

**TOTAL EP  
MYANMAR  
YWB 2D SEISMIC  
SURVEY**

**Environmental and Social Management Plan  
and Monitoring (ESMPM) Report**



**06 September 2016  
Total EP Myanmar**

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## Acronyms and Abbreviations

<b>2D</b>	Two Dimensional
<b>CMO</b>	Chief Medical Officer
<b>DNV</b>	Det Norske Veritas
<b>DP</b>	Dynamic Positioning
<b>DMA</b>	Department of Marine Administration
<b>DOF</b>	Department of Fishery
<b>ECD</b>	Environmental Conservation Department
<b>EIA</b>	Environmental Impact Assessment
<b>EMP</b>	Environmental Management Plan
<b>ESIA</b>	Environment and Societal Impact Assessment
<b>ESMPM</b>	Environmental and Social Management Plan and Monitoring
<b>FLO</b>	Fishing Liaison Officer
<b>HSE MS</b>	Health Safety and Environment Management System
<b>IAGC</b>	International Association of Geophysical Contractor
<b>IEE</b>	Initial Environmental Assessment
<b>IPIECA</b>	International Petroleum Industry Environmental Conservation Association
<b>IMO</b>	International Marine Organization
<b>JNCC</b>	Joint Nature Conservation Committee
<b>KPI</b>	Key Performance Indicators
<b>LTI</b>	Lost Time Injury
<b>LTIF</b>	Lost Time Incident Frequency
<b>MARPOL</b>	Maritime Pollution
<b>MEDEVAC</b>	Medical Evacuation
<b>MFF</b>	Myanmar Fishery Federation
<b>MGO</b>	Marine Gas Oil
<b>MMO</b>	Marine Mammal Observer
<b>MOGE</b>	Myanma Oil and Gas Enterprise
<b>NGO</b>	Non-governmental Organisation
<b>OGP</b>	Oil & Gas Producers
<b>OVID</b>	Offshore Vessel Inspection Database
<b>PAM</b>	Passive Acoustic Monitoring

<b>PSC</b>	Production Sharing Contract
<b>RSES</b>	Responsible Safety Environment on Site
<b>SOPEP</b>	Ship Oil Pollution Emergency Plan
<b>TEPM</b>	Total Exploration and Production Myanmar
<b>TRIR</b>	Total Recordable Injury Rate

# **1. Environmental and Social Management Plan and Monitoring (ESMPM) report**

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This document provides the Environmental and Social Management Plan and Monitoring (ESMPM) report for the management and monitoring of the operation of the Project. The Project operated by Total EP Myanmar is 2D Seismic survey in YWB block in the offshore area of the Tanintharyi Division in Myanmar. This ESMPM ensures the actual implementation of the environmental and social management plan of YWB 2D Seismic Campaign IEE report issued in February 2016. This ESMPM entails the project's main monitoring activities described in the commitment register of IEE report such as waste generation, safety performance indicators and the marine mammal observation. This ESMPM also make sure the requirements of national and international regulations and Total's Health, Safety, Security and Environment policies are properly carried out. In fact, after completion of the Project, this ESMPM report is the last report which is required to submit to ECD so as to be in compliance with the article (108) of EIA procedure.

## **Executive Summary**

Total Exploration and Production Myanmar (TEPM) carried out a 2D seismic survey as part of its exploration program of the offshore deepwater YWB block from 20<sup>th</sup> April to 9<sup>th</sup> May 2016. This seismic program covers 2,200 km west of the Myanmar coast and 400 km far from Yangon. The water depth in the area ranges from 200 to 2,000 m.

Seismic acquisition vessel; M/V Polarcus Asima and support vessel M/V Opal and chase vessel M/V Crest Adventurer are used during the whole survey campaign. Due to the experienced seismic crew and their strong HSE culture, there was no accident occurred during the operation and no lost time experienced.

The Project is also implemented in line with National, International and Total's group Health, Safety, Security and Environmental regulatory requirements for the Project mitigation and management measures. The environmental commitment register of the IEE report which is developed by Artelia Environmental Consulting Co., LTD is also properly followed up entailing the action taken, completion date, budget and the progress percentage.

In the monitoring program section, TEPM environmental management organization and contractor organization chart are depicted with their management roles and responsibilities. Reporting requirements of the Project such as waste generation and emissions, safety performance indications and marine mammal's observations are presented in details. Although there is no accident occurred during the Project, proper emergency response plan is developed and implemented. With regard to capacity development and training of the personnel involved, several environmental related inductions, trainings and different types of meeting were systematically organized.

In the conclusion, the achievements as well as some weakness or shortcomings experienced during the Project are discussed for future similar projects.

## 2. Introduction

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Total Exploration & Production Myanmar (TEPM) carried out a 2D seismic survey campaign as part of its exploration program of the YWB block. Since Initial Environmental Examination (IEE) has been confirmed for this 2D seismic survey by Environmental Conservation Department (ECD), the IEE report including EMP was developed by Artelia Consulting Co., Ltd in February 2016.

The project proponent is TEPM who is operating oil and gas sector in Myanmar over 15 years in Yadana field (M5-M6 blocks) since 1992. TEPM was awarded the deepwater offshore block (YWB) in 2014 and TEPM is 100% operator of YWB block.

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## 3. Description of the Project

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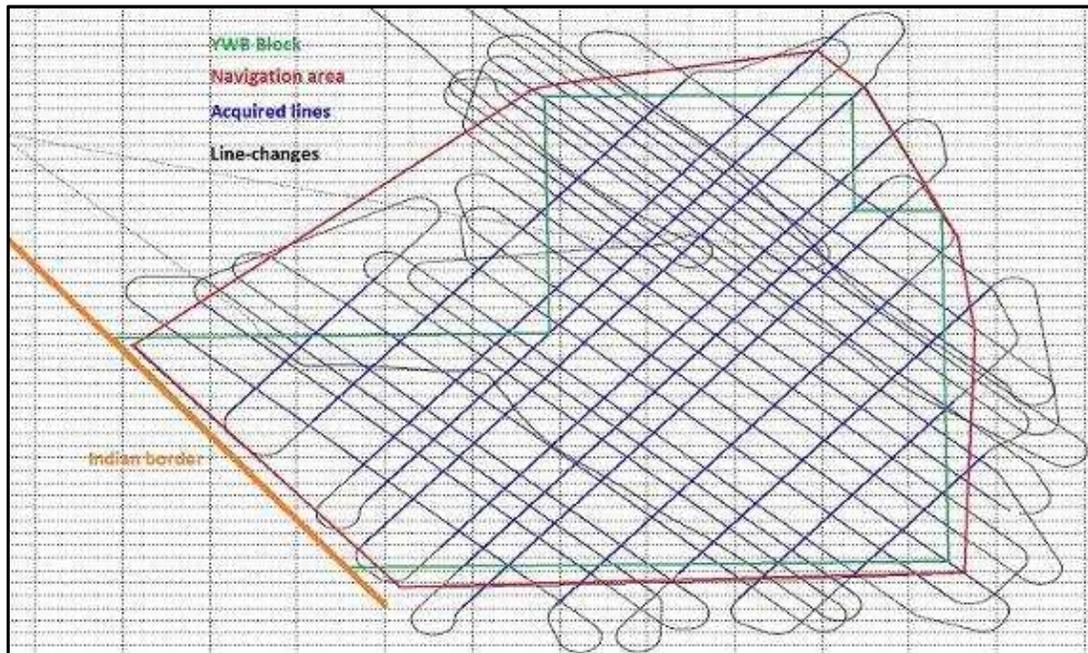
TEPM carried out a 2D seismic survey in YWB block from 20<sup>th</sup> April to 9<sup>th</sup> May 2016. The offshore block YWB covers a 3,000 square kilometers area in the Andaman Sea, approximately 200 kilometers off the Myanmar coastline. The 2D seismic program covers the acquisition of a 2,200 km west of the Myanmar coast and 400 km far from Yangon. The water depth in the area ranges from 200 to 2,000 m.

The general objective of the survey was to evaluate the prospects of YWB Block and to identify/obtain characteristics of potential hydrocarbons' reservoirs. The survey was acquired by M/V Polarcus Asima, a purpose-built 12-streamers capable, super high ice class seismic vessel featuring the ULSTEIN XBOW hull and carrying the DNV CLEAN DESIGN rating. The Polarcus Asima has been assisted by the support vessel M/V Opal and chase vessel M/V Crest Adventurer for the whole duration of the survey. Seismic data acquisition utilized a 4,300 in<sup>3</sup> air gun array of a solid type towed streamer cable having an active length of 10,050m at 12m depth.

The principle timing of the survey was with a kick-off meeting held on board Polarcus Asima at Myeik anchorage on April 20<sup>th</sup>, 2016, mobilization commencing on April 20<sup>th</sup>, 2016 just after the Total HSE Audit completion. The first acceptable line recording was made on the April 23<sup>rd</sup>, 2016. Production continued fairly steadily with the last acquisition being completed on May 08<sup>th</sup>, 2016; demobilization ends on May 09<sup>th</sup>, 2016. The location and survey map of YWB 2D seismic campaign are depicted as follow;



YWB Block Location Map



Survey Map of YWB Block

### 3.1 Seismic Acquisition Vessel: Polarcus Asima

Polarcus Asima is the third vessel in the Polarcus fleet of the ULSTEIN SX134 design with the high class notation, ICE-1A, enabling her to operate safely and effectively in the Arctic. The 92m vessel is purposely built for the high-end 3D marine seismic market and capable of towing up to 12 by 8,000m streamers. Like the Polarcus Nadia and Polarcus Naila launched before her, the double-hulled, DP2 class Polarcus Asima incorporates many modern features designed to maximize operational performance, improve safety and comfort, and minimize emissions to air and water. Polarcus Asima is also fitted with **a chemical-free ballast water treatment system** to eliminate the risk of transporting and introducing invasive marine species into new environments.

The hydrodynamic efficiency of the X-BOW, result in good sea-keeping abilities, it also provides a safe and comfortable workplace for the crew both during transit and seismic surveys, as it eliminates slamming. The soft entry in waves also reduces spray and eliminates icing. The vessel is equipped with a helpdesk (D-value 22.2 m, 12t). The vessel has one workboat, by WestPlast, and a Norsafe MOB boat on board and four life rafts each for 65 persons (gravity launch) with MES fitted on each side for quick and efficient boarding.

The vessel has diesel-electric propulsion. The main propulsion system comprises two Wärtsilä 9L26 main diesel generators, each 2850kW at 1000rpm, plus four Wärtsilä 9L20 1800kW diesel generators, at 1000rpm (total: 12900kW). There are two propellers of controllable pitch type in nozzles, the shaft line of each driven by two variable speed electric motors through twin in-single out reduction gears. The vessel “normally” runs on marine gas oil (MGO) with **low sulphur content**. The fuel oil capacity is 1925m<sup>3</sup> and fresh water capacity 1040m<sup>3</sup>. Her maximum bollard pull is 135t. Polarcus Asima has a maximum speed of 15 knots, at 6.5m draft.



There is one 1200kW tunnel thruster forward equipped with a controllable pitch propeller and one 850 kW retractable azimuth thruster forward. There is one tunnel thruster aft, 830 kW, controllable pitch. The vessel is equipped with a roll damping tank system. There are two fresh water generators, each producing 15 m<sup>3</sup>/24h. The maintenance follow-up is based on the **DNV approved ShipNet System**. Polarcus Asima has capacity for 60 persons in 32 single and 14 double cabins. There are a mess room, day rooms, internet café, gym and sauna, as well as a hospital, offices and a conference room (helicopter room).



Navigation Bridge



Engine Control Room

### 3.1.1 Seismic Equipment and Back Deck operations

Polarcus Asima is capable of deploying up to 12 Sercel Sentinel solid streamers. The navigation system is ION Orca and the depth positioning system is of type DigiBIRD combined with DigiFIN lateral control and DigiRANGE acoustic ranging. The seismic air gun source is by Bolt Technology 1500-LL/1900-LLXT with dual sources. The source controller is a fully distributed digital gun Seemap GunLink 4000 controller. The seismic operation room is located mid-ship over two decks in close vicinity to the seismic winches in the work area.

For this project, The Polarcus Asima used a “1x10050 meter” streamer configuration. Smaller vanes (mini-door) were utilized to maintain the sub-array separations. One 4300 in3 (no in-line stagger between sub-arrays) source array was deployed for this survey. This 2D array designed by Polarcus consists of 4 sub-arrays x 12 Bolt air-guns and has wide dimensions 40m (width) x 14m (length) as shown in below picture.



All the back deck operations observed on Polarcus Asima, whatever the type (deployment, retrieval, from gun deck or streamer deck) were performed safely. The back deck crew is very efficient for gear deployment and retrieval within the respect of procedures and Task Risk Assessment. Prior each gear deployment or recovery toolbox meetings were held; TEPM on-board Representatives were always notified and welcome to attend and participate to them. The accent was always put on the duty to “Speak-up, Stop and Intervene” when required and that no operation needs the crew members to rush. Self-inflatable life-jackets were worn beyond the white/red striped lines marked on gun deck and streamer deck at all time.



Streamer deployment



Gun arrays deployment

The personnel involved in the gun sub-arrays deployments/recoveries on gun deck slipway and in tail buoy recovery on gun deck side's platforms use to connect the rear D-ring of their PFD (275N smart type) to the fall arrestor via a caw-tail. As per MRT (PFD Manufacturer): *"The smart 275N PFD is not classed as a fall arrest, therefore it should not be used as a fall arrest harness system. The D ring on the buckle of the PFD is designed for light attachment via the smart Cow"*.

### 3.2 Fleet: Support and Chase Vessels

The fleet for TEPM YWB project consisted of the Polarcus Asima as acquisition vessel, one Support Vessel, the Opal and one Chase Vessel, the Crest Adventurer. Both Opal (PRO) and Crest Adventurer (Pacific Radiance) have demonstrated during the survey their competency in escorting/scouting and ship to ship operations. The communications between the three vessels appeared to be clear and direct and an obvious mutual duty of care was noted giving full meaning to the Field Unit concept.

#### 3.2.1 Support Vessel – Opal

Built in 2009 the support vessel Opal owned by Promas Shipping Limited and operated by Polskie Ratownictwo Okretowe has been chartered by Polarcus for her ability and capacity to perform supply, refueling, crew transfer and towing duties in line with the Polarcus Asima specifications. She is rated at 67 tons bollard pull and a 13 knots top speed. The Opal performed very well all the tasks she was assigned for. There was at all time and excellent communication and cooperation with the Polarcus Asima. Deficiencies noted during the pre-survey Total HSE audit was solved as much as possible by the crew soon after communicated.



She is fitted with a Westdavit davit to receive WestPlast workboat which allows personnel transfer “davit to davit”. She is under long term contract and assigned to the Polarcus Asima. The last OVID inspection was performed on March 11<sup>th</sup>, 2016.

### **3.2.2 Chase Vessel – Crest Adventurer**

The designated chase vessel was the Crest Adventurer, a utility/support vessel built in 2009. She was rated at 26.0 tons bollard pull and a 12 knot top speed. She is owned by Strato Maritime Services and operated by Pacific Radiance. Her main duty during the YWB 2D survey was to monitor the fishing activities and clear as much as possible the path for the Polarcus Asima and her 10km seismic streamer. The Captain and his crew with the two MOGE Representatives put a lot of efforts in achieving their duty and considering the difficulty of the task, their performance was excellent.



The Crest Adventurer was accepted by LSO/MAR as chase vessel only with the restriction “Not to be used for personnel transfer during offshore seismic operations except for emergency”. She was under short term charter with Polarcus and assigned to the Polarcus Asima for the Myanmar project only. The last OVID inspection was performed on March 13<sup>th</sup>, 2016.

## 4. Policy, Legal and Intuitional Framework

The Project is implemented in line with Total's group Health, Safety, Security and Environmental policy, the requirements of the Production Sharing Contract (PSC), Myanmar regulatory requirements and international conventions, standards and guidelines.

TEPM followed a comprehensive MAESTRO management system. This system is an important and integral part of the company's overall management system, which includes Total group's policies on Safety, Security, Corporate Social Responsibility, and Environment. TEPM has adopted all relevant Myanmar legislation for the project mitigation and management measures appropriate to the estimated potential impacts as described in this ESMPM.

## 5. Governing Parameters

The specific emission limit values and environmental quality standards that are relevant to the Project are shown in Table 1.

Table 1. Relevant Environmental Guidelines and Standards to the Project

Environmental Parameter	Standard	Details
Marine mammal conservation	IPECA, 2003	Summary of a series of case studies which describe some of the oil and gas industry's experience of operating responsibly in sensitive human and physical environments will be applied.
	IAGC, June 2011	Recommendations of mitigation measures for cetaceans during geophysical operations will be applied in the operation.
Emissions	WHO standards Guidelines/ MARPOL Annex VI	Vessels are in compliance with applicable WHO guidelines and standards and MARPOL 73/78 Regulations for the ambient air quality (SO <sub>2</sub> , NO <sub>2</sub> , PM <sub>10</sub> and PM <sub>2.5</sub> ) and the prevention of air pollution from ships (Annex VI). This Annex provides details of surveys and inspections required for vessel equipment and control of nitrogen oxides and Sulphur oxides. In addition, all vessels have international air pollution prevention certificates (IAPP).
Waste Discharges	MARPOL Annex I,IV&V	The survey vessels will operate in compliance with MARPOL Annexes I: any oil-in-water content of discharges should not exceed 15 ppm.  General waste (excluding food) will not be disposed of to sea in line with MARPOL Annex V Requirements. Combustible wastes will be segregated and disposed by incinerator on-board, should an incinerator be available on the selected vessel (in line with MARPOL Annex V requirements). Non-combustible and recyclable wastes will be stored in containers and returned to the selected vessel shore base for disposal (in line with MARPOL Annex V Requirements).  Food waste will be macerated into smaller pieces (25 mm) prior to discharge overboard (if discharged <12 nm from shore) in line with MARPOL Annex V Requirements.  Hazardous wastes will be stored on the vessels in appropriate containers with labels. Hazardous waste storage will be designated

		<p>in accordance with their Materials Data Sheet (MSDS) (in line with MARPOL Annex V requirements). Hazardous wastes will be returned to the vessels' selected shore base and sent to a licensed disposal facility by a licensed waste contractor (in line with MARPOL Annex V requirements).</p> <p>The disposal of non-combustible wastes will be the responsibility of the contractor, who will be required to have a Garbage Management Plan in place as well as record all waste retained on-board or transferred to the supply vessel for transport to shore. This will include information on how/where wastes have been disposed. The use of specific waste facilities will be Ranong, Thailand.</p> <p>The survey vessels will comply with applicable MARPOL 73/78 Annex IV requirements, including: the discharge of sewage into the sea is prohibited, except when the ship has in operation an approved sewage treatment plant or when the ship is discharging comminuted and disinfected sewage using an approved system at a distance of more than three nautical miles from the nearest land. Sewage which is not comminuted or disinfected has to be discharged at a distance of more than 12 nautical miles from the nearest land.</p>
	OGP Waste Management Guideline	Waste Management Guidelines given by the International Association of Oil and Gas Producers will be adopted.
Underwater sound generation	JNCC Guidelines	<p>The Project will implement the JNCC Guidelines including alignment of Contractor operating procedures with JNCC Guidelines. These guidelines include:</p> <ul style="list-style-type: none"> <li>• A soft-start procedure will be utilized at the commencement of air gun firing.</li> <li>• Dedicated Marine Mammal Observers (MMOs) will be onboard the vessel to undertake the pre-shoot search.</li> <li>• Use of Passive Acoustic Monitoring (PAM) to detect whether any marine mammals are in the vicinity of the seismic vessel during night time or low visibility operations.</li> </ul>
Spills	MARPOL Annex I	Survey vessel standard operating procedures to be prepared and implemented including (if appropriate) an offshore bunkering procedure. Contingency plans will be prepared and implemented, e.g. vessel Shipboard Oil Pollution Emergency Plans (SOPEPs).

## 6. Summary of Impacts

TEPM has committed to take actions in order to ensure appropriate environmental and social performances during the Project operations and activities. A summary of the Project impacts is described in Table 2 and the commitment register which is designed to mitigate those impacts are displayed in Table 3. Action list including responsibility, target date, budget estimation and the progress of mitigation measures taken are presented as required.

Table 2 Summary of the Potential Impacts and Description of Proposed Mitigation measures  
Socioeconomic impacts and associated measures

Synthesis of potential impact : physical and natural components

Description of residual impacts	Residual impact (R)
<b>Air quality</b>	
<p>Air emissions resulting from the seismic campaign are considered as limited in time and space; they are similar to those of any other merchant ship of a same size.</p> <p>As air emissions scatter right after their release, their impact on air quality is considered as negligible.</p>	Negligible
<b>Water column</b>	
<p>The duration of the seismic study is quite short (19 days) and the quantity of discharged treated sanitary effluents is considered to be low (and identical to any other merchant ship of similar size). The sanitary discharges impact will be localized and temporary, and the discharges easily diluted in the sea. The sanitary discharges impact is negligible.</p> <p>Crunched food waste discharged at sea are quickly scattered and will feed fish. All the discharges will satisfy the MARPOL International Convention standards. Residual hydrocarbons contained in bilge waters (&lt;15 ppm) should quickly dilute in the ocean. The impact on water quality will be negligible.</p>	Negligible
<b>Sediment and benthic communities</b>	
<p>A perturbation of the seabed or impacts on the associated benthic community can be observed when seismic surveys are carried out in less than 50 m water depth. As no geophysics activities will be performed at this water depth, the impact should be negligible.</p>	Negligible
<b>Coastal biological environment and protected area</b>	
<p>No hydrocarbon will be produced during the exploratory survey. The implementation of an adapted management plan for accidental release should reduce to the minimum the impacts on land.</p> <p>Furthermore, due to the distance from the coast of the project (at least 250 km), coastal biological environment will be not impacted.</p>	Negligible
<b>Planktonic communities</b>	
<p>Impacts on planktons are generally observed in the 5 meters around the seismic source, but seismic operation impacts on these organisms are considered as statistically insignificant, and cannot be measured.</p> <p>Even if the Andaman sea has a rich abundance of zooplankton groups, natural mortality rates are high and natural annual fluctuations in population densities is large (due to oceanographic and climatic variations).</p>	Negligible
<b>Marine mammals</b>	
<p>Though marine mammals are sensitive to underwater noise, specific surveillance should significantly reduce geophysical survey impacts on cetaceans, including the risk of physical injuries, behavior disturbance (diving and breathing patterns, vocalization), migration disturbance, social behavior change. The soft start of seismic shooting will give cetaceans time to leave the study area. The use of passive acoustic monitoring equipment (PAM) will improve, in particular at night, the observation performed by marine mammal observers (MMOs.)</p>	Minor to Negligible

<b>Turtles</b>	
The turtle surveillance by MMO should significantly reduce geophysical survey impacts on turtles, including the risk of physical injuries, the disturbance of their behavior (especially when nesting) and migration, etc. The soft start procedure will give turtles time to leave the study area before the beginning of seismic shooting. In addition, the implementation of the Turtle Guard System will avoid turtle mutilation and death caused by tail buoy towed tied at the end of the streamers.	Minor to Negligible

<b>Fish</b>	
Adult fish: adult fishes (including threatened species identified by the IUCN) are likely to be present in the project area, but avoidance behavior generally observed in response to seismic acquisition activities contributes to prevent possible damages caused on these populations. In addition, the progressive start of the activities will give fish time to leave momentarily the area. The impact is therefore considered as minor to negligible.	Minor to Negligible
Juvenile fish: The seismic survey may cause short term disturbance to reproduction patterns of certain fish species which form concentrated breeding aggregations. However, YWB block is not an important area for fish reproduction; it is considered that the marine fauna which could be affected will not be measurable and localized.	Negligible

<b>Birds</b>	
It is unlikely that birds dive near the ship if food sources (fish, food waste) are kept away. In addition, even in an accidental situation, a seismic survey does not entail a risk of major heavy oil spill (no oil production during this geophysics study) that could harm marine birds. As a consequence, the impact should be negligible.	Negligible

**Synthesis of potential impact : human component**

Description of residual impacts	Residual impact (R)
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<b>Marine traffic</b>	
Vessels presence on YWB block could disturb marine traffic. Prior to the operation, it will be necessary to inform contractor's employees during HSE or Project inductions about the risks related to the presence of fishermen or commercial ships in the Project area and the mitigation measures planned. Furthermore, communication with Myanmar marine authorities (MPA, DMA, Myanmar Navy and coastguards) and the issuance of a notice to mariners about the seismic operation by marine authorities will be needed. During the seismic operation, the implementation of a safety zone will minimize disruption of marine traffic. Due to seismic vessel movement (approximately 5 knots), occupation of a same area will last only a few hours. Equipment of the seismic vessels with loud speakers to communicate with boats not equipped with radio will minimize the risk of collision with others ships present in the area. If the ship pursues its approach and does not respond to calls, chase vessels should make physical approach to inform the captain	Negligible

<b>Fishing</b>	
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<p>The project area could encroach on the commercial and offshore fishing zone. The fishing activity will be affected by seismic activities, mainly because of the presence of the survey vessel (for a short time at the same place), but also because of the procedures aiming at driving fish back from the main ship (soft start).</p> <p>Prior to the activity, flyers on the seismic campaign in Burmese and Thai languages will be prepared.</p> <p>A scouting survey enabling to assess the fishery activity at the seismic area, to be conducted before the seismic starts, is not planned for this project due to the low probability of encounters with fishermen and of the presence of fish traps. The position of the ship and prospected areas will be notified at any time to the marine authorities and main fishery stakeholders (DoF and MFF) during the survey, in order to minimize the obstacle to maritime activities.</p> <p>Boats are not really deviated from their fishing area due to the seismic vessel movement. Furthermore, chase vessels are used to monitor the presence of ships using radar or visual observation, and establish radio or loud speaker communication with the ship operator to inform him about the operation area and the need to reroute their boat. Chase boats will also be used in case of need to contact fishing.</p>	<p style="text-align: center;">Negligible</p>
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**Local development**

<p>Short duration of seismic project implies small solicitations of local suppliers. The recruitment of a Thai translator to participate to the survey and handle encounters with Thai fishermen is advised.</p> <p>At this stage, the impact on tourism industry is negligible. The potential disruption of cruise ships roads to Myanmar is negligible due to the survey vessel movements.</p>	<p style="text-align: center;">Negligible</p>
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Table 3. Commitment Register including Action progress

Commitment register						
Impacts	Mitigation measures	Action taken	Completion Date	Type / Responsibility	Cost	Progress %
Impact on marine mammals, sea turtles and fish	Implementation of marine mammals' observation monitoring by <b>qualified specialists</b> , maintaining an observation zone of 3 km and a mitigation/exclusion zone of 2,800 m for all marine mammals (reduced to 800 m if the species are identified as being of low frequency sensitivity).	<i>In place, One PAM and one MMO on board the Polarcus Asima ensuring visual observations and acoustic monitoring</i>	07/05/2016	Seismic Contractor	24, 000 USD ( 1 MMO, 1 PAM experts, daily rate 400 USD for one month)	100 %
	Observation zone will be enforced by the deployment of a series of <b>marine vessels</b> with radio communication capabilities. It is recommended that observers could be embarked on the support vessels to complement the visual monitoring of the main MMO. This is especially relevant during undershooting operations.	<i>Yes, both Opal and Crest Adventurer watchkeepers were briefed by the Polarcus Asima MMO and PAM Operator before starting the seismic acquisition.</i>	07/05/2016	Seismic Contractor	180, 000 USD (1 Supply vessel, daily rate 6000 for one month)	100 %
	Pre-shooting visual monitoring by MMOs on the vessel for at least 60 minutes prior to air gun firing to check for marine mammal presence in exclusion zone. This should be undertaken between line changes.	<i>Yes, visual monitoring by competent MMO is systematically conducted for at least 60 minutes prior to the soft start.</i>	07/05/2016	Seismic Contractor	No specific cost allocated	100 %

	Implementation of soft start procedures, over a period of at least 20 minutes to allow marine mammals the time to leave the survey area including a mitigation air gun. This should be undertaken between line changes in the event the change time exceeds 20 minutes.	<i>Yes, JNCC guidelines are strictly applied as a rule.</i>	07/05/2016	Seismic Contractor	No specific cost allocated	100 %
	Prior to the commencement of seismic firing, if marine mammals are identified in the exclusion zone, the soft start procedure should be delayed until all mammals have left the exclusion zone. The soft start procedure should be initiated 20 minutes after the last sighting of the animal in the exclusion zone.	<i>Yes, JNCC guidelines are strictly applied as a rule.</i>	07/05/2016	Seismic Contractor	No specific cost allocated	100 %
	Passive acoustic monitoring to be implemented if sensitive areas or species are identified in the survey area, involving deployment of electronic detection equipment to detect presence of sensitive species or during night or poor visibility.	<i>Yes, both MMO are competent PAM operators and equipment has been reported as fully operational.</i>	07/05/2016	Seismic Contractor	No specific cost allocated	100 %
Physical disturbance and physical presence	Solid streamer fitted with depth monitoring and control devices.	<i>Yes, implemented during all the survey.</i>	07/05/2016	Seismic Contractor	4,000,000 USD	100%
	Best Available Technology to optimize duration of activities.	<i>Yes, deep towed streamers to reduce sea state noise induced and minimize duration of activity minimize</i>	07/05/2016	Seismic Contractor	Already integrated in conception phase	100 %
	Regular continuous monitoring of survey area during daylight hours by a MMO will reduce collision risk between vessels and marine organisms.	<i>Yes, continuous visual monitoring is ensured by competent MMO by daylight.</i>	7/05/2016	Seismic Contractor	No specific cost allocated	100 %

Atmospheric emissions	On-going maintenance program to ensure equipment is in good working order.	<i>Polarcus Asima and all onboard equipment maintenance are managed via the electronic PMS "Shipnet". Opal and Crest Adventurer are using excel spreadsheets systems.</i>	7/05/2016	Seismic Contractor	Already integrated in Polarcus prerequisite	100 %
	Best available technologies to increase efficiency of combustion and incineration processes (Using low sulphur fuel which meets the maximum IMO sulphur cap of 3.5%).	<i>Polarcus Asima has been given the "Clean Design" notation by DNV and her generators are powered by MGO with an average sulphur content of 3.5% (same MGO for Opal and Crest Adventurer).</i>	7/05/2016	Seismic Contractor	159,000 USD ( 20 cu.mtrs/day Diesel consumption – 265 USD for 1 cu.mtrs)	100 %
Discharge to sea	Perform regular monitoring.	<i>Garbage Records Books and Oil record Books were found to be properly maintained in compliance with MARPOL regulations.</i>	7/05/2016	Seismic Contractor	4000 USD for HSE audit ( 1 Auditor, 2 days rate including travel expenses)	100 %
	All vessels shall comply with MARPOL: bilge water segregated and treated to less than 15 mg/l prior to sea discharge.	<i>As a "Clean Design" vessel, the Polarcus Asima is fitted with a 5 ppm OWS. Crest Adventurer: Bilge water is pumped into bilge water holding tank for storage and will be discharged during port call or ashore. Opal: 15 ppm OWS reported as fully operational (source: OVID).</i>	07-05-2016	Seismic Contractor	Integrated in the Polarcus prerequisite	100%

	<p>Suitable sewage treatment units shall comply with Myanmar discharge limits and MARPOL.</p>	<p><i>Polarcus asima: Black water is processed by the sewage treatment plant before being discharged.</i>  <i>Crest Adventurer: Black water are retained on board and disposed to shore facilities (based on Captain information).</i>  <i>Opal: Black water are processed by the sewage treatment plant before being discharged.</i></p>	<p>7/05/2016</p>	<p>Seismic Contractor</p>	<p>Integrated in the Polarcus prerequisite</p>	<p>100 %</p>
	<p>Bilge water segregated and treated prior to sea discharge.</p>	<p><i>Yes, bilge and oily waters are processed by the 5ppm OWS prior being discharged (Polarcus Asima; Opal 15ppm OWS).</i></p>	<p>7/05/2016</p>	<p>Seismic Contractor</p>	<p>Integrated in the Polarcus prerequisite</p>	<p>100 %</p>
	<p>Survey ships equipped with sanitary wastewater treatment units.</p>	<p><i>Polarcus Asima as a DNV Clean Design vessel is fitted with a sewage treatment system to process the black waters (through three chambers) and the grey waters (third chamber only for chlorination).</i>  <i>Opal: grey water is directed straight overboard, there is no mean of treatment and any system to quantify the volume of overboard discharge.</i>  <i>Crest Adventurer: Grey water is discharged overboard without any treatment but daily records of discharged quantity are maintained. TBC</i></p>	<p>07-05-2016</p>	<p>Seismic Contractor</p>	<p>Integrated in the Polarcus prerequisite</p>	<p>100%</p>

	Food waste milled and ground to a size of <25 mm in diameter prior to discharge.	<i>The Polarcus Asima food macerator has been out of order during the seismic survey acquisition and it is planned to repair after the operation. Opal: food waste is processed by the sewage treatment plant. Crest Adventurer: As per Garbage Management Plan, vessel is below 400GRT, hence vessel is not equipped with macerator.</i>	07-05-2016	Seismic Contractor	Integrated in the Polarcus prerequisite	100%
	Implementation of maintenance and monitoring program for the performance of sewage water treatment units.	<i>Yes, Sewage treatment plant are maintained as per manufacturer's recommendations and preventive/routine maintenance is managed via the electronic PMS "Shipnet". Opal/Crest Adventurer: Maintenance program supported by excel spreadsheets.</i>	7/05/2016	Seismic Contractor	Integrated in the Polarcus prerequisite	100 %
Hazardous and non hazardous wastes	Perform a Waste Management Plan, including appropriate reporting mechanisms for the treatment of wastes.	<i>Yes, the Polarcus Waste Management Plan is in place, strictly followed and in line with MARPOL Regulation 73/7/ Annex V. Garbage Record Books and Oil Record Books appear to be well maintained on each Field Unit vessel.</i>	7/05/2016	Seismic Contractor	5000 USD for 2 times port's waste disposal charges (include. Port call, clearance, offloading etc...)	100 %

	<p>The incineration procedures shall comply with national and international standards and equipment will be the subject of regular maintenance. A follow-up report regarding the incineration of wastes will be submitted to Total E&amp;P Myanmar.</p>	<p><i>Polarcus Asima is fitted with an IMO certified incinerator (temperature range:900°C-1500°C). Its maintenance plan is managed by the PMS Shipnet. Opal and Crest Adventurer are not fitted with incinerator.</i></p>	<p>7/05/2016</p>	<p>Seismic Contractor</p>	<p>Integrated in the Polarcus prerequisite and monitoring Integrated in HSE management of Total E&amp;P Myanmar</p>	<p>100 %</p>
	<p>The crew will be trained to use waste management procedures.</p>	<p><i>Crew awareness about the waste management is a continuous process starting from the familiarisation of the vessel, placards are placed at various garbage collection locations. On board training are carried out to ensure that all personnel are familiar with the requirements of the Garbage Management Plan.</i></p>	<p>7/05/2016</p>	<p>Seismic Contractor</p>	<p>Integrated in HSE management of Polarcus</p>	<p>100 %</p>
	<p>No solid waste will deliberately be released at sea. Combustible waste and non-hazardous waste can be incinerated on board. The other waste will be stored in appropriate containers and brought onshore to be supported by an approved company.</p>	<p><i>Only food waste are disposed overboard within the limitations defined by the MARPOL Regulation.</i></p>	<p>7/05/2016</p>	<p>Seismic Contractor</p>	<p>5000 USD for 2 times port's waste disposal charges (include. Port call, clearance, offloading etc...)</p>	<p>100 %</p>

Accidental releases	Shipboard Oil Pollution Emergency Plans (SOPEP).	<i>Asima: SOPEP on board Opal: SOPEP on board Crest Adventurer: As per Regulation 37 of MARPOL Annex 1, oil tankers of GRT 150 T and above, and all other ships of 400 GRT and above must carry a class-approved SOPEP plan on board. As such, there is no requirement for Crest Adventurer to have class-approved SOPEP plan on board.</i>	07-05-2016	Seismic Contractor	No specific cost allocated	100%
	Crew trained in oil spill response procedures.	<i>Regular SOPEP (Oil Spill Response) drills and trainings appear to be conducted according to Polarcus matrix on each of the three vessels.</i>	7/05/2016	Seismic Contractor	Integrated in HSE management of Total E&P Myanmar	100 %
	On-board antipollution equipment.	<i>Each of the three vessels are equipped with Oil Spill Response Equipment Kits stowed at strategic areas.</i>	7/05/2016	Seismic Contractor	Integrated in the Polarcus prerequisite	100 %
	Modern navigation equipment to indicate the approach of other vessels complete by surroundings surveillance by chase boats.	<i>The Polarcus Asima is a DP2 vessel fitted with recent and modern navigation equipment, X and S Band RADAR are fitted with ARPA. For the duration of the seismic campaign she was escorted by one support vessel "Opal" and one chase vessel "Crest Adventurer".</i>	7/05/2016	Seismic Contractor	Integrated in the Polarcus prerequisite	100 %
	Vessels must be sufficiently visible at night with all the appropriate devices.	<i>All navigation lights were operational and floodlights and search lights are in sufficient quantity.</i>	7/05/2016	Seismic Contractor	Integrated in the Polarcus prerequisite	100 %

	Training of personnel.	<i>Marine and seismic crew were familiar with the vessel as most of them had more than one year experience on board. Regular trainings are given on board to ensure an optimum emergency preparedness.</i>	7/05/2016	Seismic Contractor	Integrated in HSE management of Total E&P Myanmar	100 %
Socioeconomic	Information to the contractor's employees during HSE or Project Inductions about the risks related to the presence of fishermen or commercial ships at the Project area and the mitigation measures planned.	<i>Information about fishing activity on the survey area vicinity was given to the Field Unit crew during the Kick Off Meeting and a section of the Project EHSQ Plan is dedicated to it.</i>	7/05/2016	Total E&P Myanmar/ Seismic Contractor	No specific cost allocated	100 %
	Communication and coordination with Myanmar marine authorities (MPA, DMA, Myanmar Navy and coastguards) and main fishery stakeholders (DoF and MFF) about the seismic location, schedule and duration (before, during and after seismic).	<i>MOGE Representatives (4) who are on board the Polarcus Asima (2) and the Crest Adventurer (2) are in charge to update the Myanmar Navy every four hours from 08.00LT to 20.00LT by radio with the Field Unit activities.</i>	7/05/2016	Seismic Contractor	No specific cost allocated	100 %
	Preparation of flyers on the seismic campaign in Burmese and Thai language.	<i>Flyers were only in English and Burmese Languages but not in Thai. No Thai boats encountered.</i>	25/04/2016	Seismic Contractor	No specific cost allocated?	100%
	Recruitment of a Fisheries Liaison Officer able to speak Burmese and Thai that will participate to the survey and handle encounters with Thai fishermen, solving any issues that could arise between these fishermen and the project.	<i>The MOGE Representatives based on board the Crest Adventurer are acting as FLO but are not Thai speakers. However they did an excellent job by communicating with the fishermen encountered on the survey area and no Thai fishermen were seen.</i>	20/04/2016	Seismic Contractor	10,500 USD ( daily rate 350 USD for a month)	100%

	Issuance of a notice to mariners about the seismic operation with the assistance of marine authorities.	<i>Myanma Oil and Gas Enterprise (MOGE) was requested to issue a NTM for the YWB 2D Survey on March 17th, 2016. Mariner Notice was issued on 18th Apr via MOGE.</i>	18/04/2016	Total E&P Myanmar	No specific cost allocated	100%
	Equipment of the seismic vessels with loud speakers to communicate with boats not equipped with radio.	<i>Loudhailers on board Asima, Opal and Crest Adventurer</i>	07-05-2016	Seismic Contractor	Integrated in HSE management of Polarcus	100%
	A scouting survey enabling to assess the fishery activity at the seismic area (localize fishermen and interview them to determine their origin, spot and count the fish traps installed in the area) should be conducted before the seismic starts even if there is a low probability of encounters with fishermen and of the presence of fish traps	<i>Meetings with fisheries authorities and fishermen were held on December 2014 and January 2015 but there was no scouting survey conducted before the 2D acquisition program to assess the fishery activity and its potential impact.</i>	16/12/2015	Seismic Contractor	No specific cost allocated	100%
	Permanent exhibition of internationally recognized symbols during daytime and emission of light signal at night-time.	<i>Days shapes and navigation lights were in use as per COLREG 72.</i>	7/05/2016	Seismic Contractor	No specific cost allocated	100 %
	Weekly communication with marine authorities on operations (date, position, issues, etc.).	<i>This is managed by the Polarcus Asima MOGE Representatives, Myanmar Navy is contacted by radio on daily basis.</i>	7/05/2016	Seismic Contractor	No specific cost allocated	100 %
	Use of chase vessels to monitor the presence of ships using radar or visual observation and keep them out of the seismic area.	<i>Both support vessel Opal and chase vessel Crest Adventurer have been ensuring escort and scouting duties for the whole duration of the seismic campaign. Both are equipped with RADAR.</i>	7/05/2016	Seismic Contractor	No specific cost allocated	100 %

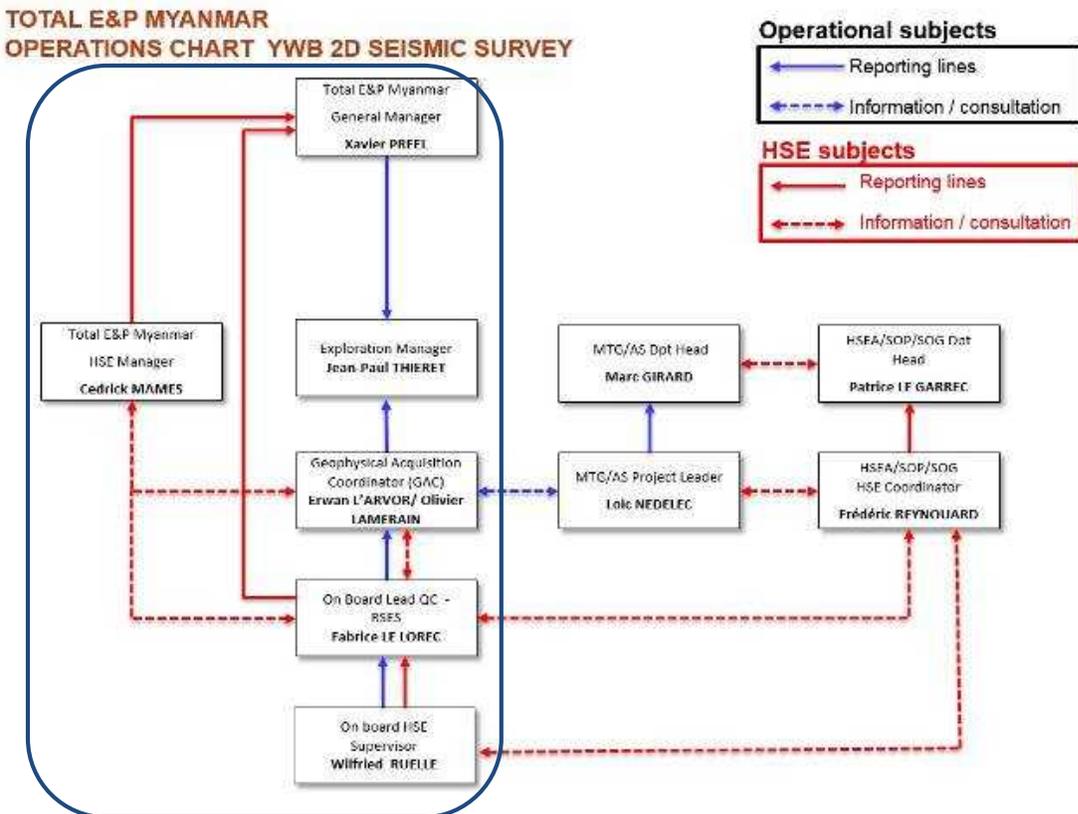
## 7. Monitoring Program

Monitoring program is developed to monitor the compliance status of the Project operational activities. This program ensures that subcontractors – Polarcus ASIMA and Opal and Crest Adventurer are following the contractual obligations defined in the contract such as safety, marine mammal observation and waste management in particular. Close monitoring is carried out by TEPM onboard HSE supervisor.

This monitoring demonstrates compliance with legal standards and TEPM's internal requirements, provides evidence of the effectiveness of the implemented control measures and ensures the accuracy of impact predictions for the Project. This monitoring program is also designed to allow for appropriate management actions to be taken as soon as possible in the event of any accident or incident. When developing the monitoring measures, the following strategies have been applied; 1) Consistent with internationally and locally acceptable practices 2) Logistically practical and 3) Cost effective.

### 7.1 TEPM Environmental Management Organization

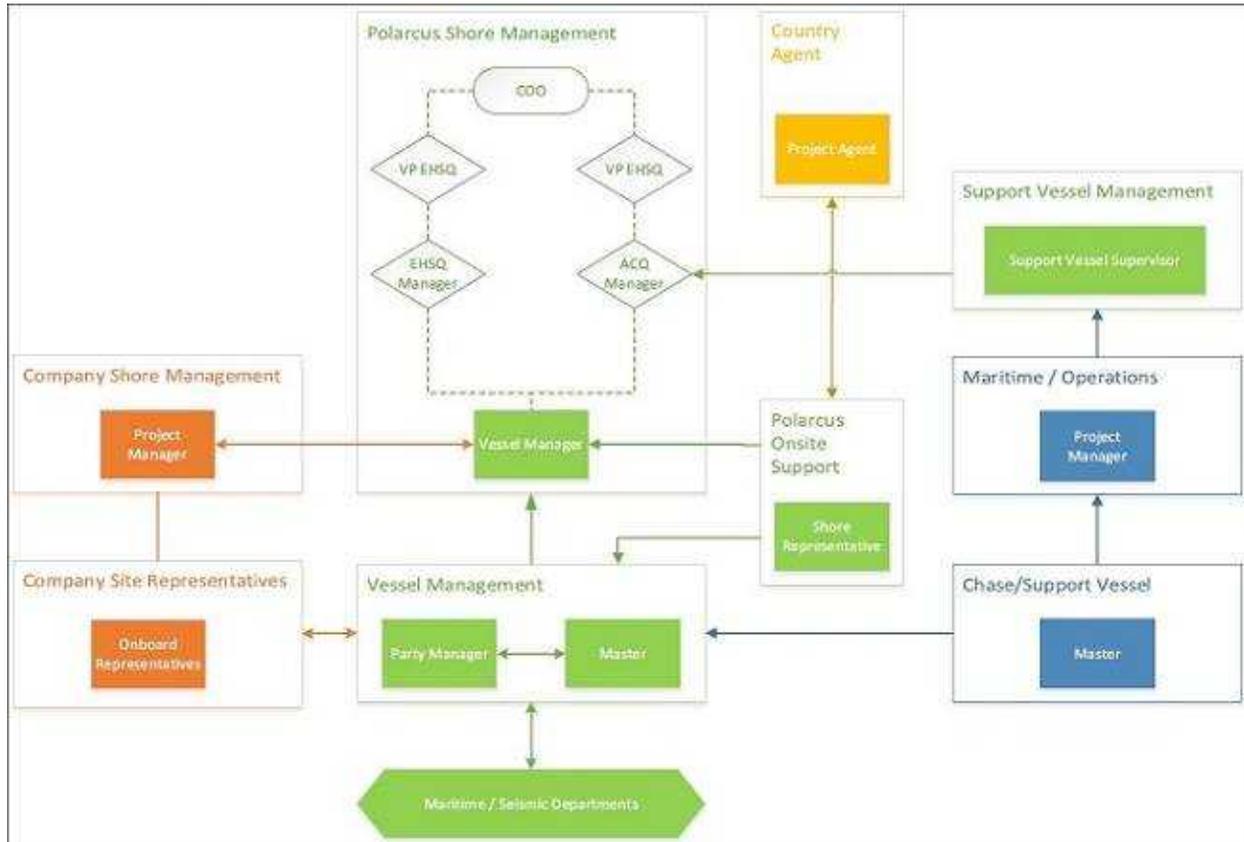
The following chart shows the basic organization of TEPM during the Project.



### TEPM personnel onboard

Name	Position	From	to
Fabrice Le Lorec	Lead QC (RSES)	20.05.2016	09.05.2016
Wilfried Ruelle	HSE Supervisor	20.05.2016	09.05.2016

### Contractor Organization Chart



### Environmental Management Organization Roles and Responsibilities

Position	Responsibilities
<b>TEPM</b>	
General Manager	Ultimately responsible for environmental, safety and social performance on all operations in the country. Responsible for obtaining necessary permits. Ensure delivery by the asset of its targets within this area. Ensure effective communication with high level authority and partner stakeholders.
HSE Manager	Provide strategic guideline and advice on the HSE and social performance management of the survey activities to ensure that TEPM management system is implemented.
Exploration Manager	Oversee and coordinate all activities pertaining to the operation of the Project. Ultimately responsible for operational performance and budget. Ensure delivery of operational targets. Ensure effective communication with all stakeholders.
Geophysical Acquisition Coordinator	Operational and technical aspects of the Project including Contractor supervision during operations.

Onboard Lead QC RSES	Ensure the implementation of risk reduction and control of impacts procedures; Check compatibility and simultaneous activities coordination; Impose additional risk reduction measure more complete if the situation requires it; Support emergency situations control
Onboard HSE Supervisor	Advise and monitor on implementation of HSE and Social (Fisheries) protection measures. HSSE representative on the seismic vessel who will have oversight of the contractors operations and be able to monitor, influence and work with the Contractor on Environmental and Social (Fisheries) Performance issues.
<b>Contractor</b>	
Project Manager	Responsible for own and subcontractor's technical performance and compliance.
HSE Manager	Ensure that HSE and social regulatory requirements are met and those ESMPM requirements are properly implemented.

Supervision of subcontractor activities is conducted by the seismic contractor and monitored by the TEPM on-board HSE supervisor. This ensures the close and continuous monitoring of subcontractor staffs where activities are taken place.

## 8. Reporting Requirements

According to the requirement specified in the article (108) of EIA procedure, TEPM need to submit the Environmental Monitoring reports within 6 months after completion of the Project to ECD. The report includes the following information collected during the period of 2D Seismic survey program.

- Waste Generation
- Safety Performance Indicators and
- Marine Mammals Observation Report

The schedule, frequency and reporting of the monitoring measures are summarized in below table.

Project activity	Monitoring measures	Frequency of Monitoring	Reporting	Responsibility
Environmental Emissions (Waste/Air)	Report including types of wastes generated and disposal	Weekly	Monitored weekly and included in Project Environmental Monitoring report	TEPM HSE Supervisor
Underwater sound from operation of air gun	Marine Mammal Observation Record	Daily log for Marine Mammal Observations	MMO report	TEPM HSE Supervisor
Accidental Release and Leaks	Safety record	If accidental release occurs	Safety record	TEPM HSE Supervisor

The Project follows MARPOL requirements and a Shipboard Oil Pollution Emergency Plan (SOPEP) is prepared and implemented. If spills occur, they are recorded and reported as prescribed in the SOPEP report.

## 8.1 Waste Generation

The Chief Officer was responsible for waste management and was supported by the GPT (Green Protection Team) to ensure the collection, separation and processing of garbage. Garbage bins points were available around the vessel, and they were distinguished by colors and names for efficient segregation.

Garbage were stored in suitable containers and big bags in designated areas, and sorted as follows:

- Overboard after maceration – food waste
- Incinerator – wood, paper, cardboard, sludge.
- Disposal Ashore – All other items (by support vessel Opal)



Polarcus Asima made efforts to minimize waste such as limiting the purchases of individual bottled waters and promoting the consumption of the vessel produced potable water. Bottled water was not supplied on board Polarcus Asima. Environmental awareness of the crew was raised on the vessel during HSE meetings. During the YWB seismic survey emphasis was put on minimising food waste and crewmembers were instructed not to overserve food to minimise left-over in plates. Placards were placed at various garbage collection locations and main areas of the vessel. Waste generated are recorded and properly documented.

**Note:** 14.3 m3 of domestic waste were disposed to shore reception facility in Ranong (Thailand) after the survey completion by the support vessel Opal on May 09th, 2016.

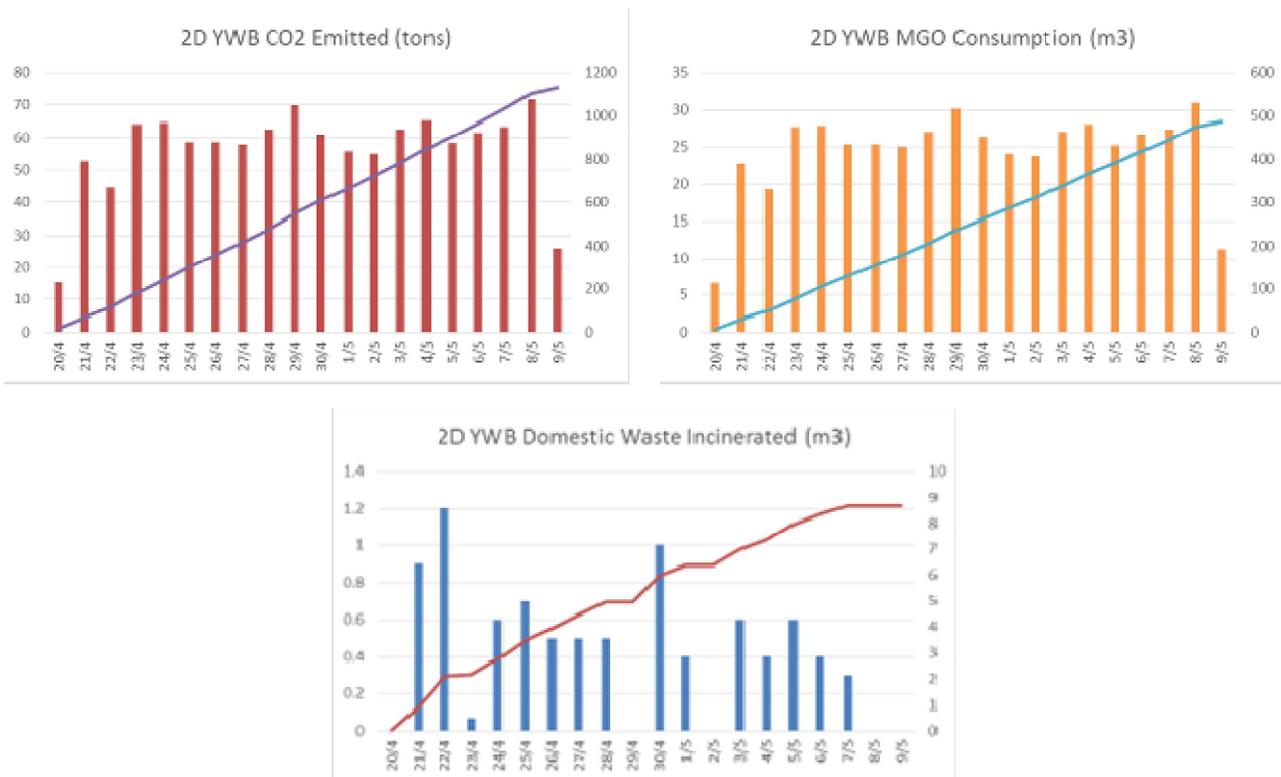
### 8.1.1 Emissions

The M/V Polarcus Asima has DNV “Clean Design” vessel notation. The DNV certification to be considered as green vessel is very difficult to obtain and requests a strict observance of various constraints to be kept. As a green vessel, the Polarcus Asima cannot reject waters with more than 5 ppm of hydrocarbons.

Concerning the emission, the Polarcus Asima is fitted with catalytic converters able to reduce drastically the emission of Nitrogen oxide (NOx) and Sulphide oxide (SOx) in the atmosphere. The chemical reaction, done at high temperature, requests continuous injection of urea in the exhaust manifold. The vessel daily consumption of urea was approximately 150 liter (for two engines at 50% load) a day and the storage capacity is 290m3. The system is efficient even if

periodic filter cleaning is requested. In the engine control room a control panel allows to monitor in real time the various emissions.

The YWB fleet ran on regular marine gas oil (sulphur content - 0.0357%). The following graphs show the CO2 emission, MGO consumption and waste incinerated during the project operation.



## 8.2 Incident/Accident

There was no incident occurred during the YWB 2D seismic survey.

## 8.3 Safety Statistics and Performance Indicators

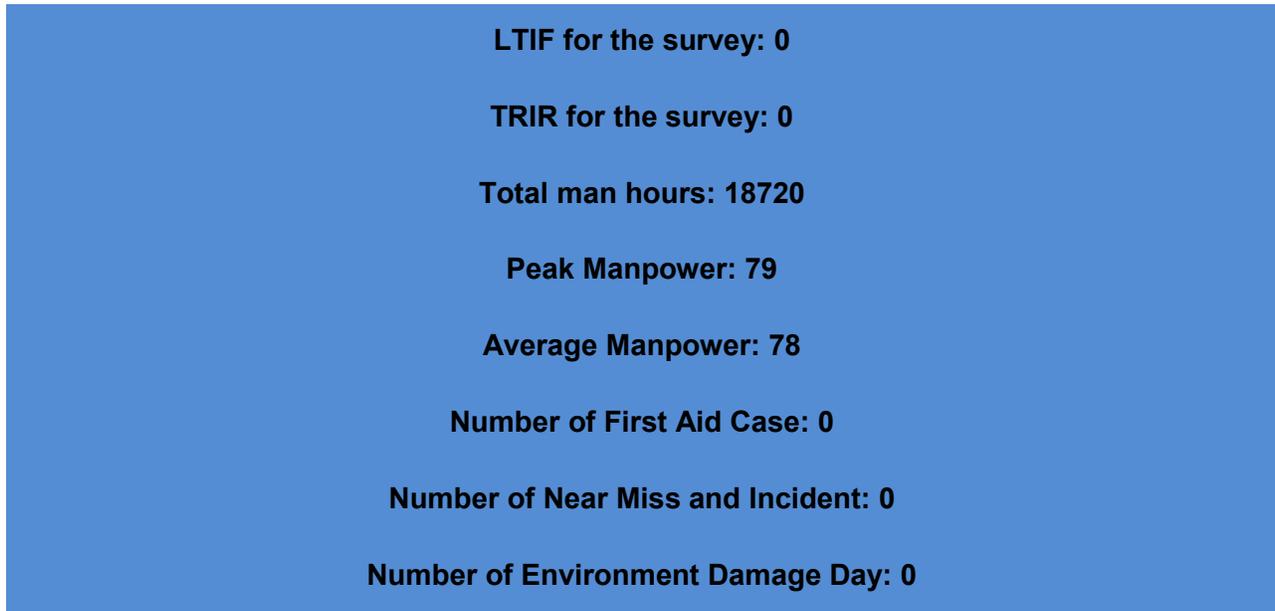
### 8.3.1 Man-hours

The total man-hours counting started from the 20<sup>th</sup> of April 2016: date of mobilization kick off meeting and fleet departure with gear deployment.

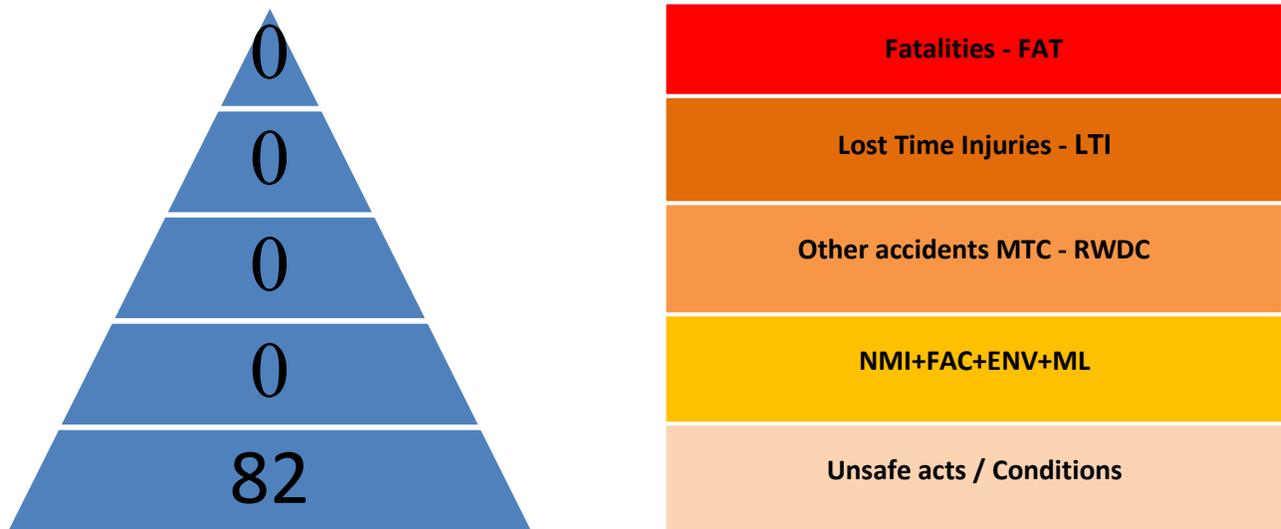
The calculation base is 12 hours per person and per day counted all along.

### 8.3.2 Safety Indicators

During the whole duration of the project no personal injury was recorded.



*Situation on May 09<sup>th</sup>, 2016 – Whole survey considered*



**MTC: Medical Treatment Case – RWDC: Restricted Work Day Case – NMI: Near Miss**

**FAC: First Aid Case – ENV: Environment Damage – ML: Material Loss**

### 8.3.3 Unsafe Act and Unsafe Condition reporting

Polarcus uses the term of NCCAPA for an Unsafe Act/Condition reporting. NCCAPA means Non-Conformance/Corrective Action/Preventive Action.

A total of 82 of NCCAPA reports have been entered in the IMS “Insite” by the YWB 2D survey fleet during the survey.

### 8.3.4 Final HSE Statistics Report

 <b>2D YWD TEPM</b> 			
<b>Myanmar 2016</b>			
<b>FINAL HSE REPORT</b>			
	April	May	TOTAL
TEPM Representatives	264	216	480
TEPM Visitors	768	432	1,200
Polarcus Visitors	792	648	1,440
Polarcus Asima	5,676	4,608	10,284
Opal	1,452	1,224	2,676
Crest Adventurer	1,452	1,188	2,640
<b>Total Worked hours</b>	<b>10,404</b>	<b>8,316</b>	<b>18,720</b>
FAT (Fatality / Fatal Accident)	0	0	0
LTI (Lost Time Injury)	0	0	0
RWDC (Restricted Work Day Case)	0	0	0
MTC (Medical treatment Case)	0	0	0
FAC (First Aid Case)	0	0	0
ED (Environmental Damage)	0	0	0
MPL (Material and/or Production Loss)	0	0	0
NMI (Near Miss Incident)	0	0	0
UA/UC (Unsafe Act/Unsafe Condition)	50	32	82
Occupational Illness/Injury	0	0	0
Non Work Related Injury / Illness	0	1	1
Safety Committee Meeting	2	1	3
Other (Dept) Meeting	16	12	28
Tool Box Meetings	165	101	266
HSE Trainings	3	7	10
HSE Training (attendees)	28	111	139
Inductions (Inducted)	18	0	18
Action Points Generated	111	62	173
Action Points Closed	75	67	142
Action Points Remaining	36	-5	31
MEDEVAC Drill	1	0	1
Muster / Abandon Ship drill	2	2	4
Fire drill	1	3	4
MOB drill	1	1	2
Helicopter Crash drill	0	0	0
SOPEP drill	1	1	2
ISPS	1	0	1
Other Drill	1	0	1
Small Boat Operations	10	4	14
Small Boat operations exposure (Hours)	48h45	11h57	60h42
Bunkering / Resupply Operations	1	2	3
Floating debris recovered	2	1	3
Soft-start non-compliance	0	0	0
Helicopter Operations	0	0	0
Medical checks	0	0	0
Clinic Visits	5	0	5
Medical Waste Produced (kg)	0	0	0
MGO consumption (m3)	263.41	224.82	488.23
CO2 emitted (tons)* 2.63	609.64	520.32	1,129.96
Domestic waste incinerated (m3)	5.97	2.70	9
Food waste disposed overboard (m3)	0.77	0.56	1
Black/Grey Water Discharge (m3)	113.07	60.55	173.62
Fauna observations	2	2	4

To be sent to: [david.albert@total.com](mailto:david.albert@total.com) & [patrice.le-garrec@total.com](mailto:patrice.le-garrec@total.com)  
 Mail object: HSE\_FINAL STATS\_YEAR\_MONTH\_SEISMIC PROJECT NAME

## 8.4 Marine Mammal Observation Report

Two qualified Marine Mammal Observers and PAM Operators were monitoring the marine biota in the area in accordance with the JNCC guidelines for minimizing the risk of injury and disturbance to marine mammals from seismic surveys (Report JNCC 2010) reinforced by the recommendations of the Initial Environmental Examination from Artelia Rev.3 issued on March 2015.

The following mitigation measures were implemented during the survey:

- Establishment of two shutdown zones (i.e. no air gun start-up); as follow:
  - radius of 2,800 m for low frequency cetaceans (i.e. adult length > 8 m)
  - radius of 800 m for medium/high frequency cetacean (i.e. adult length < 8 m)
- Establishment of an observation zone (radius of 3 km) from the centre of the seismic source array. Within this area, continuous visual monitoring was undertaken by the Polarcus Asima MMO, including continuous monitoring during a period of at least 60 minutes prior to air gun start-up.
- Implementation of a soft-start procedure as per JNCC (i.e. Ramp-up of the seismic arrays over a minimum of 20 minutes and maximum of 40 minutes). Establishment of a delay period of 20 minutes before the soft start after the last sighting of a marine mammal within the “shutdown zones”. Passive Acoustic Monitoring (PAM) provided complement to visual observation during night time and when visibility was too low to enable visual observations.

One observer is on board the Opal and the Crest Adventurer, these observers were marine crewmembers trained by the MMOs before the survey start. They were in charge of reporting any marine mammals approaching the area.

An 800 meter radius “shut-down zone” was in place as well for turtles, in water gears were designed not to entrap turtles.

### 8.4.1 PAM (Passive Acoustic Monitoring) & Magnetometer “tow fish”:

Deployments of PAM and magnetometer tow-fish were performed by the Polarcus seismic crew; PAM and Magnetometer operators (contractors) were present for the operations but not physically involved. A separate professional MMO report is prepared and submitted to ECD through MOGE in July 2016.



*Magnetometer fish*



*PAM cable*

## 9. Emergency Plan

The Polarcus Emergency Preparedness Procedures are standardized within the fleet and deal among others with the following situations:

- Abandon Ship
- Blackout and Dead Ship
- Collision
- Contact Interaction Refugee Vessel
- Extreme Weather
- Fire And Explosion
- Loss Of Power Propulsion And Steering
- Man Overboard
- Oil Spill Procedure
- Rescue From Confined Spaces Tanks And Holds
- Search And Rescue
- Hull Damage
- Contact With Third Party Activists

The Emergency Preparedness Procedures were clear, and appeared known by the personnel occupying the key positions. Drills and trainings covering emergency situations have been regularly carried out on each vessels of the YWB fleet.

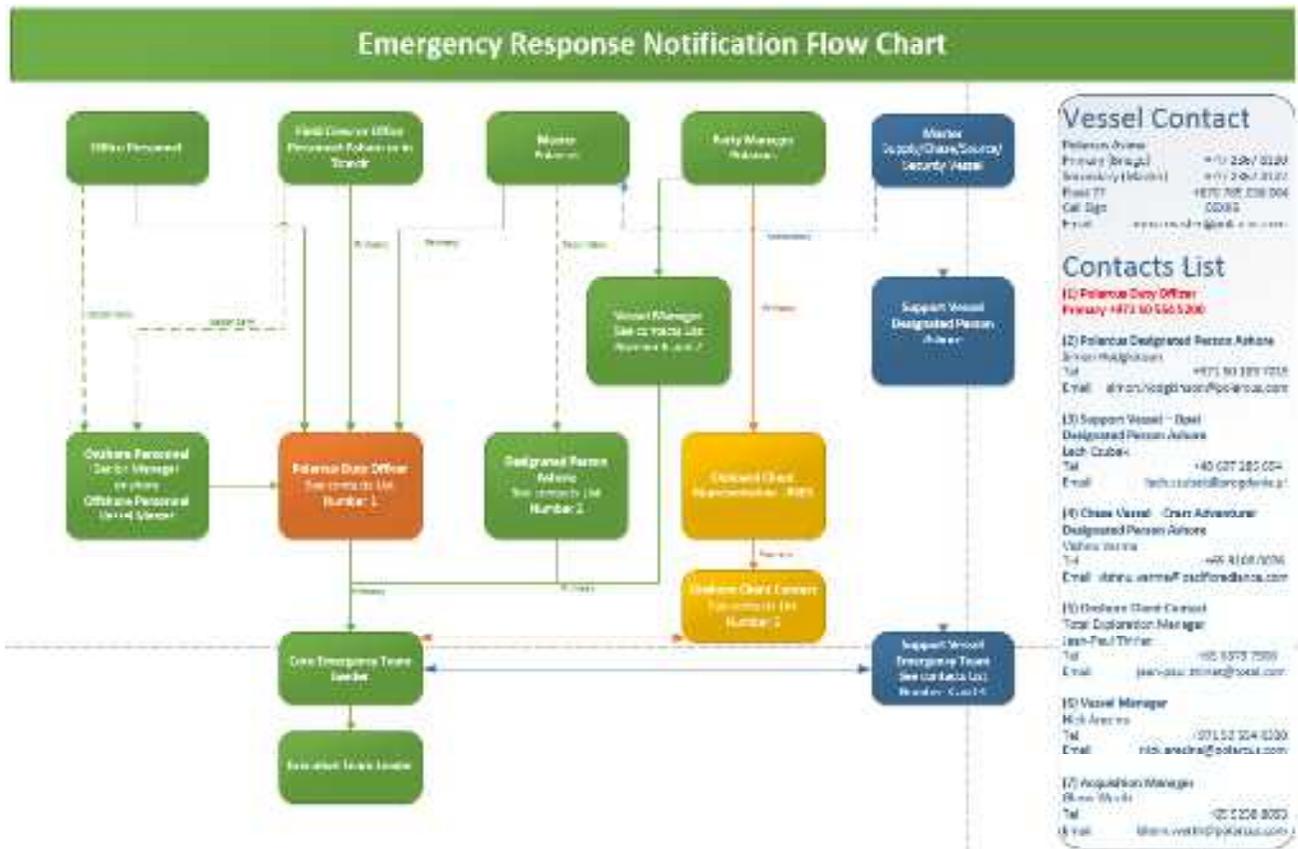
A Project Emergency Response Plan was compiled according to the Polarcus Environmental, Health, Safety and Quality Management System. It applied to the entire 2D YWB fleet operating simultaneously within the survey area.



Muster drill and MES demonstration

## 9.1 Emergency Organisation

The diagram below shows the emergency lines of communication between Polarcus and TEPM in the event of an incident.

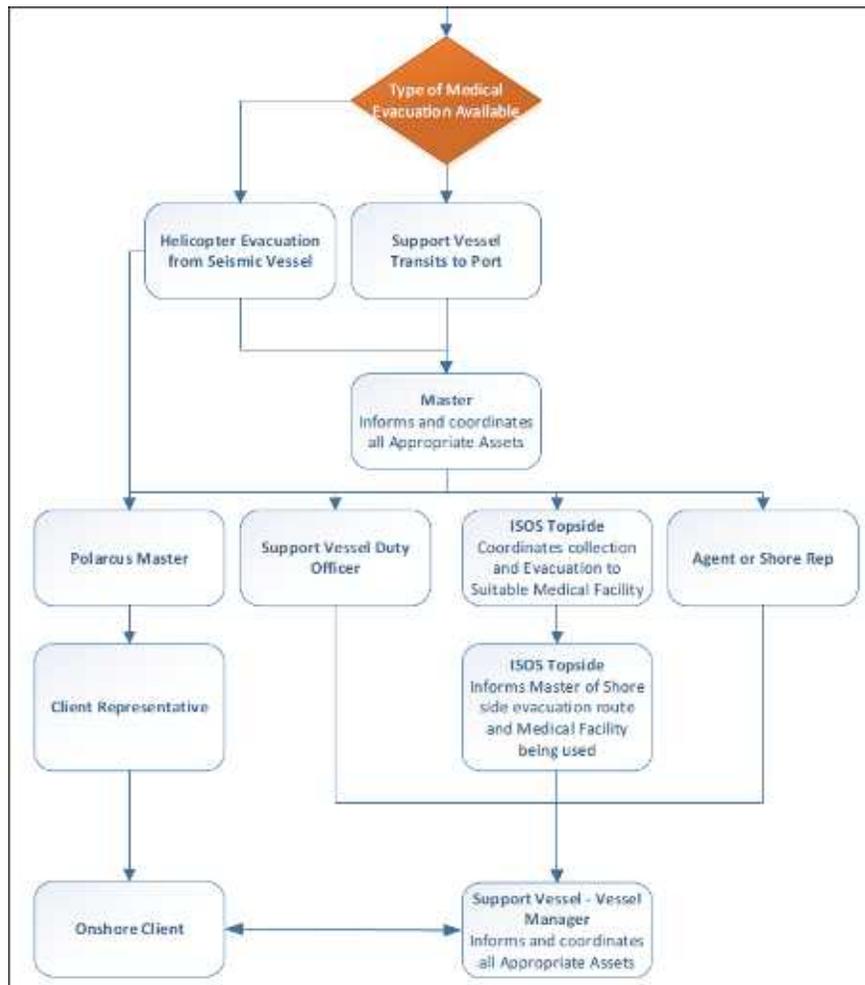


## 9.2 MEDEVAC plan

At the start of the survey TEPM RSES, TEPM HSE Supervisor and the Polarcus Medic ensured that the proper call numbers published in the plan were correct by checking all of them.

On April 25th, 2016, a MEDEVAC drill was successfully conducted:

- 12.08LT: Master informed RSES that ISOS shore support required to Medevac the IP
- 12.11LT: TEPM RSES phoned the TEPM Duty Officer to notify him a Medevac request was ongoing (PA Medic ↔TEPM Doctor) and gave a brief description of the IP condition and his personal details
- 12.14LT: Master informed the RSES that the TEPM Doctor confirmed the Medevac
- 12.25LT: TEPM Duty Officer confirmed he liaised with the TEPM Doctor and he was about to mobilize an ambulance helicopter; during this call the TEPM Duty Officer requested the RSES to provide him IP/vessel information by e-mail
- 12.30LT: TEPM RSES provided the vessel's information to the TEPM Duty Officer
- 12.32LT: TEPM Duty Officer acknowledged the TEPM RSES email
- 12.54LT: TEPM Duty Officer reverted to TEPM RSES with helicopter ETA on board Polarcus Asima (14.30LT) and informed that the flight duration from Polarcus Asima to Yangon Airport is 01h30min



MEDEVAC Flowchart (YWB 2D Survey EHSQ Plan)

## 10. Capacity Development and Training

All personnel are made aware of their responsibilities in respect to the implementation of the mitigation measures in this ESMPM. All personnel taken part in the activity are given a project specific environmental induction prior to starting work. This induction covers environmental responsibilities relevant to vessel crew duties and responsibilities on board the survey vessel in relation to waste management procedures, SOPEP responsibilities and marine fauna interactions.

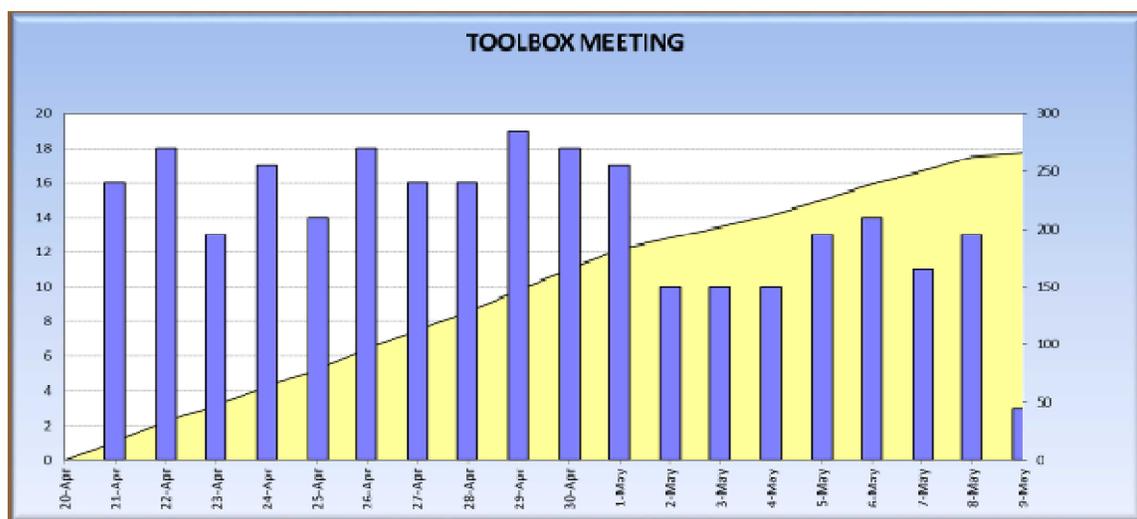
In order to reinforce environmental awareness during the survey program such as contractual and HSE requirements, scope of work, Project specific plans, Survey Hazards and Risk Assessment, different types of meeting like Start-up or Kickoff meeting, Daily work permit meetings, weekly HSE meetings, Tools Box Talk etc... were organized. These meetings are attended by the Project Manager, RSES, contractor Project Manager, contractor HSE Manager, contractor specialists and Vessel Master/representative.

### 10.1 Meetings

A total of 28 safety meetings (safety Committee, Departmental and Daily “HSE/Operation”) were recorded during the survey, performed by the YWB fleet.

General Crew Meetings were held once a trip. Minutes of meetings and associated logs were entered into the IMS “Insite”.

Tool Box Meetings as below were held at each shift change and whenever there was a need to either launch the work boat, deploy/recover air guns strings and streamer and any other unusual and major work.



## 10.2 Drills

A total of 15 emergency drills have been performed during the 19 days survey, Muster and abandon, Fire, Man Over Board, Security (ISPS), MEDEVAC, and others drills (e.g. Rescue from Height/Confined Spaces) were carried out. TEPM HSE personnel were always welcome to observe the drills and to be part of the debriefing. The following table shows the emergency drills organized during the survey.



Date	Type	Vessel	Brief Description
22/04/2016	Muster/Abandon	Polarcus Asima	All crew muster aft bridge / MES and life rafts deployment briefing
23/04/2016	MOB	Opal	MOB recovery / MOB boat deployment
24/04/2016	Muster/Abandon	Opal	All crew muster / life rafts deployment briefing
24/04/2016	Fire	Opal	Fire Muster and Dress-up
24/04/2016	ISPS	Crest Adventurer	Suspicious luggage
25/04/2016	Medevac	Polarcus Asima	Communication flowchart checked
26/04/2016	Rescue from confined space	Opal	IP Rescue from tank 1PS
30/04/2016	SOPEP	Crest Adventurer	Bunker hose burst off - Oil Spill on deck
01/05/2016	SOPEP	Opal	Oil Spill during Bunkering
02/05/2016	MOB	Polarcus Asima	FRC launched, dummy recovered 6 minutes after the general alarm
06/05/2016	Muster/Abandon	Crest Adventurer	All crew muster / life rafts deployment briefing/EPIRB & SART
06/05/2016	Fire	Crest Adventurer	Fire in paint store (main deck)
07/05/2016	Fire	Polarcus Asima	Fire in galley, Captain non-available
08/05/2016	Fire	Opal	Fire Muster and Dress-up
08/05/2016	Muster/Abandon	Opal	All crew muster / life rafts deployment briefing/EPIRB & SART

### 10.3 Trainings

A total of 10 trainings have been performed during the 19 days survey, TEPM representatives were always invited to observe or participate.

Date	Vessel	Name
22/04/2016	Polarcus Asima	Lifting/crane operations refresher for the marine deck crew
24/04/2016	Polarcus Asima	Fire Squads Trainings
26/04/2016	Opal	Rescue from height / confined spaces
01/05/2016	Polarcus Asima	Rescue from confined Spaces / use of recovery equipment
03/05/2016	Polarcus Asima	SOLAS Training - Emergency Propulsion
03/05/2016	Opal	Polarcus Safety Focus - Hands and Fingers Injury
03/05/2016	Polarcus Asima	Polarcus Safety Focus - Hands and Fingers Injury
05/05/2016	Crest Adventurer	Use of portable fire-extinguishers, fire hose and nozzles, fireman outfit/SCBA
06/06/2016	Crest Adventurer	First Aid Team Training
07/05/2016	Opal	SOLAS Training - Emergency Operation of Azimuth Thruster



*“Rescue from confined spaces” training  
Familiarisation with new “Neil-Robertson” stretcher”*



*“Emergency propulsion training”  
Engine room team*

Web-based training system (Videotel Training Modules) has recently been implemented on Polarcus fleet and each crew member has to complete modules based on a yearly program. For instance, during the YWB survey, some of the trainings’ topics were as follow:

- An introduction to resource management (situational awareness & decision making, communication, team work)
- Working with multinational crew – It’s a cultural thing!
- Intervention – Do the right thing!

## 11. Public Consultation and Information Disclosure

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In order to collect stakeholder perceptions and the recommendations on the Project, several meetings were organized with Department of Marine Administration (DMA), Myanmar Port Authority (MPA), Department of Fisheries (DOF), Fauna and Flora International Myanmar and Myanmar Fisheries Federation (MFF) from 24<sup>th</sup> to 29<sup>th</sup> September 2014.

For the awareness raising of the Project and the collection of the public opinions on the Project, TEPM organized public consultation meetings in Tanintharyi Division. The selection of 2 townships; Myeik and Dawei for the public consultation were based on the suggestions of Chief Minister Office and their local general administration department.

In Myeik, a public meeting was organized on the 16th of December 2014. It gathered 15 participants, composed of local authorities, representatives of NGO local branches and the MFF (Myanmar Fishery Federation) at the district level, and owners of fishing companies. During this meeting, a PowerPoint presentation was used as the basis of discussion. This document described the project characteristics and summarized the major potential impacts identified and the mitigation measures that will be implemented.

In Dawei, a public meeting was organized on the 27th of January, 2015. This meeting gathered around 10 participants, from the District Fishery Federation and from fishing companies operating in the area. As the meeting in Myeik, a PowerPoint presentation was used.

During the discussions, participants expressed several concerns such as the potential impacts of the Project on the fishing activities in deep offshore areas, social investment and the likely benefits to local community. In general, very few questions were asked on issues related to the project in Myeik but they advised that for the next meetings, the company send meeting arrangements well in advance to get a better participation. In Dawei, Participants' main concerns related to the impacts of the seismic campaign on the adult fish, juveniles and breeding grounds. TEPM developed a grievance mechanism adapted to the operating context as requested by stakeholders.

For the information disclosure, the newspaper advertisements, flyers and mariner notices are distributed to all concerned stakeholders accordingly. The IEE report and Myanmar translation of the executive summary of the report are disclosed on the webpage of Total ( <http://www.total.com/fr/dossiers/total-au-myanmar-engagement-et-responsabilite> ) within 15 days after submission of IEE report to ECD on 10<sup>th</sup> March 2016.



*Public consultation in Myeik*

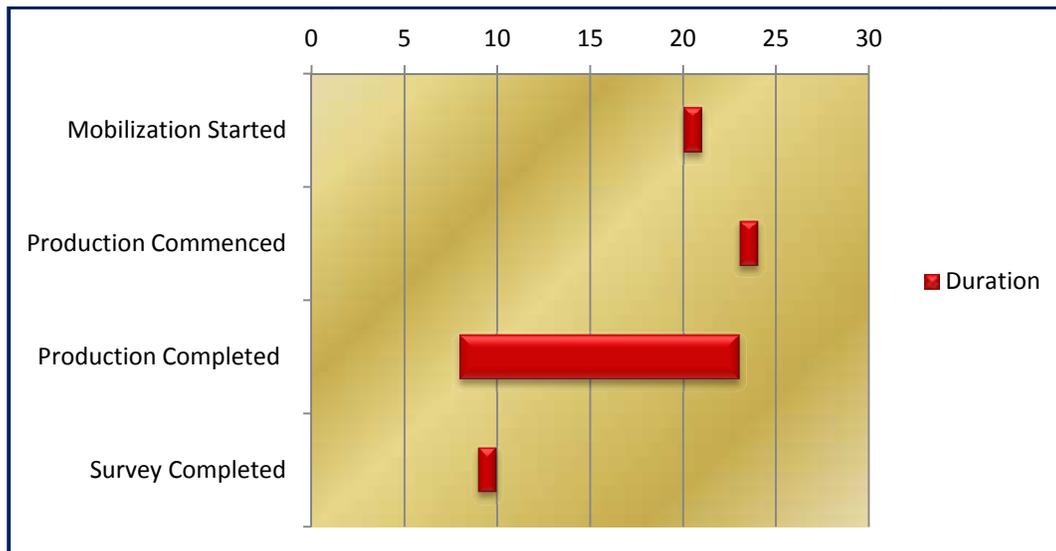


*Public consultation in Dawei*

## 12. Work Plan Implementation

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TEPM commenced the 2D seismic survey on 20<sup>th</sup> April and completed on 9<sup>th</sup> May 2016. The campaign last for 19 days. The detailed schedule is presented in the following graph.



Work plan of YWB 2D Seismic Survey campaign

## 13. Conclusions

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YWB 2D Seismic survey was completed well due to the fact that experienced seismic crew was proactive and their HSE culture is strong. There was no accident occurred during the operation and no lost time due to source related problems as the reliable guns and regular maintenance of the equipment are practiced.

In terms of MOGE participation, there were two MOGE representatives based on board the Polarcus Asima and two MOGE representatives based on board the Crest Adventurer. They were able to communicate in Burmese language with local fishermen which had been a great support to keep the Field Unit clear of fishing gears and boats and so to maintain a safe navigation environment for both Field Unit and fishing boats. They were also in charge of regular reporting to the Myanmar Navy by radio and were relaying information from the Crest Adventurer to the Polarcus Asima.

In general, the working atmosphere between Polarcus Asima crew and TEPM representatives are good as the Polarcus Asima crew shows initiatives and motivation, and the team spirit during the Project. However, there are some room for improvement with regard to Polarcus Asima's communication to the fishing societies. Although Polarcus Asima has the earlier expenced with Myanmar water and fishing communities, they are a bit late to cascade the flyers and information to the fishermen communities. This should be improved in the future projects.

In the MEDEVAC flowchart, the contacts between the RSES and Duty Officer, CMO and Polarcus Medic and CMO and Duty Officer for the joint validation is missing. This could be easily corrected by adding a chapter in the Emergency Response section and practicing in the MEDEVAC drill. All the experiences gained in this seismic acquisition campaign will be applied in the future similar projects.

## 14. PHOTOGRAPHS



*Mess room*



*Galley*



*Recreation room*



*Gymnasium*

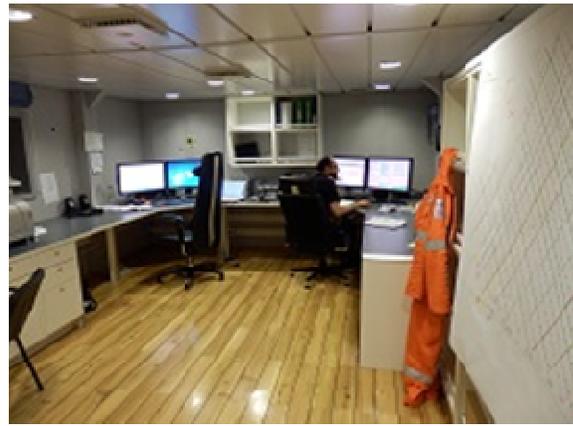


*Sauna*



*Clinic*

*Helicopter deck and basket ball field*



*Client office*



*Instrument room*



*Soliton as detected on RADAR screen*



*Work-boat launch*



*Ferry-boat (taxi boat) at Myeik jetty*