

DECISION 2005.03
RESPECTING
THE AMENDMENT
TO THE
TERRA NOVA DEVELOPMENT PLAN
DECEMBER 2005

Disponible en français

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1.0 THE APPLICATION

Section 6(c)(ii) of the *Newfoundland & Labrador Offshore Area Petroleum Production and Conservation Regulations* requires an amendment to the Approved Development Plan where an operator proposes to make substantial modifications or additions to existing production facilities at a pool or field.

On November 8, 2005, Petro-Canada as the Operator of the Terra Nova Project (the Proponent) submitted an application to amend the Terra Nova Development Plan. The Application included two parts:

- Terra Nova Development Plan Amendment Part I, Additional Living Quarters on the FPSO; and,
- Terra Nova Development Plan Amendment Part II, Additional Living Quarters on the FPSO.

The FPSO currently has 44 cabins, normally configured as 36 double cabins and 8 single cabins. The maximum allowable POB is limited to 80 persons during production operations. This can be increased to 120 persons during shutdown (i.e. no production) to facilitate maintenance work. The existing maximum of 80-POB for the Terra Nova FPSO during production operations has been a constant limitation since the facility started up in 2002. It has impeded the ability to complete planned and corrective maintenance efficiently, to complete inspections within planned timeframes, to complete plant improvements and to execute modification projects.

In order to address the need for increased POB capacity, the Proponent proposes to install Additional Living Quarters (ALQ) and lifeboat capacity on the Terra Nova FPSO. The proposed addition will consist of 21 cabins and two additional 80-person lifeboats. The resulting expanded facilities, 65 cabins, will have the capacity to accommodate up to 130 persons during production operations. Lifeboat capacity will be 400 (5 X 80) with 160 person lifeboat capacity each side forward of the blast wall and 80 person lifeboat capacity aft.

The proposed ALQ is a substantial modification to the Terra Nova FPSO. As such, it constitutes a Development Plan Amendment pursuant to section 6(c)(ii) of the *Newfoundland & Labrador Offshore Area Petroleum Production and Conservation Regulations*. A more detailed description/summary of the Proponent's application for the amendment is contained in Appendix I.

2.0 THE CONTEXT

The ALQ will be installed in 2006 as one element of a larger maintenance and repair program on the Terra Nova FPSO. The ALQ is an integral element of the Operator's approach to persistent maintenance problems on the FPSO. The POB restriction has resulted in a maintenance backlog. That backlog has been a concern to the C-NLOPB, to the extent that in 2004 the C-NLOPB ordered the FPSO to shut-in production until the safety critical and environmentally critical elements of the backlog had been addressed in a satisfactory manner. That shut-in lasted for 14 days. If the POB is not increased, the maintenance backlog will continue to be a recurring problem with the operation of the FPSO.

In this context, the operator has scheduled an extended shutdown (90 days) in 2006 to address the accumulated maintenance backlog, install the ALQ, and complete a program of required periodic surveys and certifications.

Excessive marine growth has accumulated on the hull of the FPSO. While the hull can and will be cleaned in situ, anti-fouling paint is required to prevent reoccurrence. Application of anti-fouling paint will require that the FPSO be dry docked. Also, several other elements of the maintenance program and the periodic surveys and certifications may be more efficiently completed in a dry dock setting. As a consequence, the FPSO will disconnect from its moorings and proceed to dry dock in mid-2006.

The Operator's plans are influenced in part by the requirements of the Certifying Authority (CA) and Transport Canada (TC). The Certificate of Fitness (COF) and the Class Certificate for the FPSO are due for renewal on July 14, 2006. The Class Certificate is one of the elements required to maintain the COF. The key elements of COF renewal are:

- Survey of mooring/turret;
- Survey of sea chest/shipside valves including inspection of plating in way of shell openings;
- Survey of thrusters;
- Tank inspections;
- Pressure vessel inspections; and,
- Structural inspections, non-destructive testing and thickness measurements.

Petro-Canada provided a proposal to the Government of Newfoundland & Labrador on October 12, 2005, which provides for fabrication of the ALQ and support steel in Newfoundland & Labrador with installation at a dry dock. In addition to the installation of the fabricated ALQ, the dry dock work will consist of application of anti-fouling paint to the hull, a variety of regulatory inspections and surveys to meet the COF/Class Certification requirements and other maintenance and reliability work.

A suspension of the Production Operations Authorization (POA) will be required for the disconnect of the FPSO from its moorings. The POA will have to be reinstated prior to reattaching the FPSO at the end of the program. The ALQ, because it is a modification to the FPSO, is the only element of the program which requires a Development Plan Amendment. The ALQ, as well as the other elements of the program, will proceed in accordance with the Approved Benefits Plan and any other necessary authorizations and/or approvals. An understanding has been reached between the Operator and the Government of Newfoundland & Labrador concerning the Newfoundland & Labrador content of that work, including the ALQ. The Province has asked that the C-NLOPB monitor the undertakings in the letter of

understanding as the work proceeds. (These letters are attached as Appendix II of this Decision Report.)

3.0 THE C-NLOPB DECISION

The Application by the Proponent has been the subject of a thorough review and analysis by the technical staff of the C-NLOPB in the following areas:

- Operations & Safety;
- Resource & Reservoir Management;
- Environmental Protection; and,
- Industrial Benefits.

On the basis of that analysis, and the advice of the C-NLOPB's Chief Safety Officer (CSO) and Chief Conservation Officer (CCO), the C-NLOPB hereby approves an Amendment to the Terra Nova Development Plan to accommodate the proposed ALQ on the Terra Nova FPSO.

The C-NLOPB notes that the Terra Nova Development Plan Amendment is based upon preliminary engineering studies. Consequently, its approval is based on the concepts, approaches and undertakings described in the Application. As detailed design and operational planning proceed, it will be necessary for the Proponent to comply with the requirements, and obtain the necessary additional approvals, which are set out in:

- The *Newfoundland Offshore Certificate of Fitness Regulations*;
- the *Newfoundland Offshore Petroleum Installations Regulations*;
- the *Newfoundland Offshore Area Petroleum Production and Conservation Regulations*; and,
- the draft *Petroleum Occupational Safety and Health Regulations – Newfoundland*

The following is a summary of the regulatory approvals which will be required:

Pursuant to the *Newfoundland Offshore Certificate of Fitness Regulations*, a recognized CA must undertake a detailed examination of the design and survey the construction and establishment of facilities to ensure they are fit for purpose and comply with the regulations. Lloyd's Register (LR) has been selected as the CA for the ALQ.

Pursuant to the *Newfoundland Offshore Certificate of Fitness Regulations*, the CA must submit a scope of work for approval by the C-NLOPB's CSO.

Pursuant to the *Newfoundland Offshore Petroleum Installations Regulations*, the holder of a COF must obtain the approval of the CSO and the CA prior to making any modifications to the installation. The Proponent will be required to obtain approval from the CA and the CSO for the detailed design.

Pursuant to the *Newfoundland Offshore Petroleum Production and Conservation Regulations*, the operator must submit an amendment to the approved Safety Plan to the CSO for approval. In that submission, the Proponent will be required to:

- demonstrate the timeframes presented for completion of a muster and loading of the lifeboats;
- incorporate the studies undertaken to justify the location of the ALQ and the mitigation measures associated with this location into the amendment to the Safety Plan;
- clarify the capacity and outfitting of the aft muster station; and,

- include the demonstration that the best practicable evacuation technology available is utilized on the Terra Nova FPSO.

The Proponent must comply with all aspects of all legislation, regulation, approvals and authorizations required by the legislation applicable to its operation.

The ALQ project, as well as other work completed during the 2006 turnaround, will be monitored by the C-NLOPB for compliance with the approved Benefits Plan and the letter of understanding between Petro-Canada and the Government of Newfoundland & Labrador (Appendix II).

The supporting analysis for this decision is set forth in the following section.

4.0 THE SUPPORTING ANALYSIS

The Application was reviewed and analyzed by the C-NLOPB technical staff from the perspectives of:

- Design;
- Operations;
- Conservation of the Resource;
- Protection of the Resource; and,
- Industrial Benefits.

This section summarizes that review and analysis for each of these areas.

4.1 Design

The *Newfoundland Offshore Area Petroleum Production and Conservation Regulations* require that, before production operations may be authorized, a production installation must have a COF issued by a recognized CA. The *Newfoundland Offshore Certificate of Fitness Regulations* require the CA to determine whether the design, construction and establishment of the installation are in accordance with the regulatory requirements. The CA reviews the design and surveys the modifications to determine compliance with the quality standards and regulations. Pursuant to these regulations, the CA will submit a scope of work for approval by the C-NLOPB's CSO. The CSO is responsible for determining that such scope will provide the means for determining, among other things, that the modification is in accordance with the regulations and follows an acceptable quality assurance program. The CA will ensure the appropriate level of completeness of the ALQ and other modifications at each stage of fabrication, assembly and commissioning before proceeding to the next stage.

Subsection 67(1) of the *Newfoundland Offshore Petroleum Installations Regulations* requires the holder of a COF to obtain the approval of the CSO and the CA prior to making any modifications to the installation. The Proponent will be required to obtain approval from the CA and the CSO for the detailed design. The CSO will monitor and audit the activities of the CA to ensure it carries out its work in accordance with the approved Scope of Work.

A key feature of the *Terra Nova FPSO* is its ability to disconnect from its moorings in the event of ice encroachment. The FPSO is capable of independent self-propulsion, and is registered as a ship in Canada. When disconnected from its mooring system, the FPSO is considered a "ship", as defined by the *Canada Shipping Act*, and consequently will fall under TC jurisdiction.

The *Canada Shipping Act* will apply to the hull of the FPSO and all marine equipment (as defined within that Act) that is not part of the industrial process equipment. The FPSO as a whole, including the marine and industrial plant, must also comply with the Atlantic Accord legislation, compliance with which will be verified by the CA.

The ALQ must be approved to TC rules which will include arrangements, materials etc.. TC has adopted a system of delegation where the survey work is carried out by a recognized Classification Society. The *Terra Nova FPSO* is a delegated vessel and its classification society, LR, will survey the modifications. TC will attend the vessel in dry dock to monitor activities. The Safety and Fire Control Plans will require revision and approval.

The current Memorandum of Understanding between the C-NLOPB and TC (Ship Safety) provides the basis for cooperation between the two agencies and the means to establish an offshore regulatory regime within which marine safety is a prime concern. If there is a variance between the two sets of regulatory requirements, the more rigorous requirement will take precedence. The C-NLOPB will coordinate discussions related to these matters. Applications for acceptance of equivalencies to specific regulatory requirements, if submitted by the Proponent, will be considered by the C-NLOPB and TC, or both jointly, as is appropriate.

4.1.1 Quality Management

The Proponent intends to apply quality management principles based upon the international quality assurance standard ISO-9001:2000. Contractors will be required to implement a quality management system compliant with the requirements of ISO 9001:2000. The Proponent commits to performing the appropriate levels of verification and monitoring to ensure compliance with the requirements. These will include quality assessments and audits.

The *Newfoundland Offshore Petroleum Installations Regulations* require new installations to be designed, constructed, installed and commissioned in accordance with standards respecting quality assurance published by the Canadian Standards Association. This regulation is also applied to major modifications such as the ALQ.

4.1.2 Physical Environmental Design Criteria

The Proponent has indicated that the facilities design will utilize the environmental criteria developed during the initial Terra Nova Project Development. The environmental criteria were reviewed by the C-NLOPB staff, an environmental assessment panel and the CA at the time of the original Project Development and was found suitable.

Pursuant to the *Newfoundland Offshore Petroleum Installations Regulations*, the design of production installations which are intended for use in the Newfoundland Offshore Area must be consistent with elements of the Canadian Standards Association CAN/CSA S471-92, *General Requirements, Design Criteria, the Environment, and Loads*. This standard describes the loading conditions which different types of structure are expected to resist at specified levels of reliability. This standard will be applied to the ALQ project.

4.2 Operations

The operation of a complex processing facility such as the Terra Nova FPSO depends on both the inherent safety incorporated into the design and construction of the facilities, and the presence of a skilled, well-trained workforce, all of whom are committed to safe operations. To ensure the operations are conducted with due attention to safety, the C-NLOPB also requires the Proponent to develop a Safety Plan. These considerations are discussed in the following section.

4.2.1. Concept Safety Analysis

Section 43 of the *Newfoundland Offshore Petroleum Installations Regulations* requires the Proponent, at the time of submission of its Development Plan, to provide to the CSO its definition of target levels of safety, and a Concept Safety Analysis (CSA) respecting the production installation. The Proponent submitted both documents, as Part II development studies, with its Development Application in 1996.

The Concept Safety Analysis should be updated when significant changes take place. The Proponent has evaluated the hazards associated with the ALQ and its impact on the risk profile. A summary of the results is presented in Part II of the Application. As the results of the safety analyses studies associated with the ALQ have already been submitted and found to be acceptable, an amendment to the Concept Safety Analysis is not required at this time.

The Proponent assessed a number of options to increase the living quarters capacity on the FPSO. The selected option is a five level accommodation module aft of the existing accommodations and its H 120 wall, 2 meters above the process deck. This option allowed for the largest increase in POB capacity and provided the least interruption of the existing living quarters/Temporary Safe Refuge (TSR). The proposed location presented a number of issues:

- The ALQ must also be H120 blast protected;
- The ALQ requires integration to the TSR;
- The ALQ places personnel accommodation closer to the turret and process area than previously existed; and,
- The ALQ is situated above a cargo tank

The Proponent has studied the impact of the proposed ALQ on the Terra Nova risk profile. The separation and level of passive protection was the subject of risk studies. The studies indicate the individual risk per annum and the frequency of impairment per annum is less than the target of one in a thousand, which is the approved target safety level.

The Proponent undertook a number of fire and blast studies. Two fire scenarios, turret jet fire and main deck pool fire were studied. These blast studies, conducted during the initial design, were reviewed to determine whether the introduction of the ALQ would have any impact on the study results. Based on the review, additional gas dispersion and blast studies were conducted to determine blast pressures around the area of the turret on the process deck level. As a result of these studies, it is proposed to plate over the process deck to prevent turret gas from entering the inter deck area between the process deck and the main deck. However, these proposed changes to the FPSO caused some challenges due to blast pressures from the effect of potential explosions involving a contaminated inert gas leak. It was determined that the frequency of such events is low and contributes only approximately 5% of the overall FPSO impairment frequency. The contribution from this event to individual risk is about 0.3%, and therefore is within acceptable risk parameters.

The Proponent has confirmed that the ALQ walls facing aft and to starboard (inboard) will be H120/J30 with blast rating to 0.30 bar. Further, the support structure will provide the underside of the ALQ with 0.52 bar blast integrity; and, the Passive Fire Protection for the support structure combined with the insulation on the bottom of the ALQ will provide H120 integrity. The Proponent has examined worst case blast events for the space between the main deck and the underside of the ALQ, and, the worst case main deck pool fire. Both are mitigated by the fire and blast protection planned for the underside of the ALQ and its support structure. As well, the current AFFF Foam Deluge that covers the main deck has been reviewed and deemed to be sufficient for active fire suppression below the ALQ.

As the number of personnel is proposed to be increased, the impact on egress, evacuation, escape and rescue was studied. Due to the open nature and sparse distribution of personnel on the vessel, no issues of bottlenecks were evident on route to the muster location. Therefore, the muster times for 130 persons did not vary significantly from the original study. The increased number of personnel did indicate crowding around the Total Enclosed Motor Propelled Survival

Craft (TEMPSC or lifeboat) entrance. The embarkation times were estimated to take 4 to 6 minutes longer than the 8 minutes in the initial study. This estimated addition, if it can be demonstrated, is within acceptable parameters. Various evacuation scenarios were studied and the longest duration was 14 minutes. The emergency response plans will require amendment, in particular the muster and lifeboat procedures; and, the Proponent will be required to demonstrate the timeframes presented for completion of a muster and loading of the TEMPSCs as part of the Safety Plan amendment.

The CA will also review safety studies and will monitor the “close out” of recommendations arising from these studies.

4.2.2 Safety Plan

The *Newfoundland Offshore Petroleum Production and Conservation Regulations* require that a Safety Plan be approved by the CSO before the C-NLOPB authorizes an operator to begin oil production. The development of a Safety Plan commences with the safety studies conducted during detailed design and proceeds as the Proponent develops policies and procedures, selects equipment and defines personnel responsibilities to manage and reduce the level of risk associated with the Project. The Safety Plan must provide for a comprehensive systematic approach to safety management, and be continually updated during the life of the project. The Proponent has an approved Safety Plan, which will have to be amended to incorporate the proposed changes to the accommodations.

The Safety Plan provides a comprehensive compilation of safety-related information regarding the production installation and its operation. It includes the design features and equipment that are intended to eliminate identified hazards, reduce risk or mitigate consequences. It also describes provisions aimed specifically at the safety of personnel such as the temporary safe refuge, escape routes, lifesaving appliances, and evacuation and rescue systems. Studies that evaluate the safety of these systems, and demonstrate that risk to personnel has been reduced to a level that is as low as reasonably practicable, will be reviewed as part of the Safety Plan amendment approval process. The studies undertaken to justify the location of the ALQ and the mitigation measures associated with this location will be incorporated into the amendment to the Safety Plan. With additional personnel working in the process area, the potential under certain event scenarios for more personnel than originally assumed to be unable to reach the forward primary muster station will require a review of the capacity and outfitting of the aft muster station.

4.2.3 Evacuation Systems

The Proponent intends to install additional lifesaving equipment to meet and exceed regulatory requirements. The additional equipment which the Proponent proposes to install as part of the ALQ project are outlined in section 1.6 of Appendix I.

C-NLOPB Decision 97.02 required the Proponent to demonstrate that the best practicable evacuation technology is utilized on the FPSO. In complying with that requirement, the Proponent installed two PROD assisted lifeboats, port and starboard in the forward end; and, a lifeboat starboard with a bow thruster at the aft end to assist in moving away from the FPSO. The Proponent proposes to install two additional lifeboats, identical to the existing starboard aft lifeboat, with a bow thruster. These lifeboats will be located port and starboard just aft of the existing Blast wall.

As part of its amendment of the Safety Plan, the Proponent will be required to demonstrate that the best practicable evacuation technology available has been utilized on the Terra Nova FPSO.

4.2.4 Standby Vessels

The Proponent has approval for the configuration of its support vessel fleet through an equivalency to the regulations. With the increase in the POB, the CSO will review the current equivalency to ensure existing plans are robust enough to meet any new demands. Vessel(s) will be available at all times in the field to perform standby duty as required by regulations.

4.3 Conservation of the Resource

The statutes and regulations administered by the C-NLOPB require that oil and gas resources be produced in accordance with good oil field practice, having proper regard for the efficient recovery of the resource and the prevention of waste. The Application will not have a direct effect on the Proponent's approach to recovery of the oil reserves and conservation of the gas resources. If the Proponent is able to achieve the goal of improved reliability and higher asset utilization, this may have a beneficial effect on recovery and conservation.

The ALQ will provide accommodations for additional personnel to address the gas compression facilities reliability issues. The Proponent has had significant problems with reliability of the gas compression facilities on the Terra Nova FPSO. These problems have resulted in deferred production and increased operating cost. If the production system efficiency can be enhanced via improved viability and higher asset utilization, operating costs will be reduced thereby generating additional beneficial recovery.

4.4 Protection of the Environment

This section describes the review of the potential effects of the proposed amendment upon the natural environment, and of the measures that the Proponent plans to put in place to prevent or minimize these effects.

The public review of the original Application determined that, with implementation of appropriate mitigations, there likely would be no significant adverse environmental effect associated with the project. There was no indication arising from that review that the number of persons aboard the vessel contributed substantially to the potential effects that were considered, nor to the overall conclusions of the review.

The proposed amendment would see an increase in POB on the FPSO. However, with the application of previously identified mitigative measures there should be no incremental adverse environmental effects associated with the ALQ. On the other hand, if the additional personnel enable the Proponent to achieve its goal of improved reliability, this greater reliability also should apply to those systems employed to prevent or to minimize potential environmental effects.

Therefore, the proposed ALQ and the concomitant increase in POB on the FPSO vessel are not likely to result in adverse environmental effects.

4.5 Industrial Benefits

The assessment of any proposed amendment to a Development Plan requires a determination as to whether any changes are required to the Approved Benefits Plan.

The proposed ALQ modification was examined within the context of the larger program of activities that are planned for the FPSO during the extended shutdown in 2006. During the planning process for the ALQ, several changes were made to the procurement, fabrication and installation of the ALQ. These changes, as well as changes to other aspects of the 2006 turnaround, have enhanced the Newfoundland and Labrador content of the whole program.

This approach has been reflected in a letter of understanding from the Proponent to the Government of Newfoundland & Labrador. The Government of Newfoundland & Labrador has requested the C-NLOPB to monitor the Proponent's adherence to that letter during the implementation phase (see Appendix II). The undertakings in that letter will be treated by the C-NLOPB as commitments of the Proponent. It is in this context that no amendment to the approved Benefits Plan will be required.

5.0 DEVELOPMENT PLAN AMENDMENT - PART II DOCUMENTS LIST

<u>Ref.</u>	<u>Document Number</u>	<u>Rev</u>	<u>Title</u>
1	TN-PE-LC15-X00-005	M1	Additional Living Quarters - Enhanced Evacuation Capability (Confidential)
2	TN-PE-LC15-X00-006	M1	Additional Living Quarters - Location, Fire and Blast Study Summary (Confidential)
3	TN-PE-HV15-V50-002	M1	HVAC Review for 130 POB (Confidential)
4	TN-PE-EC15-X00-037	M3	Temporary Safe Refuge, Egress, Evacuation, Escape and Rescue (Confidential)
5	TN-IM-SA15-X00-030	M4	Emergency Preparedness Analysis (Confidential)
6	TN-PE-SA15-X00-243	M1	Impact of Proposed Additional Living Quarters on Terra Nova Risk Profile (Confidential)

6.0 REFERENCES

1. Design Environmental Criteria (Internal Petro-Canada Doc. No. TN-IM-PM50-X00-001).
2. Petro-Canada Target Levels of Safety for the Terra Nova Field (Internal Petro-Canada Doc. No. TN-IM-SA02-X00-070).
3. Terra Nova Safety Plan (Internal Petro-Canada Doc. No. TN-PE-SA04-X00-001).
4. Development Application Terra Nova Development, August 1996 (including Supplement A to the Application, November 1996; Supplement B to the Application, February 1997) (Internal Petro-Canada ref. TER-0404-0002).
5. Development Application Terra Nova Development, Update to the Application, June 1997.
6. Decision 97.02, December 1997 (Canada-Newfoundland Offshore Petroleum Board report).
7. Newfoundland Offshore Area Petroleum and Conservation Regulations.
8. Development Application - Terra Nova Development - Canada-Newfoundland Benefits Plan (Internal Petro-Canada ref. TER-0404-0021).
9. Impact of Proposed Additional Living Quarters on Terra Nova Risk Profile (Internal Petro-Canada Doc. No. TN-PE-SA15-X00-243 - included in Part II documents).
10. Robust Risk Model: Quantified Risk Assessment for the Terra Nova FPSO (Internal Petro-Canada Doc. No. TN-PE-SA15-X00-231).
11. Emergency Preparedness Analysis (Internal Petro-Canada Doc. No. TN-IM-SA15-X00-030 - included in Part II documents).

7.0 LIST OF ACRONYMS

ALARP	As Low As Reasonably Practicable
ALQ	Additional Living Quarters
API	American Petroleum Institute
CA	Certifying Authority
C-NLOPB	Canada Newfoundland & Labrador Offshore Petroleum Board
COF	Certificate of Fitness
CSA	Canadian Standards Association
CSO	Chief Safety Officer
DDMT	Data and Decision Management Tool
EEERR	Egress Evacuation Escape Rescue and Recovery
EPC	Engineering, Procurement, Construction
FPSO	Floating, Production, Storage and Offloading
HVAC	Heating, Ventilation & Air Conditioning
IR	Individual Risk
IRPA	Individual Risk Per Annum
IMO	International Maritime Organization
IPMT	Integrated Project Management Team
ISO	International Organization for Standardization
PLL	Potential Loss of Life
POB	Personnel On Board
RRM	Robust Risk Model
SOLAS	Safety of Life at Sea
TEMPSC	Totally Enclosed Motor Propelled Survival Craft
TNMC	Terra Nova Management Committee
TSR	Temporary Safe Refuge

APPENDIX I:
SUMMARY OF AN APPLICATION FOR AN AMENDMENT TO THE TERRA NOVA
DEVELOPMENT PLAN

1.0 Summary of an Application for An amendment to the Terra Nova Development Plan

Currently the Terra Nova FPSO has 44 cabins, normally configured as 36 double cabins and 8 single cabins. Existing lifeboat limitations (two 80-person lifeboats port and starboard forward of the blast wall) constrain the maximum allowable POB to 80 during normal operations.

The existing maximum of 80 POB for the Terra Nova FPSO during normal operations has been a constant limitation since the facility started up in 2002. It has impeded the ability to complete planned and corrective maintenance efficiently, to complete inspections within planned timeframes, to complete plant improvements and to execute modification projects.

In order to address the need for increased POB capacity, the Proponent proposes to install ALQ and lifeboat capacity on the Terra Nova FPSO. The proposed addition will add 21 cabins, normally configured as 19 double cabins, 2 single cabins and two additional 80-person lifeboats. The resulting expanded facilities, 65 cabins, will have the capacity to accommodate up to 130 persons during production operations (65 cabins x 2 persons per cabin), normally configured as 55 double cabins and 10 single cabins (120 POB). Lifeboat capacity will be 400 (5 X 80) with 160 person lifeboat capacity each side forward of the blast wall and 80 person lifeboat capacity aft.

1.1 Advantages Resulting from Additional Living Quarters (ALQ)

The primary advantage of increased POB capacity on the Terra Nova FPSO is the ability to complete scheduled inspection and maintenance campaign work, permit vendor support and execute modifications such as potential future tie-in projects. This will result in improved reliability and higher asset utilization. It also allows the POB to increase during planned turnarounds, thereby reducing turnaround durations.

In particular, the provision of ALQ space will:

- permit completion of planned maintenance and inspections in compliance with our continuous survey regime;
- increase reliability by allowing the implementation of identified and engineered plant improvements and completion of preventive maintenance tasks as planned;
- facilitate a higher ratio of planned work to unplanned work;
- allow sustainment of adequate resources to complete the work within the schedule, thereby avoiding stops and starts in the workflow and high turnover of workers completing the work;
- reduce turnaround work scope to those activities which need a full plant outage by eliminating worksopes that now can be resourced during operation;
- allow maximization of effort during May to September period so that weather or sea state sensitive work can be completed efficiently (e.g. fabric maintenance, thruster inspection, main power generation inspection);
- permit further integration of Reliability Centred Maintenance and Risk Based Inspection methodologies which will sustain high performance;
- allow an increase in daily effort during turnarounds, thereby reducing turnaround durations;
- facilitate both technical and craft training and skill development; and
- provide ability to scale workforce, respond quickly to major equipment breakdowns, and to implement value-added modifications in an efficient, timely manner.

1.2 General Description

The increase in POB capacity will be achieved primarily through the addition of a new living quarters module on the FPSO. The module will contain 21 cabins as well as recreational space and associated plant rooms. The module will be located on the forward end of the FPSO, adjacent to the existing accommodations area, and will be integrated into existing FPSO facility systems. New structural framing will support the multi-level facility. Additional life saving equipment will be installed on the FPSO to meet the life saving requirements associated with the increase in POB capacity. In addition to the new living quarters module, minor modifications to existing accommodations utilities will also be required. The new living quarters module will be integrated as part of the Temporary Safe Refuge (TSR). The following section describes the major facilities components of the ALQ project. Figure 2.1 provides a layout of the FPSO and indicates the locations where the ALQ and associated life saving equipment is proposed to be installed.

The ALQ project is not expected to change the existing operations and maintenance processes of the Terra Nova development. The existing organizational structure (offshore and onshore) is also not expected to be impacted as a result of the ALQ project. Only the size and composition of the craft personnel population and associated support (accommodations) will be affected because of the increased POB capacity. The existing Operating and Maintenance Procedures, Ice Management Plan, Logistics, Communications and Contingency Plans should not be impacted as a result of the ALQ project.

1.3 ALQ Module

The ALQ shall be designed and fabricated as a single-lift module. The finished module weight shall be approximately 550 metric tonnes. The planned installation mode is a single lift onto the FPSO. The completed ALQ module shall have a footprint of approximately 12 x 15 meters and a height of 19.5 meters consisting of five levels, and shall be supported on a steel module support frame. The walls of the ALQ module exposed to the process area shall be H120/J30 fire and blast rated. A protected area for an additional port lifeboat shall be incorporated into the ALQ module on the port side.

The ALQ module shall contain (but not be limited to) an independent Heating, Ventilation & Air Conditioning (HVAC) system, water mist sprinkler system, electrical system, instrumentation, smoke & fire detection system, telecommunications system, firefighting and safety equipment, and a vacuum drainage sewage collection system. Architecturally, it will be fitted to a standard equivalent to the existing accommodations. All equipment supplied shall be capable of integrating with existing FPSO accommodations' systems. The ALQ shall be designed to minimize on-board hook-up and commissioning.

1.4 Module Support Frame, T06 Deck Steel & Starboard Lifeboat Enclosure

The ALQ module shall be supported from the ship's hull structure via a steel module support frame. It will rest on the main deck and become incorporated into the underlying support steel. It will transfer the loads of the ALQ module into the ship's main structure while forming a blast and fire rated barrier to the underside of the ALQ module. It will be sited aft of the existing blast wall on the port side and extend 6 meters off the main deck. The walls exposed to the process deck will form the new H120 blastwall which will be integrated into the existing H120 blastwall.

Any open areas currently on the T06 deck shall be plated over between decks. A new combined starboard lifeboat enclosure / galley laydown module shall be designed and installed to provide a protected area for an additional starboard lifeboat.

The module support frame and lifeboat enclosure shall be designed and constructed separately from the ALQ module.

1.5 FPSO System Integration

A number of integration tie-ins, to support utility services, between the new ALQ module and existing ship's systems are required to be engineered and installed. The integration tie-ins required consist of piping, telecommunications, instrumentation, electrical, controls and safety systems.

1.6 Life Saving Equipment Additions

The following life saving equipment shall be installed as part of the ALQ project.

- Two Schat-Harding MCB-34 lifeboats (80-person) complete with bow thrusters, one on the port side, one on the starboard side of the vessel (refer to Figure 2.1 for location);
- Eight additional 25 person life rafts, four on each side with split locations between forward and aft davits (refer to Figure 2.1 for location);
- 140 additional Immersion suits located in cabins and near the existing muster area;
- 70 additional lifejackets located in cabins and near the existing muster area;
- 70 additional personnel locator beacons;
- 140 additional survival kit "B" located in cabins and near the existing muster area;
- Two additional Sea Ladders, one to each lifeboat launching station.

1.7 Equipment List

The listing of equipment associated with ALQ project is as follows:

- Additional Living Quarters Module
- Additional Lifeboat / Galley Laydown Module
- Module Support Frame & Cladding
- Laydown / Lifeboat Platforming & Stairs
- Air handling Units
- EVAC black water system
- Control System Cabinets
- External Lighting
- Intumescent Spray Applied Fire Protection
- Fire Fighting Equipment
- Safety Signs
- Telecommunications Equipment
- Fire & gas Devices
- Life Saving Equipment

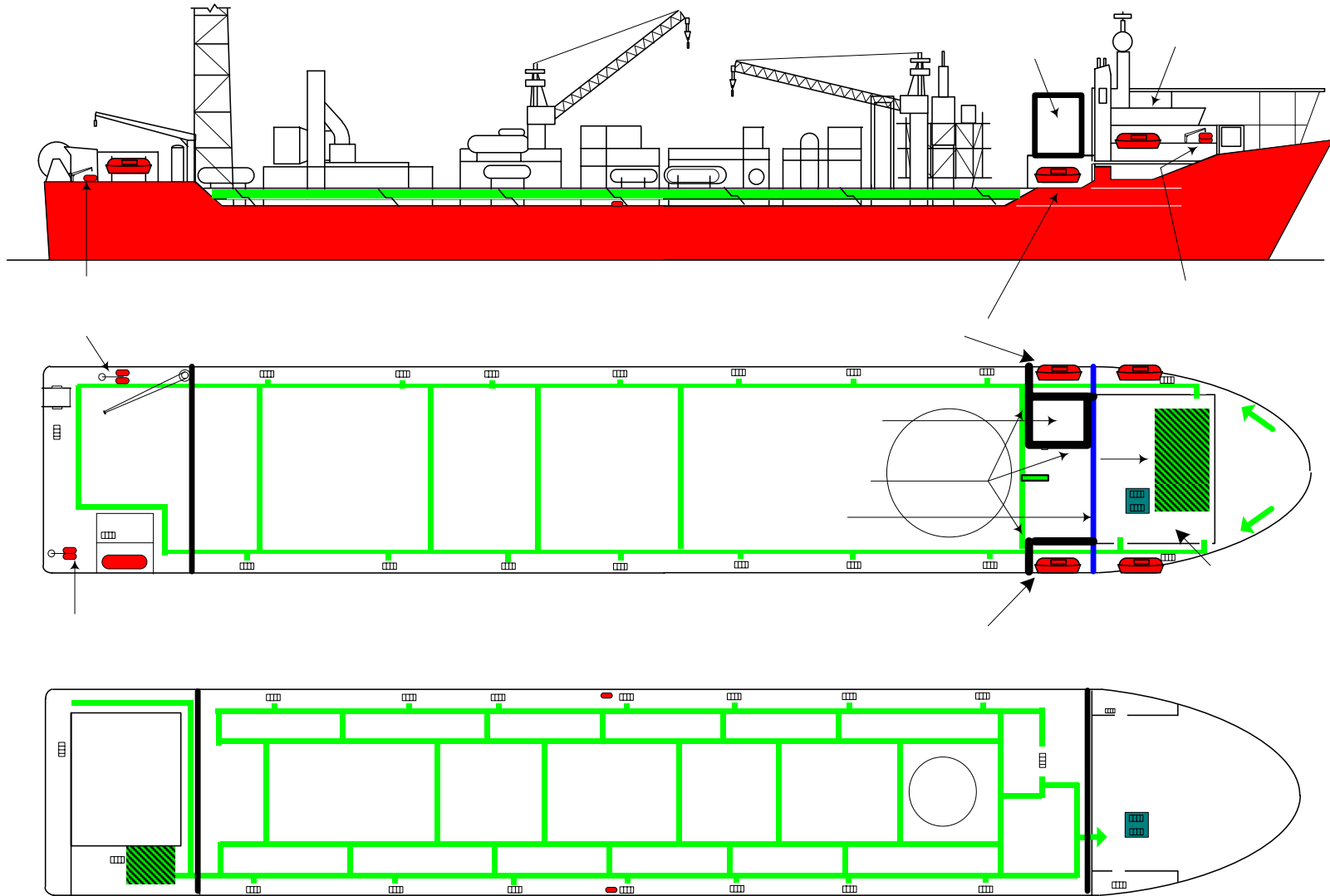


Figure 2.1: FPSO Layout Showing ALQ Including Life Saving Equipment (Source: After Petro-Canada 2005)

Decision 2005.03 - Additional Living Quarters on the Terra Nova FPSO

Five x 25 man liferafts
port and starboard
(three new each side)

1.8 Project Management & Execution Process

Petro-Canada, as Operator of the Terra Nova project, will manage the ALQ project. Generally, all ALQ workscope will be executed under the umbrella of the Terra Nova Management of Change Process.

For the project execution phase, Petro-Canada will utilize the services of an Engineering, Procurement, and Construction (EPC) contractor to provide engineering, procurement and construction for the entire project.

The project management responsibilities will be discharged through an Integrated Project Management Team (IPMT). The IPMT will consist of Petro-Canada staff and EPC contractor personnel. It will provide overall management of the project as part of the 2006 Turnaround management plan. Consistent with the 2006 Turnaround philosophy, the ALQ project will be executed following the Petro-Canada Project Delivery Model (PDM). This structured gated procedure will ensure that project controls, planning and authorizations requirements are satisfied.

The IPMT will be accountable to Petro-Canada East Coast senior management. The IPMT will communicate project progress during project execution in order to ensure alignment and satisfaction. Furthermore, the IPMT will provide the support and information to Petro-Canada senior management for communication with the regulatory bodies to ensure regulatory compliance.

Project Management Systems are in place or being developed to ensure an efficient execution of project activities. The systems/processes include Environmental, Health and Safety Management System, Quality Management Systems, Cost and Schedule Controls, Risk Assessment, Interface Management, Change Management, and Document Management. Systems are being utilized to ensure lessons learned from similar projects as well as from ongoing activities are captured and applied to the ALQ project where applicable.

Effective/transparent interface between the ALQ IPMT and the Terra Nova Operations Teams is critical. Interface and communication protocols are being established to ensure this is achieved.

1.9 Ancillary Contracts

Contracts will be established where necessary and appropriate for specialist services, which include:

- Certifying Authority
- Marine Warranty Surveyor
- Other consultants and specialists

1.10 Project Execution – Schedule

The summary schedule for the ALQ project execution phase is shown in Figure 2.2. The schedule has been established under the premise that installation will be required before the end of July 2006. This schedule is dependent on the timing of the 2006 Turnaround.

Figure 2.2 – ALQ Project Execution Schedule (Source: After Petro-Canada 2005)

	2005				2006			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Development Phase								
Preliminary Engineering								
Regulatory Approval Process								
Project Sanction Process								
ALQ Detailed Design and Procurement								
ALQ Construction								
ALQ Commissioning								
ALQ Sea Transport to Dry Dock								
Integration Tie-Ins - Engineering and Procurement								
Integration Tie-Ins - Construction								
ALQ/Integration Tie-Ins - Installation on FPSO								

1.11 Quality Assurance & Quality Control

Quality assurance and quality control shall be achieved for the ALQ project through the tactical implementation of Petro-Canada's Quality Management System. The system is designed to provide the appropriate level of quality management, assurance and control for both operational and project development applications. The system is consistent with the principles of ISO 9001:2000. Quality processes and procedures will be developed and implemented to ensure the project complies with all specified requirements.

Contractors will be required to have an effectively implemented Quality Management System compliant with the requirements of ISO 9001:2000. Contractors will be required to implement a quality assurance program throughout the project execution period up to delivery and preservation of equipment at the final location(s) and covering all activities including engineering, manufacturing, fabrication, installation, and/or service delivery process(es). Contractors will also be required to proactively manage the quality level provided by their critical sub-contractors. Contractors will be required to retain complete records that demonstrate the products and/or services provided meet all the specified requirements. Specific details of expectations of the contractors will be contained in the contracts.

Appropriate levels of verification and monitoring will be performed by Petro-Canada to ensure compliance with requirements. These surveillance and other verification tools activities will be used to verify the performance of contractors and of contractors' critical suppliers or sub-contractors to ensure compliance with relevant requirements in all areas during the execution of the work. Quality assessments / audits will also be performed by Petro-Canada during the course of the project execution.

1.12 Safety Analysis

The Terra Nova Safety Plan (TN-PE-SA04-X00-001) details the approach to and results of the risk assessment process for the Terra Nova FPSO. The risk profile for the operating phase of the development (the Robust Risk Model - RRM) has been placed on the software package, Data and Decision Management Tool (DDMT). This interactive tool builds up the risk profile from the major hazards that drive the overall risk profile and develops the various impact scenarios in the form of event trees. The impact of these hazards on personnel on the FPSO is presented in terms of Individual Risk (IR) and group risk (Potential Loss of Life – PLL).

The Impact of the proposed ALQ on the Terra Nova Risk Profile Report (TN-PE-SA15-X00-243) re-assesses the risk to POB the FPSO, as a result of an upmanning to a POB of 130, in order to demonstrate that the increase in risk due to the increased POB will not be unacceptable.

Table 2.1 presents the average Individual Risk Per Annum (IRPA) to personnel on the Terra Nova FPSO, based on a POB of 130 and including the additional hazard associated with an inert gas system release. The average IR is obtained by averaging the individual risk over all worker groups. Table 2.1 also presents the risk results for a POB of 80, based on the report Robust Risk Model: Quantified Risk Assessment for the Terra Nova FPSO (TN-PE-SA15-X00-231).

Table 2.1 - Distribution of Average Individual Risks (Source: After Petro-Canada)

Hazard	Average IRPA	
	POB 80	POB 130
Process Loss of Containment	3.86E-04	4.49E-04
Riser Release	6.44E-05	6.81E-05
Passing Ship Collision	6.92E-06	6.73E-06
Shuttle Tanker Collision	2.31E-05	2.25E-05
Iceberg Collision	1.03E-05	1.00E-05
MODU Collision	6.42E-07	6.26E-07
Helicopter Crash	4.75E-05	4.75E-05
Structural Failure	6.74E-06	8.02E-06
COT Fire/Explosion	7.57E-06	7.57E-06
Ignited Inert Gas	-	1.81E-06
TOTAL	5.53E-04	6.22E-04

1.13 Impact of Additional Living Quarters on Terra Nova Risk Profile

As part of the proposal to increase the capacity of accommodation provided on the Terra Nova FPSO, Petro-Canada intends to plate over certain sections of the T06 Main Deck. This will prevent gas from a topsides release migrating into and filling the interdeck area but does increase the confinement of the interdeck area and could therefore result in increased overpressures in the event of an explosion in that area.

Detailed explosion analysis has been undertaken for this scenario, which identifies that a gas leak from the inert gas system located on the T06 Vessel Deck has the potential to ignite and generate significant overpressures in the interdeck area.

The average IRPA for a POB of 130, including the additional risk associated with a release from the inert gas system, is below the intolerable IR level of 1×10^{-3} per year. Inspection of Table 2.1 reveals that an increase in POB from 80 to 130 results in an increase in the total average IR of approximately 12%. The additional inert gas system release event contributes approximately 0.3% of the total average IRPA for a POB of 130.

In general, although increasing the POB will increase the overall risk to personnel, measured in terms of PLL, it is unlikely to significantly affect the average IR as noted in Table 2.1. The major issue to be considered relates to escape, mustering, evacuation and rescue, since, as a result of the upmanning, there will be the potential for an increase in the number of personnel entering the sea following Totally Enclosed Motor Propelled Survival Craft (TEMPSC) failure. In general, the rescue and recovery fatality rate will increase as the number of personnel in the sea increases.


The Emergency Preparedness Analysis (TN-IM-SA15-X00-030) assesses the overall Egress Evacuation Escape Rescue and Recovery (EEERR) fatality rates, both for TEMPSC evacuation and for direct escape to sea, based on an evacuation of 130 personnel.

The revised Terra Nova risk profile is within the Target Levels of Safety (TN-IM-SA02-X00-070) established for the Terra Nova Development.

1.13.1 Process Hazards Analysis

Risks associated with the ALQ project must be reduced to As Low As Reasonably Practicable (ALARP). This principle recognizes that no industrial activity is entirely risk-free but that effort should be directed at effective identification and reduction of risk. Risk based decision making requires the systematic identification of hazards, the assessment of consequences and probabilities, and the evaluation of prevention and mitigation measures for successful management of risk. Petro-Canada's formal safety assessment process has been adopted for the ALQ project. Petro-Canada systems and processes for assessing risks of planned operations, modifications or changes are being used in assessing the risks and safety concerns related to specific components of the ALQ project. Detailed assessments of systems will use the Terra Nova Process Hazard Analysis Plan. This process will ensure that the risk profile is not compromised and the Target Levels of Safety continue to be met.

APPENDIX II:
LETTERS OF UNDERSTANDING RE: BENEFITS ASSOCIATED WITH THE ALQ AND
OTHER ELEMENTS OF THE 2006 TURNAROUND



GOVERNMENT OF
NEWFOUNDLAND AND LABRADOR

File #: 8008 D454
 Initials: _____

JAN 06 2006
RECEIVED
 Canada-Newfoundland and Labrador
 Offshore Petroleum Board

Department of Natural Resources
Office of the Minister

Mr. Fred Way
Acting Chairman & CEO
Canada-Newfoundland and Labrador Offshore Petroleum Board
4th Floor, TD Place
140 Water Street
St. John's, NL

December 22, 2005

Dear Mr. Way:

Re: Terra Nova Development Plan Amendment

The Canada-Newfoundland and Labrador Offshore Petroleum Board is presently considering a Development Plan amendment submitted by Petro-Canada for the Terra Nova 2006 Turnaround.

As you may be aware the proponent, Petro-Canada, has met with this department and has outlined its execution strategy for this work particularly as it relates to providing tangible benefits from this activity for this province. More recently, correspondence from Petro-Canada detailed its plans in term of quantative and measurable benefits (person hours of work) that will accrue to the Province as a result of this activity.

I am satisfied with Petro-Canada's execution strategy for this work and its commitments on benefits for the province. I have attached a copy of correspondence from Petro-Canada's Vice-President, East Coast operations, including its commitment for local benefits.

I ask that the Board incorporate these commitments as part of the Development Plan Amendment, and furthermore, monitor the benchmarks provided by Terra Nova against actual performance in assessing the success of the proponent efforts to maximize benefits flowing from this activity. Such monitoring should include a monthly review process to identify any deviations from the benchmarks established. The resulting information should be shared with officials of Natural Resources Canada and my department.

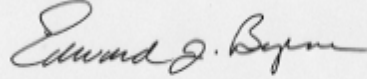
P.O. Box 8700, St. John's, NL, Canada, A1B 4J6, Telephone (709) 729-2920, Facsimile (709) 729-0059

- 2 -

I understand that there are fairly tight timelines on this activity and that the proponent has, at its own risks, advanced the contracting activity.


I look forward to your response on this matter.

Sincerely yours,

A handwritten signature in dark ink, appearing to read "Edward J. Byrne".

EDWARD J. BYRNE, M.H.A.
Minister

Attachment (s)

W.A. Fleming Vice President East Coast		File #: _____ Initials: _____
Suite 201, Scotia Centre 235 Water Street St. John's, NL, Canada A1C 1B6 Telephone (709) 778-3541 Facsimile (709) 724-2901		Vice-président Côte de L'est Scotia Centre, bureau 201 235, Water Street St. John's (Terre-Neuve) A1C 1B6 Telephone (709) 778-3765 Facsimile (709) 724-2901
		JAN 06 2006 RECEIVED Canada-Newfoundland and Labrador Offshore Petroleum Board
PES-GON-TER-0404-0001		
December 20, 2005		
Hon. Ed Byrne Minister of Natural Resources Government of Newfoundland and Labrador P.O. Box 8700 St. John's, NL A1B 4J6		
Reference: Terra Nova 2006 Turnaround		
Dear Minister Byrne:		
I am writing to clarify Petro-Canada's plan to manage the dry dock scope of work for the 2006 Terra Nova maintenance turnaround.		
As we indicated in our meetings with you and your senior officials, the primary driver and the major focus of the dry dock work for 2006 will be to complete work required for regulatory certification of the Terra Nova FPSO. The time required to repaint the hull, and inspect the thrusters and undersea valves, will determine the critical path. During this period other regulatory work will be completed as a priority. Topsides maintenance and modifications will only be completed if those tasks do not extend beyond the planned dry dock period (critical path work).		
As we continue to refine the work scope, there is potential for growth in the number of hours required to address the regulatory items. Should this occur, it will impact the amount of maintenance and modifications work that can be done. In short, if there is growth in regulatory work hours, the total work scope will need to be managed to ensure that the regulatory work retains its priority. In practical terms this means that growth in regulatory work scope would result in non-regulatory work being re-scheduled for offshore completion.		
It is our intention to build our plan based on a known scope of work to be completed at the dry dock. We are restricted in adding scope for the following reasons:		
<ul style="list-style-type: none"> • We are in the process of choosing a dry dock facility, and will have a fixed duration slot in that dry dock. 		

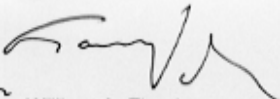


- Only the work planned for the dry dock will have the necessary engineering and procurement completed to enable execution of this work in the dry dock. We will not be in a position to add new scope in the dry dock, and in fact this scope will be frozen in the latter part of January with the completion of more engineering and after formal partner approvals are received.
- In order to complete the turnaround, return to the field, and re-connect to the wells before unfavourable fall weather sets in, we will leave the field in early summer, and reconnect in September. Again, this limits the potential to add new work scope.
- If there is currently-planned topsides work that cannot be accomplished in dry dock, we will plan to do it offshore after the Turnaround, pending approval for the fabrication of the Additional Living Quarters (ALQ) in Newfoundland and Labrador, and its installation and commissioning while in dry dock.

We will also commit to work with the C-NLOPB to regularly monitor and keep the Board apprised of project progress, and any changes in work scope that might arise as we work through the project.

If you have any questions about these matters, please contact me at 709-778-3541.

Sincerely,


For William A. Fleming

cc: Gary Vokey, Petro-Canada
Bruce Saunders, Deputy Minister
✓ Brian Condon, Assistant Deputy Minister

21-Dec-2005 12:05pm From:Petro-Canada

T-485 P.002/002 F-057

Terra Nova 2006 Turnaround – Preliminary Breakdown of Hours

Component	NL		Foreign		Total
	Hrs	% of Total	Hrs	% of Total	
FEED	10,000	2.1%			10,000
Project Management	50,000	10.5%			50,000
Engineering & Procurement					
Inspection Scope	7,000	1.5%			7,000
Maintenance Scope	13,000	2.7%			13,000
Modifications Scope	45,000	9.5%			45,000
	65,000	13.7%			65,000
ALQ Engineering, Procurement & Construction	144,000	30.3%	36,000	7.6%	180,000
Disconnection, Reconnection, Commissioning & Start-up	10,000	2.1%			10,000
	10,000	2.1%			10,000
Voyage to & from Dry-dock					
Work Scope in Dry-dock					
Project Management			10,000	2.1%	10,000
Inspection Scope			26,000	5.5%	26,000
Maintenance Scope			54,000	11.4%	54,000
Modifications Scope			46,000	9.7%	46,000
ALQ Installation & Integration			14,000	2.9%	14,000
			150,000	31.6%	50,000
TOTAL	289,000	60.8%	186,000	39.2%	475,000

Notes:

1. These employment estimates are based on the currently defined work scope, which is still a preliminary one. This work scope could vary as a higher level of definition is achieved over the coming weeks. However, it is expected content levels will be in the same range. If anything, Newfoundland content is likely to increase.
2. Current Expenditures Estimates remain in the same range as was communicated earlier. Budget is approximately \$130 million, +/- 25%. Estimate is 40% NL content, 10% Canadian, 50% foreign. Same comment applies with respect to further definition over the coming weeks.
3. Work scope is expected to move to the next level of definition in the latter part of January.
4. In the dry dock work scope (150,000 hours), items identified generally as Inspection & Maintenance constitutes the critical Regulatory work scope, while Modifications and ALQ constitute the Reliability Modifications work scope.
5. Please note that 30,000 hours of the originally identified 100,000 hours of reliability work (per October 12, 2005 presentation) would have been completed offshore in the original plan. Any scheduled reliability work not completed as planned due to an increase in regulatory work would similarly be carried over as Newfoundland based offshore work scope.