration and Production (1997)
- MARPOL (Annex IV and V)

The summarized description of above the laws and guidelines are presented in Chapter -**Error! Reference source not found.**

#### **8.9.5.3. OVERVIEW MAP AND SITE LAYOUT**

Although there are no applicable overview maps, satellite images or site layout concerning this Spill Contingency Plan, the overview map of proposed drilling campaign is presented in figure 42.

#### **8.9.5.4. IMPLEMENTATION SCHEDULE**

This programme will be developed by the PTTEPI before starting drilling operation in order to prevent and/or minimize any accidental discharge and spillage of oil and to mitigate negative effects.

### 8.9.5.5. MANAGEMENT ACTIONS

The action plan is a reference for actions and alert procedures for an efficient and effective response. It addresses oil spills, response procedures, organization and roles and responsibilities related to the current activities of PTTEPI. The following action plans are addressed for spill emergency responses.

- Spill Assessment
- Alert Procedure and Actions
- Responses Options
- Spill Response Organization and Training
- Action Checklists

#### 8.9.5.5.1. Spill Assessment

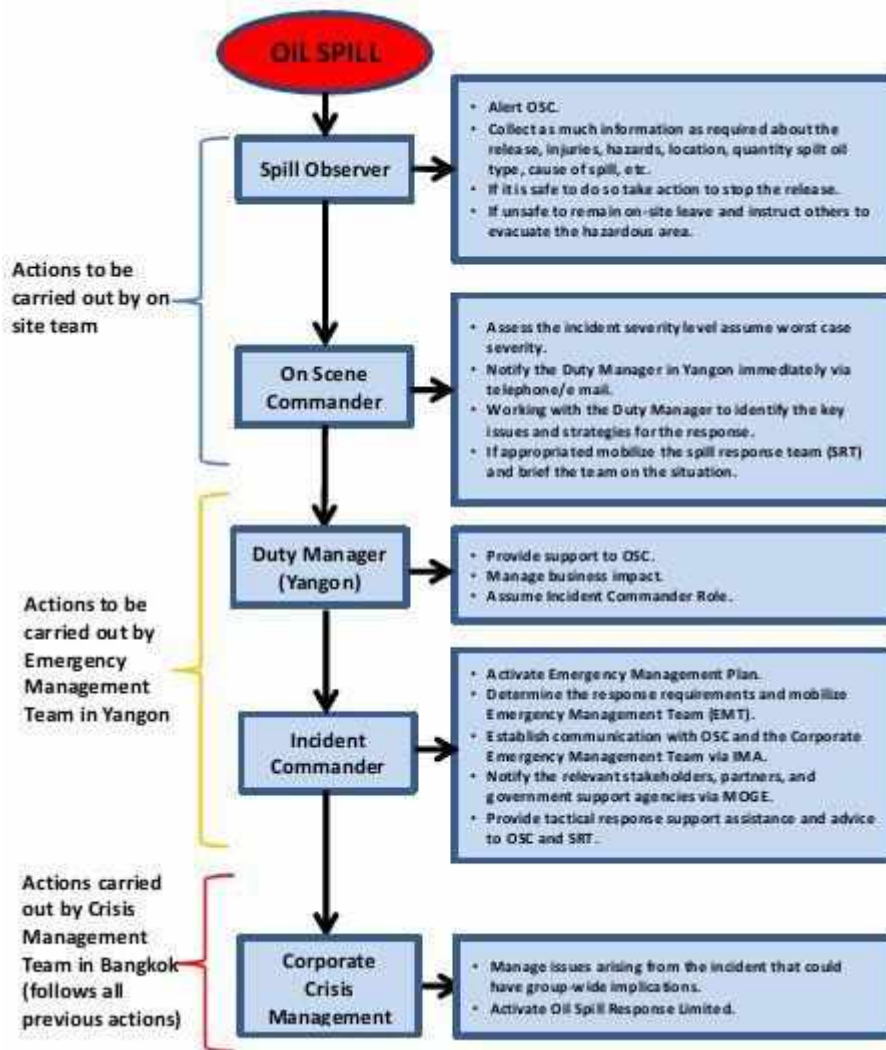
It is used to establish the tier level shown in below figure and then select an appropriate response strategy response based on the type spilled, location and the resource available.



**Fig. 49.** Tier Level of the Oil Spill

8.9.5.5.2. Alert Procedure and Actions

The following flowchart describes the alert procedure and actions for the members of the PTTEPI Emergency and Crisis Management Team.



**Fig. 50.** Spill Incident Alert Procedures Flow Chart

8.9.5.5.3. Response Options

When a spill incident is occurred, the response teams are informed and mobilized for the implementation of the response options which are given below after allocating appropriate Tier level for the spill incident. The details of the response options are described in PTTEPI's Spill Contingency Plan.

Response options are classified below;

- Onshore Response Option
- Offshore Response Option
- Coastal Response Option
- Port Responses Option

#### 8.9.5.5.4. Spill Response Organization and training

Two levels of emergency organizations are managed in PTTEPI

- The on-site emergency organization level that is under the responsibility of the OSC.
- The Emergency and Crisis management level which is under the responsibility of duty manager in Yangon.

According to the identified scenarios, three types of incidents can occur;

- Offshore spill incident-OSC should be Field Manager.
- Port spill incident-OSC should be TKT Base Manager/Supervisor.
- Onshore spill incident-OSC should be the ZOC Site Manager.

The basic minimum composition of the on-site spill response shall be;

- On Scene Commander (OSC)
- On-Site- Spill Response Team Leader (SRTL)
- On-Site- Spill Response Team (SRT)
- Administration and Logistic Team
- Event Log Keeper

The spill response trainings must be carried out especially for assigned person and teams who are responsible for encountering spill incident (PTTEPI's Emergency Management Team, Emergency Response Team, Crisis Management Plan)

#### 8.9.5.5.5. Action Checklist

Response actions in the event of a spill during production operations will be performed by;

- On Scene Commander (OSC)
- On-Site Response Team Leader (SRTL)
- On-Site Spill Response Team (SRT)
- Administration and Logistic Team
- Data Log Keeper

The responsibilities of the above personnel and checklists for the detailed actions are fully described in PTTEPI's Spill Contingency Plan.

#### **8.9.5.6. PERFORMANCE CRITERIA**

Training of personnel and contractors for monitoring the equipment used in operation and prevention of any risk from spill, and training for proper using and handling of chemical and standard procedures. Planning of spill exercise with relevant parties.

Establishment of reports, documentations, and handling the chemicals with MSDS.

Ensure the storage of chemicals and chemical additives on rig and vessels are kept in secured storage areas, drums, tote tanks from pervious and any leak.

Filing, reporting and investigating of incident or accident reports.

#### **8.9.5.7. PROJECTED BUDGETS AND RESPONSIBILITIES**

The budget for this programme is included in the overall budget which is 1,050,000 USD in total for implementation of the EMP.

### **8.9.6. Emergency & Crisis Management Plan**

#### **8.9.6.1. OBJECTIVE**

PTTEPI's Emergency & Crisis Management Plan covers roles, responsibilities, systems and processes that PTTEPI's Emergency Management Team (EMT) & Crisis Management Team (CMT) will follow when responding to an emergency or crisis.

#### **8.9.6.2. LEGAL REQUIREMENTS**

The applicable national legislation are as follows:

- Petroleum and Petroleum Products Law (2017);
- Myanmar Investment Law (2016);
- Myanmar Fire Force Law (2015)
- Environmental Conservation Rules (2014);
- Prevention of Danger of Hazardous Chemical and related Substances Law (2013);
- Environmental Conservation Law (2012);
- Import and Export Law (2012);
- Constitution of the Republic of the Union of Myanmar (2008);
- Control of Smoking and Consumption of Tobacco Product Law (2006);
- Prevention and Control of Communicable Disease Law (1995);
- Myanmar Insurance Law (1993);
- Motor Vehicles Rules (1987);
- Public Health Law (1972);
- Factories Act (1951);
- Welfare of Labors of Oilfield Act (1951);
- Oilfields Act (1918);
- Explosive Act (1887);

The applicable national and international guidelines are as follow;



- National Environmental Quality (Emission) Guidelines (2015)
- IFC Environmental Health and Safety Guidelines – Offshore Oil and Gas Developments (2015)
- IFC General Environmental Health and Safety Guidelines (2012)
- IPIEAC: The Oil and Gas Industry: Operating In Sensitive Environments (2003)

The summarized description of above the laws and guidelines are presented in Chapter -**Error! Reference source not found.**

#### **8.9.6.3. OVERVIEW MAP AND SITE LAYOUT**

Although there are no applicable overview maps, satellite images or site layout concerning this Emergency and Crisis Management Plan, the overview map of proposed drilling campaign is presented in figure 42.

#### **8.9.6.4. MANAGEMENT ACTIONS**

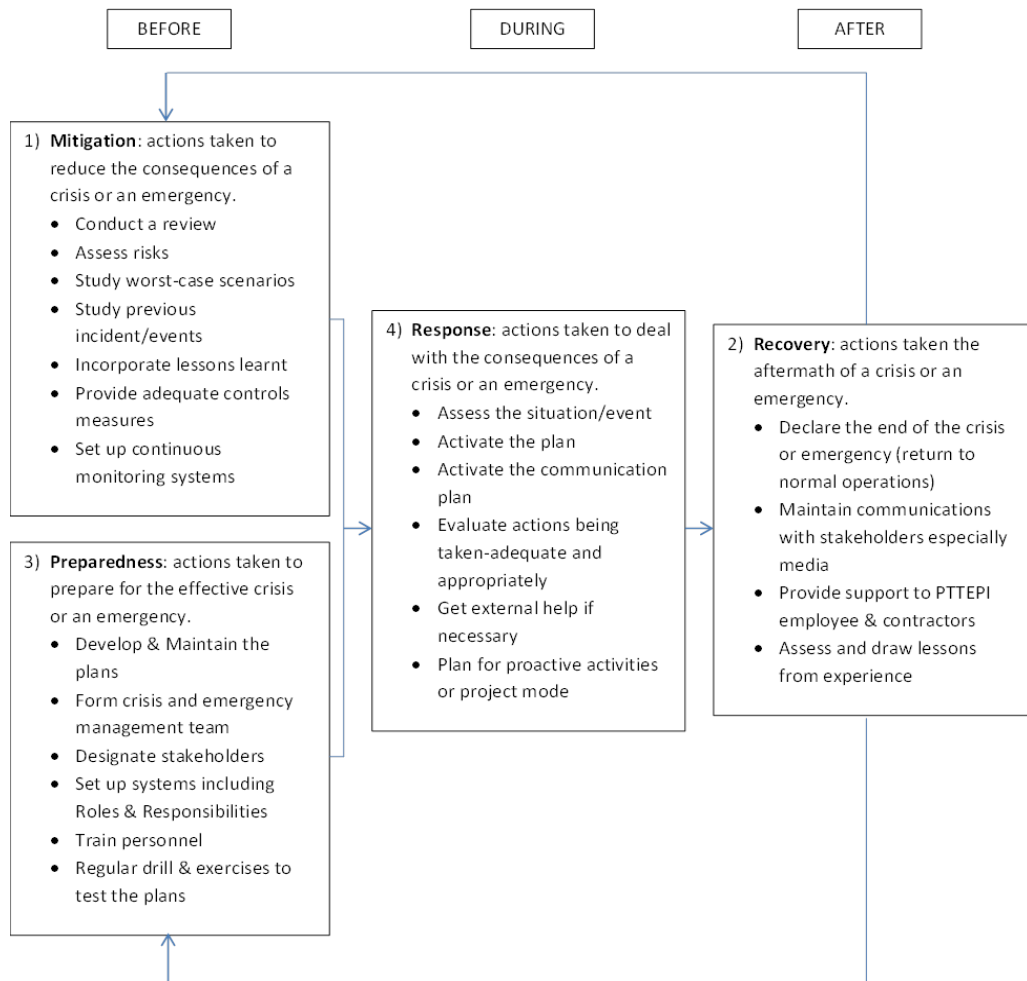
The Plan covers all operations and activities carried out by PTTEPI, including incidents of, but not limited to, the following nature:

- Offshore & Onshore Operational Incidents
- Environmental (Spill / Hydrocarbon Leak) incidents
- Security Incidents
- Logistics Related Incidents
- Occupational Health Incidents
- PTTEPI Personnel Incidents

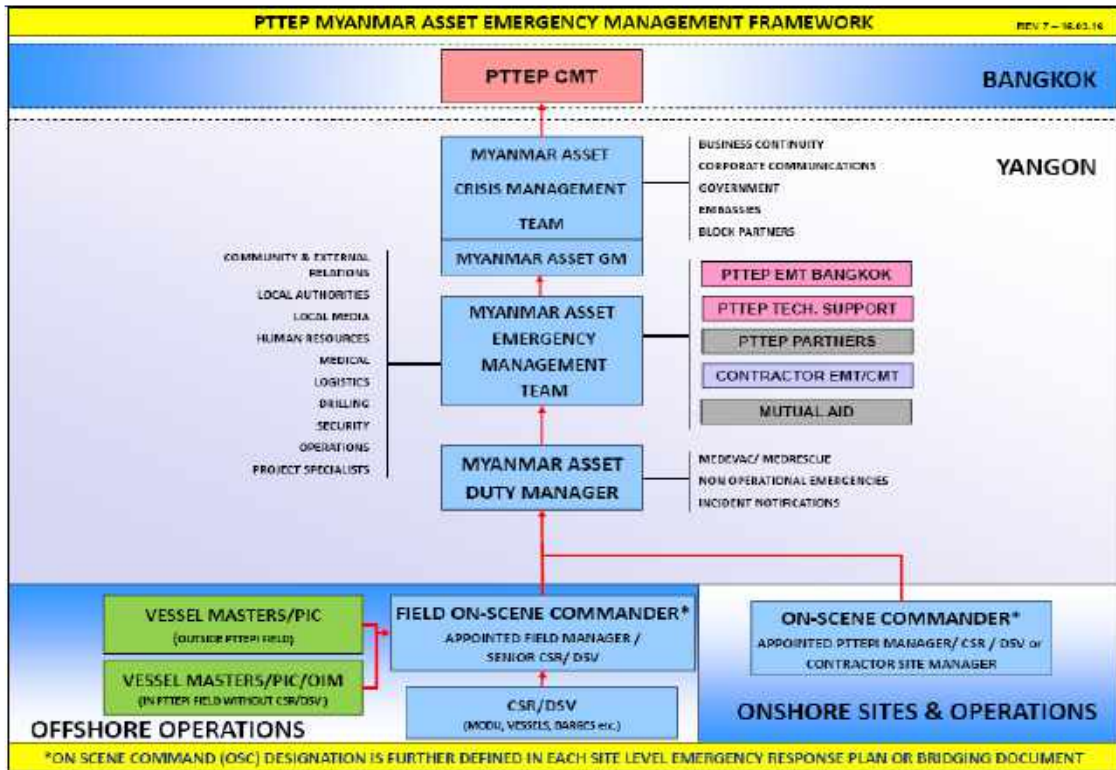
The “Emergency & Crisis Management Process”, shown below figure, provides a conceptual framework of the main phases of the Plan, and is based on an integrated approach made up four phases: mitigation, preparedness, response and recovery.

PTTEPI emergency & crisis organization includes representatives of PTTEPI management team, from all departments. This organization also liaises with PTTEP Corporate, Myanmar authorities and other strategically important stakeholders. In case of any emergencies, all employees, contractors and third party personnel have an emergency role to play as specified in site specific ERP and PTTEPI Emergency & Crisis management plan respectively. The emergency duties range from standing by to directly carrying out emergency response operations, as shown in following figure

Full details on PTTEPI’s emergency plan are outlined in PTTEP’s Myanmar Asset Emergency and Crisis Management Plan.



**Fig. 51.** *Emergency & Crisis Management Procedure*



**Fig. 52. PTTEPI Emergency Management Framework**

8.9.6.4.1. Tropical Cyclone Management Procedure

The purpose of the procedure is to provide the guidance for the response of tropical cyclone or storm, to protect maximum safety of people, protect the damage to environment, facilities and vessels and to minimize the disruption to the operation.

Tropical cyclone in Myanmar can be occurred especially in the monsoon season; 1<sup>st</sup> April to 30<sup>th</sup> June and 1<sup>st</sup> October to 31<sup>st</sup> December. Hence, it is needed to ensure the allocation of emergency response team who will be liaise with weather forecasting services to predict the potential strength and track of tropical cyclone.

Since the actions for the actual response will vary depends the type of unit, it is important to establish alert zone in order to save sufficient time to safety plan, prepare and carry out actions to avoid the impact of inbound cyclone.

Figure below shows the alert zone for PTTEP Myanmar Asset Operations

Alert Zone	Nautical Miles from Installation	TC Travel Time To Myanmar fields (hours-days)		
		At 5 Knots	At 10 Knots	At 15 Knots
Green	750	150 (6.25 days)	75 (3.15 days)	50 (2.08 days)
Yellow	600	120 (5 days)	60 (2.5 days)	40 (1.66 days)
Orange	450	90 (3.75)	45 (1.8 days)	30 (1.25 days)
Red	300	60 (2.5 days)	30 (1.25 days)	20 (0.83 days)

**Fig. 53. PTTEPI cyclone alert zone**

**Offshore M9 East Appraisal/Exploration Drilling**

Report

**ENVIRONMENTAL IMPACT ASSESSMENT**

The tropical cyclone travel at a speed between 8 & 12 knots is defined as majority case as it is possible that caclone can form within any of alert zone at any time. Since the proper procedure through various levels of alert will not likely to possible, “Tropical Cyclone Flash Alert” action must be acquired. Hence, closed attention must be paid to updates and predict by the contracted forecaster.

Actions to be taken before and during tropical cyclone season are

- To Ensure that daily weather forecast and ad-hoc alerts are informed to all applicable assets, site, logistic contractors and shore based personnel
- Ensure to include the accurate, detailed and updated list of personnel on board, in daily operational report
- To send site weather onservation to contracted weather forecaster as per requirements to assist with forecasting models.
- To perform the tasks throughout the year not only for preparedness and response

Guideline Actions : **Green Alert**

Alert Status Criteria	Evacuation Options	EMT Guideline Actions	Affected Assets
<input type="checkbox"/> TC has its centre located within 750 nautical miles of the nearest asset <input type="checkbox"/> This distance represents the approximate distance covered in 50 hours by a TC moving at 15 knots. <input type="checkbox"/> If a TC or Cyclone develops within the 750 nautical miles that is forecasted to directly affect an operational site. <input type="checkbox"/> Weather forecast / status required from Forecaster to PTTEP Myanmar Asset and site weather report from PTTEP Myanmar Asset assets to Forecaster every 6 hours. <input type="checkbox"/> The PTTEP Myanmar Asset EMT will advise of any Alert Status change.	<p><b><u>Via Helicopter or Marine Vessel</u></b></p> <p>Final decision to operate aircraft or vessel is up to the judgment of pilot or master (PIC)</p> <p><b><u>Under Power or Under Tow</u></b></p> <p>Consider available time frame to safely and effectively affix tow bridle and recover anchors</p> <p><b>NB: Tow bridle should be affixed after mean wave height reaches an agreed threshold (i.e. 2.5m) in case of the need to drop anchors and 'run'</b></p>	<input type="checkbox"/> EMT Mobilise, assess situation and confirm issue of official TC Alert Via Asset GM <input type="checkbox"/> Contact each operational site (including Onshore) and confirm receipt and understanding of TC Alert <input type="checkbox"/> Review most recent TC Readiness Report from Offshore Marine Control, Review: <ul style="list-style-type: none"> <li>○ Towing Readiness</li> <li>○ 'T' Time</li> <li>○ Safe Haven Locations</li> </ul> <input type="checkbox"/> Confirm Site POB & Personnel Categorisation. <input type="checkbox"/> Confirm forecast issue schedule and keep monitoring TC path <input type="checkbox"/> Confirm action plan with each operational site/ asset for potential evacuation & safe cessation of operations <input type="checkbox"/> Set ongoing EMT Meeting Schedule	<input type="checkbox"/> Review 'T' Time, prepare schedule for safe cessation of work, well securing and abandonment as required <input type="checkbox"/> Postpone planned non critical work activities <input type="checkbox"/> Monitor storm location and time approaching the rig/barge/installation <input type="checkbox"/> Liaise with EMT over action planning <input type="checkbox"/> Ensure vessels are suitably fuelled, winches functional and decks cleared as required for towing and anchor handling

Timing of evacuation needs to consider the speed and direction of the storm:

Alert Zone	Distance from the Rig/Barge/Installation	TC Travel Time to Applicable asset (hours-days)		
		At 5 Knots	At 10 Knots	At 15 Knots
Green	750nm	150 hrs (6.25 days)	75 hrs (3.15 days)	50 hrs (2.08 days)

Guideline Actions : **Yellow Alert**

Alert Status Criteria	Evacuation Options	EMT Guideline Actions	Affected Assets
<ul style="list-style-type: none"> <li><input type="checkbox"/> TC has its centre located within 600 nautical miles of the nearest asset</li> <li><input type="checkbox"/> This distance represents the approximate distance covered in 40 hours by a TC moving at 15 knots.</li> <li><input type="checkbox"/> If a TC or Cyclone develops within the 600 nautical miles that is forecasted to directly affect an operational site.</li> <li><input type="checkbox"/> Weather forecast / status required from Forecaster to PTTEP Myanmar Asset and site weather report from PTTEP Myanmar Asset assets to Forecaster every 6 hours.</li> <li><input type="checkbox"/> The PTTEP Myanmar Asset EMT will advise of any Alert Status change.</li> </ul>	<p><b><u>Via Helicopter or Marine Vessel</u></b></p> <p>Final decision to operate aircraft or vessel is up to the judgment of pilot or master (PIC)</p> <p><b><u>Under Power or Under Tow</u></b></p> <p>Consider available time frame to safely and effectively affix tow bridle and recover full set of anchors – some may need to be 'dropped'.</p> <p><b>NB: Tow bridle should be affixed after mean wave height reaches an agreed threshold (i.e. 2.5m) in case of the need to drop anchors and 'run'</b></p>	<ul style="list-style-type: none"> <li><input type="checkbox"/> EMT Mobilise, assess situation and confirm issue of official TC Alert Via Asset GM</li> <li><input type="checkbox"/> Contact each operational site (including Onshore) and confirm receipt and understanding of TC Alert</li> <li><input type="checkbox"/> Review most recent TC Readiness Report from Offshore Marine Control, Review:             <ul style="list-style-type: none"> <li><input type="checkbox"/> Towing Readiness</li> <li><input type="checkbox"/> "T" Time</li> <li><input type="checkbox"/> Safe Haven Locations</li> </ul> </li> <li><input type="checkbox"/> Confirm Site POB &amp; Personnel Categorisation.</li> <li><input type="checkbox"/> Confirm forecast issue schedule and keep monitoring predicted path of TC and wind/ wave conditions at site</li> <li><input type="checkbox"/> Confirm action plan with each operational site/ asset for potential evacuation &amp; safe cessation of operations</li> <li><input type="checkbox"/> Set ongoing EMT Meeting Schedule</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Cease all non-essential operations</li> <li><input type="checkbox"/> Suspend drilling and secure well</li> <li><input type="checkbox"/> Start securing the installation in survival mode (see Applicable asset procedures)</li> <li><input type="checkbox"/> Keep monitoring the storm track and time to reach the location</li> <li><input type="checkbox"/> Discuss with CSR/ DSV on response actions</li> <li><input type="checkbox"/> Brief on board personnel</li> <li><input type="checkbox"/> Commence evacuation of all non-essential personnel</li> </ul>

Timing of evacuation needs to consider the speed and direction of the storm:

Alert Zone	Distance from the Rig/Barge/Installation	TC Travel Time to Applicable asset (hours-days)		
		At 5 Knots	At 10 Knots	At 15 Knots
Yellow	600nm	120 hrs (5 days)	60 hrs (2.5 days)	40 hrs (1.66 days)

Guideline Actions : **Orange Alert**

Alert Status Criteria	Evacuation Options	EMT Guideline Actions	Affected Assets
<ul style="list-style-type: none"> <li><input type="checkbox"/> TC has its centre located within 450 nautical miles of the nearest asset</li> <li><input type="checkbox"/> This distance represents the approximate distance covered in 30 hours by a TC moving at 15 knots.</li> <li><input type="checkbox"/> If a TC or Cyclone develops within the 450 nautical miles that is forecasted to directly affect an operational site.</li> <li><input type="checkbox"/> Weather forecast / status required from Forecaster to PTTEP Myanmar Asset and site weather report from PTTEP Myanmar Asset assets to Forecaster every 3 hours.</li> <li><input type="checkbox"/> The PTTEP Myanmar Asset EMT will advise of any Alert Status change.</li> </ul>	<p><b><u>Via Helicopter or Marine Vessel</u></b></p> <p>Final decision to operate aircraft or vessel is up to the judgment of pilot or master (PIC)</p> <p>Platforms may require remaining personnel to shelter in place.</p> <p><b><u>Under Power or Under Tow</u></b></p> <p style="color: red;">Towing bridle should be affixed to assigned towing vessel – only remaining vessels may be used for anchor retrieval if weather conditions allow for safe operations.</p>	<ul style="list-style-type: none"> <li><input type="checkbox"/> EMT Mobilise, assess situation and confirm issue of official TC Alert Via Asset GM</li> <li><input type="checkbox"/> Contact each operational site (including Onshore) and confirm receipt and understanding of TC Alert</li> <li><input type="checkbox"/> Review most recent TC Readiness Report from Offshore Marine Control, Review:             <ul style="list-style-type: none"> <li><input type="checkbox"/> Towing Readiness</li> <li><input type="checkbox"/> "T" Time</li> <li><input type="checkbox"/> Safe Haven Locations</li> </ul> </li> <li><input type="checkbox"/> Confirm Site POB &amp; Personnel Categorisation.</li> <li><input type="checkbox"/> Confirm forecast issue schedule and keep monitoring predicted path of TC and wind/ wave conditions at site</li> <li><input type="checkbox"/> Confirm action plan with each operational site/ asset for potential evacuation &amp; safe cessation of operations</li> <li><input type="checkbox"/> Set ongoing EMT Meeting Schedule</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Cease all non-essential operations</li> <li><input type="checkbox"/> Suspend drilling and secure well</li> <li><input type="checkbox"/> Start securing the installation in survival mode (see Applicable asset procedures)</li> <li><input type="checkbox"/> Keep monitoring the storm track and time to reaching the location</li> <li><input type="checkbox"/> Discuss with CSR/ DSV on response actions</li> <li><input type="checkbox"/> Brief on board personnel</li> <li><input type="checkbox"/> Continue down-manning only if safe to do so</li> </ul>

Timing of evacuation needs to consider the speed and direction of the storm:

Alert Zone	Distance from the Rig/Barge/Installation	TC Travel Time to Applicable asset (hours-days)		
		At 5 Knots	At 10 Knots	At 15 Knots
Orange	450nm	90 hrs (3.75 days)	45 hrs (1.8 days)	30 hrs (1.25 days)

Guideline Actions : **Red Alert**

Alert Status Criteria	Evacuation Options	EMT Guideline Actions	Affected Assets
<input type="checkbox"/> TC has its centre located within 300 nautical miles of the nearest asset <input type="checkbox"/> This distance represents the approximate distance covered in 20 hours by a TC moving at 15 knots. <input type="checkbox"/> If a TC or Cyclone develops within the 300 nautical mile radius that is forecasted to directly affect an operational site. <input type="checkbox"/> Weather forecast / status required from Forecaster to PTTEP Myanmar Asset and site weather report from PTTEP Myanmar Asset assets to Forecaster every 3 hours. <input type="checkbox"/> The PTTEP Myanmar Asset EMT will advise of any Alert Status change.	<p><b><u>Via Helicopter or Marine Vessel</u></b></p> <p>These methods may not be available.</p> <p>Platforms likely require remaining personnel to shelter in place or receive personnel from other assets.</p> <p><b><u>Under Power or Under Tow</u></b></p> <p style="color: red;">Towing bridle should be affixed to assigned towing vessel – there may not be time to retrieve any anchors</p>	<input type="checkbox"/> EMT Mobilise, assess situation and confirm issue of official TC Alert Via Asset GM <input type="checkbox"/> Contact each operational site (including Onshore) and confirm receipt and understanding of TC Alert <input type="checkbox"/> Review most recent TC Readiness Report from Offshore Marine Control: <ul style="list-style-type: none"> <li>○ Towing Readiness</li> <li>○ "T" Time</li> <li>○ Safe Haven Locations</li> </ul> <input type="checkbox"/> Confirm Site POB <input type="checkbox"/> Confirm forecast issue schedule and keep monitoring predicted path of TC and wind/ wave conditions at site <input type="checkbox"/> Confirm action plan with each operational site/ asset for survival mode and time frame for communication updates/ recovery <input type="checkbox"/> Set ongoing EMT Meeting Schedule <input type="checkbox"/> Consider worst case scenario – Tier 3 incident consequences	<input type="checkbox"/> Cease all non-essential operations <input type="checkbox"/> Go immediately survival mode if unable to evacuate <input type="checkbox"/> Keep monitoring the storm track

Timing of evacuation needs to consider the speed and direction of the storm:

Alert Zone	Distance from the Rig/Barge/Installation	TC Travel Time to Applicable asset (hours-days)		
		At 5 Knots	At 10 Knots	At 15 Knots
Red	300nm	60 hrs (2.5 days)	30 hrs (1.25 days)	20 hrs (0.83 days)

### 8.9.6.5. PROJECTED BUDGETS AND RESPONSIBILITIES

The budget for this programme is included in the overall budget which is 1,050,000 USD in total for implementation of the EMP.

### 8.9.7. Grievance Mechanism

#### 8.9.7.1. OBJECTIVE

Grievance mechanism is to establish a formal process allowing people, communities or groups to raise complaints regarding any impact related to activities of PTTEPI or its subsidiaries.

#### 8.9.7.2. LEGAL REQUIREMENTS

The applicable national legislation are as follows:

- Environmental Impact Assessment Procedure (2015)
- Environmental Conservation Rules (2014)
- Environmental Conservation Law (2012)
- Myanmar Investment Law, 2016
- Public Health Law, 1972

- The Law Relating to Aquaculture, 1989
- The Law Relating to the Fishing Rights of Foreign Fishing Vessels, 1989

The applicable national and international guidelines are as follow;

- IFC Environmental Health and Safety Guidelines – Offshore Oil and Gas Developments (2015)
- IFC General Environmental Health and Safety Guidelines (2012)
- IPEAC: The Oil and Gas Industry: Operating In Sensitive Environments (2003)

The summarized description of above the laws and guidelines are presented in Chapter -**Error! Reference source not found.**

### 8.9.7.3. OVERVIEW MAP AND SITE LAYOUT

Although there are no applicable overview maps, satellite images or site layout concerning the Grievance Mechanism, the consultation meetings were carried out in Dawei, Yaybyu and Myeik townships according to stakeholder mapping.

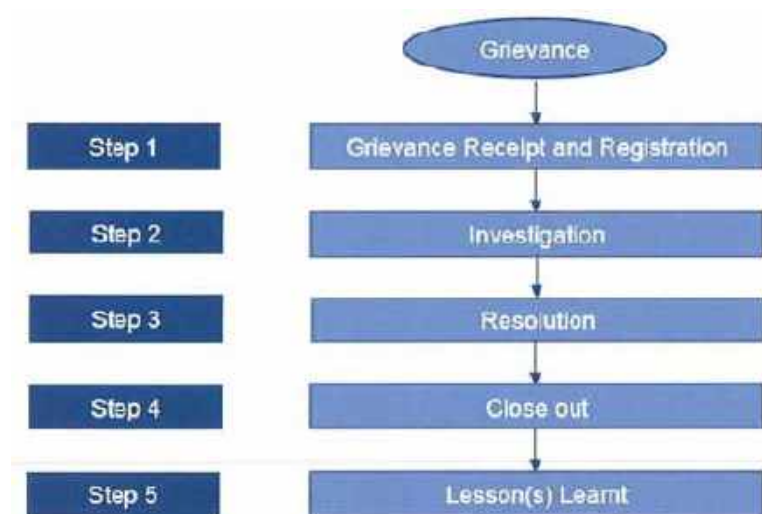
### 8.9.7.4. IMPLEMENTATION SCHEDULE

This programme will be developed by the PTTEPI before starting drilling operation and also through out the project operation cycle in order to settle the complaints and dissatisfactions from communities. Before the project implementation, the “Notice to Mariner” will be issued to all related stakeholders in order to inform about the project activities and exclusion zone. However, relationship with key stakeholders must be maintained by PTTEPI.

### 8.9.7.5. MANAGEMENT ACTIONS

This Grievance Handling Guideline is applied to all of PTTEP’s assets, domestic and international, and covers the entire lifecycle of the assets or operations from inception through decommissioning and abandonment.

The following flowchart describes the grievance handling procedure of PTTEPI’s Cooperate Communication and Public Affair.



**Fig. 54. PTTEPI Grievance Handling Process**



8.9.7.5.1. Step 1: Grievance Receipt and Registration

Expressing of dissatisfactions in different ways; in person, by means of electronic mails and in traditional way (by post mail, letter, telephone and face to face)

8.9.7.5.2. Step 2: Investigation

Delicate approaching the case and to provide clarification and explanation until the plaintiff understand and the case is closed. Ensure recording keeping and perform direct response to the plaintiff as much as possible.

8.9.7.5.3. Step 3: Resolution

Conducting grievance solution meetings to consider best internal practices to find appropriate resolution to grievance. The settlement meetings will continue till to the satisfactory acceptance of the plaintiff.

8.9.7.5.4. Step 4: Close out

Record keeping of written form with completed signatures from all relevant parties if the resolution is accepted.

All scope and processes of the grievance process is outlined in PTTEPI's Grievance Handling Guidelines.

**8.9.7.6. PROJECTED BUDGETS AND RESPONSIBILITIES**

The budget for this programme is included in the overall budget which is 1,050,000 USD in total for implementation of the EMP.

**8.9.8. Training and Awareness Programme**

**8.9.8.1. OBJECTIVE**

A training program shall be developed for sensitizing the employees and raising awareness on environmental and social issues.

**8.9.8.2. LEGAL REQUIREMENTS**

The applicable national legislation are as follows:

- The Welfare of Labors of Oilfield Act. 1951 (after notification)
- The Workmen Compensation Act (1923) (amended 2005)
- Leaves and Holidays Act (1951)
- Labour Organisation Law (2012)
- Settlement of Labor Dispute Law (2012)
- Employment and Skill Development Law

The applicable national and international guidelines are as follow;

- IFC Environmental Health and Safety Guidelines – Offshore Oil and Gas Developments (2015)
- IFC General Environmental Health and Safety Guidelines (2012)

The summarized description of above the laws and guidelines are presented in Chapter -**Error! Reference source not found.**

#### **8.9.8.3. OVERVIEW MAP AND SITE LAYOUT**

There are no applicable overview maps, satellite images, site layout maps concerning this programme.

#### **8.9.8.4. IMPLEMENTATION SCHEDULE**

This programme will be developed by the contractor before starting drilling operation in order to ensure employees have environmental awareness.

#### **8.9.8.5. MANAGEMENT ACTIONS**

Main contractors such as drilling contractors should also develop a training program which will be approved by PTTEPI.

The training program should be developed in compliance with PTTEPI's training procedure and Myanmar Asset SSHE Training and Competency Standard. A matrix "personnel category" / "training program" shall be developed for the staff and main contractors.

Environmental training needs are assessed on the basis of:

- Job function environmental responsibilities
- Knowledge or competencies needed to fulfil responsibilities and carry out defined job in accordance with HSE requirements with main environmental impacts assessed in the present report (waste management, etc.).

#### **8.9.8.6. MONITORING PLANS**

Ensuring that the trainings are conducted and monitored closely by key responsible person of PTTEPI to meet the standards. The monitoring process includes

- Completion percentage of SSHE training
- Overdue percentage of SSHE training
- Completion percentage of competency assessments etc.

### **8.9.9. Environmental Audit Programme**

#### **8.9.9.1. OBJECTIVE**

An Environmental Audit Program will be developed for the Project and shall be written in conformity with the Environmental Audit Plan of PTTEPI in compliance with ISO 14001:2015 Environmental Management System.

#### **8.9.9.2. LEGAL REQUIREMENTS**

The following national legislation which are applicable as basis for the project are:

- Environmental Impact Assessment Procedure (2015)
- Environmental Conservation Rules (2014)
- Environmental Conservation Law (2012)

The applicable national and international guidelines are as follow;

- National Environmental Quality (Emission) Guidelines (2015)
- IFC Environmental Health and Safety Guidelines – Offshore Oil and Gas Developments (2015)
- IFC General Environmental Health and Safety Guidelines (2012)
- World Health Organization (WHO) standards and guidelines (2005)

The summarized description of above the laws and guidelines are presented in Chapter -**Error! Reference source not found.**

### **8.9.9.3. OVERVIEW MAP AND SITE LAYOUT**

The overview map of drilling site is presented in **Error! Reference source not found.**

### **8.9.9.4. IMPLEMENTATION SCHEDULE**

Audit programme will be developed by conformity assessment bodies during the drilling operation in order to check the conformity.

### **8.9.9.5. MANAGEMENT ACTIONS**

The programme shall describe the audit terminology, process audit approach, audit checklist, nonconformity reporting and corrective action to reduce and/or minimize environmental impacts and set-up appropriate mitigation measures.

#### 8.9.9.5.1. Audit Terminology

It general includes a description of physical locations, organizational units, activities and processes as well as the time period covered.

#### 8.9.9.5.2. Process Audit Approach

Responsible party plans for the period or cycle, usually yearly or half yearly. The appointed team leader prepares the schedule to detail auditor, departments, timing and scope. Conduct opening meeting with auditees and personnel concerned.

#### 8.9.9.5.3. Audit Checklist

Checklists are made while reviewing the documents and observations. It is used a guide and allow for flexibility in auditing.

#### 8.9.9.5.4. Nonconformity Reporting

Nonconformity report will include the findings for both conformities and non-conformities, which are related to department/ area audited, auditee, factual evidences of findings, provide references, date of audit corrective action and follow-up visit (if any).

#### 8.9.9.5.5. Corrective action

The action to take nonconformity by addressing the causes of nonconformity and corrective actions are implemented in a timely manner.

The SSHE Department of PTTEPI is also responsible for preparing reports on environmental activities and for overseeing environmental activities on-site. This will involve general environmental management as well as specific technical aspects. Each of audit reports will be transmitted to PTTEPI for approval.

## **8.10. OCCUPATIONAL AND COMMUNITY HEALTH MANAGEMENT PLAN**

### **8.10.1.1. OBJECTIVE**

The Occupational and Community Health Management Plan will be prepared for the project, to conduct the activities in both the workplace and surrounding environment in order to manage the impacts on communities and employees due to project activities.

### **8.10.1.2. LEGAL REQUIREMENTS**

The applicable national legislations for chemical management are as follows:

- Social security Law (2012)
- The Protection and Prevention of Communicable Disease Law (2011)
- The Control of Smoking and Consumption of Tobacco Product Law (2006)
- Public Health Law (1972)

The applicable national and international guidelines are as follow;

- National Environmental Quality (Emission) Guidelines (2015)
- IFC Environmental Health and Safety Guidelines – Offshore Oil and Gas Developments (2015)
- IFC General Environmental Health and Safety Guidelines (2007)

The summarized description of above the laws and guidelines are presented in Chapter -**Error! Reference source not found.**

### **8.10.1.3. OVERVIEW MAPS AND SITE LAYOUT**

Although there are no applicable overview maps, satellite images or site layout concerning this Spill Contingency Plan, the overview map of proposed drilling campaign is presented in figure 42.

### **8.10.1.4. IMPLEMENTATION SCHEDULE**

With the specific aim of protecting and promoting workers' safety, health and well-being, as well as improving working conditions and the working environment, the Occupational and Community Health Management Plan will be developed by PTTEPI during the proposed drilling operation. The contractors and concerned person must also comply and practice the guidelines, standards and procedures of PTTEPI.

### **8.10.1.5. MANAGEMENT ACTIONS**

#### **8.10.1.5.1. Occupational Health, Safety and Environmental Management**

Establishing of occupational health, safety and environmental management system which enables an organization to control its HSE risks and to maintain high standards of for all people associated with the operations. The purposes of this plan is

- Protect, promote and maintain the health, safety and welfare of people at work
- Advise on the provision of safe and healthy conditions by informed assessment of the physical and psychological aspects of the working environment
- Identify and advise management on the causes of occupational disease and injury and the means of their prevention
- Advise on the rehabilitation and placement in suitable work of those temporarily or permanently incapacitated by illness or injury and
- Assist in the planning and preparedness of emergency response plans.

The key responsible person can be structured as 1. Top Management, to lead and demonstrate the plan, 2. Project Managers, to operate effective and efficient plan, and to ensure a best practice approach is achieved on HSE matters and 3. the contractors and employees, to comply with the occupational health procedures, rules and regulations defined by PTTEPI. All employees shall receive occupational health awareness training and worksite occupational health briefings.

Existing of field site clinic with the supplement of medical specialists and referral system for the employees who are considered to refer to the appropriate specialists. And to ensuring of the referral cost paid by the employer and to proceed the continuance of employee with the prescribed forms and fitness certification.

The specific Medical Emergency Response Plan shall be developed to manage medical emergencies by taking into considering the needs and general situation of the country and available resources. The successful implementation of MERP is based on the means of communication, transportation, trained persons or medical specialists (doctors, paramedics, etc) and adequate healthcare unit.

A copy of the PTTEPI Occupational Health Management Standard is provided as an appendix in the present EIA (see **Error! Reference source not found.**)

#### **8.10.1.6. PROJECTED BUDGETS AND RESPONSIBILITIES**

The budget for implementation of this plan is included in overall budget of environmental management plan which is 1,050,000 USD in total.

#### **8.10.2. Reporting Requirements to Myanmar Authorities**

There are a number of reporting requirements to Myanmar Authorities, as per the EIA Procedures and Administrative Instruction of Environmental Impact Assessment Procedure. These are summarized in following table: Reporting Requirements to Myanmar Authorities.

#### **8.10.3. PTTEPI's Internal Reporting**

##### **8.10.3.1. INTERNAL MONITORING AND INSPECTION**

PTTEPI conducts internal monitoring and inspection, which are primarily conducted to identify deviations/non-conformities/unsafe conditions. Where identified, temporary corrective measures are implemented or discussed.

- Reporting and follow-up are conducted as follows:
- Inspection report issued by the Team Leader;
- Includes corrective action recommendations;
- Draft forwarded to relevant Site SSHE Representative for comments and validation prior to distribution;
- Final Action plan discussed with the relevant Department Head prior to issue; and
- Highlight main findings for report to SSHE Committee

### 8.10.3.2. INCIDENT, ACCIDENT AND EMERGENCY REPORTING

PTTEPI will report all incidents, accidents and emergencies as per their Incident Management Procedure.

**Tabl. 62 - Reporting requirements to Myanmar authorities**

Report	Requirements	Frequency	Reference
Monitoring report	<p>Submit monitoring reports to the Ministry not less frequently than every six (6) months, as provided in a schedule in the EMP, or periodically as prescribed by the Ministry.</p> <p>Within ten (10) days of completing monitoring report, the P may otherwise be agreed upon with the requestor.</p> <p>Monitoring reports shall include:</p> <ul style="list-style-type: none"> <li>- documentation of compliance with all conditions;</li> <li>- progress made to date on implementation of the EMP against the submitted implementation schedule;</li> <li>- difficulties encountered in implementing the EMP and recommendations for remedying those difficulties and steps proposed to prevent or avoid similar future difficulties;</li> <li>- number and type of non-compliance with the EMP and proposed remedial measures and timelines for completion of remediation;</li> <li>- accidents or incidents relating to the occupational and community health and safety, and the environment; and</li> <li>- monitoring data of environmental parameters and conditions as committed in the EMP or otherwise required</li> </ul>	No less than every 6 months	EIA Procedure, Article 108 and 109
Report in case of breach of ECC or EMP	<p>Notify and identify in writing to the Ministry any breaches of its obligations or other performance failures or violations of the ECC and the EMP as soon as reasonably possible.</p>	<ul style="list-style-type: none"> <li>- In case of any breach which would have a serious impact or where the urgent attention of the Ministry is or may be required, within not later than twenty-four (24) hours of PTTEPI becoming aware of such incident.</li> <li>- In all other cases: within seven (7) days of PTTEPI becoming aware of such incident.</li> </ul>	EIA Procedure, Article 107
Report of any accident or incident	<ul style="list-style-type: none"> <li>- Inform appropriate authorities as soon as practicable in the event of any accident or incident.</li> <li>- As per conditions of ECC.</li> </ul>	As per conditions of ECC.	Administrative Instruction, EIA Procedure, Annex 5, page 3
Additional reporting requirements as per ECD	<p>The Ministry may prescribe conditions in the ECC. Such conditions may include additional reporting requirements, such as:</p> <ul style="list-style-type: none"> <li>- General management documentation, reporting and information disclosure procedures.</li> <li>- Monitoring documentation and reporting</li> <li>- Documentation and reporting on (i) parameters and issues that must be documented and reported; (ii) types and methods, (iii) frequency and timing, (iv) quality controls and (v) recipients.</li> </ul>	As per conditions of ECC.	EIA Procedure, Article 91.

### **8.11. CORPORATE SOCIAL RESPONSIBILITY (CSR) ACTIVITIES**

There are currently a number of ongoing CSR activities taking place by PTTEPI under the Zawtika Project. These activities have the objective to uplift quality of life and gain favourable relations from all stakeholders in the operating area. The CSR program for the Zawtika Project consists of 3 main sectors: "Health, Education and Community Development Sector". All CSR activities are conducted in compliance with MOGE's Guidelines for Implementation of CSR Programmes.

### **8.12. STATEMENT OF COMMITMENT**

PTTEPI will act in accordance with the commitments, mitigation measures, and plans that have been included in this EIA Report.

PTTEPI shall execute the EMP, all commitments, and conditions, and is liable to ensure that all contractors and subcontractors of the project follow with all applicable Laws, including the Environmental Conservation Law (2012), Environmental Conservation Rules and Environmental Impact Assessment Procedure (2015), as well as the EMP, project commitments and conditions.

PTTEPI and ARTELIA hereby confirm that:

- The EIA Report is accurate, consolidated and complete;
- The EIA has been conducted in accordance with relevant laws, including the EIA Procedure (2015).
- The project will fully comply the commitments, mitigation measures and plans set out in this EIA Report.

### **8.13. MITIGATION MEASURES**

This section presents the proposed mitigation measures that PTTEPI will adopt to facilitate the management and control of potential adverse impacts associated with the project, which were proposed in chapters 6 & 7 of the present document. These mitigation measures will be taken into account in project implementation and execution, such that potential adverse impacts are reduced As Low As Reasonably Practicable (ALARP). The mitigation measures are presented for each phase from Tabl. 63 - to Tabl. 66 - .

Tabl. 63 - Mitigation measures for project during the mobilization and installation phase

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impacts	Specific action	Location	Duration	Responsibility
<b>Environmental mitigation measures</b>							
1- Air quality / GHG emissions	Air emissions from combustion due to operation of machines and engines installed on support and supply vessels.	<ul style="list-style-type: none"> <li>Regular maintenance of marine engines, generators and compressor.</li> <li>Compliance with MARPOL 73/78 Annex VI – prevention of air pollution from ships, and if applicable based on age of vessels (MARPOL Annex VI Chapter 4 – ship energy efficiency management)</li> <li>To warn vessels of any delays in required times of arrival so that they may reduce speed accordingly for energy efficiency if possible</li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>Regular maintenance of marine engines, generators and compressor.</li> </ul>	All project vessels	Mobilization and installation phase	PTTEPI/Contractor
2- Seawater & sediment quality	<p>Discharge of oil-containing wastewater (i.e., bilge water, oil-chemical containing wastewater from engine room and deck drain) containing hydrocarbons or untreated sewage from marine vessels could potentially degrade seawater quality.</p> <p>Discharge of wastewater and sewage from drilling rig, support and supply vessels may impact seawater quality.</p>	<ul style="list-style-type: none"> <li>Rig, support and supply vessels shall be equipped with sanitary wastewater treatment unit.</li> <li>All vessel shall comply with MARPOL (discharged bilge water into the sea shall not exceed 15 mg/l) and PTTEPI's Waste Management Procedure.</li> <li>Bilge water separately collected and treated prior to discharge into the sea. All discharges should be treated and has &lt;15 ppm of oil content.</li> <li>Food waste is milled and ground to a size of &lt;25 mm in diameter prior to discharge.</li> <li>Ballast water will not be discharged into the environment without prior treatment. Ballast water discharges, if any, will comply with the international convention for the control and management of ships' ballast water and sediment (IMO, 2004).</li> <li>Marine vessels have open drain system, which collects and treats run-off water potentially contaminated with hydrocarbons and/or chemicals.</li> <li>Vessels not to be stationary when undertaking discharge.</li> <li>Suitable sewage water treatment units shall be available on the vessels and adequately sized according to the number of people working on-</li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>Treat all sewage prior to discharge with wastewater treatment system according to MARPOL 73/78.</li> <li>See mitigation measures for specific action on hazardous and non-hazardous wastes.</li> </ul>	All project vessels	Mobilization and installation phase	PTTEPI/Contractor



Aspects	Potential impacts	Mitigation measures	Significance of Residual Impacts	Specific action	Location	Duration	Responsibility
		board. <ul style="list-style-type: none"> <li>Chemical additives on all marine vessels will be stored in drums or tote tanks located in area equipped with means to contain any leaks or spills.</li> </ul>					
	The project will generate various types of hazardous and non-hazardous wastes. Inappropriate management (including transportation, storage and disposal) of waste will impact seawater quality.	<p>Manage waste at offshore facilities in compliance with the requirements under MARPOL 73/78 and PTTEPI's Waste Management Plan.</p> <p><b>Hazardous Waste</b></p> <ul style="list-style-type: none"> <li>Waste storage areas shall be clearly defined.</li> <li>Collected and stored in suitable containers that are protected from the environment (rain, wind, etc.).</li> <li>The vessel deck shall be cleaned to minimize the impact from oil and chemical contamination into the sea during period of rain.</li> <li>Containers equipped with means to contain any spills or leaks.</li> <li>Transferred to a suitable authorized disposal facility onshore by a certified transporter.</li> <li>Prohibit any discharge of hazardous waste into the sea.</li> </ul> <p><b>Non-hazardous waste</b></p> <ul style="list-style-type: none"> <li>Segregate non-hazardous waste, including food waste, paper, aluminum can, glass, rag and other wastes in separate containers or proper areas.</li> <li>Waste storage areas shall be clearly defined.</li> <li>Food wastes will be ground to 25 mm prior to discharge to sea. All non-food wastes will be collected and transported to shore for landfill or acceptable disposal.</li> <li>Dispose non-hazardous waste at onshore treatment facilities in accordance with the law of Myanmar and PTTEPI's Waste Management Plan.</li> <li>Transported to the onshore bases for collection and recycling by an authorized waste management contractor.</li> <li>Keep the record of waste inventories, including type and quantities updated.</li> </ul>	NEGLIGIBLE				

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impacts	Specific action	Location	Duration	Responsibility
	Drilling rig installation and anchoring of support vessels can disturb the seafloor and consequently cause a temporary suspension of the sediments, increasing turbidity.	<ul style="list-style-type: none"> <li>Before the drilling starts, PTTEPI will coordinate with MOGE, who will then issue "Notice to Mariner" regarding project activities to concerned parties (i.e., Department of Fisheries, Ministry of Livestock, Fisheries and Rural Development, Myanmar Navy and Myanmar Fisheries Federation).</li> </ul>	MINOR	<ul style="list-style-type: none"> <li>Generalisation of the vessel dynamic positioning devices for drilling.</li> <li>At least 30 days prior to rig transport and installation, coordinate with MOGE, who will issue "Notice to Mariner" regarding project activities.</li> <li>Conduct seafloor surveys, prior to installation rig.</li> </ul>	All project vessels Drilling rig	Mobilization and installation phase	PTTEPI / Contractor
3- Seabed characteristics	The pattern of seafloor sediment topography could be affected by rig and anchoring of support vessels.	<ul style="list-style-type: none"> <li>Conduct seafloor surveys to identify seabed features that could impact on or be impacted by rig installation.</li> <li>Prohibit anchor dragging.</li> <li>Before the drilling starts, PTTEPI will coordinate with MOGE, who will then issue "Notice to Mariner" regarding project activities to concerned parties (i.e., Department of Fisheries, Ministry of Livestock, Fisheries and Rural Development, Myanmar Navy and Myanmar Fisheries Federation).</li> </ul>				All project vessels Drilling rig	
4- Marine life and marine ecology	Offshore activities may disturb marine mammals.	<ul style="list-style-type: none"> <li>Adoption of equipment designed to current engineering standards.</li> <li>Regular maintenance of marine engines, generators and compressor.</li> <li>Vessels to use slow speed and adapt the routes to avoid sensitive areas to marine mammals</li> <li>Adoption of passive acoustic monitoring system to observe the presence of marine mammals</li> </ul>	NINOR TO NEGLIGBLE	<ul style="list-style-type: none"> <li>Observe the presence of marine mammals prior to seafloor survey activities.</li> <li>Implement all mitigation measures for Item 2 and 3.</li> </ul>	All project vessels.	Mobilization and installation phase	PTTEPI / Contractor
	Waste, wastewater and discharges from drilling rig and vessels may cause an impact on seawater and sediments, which may indirectly affect the community of marine biota at the surface level and the seabed.	<ul style="list-style-type: none"> <li>Implement all mitigation measures for Item 2 and 3.</li> </ul>					

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impacts	Specific action	Location	Duration	Responsibility
<b>Social mitigation measures</b>							
5- Fishing communities and fisheries	Reduced fishing area due to the presence of drilling rig and vessels, and 500 m exclusion zones.	<ul style="list-style-type: none"> <li>Before drilling starts, PTTEPI will coordinate with MOGE, who will then communicate to issue “Notice to Mariner” regarding all the project activities to concerned parties (i.e. Department of Fisheries, Ministry of Livestock, Fisheries and Rural Development, Myanmar Navy, and Myanmar Fisheries Federation).</li> <li>An exclusion zone (radius of 500 m) will be established surrounding the drilling rig.</li> <li>Use support vessels to warn off traffic.</li> <li>Provide appropriate lights and warning signals at offshore facilities to prevent accidental collision.</li> </ul>	MINOR	<ul style="list-style-type: none"> <li>At least 30 days prior to rig transport and installation, coordinate with MOGE, who will issue “Notice to Mariner” regarding project activities.</li> <li>Established 500 m safety zone around the drilling rig.</li> <li>Use support vessels to warn off traffic.</li> <li>Provide appropriate light and warning signals at offshore facilities.</li> </ul>	All project vessels Drilling rig	Mobilization and installation phase	PTTEPI / Contractor
	The quantity and quality of aquatic biota may decrease due to waste contamination in the sea. Contaminants may consist of non-hazardous and hazardous waste.	<ul style="list-style-type: none"> <li>Implement all mitigation measures for Item 2 and 3 above.</li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>Implement all mitigation measures for Item 2 and 3 above.</li> </ul>	All project vessels Drilling rig		
6- Shipping and navigation	Marine vessels may obstruct marine navigation during transporting the rig and equipment from onshore.	<ul style="list-style-type: none"> <li>Before drilling starts, PTTEPI will coordinate with MOGE, who will then communicate to issue “Notice to Mariner” regarding project activities to concerned parties (i.e. Department of Fisheries, Ministry of Livestock, Fisheries and Rural Development, Myanmar Navy, and Myanmar Fisheries Federation).</li> <li>Use support vessels to warn off traffic.</li> <li>Provide appropriate lights and warning signals at offshore facilities to prevent accidental collision.</li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>At least 30 days prior to rig transport and installation, coordinate with MOGE, who will issue “Notice to Mariner” regarding project activities.</li> </ul>	All project vessels Drilling rig	Mobilization and installation phase	PTTEPI / Contractor
	The presence of the offshore facilities may obstruct navigation.						

**Offshore M9 East Appraisal/Exploration Drilling**

Report

**ENVIRONMENTAL IMPACT ASSESSMENT**

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impacts	Specific action	Location	Duration	Responsibility
		<ul style="list-style-type: none"> <li>An exclusion zone (radius of 500 m) will be established surrounding the drilling rig.</li> </ul>		<ul style="list-style-type: none"> <li>Established 500 m safety zone around the drilling rig.</li> <li>Use support vessels to warn off traffic.</li> <li>Provide appropriate light and warning signals at offshore facilities.</li> </ul>			
7- Socio-economy	Increase in industrial expenditure and income (positive impact)	<ul style="list-style-type: none"> <li>Enhance utilization of local goods and services as much as possible.</li> </ul>	<b>POSITIVE Impact</b>	<ul style="list-style-type: none"> <li>Utilize local goods and services as much as possible.</li> </ul>	Onshore bases		PTTEPI / Contractor
<b>Health mitigation measures</b>							
8- Occupational health and safety	Injuries or illness due to exposure to harmful substances or accident	<p>Implement relevant components of PTTEPI's SSHE Management System, including the following:</p> <ul style="list-style-type: none"> <li>Implement PTTEPI's Occupational Health Management Standard.</li> <li>Ensure that all employees wear appropriate equipment, and implement PTTEPI's Personal Protective Equipment Standard.</li> <li>Personnel will be provided with safety training to ensure that all workers practice under safety operation and regulation of work, as per PTTEPI's SSHE Training &amp; Competency Standard.</li> </ul> <p>Cooperate with the nearest health center/hospital in order to immediately support response to emergency events, as per PTTEPI's MERP. Duty Manager and Emergency Management Team for Medevac response or Medical Referral in case of emergency events.</p> <p>Implement following operational measures for prevention and control of accidents:</p> <ul style="list-style-type: none"> <li>Safety Data Sheets must be provided with every chemical products.</li> </ul>	<b>NEGLIGIBLE</b>	<ul style="list-style-type: none"> <li>See mitigation measures.</li> </ul>	All project vessels Drilling rig Onshore bases	Mobilization and installation phase	PTTEPI / Contractor

**Offshore M9 East Appraisal/Exploration Drilling**

Report

**ENVIRONMENTAL IMPACT ASSESSMENT**

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impacts	Specific action	Location	Duration	Responsibility
		<ul style="list-style-type: none"> <li>Adequate storage will be provided for each chemical in accordance with safety instruction (storage conditions, etc.).</li> <li>Provide spill kits on-site.</li> <li>Provide first aid kits on-site.</li> <li>Provide proper sanitary systems, including drinking water, potable water, toilet and waste management.</li> </ul>					
	Injuries due to working in noisy areas.	<ul style="list-style-type: none"> <li>Regular maintenance of marine engines, generators and compressor.</li> <li>Provide personal protection equipment (ear plug for instance) to workers working on high level noise activities.</li> </ul>			All project vessels Drilling rig		PTTEPI / Contractor
9- Public health and Health service	Project activities could involve general public around shore bases that will be used for staff, materials and waste transportation.	<ul style="list-style-type: none"> <li>Implement PTTEPI's Occupational Health Management Standard. (<b>Error! Reference source not found.</b>)</li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>See mitigation measures.</li> </ul>	Shore bases	Preparation and installation phase	PTTEPI
	In case of accident or illness during project activities, it may be required to use healthcare services around the shore bases.	<ul style="list-style-type: none"> <li>Cooperate with the nearest health center/hospital in order to immediately support response to emergency events, as per PTTEPI's MERP. Duty Manager and Emergency Management Team for Medevac response or Medical Referral in case of emergency events.</li> </ul>					

Tabl. 64 - Mitigation measures for project during the drilling phase

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impact	Specific action	Location	Duration	Responsibility
<b>Environmental mitigation measures</b>							
1- Air quality / GHG emissions	Air emissions from combustion due to operation of machines and engines.	<ul style="list-style-type: none"> <li>Maintaining generators and compressors in good working order.</li> <li>To warn vessels of any delays in required times of arrival so that they may reduce speed accordingly for energy efficiency if possible</li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>Conduct routine inspection of machinery.</li> <li>Conduct preventive maintenance of all machinery as per maintenance schedule.</li> </ul>	All project vessels Drilling rig	Drilling phase	PTTEPI/Contractor
	Exhaust gases from helicopter jet fuel combustion.	<ul style="list-style-type: none"> <li>Use the helicopter only for crew transportation and emergency case</li> </ul>		<ul style="list-style-type: none"> <li>Conduct routine inspection of machinery.</li> </ul>	Onshore bases Drilling rig		
2- Seawater & sediment quality	Discharge of mud and cuttings into the sea could impact seawater and sediment quality.	<ul style="list-style-type: none"> <li>Use of WBM with high biodegradability and low toxicity additives as main drilling fluid for all well sections.</li> <li>For contingency and technical reason, SBM will be used with low toxicity biodegradable and non-persistent.</li> <li>The discharge of cuttings shall be complied with Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (IFC, 2015).</li> <li>Discharge of cuttings will be 15m below sea surface.</li> <li>Use of centrifuges, shale shakers and mud cleaners to separate out the cuttings from the mud.</li> <li>Drilling mud will be treated and then send back to the cycle in a continual circulation through the rig's mud handling system: recycling of mud to minimize the quantity discharge to sea.</li> <li>Optimization of the quantities of cement and the dosing of chemicals used.</li> <li>SDS available on the drilling rig</li> </ul>	MINOR	<ul style="list-style-type: none"> <li>Processing in place the cuttings from sections using WBM and SBM so that they are discharged via discharge line 15 m below sea surface.</li> <li>Recycling system for WBM and SBM and treatment of cuttings before being discharged in order to obtain a total oil concentration limit as per Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (IFC, 2015)</li> </ul>	Drilling rig	Drilling phase	PTTEPI/Contractor
	Discharge of cement could impact seawater quality.		NEGLIGIBLE				
	Chemical additives in the drilling fluid may impact seawater and sediment quality.	<ul style="list-style-type: none"> <li>Chemicals shall be selected according to their low toxicity.</li> </ul>				All project vessels Drilling rig	

**Offshore M9 East Appraisal/Exploration Drilling**

Report

**ENVIRONMENTAL IMPACT ASSESSMENT**

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impact	Specific action	Location	Duration	Responsibility
				<ul style="list-style-type: none"> <li>• Selection of chemicals added to drilling muds (according to criteria such as the lowest toxicity, the smallest bioaccumulation potential, the highest biodegradability)</li> <li>• Implementatoin of a waste management plan and an environmental management plan.</li> </ul>			

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impact	Specific action	Location	Duration	Responsibility
	The Project will generate various types of hazardous and non-hazardous wastes. Inappropriate management (including transportation, storage and disposal) of waste will impact seawater quality.	<p>Manage waste at offshore facilities in compliance with the requirements under MARPOL 73/78 and PTTEPI's Waste Management Plan.</p> <p><b>Hazardous Waste</b></p> <ul style="list-style-type: none"> <li>Waste storage areas shall be clearly defined.</li> <li>Collected and stored in suitable containers that are protected from the environment (rain, wind, etc.).</li> <li>The vessel deck shall be cleaned to minimize the impact from oil and chemical contamination into the sea during period of rain.</li> <li>Containers equipped with means to contain any spills or leaks.</li> <li>Transferred to an authorized disposal facility onshore by a certified transporter.</li> <li>Prohibit any discharge of hazardous waste into the sea.</li> </ul> <p><b>Non-hazardous waste</b></p> <ul style="list-style-type: none"> <li>Segregate non-hazardous waste, including food waste, paper, aluminum can, glass, rag and other wastes in separate containers or proper areas.</li> <li>Waste storage areas shall be clearly defined.</li> <li>Food wastes will be ground to 25 mm prior to discharge to sea. All non-food wastes will be collected for compaction and transport to shore for landfill or acceptable disposal.</li> <li>Dispose non-hazardous waste at onshore treatment facilities in accordance with the law of Myanmar and PTTEPI's Waste Management Plan.</li> <li>Transported to the onshore bases for collection and recycling by an authorized waste management contractor.</li> <li>Keep the record of waste inventories, including type and quantities updated.</li> </ul>		<ul style="list-style-type: none"> <li>See mitigation measures.</li> </ul>			
3-	Seabed characteristics	The pattern of seafloor sediment topography could be affected by discharge of drilling mud and cuttings.	<ul style="list-style-type: none"> <li>Implement all mitigation measures in Item 2.</li> </ul>	NEGLIGIBLE	All project vessels Drilling rig	Drilling phase	PTTEPI / Contractor



Aspects	Potential impacts	Mitigation measures	Significance of Residual Impact	Specific action	Location	Duration	Responsibility
4- Marine life and marine ecology	Offshore activities may disturb marine species.	<ul style="list-style-type: none"> <li>Implement all mitigation measures for Item 2.</li> </ul>	MINOR	<ul style="list-style-type: none"> <li>Implement all mitigation measures for Item 2.</li> </ul>			PTTEPI / Contractor
	Drilling discharge may cause an impact on seawater and sediments, which may indirectly affect the community of marine biota at the surface level and the seabed.						
<b>Social mitigation measures</b>							
5- Fishing communities and fisheries	Reduced fishing area due to the presence of drilling rig and vessels, and 500 m exclusion zones.	<ul style="list-style-type: none"> <li>Before drilling starts, PTTEPI will coordinate with MOGE, who will then communicate to issue "Notice to Mariner" regarding project activities to concerned parties (i.e. Department of Fisheries, Ministry of Livestock, Fisheries and Rural Development, Myanmar Navy, and Myanmar Fisheries Federation).</li> <li>An exclusion zone (radius of 500 m) will be established surrounding the drilling rig.</li> <li>Use support vessels to warn off traffic.</li> <li>Provide appropriate lights and warning signals at offshore facilities to prevent accidental collision.</li> </ul>	MINOR	<ul style="list-style-type: none"> <li>At least 30 days prior to rig transport and installation, coordinate with MOGE, who will issue "Notice to Mariner" regarding project activities.</li> <li>Established 500 m safety zone around the drilling rig.</li> <li>Use support vessels to warn off traffic.</li> <li>Provide appropriate light and warning signals at offshore facilities.</li> </ul>	All project vessels Drilling rig	Drilling phase	PTTEPI / Contractor
	The quantity and quality of aquatic biota may decrease due to waste contamination in the sea. Contaminants may consist of non-hazardous and hazardous waste and mud and cuttings from drilling activities.	<ul style="list-style-type: none"> <li>Implement all mitigation measures for Item 2 and 3 above.</li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>Provide appropriate light and warning signals at offshore facilities.</li> </ul>	All project vessels Drilling rig		PTTEPI / Contractor
6- Shipping and navigation	Marine vessels may obstruct marine navigation during transporting the rig and equipment from onshore.	<ul style="list-style-type: none"> <li>Before drilling starts, PTTEPI will coordinate with MOGE, who will then communicate to issue "Notice to Mariner" regarding project activities to concerned parties (i.e. Department of Fisheries, Ministry of Livestock, Fisheries and Rural Development, Myanmar Navy, and Myanmar Fisheries Federation).</li> <li>Use support vessels to warn off traffic.</li> <li>Provide appropriate lights and warning signals at</li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>See mitigation measures</li> </ul>	All project vessels Drilling rig	Drilling phase	PTTEPI / Contractor
	The presence of the offshore facilities may obstruct navigation.						

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impact	Specific action	Location	Duration	Responsibility
		offshore facilities to prevent accidental collision. <ul style="list-style-type: none"> <li>An exclusion zone (radius of 500 m) will be established surrounding the drilling rig.</li> </ul>					
7- Socio-economy	Increase in industrial expenditure and income (positive impact)	<ul style="list-style-type: none"> <li>Enhance utilization of local goods and services as much as possible.</li> </ul>	POSITIVE Impact	<ul style="list-style-type: none"> <li>Utilize local goods and services as much as possible.</li> </ul>	Onshore bases		PTTEPI / Contractor
<b>Health mitigation measures</b>							
8- Occupational health and safety	Injuries or illness due to exposure to harmful substances or accident	Implement relevant components of PTTEPI's SSHE Management System, including the following: <ul style="list-style-type: none"> <li>Implement PTTEPI's Occupational Health Management Standard.</li> <li>Personnel will be trained with the safe handling of the chemicals</li> <li>Personnel will be provided with the necessary personnel protective safety equipment.</li> <li>Personnel will be provided with safety training to ensure that all workers practice under safety operation and regulation of work, as per PTTEPI's SSHE Training &amp; Competency Standard.</li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>See mitigation measures</li> </ul>	All project vessels Drilling rig Onshore bases	Drilling phase	PTTEPI / Contractor
		<ul style="list-style-type: none"> <li>Cooperate with the nearest health center/hospital in order to immediately support response to emergency events, as per PTTEPI's MERP. Duty Manager and Emergency Management Team for Medevac response or Medical Referral in case of emergency events.</li> </ul>					
	Implement following operational measures for prevention and control of accidents: <ul style="list-style-type: none"> <li>Safety Data Sheets must be provided with every chemical product for safety and the environment.</li> <li>Adequate storage will be provided for each chemical in accordance with safety instruction (storage conditions, etc.).</li> <li>Provide spill kits on-site.</li> <li>Provide first aid kits on-site</li> <li>Provide proper sanitary systems, including drinking water, potable water, toilet and waste management.</li> </ul>						
	Injuries due to working in noisy areas.	<ul style="list-style-type: none"> <li>Maintaining generators and compressors in good working order.</li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>See mitigation measures</li> </ul>	All project vessels	Preparation and installation phase	PTTEPI / Contractor

**Offshore M9 East Appraisal/Exploration Drilling**

Report

**ENVIRONMENTAL IMPACT ASSESSMENT**

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impact	Specific action	Location	Duration	Responsibility
		<ul style="list-style-type: none"> <li>Provide personal protection equipment (ear plug for instance) to workers working on high level noise activities.</li> </ul>			Drilling rig		
9- Public health and Health service	Project activities could involve general public around shore bases that will be used for staff, materials and waste transportation.	<ul style="list-style-type: none"> <li>Implement PTTEPI's Occupational Health Management Standard. <b>(Error! Reference source not found.)</b></li> </ul>					
	In case of accident or illness during project activities, it may be required to use healthcare services around the shore bases.	<ul style="list-style-type: none"> <li>Cooperate with the nearest health center/hospital in order to immediately support response to emergency events, as per PTTEPI's MERP. Duty Manager and Emergency Management Team for Medevac response or Medical Referral in case of emergency events.</li> </ul>				Shore bases	

Tabl. 65 - Mitigation measures for project during the P&amp;A (Plug and Abandon) and Demobilization

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impact	Specific action	Location	Duration	Responsibility
<b>Environmental mitigation measures</b>							
1- Air quality / GHG emissions	Air emissions from combustion due to operation of machines and engines installed on support and supply vessels.	<ul style="list-style-type: none"> <li>Regular maintenance of marine engines, generators and compressor.</li> <li>Compliance with MARPOL 73/78 Annex VI – prevention of air pollution from ships, and if applicable based on age of vessels (MARPOL Annex VI Chapter 4 – ship energy efficiency management)</li> <li>To warn vessels of any delays in required times of arrival so that they may reduce speed accordingly for energy efficiency if possible</li> </ul>	NELIGIBLE	<ul style="list-style-type: none"> <li>Regular maintenance of marine engines, generators and compressor.</li> </ul>	All project vessels	Demobilization of the equipment	PTTEPI/Contractor
2- Marine life and marine ecology	Offshore activities may disturb marine mammals.	<ul style="list-style-type: none"> <li>Regular maintenance of marine engines, generators and compressor.</li> <li>Vessels to use slow speed and adapt the routes to avoid sensitive areas to marine mammals</li> <li>Adoption of passive acoustic monitoring system to observe the presence of marine mammals</li> </ul>	MINOR to NEGLIGIBLE	<ul style="list-style-type: none"> <li>Generalisation of the vessel dynamic positioning devices for drilling.</li> <li>At least 30 days prior to rig transport and installation, coordinate with MOGE, who will issue “Notice to Mariner” regarding project activities.</li> <li>Conduct seafloor surveys, prior to installation rig.</li> </ul>	All project vessels.		PTTEPI / Contractor
	Waste, wastewater and discharges from drilling rig and vessels may cause an impact on seawater and sediments, which may indirectly affect the community of marine biota at the surface level and the seabed.	<ul style="list-style-type: none"> <li>Implement all mitigation measures for Item 2 and 3.</li> </ul>					
<b>Social mitigation measures</b>							
3- Fishing communities and fisheries	Reduced fishing area due to the presence of drilling rig and vessels, and 500 m exclusion zones.	<ul style="list-style-type: none"> <li>An exclusion zone (radius of 500 m) will be established surrounding the drilling rig.</li> <li>Use support vessels to warn off traffic.</li> <li>Provide appropriate lights and warning signals at offshore facilities to prevent accidental collision.</li> </ul>	MINOR	<ul style="list-style-type: none"> <li>At least 30 days prior to rig transport and installation, coordinate with MOGE, who will</li> </ul>	All project vessels Drilling rig	Demobilization of the equipment	PTTEPI / Contractor PTTEPI / Contractor

**Offshore M9 East Appraisal/Exploration Drilling**

Report

**ENVIRONMENTAL IMPACT ASSESSMENT**

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impact	Specific action	Location	Duration	Responsibility
				issue "Notice to Mariner" regarding project activities. <ul style="list-style-type: none"> <li>Established 500 m safety zone around the drilling rig.</li> <li>Use support vessels to warn off traffic.</li> <li>Provide appropriate light and warning signals at offshore facilities.</li> </ul>			
	The quantity and quality of aquatic biota may decrease due to waste contamination in the sea. Contaminants may consist of non-hazardous and hazardous waste and mud and cuttings from drilling activities.	<ul style="list-style-type: none"> <li>Implement all mitigation measures for Item 2 and 3 above.</li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>Implement all mitigation measures for Item 2 and 3 above</li> </ul>	All project vessels Drilling rig		PTTEPI / Contractor
4- Shipping and navigation	Marine vessels may obstruct marine navigation during transporting the rig and equipment from the drilling site to the next Project's proposed drilling position.	<ul style="list-style-type: none"> <li>Use support vessels to warn off traffic.</li> <li>Provide appropriate lights and warning signals at offshore facilities to prevent accidental collision.</li> <li>An exclusion zone (radius of 500 m) will be established surrounding the drilling rig.</li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>At least 30 days prior to rig transport and installation, coordinate with MOGE, who will issue "Notice to Mariner" regarding project activities.</li> <li>Established 500 m safety zone around the drilling rig.</li> <li>Use support vessels to warn off traffic.</li> </ul>	All project vessels Drilling rig	Demobilization of the equipment	PTTEPI / Contractor

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impact	Specific action	Location	Duration	Responsibility
				<ul style="list-style-type: none"> <li>Provide appropriate light and warning signals at offshore facilities.</li> </ul>			
<b>Health mitigation measures</b>							
5- Occupational health and safety	Injuries or illness due to exposure to harmful substances or accident	Implement relevant components of PTTEPI's SSHE Management System, including the following: <ul style="list-style-type: none"> <li>Implement PTTEPI's Occupational Health Management Standard.</li> <li>Ensure that all employees wear appropriate equipment, and implement PTTEPI's Personal Protective Equipment Standard.</li> <li>Personnel will be provided with safety training to ensure that all workers practice under safety operation and regulation of work, as per PTTEPI's SSHE Training &amp; Competency Standard.</li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>See mitigation measures</li> </ul>	All project vessels Drilling rig Onshore bases	Demobilization of the equipment	PTTEPI / Contractor
		<ul style="list-style-type: none"> <li>Cooperate with the nearest health center/hospital in order to immediately support response to emergency events, as per PTTEPI's MERP. Duty Manager and Emergency Management Team for Medevac response or Medical Referral in case of emergency events.</li> </ul>					
		Implement following operational measures for prevention and control of accidents: <ul style="list-style-type: none"> <li>Safety Data Sheets must be provided with every chemical product for safety and the environment.</li> <li>Adequate storage will be provided for each chemical in accordance with safety instruction (storage conditions, etc.).</li> <li>Provide spill kits on-site.</li> <li>Provide first aid kits and first aid rooms</li> <li>Provide proper sanitary systems, including drinking water, potable water, toilet and waste management.</li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>See mitigation measures</li> </ul>			

**Offshore M9 East Appraisal/Exploration Drilling**

Report

**ENVIRONMENTAL IMPACT ASSESSMENT**

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impact	Specific action	Location	Duration	Responsibility
	Injuries due to working in noisy areas.	<ul style="list-style-type: none"> <li>Regular maintenance of marine engines, generators and compressor.</li> <li>Provide personal protection equipment (ear plug for instance) to workers working on high level noise activities.</li> </ul>			All project vessels Drilling rig		PTTEPI / Contractor
6- Public health and Health service	Project activities could involve general public around shore bases that will be used for staff, materials and waste transportation.	<ul style="list-style-type: none"> <li>Implement PTTEPI's Occupational Health Management Standard. <b>(Error! Reference source not found.)</b></li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>See mitigation measures.</li> </ul>	Shore bases	Demobilization of the equipment P&A	PTTEPI
	In case of accident or illness during project activities, it may be required to use healthcare services around the shore bases.	<ul style="list-style-type: none"> <li>Cooperate with the nearest health center/hospital in order to immediately support response to emergency events, as per PTTEPI's MERP. Duty Manager and Emergency Management Team for Medevac response or Medical Referral in case of emergency events.</li> </ul>					

**Tabl. 66 - Mitigation measures for unplanned events**

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impact	Specific action	Location	Duration	Responsibility
1- Vessel collision	Collision could potentially occur during transport of material and rig tow-out.	<ul style="list-style-type: none"> <li>Emergency Response Plan</li> </ul>	MINOR	<ul style="list-style-type: none"> <li>In case of vessel collision, follow PTTEPI's Emergency and Crisis Management Plan including procedures in the event of an accidental vessel collision.</li> </ul>	All project vessels	Entire appraisal activities	PTTEPI / Contractor via EMP
2- Spills	Accidental spills of drilling fluids, chemicals, or diesel fuel could occur throughout all project phases, and may directly affect surface water quality and indirectly affect	<ul style="list-style-type: none"> <li>Emergency Response Plan</li> <li>Oil Spill Contingency Plan shall be implemented and updated.</li> <li>Perform current monitoring and incorporate data into oil spill contingency plan</li> </ul>	NEGLIGIBLE	<ul style="list-style-type: none"> <li>Implement PTTEPI's Emergency and Crisis Management Plan (in case of oil or</li> </ul>	All project vessels Drilling rig		

Aspects	Potential impacts	Mitigation measures	Significance of Residual Impact	Specific action	Location	Duration	Responsibility
	sediment quality and marine ecology.	<ul style="list-style-type: none"> <li>● Blowout preventer</li> <li>● Requirements to have a Shipboard Oil Pollution Plan (SOPEP) in compliance with MARPOL 73/78.</li> <li>● On-board anti-pollution equipment.</li> <li>● On-going maintenance program to ensure equipment is in good working order.</li> <li>● Risk assessment prior to maintenance works or lifting operations.</li> <li>● Training of personnel.</li> </ul>		chemical spills). <ul style="list-style-type: none"> <li>● Impelment PTTEPI Spill Contingency Plan.</li> <li>● Implement PTTEPI SSHE Training &amp; Competency Standard.</li> <li>● Implement PTTEPI Incident Maangement Standard.</li> <li>● Implement PTTEPI Waste Management Plan.</li> </ul>			
3- Well blowout	A blowout can result in the release of hydrocarbons into the sea and surrounding environment at high pressure, potentially impacting seawater/sediment quality, marine life and marine ecology, occupational health and safety and public health.		MAJOR	<ul style="list-style-type: none"> <li>● Implement PTTEPI's Blowout Contingency Plan.</li> <li>● In case of oil or chemical spills, follow PTTEPI's Emergency and Crisis Management Plan.</li> <li>● Implement PTTEPI's Spill Contingency Plan.</li> <li>● Implement PTTEPI's SSHE Requirement for Contractor.</li> <li>● Implement PTTEPI's Incident Management</li> </ul>			



Aspects	Potential impacts	Mitigation measures	Significance of Residual Impact	Specific action	Location	Duration	Responsibility
				procedure. <ul style="list-style-type: none"> <li>• Install blowout preventer and shear ram appropriately</li> </ul>			
4- Tropical cyclone	Potential threat to the safety of offshore personnel and could result in multiple facilities and damage to assets.	<ul style="list-style-type: none"> <li>• Training of personnel.</li> </ul>	MODERATE	<ul style="list-style-type: none"> <li>• Implement PTTEPI SSHE Training &amp; Competency Standard.</li> <li>• Implement PTTEPI's Tropical Revolving Storm Procedure and Emergency and Crisis Management Plan.</li> </ul>			
5- Fire or explosion	Fire or explosion could potentially impact air quality, health and safety concerns to PTTEPI's employees and contractors, and damages structures.	<ul style="list-style-type: none"> <li>• High integrity design safety system</li> <li>• Conduct regular inspections and drills for fire protection equipment</li> <li>• Provide fire protection equipment, including fire extinguishers and alarms, on all offshore facilities.</li> <li>• Emergency Response Plan and Crisis Management Plan.</li> </ul>	MODERATE	<ul style="list-style-type: none"> <li>• Provide fire protection equipment on all offshore facilities.</li> <li>• Conduct regular inspection and drills for fire protection equipment.</li> <li>• Implement Emergency and Crisis Management Plan;</li> </ul>			

## 9. PUBLIC CONSULTATION AND DISCLOSURE

*This chapter gives a report on the approach of the information and consultation process of the authorities and the public during the performance of the EIA. Comments, opinions and suggestions from public consultations, which were performed during the EIA, are summarized in the following paragraphs.*

### 9.1. OBJECTIVES

This environmental impact assessment study was conducted in compliance with the Myanmar law and with the international best practices recognized in the field of information and consultation of stakeholders. The consultation and participation of stakeholders are a fundamental phase in the EIA and the Block M9 appraisal drilling project. It is understood that the consultation process will continue throughout the project cycle: the iterative nature of the consultation process is essential.

The fundamental principles applied in accordance with the international best practices are:

- **Implement the processes of consultation at an early stage of the project** in order to identify potential problems and to adapt decisions related to the project.
- **Provide practical and accessible information to all stakeholders**, so that they could form an objective judgment about positive and negative potential impacts that the drilling project could have on their livings. We remind that the drilling project on Block M9 is located more than 170 km from the coast.
- **Involve an inclusive and two-way process**: identified stakeholders include all persons, groups or organization potentially affected.
- **Select an appropriate culturally acceptable mode of consultation**: taking into account the local context sensitivity.
- **Ensure a transparent process** and free from manipulation process, interference, coercion and intimidation.

Therefore, the consultation with stakeholders was organized in the objectives to:

- **Provide information** to stakeholders on the progress of the project, its location, schedule and technical specifications;
- **Draw up an initial inventory** of the institutional, social, economic, security and cultural in which the project will be implanted;
- **Identify** the perceptions, concerns, questions and expectations of different stakeholders;
- **Prepare**, in consultation with representatives of concerned communities, the outline of the contribution of PTTEPI to local development.
- **Anticipate the socio-environmental problems** that could result during the future exploration drilling project.

All stakeholders' points of view are considered in the EIA, especially with respect to the estimation of potential impacts, the development of mitigation measures and support measures for the project.

## 9.2. METHODOLOGY AND APPROACH OF CONSULTATION PROCESS

### 9.2.1. Regulatory Framework

According to the EIA procedure, the public consultation meetings are planned separately at two stages (scoping and EIA investigation) in order to collect the concerns, expectations and suggestions of stakeholders on the project. The consultation process in EIA procedure are as follow:

**EIA procedures (2015), article 50.** As part of the Scoping, the project proponent shall ensure that the following public consultation and participation process is carried out:

- a) disclose information about the proposed project to the public and civil society through posting on the project or project proponent's website(s) and local media, including by means of the prominent posting of legible sign boards and advertising boards at the Project site which are visible to the public; and
- b) arrange the required complement of consultation meetings as advised by the Ministry, with local communities, potential PAPs, local authorities, community based organizations, and civil society, and provide appropriate and timely explanations in press conferences and media interviews.

**EIA procedures (2015), article 61.** As part of the EIA investigations, the project proponent shall undertake the following consultation process:

- a) timely disclosure of all relevant information about the proposed project and its likely Adverse Impacts to the public and civil society through local and national media, the website(s) of the project or project proponent, at public places such as libraries and community halls, and on sign boards at the project site visible to the public, and provide appropriate and timely explanations in press conferences and media interviews;
- b) arrange consultation meetings at national, regional, state, Nay Pyi Taw Union Territory and local levels, with PAPs, authorities, community based organizations and civil society;
- c) consultations with concerned government organizations including the Ministry, the concerned sector ministry, regional government authorities and others; and
- d) field visits for the Ministry and concerned government organizations.

### 9.2.2. Approach of Consultation Process

At this stage, the target groups are the fishery groups and communities along the shoreline of the Tanintharyi region. Considering the project location, the cities of Dawei, Yephyu and Myeik shall be considered as the main target of the public consultation. This point was discussed with the project proponent during EIA.

The following stakeholders have to be part of the consultation process:

- Government Authorities (DOF, ECD, MPA, etc.)
- Potentially Affected People or stakeholders living close to project area (residents, fishermen, etc.)
- Local communities
- Civil society (NGOs, media, etc.)
- Business Association (MFF, companies, professional organizations, etc.).

Stakeholder consultations will focus on

- Disclosing information about the project to the public, introducing the project owner, presenting the EIA process and the main impacts of the project.
- Collecting information on the stakeholders' perception of the project, their question and concerns towards it as well as their expectations, whether in terms of impact management, dialog and communication, economic benefit (job creation, local content) or local development projects.... bearing in mind the low effect of offshore facilities on the local communities.
- Collecting data about the local Environmental & Social context

### 9.2.3. Stakeholder Identification

The first step in establishing a dialogue is identifying the project stakeholders. Stakeholders are persons or groups who are directly or indirectly affected by a project, and those who may have interests in and/or the ability to influence a project's outcomes (either positively or negatively).

The marine space off Myanmar coast has long been the preferred area of oil and gas companies. However, the government wishes to diversify its economy particularly through the development of the fishery industry. With several port upgrades and new infrastructure developments, it also aims at increasing its commercial exchanges with foreign countries using marine transportation means. Accordingly, the use of marine space by multiple actors is bound to increase, along with pressures on the marine ecosystems and on the individuals and companies that benefit from its resources or are engaged in its protection.

A comprehensive identification of stakeholders will allow to build an efficient stakeholder engagement plan which will indeed identify the right audience for the public consultations that will aim at gathering stakeholders' perception on the impacts identified and the mitigation measures prepared in this report.

The stakeholders mapping can be described as

- Public Authorities
  - Ministries:
    - **Ministry of Natural Resources and Environmental Conservation (MONREC):** MONREC is in charge of developing the country environmental policy, in particular in the fields of water and marine resources conservation. It is also responsible for introducing a new environmental permitting system, which is in process of implementation.
 

**Environmental Conservation Department (ECD) of Ministry of Natural Resources and Environmental Conservation (MONREC):** the ECD of MONREC has ultimate responsibility in the review and approval, or otherwise, of submissions under the IEE/EIA process.
    - **Ministry of Livestock, Fisheries and Rural Development (MLFRD):** MLFRD is in charge of developing, implementing and monitoring the country policies in the field of livestock, fishery and rural development, to ensure food security is achieved in the country, and prevent infectious diseases development that could endanger the national production.
      - Department of Fisheries (DoF): Under the MLFRD, the DoF main mission is to guarantee the preservation of fish resources in order to ensure the sustainability of the fishery sector. The DoF develops conservation efforts, promotes research and surveys on the current condition of marine resources in partnership with intergovernmental agencies, maintains statistics on fisheries, and supervises the fishery sector through the delivery of licenses to fishing vessels.

- DoF has regional offices at the township level: these offices are responsible for handling the licensing system and taxes collection at the local level.
- **Ministry of Transport (MOT):** MOT is responsible for the organization of the country's transport infrastructures, from air to marine transportation.
 

**Myanmar Port Authority (MPA):** MPA is a government agency under the Ministry of Transport, founded in 1989 and located in Yangon. It is responsible for the regulation and administration of 8 coastal ports. It is also in charge of developing and improving the port infrastructures, notably through the development of Special Economic Zones and their associated ports.
- **Department of Marine Administration (DMA):** DMA is placed under the management of the Ministry of Transport. It is responsible for marine traffic safety (conformity of ships to national safety standards, improvement of rescue operations at sea) and human resources development in the maritime sector. It is in charge of the offshore fishing vessels inspection to determine if they meet safety standards, prior to the delivery of fishing licenses by the DoF.
- **Myanma Oil and Gas Enterprise (MOGE):** MOGE is a Myanmar oil and gas state-owned enterprise responsible to work closely with oil and gas companies (local and international) in Myanmar and oversees the PSCs in cooperation with foreign oil companies. MOGE involves in direct communication and coordination with various levels of different government agencies for SSHE related issues.
- **Department of Marine Science – Myeik University**
  - Regional Authorities: The Chief Minister; district and township administrators represent the highest levels of authority in the region of Tanintharyi.
  - Municipal Authorities: government authorities at town and village level.
- Business Association
  - **Myanmar Fisheries Federation:** Non-profit association founded in 1989 with the objective to encourage and promote fishing and fishery industries of Myanmar, through cooperation, training and knowledge sharing with other actors of the national fishery sector. The MFF counts 9 functional associations, and 13 regional fisheries associations under its umbrella. It has an important role in advocacy and opinion-making by regularly intervening in Myanmar media on issues of overfishing and depletion of the country marine resources.
- National Non-Governmental Organizations (NGOs): The economic strategy implemented by the government has succeeded in attracting international investors interests in various business sectors. Industrial developments are significant but increasingly threatening ecosystems. To face these new environmental challenges, several national NGOs have been created over the last years to preserve and protect the wide range of Myanmar natural ecosystems. Ex: WWF.
- Media

### 9.3. SUMMARY OF PUBLIC CONSULTATIONS

Public consultation is an important aspect of the impact assessment process. As part of the impact assessment study, PTTEPI has engaged with a number of stakeholders at the region and township level during consultations as per Myanmar EIA Procedure.

PTTEPI initially engaged with various local authorities, including GAD and Chief Minister of Tanintharyi Region. Based on these discussions, Tanintharyi Region and Yangon Region were found to be the most relevant administrative locations in terms of potential impacts from the project (in particular fisheries, since most of the fisherman in Block M9 are likely to be from Tanintharyi Region).

Two rounds of public consultation meetings were held with various relevant stakeholders at the regional level in Yangon Region (with the Myanmar Fisheries Federation) and Tanintharyi Region (in Dawei, Ye Phyu and Myeik). The first round of consultations took place between July and August of 2017, and the second round took place in October 2017.

#### **9.4. LOCATION AND PERIOD OF PUBLIC CONSULTATION (INCLUDING COURTESY VISIT)**

Prior to any public consultation meeting, PTTEPI organized a courtesy visit with the Chief Minister of Tanintharyi Region on 21st August 2017 at Tanintharyi Regional Government Office, approximately 10 attendees joined. The objectives are to introduce the project activities and to request the permit to engage with the local authorities, NGOs and villagers within the boundaries of Tanintharyi Region. Based on discussion with Chief Minister, the most relevant areas in which to conduct public consultation were determined to be located in Dawei, Yebyu and Myeik (in Tanintharyi Region) and Myanmar Fisheries Federation (MFF) in Yangon.

Meetings were conducted in the form of individual meetings with a power point presentation of the project, in order to conduct semi-structured type interviews (see pictures below). Stakeholders meeting summary is presented in Tabl. 1 - Stakeholders meetings summary.



**Fig. 55.** Courtesy visit meeting

**Tabl. 1 - Stakeholders meetings summary**

<b>Preliminary Stakeholders Consultation Meetings</b>	
<b>Public Meetings</b>	
Myanmar Fisheries Federation (Yangon) on 25 <sup>th</sup> of July 2017	MFF head office, Yangon
Dawei Township (Tanintharyi Region) on 23 <sup>rd</sup> of August 2017.	Meeting Hall, Hotel Zayar Htet San, Dawei
Yebyu Township (Tanintharyi Region) on 24 <sup>th</sup> of August 2017.	Meeting Hall, Township Administrative Office Hall, Yebyu
Myeik Township (Tanintharyi Region) on 29 <sup>th</sup> of August 2017.	Pearl Yanadar City Hall, Myeik
<b>Individual Meetings</b>	
Individual Meeting with Department of Fisheries on 22 <sup>nd</sup> of August 2017	Department of Fisheries' office, Dawei
Individual Meeting with Department of Fisheries in Myeik on 26 <sup>th</sup> of August 2017	Department of Fisheries' office, Myeik
Individual Meeting with Environmental Conservation Department in the Dawei on 22 <sup>nd</sup> of August 2017.	Environmental Conservation Department's office, Dawei
Individual Meeting with Department of Marine Science of the University of Myeik on 29 <sup>th</sup> of August 2017.	Department of Marine Science's office, Myeik University, Myeik
Individual Meeting with Department of Marine Administration in Dawei on the 23 <sup>rd</sup> of August 2017	Department of Marine Administration's office, Dawei
<b>Second stage of Stakeholders Consultation Meetings</b>	
<b>Public Meetings</b>	
Myanmar Fisheries Federation (Yangon) on 24 <sup>th</sup> of October 2017	MFF head office, Yangon
Dawei Township (Tanintharyi Region) on 26 <sup>th</sup> of October 2017.	Meeting Hall, Hotel Zayar Htet San, Dawei
Yebyu Township (Tanintharyi Region) on 27 <sup>th</sup> of October 2017.	Meeting Hall, Township Administrative Office Hall, Yebyu
Myeik Township (Tanintharyi Region) on 30 <sup>th</sup> of October 2017.	Myanmar Fisheries Federation Meeting Hall, Myeik

## 9.5. PRELIMINARY CONSULTATIONS

The consultations were carried out in a public manner (in the areas covered by the project). The group, which were consulted, were free to express their concerns, expectations, suggestions and questions at consultation meetings between the 22<sup>nd</sup> of July to 29<sup>th</sup> of August 2017.

### 9.5.1. Summary of Consultations and Activities Undertaken

Regarding to the instruction from Tanintharyi regional authorities and Chief Minister, PTTEPI conducted both individual and public consultation meetings at Yangon, Dawei, Yebyu and Myeik townships.

The following summarized outlines are the main discussed topics during the scoping stage public consultation. The stakeholders concern about the benefits for the region, CSR plans and impacts on marine environments, in relation to the appraisal drilling project. Despite the detail Q&A section is described in following chapter, the main discussions from stakeholders are summarized as below:

- Location of the project and its distance from shoreline and nearest protected areas
- Coincident with the project commencement date and the fishing season
- Range of restrict area
- The plans for oil spill and unplanned event
- Disposal site of waste, discharge and drilling cuttings
- Monitoring actions by the government authorities (MOGE)
- Suggestion to rehabilitate the fish species and conserve the corals as a part of PTTEPI's CSR plan
- To organize more public consultation meetings with fishermen who are likely to be impacted by the project activities
- Effective coordination with fishery association
- Plans for regional development and power supply for domestic use

### 9.5.2. Public Meetings

The schedule and location of public consultations meetings are presented in the table below

INFORMATION
<ul style="list-style-type: none"> <li>● Myanmar Fisheries Federation of Yangon on the 25<sup>th</sup> of July 2017 (10:00 am to 11:00am)</li> <li>● Dawei Township (Tanintharyi Region) on the 23<sup>rd</sup> of August 2017 (1:30pm to 4:00pm)</li> <li>● Yebyu Township (Tanintharyi Region) on the 24<sup>th</sup> of August 2017 (9:00am to 11:00am)</li> <li>● Myeik Township (Tanintharyi Region) on the 29<sup>th</sup> of August 2017 (10:00am to 12:00pm)</li> <li>● Individual meetings with different departments in Dawei and Myeik were realized between the 22<sup>nd</sup> and 29<sup>th</sup> of August.</li> </ul>

(The attendant list for all public consultation meeting is provided in the **Error! Reference source not found.** of this EIA report.)



### 9.5.2.1. CONSULTATION WITH THE MYANMAR FISHERIES FEDERATION

The Myanmar Fisheries Federation were consulted on the 25<sup>th</sup> of July 2017 from 10:00am to 11:00am. The meeting's agenda included:

- Announcement of ceremony opening
- Introducing with PTTEPI staffs
- Greeting message of U Naing Win Aung, the representative of Myanma Oil & Gas Enterprise
- Explanation and presentation about PTTEPI Company by U Khin Maung Gyi, advisor of PTTEPI
- Explanation and presentation of oil and gas drilling process by U Wunna Win, drilling engineer from PTTEPI
- Explanation and presentation of environmental impact assessment process by Daw Shwunn Lak Yadanar Soe, environmental engineer from Artelia Myanmar
- Questions and answers between guests and respective speakers
- Announcement of ceremony closing

#### 9.5.2.1.1. Discussion

The Public Consultation at Myanmar Fisheries Federation (Yangon) was opened with the PTTEPI presentation and Q&A section is presented as below.

- Project-Related Questions:

*Q: Commencement Date of Project*

A: M9 Drilling Campaign will begin on 2<sup>nd</sup> quarter of 2018 and M11 Drilling Campaign will begin on 4<sup>th</sup> quarter of 2018.

*Q: Suggest to have transparency through the project process.*

*Advice to meet with local people and fishermen and disclose the information of PTTEPI drilling campaign*

A: Suggestion is noted and PTTEPI is trying to meet with Tanintharyi Chief Minister, other regional fisheries associations and fisheries workers and follow by public consultations in respective townships.

*Q: The project is located in Tanintharyi offshore region and will encounter different marine species. Hence, suggest taking into account all marine species that may be impacted by the oil and gas exploration.*

A: Noted well.

*Q: Must consider the aquatic resources and its ecosystem. Advice to raise a methodology that can help to protect the resources and ecosystem. And then, forward the information to all respective parties,*

A: Advice is noted and the mitigation measure will be developed to prevent the potential impacts to aquatic resources.

*Q: During Seismic Survey, might have various impacts on some fish species.*

*In operation period, it is difficult to prohibit fishing vessels from entering the project area, as a solution, the visual boundaries should be placed around the area and should also be informed to fishery companies.*

*Moreover, advice to have good coordination and flexibility between fishery and oil and gas business as both of them generate nation income.*

A: Agree on that both businesses generate nation income and should have flexibility.

The project information is normally disclosed through the Department of Fisheries. Before Seismic Survey, one-month advance notice is usually forwarded to Department of Fisheries.

Delivering the project information by newspaper and radio channel are used but it is sometime difficult to reach to the fishermen as in case of network connection.

However, project information is delivered in details by describing latitude and longitude of drilling campaign.

This concern will also be reported to all respective officers.

*Q: MFF questioned about ARTELIA's EIA references in Myanmar and where to ascertain them.*

A: ARTELIA has already performed many IEEs and EIAs for offshore Oil & Gas projects in Myanmar, for multiple project proponents: TOTAL E&P Myanmar, OPHIR, CFG Energy - The environmental studies that have been performed are usually available on these Oil & Gas Companies' websites.

For Zawtika Phase IC and 1D development Project, report is available on PTTEP's website and a hardcopy has been submitted to the MFF. For M9 and M11 Drilling Campaign, the EIA reports will be submitted to the MFF after all the studies are finished.

#### 9.5.2.1.2. Event Photos



**Fig. 56.** Consultations meeting at MFF

### 9.5.2.2. CONSULTATION MEETING IN DAWEI

A public consultation was held in Dawei on the 23<sup>rd</sup> of August 2017 from 1:30pm to 4:00pm. The meeting's agenda included:

- Announcement of ceremony opening
- Introducing with PTTEPI staffs
- Greeting message of U Nay Aung, the representative of Myanmar Oil & Gas Enterprise
- Explanation and presentation about PTTEPI Company by U Khin Maung Gyi, advisor of PTTEPI
- Explanation and presentation of oil and gas drilling process by U Wunna Win, drilling engineer from PTTEPI
- Displaying recorded video of PTTEPI's oil & gas exploration and production process
- Explanation and presentation of environmental impact assessment process by Daw Shwunn Lak Yadanar Soe, environmental engineer from Artelia Myanmar
- Questions and answers between guests and respective speakers
- Announcement of ceremony closing

#### 9.5.2.2.1. Discussion

The following points were discussed:

- Project-Related Questions:

*Q: Does PTTEPI have plan to organize more public consultations for local villagers (including fishermen) in affected area?*

A: *PTTEP:* There will be no effects for nearshore fishermen because offshore project area is too far away (250km) from shore. That's why we are organizing public consultation in Township level and invite more relevant stakeholders Department of Fisheries and Fisheries Federation who normally know more about offshore area we already had individual meetings with Myanmar Fisheries Federation and Department of Fisheries in Yangon.

*Q: Is inland pipeline transferring process is included in this stage? Is Yebyu the base station for gas transfer? Are environmental impact issues of villages across which gas pipe line being transferred included in first stage or in second project?*

A: *PTTEP:* Production, offshore and onshore pipelines are all included in the existing Zawtika project. ZOC is the transfer station in Kanbauk where gas pipe lines are transferred for domestic use and to Thailand. PTTEP will use existing onshore facilities for this project.

*Q: Can public know about the result of EIA?*

A: *PTTEP:* The result of EIA will be disclosed and discussed at the next public consultation that will be held tentatively in mid-October. And it will be available at PTTEPI website and township administrative office. Public opinion will be then included in EIA report.

*Q: Will PTTEPI produce EIA, SIA and environmental management report for all the projects as required by the law? Will PTTEPI take needed time to produce proper EIA and SIA reports and will PTTEPI stop all the operation until PTTEPI has done what's required by the law? What will PTTEPI do and what proactive measure will PTTEPI take to institute some kinds of operational grievance mechanism within the company?*

A: *PTTEP:* These reports will be disclosed in the PTTEP website, newspapers and at the township administrative office.

*Q: What is the range of restricted area of project? Can fishermen enter to this area? How long it will take?*

A: *PTTEP:* Exclusion zone 500m will be announced and fishing vessel and commercial vessel not allowed to enter during operation period that will normally takes 1 month to 2 months for one well Drilling.

PTTEP will communicate with MOGE to announce mariners notice for exclusion zone around 1 month ahead.

*Q: Why doesn't PTTEP have plan to arrange public consultation with fishermen?*

A: *PTTEP:* As mentioned earlier, this public consultation is just for drilling process and it won't make any impact on nearshore local fishermen group. However we invite nearshore local fishermen to this event for sharing information and we will do so for future projects.

*Q: Is onshore transferred pipe line is new one or existing one? If new one, does PTTEP have plan to manage the usage of local people's land?*

A: *PTTEP:* Existing 28 inches pipe line will be used for sending gas and we will not construct new pipeline.

- Other Questions:

*Q: Is PTTEPI included in EITI process and report?*

A: *MOGE:* Yes. All oil & gas partner companies of MOGE including PTTEPI are involved in this report. All their income, expense and other information are mentioned in this report. Currently we are preparing scoping report and collecting data for 2014-2015 and 2015-2016 reports.

*Q: How Zawtika project will supply needed electricity for regional development? What has been planned to supply electricity for local community when implementing M9 & M11 project?*

A: *MOGE:* M9 project is for maintain gas production for Zawtika project and M11 is new exploration project. Concerning the regional electricity supply, this is the Governmental issue and they need to implement connecting with electricity master plan. For M9, M11 and further projects, gas and electricity distribution plan is the governmental issue and MOGE cannot give the certain answer at the moment.

*Q: How many percentage of PTTEPI profits will be used in regional development activities; health, education, promoting youth ability, etc.?*

A: *PTTEP:* It is difficult to mention the percentage for regional development as we have to propose to MOGE for plan and amount of budget to be used for CSR program every year and we used after MOGE approved. PTTEPI doing CSR projects for health, education and community support in 29 villages in Kanbauk where pipeline crossing area.

*Q: Does PTTEP have plans to form partnership with regional associations for development activities?*

A: *PTTEP:* Yes. We have partnership with regional associations for development activities such as transportation, educational campaigns and knowledge sharing activities.

*Q: Will government earn half of the profit or just 20% of the profit? What are the opportunities for local people who live in the area where the pipeline was crossed?*

A: *PTTEP:* There are so many benefits for Myanmar government such as signature bonus, loyalty fees and 60% of gas productions are for government.

*MOGE:* Government only need to pay 20% of expense on project when it's reached to the production phase.

*Q: Is there any tax exemption for 20 years and 30 years? What is the plan for tax?*

A: *PTTEP:* Duration of tax exemption is only 5 years as per recent Myanmar regulation.

9.5.2.2. Event Photos





**Fig. 57.** Consultations meeting in Dawei

9.5.2.2.3. Suggestions for next public consultation

- Mutual discussion
- All related people and organization need to be invited and transportation to be arranged
- Agenda should be provided
- The opinions of local community should be considered

**9.5.2.3. CONSULTATION MEETING IN YEBYU**

A public consultation was held in YeByu on the 24<sup>th</sup> of August 2017 from 9:00am to 11:00am. The meeting's agenda included:

- Announcement of ceremony opening
- Opening remarks of township deputy administrative officer
- Introducing with PTTEPI staffs
- Greeting message of U Nay Aung, the representative of Myanmar Oil & Gas Enterprise
- Displaying recorded video of PTTEPI's oil & gas exploration and production process
- Explanation and presentation about PTTEPI Company by U Khin Maung Gyi, advisor of PTTEPI
- Explanation and presentation of oil and gas drilling process by U Wunna Win, drilling engineer from PTTEPI

- Explanation and presentation of environmental impact assessment process by Daw Shwunn Lak Yadanar Soe, environmental engineer from Artelia Myanmar
- Questions and answers between guests and respective speakers
- Announcement of ceremony closing

#### 9.5.2.3.1. Discussion

The following points were discussed:

- Project-Related Questions:

*Q: Are EIA & SIA studies conducted only in offshore area? What about the villages on land?*

A: *PTTEP: Those projects are only for Drilling and we will only do the operation in offshore so that EIA & SIA for those projects will be covered offshore only.*

*Q: Where drill cuttings will be disposed?*

A: *PTTEP: We will comply with all the laws & regulations requirements for waste management system of offshore oil & gas production set by Environmental Conservation Department.*

*Q: When gas production is finished, how drilling pipe will be removed to ensure the seabed remain the same as before?*

A: *PTTEP: After production, we remove casing and small testing pipes. Then some meters of pipe under the seabed is cut by the cutter according to international standards. Finally it will be abandoned by cement plugs and mechanical plugs, as international practices.*

- Other Questions:

*Q: Is there any plan to increase percentage of gas supply for domestic use when implementing new projects?*

A: *MOGE: There is a government policy that domestic use is first priority when we explore new blocks.*

*Q: Where does PTTEPI pay tax? Local tax department or commercial tax department related to companies?*

A: *PTTEP: PTTEPI pays tax at Internal Revenue Department in Yangon.*

*Q: May I know the estimated electricity price for public?*

A: *MOGE: It is not easy to give certain facts about price at the moment because Government need to be considered connecting with other various sectors; national master plan, electricity distribution plan, infrastructure, possibility to install power grid, etc.*

*Q: There are (42) village tracts and (132) villages in our township. I think the area of your CSR program is narrow and suggest you to expand more.*

A: *PTTEP: At present, there are 3 main sectors for our CSR programs; health, education and community support in 29 villages in Kanbauk and nearby area.*

*Q: Is there any plan to organize CSR program for other villages in the region in addition to 29 villages? Only in Kanbauk area? What about whole Yebyu Township?*

A: *PTTEP: We will take note of your comment and will report to management and MOGE for CSR program in Yebyu and other areas.*

*Q: When implementing CSR projects, does PTTEPI pay all expenses or does government also pay part of it?*

A: *PTTEP: According to the contract, government pays 20% of all expenses on project including CSR program only when the project turned to production phase.*

9.5.2.3.2. Event Photos







**Fig. 58.** Consultations meeting in YeByu

9.5.2.3.3. Suggestion for next public consultation

- CSR programs for other villages in the region
- Group discussion / workshops for public consultations.

#### 9.5.2.4. CONSULTATION MEETING IN MYEIK

A public consultation was held in Myeik on the 29<sup>rd</sup> of August 2017 from 10:00am to 12:00pm. The meeting's agenda included:

- Announcement of ceremony opening
- Introducing with PTTEPI staffs
- Greeting message of U Nay Aung, the representative of Myanmar Oil & Gas Enterprise
- Displaying recorded video of PTTEPI's oil & gas exploration and production process
- Explanation and presentation about PTTEPI Company by U Khin Maung Gyi, advisor of PTTEPI
- Explanation and presentation of oil and gas drilling process by U Wunna Win, drilling engineer from PTTEPI
- Explanation and presentation of environmental impact assessment process by Daw Shwunn Lak Yadanar Soe, environmental engineer from Artelia Myanmar
- Questions and answers between guests and respective speakers
- Announcement of ceremony closing

##### 9.5.2.4.1. Discussion

The following points were discussed:

- Project-Related Questions:

*Q: How does ARTELIA monitor whether PTTEPI is complying with the standards in the EIA report or not?*

A: *PTTEP:* After submitting EIA report to ECD and when operation started, monitoring will be conducted once every six months. And PTTEPI will follow the monitoring program as mentioned in the EIA report.

*Q: Is MOGE actually monitoring oil & gas projects every six months? If yes, what are the results and difficulties?*

A: *MOGE:* Actually MOGE not yet monitored together with ECD for offshore projects. But MOGE onsite representatives are coordinating with operator in every stage of process and in regular making of impact studies for MOGE and ECD. As the result of issuing Environmental Conservation Law, local people will be well informed at systematic public consultation and we can develop reports with their comments, suggestions and opinions.

*Q: How many percentage of production will be used for electricity supply of Tanintharyi region?*

A: *MOGE:* Concerning the regional electricity supply, it will depend on distribution policy between central and regional governments. But there is a government policy that domestic use is first priority when new blocks are explored.

*Q: How is the water depth of M9 and M11?*

A: *PTTEP:* M9 is approximately from 50m to 800m depth and for M11 approximately from 600m to 1500m depth.

*Q: Will notice to Mariners be issued?*

A: *PTTEP:* Yes, normally it will be announced in newspapers after MOGE and MOEE approval. In addition, this will distribute to Department of Fisheries through government channel. If possible, PTTEPI will also distribute notice and make fishermen to be well informed in advance not to cause any disturbance in their work.

*Q: The project area is closed to shore and if fishing will have to be delayed for too long, it may impact on fishery industry. Please explain about that.*

A: *PTTEP:* This area is far away from shore approximately 250 km. The duration for drilling process is only 1-2 months. Concerning the depth and area of project, these blocks are set by Ministry of Energy

and PTTEPI has been awarded for exploration and production. We already have meeting with Myanmar Fisheries Federation and we are implementing our project following all the guidelines from the government.

*Q: How PTTEPI will take responsibility for consequences of disposing waste on the shoreline?*

A: *PTTEP*: Waste won't be disposed on the shoreline. Hazardous waste will be carried to Waste Management Company (DOWA) at Thilawa for treating and disposing. Food waste disposal will be complied with MARPOL regulations.

*Q: What is the recovery plan and how PTTEPI will take responsibility if an accidental oil spill that affects the shore happens? Are these plans and terms included in the contract?*

A: *PTTEP*: If there is any emergency or oil spill happens, PTTEPI has contingency plan that how oil spilling will be recovered. PTTEPI is also a member of OSRL and they will be handled for oil spill case. If there is an emergency case, PTTEP also have agreement with other operator companies to recover oil spill quickly. But for now, we are producing gas and the impact for oil spill is quite low when comparing with crude oil production.

*Q: Are M9 & M11 projects for the needs of Myanmar or Thailand? How government has influence and control on this project? What are the benefits for our region and country?*

A: *PTTEP*: For our country, there are signature bonus and royalty fees in our Production Sharing Contract. According to this contract, the more gas is produced, the more percentage of production our country will get. Besides, government will get 20% of profit for the investment. Our contract has been reviewed by Union Attorney General's Office not to cause any loss for our country and this is a fair contract for both parties.

- Other Questions:

*Q: Can government assure that Tanintharyi region will get more electricity?*

A: *MOGE*: At the moment, it is not easy to mention in terms of MOGE how much percentage will be used in this region. Because it also depends on Central Government and other sectors; national electrification project, energy master plan, economic policy, infrastructure, resources, budget, etc.

*Q: How much Government get pipeline tolls per year?*

A: *PTTEP*: Government gets \$1 to maximum \$1.6 per year for pipeline tolls. And these charges are already included in the tariffs of the total gas price.

#### 9.5.2.4.2. Event Photos







**Fig. 59.** Consultations meeting in Myeik

9.5.2.4.3. Suggestions for next public consultation

- To explain about the benefits for the region and country with transparent facts that are easy to understand for the local people
- To make CSR program based on the needs of public
- To reveal the terms of Production Sharing Contract and explain transparently the benefits for region and country

### 9.5.3. Individual Meetings

The Individual meetings with different departments in Dawei and Myeik were realized between the 22<sup>nd</sup> and 29<sup>th</sup> of August.

#### 9.5.3.1. INDIVIDUAL MEETING WITH THE DEPARTMENT OF SFSHERIES (DAWEI)

A focus group was held with the Department of Fisheries in Dawei on the 22<sup>nd</sup> of August 2017.

##### 9.5.3.1.1. Attandance

The participants are presented in following table

**Tabl. 2 - Attendance list**

No	Name	Position	Department
1	U Soe Myint Thein	Regional Chief Officer	DOF
2	Other DOF members	Regional Office	DOF

##### 9.5.3.1.2. Discussion

The following points were discussed:

- Project-Related Questions:

*Q: How far from the coastline to the project?*

A: *PTTEP: Generally, it is about 250 km far from the shore to the project.*

*Q: Is it about to start soon?*

A: *PTTEP: Schedule for commencement is 2<sup>nd</sup> quarter of 2018 for M9 and last quarter of 2018 for M11.*

*Q: Due to M9 and M11 drilling campaigns, although there would be less impact for inshore fisheries, it could be sensitive for offshore fisheries. Suggest to disclose the mariners notice, rules and disciplines in advance.*

*A request for fishermen is – To have a plan with certain amount of funds from company’ profits in order to benefit the society who are indirectly affected by drilling projects.*

A: *PTTEP: As the project will run under Production-Sharing Contract with MOGE, PTTEP needs to issue the effective CSR program to respective departments for approval. And later, the government will deliver its instructions based on the type of project.*

*Q: The DOF added a suggestion for PTTEP’s CSR plan: to regrow the natural resources, for example: fish breeding, fish planting and conservation of corals in order to improve rehabilitating the livelihood of fishermen.*

A: *PTTEP: Despite education, health and occupation are priorities, the suggestion is well noted and will be taking into account.*

*Q: Is there any context concerning social and environmental impacts that should be carefully addressed during the studies?*

A: *PTTEP: It could probably affect the living of some fisheries as the project exclusion zone may occupy few fishing grounds for months. Because of inadequate disclosure and mariners notices about project, the fishing vessels may aimlessly enter into project area and could be sued by the project proponent. So, suggest to inform the inhabitants and to raise programs such as fish and coral conservation.*

*Q: Moreover, they would rather want to request to share seismic survey data in order to know more about impacts on marine species, and condition changes on seabed after seismic survey.*

A: *PTTEP:* Unlike seismic survey, these projects are deep water drilling projects, which are unlikely to disturb commercial offshore fishing, but there will be a 500m exclusion zone. The mariner notice will only be during drilling phase.

*Q: What is the plan for Oil spill?*

A: *PTTEP:* The comprehensive Oil Spill Contingency Plan compliant with international standards, will be described in EIA report. The copy of report will be provided at respective regional governmental offices.

*Q: How far from the coastline to the project?*

A: *PTTEP:* As it has two types; inshore and offshore fishin.

Inshore fishing is within 10 nautical miles from coastline and offshore fishing starts beyond this area and ends before Myanmar maritime boundary.

Although it is unlikely to encounter offshore fishing boats, fishermen will complain as it is still possible to enter the project area while they are chasing group of fishes.

*Sugg: Suggest to invite offshore fisheries groups in Myeik. It was rumored that fishermen were trying to boycott Block MD2 and MD4 recently.*

*Q: As some exclusion zones will be needed around drilling area, how to make sure that the coordination will be carefully done between PTTEP and Authorities?*

A: *PTTEP:* Mariners notice will be issued by PTTEP one month in advance after coordinated with MOGE. MOGE will officially request DOF to disclose the notice to all fisheries organizations.

*Info: Four townships in Dawei Region are – Thayet Chaung, Yebyu, Long Lone and Dawei  
And three townships in Myeik Region – Pa law, Myeik, Kyun Su  
Most fishermen live in Long Lone*

#### 9.5.3.1.3. Event Photo



**Fig. 60.** Interview with the Department of Fisheries (Dawei)

**9.5.3.2. INDIVIDUAL MEETING WITH THE DEPARTMENT OF FISHERIES (MYEIK)**

A focus group was held with the Department of Fisheries in Myeik on the 26<sup>th</sup> of August 2017.

**9.5.3.2.1. Attendance**

The participants are presented in following table.

**Tabl. 3 - Attendance list**

No	Name	Position	Department
1	U Yan Kin	Regional Chief Officer	DOF
3	U Nay Aung	Manager	MOGE

**9.5.3.2.2. Discussion**

The following points were discussed:

- Project-Related Questions:

*Info: PTTEP introduces and explains M9 & M11 drilling campaigns which will be implemented in Tanintharyi offshore. And request what are the DOF's concerns about M9 & M11 drilling campaigns from the view of fisheries in Myeik. Then inviting DOF to join the public consultation on 29th August.*

A: DOF: Answering that DOF will try their best to join the meeting and suggest to invite also Fisheries Federation (Myeik) and local NGO associations.

*Q: ART: Any concerns for the project?*

A: Based on the DOF experiences, we would like to suggest to invite offshore fishermen by requesting fisheries federation (Myeik)

*Info: DOF suggest to convene next public consultation at Fisheries Federation office hall.*

**9.5.3.3. INDIVIDUAL MEETING WITH THE ENVIRONMENTAL CONSERVATION DEPARTMENT – TANINTHARYI OFFICE (DAWEI)**

A focus group was held with the Environmental Conservation Department in the Tanintharyi office of Dawei on the 22<sup>nd</sup> of August 2017.

**9.5.3.3.1. Attendance**

The participants are presented in following table

**Tabl. 4 - Attendance list**

No	Name	Position	Organisation
1	U Myo Thura	Chief Officer	ECD
2	Other ECD members		ECD



9.5.3.3.2. Discussion

The following points were discussed:

- Project-Related Questions:

*Info: PTTEP informed that the project proposal is approved with comment from ECD review team and instructed to perform EIA. ECD hasn't still received that information letter from ECD Head office. Anyhow PTTEP would share the information to ECD (Dawei) mail address [tanintharyi.ecd@gmail.com](mailto:tanintharyi.ecd@gmail.com)*

*Q: PTTEP raised ECD's concerns for the project?*

*A: ECD: Straightly, the other project proponents rarely visit to ECD except PTTEP.*

*And for suggestion, ECD wants to send one or two of their people to offshore project site since ECD's head office is practicing project site inspection.*

*A: PTTEP: During PTTEP courtesy visit to Tanintharyi Minister, PTTEP has been requested to accept their site visit otherwise site inspection.*

*As known, the documentation and permit requesting process is complex since M9 drilling project is under PSC with MOGE, however, if MOGE allows, PTTEP will manage to gather all respective parties to perform site inspection.*

*Q: Does ECD plan to perform monitoring activities?*

*A: ECD: Although the guidelines are described, ECD is now facing insufficient manpower to perform monitoring activities and ocular inspections. It is expected to start in the near future. Currently, ECD is investigating on some industrial projects as Tanintharyi has approximately 60 projects under EIA, IEE and EMP, especially Rubber and Palm oil sectors. Normally, the regional ECD runs the investigations based on project lists of MIC (Myanmar Investment Council), where ECD's comments are gathered attached.*

*Q: ART: queried ECD's concerns on the project and its surrounding environment?*

*A: ECD: For offshore, regional ECD has to focus on ocular investigations although the guidelines are described.*

*Q: ART: queried that ECD have any available information regarding Fauna & Flora in the area?*

*A: ECD: For offshore, the department doesn't have enough information.*

*Q: For Dawei Public Consultation, does PTTEP plan to explain oil spill contingency plan?*

*A: PTTEP: In scoping stage, the explanation will not go further in details but can explain in EIA investigation stage.*

*Q: ECD: How can it be checked whether the project proponent comply the mitigation measures or not?*

*A: PTTEP: The project proponent has to issue reports to ECD every 6 months to verify that they are following the guidelines and mitigation measures. Unlike other sectors, the drilling process ordinarily takes 6-10 months.*

*Q: ECD: To what extend does PTTEP assess the impacts on fisheries in the project area? And suggest to take aware of Kan Pauk village which is likely to protest.*

*A: PTTEP: There aren't much studies so far and one of the reasons for organizing individual meeting and scoping public consultation is to collect more data which could help in developing comprehensive reports.*

*Info: PTTEP commits that they are following the legislations and complying with ECD laws.*

*Info: ECD will try its best to join Public Consultation in Dawei on 23th August, 2017.*

9.5.3.3.3. Event Photos



**Fig. 61.** Interview with the Environmental Conservation Department – Tanintharyi office (Dawei)

9.5.3.4. **INDIVIDUAL MEETING WITH THE DEPARTMENT OF MARINE SCIENCE – MYEIK UNIVERSITY**

A focus group was held with the Department of Marine Science of the University of Myeik on the 29<sup>th</sup> of August 2017.

9.5.3.4.1. Attendance

The participants are presented in following table.

**Tabl. 5 - Attendance list**

No	Name	Position	Organisation
1	Daw Nyo Nyo Htun	Head of Department	Department of Marine Science
2	Other lecturers	Lecturers	Department of Marine Biodiversity

9.5.3.4.2. Discussion

The following points were discussed:

- Project-Related Questions:

*Info: PTTEP: Introducing and explaining PTTEP’s M9 & M11 drilling campaigns and sharing PTTEP’s monitoring report of seismic survey for Block M9.*

*Q: DMS: When will the project start?*

*A: PTTEP: Drilling at Block M9 will start on 2nd quarter of 2018 and Block M11 on last quarter of 2018.*

*Q: ART: Does DMS have any available information about Marine Biology that can be shared?*

*A: DMS: Although the DMS performed offshore studies with a Norwegian team before, the information is difficult to disclose and are controlled by Department of Fisheries.*

*Q: PTTEP: Can DMS provide marine mammal observers?*

*A: DMS: The DMS recommends U Tin Htun, a researcher of marine mammals. The DMS has researchers who study on turtles, benthos organisms. So, if they are relevant with requirements, DMS will manage to provide the researchers.*

*Sugg: DMS: The suggestion is to take into account of marine mammals migratory routes, as whales sometimes washed up on shore. Although the department does not have sufficient equipment to perform the surveys, according to experiences and messages from local fishermen, whales are likely to be encountered in project area and should be taken into account*

*Q: ART: Any update or official announcement date regarding possible new marine protected areas?*

*A: DMS: Most of the marine protected areas are closed to Kaw Thaug region. DMS is uncertain of official announcement date for new marine protected area.*

*Q: DMS: Exploration is for domestic supply or export? Transportation of Oil & Gas pipeline?*

*A: PTTEP: The project is aimed for both domestic use and export. Production from Block M9 will join to existing O&G platform; Zawtika and M9 will rely on Engineering designs and other considerations.*

*Q: DMS: Is PTTEP already a member of international or ASEAN oil spill control organization?*

*A: PTTEP: PTTEP is the member of OSRL (Oil Spill Response Limited). For other emergency cases, PTTEP has its own plans and regulations.*

*Q: DMS: As a stakeholder, what are the DMA's recommendations and opinions on EIA procedures for offshore drilling projects?*

*A: PTTEP: On account of poor internal communication between governmental departments, it would be difficult to express opinion on ECD regulation and EIA procedures.*

*Info: Some data (Water Analysis) are assumed to be publicized on December 2017*

#### 9.5.3.4.3. Event Photo



**Fig. 62.** Interview with the Department of Marine Science – Myeik University

**9.5.3.5. INDIVIDUAL MEETING WITH THE DEPARTMENT OF MARINE ADMINISTRATION (DAWEI)**

A focus group was held with the Department of Marine Administration in Dawei on the 23<sup>rd</sup> of August 2017.

9.5.3.5.1. Attendance

The participants are presented in following table.

**Tabl. 6 - Attendance list**

No	Name	Position	Organization
<b>1</b>	U Kyaw Thu Win	Regional Chief Officer	DMA
<b>2</b>	Other DMA members		DMA

9.5.3.5.2. Discussion

The following points were discussed:

- Project-Related Questions:

*Q: PTTEP: Is there any concern about PTTEP drilling campaigns from the point of DMA (Dawei)?*

*A: Preliminarily, DMA inquired the statement of Regional Government as DMA is under the management of Regional Government. Generally, for some mission, DMA has to issue comments and statements then the Regional Government take account and continue their instructions after reviewing DMA's comments and statements.*

*Info: PTTEP had courtesy visit to Tanintharyi Minister and now PTTEP is following the instructions. One of the reason for this individual meeting is to collect more concerns and information from respective departments.*

*Q: DMA: The location of M9 & M11 drilling project?*

*A: PTTEP: Both M9 and M11 projects exist in Tanintharyi offshore ground.*

*Q: DMA: Is the project close to island or navigation routes?*

*A: PTTEP: Both projects are far from islands. Block M9 could be assumed as in between of navigation routes but not blocking. And there will be supply vessels around project area in order to warn off the entry of ships to the project area.*

*Q: DMA: Any survey performed?*

*A: PTTEP: Marine Environmental Monitoring survey has been performed at Block M9 by PTTEP in 2016.*

*Q: Request for Latitude & Longitude map of M9 and M11 project.*

*A: PTTEP: Latitude and longitude mapping will be included in mariners' notice and noted to disclose on next public consultation.*

9.5.3.5.3. Event Photo



**Fig. 63.** Interview with the Department of Marine Administration (Dawei)

## 9.6. SECOND STAGE OF PUBLIC CONSULTATIONS

The groups, which were consulted, were free to express their concerns, expectations and questions at public meetings between the 24<sup>th</sup> and 30<sup>th</sup> of October, 2017. The schedule and location of these consultations meetings are presented in the table below.

INFORMATION
<ul style="list-style-type: none"><li>• Myanmar Fisheries Federation (of Yangon on the 24<sup>th</sup> October 2017 (10:00 am to 11:00am)</li><li>• Zayar Htet San Hotel Meeting Hall in Dawei on the 26<sup>th</sup> October 2017 (1:30pm to 3:30pm)</li><li>• Township Administrative Office Hall in Yebyu on the 27<sup>th</sup> October 2017 (9:30am to 11:30am)</li><li>• Myanmar Fisheries Federation Meeting Hall in Myeik on the 30<sup>th</sup> October 2017 (9:30am to 11:30am)</li></ul>

(The attendant list for all public consultation meeting is provided in the **Error! Reference source not found.** of this EIA report.)

### 9.6.1. Summary of Consultations and Activities Undertaken

During the second stage EIA public consultation meetings, the stakeholders mainly discuss on the following outlines;

- Any gurantee that the project will cause least impacts on the environment
- Vibration and noise level which will be generated from the project activities
- PTTEPI's CSR plan regarding to this project
- Responsibilities of the project proponent for any unexpected event
- Benefits to the country

### **9.6.2. Consultation with the Myanmar Fisheries Federation**

The Myanmar Fisheries Federation were consulted on the 24<sup>th</sup> of October 2017 from 10:00am to 11:00am. The meeting's agenda included:

- Announcement of ceremony opening
- Introducing with PTTEPI staffs
- Greeting message of U Nay Aung, the representative of Myanmar Oil & Gas Enterprise
- Explanation and presentation about PTTEPI Company by U Khin Maung Gyi, advisor of PTTEPI
- Explanation and presentation of oil and gas drilling process by U Wunna Win, drilling engineer from PTTEPI
- Explanation and presentation of environmental impact assessment process by Daw Shwunn Lak Yadanar Soe, environmental engineer from Artelia Myanmar
- Questions and answers between guests and respective speakers
- Announcement of ceremony closing

#### **9.6.2.1. DISCUSSION**

The Public Consultation at Myanmar Fisheries Federation (Yangon) was opened with the PTTEPI presentation and Q&A section is presented as below.

- Project-Related Questions:

*Q: MFF: To inform the detail of project operation to the offshore fisheries (schedule, location, scale of activities and to adopt the good communication between fisheries and O&G.*

*A: PTTEP: The mariner notice will be distributed to all the fisheries associations through the Department of Fisheries in one-month advance. The chase vessels and MOGE representative will be onboard as to patrolling and to notify the fishermen. Those who are responsible to be onboard will be requested to maintain a good communication with the fishermen which are unintentionally enter into the exclusion zone. The monitoring program is needed to develop by the project proponent in every six months as mentioning in the EIA report.*

*Q: MFF: To implement the proposed project without negative impacts on the ecosystem and fish species, to research natural resources before the project starts as to mitigate the negative impacts at all phases, and to research how much natural resources remain after the project finished.*

*A: PTTEP: MOGE: committed to take account of all requests and concerns*

### 9.6.2.2. EVENT PHOTOS



**Fig. 64.** Public consultations meeting at the Myanmar Fisheries Federation in Yangon

### 9.6.3. Consultation Meeting in Dawei

The Myanmar Fisheries Federation were consulted on the 26<sup>th</sup> of October 2017 from 1:30pm to 3:30pm. The meeting's agenda included:

- Announcement of ceremony opening
- Introducing with PTTEPI staffs
- Greeting message of U Nay Aung, the representative of Myanmar Oil & Gas Enterprise
- Explanation and presentation about PTTEPI Company by U Khin Maung Gyi, advisor of PTTEPI
- Explanation and presentation of oil and gas drilling process by U Wunna Win, drilling engineer from PTTEPI
- Explanation and presentation of environmental impact assessment process by Daw Shwunn Lak Yadanar Soe, environmental engineer from Artelia Myanmar
- Questions and answers between guests and respective speakers
- Announcement of ceremony closing

#### 9.6.3.1. DISCUSSION

The following point were discussed:

*Q: Does PTTEP invite the local fishermen in order to explain the impacts on them? Does PTTEP follow the environmental legislation? And is there any action if the project owners disobey or break the rules?*

*A: PTTEP had a meeting with Myanmar Fisheries Federation on 24th October, 2017 in order to discuss and ask the suggestions, concerns. Regarding to this meeting, only industrial fishing boats are likely to pass the project area. And PTTEP will plan to perform individual meetings if the project was located near shore. The purpose of present meeting is to collect the comments from all parties; CSOs, NGOs and local people. PTTEP will organize two more public consultation meetings at Yaybyu and Myeik where local fishermen are already invited to join.*

PTTEP, for its reputation as an international company, will always do follow the rules and regulations of Myanmar. As an addition, the penalties and punishments are stated in EIA procedures if the project proponent have no compliance of regulation.

*Q: As the project is the joint venture of PTTEPI & MOGE, what is the profit? The EIA report haven been issued to ECD? Is there any guarantee that the project will implement with least impacts on environment? How can it be known that the area is already impacted or not?*

A: After finalizing of Production Sharing Contract (PSC), the government will received approximately 2 to 10 million US\$ from signature bonus. If the exploration and apprising is successful, as an example; from 300 million cubic feet concession, MOGE will benefit 55% and the company will benefit 45%. MOGE will profit more percentage base on the development of future concession. And at the development phase, MOGE can play 15 - 20% of the share and the company will play 80%.

The public consultation chapter is outlined to be included in EIA report and which must be submitted to ECD for review. The project can only be implemented after the completion of EIA review and approval from ECD. The purpose of organizing public consultation is mainly targeted to collect comments, suggestion and either to explain the similar questions.

In EIA report, the mitigation measures are need to be included. The project proponent shall issue a letter of endorsement which is to commit that the project will comply fully with the commitments, mitigation measures, and plans in the EMP which all are described in EIA report. Regarding to the condition of project environment, according to the recent study in 2016, the situation of sediment and water quality is generally in good condition. However, the Ministry will determine whether the survey or any measure is needed to develop or not.

The project will comply with the international standards and National Emission (Quality) Guideline which was stated on 2015.

#### 9.6.3.2. EVENT PHOTOS



**Fig. 65.** Public consultations meeting at the Zayar Htet San Hotel Meeting Hall of Dawei

#### 9.6.4. Consultation Meeting in YeByu

A public consultation was held in YeByu on the 27<sup>th</sup> October, 2017 from 9:30am to 10:30am. The meeting's agenda included:

- Announcement of ceremony opening
- Opening remarks of township deputy administrative officer
- Introducing with PTTEPI staffs
- Greeting message of U Nay Aung, the representative of Myanmar Oil & Gas Enterprise
- Displaying recorded video of PTTEPI's oil & gas exploration and production process
- Explanation and presentation about PTTEPI Company by U Khin Maung Gyi, advisor of PTTEPI



- Explanation and presentation of oil and gas drilling process by U Wunna Win, drilling engineer from PTTEPI
- Explanation and presentation of environmental impact assessment process by Daw Shwunn Lak Yadanar Soe, environmental engineer from Artelia Myanmar
- Questions and answers between guests and respective speakers
- Announcement of ceremony closing

#### 9.6.4.1. DISCUSSION

*Q: What is exclusion zone and mariner notice?*

A: The mariner notice should be announced through media and newspaper in order to let the fisheries notice about the project operation. The department of Fisheries is usually requested to deliver 500 brochures to related associations, departments and organizations. The chase vessels are allocated as to supplied and notify the entrance of fishing boats into the exclusion zone.

*Q: What is the method and control of oil spill during drilling operation?*

A: Spills or losses of oil or chemical are unlikely to possible. However, for such event PTTEP's Oil Spill Response Plan and National guidelines (NEQG) or International guidelines would be implemented.

*Q: Who is responsible for monitoring the impacts on environment which are caused by O&G drilling activities?*

A: In the EIA report, PTTEP has to perform environmental monitoring plan. The monitoring programs and check lists will be developed during drilling operations.

PTTEP has to submit monitoring reports to the Ministry generally in every six (6) months, as provided in a schedule in the EMP, or as prescribed by the Ministry.

*Q: How can the vibration produced by drilling operation be impact to the marine environment or ecosystem?*

A: The ranking of noise from the vibration of drilling operation is negligible and minor on the marine life.

*Q: Since the exclusion zone is 500 m, would there have impacts on offshore fisheries?*

A: The exclusion zone is only 500 m and it is supposed not to impact on fisheries since the water depth is above 150 m and near shore fisheries are usually active in 500 m from coastal area.

*Q: Any visual observation has been performed by third party? Can sea turtles be found in the project area?*

A: For visual observation, a monitoring survey was performed by an international organization in 2016. Therefore, the results are taken as reference data and remain as unspoiled & in good condition.

*Q: What kind of CSR program will be adapted for this project?*

A: PTTEP's CSR plans were developed since 2008-2009. PTTEP's annual CSR plans are to be submitted to MOGE and respective departments and then after PTTEP has to follow the instructions.

*Q: Based on previous experiences, how much vibration (dB) was produced?*

A: The vibration is grading down since the application of casing, cementing and water based mud would also assist to grade down the vibration. The detail results can be sent by email.

#### 9.6.4.2. EVENT PHOTOS



**Fig. 66.** Public consultations meeting in the Township Administrative Meeting Hall of Yebyu

#### 9.6.5. Consultation Meeting in Myeik

A public consultation was held in Myeik on the 30<sup>th</sup> October, 2017 from 9:30am to 11:30am. The meeting's agenda included:

- Announcement of ceremony opening
- Introducing with PTTEPI staffs
- Greeting message of U Nay Aung, the representative of Myanmar Oil & Gas Enterprise
- Displaying recorded video of PTTEPI's oil & gas exploration and production process
- Explanation and presentation about PTTEPI Company by U Khin Maung Gyi, advisor of PTTEPI
- Explanation and presentation of oil and gas drilling process by U Wunna Win, drilling engineer from PTTEPI
- Explanation and presentation of environmental impact assessment process by Daw Shwunn Lak Yadanar Soe, environmental engineer from Artelia Myanmar
- Questions and answers between guests and respective speakers
- Announcement of ceremony closing

##### 9.6.5.1. DISCUSSION

*Q: How much percentage is defined for CSR program regarding to Production Sharing Contract?*

A: Regarding to the Production Sharing Contract, the investment ratio is 20% and 80% for the government and the company respectively. The government also invest atleast 15% for seismic activities but only for possible explorations. In production phase, the specific ratio is detail in the contract. However, there is no description for CSR programs in details and those CSR plan are usually performed under MOGE instruction.

*Q: How to solve or take the responsibilities as the project is located in Tanintharyi fishing ground and the limitation of exclusion zone during fishing season?*

A: The project is 250 km far from the coastal area and the water depth is about 150 m which mean there is unlikely to be encounter or interrupt the fishing activities and the exclusion zone will be 500 m.

*Q: In reality, the exclusion zone is about 10 miles and can the project owner commit that the fishing boats are allow to enter outside of the exclusion zone?*

A: 500 m exclusion zone is limited for drilling project. As the production rig are too dangerous to allow the entrance of other vessels. For any unexpected accident, it could be a great loss for the country, O&G and fisheries sectors.

Q: *Every year, O&G activities produce impacts on fisheries sector, is there any plan that could relieve the severity?*

A: PTTEP has plans to perform rural development programs according to its financial planning. However, no separate budget is planned to use only for fisheries but the suggestion will be taken into account for future activities.

Q: *Any plan has been initiated to continue the drilling project if the federal constitution is confirmed or any political changes happen? What is the opinion of no electricity in Tanintharyi but O&G export to Thailand?*

A: The electricity issue is under governance of regional ministry and central government. Regarding to political changes, as an example of Indonesia, the central government and regional government is cooperating for production sharing and consumption. As the term of the project is 30 years, all import and export activities are developed with the contracts. No official statement has been announced. And the suggestions and concerns will be reported and adopted for future campaigns.

Q: *Will the profits of M9 & M11 project benefit to Myanmar or the other country?*

A: The Company executes projects for its profits and the government involves and invests for the country. Anyhow, the government will profit both from signature bonus and future O&G concession.

#### 9.6.5.2. EVENT PHOTOS



**Fig. 67.** Public consultations meeting at the Myanmar Fisheries Federation Meeting Hall of Myeik

## 9.7. RESULTS FROM THE EIA PUBLIC CONSULTATION

### 9.7.1. Suggestion from all of the Public Consultations

According to these consultations, the project is too far from the coast and unlikely to encounter local fishing boats in its vicinity. However, specific mitigation measures shall be developed to facilitate the needs of community. The following points was suggested and commented during the meetings.

Meeting Location	Respondent Person	Suggestion
Myanmar Fisheries Federation, Yangon	Local and regional representatives from Myanmar Fisheries Federation & 36 attendees	<ul style="list-style-type: none"> <li>Detailed project operations to the offshore fisheries should be given (better communication between both parties).</li> </ul>

Meeting Location	Respondent Person	Suggestion
		<ul style="list-style-type: none"> <li>Research natural resources before the beginning of the project (help to reduce negative impacts)</li> </ul>
Zayar Htet San Hotel Meeting Hall, Dawei	Representative from ECD/ MFF and DOF & 67 attendees	<ul style="list-style-type: none"> <li>How can it be known that the area is already impacted or not and the project will implement with least impacts on environment?</li> </ul>
Township Administrative Office Hall, Yebyu	Representative from township office & 99 attendees	<ul style="list-style-type: none"> <li>Prevention regarding oil spill</li> <li>The exclusion zone is noted as 500 m, would there have impacts on offshore fisheries?</li> <li>What kind of CSR program will be adapted for this project?</li> </ul>
Myanmar Fisheries Federation Meeting Hall, Myeik	Representative from MFF and DOF & 48 attendees	<ul style="list-style-type: none"> <li>O&amp;G activities produce impacts on fisheries sector every year; how to reduce the severity of the impact?</li> <li>How much percentage is allocated for CSR program regarding Production Sharing Contract?</li> </ul>

### 9.7.2. Results from EIA Public Consultation

During the public consultations, stakeholders discussed their views and concerns in relation to the appraisal drilling project, about which PTTEPI made some answers. Those main concerns and PTTEPI's answers are summarized below:

- Fragility and vulnerability of the Myanmar coastal areas. PTTEPI assures that the entire appraisal drilling phase will be carried out according to the rules of the art (PTTEP's Oil Spill Response Plan and National Environmental Quality (Emission) Guidelines (NEQG)), reducing as much as possible the risks of pollution.
- Proposed actions regarding potential impacts on offshore fishery sector and potential conflicts between fisheries and the project proponent. Mariner notice will be announced through media and newspaper in order to let fishermen about project operation. Then, the chase vessels are usually allocated providing and notifying the entrance of fishing boats into the exclusion zone.
- CSR program adopted for the project. PTTEP's CSR plans were developed since 2008 and PTTEP's annual CSR plans are submitted to MOGE and respective departments.
- Support to local project. In case hydrocarbons are discovered in enough quantity for economic, local people of Myeik wished partnerships for local development (electricity for instance). PTTEPI took notice of the remark.

## 9.8. FURTHER ONGOING CONSULTATIONS

Since PTTEPI is managing on ongoing activities such as CSR activities under Zawtika project and other proposed projects, there will be continuance of relation with the stakeholders and the project proponent. PTTEPI will also disclose the update project information on their addressed website, keep in touch with the stakeholders and plan to coordinate with Department of Fisheries, Myanmar Fisheries Federation and local fisheries group prior to the project implementation and during the project operation. However, additional consultations will be conducted if there was any complaint from stakeholder before and during the project operation.

The invitation for further meeting will be prepared at least one month in advanced in order to cover all the related stakeholders, nearshore and offshore fishermen and government officials.

### 9.9. PROJECT DISCLOSURE

Regarding to EIA procedure, the project information shall be disclosed via media, state owned newspaper and project proponent's websites during the different stages of the EIA process.

- 1) After the scoping investigation period, PTTEPI organized three public consultation meetings at Dawei, Yebyu and Myeik townships. In align with the EIA procedure; PTTEPI disclosed the project to the public and civil society through posting on PTTEPI's website, as well as placing advertisements in local media on 2017 November.
- 2) Based on the discussion with GAD authorities and Tanintharyi region Chief Minister, PTTEPI organized next three public consultation meetings at Dawei, Yebyu and Myeik townships and disclosed the project information through on PTTEPI's website, as well as on state-owned newspaper; The Mirror & New Light of Myanmar on 2018 February.
- 3) After submission of the EIA Report to ECD, PTTEPI commits to provide the Myanmar version executive summary of EIA Report to local society, local communities, township libraries, and respective governmental office. The project disclosure will also be publicized after the EIA report submission to the ECD.



The above articles were publicized after the completion of scoping stage public consultation.



**PTTEP**

**ကမ်းလှန်ချေမှုလုပ်ငန်းစဉ်အမှတ် M11 တွင် PTTEPI တူးဖော်မှု ဆောင်ရွက်သွားမည့် ရွာမခွဲအစုတွင်း တူးဖော်ရေး လုပ်ငန်းများအတွက် ပတ်ဝန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်း(EIA)လေ့လာခြင်းအားထပ်ပြခြင်း။**

PTTEP International Limited (PTTEPI) သည် ကမ်းလှန် လှုပ်ကွက်အမှတ် M11 တွင် ချွန်နှင့်သဘာဝဓာတ်ငွေ့များ ထည်နေခြင်းကို အတည်ပြုနိုင်ရန် ရွာမခွဲတွင်းတူးဖော်ခြင်း လုပ်ငန်းများကို စီစဉ်ဆောင်ရွက်လုပ်ကိုင်ခဲ့ပါသည်။

အဆိုပါရွာမခွဲတူးဖော်ရေးလုပ်ငန်းများကို တွင်း(၁)တွင်းအထိ အများဆုံးတူးဖော်သွားမည်ဖြစ်ပြီး (၂၀၁၈) ခုနှစ်၏ ဇူလိုင်လလိုင်အတွင်း စတင်ဆောင်ရွက်သွားမည်ဖြစ်ပါသည်။

ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ဦးစီးဌာန (ECD) သို့ ပေးပို့တင်ပြ ခဲ့ပြီးသော နယ်ပယ်အတိုင်းတာသတ်မှတ်ခြင်း အစီရင်ခံစာအရ PTTEPI နှင့်တကွ Artelia ကုမ္ပဏီတို့သည် ဒေသခံအဖွဲ့ အစည်းများ သက်ဆိုင်သူများနှင့် လူထုနှင့်တွေ့ဆုံပွဲများတွင်ပစ္စည်း ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လေ့လာမှုများကို ဆောင်ရွက်လျက်ရှိပါသည်။

အဆိုပါ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအား ပြည်ပထောင်စု သမ္မတမြန်မာနိုင်ငံတော်၏ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း ဆိုင်ရာ လုပ်ထုံးလုပ်နည်း (၂၀၁၅) နှင့် အညီဆောင်ရွက်သွား မည် ဖြစ်ပါသည်။

အဆိုပြုလုပ်ငန်းများနှင့် ပတ်သက်သည့်အကြောင်းအရာများ ကို PTTEPI ၏ website [www.pttep.com](http://www.pttep.com) တွင် ဝင်ရောက်လေ့လာကြည့်ရှုနိုင်ပြီး မေးခွန်းများနှင့် အကြံပြုချက် များပို့လာ စီမံအဖွဲ့ဝင် TinNilarSoe@pttep.com သို့ ဆက်သွယ်မေးမြန်းနိုင်ပါသည်။



**PTTEP**

**ကမ်းလှန်ချေမှုလုပ်ငန်းစဉ်အမှတ် M9 တွင် PTTEPI တူးဖော်မှု ဆောင်ရွက်သွားမည့် ရွာမခွဲအစုတွင်းနှင့် အတည်ပြုခြင်း တူးဖော်ရေး လုပ်ငန်းများအတွက် ပတ်ဝန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်း (EIA) လေ့လာခြင်းအားထပ်ပြခြင်း။**

PTTEP International Limited (PTTEPI) သည် ကမ်းလှန်လှုပ်ကွက်အမှတ် M9 ၏ အခြေအနေအထားတွင် ချွန် နှင့်သဘာဝဓာတ်ငွေ့များ ထည်နေခြင်းကို အတည်ပြုနိုင်ရန်နှင့် လက်ရှိ ဓာတ်ကမ်းမိန်း ဖွံ့ဖြိုးရေးအတွက် အထောက်အပံ့မေး နိုင်ရန် ရွာမခွဲအစုနှင့် အကျဉ်းတွင်းများ တူးဖော်ခြင်းလုပ်ငန်း များကို စီစဉ်ဆောင်ရွက်လုပ်ကိုင်ခဲ့ပါသည်။ အဆိုပါ ရွာမခွဲအစုနှင့် အတည်ပြုတွင်းများ တူးဖော်ခြင်းလုပ်ငန်းများကို တွင်း(၁) ခွဲတွင်း အထိ အများဆုံးတူးဖော်သွားမည်ဖြစ်ပြီး (၂၀၁၈) ခုနှစ်၏ ဇူလိုင်လလိုင်အတွင်း စတင်ဆောင်ရွက်သွားမည်ဖြစ်ပါသည်။

ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ဦးစီးဌာန (ECD) သို့ ပေးပို့တင်ပြ ခဲ့ပြီးသော နယ်ပယ်အတိုင်းတာသတ်မှတ်ခြင်း အစီရင်ခံစာအရ PTTEPI နှင့်တကွ Artelia ကုမ္ပဏီတို့သည် ဒေသခံအဖွဲ့အစည်း များ သက်ဆိုင်သူများနှင့် လူထုနှင့်တွေ့ဆုံပွဲများ တွင်းပစ္စည်း ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လေ့လာမှုများကို ဆောင်ရွက်လျက်ရှိပါသည်။

အဆိုပါ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအား ပြည်ပထောင်စု သမ္မတမြန်မာနိုင်ငံတော်၏ ပတ်ဝန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်း ဆိုင်ရာ လုပ်ထုံးလုပ်နည်း (၂၀၁၅) နှင့်အညီ ဆောင်ရွက်သွား မည် ဖြစ်ပါသည်။

အဆိုပြုလုပ်ငန်းများနှင့် ပတ်သက်သည့်အကြောင်းအရာများ ကို PTTEPI ၏ website [www.pttep.com](http://www.pttep.com) တွင် ဝင်ရောက် လေ့လာကြည့်ရှုနိုင်ပြီး မေးခွန်းများနှင့် အကြံပြုချက်များပို့လာ စီမံအဖွဲ့ဝင် TinNilarSoe@pttep.com သို့ ဆက်သွယ်မေး မြန်းနိုင်ပါသည်။

The above articles were publicized on state owned newspaper, the mirror, after the completion of EIA stage public consultation.

## 10. CONCLUSION AND RECOMMENDATION

PTTEPI's proposed drilling EIA involves a maximum of twelve appraisal wells, which has been identified in Block M9, situated at approx. 260 km from the south coast of Yangon and 178 km west of Dawei, in the Tanintharyi Coastal Zone. The tentative schedule of the project is in Q3-Q4 of 2018, during an estimated period of 540 days.

A semi-submersible rig, which is capable of operating in sea water depths up to 100 to 3,000 m, will be used. The principle of an offshore drilling is to confirm (or deny) and indicate the presence of hydrocarbon reservoirs and would serve the development of the existing Zawtika field. And it is typically carried out to explore for and subsequently extract petroleum which lies in rock formations beneath the seabed.

The two material support vessels will serve transportation of drilling rig and identify any possible disturbance to the operation (as floating objects, for example). A helicopter will be used to transfer staff, with capacity of 12 staff per flight.

The project area is located the Tanintharyi continental shelf in the Andaman Sea in the west and Thailand to the east. This coastal zone covers south of the Gulf of Martaban up to the mouth of Pakchan River and includes Myeik Archipelago and the Andaman Sea.

The characteristic of surface water is low salinity due to large freshwater influx from the Irrawaddy River which has also an impact on the local turbidity and chlorophyll-a concentration. Marine Baseline Survey performed in Block M9 shows that the sediment quality is expected to be thick silty clays due to the large amount of sediment inputs of Irrawaddy River and the geomorphological context of the study area.

The description of the environment has shown that cetaceans, fish and turtles are the most sensitive components of the project's environment. Also, the richness of zooplankton in the study area is important with planktonic shrimps, larvaceans, crab larvae, etc. According to the bibliographic research performed for this report, 37 pelagic fish species were identified by the IUCN with different levels of vulnerability in Andaman Sea and Bay of Bengal. All these species may potentially be found in the project area. Among the 29 marine mammals identified by IUCN in Myanmar's waters, 21 may be encountered in Block M9 (2 EN / 4 VU). 45 seabird species have been identified in Myanmar's waters. Even if most observation of sea turtles occurs in shallow waters, as the 5-main species are migrant they may be encountered in Block M9.

The socio-economic activities that may interact with the exploration drilling activity, are commercial marine traffic and large-scale fishery. However, according to discussion with local regional offices, only fishery groups from Tanintharyi Region are located within Block M9. There are also indications that November to April is the best season for fishing in terms of weather condition. Fishing occurs during this period in shallow water, across the continental slope but also in deep-water.

An offshore drilling campaign may generate emissions to air, wastewater and liquid discharges, and production of hazardous and non-hazardous wastes. Accidental discharges such as spills are also possible. The main potential impacts of the project identified are atmospheric emissions, generation of waste, liquid discharges into the sea, potential interaction with fishing activity and marine traffic. Impacts of the project on the human environment are expected to be of minor importance.

Mitigation measures are nevertheless planned to limit disturbances of marine users, in particular to decrease the risks of vessel collisions and damages to fishing gears. These measures range from information of various marine stakeholders on the project, to preparation of flyers to be distributed to fishermen encountered at sea during the operation and the preparation of the contractor's team to handle vessels approaching the project area.

Mitigation measures have been proposed in accordance with international & national standards, and PTTEPI's standards. The presented EMP is as a tool to manage impacts associated with the project and to ensure legislative compliance and standards of good practice during the project execution.

The impacts have been assessed and mitigation measures should allow reducing, compensating or removing these potential impacts to make them acceptable.



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