ENVIRONMENTAL PROTECTION AUTHORITY

Assessment Report

Application Ref No.: EEZ100016

Technical Review & Analysis of Operational Activities associated with Sidetrack Development Drilling & Marine Discharge Consent

Disclaimer

Document No.: D0010-OPS-REP-GN-0001	**Revision:** 1	**Date Issued:** 22/05/2018
Prepared by: F. Broomhead Signature: Date:	**Checked by:** B. Somers Signature: Date:	**Approved by:** P. Winterbourne Signature: Date:

Document History

Rev	**Date**	**Description**	**Prepared**	**Checked**	**Approved**
A	22/05/18	Issued for client review and comments	FB	BS	PW
0	29/05/18	Comments incorporated and issued as final to client	FB	BS	PW
1	06/06/18	Additional comment incorporated and issued as final to client	FB	BS	PW

TABLE OF CONTENTS

FIGURES

1.0 QUALIFICATIONS AND EXPERIENCE

My name is Frank Lyle Broomhead and I am a Senior Operations Consultant employed by Oil & Gas Solutions Pty Ltd for the purpose of undertaking a technical review and analysis on information specified in the Tamarind Marine Consent application no. EEZ100016.

I have previous experience in the Electrical and Instrument and Control field in the papermaking industry in Scotland, the steel industry in South Africa and the sugar refining industry in Swaziland before joining Shell B.P. Todd in New Zealand in 1974.

In 2010, I completed thirty-six years of service with Shell companies worldwide involved in both the onshore and offshore environments at a supervisory and senior management level.

I joined Shell BP Todd in 1974 as an Electrical and Instrument Control Supervisor at the Kapuni Field before making the transition to Production Operations in 1978 and working in the Maui Field as Operations Supervisor involved in the commissioning and start-up of the Maui Production Station (MPS).

I transferred to Petroleum Development Oman (PDO) in 1980 and was Production Supervisor at the onshore oil and gas facilities at Fahud and Qarn Alam.

I returned to New Zealand in 1984 as Kapuni Field Superintendent until 1987 when I moved to The Netherlands and joined Nederlandse Aardolie Maatschappij (NAM) BV as Onshore Platform Manager responsible for three gas and condensate platforms in the Dutch sector of the North Sea.

In 1990, I transferred to Shell Expro, Aberdeen as Offshore Installation Manager (OIM) on the Brent Delta. I remained there until 1993 when I returned to New Zealand and took the position of Maui Field Superintendent, responsible for Maui-A (MPA), Maui-B (MPB) and MPS. This included the manning, commissioning and steady state operation of the new Floating Production and Storage Offloading (FPSO) facility. I also transitioned MPB to a Not Normally Manned (NNM) installation.

In 1998 I left New Zealand to take a position on the Camisea Project in Peru as Onshore Coastal Facilities Manager based in Houston in the USA, where the design office for this project was located.

The Camisea project was later deferred so in 1998 I transferred to the Malampaya project as Platform Manager. The design office for this project was also in a Houston. I later relocated to Singapore where the construction of the Malampaya platform was being carried out and then to The Philippines where I was responsible for establishing the offshore procedures and business processes for the project, the technical training of local staff and the handover from Projects to Production Operations. I finished with the project in 2004 having achieved the position of Operations Manager, responsible for the onshore and offshore facilities.

In 2004, I transferred to the Sakhalin Energy Investment Company (SEIC) on the Sakhalin project in Russia and remained there until 2008 as Upstream Operations Readiness Manager, responsible for managing the handover of two offshore platforms, an onshore gas plant and two 800 km pipelines from Projects to Production Operations. I also established a suite of policies and procedures covering operations and maintenance, Permit to Work (PTW), Health, Safety and Environmental (HSE) in preparation for the handover from Project to steady state operations. In addition, I developed and implemented a technical competency system for local staff. I was also responsible for negotiating and managing the transition of the two pipelines and SEIC staff to Gazprom, a Russian energy company.

In 2008 I joined the North Caspian Operating Company (NCOC) Kashagan project in Kazakhstan charged with managing the transition of all responsibilities from the current operator to NCOC. I later became Technical Capability Manager, establishing a technical competency framework for local staff.

During this time, I assisted the Shell Learning and Development department in The Hague in building competency profiles for technicians.

I was also involved with local government and other agencies associated with the project and technical competency training. I left Kazakhstan and Shell service in 2010.

From 2010 to 2016, I provided consultancy services through a third-party consultancy company Wood Group ODL as a Senior Operations Consultant. During this time, I provided services to Apache, Chevron and INPEX which covered the development of documentation management systems and I carried out a manning study for Bumi Armada. In addition, I project managed an offshore organisation and efficiency review on behalf of Wood Group ODL prior to a major reorganisation by Repsol – Talisman in Malaysia.

I also provided consultancy services to OMV, again through the third-party consultancy company Wood Group ODL. I was not directly employed by OMV. The services provided covered the development of an Operations Readiness Assurance (ORA) Graduate Training toolkit for OMV corporate in Austria. This was a short-term assignment, conducted over 1 month in July/August 2012 and was completed on 17th August 2012. Under a separate assignment through Wood Group ODL, I also developed Performance Standards for Safety Critical Elements on for OMV corporate in Austria. This was also a short-term assignment, conducted over 1 month in May 2013 and was completed on 4th June 2013. I am not providing any ongoing support to OMV.

I have also worked independently on a review of BHP assurance processes on a mining project, assisting Lloyds Register Energy Drilling on developing an assurance process and for Woodside Energy in a ‘cold eye’ review of operating expenditure.

More recently, I have provided consultancy services to AWE Limited through a third-party consultancy company, Oil & Gas Solutions Pty Ltd. I was not directly employed by AWE Limited. The services provided covered the Operability & Maintainability review of the Front End Engineering Design of a new onshore natural gas processing facility, the Waitsia Gas Plant (WGP) in the Northern Perth Basin approximately 360km from Perth which will provide conditioning of raw gas to sales gas quality prior to export to gas distribution pipelines. This was a short-term consultancy assignment, conducted over 1 month in March 2017 and was completed on 31st March 2017. Under a separate assignment through Oil & Gas Solutions Pty Ltd, I also conducted an audit of the Computerised Maintenance Management System (CMMS) used on the current AWE Perth Basin Operational assets of Xyris and Dongara, also situated in the Northern Perth Basin. This was a short-term assignment and was conducted over a 2-week period in April/May 2018, with the work completed on 4th May 2018.

I was a member of the Instrument & Control panel (NZ) setting the curriculum for Instrument & Control apprenticeship schemes. I have presented papers in New Zealand on Dual-Skilling and in Kazakhstan on developing a technical competency framework.

My qualifications are:

a) New Zealand University Diploma in Industrial Production.

b) U.K. Full Technological Certificate (Credit) – Electrical Installation Work.

c) U.K. Technological Certificate (Credit) – Industrial Measurement & Control.

d) Management of Major Emergencies (Offshore Installation Manager assessment) – Health and Safety Executive U.K.

2.0 EXECUTIVE SUMMARY

In March 2018, Tamarind Taranaki Limited (Tamarind) applied for a Marine Consent and a Marine Discharge Consent EEZ100016. The operatorship was originally granted to AWE Taranaki Limited in 2005 for a period of 20 years commencing 25 November 2005 and ending on 24 November 2025.

In March 2017 Tamarind purchased all shares and is now 100% owner and operator of the field, which encompass activities relating to the extraction, production and transport of oil within the Tui Field in New Zealand.

The Tui Field comprises of five (5) producing oil wells situated in water depths of approximately 125 metres. The field started production in July 2007 with the wells connected to a Floating Production Storage and Offloading (FPSO) facility, the Umuroa which is located approximately 50 km offshore and processes the produced reservoir fluids.

The proposed activities will be carried out on four (4) of the existing Tui production wells and will side-track off these to access additional areas within the reservoir within Tamarind's pre-existing Petroleum Mining Licence (PML 38158).

The focus of this report is to review the operational effects associated with the activities listed below, identify any gaps or conflicting information and best practices to assess if any issues should be brought to the attention of the Board of Inquiry.

This report is therefore limited to statements lodged by Tamarind covering the following five activities, which are restricted under Section 20 (2) to (4) of the Exclusive Economic Zone (EEZ) Act.

1. Side-track of four (4) development wells in the Tui Field, with the potential for a fifth side-track in one of the wells should difficulties be encountered.
2. Installation, operation and removal of a semi-submersible drilling rig
3. Activities associated with logistics
4. Activities that occur during well drilling, servicing and well commissioning
5. Discharges of water from processing drainage from hazardous and non-hazardous deck drains on the drilling rig.

This report does not consider any issues associated with marine ecology or activities covered by an existing marine consent.

Alternative methods and locations were considered such as drilling of entirely new wells from new subsea locations (ref: Tamarind Impact Assessment document, Section 1.5, page17, para 2, 3). However, the utilisation of existing wells and modification of these by using side-track technology shortens the duration of the drilling activities. Reusing the current wells also means that existing subsea infrastructure such as flowlines and control lines can be used.

The use of a Remotely Operated Vehicle (ROV) to survey the well and surrounding area and execute certain tasks on or around the well is in line with industry best practice. The supply and support vessels will have Dynamic Positioning (DP) capability, which is also industry best practice.

A semi-submersible drilling rig has been chosen for the activities following assessment of alternative methods. A semi-submersible rig can be safely positioned and requires no special preparation of the seabed which would be the case for a jack-up drilling rig. It is also able to withstand more extreme weather conditions than other rig types.

Selection and contracting of an appropriate semi-submersible is still in progress, therefore the options available for the onboard management of harmful substances and treatment of deck drainage prior to discharge is unknown at this stage. However, the final design of the deck drainage system and procedures to be used to manage the hazardous and non-hazardous drains appear to capture industry best practice.

Also, the hazardous chemicals to be used for the work could not be verified although an indication of likely chemicals was provided (ref: Tamarind Impact Assessment document, Section 3.6.2, page 68, Table 3.3). However, Tamarind did indicate that any gaps in information would be made available to EPA prior to the work commencing.

To comply with other relevant legislation, Tamarind will provide an Oil Spill Contingency Plan to cover the Semi-submersible drilling rig (ref: Tamarind Impact Assessment document, Section 7.1, page 156, bullet point 14).

A safety case approved by WorkSafe New Zealand (High Hazards Unit) exists for the current operation and is valid until June 2018. A new operational safety case was due for submission to WorkSafe in March 2018. In addition, a safety case specifically relating to the drilling operations that is the subject of the Impact Assessment (IA) is being developed and is scheduled to be submitted to WorkSafe for approval prior to any drilling operations commencing.

There is a lack of detail on the processes used by Tamarind to manage asset integrity, HSSE, competence and skills training (including emergency response events), inspection, maintenance, wells and reservoir. However, it is acknowledged that these activities fall under the mandate of Maritime New Zealand and do not require certification from the EPA.

It appears from the information supplied by Tamarind that it has established a strong presence in the Taranaki region and is committed to developing long-term and meaningful relationships with the communities in which it operates. It contributes to community investment programs that bring positive and sustainable benefits to communities near Tamarind operations.

Tamarind also continues to place a high priority on the management of health, safety and the environment. Refer to Appendix 1, Tamarind Resources Health, Safety & Environment Policy, dated 6 March 2018.

A proposed request for further information has been included relating to the five activities, comprising of 24 clarifications (refer to Appendix 6). These clarifications are included as an optional aid for the Board of Inquiry, should they choose to request information we feel Tamarind's impact assessment is lacking. If the proposed clarifications are pursued by the Board of Inquiry and a further assessment of the response from Tamarind is required, a second report will be drafted that reviews this information.

It is also important to confirm that the new activities can be safely integrated within Tamarind's daily operations.

The application of best industry practice is apparent in some activities such as employing a ROV for survey work and removing marine deposits from critical wellhead equipment. Contracting support and supply vessels with dynamic positioning is also best practice, as it negates the need for the vessels to deploy an anchor to remain on-station. In addition, vessels supplying fuel to the rig will use dry break couplings on the bunkering hoses. In addition, bunkering of fuel will only take place in daylight hours.

By far the biggest risks are associated with the falling objects, well problems and spill/release. Refer Section 5.1, page 11.

I deem that the key risks as stated in section 5.1 have been recognised, understood and addressed by Tamarind as part of their application. However, in some cases the level of detail is sparse and hence the request for further information should provide the necessary clarification in those areas and close the gaps.

It is apparent that Tamarind has applied a structured approach to reviewing technical documents on the current and potential future activities by convening a series of workshops with key operational and technical personnel.

A similar exercise took place with drilling and engineering teams from Tamarind to identify the general categories of products that may be used during drilling activities and could potentially enter the rig's drainage system. A list of substances with potentially harmful components has been provided by Tamarind.

However, some proposed activities are in the early stages of planning and therefore certain information such as type of semi-submersible rig, drain system configuration on the rig and chemicals is not available. Tamarind is committed to containing harmful discharges and has acknowledged this and has stated that these details will be provided to the EPA prior to the works.

The key considerations given in section 5.2 identify the areas that Tamarind must maintain to guarantee success of the drilling campaign with special focus on emergency exercises, interface management between the Semi-submersible rig, supply/support vessels, helicopters, FPSO and the control of any modification or repair work on the rig.

3.0 INTRODUCTION

Tamarind has lodged an application for a marine consent to obtain all necessary consents associated with the pre-installation, installation, operation and removal of a semi -submersible drilling rig and associated logistics to support side-track development drilling within the Tui field.

Tamarind has also applied for a Marine Discharge Consent as part of the current application to cover the potential discharge of harmful substances through hazardous and non-hazardous deck drains on the drilling rig.

These activities are restricted under section 20 (2) to (4) of the Exclusive Economic Zone (EEZ) Act.

The Environmental Protection Authority (EPA) may obtain advice or information by commissioning any person to provide a report on any matter described in the activity to which an application relates.

The purpose and scope of this report is to:

- Review the marine consent application activities contained in the Tui Field Drilling Activities Impact Assessment document with particular focus on Sections 3, 6, 7 and 8
- Make an assessment of the responses received from Tamarind on further information requested
- Provide a findings and recommendations report based on assessment of the contents contained in the documents and information received and through further requests for information.

4.0 ASSESSMENT OF APPLICATION

4.1 Documents Reviewed

The following documents issued by EPA were reviewed as part of this study:

- Environmental Protection Authority Application Form EPA0404, Marine Consent Tamarind Taranaki, dated 7 March 2018
- Environmental Protection Authority Public Notice, Tamarind development drilling applications EEZ100016
- Tamarind Tui Field Drilling Activities - Impact Assessment to Support Notified Marine Consent and Marine Discharge Consent Applications, Document ERM Ref: 0435786.

In addition, the following source documents were also used:

- Marine Technology News 6 March 2014, Oil Rig Ballast Control Accidents, Claudio Paschoa
- Health and Safety Executive U.K. 2007, Accident statistics for floating units on the UK Continental Shelf 19802005.

4.2 Information Principles

It is understood that more detailed information cannot be presented by Tamarind on the type of semi – submersible drilling rig that will be employed in the field and the range of drilling chemicals that will be used as the project is currently in the early stages of planning. Therefore, information and schematics concerning these areas are not based on specific data.

However, in my opinion the application has provided the best available information known to Tamarind at this time and more detail will be supplied to the EPA by Tamarind when the extent of the work is known. Any outstanding issues will be risk assessed as part of the final report and a recommendation put forward making them a condition of the consent.

5.0 KEY RISKS AND CONSIDERATIONS

A semi-submersible drilling rig offers exceptional stability for drilling operations in rougher waters. The ability to float also allows for more flexibility when selecting locations for drilling. It comprises of underwater pontoons to support a rig while it drills in a particular location. The rig equipment and personnel quarters are above water and mooring lines anchor the rig to the sea floor. Refer to Appendix 2, which shows two examples typical semi-submersible drilling rigs.

Semi – submersibles generally speaking, have the ability to withstand the occasional weather threats such as storm force conditions. Semi-submersibles are moored in systematic ways but the mooring (anchor) spreads are chosen depending on the shape of the vessel being moored and the sea conditions in which they will be moored. Temporary anchors and anchor handling boats are normally used to control the final position.

As the wellbore is extremely precise, it is important that the semi – submersible rig is kept in position, despite the waves and the winds working to move it about. The drilling equipment is somewhat flexible to overcome slight movements caused by the wind and waves, but the drilling risers must not be bent beyond what it can manage, or damage will occur.

Additionally, dynamic positioning can be used to supplement the mooring lines to keep the rig in place. Dynamic Positioning (DP) uses different motors or propulsion units on the vessel to counteract against the motions of the water. In some cases, the dynamic positioning system is guided by telemetry signals from beacons on the ocean floor, satellite information and the angular movements of a cable. If the rig uses a hybrid of the two systems then it may be possible to reduce the number of anchors required. (Refer to Appendix 6, Clarification 1)

As mentioned above, a semi-submersible rig is self-contained with personnel accommodation and services but the generation (age) of the rig contracted for the work could drive different logistics and supply vessel needs due to deck space and the type of liquid storage equipment e.g. fixed or transportable Intermediate Bulk Containers (IBCs) on the rig. (Refer to Appendix 6, Clarification 2)

Each of the subsea production wells consist of a wellhead, a gas lift flowline, a production flowline and an umbilical, which are deployed on the seabed (ocean floor) to supply necessary control, energy (electric, hydraulic) and chemicals to the subsea oil well, subsea manifolds and any subsea system requiring remote control, such as a remotely operated vehicle (ROV). Therefore, the spread of the mooring lines and anchors and the laying and retrieval of the mooring lines and anchors will have to take this into consideration when installing and removing the semi-submersible drilling rig.

To ensure that the rig systems are operated and maintained correctly, it is important that the personnel are familiar with the rig and are deemed competent in their area of expertise. This includes knowledge of oil spill procedures, the deployment of oil spill equipment and the lines of communication between the field and those managing the spill event in the Tamarind emergency control centre.

A chart showing the number of occurrences for floating drilling units is shown below in Figure 5-1. It should be noted that this data not only covers semi – submersible drilling rigs but also jack-ups, ships and tension-leg platforms engaged in drilling, accommodation, production and storage. However, the events collected over the period 1980 -2005 provides an indication of the areas of risk that are relevant to the semi-submersible to be contracted by Tamarind. A supporting table is given in Appendix 3.

As mentioned previously, the drilling campaign will involve side – track drilling on four (4) of the existing wells, some of which are in close approximation to the FPSO. The current procedures covering emergencies should be reviewed to ensure that they cover all eventualities and the potential risks and mitigation measures feature in the rig safety case. (Refer to Appendix 6, Clarifications 3 and 4).

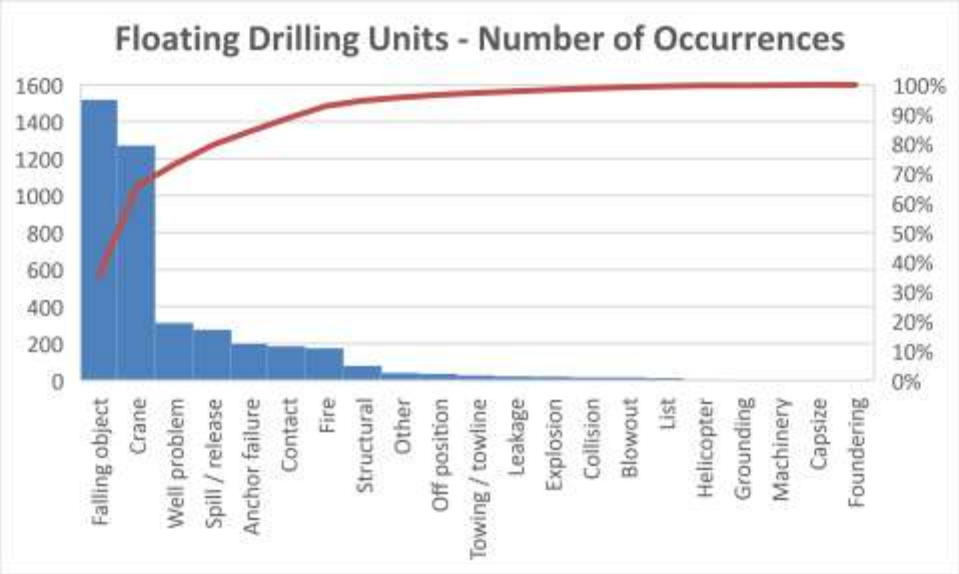


Figure 5-1: Health and Safety Executive U.K. 2007, Accident statistics for floating units on the UK Continental Shelf 19802005.

Source: http://www.hse.gov.uk/research/rrpdf/rr567.pdf

5.1 Key Risks

The key risks and considerations are given below:

Key Risks:

- Unauthorised repair or modification work to the ballast control system
- Contracting an aged semi-submersible drilling rig with a history of integrity issues
- Inadequate drilling rig deck drainage system
- Poor electrical connections between the rig and wellhead Intervention and Workover Control System (IWOCS). (Refer to Appendix 6, Clarification 5)
- Pushing the weather window for installation or removal of the mooring lines and anchors
- No modelling or procedure to prepare for a seismic event. (Refer to Appendix 6, Clarification 6)
- Gaps in technical skills and oil spill response
- Damage to wellhead, flowlines and umbilical by a falling object or crane failure.

5.2 Key Considerations

- Visible commitment by Tamarind management in maintaining the integrity and reliability of structures and equipment by providing the processes and tools to achieve this, including adequate financial resources to support the planned activities

- Applying a robust and structured approach to the planning and execution of the side-track drilling and support activities

- Employing competent and experienced staff at all levels within the organisation

- Ensuring service contract staff and equipment meet Tamarind standards. This ensures a degree of consistency in the quality of work carried out on the semi-submersible rig and the standard of the equipment brought onto the rig to execute the planned activities

- Carrying out regular emergency exercises on the drilling rig and also between the rig, support vessels, Floating Production Storage and Offloading facility, the Umuroa and the Tamarind emergency control centre

- Ensuring that any on-site repair or modification work to the semi-submersible rig or any of its critical systems is subject to a review and if required re-classification by a recognised certifying authority e.g. Det Norske Veritas (DNV) or Lloyds Register (LR) to guarantee compliance

- Safeguarding the wellhead and associated subsea equipment during drilling activities either by adopting industry best practice procedures or providing mechanical protection to exposed areas

- Valid class certificates for the duration of the drilling campaign with no conditions of class placed on the semi-submersible drilling rig.

6.0 EVALUATION OF INFORMATION

6.1 Pre-Installation Works

6.1.1 Potential Modification Work to the Semi-Submersible Drilling Rig

Until a decision has been made on the type of rig to be used, the extent of any work to the semi-submersible drilling rig will not be known. Any modification work carried out off-site or on location may be subject to inspection by a certifying authority to comply with the necessary vessel classification. (Refer to Appendix 6, Clarification 7)

6.1.2 Surveys, Sampling and Measurement

Data can also be obtained from previous side-track drilling and semi-submersible rig installations for the area to allow potential problem to be identified. (Refer to Appendix 6, Clarification 8)

An initial survey by the ROV will identify any issues that have to be addressed prior to the start of the drilling.

6.1.3 Seabed Site Clearance and Mooring

There should be no need to carry out any site clearance unless the ROV finds objects, which could possibly interfere with the placement of the mooring lines or anchors. (Refer to Appendix 6, Clarification 9)

Various measures to remove solid debris can be considered depending on the size and type of debris, such as grappling from a vessel, assisted by a Remote Operated Vehicle (ROV) to collect the debris, or a vessel-based winch. Larger pieces of hardware or dropped objects should be recovered and returned to shore.

As the drilling campaign requires the rig to move to various well locations, it is being considered to have a second set of anchors that could be pre-laid at the next planned drilling location. This approach would mean that up to 24 anchors could be in place on the seabed at any one time. Once the drilling rig has relocated to the new site, then the anchors at the previous site would be removed by an anchor handling vessel.

Mooring a semi-submersible drilling rig is more straight forward than positioning a jack-up rig or mono-hulled intervention vessel over a well. Hence the semi-submersible rig is the obvious choice as the rig involves no pre-load issues, scouring or extensive preparation of the immediate area.

The semi-submersible rig is not normally weather dependent during the approach, installation and removal stages. However, there may be limits imposed for the laying and retrieval of the anchor spread to ensure a safe operation and integrity of the wellhead area and associated equipment. (Refer to Appendix 6, Clarification 10)

6.1.4 Final Positioning of Semi-Submersible Drilling Rig

As previously mentioned, the final positioning of the rig and well activities involve some risk irrespective of whether the weather and sea-state meets the desired conditions.

To manage this risk, it is industry practice to use a combination of both temporary anchors and anchor handling vessels. The type of anchor is dependent on the sea floor type. The same anchor pattern and vessel support is employed for the demobilisation of the drilling rig.

Another risk may be caused by problems with the ballast control system. The ballast control system is made up of a network of pipes, valves, pumps and tanks, which work to keep the rig at an even keel. It is therefore important to ensure that the maintenance and integrity of the system is assured and that the ballast control operators are knowledgeable on the design of the user interface and skilled in the use of the system. Refer to Appendix 4, which shows an accident initially caused as the result of faulty pumps and valves that were part of the ballast control system. (Refer to Appendix 6, Clarification 11)

6.2 Well Drilling, Servicing and Commissioning

The proposed side-track drilling from a semi-submersible drilling rig on existing Tui well slots/conductors are a restricted activity, under section 20 (2) to (4) of the EEZ Act and requires a Marine Consent.

Prior to side-track drilling, the well selected for drilling will be shut in and all flowlines flushed and cleaned of hydrocarbons prior to the arrival of the rig and will remain shut in for the duration of the drilling activity at that location.

Details of the preparation of the well prior to drilling and the side-track activity have been provided in the Tamarind IA application. It has also been stated that there will be no flaring of hydrocarbons relating to the drilling program. However, it gives no indication of the activities associated with returning the well to service and if this activity is covered by the current application, allowable under the Permitted Activities Regulations or if a separate consent is required. (Refer to Appendix 6, Clarification 12)

6.3 Deposit of Material Removed from Wells

Drilling fluids are a key component of drilling operations and both water-based mud (WBM) synthetic based drilling mud (SBM) may be used for the side-track drilling of the Tui wells. It is proposed that cuttings from sections drilled with WBM will be discharged on site. However, this will be the subject of a separate non-notified Marine Discharge Consent application once the final chemical composition of the drilling muds is confirmed.

Cuttings from sections drilled with SBM will be treated through a cutting cleaning process and transported onshore for analysis and disposal at an approved waste disposal facility. A schematic of a typical solids control equipment layout used for cuttings cleaning was shown in the Tamarind IA application.

As the semi-submersible rig has yet to be identified, best industry practice should be applied to the filtration and disposal method of materials removed during drilling, servicing and commissioning activities.

6.4 Logistics

In addition to the vessels supporting the installation and removal of the semi-submersible rig, it has been identified that supply vessels will be required in the field for all or part of the drilling campaign.

It is envisaged the supply and support vessels will not be moored or anchored in the field during the drilling campaign but will use DP when maneuvering near to the rig and normal propulsion during transit or when holding station. The support vessel may serve as a multi-purpose vessel, including transport of supplies, emergency response e.g. man- overboard or spill incident. (Refer to Appendix 6, Clarification 13)

A vessel may also be fitted out with oil spill containment equipment to provide a fast response to any spillage. (Refer to Appendix 6, Clarification 14)

The vessel will also intercept any unauthorised vessels approaching the safety exclusion zone, assist other support vessels with logistical activities and retrieval of any floating debris that may be accidently lost overboard.

While the use of vessels and helicopters to supply and provide support to the drilling activities and crew transfer does not trigger the requirement for a Marine Consent, the placement of structures on the seabed that can be used as moorings to reduce fuel use and improve safety does require a Marine Consent.

6.5 General Field Activities

The two activities listed below may occur during the drilling activities and may also be relevant to other general field operations and activities, which are not authorised by the current marine consent and for which consent is sought.

6.5.1 Placement of Temporary Structures for Subsea Works

A range of subsea works is currently authorised by the existing Marine Consent or have been included in Tamarind's current application (EEZ100016).

The works may require small frames or other types of light structures to be constructed or placed on the seabed to allow Remote Operated Vehicles (ROV) or other devices to hold position for extended periods to facilitate the works. Any such frames or structures would have to be removed at the conclusion of the works.

The use of subsea structures and equipment of this type were not specifically mentioned in the IA application submitted by Tamarind and are not approved under the current marine consent (EEZ100016) therefore Consent would have to be sought for this activity. (Refer to Appendix 6, Clarification 15)

As previously mentioned (Ref: section 5.2, Key Considerations, bullet point 6), the temporary placement of protective devices may be deemed necessary to mitigate against potential damage to flowlines and the umbilical during preparation of the well for drilling and the subsequent demobilization after completion of the works. This activity was not specifically mentioned in the IA application submitted by Tamarind and is not approved under the current marine consent (EEZ100016) therefore Consent would have to be sought for this activity. (Refer to Appendix 6, Clarification 16)

As the support and supply vessels will have DP capability, there is no plan to locate a mooring buoy in the field for the vessels.

6.5.2 Marine Discharges from Drill Deck Drains

A range of chemicals are anticipated to be used during side-track drilling activities and the current application for a Marine Discharge Consent covers for the planned discharge of harmful substances via the hazardous deck drain system on the semi-submersible drilling rig.

As Tamarind are in the early planning phase of identifying and securing a drilling rig, the full details of the deck drain system used on the semi-submersible drilling rig cannot be provided.

Also, a comprehensive list of chemicals products, hazardous classifications, physical properties, maximum volumes and frequency of discharge cannot be provided for the same reason. (Refer to Appendix 6, Clarification 17)

6.5.3 Deck Drainage System

Tamarind will focus on drilling rigs that segregate and treat any rainwater runoff from regions of the rig deck which could potentially contain contaminants. Rainwater captured from such areas will be directed to holding tanks after passing through an oily water separator. (Refer to Appendix 6, Clarification 18 and 19)

A schematic of a typical drain system showing the separation between hazardous (closed) and non-hazardous (open) drains and the controls and treatment measures is shown in Appendix 5. (Refer to Appendix 6, Clarification 20)

Harmful substance storage will take place in bunded areas, which are only connected to the hazardous drain system. Operations and handling of harmful substances also occur in areas where any release would be captured and only flow to the closed drain system.

All accidental spills of harmful substances onto the drill rig deck would be contained by bunds, as far as practicable then cleaned using spill kits held on board the rig. Rig personnel will be trained in spill response and the use of relevant response equipment. (Refer to Appendix 6, Clarification 21).

The training should be included in the platform and rig emergency exercise plans with the roles and responsibilities clearly defined. (Refer to Appendix 6, Clarification 22)

Drains can also be temporarily blocked to prevent discharge into the deck drain system while clean-up activities are being carried out. (Refer to Appendix 6, Clarification 23).

Liquids in the collection tanks will be treated to reduce the oil-in-water content to a maximum specification in accordance with Marine Pollution (MARPOL) standards, which is typically 15 ppm prior to discharge overboard. Regular testing of overboard water is undertaken to ensure equipment on the rig is meeting design specifications and it is likely that the semi-submersible rig will have automated alarms to monitor oil-in-water content prior to discharge. (Refer to Appendix 6, Clarification 24)

6.5.4 Possible Discharge Substances

As mentioned in section 6.5.2, paragraph 3, at this stage in activity planning no specific chemicals have been selected for use. Tamarind would confirm all chemicals to be used, including their potential for ecotoxicity and other hazard characteristics. Full details would be provided to EPA prior to work commencing.

7.0 PLANNED ACTIVITIES

A scoping exercise was conducted (Refer to IA, section 6.1, page 109), including a workshop with key operational and technical personnel at Tamarind to review technical documents on the current and potential future activities at the Tui field. The scoping workshop explored the specific processes and activities that would be involved in each work item so that potential interactions could be fully assessed.

Whilst the assessment process mainly focused on environmental interactions (ref: Tamarind Impact Assessment document, section 11, pages 186 - 196, Table 11.1), it touched on the issues associated with the following:

- Pre-Installation Works for the Semi-submersible Drilling Rig
  - Use of ROV for subsea surveys and preparation for drilling phase
  - Preparing the well for entry
  - Cleaning the wellhead Intervention and Workover Control System of marine growth
  - Marine vessels
- Installation, Operation and Removal of the Semi-submersible Drilling Rig
  - Restricted access to unauthorised marine vessels
  - Planning of the drilling campaign
  - Location of the anchor spread
  - Moving location based on priorities of the drilling campaign
- Well Drilling, Servicing and Commissioning
  - Handover of the well from asset holder to the rig manager
  - Cement production
  - Chemical selection
  - On-shore disposal of excess products
- Logistics
  - Placement and removal of temporary anchoring structures for the drilling rig
  - Routine vessel and helicopter movement
  - Support and supply vessel scale and activities.

No new issues were found. The focus on the careful planning of activities to limit the duration and exposure from the activities has been fully adopted and the stated mitigation measures appear to be in line with the activities whilst still meeting operational requirements.

The scale of vessel operations required for the activity will depend on the amount and supply frequency of drilling equipment and the available storage space available on the deck of the rig.

8.0 UNPLANNED EVENTS

The potential, unplanned events do not constitute activities for which consent is required. However, a review of section 8, Impact Assessment was conducted to ensure that no gaps or conflicting information existed with respect to the use of the semi-submersible drilling rig and associated activities.

The four unplanned events are:

1. Hydrocarbon or chemical spills from the rig or vessels engaged in field activities.
   a) Chemicals or fuel during transfer operation.
   b) Chemicals during handling storage and use.
   c) Bunkering fuel spill in the event of a vessel incident.
2. Loss of well control.
   a) Unexpected well pressures or geological conditions.
   b) Lack of accurate well design data, procedures and activity steps.
   c) Malfunction of Blow Out Preventer (BOP).
3. Dropped objects that may result in damage to subsea structures and pipelines.
   a) Physical loss of equipment and materials during rig operations.
   b) Physical loss of equipment and materials during transfer by crane.
4. Marine vessel incident.
   a) Involving logistic support vessels operating in the field to support the semi-submersible rig.
   b) Collision between the support or supply vessels and the rig.

A qualitative approach was adopted in assessing the likelihood of an unplanned event occurring and the potential consequence on the environment and public health and safety. Criteria to assess the level resulting from an unplanned event are provided in a series of tables.

Mitigation and control measures are also included in the assessment for each of the four unplanned events.

9.0 CONCLUSIONS

Based on a review and analysis of the information provided by Tamarind, it is my opinion that there are no perceived residual risks that cannot be mitigated or managed that the Board of Inquiry should be aware of when making a decision.

A comprehensive outline of environmental management actions, mitigation measures and means of verifying compliance is provided in table 11.1 (ref:Tui Field Drilling Activities Impact Assessment report, March 2018, page 186 – 196).

However, I have raised 24 clarifications which are noted in the report and listed in a Clarification Register under appendix 6. The clarifications have been assigned a significance level to guide the Board of Inquiry, with 6 clarifications assigned a RED level, 13 clarifications assigned an AMBER level and 5 clarifications assigned a GREEN level.

As a minimum, answers to those clarifications assigned as RED require a response before I can confirm that the activities associated with using a semi-submersible drilling rig are acceptable and pose no risk.

In the final conclusion, a risk matrix will be developed as part of the final report and any activities deemed to be of low risk can be mitigated by the EPA by making them a condition of the consent. Any medium or high-risk items will be addressed accordingly.

Appendix 1 Tamarind HSE Policy

TAMARIND

TAMARIND RESOURCES

HEALTH, SAFETY & ENVIRONMENT POLICY

Tamarind is committed to protecting the health and safety of all employees and workers, ensuring that our activities have minimal impact on the environment and greater community.

Our vision is that while undertaking our activities we will cause "No Harm" and that:

- All accidents are preventable
- No task is so important that the risk of injury to people is justified.
- Our environment will suffer no long term effects. We will protect and minimize the impact of our activities on the environment

To achieve our vision Tamarind will:

- Create an HSE culture in which every worker shares the HSE commitment.
- Require all workers to comply with our HSE expectations.
- Identify, assess and mitigate health, safety and environmental hazards and risks, to as low as is reasonably practicable.
- Consult, listen and respond openly to Workers, to ensure the input of all is included in decision making processes impacting on workplace health and safety.
- Operate in a sustainable manner by conserving natural resources, reducing waste, recycling and re-using materials where possible.
- Continually strive to improve health and safety performance by establishing clear and measurable objectives and targets, auditing, reviewing and reporting performance.
- Provide training, equipment and facilities necessary to maintain a safe and healthy worksite
- Comply with all applicable HSE legislation, regulations and industry standards

Tamarind requires workers to STOP work if they believe any work compromises their personal safety, the safety of others or the protection of the environment.

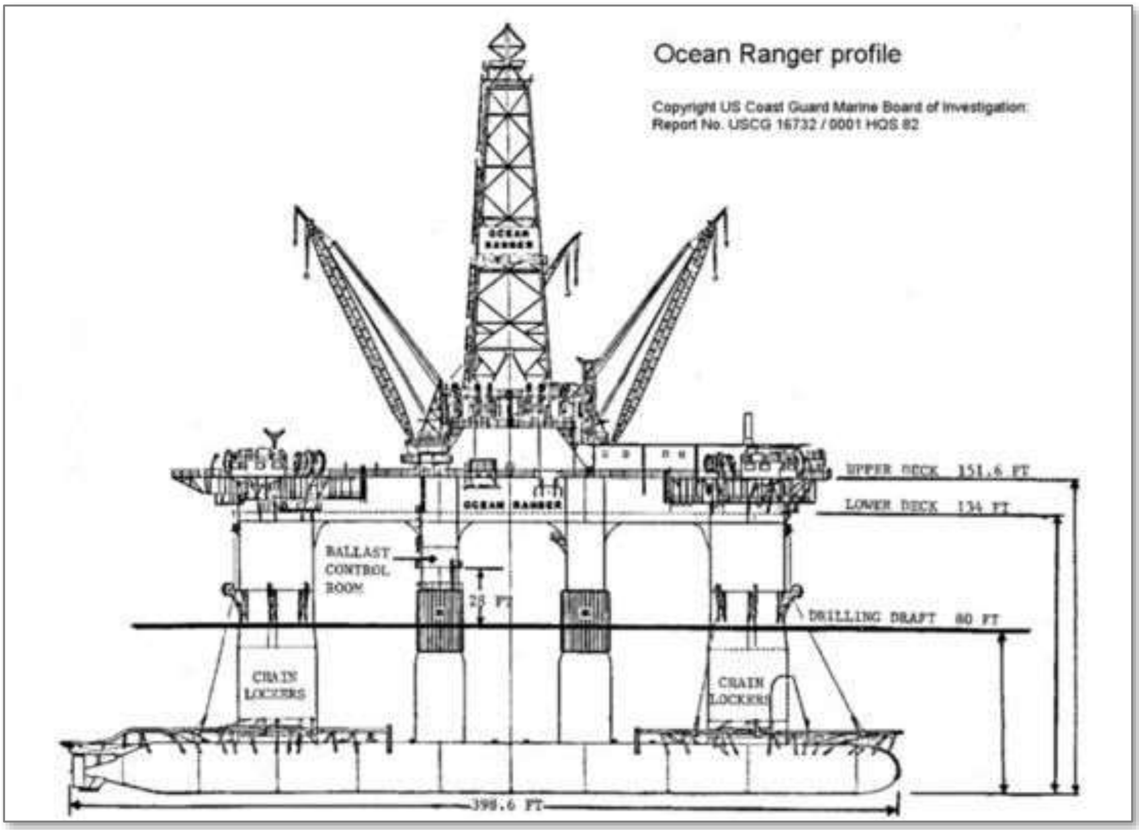
Ian Angell
CEO Tamarind Resources

6th March 2018
Date

Figure 1.3 The Tamarind Health, Safety and Environmental Policy

ENVIRONMENTAL RESOURCES MANAGEMENT 0368292 TAMARIND CONSENT/FINAL/5 APRIL 2018
8

Appendix 2 Semi-Submersible Rig Overview



Appendix 3 Floating Drilling Units – Type of Event and Number of Occurrences

Type of Event	Period 1980 – 2005 No. of occurrences
Anchor failure	200
Blowout	18
Capsize	3
Collision	19
Contact	186
Crane	1272
Explosion	21
Falling object	1519
Fire	175
Foundering	2
Grounding	4
Helicopter	7
Leakage	24
List	14
Machinery	4
Off position	38
Spill / release	276
Structural	81
Towing / towline	28
Well problem	313
Other	43

Source Reference: http://www.hse.gov.uk/research/rrpdf/rr567.pdf

Appendix 4 Ballast Control Failure

This disaster occurred in 2001 when the rig began to sink after a series of explosions.

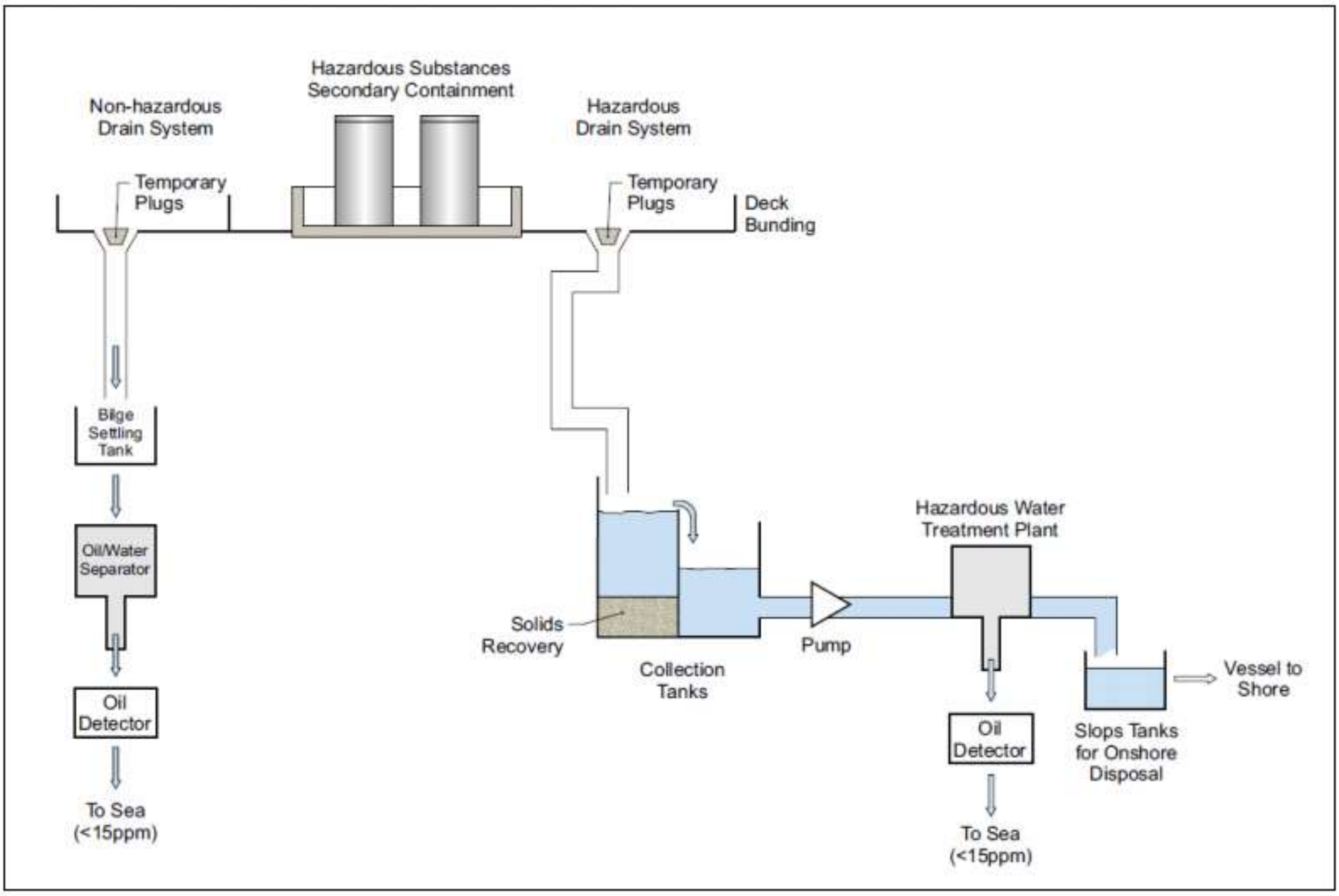
A range of small, improbable events came together starting with the starboard drain storage tank rupturing, which released gas, oil and water into the forth level of the starboard aft column.

These materials were able to flood the column because of a series of faulty pumps and valves that were part of the ballast control system.

The ballast control operators tried to stabilise the vessel but their efforts failed.

Source Reference: https://www.marinetechnologynews.com/blogs/oil-rig-ballast-control-system-accidents-700459

Appendix 5 Key Elements of a Typical Drilling Rig Deck Drainage System



Source Reference: Tui Field Activities Impact Assessment Report

Final Report March 2018 (0435786) - Section 3.6.1, Figure 3.7 Key Elements of the Drilling Rig Deck Drainage System

Appendix 6 Clarification Register

A summary of clarifications are tabled below. Please note that references in bold text relate to the Tamarind Marine Consent application no. EEZ100016. For completeness, the relevant section in this report is also is referenced.

All clarifications have been assigned a significance level to guide the Board of Inquiry based on the following:

RED: Obtaining answers to these clarifications is critical to understanding the proposed activities

AMBER: Obtaining answers to these clarifications would be valuable in understanding the proposed activities

GREEN: Obtaining answers to these clarifications would provide insight towards understanding the proposed activities.

No.	REFERENCE #	CLARIFICATION	LEVEL	STATUS	RESPONSE
1	5.0 para 2, p10 **3.2.1 para 4, p49**	Advise the final number of anchors and the chain / anchor spread to be used by the rig once the rig has been chosen.		Open	
2	5.0 para 5, p10 **3.6.1 para 4, p66**	Provide a list of the bunded containers and their contents once the semi-submersible rig has been chosen.		Open	
3	5.0, para 9, p10 **1.2.4 Figure 1.2, p6**	Confirm that the FPSO swing radius including any offtake tanker will not interfere with the semi-submersible drilling campaign.		Open	
4	5.1 para 9, p10 **7.2.1 Bullet 13, p155**	As the semi-submersible rig cannot pull away from the well in an emergency on the rig or in the event of a well integrity issue, what changes will be made to current Emergency Procedures / SIMOPS, MOPO etc. to prevent escalation?		Open	
5	5.1 bullet 4, p11 **3.3.1 para1, p60**	What procedure will be put in place should communication between the rig and the IWOCS fail?		Open	
6	5.1 bullet 6, p11 **No Reference**	Will modelling be carried out to assess the risk to the semi-submersible rig associated with seismic events?		Open	
7	6.1.1 para 1, p13 **No Reference**	Will any modification or repair work carried out to the rig or any of its systems in the field be subject to a Management of Change (MOC) review by Tamarind or by a recognised certifying authority to ensure		Open	

		vessel classification is maintained?			
8	6.1.2 para 1, p13 **No Reference**	Is data available from previous semi-submersible rig installations in the area to supplement the existing geotechnical data and allow lessons learned to be included in the planning process?		Open	
9	6.1.3 para 1, p13 **No Reference**	Will the ROV carry out a survey to ensure there are no objects, which could interfere with placement of the anchor spread?		Open	
10	6.1.3 para 5, p13 **No Reference**	What weather limits will be imposed e.g. wind, current, sea-state to allow the safe operation for laying and retrieval of the anchor spread?		Open	
11	6.1.4 para 3, p14 **No Reference**	Has there been any integrity issues recorded on the ballast control system of the chosen rig?		Open	
12	6.2 para 3, p14 **3.1 para 5, p45**	What activities will be carried out when returning the well to service and what handover procedures will be put in place?		Open	
13	6.4 para 2, p15 **3.4 para 3, p61**	Will a vessel remain in the field to cover emergency response duties e.g. man overboard, spill response?		Open	
14	6.4 para 3, p15 **3.4 para 3, p61**	Will any of the support / supply vessels be fitted out with spill containment equipment e.g. chemicals, booms, skimmers?		Open	
15	6.5.1 para 2, p15 **6.6.3 Bullet 7, p138**	Will placement of a temporary structure be required to allow the ROV to hold position for extended periods?		Open	
16	6.5.1 para 4, p15 **7.3 para 1, p165**	Has consideration being given to the placement of any protective devices to mitigate against potential damage to flowlines and the umbilical during activities associated with the drilling campaign?		Open	
17	6.5.3 para 3, p15 **3.6 para 7, p65**	Provide a comprehensive list of chemicals and their hazard characteristics once known.		Open	
18	6.5.3 para 1, p16	Provide information on the calibration regime put in place		Open	

	No Reference	to ensure the oil detector is properly maintained.			
19	6.5.3 para 1, p16 **3.6.1 Fig 3.7, p67**	How are the solids collected and where do the solids go as they build up in the collection tank?		Open	
20	6.5.3 para 2, p16 **3.6 para 6, p67**	Provide a schematic of the actual deck drainage system once the semi-submersible rig has been chosen.		Open	
21	6.5.3 para 4, p16 **7.1.1 para 2, p146**	What spill response training will be provided to the personnel on the rig?		Open	
22	6.5.3 para, p16 **7.1.1 para 2, p146**	What will be the structure of the oil spill response team on the rig?		Open	
23	6.5.3 para 6, p16 **3.6.1 para 5, p66**	In the event of a spill on the rig, how will the insertion and removal of temporary bungs be controlled to ensure that the drain system is returned to normal operation?		Open	
24	6.5.3 para 7, p16 **3.6.1 para 8, p66**	If the rig does not have automated alarms to monitor oil-in-water content prior to discharge, what method or system will be used?		Open	