Marathon Oil Norge AS.

Management Review – HES Event

I. Management Review Information			
Date of Management Review:	**26. August 26, 2013**	**Completed by:**	**Jan Erik Hidle**
Management Review Attendees:	**Richard Miller and Leif Gunnar Hestholm**		

II. Event / Case Information					
Synergi Reference #.:	**41445**			**Case Owner:**	**Ken Woodworth**
Event Type:	☐ Near Miss **OR** ☒ Incident	**If Incident, Incident Type?**	☐ Injury ☐ Illness ☐ Spill/Release ☐ PSE ☐ Reliability ☒ Property Damage ☐ Fire ☐ Explosion ☐ Motor Vehicle ☐ Security ☐ Agency Notice of Non-Compliance		
Date:	**22.06.13**	***Time:**	**21:30**	**Location (specific):**	**Skandi Arctic**
Operations Category:	☐ Production ☐ Drilling / Completions ☒ Projects ☐ Exploration				
Potential Consequence:	☐1 ☐ 2 ☐ 3 ☒4			**Actual Consequence:**	☒1 ☐ 2 ☐ 3 ☐4
Barrier Controls:	**Human Factors:** ☐ 1 ☒ 2 ☐ **3**	**Engineering:** ☐ 1 ☒ 2 ☐ **3**	**Procedures:** ☐ 1 ☒ 2 ☐ 3		
Consequence Type	☒ Safety ☐ Environmental ☐ Process Safety ☐ Reliability or Equipment Loss ☐ Stakeholder Impact				
Title of Incident (40 Characters or less):	**Skandi Arctic – Uncontrolled Bell Decent**				

Incident Description:

On the evening of 22nd of June, while the DSV Skandi Arctic conducted diving operations for Marathon at the Kneler A worksite, the port diving bell had two uncontrolled descents whilst being lowered into the moonpool. During the second uncontrolled descent the umbilical was damaged causing gas from the bell interior to leak out.

The divers in the bell experienced a pressure drop equivalent to approximately 18 meters of depth. To stop the leaks they had to close all internal umbilical related penetration valves and to re-pressurize back to a living depth equivalent to 110 meters using the bell's on-board emergency gas. The bell was subsequently recovered and re-connected to the ship's saturation system and the divers returned to their living quarters.

III. Investigation Information			
Investigation Start Date:	**23rd of June**	**If applicable, Date of Notification to Authorities**	**22nd of June 2013**
Investigation Team Members:	**Team Lead: Øivind Loennechen (Technip). For a full list – please see page 8 in the investigation report.**		
Company Involved (Marathon and/or Contractors:	**Completed by: Technip and Marathon**		

IV. Synergi Information	
Ensure the following attachments are included with the Synergi Case:	☒ Mandate ☒ Investigation Report ☐ Lessons Learned ☐ Internal/External Event Presentations ☒ Management Review
Update existing Synergi Case to reflect recommendations from Management Review (ensure there are no duplicate actions, etc.)	**Completed by:**
Share lessons learned from investigation with relevant contractors	**Completed by:**

Table 1 Recommendations to MONAS

RECOMMENDATIONS			Action Tracking	
No.	**Description**	**Recommendation from MR**	**Responsible** ***NAME AND TITLE***	**Due date**
1	Modify the LARS PLC code to ensure that it is not possible to place the system into Traverse Mode when the bell is not locked into the trolley hooks. This should not be affected by any other modes being active (such as Maintenance).	**Accepted**	**Technip**	**Prior to MUO**
2	If, during Manned Underwater Operations, a particular function is needed that is currently only available by activating Maintenance Mode (specifically when the bell is not level and a winch has to be adjusted to recover it to the hooks) this should be made available as a separate function. Furthermore the design should ensure that only essential interlocks (to accomplish said function) are overridden and that such overrides do not put the system into an unsafe state.	**Accepted**	**Technip**	**Prior to MUO**
3	Modify the LARS PLC code to ensure that Maintenance Mode can't be activated during Manned Underwater Operations. It should only be used for maintenance purposes when there are no divers in the bell.	**Accepted**	**Technip**	**Prior to MUO**

RECOMMENDATIONS			Action Tracking	
No.	**Description**	**Recommendation from MR**	**Responsible** ***NAME AND TITLE***	**Due date**
4	Review the Maintenance Mode screen and remove any functions that are not required. It has been suggested that the right hand side of this screen that allows winches to be switched between Traverse and Winch Mode was written for commissioning purposes only and is no longer needed.	**Accepted**	**Technip**	**Prior to MUO**
5	Modify the PLC code so that the HMI can only display the mode that the system is actually in (not the mode requested). Eliminate the ability for the Trolley & TUP and Dashboard screen to display that the system is in Traverse Mode when it is actually in Winch Mode (and vice versa). Review the HMI to ensure that there are no other instances of false indications.	**Accepted**	**Technip**	**Prior to MUO**
6	Review the LARS HMI screen header with respect to the clarity and effectiveness of the warnings indications for 'Overrides Active' , 'Maintenance Active' and any other messages displayed. Though these display as expected they do not convey	**Review and modify as deemed appropriate the LARS HMI screen header with respect to the clarity and effectiveness of the warnings indications for 'Overrides Active' , 'Maintenance Active' and any other messages displayed.**	**Technip**	**Prior to MUO**

RECOMMENDATIONS			Action Tracking	
No.	**Description**	**Recommendation from MR**	**Responsible** ***NAME AND TITLE***	**Due date**
7	Review the LARS HMI screens for operator selectable overrides and modes that could place the system into a similar unsafe operating state. In particular it is possible to make multiple selections from Overrides Screens 1, 2 and 3 which might allow the system to operate in the incorrect mode.	**Review the LARS HMI screens for operator selectable overrides and modes that could place the system into a similar unsafe operating state. (Note: In particular it is possible to make multiple selections from Overrides Screens 1, 2 and 3 which might allow the system to operate in the incorrect mode. Make modifications to remove possibilities to achieve unsafe states.)**	**Technip**	**Prior to MUO**
8	Review the password protection to the system ensuring that there is not a common password. It was reported that there were separate passwords for Maintenance Mode and Overrides but that they are now the same. Note that the LARS HMI Detailed Design Specification claims that there is only a single password level.	**Review the password protection system and modify to ensure appropriate independent levels of password protection. (Note: It was reported that there were separate passwords for Maintenance Mode and Overrides but that they are now the same. Note that the LARS HMI Detailed Design Specification claims that there is only a single password level.)**	**Technip**	**Prior to MUO**
9	Involve third party Functional Safety specialists to both review the changes to the code and witness proving trials onboard the vessel.	**Accepted**	**Technip**	**Prior to MUO**
10	Go through and verify numbering and function of all valves, internally and externally, in both SDC`s.	**Accepted**	**Technip**	**Prior to MUO**
11	Update all internal and external SDC checklists for both SDC`s in accordance with above	**Accepted**	**Technip**	**Prior to MUO**

RECOMMENDATIONS			Action Tracking	
No.	**Description**	**Recommendation from MR**	**Responsible** ***NAME AND TITLE***	**Due date**
12	Consider to mark valves on copy of drawing no SDC 100101201S1 - SY113, Rev R03B, Port & Starboard SDC`s Overall Gas and Fluid Schematic available in Dive Control according to above numbering, in addition to Divex original numbering system. This would ease reference to drawings if and when necessary.	**Accepted**	**Technip**	**Prior to MUO**

RECOMMENDATIONS			Action Tracking	
No.	**Description**	**Recommendation from MR**	**Responsible** ***NAME AND TITLE***	**Due date**
13	Revise OOS-DIV-C-248 Internal Valve Isolation Checklist (Ruptured or Loss of Umbilical) – Skandi Arctic, in accordance with above. Prioritize valves to be closed immediately in accordance with criticality i.e.: 1. Related to umbilical and not equipped with check valves and open ended inside the bell, 2. Related to umbilical and equipped with check valves (in case check valves leak), 3. Related to umbilical and not equipped with check valves and NOT open ended inside the bell(If leak continues). When the leak is under control, a checklist preparing for receiving an emergency umbilical can be initiated, observing caution if having to operate any of the critical valves. Also, an effort should be made to reconfigure valves so that same category valves are grouped together on the hull penetrations, i.e. pneumo`s with pneumos, sample lines with other sample lines etc. This would further ease the identification of critical valves in an emergency situation.	**Accepted**	**Technip**	**Prior to MUO**
14	Mark the critical valves, ref above, internally and externally in a manner rendering them easily recognisable both in light and darkness and standing out from other, less critical valves.	**Accepted**	**Technip**	**Prior to MUO**

RECOMMENDATIONS			Action Tracking	
No.	**Description**	**Recommendation from MR**	**Responsible** ***NAME AND TITLE***	**Due date**
15	Make OOS-DIV-C-248 Internal Valve Isolation Checklist (Ruptured or Loss of Umbilical) - Skandi Arctic(see above) available for easy reference in dive control and in both SDC`s.	**Accepted**	**Technip**	**Prior to MUO**

RECOMMENDATIONS			Action Tracking	
No.	**Description**	**Recommendation from MR**	**Responsible** ***NAME AND TITLE***	**Due date**
16	During Normal Launch and recovery of the SDC`s using LARS, the operators are referring to an "Aide Memoire" to guide them through the actions needed. This "Aide Memoire" is taped on the LARS operating console for easy reference. The "Aide Memoire" does not have status as a procedure and has no place in the Technip document system. Further, it differs on several crucial points when compared to the approved documents, i.e. MOS-DIV-116- SDC Launch - LARS Normal Procedure - Skandi Arctic and MOS-DIV-117 - SDC Recovery - LARS Normal Procedure – Skandi Arctic respectively. If the "Aide Memoire" is followed to the letter, it circumvents important steps to confirm, amongst other, actual winch modes, CT or SP, which played a role in this incident. These steps are taken consistently throughout the launch sequence when using the official document/launch procedure. All "unofficial" and unverified documents, "Aide Memoirs", check lists and other should be removed asap and replaced with proper, verified and approved procedures and/or checklists. A systematic means of correct document control has to be implemented.	**All "unofficial" and unverified documents, "Aide Memoirs", check lists and other should be removed prior to resumption of MUO and be replaced with proper, verified and approved procedures and/or checklists.** **Ensure a proper document control process exists / is implemented on the Skandi Artic.**	**Technip**	**Prior to MUO**

RECOMMENDATIONS			Action Tracking	
No.	**Description**	**Recommendation from MR**	**Responsible** ***NAME AND TITLE***	**Due date**
17	LARS Normal Operational Procedures are described in Doc no OOS-DIV-067 - "Dive System Operations and Emergency Manual - Skandi Arctic", Section 23. These should be reviewed and revised to reflect current situation and to include limitations to which repair-, override- and/or maintenance-actions that are allowed in an operational situation with divers in the SDC`s. It should also reflect the fact that it is the Diving Supervisor, and nobody else, who carries the full	**LARS Normal Operational Procedures are described in Doc no OOS-DIV-067 - "Dive System Operations and Emergency Manual - Skandi Arctic", Section 23. These should be reviewed and revised to reflect current situation and to include limitations to which repair-, override- and/or maintenance-actions that are allowed in an operational situation with divers in the SDC`s. It should also reflect the fact that it is the Diving Supervisor, and nobody else, who carries the full responsibility.**	**Technip**	**Prior to MUO**

RECOMMENDATIONS			Action Tracking	
No.	**Description**	**Recommendation from MR**	**Responsible** ***NAME AND TITLE***	**Due date**
18	Doc no OOS-DIV-067 - "Dive System Operations and Emergency Manual - Skandi Arctic" is in revision A, dated 31.November 2009, and described as Initial Proposed Manual. It is in use offshore and seems to be the only document that gives operational and emergency procedures for all or most relevant operational and emergency scenarios. Step by step procedures, operating instructions and checklists contained in this manual should be extracted, verified for relevance and correctness and re-issued as stand-alone documents within the Technip Diving Management System, to facilitate revisions in accordance with future modifications/changes. Only a reference to these stand-alone documents should remain at the appropriate place in the manual itself. The rest of the manual should be revised to reflect current status as per DIVEX and/or internal modifications performed during and after commissioning. Emergency scenarios described should be linked to relevant FMECA`s and Hazid performed and should reflect findings and mitigating actions resulting from these. The manual should then be reissued as a vessel specific procedure within the Diving Management System. Examples: 1.:"MOS-DIV-116 SDC Launch - LARS Normal Procedure - Skandi Arctic" differs from OOS-DIV-Dive System Operation and Emergency Manual - Skandi Arctic, Section 23, 23.2.1 SDC Launch - Normal SDC Launch Procedure. Presumably the stand alone document is the correct one, because it was issued 11 Jan. 2012 as opposed to the manual which was issued in 2009. 2.: OOS-DIV-Dive System Operation and Emergency Manual - Skandi Arctic, Section 24, 24.25 Loss of Main Umbilical refers under "SDC Actions" to a Valve Isolation Checklist without further identification. The reference should be to: OOS-DIV-C-248 Internal Valve Isolation Checklist (Ruptured or Loss of Umbilical) - Skandi Arctic which contains the relevant checklist.	**Revise Doc no OOS-DIV-067 - "Dive System Operations and Emergency Manual - Skandi Arctic" in accordance with the bullets below:** **1) Step by step procedures, operating instructions and checklists contained in Doc no OOS-DIV-067 - "Dive System Operations and Emergency Manual - Skandi Arctic" is in revision A, dated 31.November 2009 should be extracted, verified for relevance and correctness and re-issued as stand-alone documents within the Technip Diving Management System.** **2) The rest of Doc no OOS-DIV-067 - "Dive System Operations and Emergency Manual - Skandi Arctic" should be revised to reflect current status as per DIVEX and/or internal modifications performed during and after commissioning.** **3) Emergency scenarios described in Doc no OOS-DIV-067 - "Dive System Operations and Emergency Manual - Skandi Arctic" should be linked to relevant FMECA`s and Hazid performed and should reflect findings and mitigating actions resulting from these.** **4) The Doc no OOS-DIV-067 - "Dive System Operations and Emergency Manual - Skandi Arctic" should be reissued as a vessel specific procedure within the Diving Management System.**	**Technip**	**Prior to MUO**

RECOMMENDATIONS			Action Tracking	
No.	**Description**	**Recommendation from MR**	**Responsible** ***NAME AND TITLE***	**Due date**
19	There is a training system for operators in Skandi Arctic (detailed in MOS-HR-006 Rev 4 2011 Skandi Arctic Dive System – Skills Assessment & Verification). This is for Dive Supervisors, OCM/AOCM, Gas Supt, LSS, LST & Gasman. The LARS control system has not been included in this programme. The LARS control system is recommended to be part of the above training system.	**Accepted with comments;** **The training shall not only be modified, but shall also be provided to the identified personnel.**	**Technip**	**Prior to MUO**
20	The Mechanical, Electrical and PLC dive technicians are required to maintain the entire system and operate parts of it. They need to be included in the above group of personnel and be suitably integrated into appropriate parts of the training programme.	**Accepted**	**Technip**	**Prior to MUO**
21	Drills shall be based on the Skandi Arctic Operation and Emergency Manual and are to be conducted, paying particular attention to use of checklists and operation/incident control by the Dive Supervisor and Bellman.	**The Skandi Artic emergency response drill plan shall be revised to include all scenarios described in Skandi Arctic Operation and Emergency Manual. Execution of drills shall include particular attention to use of checklists and operation/incident control by the Dive Supervisor and Bellman.**	**Technip**	**Prior to MUO**

RECOMMENDATIONS			Action Tracking	
No.	**Description**	**Recommendation from MR**	**Responsible** ***NAME AND TITLE***	**Due date**
22	Start the review process for the FMECA. The links from Hazid, to FMECA, to design and operating documents, and back to the FMECA need to be reviewed and updated as a continuous process taking into account modifications and operational experience. This is unlikely to be completed prior to diving again, but needs to be commenced as soon as possible and shortfalls identified.	**Accepted with comments:** **Marathon thinks this action is unclear, but understands two intentions.** **Firstly, revise the FMECA and HAZID to reflect recent modifications (originating from the incident).** **Secondly, to ensure a robust process exists to keep the FMECA/HAZID evergreen.**	**1) Technip** **2) Technip**	**Prior to MUO** **TBA**
23	Carry out inspection of the structural integrity of the Bell & LARS load path.	**Accepted**	**Technip**	**Prior to MUO**
24	Ensure that all main umbilical hoses terminate via a termination plate and not directly at the hull penetrator. The external isolation check valve should be positioned to afford them maximum protection.	**Accepted**	**Technip**	**Prior to MUO**
25	Identify and mark critical through hull skin valves so that they stand out and are easy to identify both in darkness and light	**Accepted with comments;** **Please clarify the recommendation in relation to recommendation number 12 as they seems to be similar.**	**Technip**	**Prior to MUO**

RECOMMENDATIONS			Action Tracking	
No.	**Description**	**Recommendation from MR**	**Responsible** ***NAME AND TITLE***	**Due date**
26	Enforce the fact that it is the Diving Supervisor who is responsible for diver safety during a bell run. If repairs are required with divers in the bell, the responsibility remains his. He must actively satisfy himself that operational status is re-instigated prior to carrying on the bell run. Statements to this effect could be included in Dive Supervisor's job description.	**Review and revise roles and responsibilities for critical personnel, including dive supervisor, during MUO. Communicated this as appropriate to the organisation, training personnel as necessary.**	**Technip**	**Prior to MUO**

RECOMMENDATIONS			Action Tracking	
No.	**Description**	**Recommendation from MR**	**Responsible** ***NAME AND TITLE***	**Due date**
27	Reinforce the use of the Safety Delegate system onboard. The employer has a legal obligation to ensure that the employees are consulted and heard in matters regarding safety, health and working environment. Elected safety delegates on their side also have a legal obligation to participate in activities to improve safety, health and the working environment, and to stop unsafe practices. A well functioning safety delegate system can assist management in creating a culture where one utilise the available resources and knowledge to ensure a safe outcome. To ensure understanding and respect, it is recommended that TMOS onshore management are also trained in working environment law, at the level that supervises and audits Skandi Arctic diving activity.	**Accepted**	**Technip**	**TBA**

RECOMMENDATIONS			Action Tracking	
No.	**Description**	**Recommendation from MR**	**Responsible** ***NAME AND TITLE***	**Due date**
28	De-brief Skandi Arctic supervisory personnel on this incident, with particular emphasis that when faced with a crisis situation the supervisor in charge is to use all available information to establish the fault condition, and if time permits the available expertise is to be consulted before committing to a course of action.	**Accepted with comments;** **1) Run de-brief as recommended** **2) Establish a systematic approach in the organisation for creating risk awareness and a culture for stopping work following an incident/deviation**	**1) Technip** **2) Technip**	**Prior to MUO** **TBA**
29	Onshore management in Marathon and Technip are to ensure they have an auditable process that demonstrates foreseeable risks have been accounted for and that safety delegates have been properly consulted when consenting to dive after an incident.	**For Technip: Onshore Management in Technip are to ensure that they have an auditable process that demonstrates foreseeable risks have been accounted for, that these risks are described in the risk analysis, and that the Safety Delegate is involved and supports the analysis.** **For Marathon: Marathon shall revise their procedure "HES Event Notification and Reporting Procedure" with a requirement stating that Filter Group meetings shall be documented with a minutes of meeting which is to be archived in the Synergi case.**	**For Technip: TBA** **For Marathon: Jan Erik Hidle**	**TBA** **1st of October, 2013**

RECOMMENDATIONS			Action Tracking	
No.	**Description**	**Recommendation from MR**	**Responsible** ***NAME AND TITLE***	**Due date**
30	Technician Training Formalize and document a Dive Technician training program focusing on diving methods, Diver safety and the relation between the work of the Technicians and the safety of the Divers. Technicians also need to achieve a consistent knowledge of the system (including PLC) functions and limitations.	**Accepted**	**Technip**	**TBA**
31	OMT and Supervisor Training OCMs, AOCMs and Dive Supervisors should receive sufficient training in the dive control systems to understand the operational and safety implications of the selection of differing operating modes, maintenance modes and over-ride functions. The training is to emphasise the Dive Supervisor's responsibility to remain in full control of Technician actions at all times that divers are exposed to system hazards.	**Accepted with comments;** **Firstly this action seems to be an improvement of the training mentioned in action 19.** **Secondly, it is Marathons recommendation that this action is incorporate in action number 19 and 26.**	**Technip**	**TBA**

RECOMMENDATIONS			Action Tracking	
No.	**Description**	**Recommendation from MR**	**Responsible** ***NAME AND TITLE***	**Due date**
32	Risk Management and Procedures The technical risk analyses (FMECA, FMEA, HAZID) for Skandi Arctic should be reviewed, re-written and re-issued such that there is a single consistent topdown approach for all diving related risks, to ensure there are no gaps in the suite of risk documentation, to ensure that human interaction and operator error risks are accounted for, and to ensure that there are proper emergency operating procedures or checklists covering all reasonably foreseeable hazard conditions. Specifically the SIL rating for LARS has to be reviewed. The technical risk analyses should be regularly reviewed and updated to reflect changes in conditions, equipment and knowledge gained from operational experience, incidents and accidents.	**Accepted with comments;** **It is unclear what is the difference between this action and action 22, as both are generic to all systems that influence diver safety. Recommend to revise recommendation 22 and 32 accordingly.**	**Technip**	**TBA**

RECOMMENDATIONS			Action Tracking	
No.	**Description**	**Recommendation from MR**	**Responsible** ***NAME AND TITLE***	**Due date**
33	Emergency Checklists Checklists for operating and supervisory personnel should be re-written in an easy to read format based on practice in safety critical industries such as aviation. They also need to be instantly available to operating and supervisory personnel. As an example, Appendix G contains an assessment and suggestion from a consulting firm engaged by the investigation team.	**Accepted**	**Technip**	**TBA**
34	Emergency Drills The emergency checklists need to be exercised with drills, either on the dive systems themselves under controlled supervision, or on a simulator such as is available for saturation control. The performance of the team and Dive Supervisor conducting the drills needs to be periodically evaluated.	**Accepted**	**Technip**	**TBA**
35	Ergonomic Arrangements Bell through hull penetrations for the umbilical gas, hot water, and signal/sensor lines should be positioned together in a logical way for easy identification and operation under normal and emergency conditions.	**Accepted**	**Technip**	**TBA**

RECOMMENDATIONS			Action Tracking	
No.	**Description**	**Recommendation from MR**	**Responsible** ***NAME AND TITLE***	**Due date**
36	Contingency Diver Clarify the role of the contingency (stand-by) diver and his ability to access the bell exterior whilst in the moonpool in order to conduct emergency operations. If he is needed to enter the moonpool then appropriate protective equipment and training has to be identified and provided. This clarification can be based on technical risk assessment of the need to enter the moonpool for bell accident conditions.	**Accepted**	**Technip**	**TBA**
37	Situational Awareness Training A modern DSV has complex multi-disciplinary safety critical systems that require Supervisors to have good Situational Awareness. T-MOS has initiated a programme that develops these skills. This incident is a good example of why this programme is essential. See the Note 1 below on Situational Awareness.	**This recommendation is not formulated as an action**		

RECOMMENDATIONS			Action Tracking	
No.	**Description**	**Recommendation from MR**	**Responsible** ***NAME AND TITLE***	**Due date**
38	Repairs during Operations The Standing Orders need to clarify the types of repairs that can be done by Technicians on shift, and which of these need to be referred to the Dive Technician Supervisor for permission to proceed.	**Accepted**	**Technip**	**TBA**
39	Modification Control The management of change system needs to be rigorously enforced for diving systems changes, and should be regularly audited as part of the compliance process.	**This recommendation is not formulated as an action and should be rewritten.**		
40	Compliance, Audit, Inspection and Operational Feedback A compliance function exists within TMOS and TNorge which covers whole ship safety issues such as classification & marine assurance, general HSE management and competency assurance. This compliance function needs to be enhanced towards diving systems, diving operations, diving technical risk assessment, diving operating documentation (normal and emergency conditions) and diving drills.	**Accepted**	**Technip**	**TBA**

RECOMMENDATIONS			Action Tracking	
No.	**Description**	**Recommendation from MR**	**Responsible** ***NAME AND TITLE***	**Due date**
41	Procurement of DSVs and the Intelligent Customer Function Technip New Marine Builds needs to ensure that it has learned from this investigation and for safety critical systems (ie where human life is totally dependent on technology), that it has sufficient knowledge of the technologies being purchased, and sufficient influence over contractors to ensure that new DSVs are commissioned with optimal safety and operability built in. Please see Note 2 below on Intelligent Customer.	**Accepted**	**Technip**	**TBA**
42		**For Marathon: Prepare a Lessons Learned report from incident and share with relevant stakeholders.**	**Aksel Nesse**	**15th of September, 2013**