WHITE ROSE OILFIELD
DEVELOPMENT APPLICATION

VOLUME 1
CANADA-NEWFOUNDLAND BENEFITS PLAN

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This Development Application is submitted by Husky Oil Operations Limited (as Operator) on behalf of itself and its co-venturer Petro-Canada, who are the project proponents. The Application is comprised of a Project Summary and five volumes.

- Project Summary
- Volume 1 – Canada-Newfoundland Benefits Plan
- Volume 2 – Development Plan
- Volume 3 – Environmental Impact Statement (Comprehensive Study Part One (issued October 2000))
- Volume 4 – Socio-Economic Impact Statement (Comprehensive Study Part Two (issued October 2000))
- Volume 5 – Safety Plan and Concept Safety Analysis

This is Volume 1 – the Canada-Newfoundland Benefits Plan. The following Part II documents have also been prepared in support of Volume 1 of the Development Application:

JWEL (Jacques Whitford Environment Limited). 2000. White Rose Oilfield Development Public Consultation Report. Part II Document prepared for Husky Oil Operations Limited, St. John's, NF.

PETRO-CANADA

Husky Oil

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1 INTRODUCTION

1.1 Document Scope and Format

This Canada-Newfoundland Benefits Plan has been prepared in response to the requirements of Section 45 of the *Canada-Newfoundland Atlantic Accord Implementation Acts.* It documents, based on the guidance provided in Chapter 5 of the Canada-Newfoundland Offshore Petroleum Board (C-NOPB) Development Application Guidelines (C-NOPB 1988), Husky Oil Operations Limited's (Husky Oil or 'the Company') commitments to, and plans concerning:

- the employment of Canadians and, in particular, residents of the Province of Newfoundland and Labrador during the White Rose project (the Project); and
- the participation of Canadian and, in particular, Newfoundland and Labrador businesses in the provision of goods and services for the Project.

As specified in the Development Application Guidelines (C-NOPB 1988), it addresses the requirements of the *Atlantic Accord* and the *Acts*, describes Husky Oil's benefits policies and procedures (including those related to consultation, monitoring and reporting), and assesses procurement and labour requirements.

The White Rose oilfield development will involve recovering an estimated 36 million cubic metres (m^3) (230 million barrels) of recoverable oil from an area of approximately 40 km^2 in the Jeanne d'Arc Basin. A ship-shaped floating production, storage and offloading (FPSO) facility, similar to that selected for Terra Nova, is proposed to be used to develop the oilfield. This ship-shaped facility will be able to store between 111,000 and 135,000 m^3 (700,000 and 850,000 barrels) of oil (approximately eight to ten days of oil production) and will contain topside processing units, accommodations and a turret.

As noted above and as described in the Development Plan (Volume 2), Husky Oil is proposing to develop the White Rose oilfield using a ship-shaped FPSO. As a result of a thorough concept evaluation process, a steel semi-submersible with detached storage is considered the only technically and economically feasible alternative production system. This Benefits Plan considers both of these floating production facility (FPF) alternatives.

This Plan has five main sections:

- **Approach to Benefits.** This chapter provides a background to the requirements for a Canada-Newfoundland Benefits Plan and describes Husky Oil's general approach to benefits in terms of its philosophy, beliefs, guiding principles and overall benefits process.

- **Policies and Procedures.** This chapter describes Husky Oil's policies and procedures, as well as general commitments, in respect of project management, supplier development, procurement and contracting, employment and training and research and development. This includes policies and procedures related to monitoring and reporting, which are seen as critical to the effectiveness of the Plan.
- **Development and Production Scenarios.** This chapter describes the specifics of the construction and operations processes with respect to the major White Rose work components: hull fabrication, topsides module fabrication and assembly, on-shore/at-shore hook-up, offshore installation, production drilling, subsea fabrication and installation, and operations and production.
- **Procurement Requirements.** This chapter describes goods and services requirements for the White Rose project, including fabrication and construction services, bulk materials, equipment, and support services. The ability of companies in Newfoundland and Labrador (hereinafter, Newfoundland) and elsewhere in Canada to deliver these goods and services is also assessed.
- **Labour Requirements.** This chapter describes the labour requirements for different components of the White Rose project. The availability of residents of Newfoundland and Labrador and other Canadians to work on the Project is also assessed.

Appendices present supplementary information with respect to updated descriptions of fabrication facilities in Eastern Canada and a copy of the Canada-Newfoundland Benefits Content Tables, which form an integral part of each White Rose Request for Proposal.

Also attached in Appendix A is a complete section, entitled Atlantic Canadian Capabilities, from the Newfoundland Ocean Industries Association (NOIA) report: "Harnessing the Potential-Atlantic Canada's Oil and Gas Industry". This provides relevant discussion on supply capabilities, labour capabilities, training capabilities, and research development capabilities.

1.2 Aims and Objectives

The Canada-Newfoundland Benefits Plan (or 'the Benefits Plan') for the development of the White Rose oilfield places Husky Oil's broad goals for the project in the greater context of building a sustainable oil industry in Newfoundland. With each new offshore Development Application (DA), there is a tendency to focus on production scenarios, and their impact on potential short-term construction activity, arguably the most visible aspect of *benefits.* Husky Oil's vision, however, considers the four main stages of the oilfield cycle:

- exploration;
- delineation;
- development; and
- production.

By focusing on all of these, a broader groundwork for skills development in Newfoundland and Canada can be laid in terms of the infrastructure and technology resources being established.

Considerations by the proponents (Husky Oil and its co-venturer Petro-Canada) of the White Rose oilfield development mirror the decisions faced by the oil industry for a long-term development strategy in Newfoundland. These considerations must take into account technological trends to best predict the means whereby each stage of development will be executed in future, in an effort to determine *what* will become the norm. The overall continuity of the industry is the responsibility of all stakeholders, and all must therefore be ever cognisant of education, training and research commitments that are relevant and applicable in the future.

The commitments documented in this Benefits Plan are not just Husky Oil's commitments for White Rose; they are also indicative of Husky Oil's continued planning strategy for sustained involvement in the Newfoundland offshore oil industry. In 2000, Husky Oil explored the Cape Race exploration block, and is also working on development concepts geared to allow for economic development of oilfields with reserves in the 50 to 100 million barrel range. Based on innovative production solutions developed in other challenging environments, Husky Oil believes that new production facility designs that accommodate multi-pool or sequential development concepts can be developed so that these fields can be pursued in the future. Underlying this belief is the conviction that benefits to both petroleum companies and Newfoundland and Labrador will be substantially increased through the simultaneous pursuit of a variety of projects in an exploration, delineation, development and production context. This approach to development is a natural progression from the "one project at a time, small fields following major fields as satellites" model that has been necessary in East Coast development planning thus far.

The industry in Newfoundland and Labrador must embrace technologies that permit this concurrent approach in order to secure sustained economic benefits and a continuing basis for development of skills and infrastructure. These technologies must allow maximum flexibility to also pursue additional future exploitation opportunities as they become commercially viable, with prerequisite infrastructure established on a planned, rational basis.

Finally, the ability of the offshore region to attract new participants from the independent, senior producer sector of the industry will be greatly influenced by the expectation of shorter cycle times between initial investment and production. As future, more challenging developments will require shorter schedules to be viable, construction and management processes must become more focused on the priority issues which affect the industry as a whole and, therefore, help determine its long-term direction.

1.3 Issues Scoping and Stakeholder Consultation

Husky Oil conducted an extensive issues scoping and stakeholder information/consultation program for the White Rose oilfield development. This program met the requirements of the *Canadian Environmental Assessment Act* (CEAA), C-NOPB Development Application Guidelines (1988) and the *Atlantic Accord Acts.* A detailed report of the issues scoping and stakeholder consultation program is provided in the Part II Document to this DA, titled White Rose Oilfield Development Public Consultation Report (JWEL 2000). The program involved:

- reviewing relevant legislation and guidelines;
- reviewing the scoping document issued by C-NOPB, Department of Fisheries and Oceans (DFO), Environment Canada (EC) and Industry Canada (IC);
- reviewing documents prepared for the Terra Nova and Hibernia oilfield developments;
- reviewing issues raised during the Terra Nova Development environmental assessment review process;
- consulting community, business, women's and non-governmental organizations, and the general public (key informant workshops, open houses and meetings/presentations);
- holding meetings with government departments and agencies;
- conducting media briefings and preparing press releases;
- tracking articles/stories from media sources;
- distributing project information (two mail distributions);
- establishing a project information telephone number (724-7244 and 1-877-724-7244);
- setting up a project-specific web site (www.huskywhiterose.com);
- documenting issues and concerns, and following up when necessary; and
- using professional judgement based on the particular characteristics of the White Rose oilfield development.

The main message heard throughout the scoping/consultation program was that the majority of participants were supportive of the development and interested in seeing it proceed. There was also a strong interest in ensuring that the project proceed in an environmentally, socially and economically responsible manner.

A number of general items that apply to all aspects of the project were noted throughout the consultation program. They are:

- learn from the Hibernia and Terra Nova experience;
- ensure ongoing, two-way communication with stakeholders;
- ensure project information is accurate, timely and appropriate; and
- do not raise undue expectations in relation to benefits from the project.

Items raised throughout the scoping/consultation program have been incorporated in project planning and are reflected in the DA. A comprehensive list of items heard from stakeholders throughout the scoping/consultation program is provided in JWEL (2000). Items specific to each component of the DA are highlighted in the relevant DA documents. Specific comments about benefits to Newfoundland and Labrador are listed in Table 1.3-1, with the locations noted as to where they are addressed.

Table 1.3-1 Comments About Canada-Newfoundland Benefits

Comments	Where Addressed
Business	
Need to maximize benefits to local businesses, facilities, services and suppliers.	Chapters 2, 3
Need for appropriate contracting strategy.	Section 3.2
Need to work with and provide information to the business community, education and research institutions, and economic development organizations on a timely basis.	Chapters 2, 3
Perceived obstacles to maximizing local benefits, such as ensuring local suppliers are competitive.	Chapters 5, 6
Need to monitor business-related commitments.	Section 3.2, 3.4, 3.7
Economy	
Need to maximize benefits to Newfoundland and Labrador, including taxes and royalties and any potential related projects.	Chapters 2, 3
Need to facilitate local benefits by integrating site work forces into the local communities, where practical.	Section 2.2, 3.4
Need to encourage and expedite development of the natural gas reserves at White Rose.	Volume 2, Section 6.7
Need to maintain continuity with other oil development projects to maximize benefits and avoid "boom/bust" development.	Sections 1.2, 3.1, 3.2, 3.4, 6.11 Chapter 7
Effect of world oil prices on project feasibility.	Comprehensive Study Part One Section 1.3
Employment	
Need to maximize local (including women's) employment, training and technology transfer.	Sections 2.3, 3.4, Chapter 6
Project schedule and lifespan.	Volume 2, Chapters 10, 11
Human resources and hiring policies, in particular local hiring and gender equity.	Chapter 3
Need to reduce out-migration trend, bring Newfoundlanders back home.	Section 6.7
Maintaining continuity for employment following the Terra Nova work to facilitate long-term growth.	Sections 1.2, 3.1, 3.2, 3.4, 6.11, Chapter 7
Need to work with, and provide information to, local research and education institutions.	Section 3.4, 3.5
Need for effective monitoring of employment-related commitments.	Section 3.7

2 APPROACH TO BENEFITS

This chapter provides a background to the requirements for a Canada-Newfoundland Benefits Plan and describes Husky Oil's general approach to benefits in terms of its philosophy, beliefs regarding benefits opportunities, guiding principles and overall benefits process.

2.1 The Atlantic Accord

The *Atlantic Accord* provides the legislative basis for the development of the oil and gas resources offshore Newfoundland to benefit Canada as a whole and, in particular, the Province of Newfoundland. The *Atlantic Accord* recognizes the right of the province to be the principal beneficiary of the oil and gas resources off its shores.

The *Canada-Newfoundland Atlantic Accord Implementation Act* and *the Canada-Newfoundland Atlantic Accord Implementation (Newfoundland) Act* are federally and provincially enacted legislation ('the *Acts*'). These parallel *Acts* require that a benefits plan must be submitted to and approved by the C-NOPB before it may approve the development plan. As stated in the *Acts*, specific provisions of the benefits plan must include:

- a plan for the employment of Canadians and, in particular, members of the provincial labour force;
- a plan for providing manufacturers, consultants, contractors and service companies in Newfoundland and other parts of Canada with full and fair opportunity to participate on a competitive basis in the supply of goods and services used in a proposed work or activity referenced in the benefits plan;
- the establishment of an office in Newfoundland where appropriate levels of decision-making take place; and
- expenditures for research and development, and education and training, in Newfoundland.

Consistent with the *Canadian Charter of Rights and Freedoms*, individuals resident in the province are to be given first consideration for training and employment opportunities in the work program for which the plan is submitted. Also, first consideration is to be given to services provided from within the province and to goods manufactured in the province where those services and goods are competitive in terms of fair market price, quality and delivery.

2.2 Benefits Philosophy

Husky Oil is committed to bringing maximum benefits associated with the development of White Rose to Newfoundland where practically and commercially achievable on a competitive basis. The Company is fully supportive of policies and practices that support industry and labour in the region of the development, including long term economic benefits, both to the community and to the project.

Substantial skills and industrial infrastructure have been established in Newfoundland, and there are experienced and capable training and research and development facilities in the province. Oil exploration activities, and the Hibernia and Terra Nova developments, have provided a solid foundation upon which the oil industry can now grow and mature based on its own commercial integrity. This is an evolving process, steadily building resiliency and self-reliance as the industry comes of age. Husky Oil believes that substantial work associated with the engineering, procurement, construction and operations can be performed in Canada and in particular, Newfoundland, on the basis that the work is competitive. Indeed, Husky Oil believes that over the long term, it generally makes economic sense to perform as much work as is economically possible close to the field.

2.3 Benefits Beliefs

The development of Husky Oil's Canada-Newfoundland benefits philosophy for its Grand Banks programs is based on certain beliefs and guiding principles. The following sections describe Husky Oil's beliefs applicable to Canada-Newfoundland benefits.

2.3.1 Substantial Skill Base

The studies conducted for other developments and documentation compiled by Husky Oil indicate a substantial skill base exists in Newfoundland and Labrador, and other parts of Canada. The availability and use of this skills base at this time, however, is largely dependent upon international competitiveness and timing of projects, another aspect that *sustained* development will ultimately address. The combined resources of the engineering community and labour force in Newfoundland in particular, and in the remainder of Canada, can provide a major portion of the skills required to carry out the scope of work that is required.

2.3.2 Substantial Industrial Base

Husky Oil has an extensive knowledge of Newfoundland facilities and large fabrication facilities in Canada. Based on this, the Company believes that over the life of the project, the capabilities and resources exist to perform the majority of the work required for offshore development in Newfoundland and in Canada. The management of this infrastructure has been strengthened, and continuous further improvement will be required in order to sustain and develop top-notch systems and personnel in the province.

2.3.3 Training and Transfer of Technology

The training of local personnel and the transfer of technology to local Canadian companies reduces long-term operating costs and provides cost-effective support for current programs and future projects. The earlier these activities are conducted in ways which provide significant opportunity for participation

by Newfoundland and Canadian companies and individuals, the greater the long-term return for all stakeholders. Husky Oil is committed to ascertain training and upgrading requirements early in the project development so that the public and private sectors can respond to operations employment opportunities with programs specifically tailored to meet the array of demands posed by White Rose and the future industry in general.

2.3.4 Rights of Government and People

Husky Oil recognizes the right of Newfoundland and Labrador to be one of the principal beneficiaries of the oil and gas resources off its shores.

2.3.5 Husky Oil Understanding

Husky Oil understands the objectives, conditions and commitments necessary to achieve cost-effective Canadian and Newfoundland and Labrador benefits.

2.4 Benefits Principles

Based on the beliefs described above, Husky Oil has documented principles to guide its approach to identify and provide opportunities for Canada-Newfoundland participation. These guiding principles are described in the following sections.

2.4.1 Full and Fair Opportunity

Full and fair opportunity will be provided for Canadian and, in particular, Newfoundland and Labrador companies and workers to participate in the supply of goods and services. This is best defined by the Husky Oil business approach, as characterized by the following:

- sizing and design of packages, where appropriate, to fit the capabilities of Canadian and, in particular, Newfoundland and Labrador companies;
- development and use of vendor database;
- investigation of labour and fabrication capabilities;
- early dissemination of information on the scope of work;
- open communication with all personnel and companies requesting non-proprietary information;
- presence of engineering, procurement and project management in Newfoundland and Labrador;
- open communication with government and industry associations to identify potential suppliers; and
- assisting and advising on the development and implementation of transfer of technology and training programs for long-term cost effectiveness.

2.4.2 First Consideration to Newfoundland and Labrador and to Canada

Husky Oil supports the principle that first consideration be given to personnel, support and other services that can be provided by Newfoundland and Labrador, and to goods manufactured in Newfoundland and Labrador, where such goods and services are competitive in terms of fair market price, quality and delivery. Ensuring that individuals resident in Newfoundland and Labrador are given early and ample opportunity for training and employment, and then applying this, in turn, to Canadian companies and personnel relative to international competition, is integral to this principle. The rigorous application of this principle will, within a competitive framework, result in opportunities to Newfoundland and Labrador and Canada.

2.4.3 Proactive Approach

Husky Oil is proactive in its approach to Canada-Newfoundland opportunities. This means that it will engage in innovative, cooperative, supportive and open pursuit of opportunities for involvement of Canadian, and in particular, Newfoundland and Labrador companies and residents to achieve best value for the project. Husky Oil will definitively challenge the mentality that suggests "it can't be done!" in Newfoundland and/or Canada.

2.4.4 "Value Adding" is Imperative

Husky Oil, in the evaluation of opportunities, will emphasize best value for the project. Opportunities must be cost-effective in the long term, bringing value to the project stakeholders.

2.5 The Benefits Process

The following sections describe the process whereby Husky Oil assures that its beliefs and guiding principles for Canada-Newfoundland Benefits evolve into corporate culture and are adopted as policy by all contractors, sub-contractors, manufacturers, suppliers and vendors in the procurement chain.

2.5.1 Development in Accordance with Atlantic Accord

The *Atlantic Accord Acts* require that the policies and procedures of proponents of offshore oil and gas projects embody the commitment to carry out the program in the spirit of the *Accord*. This translates into:

- full and fair opportunity for Canadian and Newfoundland and Labrador companies to participate in the supply of goods and services;
- goods manufactured in and services provided from Newfoundland and Labrador are given first consideration where they are competitive; and

- residents of Newfoundland and Labrador are given first consideration for employment opportunities and training.

2.5.2 Canada–Newfoundland Benefits Guidelines

Husky Oil's Canada-Newfoundland Benefits Guidelines will be a contractual obligation for all companies involved in the White Rose project. They are, and will continue to be, an integral part of each of the Company's Requests for Proposals and require a commitment to maximize, within a competitive framework, the benefits from the project available to Canada in general, and Newfoundland in particular. Contractors and sub-contractors will be required to adhere to the Guideline's philosophy and guiding principles. Husky Oil will work with prospective contractors in order to ensure the incorporation of the Company's Canada-Newfoundland Benefits Guidelines into final contract agreements.

2.5.3 Regional Offshore Capabilities

A survey of Eastern Canadian Offshore Fabrication Capabilities is attached to this document as Appendix B. For each Request for Proposal issued by Husky Oil for the White Rose project, requirements to identify regional contractors with offshore expertise will be outlined together with contact details. Prospective contractors will be encouraged to use this information to maximize the Newfoundland and Canadian content. They will also be encouraged to contact associations that promote local offshore products, including NOIA, the Offshore Technologies Association of Nova Scotia (OTANS) and the Association of Professional Engineers and Geoscientists of Newfoundland (APEGN). Contacts for these organizations will also be provided with major Requests for Proposals.

Contractors receiving Requests for Proposals will also be informed of the trade and infrastructure information that can be obtained from the provincial Department of Industry, Trade and Technology (DITT) through the "Success~Works" database. This is an Internet-accessible information source of Newfoundland and Labrador industrial and manufacturing companies.

2.5.4 Submissions Required from Prospective Contractors

Clear evidence of how prospective contractors will maximize Canadian-Newfoundland content within a competitive framework and how they propose to comply with the guidelines in respect to Canada-Newfoundland benefits will be a requirement of each bid. In their proposals, prospective contractors will be required to state specifically how the Guidelines will be addressed and implemented. The information to be provided by major contractors will be assessed in a competitive context and will, as appropriate, include the following:

- levels of participation of Newfoundland residents and firms involved in engineering, procurement, construction, commissioning, installation and operations and decommissioning phases;
- a description of project-related technology transfer initiatives, as well as the strategy and methods proposed to achieve these;
- provisions to be made for employment of Newfoundland residents and Canadians, and for training opportunities to be provided in Newfoundland, including on the job training, formal courses, self-study and workshops;
- details of how Newfoundland/Canadian succession planning will be implemented to phase out foreign workers as the contract proceeds;
- provisions for research and development activities related to the project to be carried out in Newfoundland; and
- how existing "Centres of Excellence" established in Newfoundland will be considered in planning, training, and research and development initiatives.

3 POLICIES AND PROCEDURES

This chapter illustrates Husky Oil's commitment to the approach described in the previous chapter. The Company's commitment is reflected in its policies and procedures for planning and executing the White Rose oilfield development. These build on, or see the continued application of, policies which have been in effect since Husky Oil started work on the White Rose project, particularly with respect to training, employment equity, technology transfer, and research and development. These have been, and will continue to be, key factors in increasing the overall capability in the oil industry on the east coast of Canada - for long-term benefits.

3.1 White Rose's Canada-Newfoundland Benefits Commitments

The following summarizes Husky Oil's principal Canada-Newfoundland benefits commitments that are consistent with management systems and procedures for the White Rose project:

Key functions will be performed in Newfoundland and Labrador - Husky is committed to managing the White Rose project from St. John's. Management activities will include project management, engineering, operations management, procurement, geosciences and reservoir engineering, drilling operations, logistics and project communications.

Goods and services on "Best Value" Basis - Goods and services must be acquired on a "best value" basis. Local industry must be encouraged to strive to provide goods and services that will compete effectively in a global marketplace. Consistent with the criteria for competitiveness outlined in the *Atlantic Accord Acts*, "best value" is defined as a blend of total cost, quality, technical suitability, delivery and continuity of supply and service; and, total cost is composed of initial purchase price plus operating and maintenance cost.

Canada-Newfoundland benefits will be a factor in procurement - Husky Oil will establish procurement policies and procedures consistent with the requirements of the *Acts* and the C-NOPB. These policies and procedures, without limiting the scope of the *Acts,* will include provisions to ensure that:

- The requirements for goods and services are communicated, in a timely fashion, to Canadian and, in particular, Newfoundland and Labrador firms, and to appropriate departments of the federal and provincial governments.
- The bid packaging, technical specifications, bidding procedures, and bid follow-up provide Newfoundland and Labrador, and other Canadian, firms and individuals with a full and fair opportunity to provide goods and services.
- Where bids are essentially equal on a "best value" basis, first choice will be given to goods and services provided from Newfoundland and Labrador. In all bidding processes, the level and quality of Newfoundland benefits, as well as technical and commercial considerations, shall be selection factors in awarding development contracts.
- Newfoundland and Labrador participation in joint bids is identified – the Proponents will require bidders to fully disclose information relevant to Newfoundland and Labrador benefits content, including:
  - the nature of the arrangements among the participants in the bid, including the respective shares of equity in the consortium;
  - the share and nature of the work to be carried out by each of the participants in the bid;
  - the nature of arrangements for the transfer of technology.

Supplier identification – Husky Oil will provide early identification of opportunities for the supply of goods and services required for the project, work with governments and industry organizations to jointly identify potential Newfoundland and Labrador suppliers of such required goods and services, and, on request, provide feedback to unsuccessful suppliers, as appropriate. Husky Oil will also:

- ensure that the names and locations of procurement personnel are communicated;
- require procurement personnel to be familiar with the capacities and capabilities of Newfoundland and Labrador and other Canadian suppliers;
- facilitate the inclusion of technically qualified and financially sound Newfoundland and Labrador, and other Canadian, suppliers on appropriate bid lists; and
- provide the C-NOPB with an indication of upcoming contracts, pre-qualification lists, final bid lists and notification of intent to award major contracts prior to their issuance.

Supplier development - Husky Oil will work with governments and industry organizations to improve local supply capability by providing information about the project requirements and specifications in a timely manner. The Company will also:

- encourage the formation of appropriate business arrangements involving Newfoundland and other Canadian firms that would enhance the ability of domestic firms to compete for project work; and
- evaluate the quality and reliability of appropriate new products from suppliers whose products warrant this opportunity.

Newfoundland and Labrador and Canadian infrastructure use to be encouraged – Qualified offshore fabrication and construction yards in Newfoundland and Canada will be provided a full and fair opportunity to bid, such that:

- The Company will undertake to cause, when competitive under international bidding on a best value basis, the fabrication, assembly and outfitting services associated with the topsides facilities of the FPF, the subsea facilities, the mooring system and the production risers to be performed in Canada.
- Where Newfoundland fabrication/assembly/outfitting facilities exist and are qualified to be capable of undertaking development activity, the Company will require contractors to bid the work using a Newfoundland location in addition to bidding other locations of normal preference.

Project Management and Engineering - The Company will require project management and system engineering work for the FPF and associated systems, subsea equipment, well construction and production operations, to take place in Newfoundland.

Employment and Training - The Company will give individuals resident in the province first consideration for training and employment opportunities with the development, and:

- The Company will provide a human resources plan outlining participation by Newfoundland engineers, geoscientists and other technical and non-technical disciplines, along with an appropriate succession plan to maximize participation of Newfoundland residents and Canadians.
- It is planned for the White Rose production vessel, support vessels and tankers to be Canadian-registered and crewed, consistent with the employment provisions of the *Atlantic Accord Implementation Acts.*

Contractors and subcontractors will adhere to benefits philosophy – Contractors play a large role in the procurement of goods and services.

- To ensure the benefits objectives and commitments are achieved in all areas, Husky Oil requires all contractors and subcontractors to comply with the benefits principles, objectives and commitments.
- To ensure that the concept of full and fair opportunity is extended to all potential suppliers, Husky Oil requires its contractors and subcontractors to provide full and fair opportunity to Canadian, including Newfoundland and Labrador, manufacturers, consultants, contractors and service companies to participate on a competitive basis in the supply of goods and services to the development.

Technology Transfer, Research and Development – Technology transfer and Research and Development are important components of the Canada-Newfoundland Benefits Plan. Husky Oil supports and encourages initiatives in these areas and, in association with its major contractors, will be developing strategies for achieving its objectives in these areas. Specific initiatives are discussed in Sections 3.3 and 3.4.

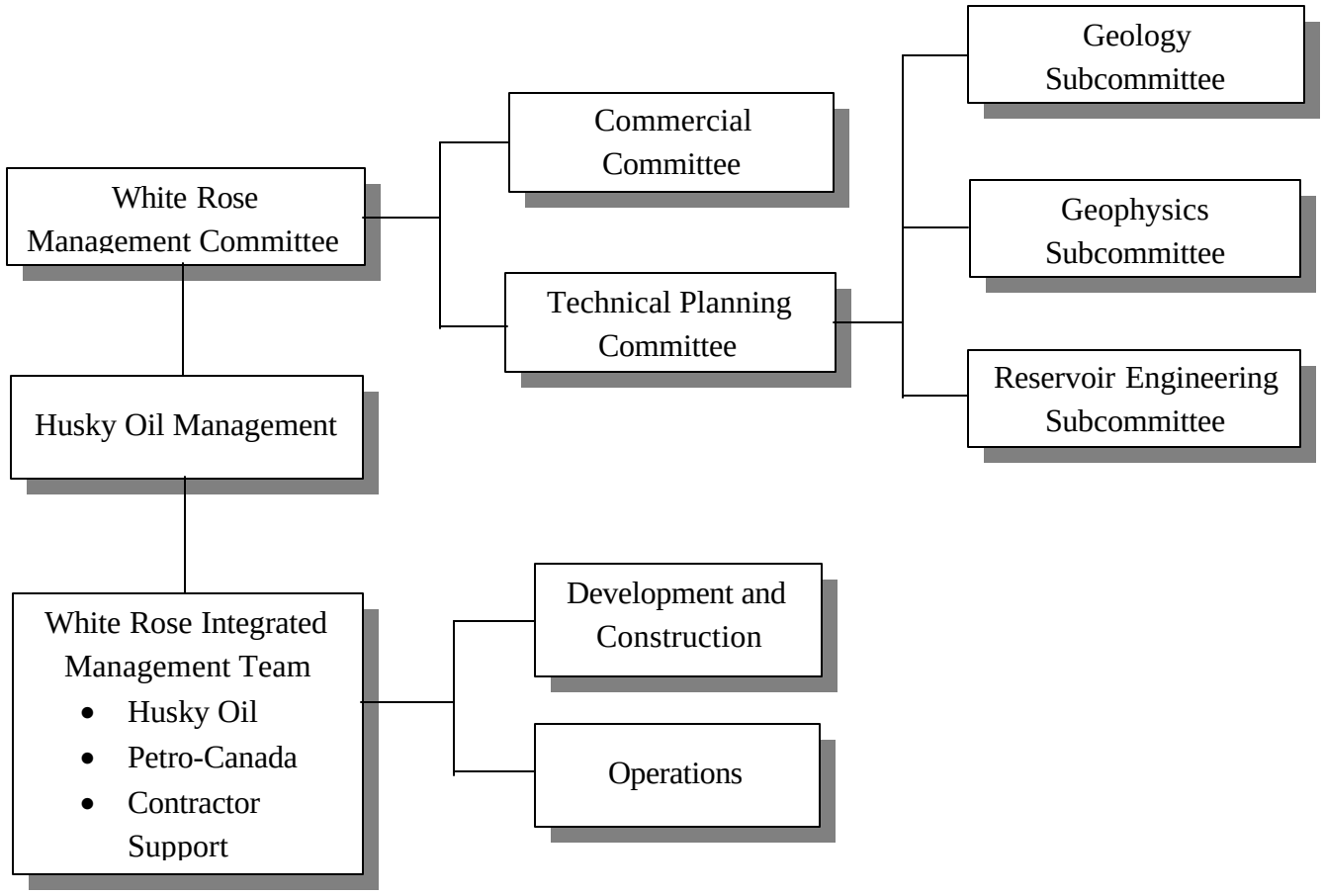
3.2 Project Management

Husky Oil has identified the East Coast as a core business area for the company. The Husky Oil project management team, located in Newfoundland and Labrador, has responsibility for development plan execution and ensuring that all operations are conducted safely, in an environmentally responsible manner, and in accordance with all corporate and regulatory policies.

Husky Oil, as operator, has assembled an integrated management team comprising Husky and Petro-Canada personnel, as well as some contractor personnel. This integrated management team reports, through Husky Oil, to a top level Management Committee of project owners established to provide for the orderly planning and supervision of all project activities (Figure 3.2-1). The Technical Planning Committee and the Commercial Committee support this committee in all its endeavours.

The Technical Planning Committee reports to the Management Committee on issues relating to field evaluation, development and operations, including items concerning business, technical, and health safety and environment. The Commercial Committee also reports to the Management Committee, and is responsible for reviewing and providing expert input into the negotiation and execution of major contracts, commercial agreements and owner agreements. This committee will establish a common economic evaluation system for implementation on the project.

Figure 3.2-1 Project Team Structure



Each White Rose co-venturer has the right to appoint one member and one alternate member to any Committee or Subcommittee. The chairperson for each committee or subcommittee is a Husky Oil appointee based on the Company's responsibility as Operator.

The integrated management team will eventually evolve into a "life-of-field" group as the Project proceeds into the production stage. Part of this evolution will see managers and personnel with specific exploration, delineation and development expertise move on to additional projects (at their various life stages), expanding the local resource pool in project management, procurement, geosciences and reservoir engineering, drilling operations, logistics and project communication. This process will help realize the continuity demanded by a successful oil and gas industry.

To ensure technical competencies are in place for all aspects of the project, required specialized expertise will be contracted to augment the existing Husky Oil staff on an as-needed basis. The task of assembling an integrated management team for the White Rose development, incorporating managers and personnel from within the Husky Oil organization, from project co-venturer Petro-Canada, and from contracted resources, is now well underway.

The following section outlines the general requirements for the project administration on White Rose. Husky Oil and Petro-Canada will continue to identify staffing requirements and ensure the development of the necessary skills. This provides local continuity and increases the ability to apply the lessons learned from Terra Nova. In addition, recruitment from the local community will be an ongoing process to maximize the benefits of the White Rose development to Newfoundland and Labrador and other Canadian residents.

3.2.1 Technical Project Management

Assembling a local competence to handle the White Rose Project is critical for its success. Activities will include the following:

- The General Manager will oversee the construction planning and execution of the Project. This position will lead the integrated project team through the front-end engineering, contractor/partner selection, project sanction and construction phases. The responsibilities of this position include:
  - designing and delivering a complete production facility and transportation systems for offshore production, including special purpose shuttle tankers, on time and on budget,
  - coordinating development planning for additional projects in the White Rose region in order to optimize the area's resource potential,
  - integrating Husky Oil's established development and operations team with the contractor's project management teams, and
  - ensuring project compliance with Husky Oil's project engineering guidelines, administration procedures, and health, safety and environmental policies.

- Managing a core team of highly experienced specialists for the FPF contractor selection process and then combining them with contractor staff for the execution phase. During the contractor selection phase, senior, experienced personnel will be required to lead the engineering process. After the FPF contract award, the design and fabrication will be conducted by contractor staff with a defined reporting requirement that Husky Oil will review and supervise.

- Organizing staffing resources into three teams: an FPF bid and evaluation team, subsea front end engineering and design (FEED)/bid team and a Project Services support team. It is critical that open communication is maintained between all participants in the project.

- Establishing clear and well-defined tasks for the development team to carry the project through to first oil. This team will include technical specialists, project controls staff and contractor representatives upon award of major contracts for the FPF, the subsea package, and the glory hole excavation.

3.2.2 Benefits Coordination

A benefits team will be responsible for the overall coordination of Canada and Newfoundland benefits among all White Rose project client and contractor groups. As a minimum, this team will initially be comprised of the benefits coordinator, procurement staff, major contractor representatives, and appropriate project staff to advise on specific project components. To ensure that benefits issues receive management attention, senior management will be involved in the ongoing activities of the team. Over the life of the project the team will evolve to suit the requirements of the Project.

The Benefits team will be responsible for developing internal communications and information procedures, as well as for developing compliance monitoring and reporting standards. Members of the team will provide liaison on benefits issues with the supply community, the C-NOPB, other applicable regulators, and key benefits personnel with contractors. The team will also be responsible for the development and implementation of the information systems that support industrial benefits activities.

3.2.3 Key Functions Performed in Newfoundland

Husky Oil opened its East Coast Regional Office in St. John's in November 1997. This office has the responsibility for managing all operational aspects of Husky Oil's programs on the Grand Banks. As was noted in the 1999 Benefits Plan submission to C-NOPB (Husky Oil 2000), the project management personnel based in this office have decision-making authority for all operations, including procurement. Consistent with this, Husky Oil's east coast bid committee held all its 1999 meetings, undertaking procurement evaluations and related decisions, in the St. John's office.

Husky Oil has committed to managing the White Rose project from St. John's.

All program decision-making authority consistent with normal corporate business practices will take place in this office. Having decision-making and key management functions in the local office will assist in focusing on local and regional benefits issues, increase understanding of local capabilities and increase sensitivity to local concerns. Activities at this office will include project management, engineering, operations management, procurement, geosciences and reservoir engineering, drilling operations, logistics and project communications. A significant number of personnel at this office, including senior managers, are residents of the province, and this is indicative both of Husky Oil's commitment and of a maturing process occurring in the province's oil industry.

3.2.4 Contracting Strategies

The White Rose oilfield development project is confronted with some key challenges that must be effectively addressed if a successful field development is to be achieved. These challenges include a complex reservoir, technical and operational considerations and a harsh operating environment.

Responses to these challenges will require innovative and cost-effective solutions that enhance the project's long-term economic viability.

In consultation and briefing sessions held with the supply community, it was made evident to Husky Oil that contracting strategies must be clearly communicated to potential Newfoundland and Canadian manufacturers, vendors and suppliers in a timely fashion. This will provide the greatest opportunity for companies and individuals to ascertain ways and means in which their product or service can be used on the project. The following sections provide a description of the contracting approach.

3.2.4.1 Floating Production Facility

Experienced contractors with proven track records of successfully managing and operating similar FPF projects, from design through to production operations, are able to provide the necessary construction and operational expertise and technical support required. It is possible that, by leveraging the contractor's experience and corporate resources, an aggressive project schedule may be pursued, with a potential reduction in both the commercial and technical risks.

One viable contracting strategy is to appoint a contracting company which provides an FPF under a charter party arrangement that includes all operating and maintenance services throughout field life. Using this strategy, the selection of the contractor best qualified to provide the depth of support will be absolutely crucial to the ultimate success of the White Rose oilfield development.

Several contractors have approached Husky and expressed their interest in participating in the White Rose project. In order to obtain the commercial information needed to sanction the project and facilitate achievement of the project schedule, a competitive bid process for an FPF provider is being conducted. Award of any contract will be contingent upon the regulatory approval and project sanction process.

Issuing a Request for Proposals to interested contractors is the starting point in the evaluation process. Proposals from contractors will be evaluated and will result in the determination of a short list of potential contractors. Furthermore, these proposals will provide a clear indication of the efficacy and feasibility of this contracting strategy. Discussions will then be conducted with the short-listed contractors to determine if this strategy is viable and, ultimately, identify the successful contractor.

The contracting strategy is based on leveraging the value of a contractor's established FPF operating skills as the key agent throughout the life cycle of an FPF project. The focus on operations is the most critical criterion. This strategy is supported internationally by the increasing number of contracts signed with FPF contractors with a scope of work that covers full project cycle skills.

The FPF contract will be developed through negotiations that will address technical, commercial and Canada-Newfoundland benefits aspects. In addition, a value engineering exercise will be carried out

that challenges the existing basis for design, targeted at capturing cost reductions and performance enhancements through improvements in design while ensuring health, safety and environmental integrity. These negotiations will commence upon the initial review of the proposals. The FPF Request for Proposal has therefore been issued with the following objectives:

- establishing the basis and criteria for comparing different proposals and contracting strategies;
- defining the scope of work for the FPF contractor, outlining what the required deliverables are for the evaluation and assessing the contractors proposed solutions;
- setting the stage for a value engineering process designed to capture improvements in both cost and performance over proposed target levels and existing benchmarks;
- identifying a recommended contractor, and creating a supporting document that includes a well defined technical definition of the FPF facility, a commercial agreement with terms and conditions agreed to by both parties, a competitiveness assessment, and an industry benchmark analysis; and
- defining specific Canada/Newfoundland benefits for the construction, development and production activities.

Alternatives to the previously described preferred FPF contractor strategy will also be considered. The decision on proceeding with an engineer, procure, install and construct (EPIC) fixed price contract Request for Proposal will be reviewed following the initial review of the short-listed contractors' submissions.

In addition, to capture potential synergy between the FPF and the transportation of oil to market, the FPF bidders are being asked to provide a proposal that demonstrates advantages to combine the FPF and a transportation solution. The FPF contractors who express an interest in providing such a solution will be included in the shuttle tanker tender process to capture any value in the synergy of combining the two vessels. However, the shuttle tanker will be dealt with as separate tender.

3.2.4.2 Subsea

The subsea contract package will consist of all equipment from and including the subsea christmas tree to the riser connection on the FPF. The strategy for this component of the project will be to contract for the complete subsea system in a single contract, which will encompass everything from detailed design to installation, commissioning interfacing and the option of providing ongoing operational support. The first phase of the contract, FEED, will be conducted several months prior to sanction. The installation of subsea equipment for initial development drilling will occur in the months following sanction, with installation of flowlines and risers completed the following year.

The glory hole excavation will be dealt with as a stand-alone contract and bid competitively. In conducting a contractor capacity assessment, it was confirmed that current international projects have restricted the availability of required equipment for this work. Several of the potential contractors have

indicated an ability and willingness to work with Husky Oil to develop a solution, however, they have all indicated the need to plan as much lead time as is possible. To address this situation, a Request for Proposals was issued to qualified companies in June, 2000. The intention is to initiate discussion and to define the process that will generate a cost-effective solution at the lowest risk. Contract award will be scheduled following an in-depth assessment of the contractor's proposals and again will be dependent on the outcome of the regulatory review and project sanction processes.

In line with the objectives for the project, the preferred solution is to conclude agreements with experienced lead contractors who will manage the supply of all subsea and glory hole services required, preferably under a lump sum "turnkey" contract, or depending on commercial and interface considerations, multiple contracts.

3.2.5 Management/Design Culture

The correct approach to pursuing design (Nervi n.d.):

> "*…is impossible unless one obeys and is guided by these premises of general character: a) A clear idea of the goal to be reached, and an understanding of the methods available to reach it. b) An absolute independence of mind with respect to solutions that have already been proposed for similar problems...*"

This statement is representative of Husky Oil's management and design culture in its approach to Canada-Newfoundland Benefits. The goals to be reached, as documented previously in Chapter 2, have been embraced by the White Rose project team. The key to realizing these goals is through the challenge and commitment of individuals to hold up each and every working exercise, regardless of routine, and subject it to a scrutiny that asks:

- Can this service or product be provided in Newfoundland or Canada?
- If not, what are the impediments?
- Are there commercially viable ways to overcome the impediments for White Rose?
- If not, are there commercially viable ways to overcome the impediments for the future (and thereby contribute to the long-term sustainability of the local industry)?

Project management and engineering has become ever more complex in recent years. The traditional roles that dealt with basic issues of project engineering and the various disciplines such as structural, piping, mechanical, electrical and instrumentation now work alongside specialist disciplines of quality assurance, information technology, planning and scheduling, safety, health and environment, and continuous improvement. Engineering now has the additional responsibility to ensure that the work conforms to an array of project commitments prescribed outside the respective disciplines.

In an environment of ensuring project guidelines and budgets are met, these considerations are often considered to be secondary. As a result, there is sometimes a tendency to "get on with the engineering or purchasing effort" and attempt to meet the prescriptive requirements of quality assurance, health/ safety/environment or continuous improvement, on an as-required basis. This can lead to designing "in silos", whereby individual engineering efforts are progressed independent of overall project goals. This can have long-term negative ramifications, and in this atmosphere local benefits opportunities can also be diminished.

Husky Oil is determined, therefore, to elevate Canada-Newfoundland Benefits to a distinct position in White Rose corporate culture. This will see the Company challenging individuals at every level to consider how any preconceptions might compromise local benefits and opportunities.

Canada-Newfoundland benefits discussions in internal workshops will be initiated to encourage Husky Oil employees and contractors in engineering and procurement to pursue methodologies that will encourage regional participation. Facilitated independently, these sessions will:

- explore specific engineering and procurement routines;
- question decision-making processes and examine the effects of actions taken;
- consider how the demands of design, procurement, research and development, testing, and training can be changed or adjusted to enhance Canada-Newfoundland benefits potential;
- record specific avenues to be explored and set actions, responsibilities and time-lines;
- see the results of these investigations and deliberations reported to the C-NOPB;
- act on the concepts considered to have potential; and
- ensure follow-up mechanisms are in place.

3.2.6 Management Systems and Procedures

Husky Oil's Canada-Newfoundland Benefits Guidelines will continue to serve as the Company's guiding principle for offshore development in Newfoundland and Labrador.

Management is committed, and staff is mandated, to maintain an open approach to deliver full and fair opportunity for Newfoundland and Canadian companies to participate in the White Rose Project plan.

Procedures pertaining to promoting and monitoring Canada-Newfoundland benefits have been developed and will be documented in Requests for Proposals issued by Husky Oil to prospective contractors. These are presented as attachments within the Request for Proposal and include a copy of the Canada-Newfoundland Benefits Guidelines, a list of contacts for local offshore associations and training establishments and the reporting requirements under the Canada-Newfoundland Benefits Monitoring Programme. The latter document presents and illustrates:

- the methodology whereby Canadian and Newfoundland content is determined;
- specific expectations by way of Research and Development, Supplier Development, Technology Transfer, Training and Compliance; and
- reporting requirements.

Request for Proposals note the following: "Failure to provide the information requested will result in the assumption that contractor's commitment to Canada-Newfoundland benefits in that area is zero and the bid will be evaluated accordingly."

3.2.7 Calculation of Canadian and Newfoundland Content

Requests for Proposals issued by Husky Oil to prospective contractors also include, and will continue to include, definitions and examples of content calculation (Appendix C). The examples include detailed explanations of the methodology to calculate labour, materials, equipment, services, transportation charges and overhead charges with respect to Canadian, and in particular, Newfoundland and Labrador content.

3.3 Supplier Development

Husky Oil has made a concerted effort to inform the local supply community of its plans for the project program as soon as they are confirmed, or as aspects of the development become known. The Company has disseminated engineering information throughout the community and has been proactive in updating the information. It has also cooperated extensively with contractors expressing an interest in the project.

Husky Oil has also provided details, as they evolve or become available, to vendor and supplier representatives in the province by conducting information sessions and workshops for NOIA and the St. John's Board of Trade. NOIA has expressed its support of Husky Oil's activities to date involving the supplier community (NOIA 2000):

> *"Husky Oil has conducted its pre-development activity in a professional and open manner, carrying out a series of public consultation sessions throughout the province. Husky Oil has frequently provided information openly to NOIA and has kept the community advised through press releases and presentations as it prepares the various elements of its development plan. NOIA applauds Husky Oil's transparent and communicative approach.*
>
> *As part of Husky Oil's openness, the Company has commonly stated its corporate beliefs and its guiding principles for White Rose South and other projects. These principles reflect confidence in the skills and industrial base of our province and country. Husky*

Oil's "Canada - Newfoundland Benefits Philosophy" supports technology transfer, recognizes Newfoundland and Labrador as a principal beneficiary of our offshore oil and gas resources, supports full and fair opportunity for local firms on a competitive basis, and provides first consideration to our province's supply and service companies for delivery of competitive goods and services.

Husky Oil has committed to requiring its contractors and subcontractors to adhere to these beliefs and principles. As evidence to this approach, Husky Oil has stated that key functions - including engineering and related procurement - will be conducted in Newfoundland. NOIA fully supports this approach, which is well-aligned with this Association's own position on local procurement and supplier development. It fully endorses and applauds Husky Oil's commitment, most recently demonstrated by conducting its White Rose Concept Selection Study, right here in Newfoundland. Such action is vital to our local supply and service firms' access to potential business opportunities and, therefore, to our growth."

3.3.1 Identification of Potential Canadian and Newfoundland Suppliers

Within the framework of Requests for Proposals issued by Husky Oil, prospective contractors are required to identify potential Canadian and Newfoundland suppliers of the required goods and services. Contractors are recommended to make every use of services provided by governments and industry organizations to achieve this end, and support and assistance is offered by Husky Oil in any such investigations by:

- providing information about program requirements and specifications as early as possible;
- encouraging the establishment of new suppliers in Newfoundland and Labrador where needed, and the formation of appropriate business arrangements involving Newfoundland and Labrador firms, with established offshore suppliers where such arrangements are economically viable and enhance the ability to compete for the work;
- encouraging local industry to provide goods and services that compete effectively in a global marketplace; and
- providing technical assistance and advice where necessary.

Once they are in place, the names and contact information for procurement personnel, as well as the details of procurement opportunities, will be made widely available to business community through media, print materials, and electronic means.

In all bidding processes, the level and quality of Canada-Newfoundland benefits, as well as technical and commercial considerations, are selection factors in Husky Oil's award of contracts. Also, in this context, where joint ventures or other alternative business arrangements exist and where such arrangements add value, it is Husky Oil's intention to award contracts to the local supplier and not to the international parent company.

3.3.2 Location of Contractor Engineering

In keeping with Husky Oil's Canada-Newfoundland benefits philosophy, major contractors' project management and systems engineering activities are to be undertaken in Newfoundland and Labrador whenever practical on a competitive basis.

3.3.3 Encouraging the use of Newfoundland and Labrador and Canadian Infrastructure

Husky Oil will ensure qualified Newfoundland and Labrador and offshore fabrication and construction yards are provided a full and fair opportunity to bid on work.

To this end, the Company has prepared descriptions of Newfoundland and regional Canadian fabrication facilities on the basis of responses to surveys and questionnaires circulated to known interested parties. This assessment is not considered exhaustive, but has been based on companies that have previously provided construction and fabrication services to the offshore industry. These descriptions are provided in Appendix B. Recent labour relations issues at existing Newfoundland fabrication yards are of significant concern to the proponents as such issues may impact the yards' international competitiveness and, potentially, the viability of effective participation in the White Rose project. A stable, equitable labour relations environment is a critical component to allow the project schedule and viability to be achieved and to reduce risks associated with a marginal economic project.

Throughout the project, and especially during the Project Optimization phase, major contractors will be encouraged to conduct a thorough assessment of the procedures, capabilities, equipment and personnel of local facilities.

3.3.4 Supplier Development Initiatives to Date

Husky Oil has already pursued a number of supplier development initiatives. For example, in 1999 Husky Oil (Husky Oil 2000):

- issued the Request for Proposals for DA preparation only to Newfoundland and Canadian-based companies, resulting in nine of a total of eleven components being awarded to Newfoundland firms. This example is consistent with Husky Oil's guiding principle that the sizing of work packages should be suited to the capability of local companies to respond;

- issued the Concept Screening bid only to Canadian-based companies, with a requirement that the work be done in Newfoundland;
- contracted Cougar Helicopters to develop and deliver to Husky Oil the Cougar Offshore Personnel System (COPS), thus expanding Cougar's expertise and providing it additional business opportunities in this area. This saw a phased payment of the development cost over the course of the initial two-well program;
- had glory hole engineering management undertaken locally;
- debriefed potential future supplies which were not yet in a position to bid Husky Oil's shore-base requirements for the initial delineation program so that they would be fully familiar with requirements and better able to bid work in future years; and
- carried out site visits with potential contractors to educate them to opportunities and requirements related to Husky Oil's program.

3.3.5 Technology Transfer

The transfer of technology is a critical aspect of Canada-Newfoundland benefits. Each international alliance and co-venture into which the local engineering and manufacturing community enters can be regarded as another building block in the construction of the provincial offshore industry. Under the 1991 Offshore Technology Transfer Fund (OTTF), an $11 million agreement between the Province of Newfoundland and the Hibernia consortium, technology transfer was facilitated to over 30 Newfoundland companies (DITT 1998). This fund (together with other federal/provincial funding arrangements such as the Offshore Development Fund) "was not simply intended to create direct employment and business benefits, and longer-term production revenues; it was seen as part of a strategy to further develop and diversify the provincial economy" (CRS 1995).

Many of the companies that have benefited from technology transfer through the construction and production phases of Hibernia and the construction phase of Terra Nova are regarded as experienced players in the Canadian offshore industry. It is Husky Oil's desire to build upon this expertise through the continued promotion of technology transfer within these companies and in the inception of new joint ventures.

In the execution of the White Rose oilfield development program, the company will:

- encourage the participation of Newfoundland residents and firms in the development;
- encourage the development of licensing agreements or other business arrangements between Canadian and international firms with Newfoundland and Labrador-based firms where such arrangements add value;
- identify development-specific training program opportunities for qualified Newfoundland residents; and
- require each potential White Rose contractor to detail initiatives that will promote technology transfer to Canadian and Newfoundland companies.

Husky Oil recognizes that it has a role to play in introducing and promoting high-tech, value-chain service providers to Newfoundland. For example, Husky Oil has maintained a close business relationship with several companies which service oil and gas exploration companies with leading-edge technology. Bringing along such specialist companies and introducing them to the east coast oil and gas industry can result in technology transfer to the region and, ultimately, increased employment opportunities to local individuals as these companies set up branch offices and business arrangements locally. Husky Oil's role in these efforts, together and in concert with those of government and the entire industry, will encourage a broadening of the engineering and technology base in the region. This is yet another step down the road towards a sustained offshore industry.

3.4 Employment and Training

3.4.1 Training Strategies

Husky Oil believes that that the greatest opportunity to increase Canada-Newfoundland benefits is associated with the entire life cycle of the White Rose project and, indeed, with the life cycle of the east coast oil and gas industry. To this end, sustainable industry must recognize that the ongoing development of local skills is essential.

Training requirements for offshore developments cover a broad spectrum from regulated, industry health and safety requirements to skilled trades upgrading, such as welding and pipefitting. With respect to regulatory requirements, as part of the project and human resources planning processes, Husky Oil and its contractors will identify the minimum training standards to staff all phases of the Project. Also as part of the human resources planning, Husky and its contractors will collaborate with government and training institutions to identify existing or anticipated skills gaps and shortages in the labour pool. Based on this gap analysis, Husky Oil will also provide technical advice to training institutions (public and/or private) in the development and/or revisions to trades training programs. Estimates of

expenditures associated with training will be developed in conjunction with contractors and will be available as these plans are completed.

In anticipation of the White Rose development and production stages, Husky Oil will commit to the following:

- the early proactive identification of human resource needs, and the considered analysis of needs that involve foreign hiring at the contractor and sub-contractor level (for example, during the commissioning phase);
- pre-start-up training for key offshore operations personnel that provides for hands-on experience in similar operating environments;
- bringing discipline-specific, offshore operations training expertise to the province;
- the use of existing training infrastructure in the province from classrooms to simulator facilities (process, well control, marine); and
- the use of established training "centres of excellence" established in Newfoundland and Labrador.

Contractors, and sub-contractors engaged by Husky Oil are, and will continue to be, required to provide training and learning opportunities relevant to their scope of work. Contact details of local organizations involved in training for the offshore industry are included with Requests for Proposals.

The quality and performance of contractor training will be subject to audit by Husky Oil during the contract term. Husky Oil will establish mechanisms for timely measurement of all training commitments in terms of the number of personnel involved and time expended, training objectives, success rates, and the impact upon local facilities used for such skills enhancement activities. This information will be documented for semi-annual reporting to C-NOPB and on the White Rose website.

3.4.2 Succession Planning

Succession planning refers primarily to the replacement, over time, of non-Canadians with qualified Newfoundland residents, and other Canadians. Succession planning must be based on a rational, systematic approach to human resources planning, which takes into consideration operational requirements, competency, safety, training and employee development.

It is recognized that long term benefits to the local community accrue through the planned transfer of expertise and knowledge to individuals from the community. Consistent with Husky Oil's vision for an emerging petroleum economy in Newfoundland and Labrador, Husky Oil will plan and seek opportunities for the integration of local personnel in all phases of the project life cycle.

Transfer of knowledge and expertise will be facilitated through a range of programs, including mentoring, work-term placements, job enrichment, job sharing initiatives and management development programs. Major contractors will be required to identify succession plans as part of their bid

submissions. Husky Oil will work with its major contractors on the development of these human resource plans, which will set out specific steps relating to the recruitment and advancement of Newfoundland residents and other Canadians, for a full spectrum of positions and capabilities associated with the project. Management capabilities, again at all phases of the project life cycle, will be a focus of attention. Where succession planning is not practical due to the short term nature of specific duties, monitoring will be used to identify and encourage technology transfer of skills to Newfoundland and other Canadian workers.

The succession plan will apply to Husky Oil, and all major contractors involved with the White Rose project, and will be directed in a manner that aims for sustained employment benefits in a long-term, local petroleum economy.

3.4.3 Employment and Training Initiatives to Date

Husky Oil's approach to education and training is reflected in its success thus far in employing Newfoundland residents and Canadians. For example, in 1999, Husky Oil and its major contractors employed 529 people on the project, of whom 498 (94 percent) were Canadian and 455 (86 percent) Newfoundland residents. This provided 2,218 work-months of employment to these individuals, of which 1,531 went to Newfoundland residents and 307 to other Canadians. These figures exceeded, in both absolute and relative term, commitments made in the 1999 Benefits Plan for the delineation drilling program.

This is, in part, a result of the Husky Oil commitment to giving first consideration to Newfoundland residents for any vacancies in its operations. During its 1999 drilling operations, Husky Oil, in conjunction with Schlumberger IPM, directly employed a total of 20 persons, 14 of whom are Newfoundland residents. The non-Newfoundland residents comprised five Canadians and one non-Canadian. It should also be noted that, as of June 2000, most of the Husky Oil St. John's management team are Newfoundland residents.

As part of its recruiting strategy, Sedco-Forex (Husky Oil's drilling contractor) also had a process designed to ensure first consideration for Newfoundland and Canadian workers. In 1999, Sedco-Forex advertised locally, regionally and nationally for qualified candidates to fill approximately 70 positions on the FPS *Bill Shoemaker*. The approximately 1,200 applications were initially screened to identify basic requirements, with Newfoundland residents then being evaluated first in filling the positions. This process has also been used in filling any subsequent vacancies. It should be noted that this process has been used with respect to all positions, regardless of level.

In 1999, direct training expenditures by Husky Oil, Schlumberger Oilfield Services and Schlumberger Sedco-Forex related to the White Rose program totalled $2,394,558. Husky Oil's direct training expenditures totalled $84,390, while those of Schlumberger Oilfield Services and Schlumberger Sedco-

Forex, related to the White Rose program, totalled an additional $94,568 and $2,215,600, respectively. Further to this, Husky Oil employed two Memorial University engineering cooperative students during each of the three work-terms over the course of 1999, one each in the St. John's and Calgary offices, thus providing a total of two person-years of work. Support for the Memorial University of Newfoundland cooperative program is continuing with three students (two engineering and one business) currently on work term in the St. John's office.

Husky Oil and Sedco-Forex also initiated a training program for two Newfoundland petroleum technology students who were assigned to Sedco to develop their knowledge and experience of drilling and sub-sea engineering. As well, Husky provided $10,000 in support of a Drilling Engineering Association course/workshop in horizontal drilling technology related to the White Rose project. Finally, the Petroleum Engineering Resource Centre at Memorial University, established with seed-funding of $20,000 from Husky Oil, is now operational, providing an important learning resource for Faculty of Engineering students.

3.4.4 Employment Equity

Section 45(4) of the *Acts* makes reference to affirmative action programs: "*The Board may require that any Canada-Newfoundland benefits plan include provisions to ensure that disadvantaged individuals or groups have access to training and employment opportunities and to enable such individuals or groups or corporations owned or cooperatives operated by them to participate in the supply of goods and services used in any proposed work or activity referred to in the benefits plan.*"

Husky Oil maintains a documented Workforce Diversity Policy that will be enforced throughout the White Rose project. White Rose contractors operating or hiring in Canada will be obligated to follow policies consistent with those of Husky Oil. The Company is committed to providing equal access to employment opportunities and taking steps to achieve employment equity.

The tenets of the policy are such that Husky Oil:

- is committed to building a work environment that is free of discrimination and harassment;
- will ensure its employment policies are implemented in a fair manner and are free of discrimination and barriers;
- is committed to the principle of fair representation of the designated target groups (women, aboriginals, visible minorities and people with disabilities) at all levels of the organization; and
- will take special measures to facilitate the full participation of under-represented designated groups at all levels of the organization.

This policy is designed to reflect Husky Oil's desire to create an environment that enables all employees to contribute to their full potential, thereby increasing business opportunity and competitive advantage, and providing employees with a positive and valued work environment. The Company's commitment

applies to all areas of employment practices, including recruitment, hiring, training, development, promotion, compensation, working conditions, disciplinary action, termination and the general work environment.

As an indication of its support for workforce diversity, in 1999 Husky Oil was presented with the Vision Award, the highest award offered by Human Resources Development Canada (HRDC) to honour companies governed by the *Employment Equity Act*.

Based on the success of a pilot program begun in 1996, Husky Oil ratified a corporate and business unit initiative designed to assist individuals in attaining the minimum job requirements for employment in non-traditional job areas. The Bridging Program, as it is known, has been one of Husky Oil's most successful initiatives, and from its original target audience of women, it has been reviewed and expanded in recent years to include people from other designated groups. The program seeks to remove traditional barriers to employment diversity emanating from socialization, myths and lack of awareness through an ongoing program of workshops, training positions, mentoring and communication. After women complete the bridging process, they are encouraged to apply for operation positions, competing with other qualified individuals on an equal footing.

The Bridging Program is specifically aimed at field locations in the oil and gas industry, where a distinct lack of diversity is apparent in the employment base. The White Rose project is considered by Husky Oil to be an ideal opportunity to broaden to its Bridging Program support base.

As promoted within this project, the program will have the following objectives:

- to provide development and career advancement opportunities for women and other designated groups by creating cross-learning;
- to enhance the employment diversity record in offshore Canada;
- to improve the retention of women and other designated groups on the project;
- to create an unbiased system of training and development; and
- to develop a pool of women, and employees in other designated groups, in operating positions, to act as mentors to others in the same group.

Overcoming the obstacles and employment barriers to women and visible minorities is an essential aspect of workforce diversity. Husky Oil is committed to liaise with community-based organizations such as the Women in Resource Development Committee (WRDC) and participate in programs which focus on increasing women's participation in the oil and gas industry and in related construction and fabrication opportunities. The Company endorses ongoing dialogue that promotes improved understanding of the legitimate concerns of women who will be affected by the development of oil and gas reserves, and considers it necessary and worthwhile to both the industry and the community. This

would serve to assist Husky Oil and all its contractors in developing proactive strategies for implementation of its equity policy, particularly in the areas of employment and training.

The means for monitoring these strategies are also critical, so that success can be measured against time and resources expended.

To this end, Husky Oil plans to collect and maintain gender-based and other related employment data, particularly as they relate to the roles and positions of women. The Company further proposes that a yearly event be structured wherein these statistics are reviewed by stakeholders and Husky Oil's major contractors. The actions and commitments resulting from this forum will be formally documented and tracked on an ongoing basis.

Husky Oil recognizes that all employees make a valuable contribution to the success of the Company by working effectively and productively. Each individual has the right to work in an environment that is receptive to diversity and free of harassment. Through initiatives such as the Bridging Program, Husky Oil will also continue to seek to employ qualified individuals from disadvantaged groups within the Province of Newfoundland, and remove the barriers and impediments to employment facing these individuals.

3.5 Research and Development

Research and Development (R&D) is an important component of the Canada-Newfoundland Benefits Plan for White Rose. Husky Oil supports and encourages technically worthy R&D activities and programs that have application to its work, and has a history of promoting such programs for technology development in Canada's on-shore and frontier regions.

Husky Oil will continue to participate with other industry representatives in forums designed to identify R&D priorities and projects which will advance the province's offshore industry as a whole, and fit with the overall objectives of a sustainable, commercial petroleum economy. At the same time, Husky Oil will also undertake internal consultation processes to identify R&D priorities, which are tangentially related to project activities. Research workshops, conducted annually, and led by the benefits team and technical personnel will result in the production of a multi-year research priority listing and budget.

3.5.1 Research and Development Topics for Consideration

A number of topics are already under consideration by the Company, including:

- the technical aspects and potential benefits of alternative ice protection strategies;
- an engineered basis for FPSO disconnect times;
- ice management studies;
- transportation of compressed natural gas;
- specialized core analysis;
- mooring and riser analysis;
- subsea technology;
- life-cycle value analysis of drillings cutting management;
- produced water and drill cuttings disposal options;
- biophysical and environmental aspects of offshore gas development;
- seismic imaging;
- structural and tectonic characterization of the Grand Banks;
- 3D and 4D seismic technologies; and
- water bottom seismic cable acquisition technology.

Contractors will be obliged to identify facilities and institutions in Newfoundland proposed for any R&D efforts deemed necessary for completion of their scopes of work.

3.5.2 Research and Development Initiatives to Date

Husky Oil is a sponsor of the Centre for Cold Ocean Resources Engineering (C-CORE), located in St. John's. Together with Petro-Canada and other oil industry companies, Husky Oil was involved with the engagement of C-CORE to undertake research applicable to FPF designs prior to the Terra Nova Development, which included ice-vessel interaction studies, iceberg impact assessment, and the development of engineering guidelines for the design of pipelines for an iceberg scour environment. Husky Oil is also a founding member of the Memorial University Seismic Imaging Consortium (MUSIC).

Husky Oil has already contributed to R&D in Newfoundland through its participation in industry and government committees and workshops and through direct expenditures. As a member of the Canadian Association of Petroleum Producers (CAPP), Husky Oil also contributes to CAPP study initiatives. R&D expenditures committed during 1999 and 2000 comprised:

- $70,000 towards the integrated ice management initiative at the C-CORE at Memorial University;
- $50,000 as its 50 percent share of the C-CORE "Subsea Well Iceberg Prediction Study". Petro-Canada, Husky Oil's White Rose co-venturer, spent the same;
- $9,000 per year in support of MUSIC in the Department of Earth Sciences;
- $18,000 in cooperation with Memorial University for a seabird monitoring programme during operations; and
- $15,000 as a contribution to a Newfoundland and Labrador Environmental Industry Association (NEIA) study of the effects on seabirds of shipping traffic oil pollution on Newfoundland's southwest coast.

Additional "in kind" research-related initiatives included the donation of over $100,000 of seismic data to the Geological Society of Canada (GSC) Atlantic research library, donations of seismic information to Memorial University for research work, funding postdoctoral research at Memorial University of Newfoundland (MUN), and ongoing collaborative work with MUN facility, staff and graduate students.

3.6 Procurement and Contracting

As part of the procurement process, White Rose contractors must communicate requirements for equipment, goods and services in a timely fashion to qualified suppliers in Newfoundland and Labrador, and Canada. In this respect, major contractors are required to demonstrate that they have made sufficient efforts to identify potential Canadian suppliers.

Major contractors will be required to:

- have Internet websites dedicated to providing the following procurement information
  - dates for submission of bids, placement of the order and delivery,
  - contact information for the buyer responsible for the package,
  - outline technical data, and
  - appropriately sized bid packages to afford Newfoundland and Canadian suppliers full and fair opportunity to bid on a competitive basis; and/or
- post this information on, or have it appropriately linked to, the White Rose website to facilitate identification of project requirements by local suppliers.

The technical specifications and bid procedures used by White Rose contractors are to provide companies and individuals in Newfoundland and Labrador, and Canada with a full and fair opportunity to supply goods and services. This is to ensure that artificial barriers to domestic participation in the project are not created. Specifications, therefore, must be consistent with products or components produced in Canada if such a component is available domestically and is technically acceptable.

Debriefing procedures will be part of the procurement activity, with the objective of constructively informing Canadian and Newfoundland manufacturers and suppliers of specific shortfalls when their bids are unsuccessful. This will assist local industry to:

- further increase competitiveness;
- become more aware of the international marketplace;
- design and provide products in accordance with specific offshore technical demands;
- identify gaps or deficiencies in their product lines; and
- adjust their project management or quality assurance/quality control policies to meet the high specifications required by offshore developments.

3.6.1 Procurement Initiatives to Date

Husky Oil has already undertaken a number of procurement initiatives in such areas as bidding and bid evaluation. In order to facilitate local companies receiving full and fair access to work, Requests for Proposals and calls for Expressions of Interest have been provided to NOIA and other avenues and hence, the supplier community. Some expressions of interest have also been advertised in newspapers, including the St. John's *Telegram*.

Husky Oil has, where appropriate, sized bid requests to facilitate easy access by local suppliers with specific expertise. For example, during 1999 and early 2000, Husky Oil (Husky Oil 2000):

- bid weather forecasting, environmental monitoring and ice management requirements either combined or separately, at the bidder's choice;
- bid waste management separately from its supply base contract;
- separated out its supply boat and rig towing requirement;
- allowed separate bids for each of two required supply boats;
- split its communications services requirements into computers/data and telephones components; and
- provided for bidding on separate components of its medical, environmental services and Development Application requirements.

Further to its commitment to include Canada-Newfoundland benefits as a factor in bid evaluations on a "best value" basis, a Canada-Newfoundland Benefits Questionnaire was used in all Requests for Proposals. As an example, the Canada-Newfoundland benefits weighting component for bid evaluations during the evaluation of individual contracts in the 1999 and 2000 drilling programs ranged from 5 percent (on highly-specialized tasks such as directional drilling services) to 35 percent (for the concept evaluation study) of the total bid evaluation score.

3.7 Monitoring and Reporting

3.7.1 Role of Benefits Policy in Award of Contracts and Sub-Contracts

As they will play a major role in the procurement of goods and services, contractors and subcontractors will be required to adhere to the Canada-Newfoundland Benefits Guidelines.

To ensure that the concept of full and fair opportunity is extended to Canadian, including Newfoundland and Labrador, manufacturers, consultants, sub-contractors and service companies, Husky Oil requires that its contractors also comply with the benefits principles, objectives and commitments set out in the Guidelines.

The critical contract evaluation sequence for Husky Oil is enshrined in the principles of the *Atlantic Accord*:

- after Newfoundland and Canada have been given *full and fair opportunity,*
- Newfoundland will be afforded *first consideration* where competitive.

The monitoring of contracting activities is an essential component of ensuring that a total perspective is maintained vis-à-vis project procurement goals. This will assist Husky Oil and the industry as a whole in identifying future capabilities as companies expand and diversify.

For major procurement activities, Husky Oil will provide the C-NOPB with an indication of upcoming contracts, pre-qualification lists, final bid lists, and notification of the intent to award contracts prior to their issuance.

For major contracts being awarded outside Newfoundland or Canada, Husky Oil will report to C-NOPB the rationale for such a decision, particularly if a shortage in capability or capacity has been integral in the decision. This will assist all levels of government and industry in information gathering to improve local offshore development capabilities to further the goal of a sustainable petroleum economy.

All major sub-contracts are, and will be, subject to approval by Husky Oil. As part of this approval process, contractors are required to demonstrate that their sub-contractors also meet the requirements of the Canada-Newfoundland Benefits Guidelines, and that the levels of benefits to be gained from the sub-contract meet the level identified by the contractor during the bidding phase. Prior to the award of any sub-contract, contractors are required to ensure that their sub-contractor complete the Canada–Newfoundland Benefits Monitoring questionnaire issued as an attachment to each Request for Proposals.

3.7.2 Establishing Canada-Newfoundland Benefits

Husky Oil has put in place the means to establish Canadian and Newfoundland content before contract and sub-contract award. This is achieved through a series of forms that must be completed by each contractor for bid submission. The calculation of Canadian and Newfoundland content is based upon a value-added concept and is a representation of the value of the various components of contractor's tender expressed as a percentage of contractor's total cost. These tables are described in Appendix C.

3.7.3 Contractor's Commitment to Canada-Newfoundland Benefits

Each Request for Proposals issued by Husky Oil also requires the bidder to comply, to a reasonable degree, with the commitments and undertakings in the Summary of White Rose's Canada-Newfoundland Benefits Commitments as presented in Section 3.1. Contractors are also required to state that they will comply with all statutory requirements with respect to benefits, and that they will comply with the benefits commitments made in their specific proposal concerning research and development, supplier development, technology transfer and training. Canada-Newfoundland Benefits considerations are therefore integrated into the competitive bidding process, increasing the chance for successful achievement of the Company's goals. Specifically, major contractors will be required to describe the following:

- Research and Development - Canadian and Newfoundland R&D to be conducted or supported for the particular scope of work.
- Supplier Development - Detailed policies and initiatives to promote the development of Canadian and Newfoundland suppliers.
- Technology Transfer - Detailed policies and initiatives to promote technology transfer to the Canadian and Newfoundland participants within the contractor's company, partnership or co-venture and/or to proposed Canadian and Newfoundland contractors, including
  - a description of the intended technology transfer and the strategy and methods which will be employed to achieve this transfer; particularly, the arrangements for the transfer of technology from non-Canadian participants to Newfoundland and Canadian-led, owned or controlled participants, and
  - the nature of the arrangements amongst the participants, including the respective shares of equity and the long-term intentions for their business entity; and
  - the share and nature of the work to be carried out by each of the participants, and Newfoundland suppliers.
- Succession Planning – Arrangements to replace non-Canadian workers with Canadian and, specifically, Newfoundland residents.
- Training - Detailed policies and initiatives for the development and training of Canadian and Newfoundland employees, including on-the-job training and formal training programs to be carried out in Newfoundland.

3.7.4 Benefits Performance

Husky Oil and the White Rose contractors and sub-contractors are required, and will continue to be required, to actively manage the procurement of goods and services to ensure that benefits objectives and commitments are achieved.

Husky Oil will monitor its performance and that of the contractors and sub-contractors via audits. To assist this process, major contractors are required to provide Husky Oil with a detailed monthly report showing the levels of Canadian and Newfoundland benefits achieved, and their future goals.

Employment activities, technology transfer, education and training, and research and development initiatives are seen as being of particular importance. Reporting to C-NOPB on the measured impact of these benefits will occur on a semi-annual basis. All contracts above a pre-determined threshold value will be evaluated.

An employment benefits audit will be performed at the end of each project phase or major milestone to determine if Newfoundland and Labrador employment benefits goals are being realized, and to develop strategies to ensure continuous improvement in this area, both for future project phases and for the progress of the industry as a whole.

Benefits considerations and commitments are currently included in contracts for all suppliers. Husky Oil is receptive to independent, external audits on its Canada-Newfoundland benefits performance by the C-NOPB on an as-required basis.

3.7.5 Success~Works

Success~Works is an Internet-accessible database of Newfoundland and Labrador industrial and manufacturing companies. It has been developed and is maintained by the provincial DITT. Husky Oil will typically require the use of this database by all its major White Rose contractors and subcontractors for procurement activities, particularly as they relate to the development of vendor lists. The data available from Success~Works include:

- information on each company registered in the system, including details of all management and personnel resident in the province/Canada/abroad, including their position and full-time or part-time status;
- company ownership information, in terms of Newfoundland, Canadian and foreign content (by percent); and
- details on collaboration with other companies and subsidiary information.

The database can potentially be queried on bidding and award of contracts related to the White Rose development. Monitoring bidding efforts can potentially provide a range of information, including the success of any given company (leading to encouragement, inquiry and assistance as required) or the success of Newfoundland companies in general (based on contract values) as compared to the total value of White Rose contracts let.

Given that the applicable product and service of each company is also registered, procurement success of specific contracts could be monitored, leading to the critical exercise of product/service gap identification (that is, supplier capability).

Husky Oil will also explore the potential use of Success~Works as a monitoring tool, and will continue discussions on this emerging database technology with DITT.

3.7.6 White Rose Project Web Page

An Internet website has been established by Husky Oil for the White Rose project (www.huskywhiterose.com) and will continue to be an important tool in providing early information to manufacturers, vendors and suppliers on upcoming contractor and sub-contractor procurement packages.

In addition to information about the project in general, milestones, schedule, press releases, procurement and employment opportunities, and information on contacting the White Rose project, Canada-Newfoundland Benefits will be a featured headline on the website, and this section will be regularly updated. Benefits reporting, both on the website and in public information material, will include statistical information and updates on the following:

- Labour statistics - these would be presented in terms of numbers of persons employed and in cumulative person-hours.
- Contract awards – the status of contracts (goods and services) awarded in the province, and information on contracts awarded abroad.
- Economic contributions - the effects of the project (in dollars) on the local economy will be presented in terms of direct and indirect contributions.

3.7.7 The White Rose Public Forum

Husky Oil will implement a forum series to encourage the discussion of issues related to the project with the public and with special interest groups.

An open-house or round-table workshop format will be held twice each year to afford attendees a full opportunity to receive input respecting the project and industry and express their concerns and opinions. White Rose Forum topics might include:

- employment prospects and projections;
- procurement opportunities;
- offshore R&D - projects and facilities;
- oil development and the fishery;
- environmental performance; and
- offshore safety.

4 DEVELOPMENT AND PRODUCTION SCENARIOS

Possible Canadian and Newfoundland benefits are predicated on the specifics of the construction and operations processes. Following a thorough evaluation of potential development concepts, two economically and technically feasible production alternatives have been identified and further examined in the context of potential Canada-Newfoundland Benefits. Both of these are FPFs: a steel semi-submersible solution and a ship-shaped FPSO solution. This chapter describes the construction and operations processes with respect to each of these solutions on a comparative basis. The work components that have been examined include:

- hull fabrication (with turret fabrication and assembly taken as a separate component for the FPSO option);
- topsides module fabrication and assembly;
- on-shore/at-shore hook-up;
- offshore installation;
- production drilling;
- subsea fabrication and installation; and
- operations/production.

Major sub-contract packages for the construction and fabrication work associated with the White Rose development will be tendered and awarded either by Husky Oil or White Rose major contractors. Depending on the procurement philosophy, these packages may also include various arrangements for leasing of major equipment required, for instance, for subsea installation and production drilling, or for long-term operations and maintenance. The above categories of work will create both labour and infrastructure demands regardless of which production option is selected.

Within this and succeeding sections, references will be made to the National Occupation Classification, or NOC. This is a systematic taxonomy of occupations in the Canadian labour market intended for use in compiling, analyzing and communicating information about occupations based on a four digit construct. First published in 1993, it replaces the previous occupation classification system known as the Canadian Classification and Dictionary of Occupations, or CCDO, and better reflects many of the occupational changes that have occurred in recent decades. As an example specific to this study, offshore petroleum exploration and production activities are, as a result of the NOC, well defined in terms of category and skill level.

4.1 Steel Semi-Submersible with Detached Storage

4.1.1 Description

A steel semi-submersible production unit consists of a large deck connected to submerged steel pontoons by widely-separated water surface-piercing steel columns. The pontoons provide buoyancy to support platform weight, the columns provide floating stability and structural strength, and the deck supports the production, process, accommodation and marine facilities.

The steel semi-submersible is a stable platform with low vertical motions that allow for production operations in rough seas and extreme environments. Station keeping systems for semi-submersibles are considered to be robust and highly reliable. Having evolved over 35 years based on mobile offshore drilling units (MODUs), this production option represents a hull based on mature, proven technology.

A semi-submersible for White Rose, equivalent to a fourth-generation design, would have a length of approximately 100 m, a width of approximately 70 m and a process capacity of approximately 15,000 m^3 per day. Deck load capacity would be approximately 10,000 t. Although moored for normal production, the semi-submersible would be able to disconnect its moorings in an emergency. Propulsion systems allow the platform to move off location, and also assist in transportation.

Detached oil storage in the form of a storage tanker is an integral part of a semi-submersible production option. The storage tanker would be moored approximately 2 km away from the semi-submersible platform and would have weather-vaning capability, allowing it to respond to wind, wave and tidal conditions.

4.1.2 Hull Fabrication

The main construction activities include hull fabrication and outfitting. The hull is commonly built in sub-assembled components. Steel material delivered to the shipyard is normally shot blasted and painted with primer before cutting and forming. Panels, webs, girders and other small components are usually prefabricated before being included in the sub-assembled structures. Mechanical components and other outfitting materials are delivered to the shipyard in sequence to allow extensive pre-outfitting during the fabrication of sub-assemblies. The completed subassembly structures, which may weigh up to 500 t each, are delivered to the hull assembly area.

The lower hull sections (pontoons and lower column sections) may be fabricated in a single dry dock. Alternatively, they can be built in two dry docks, and then launched and mated at a wet dock. The columns are completed at the wet dock after mating.

4.2 Floating Production, Storage and Offloading Facility

4.2.1 Description

FPSOs are also referred to as monohull or “ship-shaped” offshore production platform solutions. They range in length from 200 to 300 m and are typically in the order of 45 m in width. Storage capacities vary from 50,000 to 159,000 m^3 (up to a million barrels). Designed to stay on location in severe weather conditions, these vessels feature a turret that allows the vessel to “weathervane” without restriction. A heading control system ensures optimum orientation to wind and waves, while providing the best operating environment for the process system and crew. Based on the example of Terra Nova that has a lightship weight of 42,000 t, an FPSO is comprised of 76 percent steel (32,000 t) and 26 percent pipe, cable and miscellaneous equipment (10,000 t) (Terra Nova Project 2000).

An FPSO hull features multiple segregated oil storage tanks. Double-sided or double-hulled structures and wing tanks provide segregated water ballast within the cargo area. The vessel is moored to the seabed with mooring lines distributed out from the turret. The turret is arranged with tubes for guiding flexible production and injection risers and service umbilicals. Production fluids pass through the flexible risers via the turret manifolds into a multi-path swivel. These risers also provide the means for gas and water injection used to maintain required pressure levels within the reservoir. From the swivel, the fluids enter the process system, and following separation, the crude is transferred to the oil storage tanks. The type of FPSO turret typically considered for harsh environments (in this case the Grand Banks) allows the vessel to disconnect from its risers and moorings in the event of an emergency. Offloading crude from an FPSO is generally direct to shuttle tankers off the stern of the vessel by means of a flexible offloading hose.

4.2.2 Hull Fabrication

The hull and topsides of an FPSO are typically built in separate facilities. In accordance with modern shipbuilding methods, the hull will be constructed in "blocks" that have a specific size and tonnage limit. These blocks are fabricated separately and welded into position after they have been prepared and painted. Prefabrication of the blocks starts with the cutting and marking of steel plates using optically or numerically controlled thermal cutting tools.

The cut and marked plates are palletized and transported to a subassembly shop for manufacturing of webs, ribs and floor, which in turn are fitted into panels. Panels are flat structural pieces consisting of one or more plates joined together and stiffened by profiles. The blocks are built up from the panels.

The lower turret (the cylindrical structure that allows the vessel to weathervane) is the first piece of equipment to enter the dry dock, and the blocks are added in sequence around it.

When completed, the hull can receive the topsides modules, skid-mounted facilities and other deck-mounted equipment. The lifting, hook-up and commissioning of the topsides can be done at the hull fabrication yard or, alternatively, the FPSO, outfitted with all marine systems, can make its way under its own or vessel assisted power, to a separate hook-up site. Prior to sailing, the FPSO will be required to undergo sea-trials and inclination testing as prescribed by maritime authorities.

4.3 Floating Production, Storage and Offloading Facility Turret

Internal turret mooring systems allow FPSOs to remain on location permanently, even in very harsh environmental conditions. Disconnectable internal mooring systems are used where offshore fields may be subjected to harsh conditions and allow the vessel to be disconnected from its moorings to avoid severe weather and sea conditions, and icebergs. The FPSO turret is a highly specialized fabrication limited to only a handful of companies world-wide.

The turret provides the interface between the subsea facilities and the topsides. All fluids and information communication systems pass through the turret, including well fluids, injection water and gas, and the electrical connections and controls for the subsea systems. For example, the turret designed for the Terra Nova Development consists of the following components:

- Upper Turret: supports the manifold deck for the production, test, gas injection and water injection manifolds, and the swivel deck, where the multi-path swivel is located along with pigging facilities and various system cabinets and packages. This portion of the turret assembly was installed at the hook-up site.
- Lower Turret: carries the riser piping from the disconnect buoy to the upper turret and also contains the bearing system to transfer mooring loads and allow weathervaning. It features mooring winches used to secure the disconnect buoy to the lower turret. This portion of the turret was installed at the FPSO fabrication yard, and is integral to the vessel.
- Riser Buoy: the riser buoy (also known as riser connector, spider buoy or disconnect buoy) is integral to the disconnect/reconnect operation of the FPSO. The vessel mooring chains and production risers are permanently connected to the buoy. The riser buoy was installed on the offshore field prior to locating the FPSO. Retrieval of the buoy secures the vessel into its permanent position.

The Terra Nova turret in its entirety weighs approximately 4,000 t and has an overall height of 70 m. The disconnect portion of the turret (the spider buoy) has a 20-m diameter (Terra Nova Project 2000). It is anticipated that a White Rose FPSO would require a smaller turret.

4.4 Topsides Fabrication and Assembly

4.4.1 Semi-Submersible Topsides

The topsides for a steel semi-submersible would weigh approximately 10,000 t and consist of several assemblies, including skid-mounted packages and modules weighing up to 2,000 t. A structural deck of approximately 5,000 t is required to support the topsides. Depending upon schedule constraints, topsides production and living quarters facilities may be constructed at one or more sites or at the same site as the hull structure.

If the topsides are built at a different site than the hull structure, they and the deck structure are usually constructed as a complete unit and then mated to the hull. To accomplish this, the hull is relocated to a suitable nearshore location, moored in sheltered waters, and ballasted down to a mating draught. The entire topsides and deck structure are towed to the nearshore location on a barge small enough to allow the structure to be floated between the columns of the hull. The hull is then deballasted with the deck structure positioned over the columns. Landing devices take the structure's load off the barge. Final alignment, mating preparation and welding precede final deballasting and removal of the barge.

If the topsides facilities are built at the same site as the hull structure, the hull, deck, and topsides components can be assembled in one shipyard with a large drydock facility.

During construction of the production facility, special emphasis must be placed on:

- maintaining weight and dimensional control during construction;
- scheduling construction activities to ensure coordinated delivery of subassemblies to the erection site; and
- quality control of welding procedures and materials assembly operations to ensure structural integrity and dimensional accuracy.

Topside production equipment is integrated into the deck as much as possible. This minimizes the need to package the equipment into separate structural modules on top of the deck. Accordingly, most of the outfitting is completed during the construction of the sub-assembled components.

A semi-submersible presents additional options for module fabrication. The living quarters together with the helideck are usually fabricated and installed as separate modules for these production options. Additionally, cranes and boat stations can also be regarded as "modules", and therefore bid and fabricated separately from the remainder of the platform.

4.4.2 Floating Production, Storage and Offloading Facility Topsides

Topsides facilities for an FPSO are generally fabricated in what are commonly called modules, skids, or pre-assembled units (PAUs). They range considerably in size and weight, and perform a wide variety of functions including:

- separation/compression;
- water injection;
- produced water/glycol;
- power generation;
- utility; and
- flare system.

Modules for FPSOs are typically limited to 20-m lengths, based on the vessel's beam of 45 m.

With either production scenario, modules are unlikely to exceed 2,000 t. A range of much smaller PAUs is possible, however, this will also lead to greater cost, and a more complex hook-up phase, imposing specific demands on schedule.

Preliminary engineering indicates that the typical maximum topsides weight for the White Rose FPSO is in the order of 8000 t.

With an FPSO, the accommodations and helideck are regarded as integral to marine operations and, therefore, are built as part of the hull in preparation for sea trials and inclination testing prior to certification by maritime regulatory authorities.

The accommodations for a floating platform, whether FPSO or semi-submersible, will be sized for an operations and marine crew of between 45 and 50 persons, depending on operating philosophy.

4.5 On-shore/At-shore Hook-up and Commissioning

This term describes the installation, testing and commissioning of topsides modules at a designated hook-up site. The site will have to provide sufficient water depth at quayside to permit the vessel to be moored. The hook-up site will also require substantial industrial infrastructure to support the physical and technical work associated with this stage of construction.

A semi-submersible hull would likely be towed to the hook-up site. An FPSO would typically reach the site under its own power after passing sea trials at its point of origin.

The hook-up and commissioning process requires a well-coordinated plan that involves substantial input from the hook-up technical team, the hull fabricator, module fabricators and equipment vendors and suppliers.

4.6 Offshore Installation

In a generic context, offshore installation of a production vessel begins with setting out and embedding the anchors or piles at the installation site using anchor handling vessels and additional support vessels. Depending upon seabed conditions at the installation site, a remote-operated vehicle (ROV) is employed to accurately place drag anchors on the bottom, or a crane or construction/lay vessel is deployed to install steel anchor piles or suction anchors.

Survey vessels perform pre-installation surveys to confirm that installation areas and mooring line laydown corridors are free of debris and suitable for installation. Subsea positioning is then performed using hydro-acoustical and global positioning systems.

Both semi-submersible and FPSO solutions employ chain mooring legs. Typically, 9 to 12 legs are employed. The moorings are designed to hold the vessel on site unaided by thrusters. When the moorings have been installed, the production vessel locates to the installation site, while stand-by vessels patrol surface buoys. Anchor handling vessels are employed to retrieve the temporary pendant buoys and recover the mooring pendants. ROVs are employed to secure wire leads (messenger lines) to the chain moorings, and the chains are then recovered through mooring hawser pipes located in the vertical legs of the semi-submersible, or in the case of an FPSO, the turret.

4.7 Development Drilling and Workover/Intervention

With both the semi-submersible and FPSO production scenarios, drilling, well completion and workovers will be performed using a semi-submersible MODU.

Workover, as defined by C-NOPB regulations in respect of a development well, means any operation that requires the removal of the christmas tree. This term generally refers to maintenance and re-drilling of existing wells based on an evolving picture of well and reservoir characteristics and performance derived from information gathering conducted through the production drilling and operations stages. Typical well intervention activities include those initiated to increase productivity, reduce water production, repair mechanical damage, etc.

A typical MODU crew can be characterized by the skills and demands shown in Table 4.7-1. This crewing example forms the basis for labour projections provided in Section 6.7.

Table 4.7-1 MODU Crew

Persons on Board (POB) Drilling Rig (x 2 for total on-shore and offshore shift) – Total 75					
Position	**NOC**	**Qty.**	**Position**	**NOC**	**Qty.**
Senior Toolpusher	9232	1	Deck Hands	7433	4
Toolpusher	8222	1	Food Preparation	6641	12
Driller	8232	2	Cleaners / Stewards	6661	4
Assistant Driller	8232	2	Medic	3234	1
Lead Roustabout	8615	2	Mud Logging	8232	6
Roustabout	8615	4	Well Drilling	8232	3
Floormen	8615	6	Directional Drilling	8232	2
Storemen	8615	1	Crane Operator	7371	1
Lead Maintenance	2232	1	Radio Operator	1475	2
Mechanical Technician	2232	3	Ballast Control Operator	7434	2
Electrical Technician	7242	2	Engineer	2100	1
Instrumentation Technician	2243	2	Geologist	2100	1
Deck Officers	2273	2	Operator's Representative	2100	1
Marine Crew	7434	4	Forecasters	2114	2

4.8 Subsea Fabrication and Installation

Subsea facilities typically consist of:

- wellheads and christmas trees arranged in clusters or subsea templates;
- production/injection/control manifolds; and,
- flowlines connected to flexible risers which terminate on-board the production platform (at the loading porch on a semi-submersible or at the riser buoy for an FPSO). White Rose concept engineering studies suggest that up to 18 to 25 wells may be required, just less than half of them injection wells.

The subsea wellhead supports critical well casings and the production tubing that extends from the reservoir producing zones to the mudline, and serves as a conduit for all well fluids. A subsea component known as a christmas tree (due to the characteristic grouping of valves that control the flow of well fluids) is connected to each wellhead. Besides controlling the fluid flow, the christmas tree permits access to the well bore for workover operations. The wellheads and christmas trees are protected from ice scouring by locating them in glory holes or excavations, and are installed from a semi-submersible unit or vessel with the assistance of ROVs.

The individual wellheads and christmas trees may either be arranged in clusters or are integrated into structures called templates. The latter are seabed support structures that feature well slots to accommodate the subsea wellheads and trees or tie-in of satellite wells. A manifold, containing the piping arrangement for guiding and controlling the flow of fluid from the subsea wells to the flowlines, may either be installed as a separate component or integrated on each template. These also distribute injection fluids to the appropriate injection wells. Based on the experience of Terra Nova, the templates to be fabricated for White Rose may weigh up to 20 t.

Various methodologies have been studied for protecting wellheads and subsea equipment from iceberg scouring. Caisson wellheads were developed in the 1980s, whereby the wellhead and the lower master valves were located below the scour depth, offering a high level of safety in areas where drilled wells were subject to ocean floor hazards. Given the limited amount of space inside the caisson, special slimline tree valves with vertically-oriented actuators were developed. Another method is the glory hole, where a conventional subsea tree is placed in a deep excavation dredged in the sea floor.

The Terra Nova development opted to install the wellheads and subsea trees using templates. The entire assembly is installed in 10-m deep glory holes, including the manifold assembly. Another option would be to install the wellheads and trees (only) in cased glory holes or in subsea excavations without templates, and manifold on the seafloor immediately adjacent. This method reduces offshore excavation to a minimum and may simplify workovers on individual wells. Jumper flowlines are used to connect manifolds to the subsea trees.

Typically, templates, manifolds, flowlines and risers are installed from construction lay/diving support vessels. Flexible flowlines are installed between the production vessel and the drill centres, and deliver well fluids from the satellite templates or manifolds. These flowlines can be trenched into the seabed or insulated and laid simultaneously from the multi-purpose construction vessel. Risers, flanged to the flowlines at the seabed and secured with concrete riser bases (each weighing from 100 to 150 t), are suspended from the vessel in catenary or “lazy wave” configurations to accommodate vertical and lateral environmentally-induced vessel motions. The risers are flexible pipes that carry the oil to the production vessel and transport injection and control fluids to the subsea wells. Risers are made up of layers of different composition and thickness, each serving a specific function, and typically range in diameter from 125 to 300 mm in diameter.

Divers and/or ROVs will be employed for hook-up of the various components.

A portion of the subsea work occurs on-shore, after fabrication but prior to installation. This is designed to avert the huge cost of testing and rework offshore. Factory acceptance and systems integration testing involves the assembly and testing of production trees, template and manifold elements, the pull-in heads of the actual flowlines and umbilicals, and the subsea control system used to monitor well performance and control remote actuation of the subsea valves. Due to the sensitivity of the control system to

contamination, facilities for integration testing are often indoors, where a high level of cleanliness can be assured. The equipment providing hydraulic fluid for testing must also meet specific criteria demands, and the labour force must be highly trained and familiar with procedures pertaining to this aspect of the work.

4.9 Production and Operations

4.9.1 Vessel Operations

The total crew required to maintain and operate a floating production facility ranges world-wide from 35 to 60 persons, depending upon owner operating strategies and the field environment and individual facility requirements. A recent study by CAPP put the crew estimate for an FPSO operating on the Grand Banks at approximately 50 persons.

A typical crew would be characterized by the skills and demands shown in Table 4.9-1. This crewing example forms the basis for labour projections provided in Section 6.9.

Table 4.9-1 Vessel Crew

Persons on Board (POB) **Production Vessel - Total POB = 46 (x 2 for total on-shore and offshore shift = 92 workers)**					
Position	**NOC**	**Qty.**	**Position**	**NOC**	**Qty.**
Offshore Installation Manager OIM	9232	1	Mechanical Technicians	2232	1
Deck Officers	2273	1	Pipefitters	7252	1
Able Bodied Seamen	7433	2	Welders	7265	1
Shift Supervisors	8222	2	Radio Operators	1475	2
Control Room Personnel	7434	2	Weather Forecasters	2114	2
Operators	9232	4	Crane operator	7371	1
Process Operators	9232	1	Logistics Technicians	1215	1
General Maintenance Supervisor	7216	1	Maintenance Crew	7433	2
Instrumentation Supervisor	2243	1	Food Service	6641	6
Mechanical Supervisor	8222	4	Cleaners / Stewards	6661	2
Instrumentation Technicians	2243	3	Laundry	6661	1
Electrical Technicians	7242	3	Medic	3234	1

4.9.2 Oil Transport

As explained previously, a semi-submersible production facility would require a separate storage tanker but an FPSO has inherent storage by virtue of its hull. Either production option, however, will require the services of shuttle tankers to transport the oil to market or transshipment facilities. These would be in the 80,000 to 120,000 dead weight tonnage (DWT) range, probably with dynamic positioning capability. They would meet the appropriate class requirements for operations in ice-prone waters.

4.9.3 Marine Support Facilities

During pre-production drilling, and throughout the life of the FPF, life safety operations assistance and re-supply will require standby and supply vessel support. The supply vessels will provide everything to the field, from drill casings and fluids to food and equipment, and will be equipped with anchor handling capabilities. These will be leased on the world market rather than purpose-built specifically for White Rose operations. The functions of the support vessels include:

- stand-by duty;
- ice management;
- oil spill response;
- cargo and consumable re-supply;
- anchor handling;
- tug assistance;
- towing; and
- environmental monitoring.

Helicopter support for the field (drilling and operations crew changes) will be contracted. Primary and back-up helicopter service will be required on a 24-hour a day basis, with provision for passenger handling, flight following services and first response capability.

Supply base facilities will also be contracted to support both drilling and production. An industrial park site will be required with warehouse facilities of up to 4,000 m^2 for drilling services and in the vicinity of 7,500 m^2 for exterior storage and handling of drill casings. Additional space will be required for mud and cement storage, laydown yard, various bunker and explosives storage, bulking material and receiving. Husky Oil will examine the potential for synergies with existing operations for the provision of these services.

5 PROCUREMENT REQUIREMENTS

This chapter describes the goods and services requirements for the White Rose project, including fabrication and construction services, bulk materials, equipment, and support services. The ability of various companies in Newfoundland and Labrador and elsewhere in Canada to deliver these goods and services is also considered.

5.1 General Fabrication Demands

As a prerequisite to specific infrastructure demands, the fabrication and/or construction of various components for either an FPSO or semi-submersible production scenario requires certain basic skill sets and procedures. These include:

- an adequately sized workforce skilled in offshore fabrication and construction methodologies;
- a formal quality control and quality assurance program endorsed by both the yard management and the workforce, and complying with regulatory requirements and industry standards;
- an established engineering group capable of producing working drawings for yard use;
- an established management group with successful experience in offshore fabrication and construction; and
- a formalized project management and control system, including cost, schedule, weight and materials control procedures.

Many Newfoundland and Canadian companies struggled with these demands throughout the 1990s, but as industries supporting the offshore were established, or evolved from shipbuilding, an increasing realization that these skills and systems were not optional took hold. The result has been a widespread acceptance of technology transfer and joint venturing, a large demand for quality assurance/quality control consulting, a general understanding of the value of management systems and tools, and an appreciation for the expectations of operators.

There is currently a growing expectation that Newfoundland and Canadian companies can meet, or can be prompted and assisted to meet, a growing number of these fabrication demands, with competitiveness the key consideration.

5.2 Hull Fabrication

5.2.1 Semi-Submersible

A shipyard for the construction of a steel semi-submersible FPF would require:

- a lifting capacity in the order of 1,000 t;
- large automated, steel-fabricating equipment capable of handling, cutting, shaping and welding large plate widths, steel profiles and piping;
- generous storage areas for steel stock and plate with overhead cranes for handling;
- covered warehousing facilities, which can be dedicated to the project, for receiving and storing vessel equipment, components and subassemblies;
- a large hull construction area, such as a dry dock with a usable width of 100 m, or two parallel graving docks that would permit construction of a pontoon in each dock, with the deck and bracing members spanning the intervening partition between the docks;
- indoor fabrication areas that would allow the manufacture (including surface preparation and painting) of large, skid-mounted packages and pre-outfitted sections of the structure; and
- a dock or outfitting berth on the quayside that would allow access for large equipment packages and installation cranes.

The nearshore site for mating the hull and topsides facilities would be selected using the following criteria:

- adequate water depth for deck mating;
- natural shelter from wind, waves and ice; and
- adequate water depth for towing directly to the offshore field.

A semi-submersible production platform has never been built in Canada, although, Halifax, Saint John and (the now defunct) MIL Davie shipyards can all claim experience in semi-submersible drilling rig fabrication. The Halifax Shipyard constructed six drilling semi-submersibles, three of which were of the Sedco 700 design, and one drillship in the 1970s. Saint John Shipyard constructed the semi-submersible Bowdrill 3 for drilling operation on the Grand Banks in the early/mid 1980s, and MIL Davie has built more than a dozen jack-up drilling rigs. MIL also rebuilt/modified the Spirit of Columbus rig for production services. In building the Bowdrill 3, the Saint John Shipyard built the pontoons in separate sections in drydock, the moved them out for joining and completion in a temporarily dammed area adjacent to the drydock.

A similar unconventional approach could be used to fabricate a production semi-submersible of a type that would be required for White Rose. However, such yard modifications and temporary measures may render these shipyards non-competitive with foreign ones that specialize in vessel fabrication for offshore production. None of the eastern Canadian yards mentioned offer a drydock that could accommodate semi-submersible width or the parallel graving docks that would permit construction of a pontoon in each dock. Physical constraints and resultant additional cost if modifications or temporary measures were undertaken make it unlikely that a production semi-submersible hull could be competitively built in Canada.

It should also be noted that drilling semi-submersibles and production semi-submersibles differ significantly. This is an important point, essential to risk management of schedule demands. Production semi-submersibles have considerably higher payloads affecting pontoon buoyancy and overall stability. Process facilities not only add to increased weight and demand for deck area, but also result in far more extensive requirements for accommodations, fire and gas detection and suppression systems, and utility systems. Class societies (Lloyd's Register, Det Norske Veritas, American Bureau of Shipping, etc.) also treat vessels with service lives longer than 2.5 years as permanent facilities to be designed for environmental conditions with return periods between 50 and 100 years.

Overall, a production semi-submersible is a considerably greater undertaking than an exploration rig, consuming 300 percent more engineering hours and 70, 60 and 50 percent more labour for steel fabrication/erection, mechanical/piping, and electrical/accommodation, respectively (D'Souza et al. 1993).

5.2.2 Floating Production, Storage and Offloading Facility

An FPSO can be built in many modern shipyards that offer a drydock large enough to accommodate the full length, beam and draught of the vessel. Adequate lifting capacity is required for the hull to be efficiently built in large blocks and "super blocks".

The construction yard also requires a quay where the vessel can be safely moored. If the quay is not capable of supporting mobile crawler cranes used in vessel completion, barge mounted cranes can be used to lift sub-assemblies and components.

The fabrication of an FPSO hull using conventional construction techniques cannot be performed in Canada because no Canadian shipyard offers drydock facilities suitable to accommodate a vessel of the required length and beam. There are numerous shipyards in Europe and Asia that can accommodate the fabrication of an FPSO, many with past experience with two or more such vessels. A shipyard survey for the fabrication of a steel FPSO hull performed for Husky Oil indicated that there are currently seven shipyards world-wide with FPSO experience that have sufficient capacity to deliver an FPSO hull for White Rose on schedule (KSLO 2000).

Such fabrication would have only a marginal effect (if any) on the Newfoundland economy. However, certain items of systems and/or equipment may be procured nationally due to requirements of system commonality or servicing. For example, various mechanical and electrical components manufactured in Europe or Asia could not be properly serviced or maintained by local companies. Furthermore, certain systems and components will need to be the same throughout the vessel and the topsides, and will be purchased on a project-wide basis.

Construction of an FPSO will also typically require that all marine and accommodations systems/ facilities are installed at the fabrication yard where the hull is constructed and launched. These are necessary to perform sea-trials and inclination testing (a prerequisite for marine certification) and for transportation to the designated hook-up site. An FPSO will travel to the site under its own power or with vessel assistance.

5.3 Topsides Fabrication

Topsides module fabrication in Newfoundland has historically been limited to only a few major players. Facilities currently operated at Bull Arm by PCL Industrial Constructors, and those owned and operated by Friede Goldman Halter in Marystown and Cow Head, have specific capabilities relevant to this type of offshore fabrication work. For White Rose, co-ventures and other alternative business arrangements between these companies may positively impact throughput capacity of local fabricators.

For the Terra Nova Development, the water injection module (approximately 1,000 t) and the produced water module (approximately 1,400 t), as well as the flare tower (approximately 550 t), the power generation skid (approximately 1,300 t) and miscellaneous deck assemblies have been, or are being fabricated and/or assembled at the Bull Arm site (Terra Nova Project 2000). Previous evaluations projected an annual production throughput at Bull Arm for Terra Nova topsides fabrication of approximately 3,000 t based on relatively complex modules. PCL have bettered this with a production of 4,800 t the first 18 months, and although the PCL modules contain a significant portion of basic steel fabrication, it is generally accepted that based on the infrastructure at Bull Arm, further improvement on throughput capacity is possible

A key consideration for the achievement of the project schedule and overall viability, is the presence of a stable and equitable labour relations environment. Recent labour relations issues at Newfoundland fabrication sites have raised concerns as these issues may impact competitiveness in an international framework.

In eastern Canada, there are also a number of fabrication yards with capabilities for offshore module fabrication. These include Saint John Shipbuilding, Halifax Shipyards, MM Industra in Dartmouth, and E. S. Fox in Port Robinson (Ontario) (see Appendix B).

By involving a number of Newfoundland and Canadian fabricators, most, if not all, topsides modules required for process and production could be fabricated domestically. This possibility will, however, be subject to the ability of these companies to bid competitively on the international market. Contractors bidding for the work may also wish to limit the number of venues for management cost effectiveness and scheduling reasons.

The living quarters, control rooms, helideck and boat stations for a semi-submersible could also be fabricated domestically. The Hibernia helideck and boat stations were designed in St. John's and fabricated in Bull Arm, while the Hibernia living quarters was designed in St. John's. The Sable Offshore Energy Project's Thebaud and Venture living quarters were designed in St. John's and Halifax and fabricated by a joint venture of the Nova Scotia fabrication and maintenance contracting firm (Fabco) and a Dutch engineering and project management company (CKT) in Dartmouth (SOEP 1999).

5.4 Floating Production, Storage and Offloading Facility Turret

The fabrication experience and equipment required for turret construction is limited on the world market. Few facilities can competitively undertake this work, and many prudent operators would be unwilling to risk entering into a contract for turret construction with an inexperienced company.

Fabrication of the lower turret is very demanding in terms of equipment requirements and dimensional tolerances. Because this section of the turret presents the bearing surface around which the FPSO rotates, the most limiting facilities demand will be for equipment that can roll-form steel plate sections, 75 to 150 mm in thickness, to exacting radii. Most fabrication shops and yards that could undertake the rigorous quality control procedures for lower turret fabrication would still have to subcontract steel rolling to the limited number of large industrial companies that offer this capability. Transportation costs would then play a major role in overall fabrication costs.

The disconnect buoy portion of the turret assembly would normally be built at the same location as the lower section due to the critical nature of mating the two components. Tests would be performed for exact interconnection before the disconnect portion is transported and installed at the field, and the lower turret sent to the FPSO fabrication site for incorporation into the hull.

The upper turret, though complex, could potentially be fabricated in Canada, and, quite possibly, Newfoundland, again, predicated on the competitiveness of local industry on the international market. Steel rolling is not a limitation (plate thicknesses do not compare to those of the lower turret) and mating with the lower turret is not as critical. As an example, the facilities now offered at sites such NEWDOCK, Bull Arm and Friede Goldman Newfoundland, in terms of machining, and pipe and hydraulic testing shops, provide some of the key skills required in the fabrication of the upper turret.

5.5 On-shore/At-shore Hook-Up

The hook-up of topsides modules, structures and equipment onto a production platform is a critical phase of an offshore development project. It occurs at a time when the project schedule is usually under considerable pressure.

The physical infrastructure demanded by the hook-up phase of an offshore project was described in Section 4.5: a sheltered quayside with sufficient water depth and availability of adequate craneage/ lifting capacity, along with sufficient infrastructure to permit technical work to be performed expeditiously.

An FPSO for White Rose will require in the order of a minimum 130-m quay, with a draught of 10 m, and a minimum working apron depth of 30 to 40 m to accommodate the topsides modules prior to lifting. The facilities at Bull Arm, having been substantially modified for the Terra Nova FPSO, could also be suitable as the hook-up and commissioning site for a White Rose FPSO. Dock facilities offered by both Friede Goldman Newfoundland and Irving Shipbuilding are inadequate to accommodate FPSO hook-up operations. MM Industra in Dartmouth Nova Scotia offer a 230-m dock with sufficient depth for locating modules prior to installation and a 9-m water depth. Presuming some modifications, this may be the only other facility in eastern Canada with the potential to offer FPSO hook-up services.

The Cow Head facilities owned by Friede Goldman Newfoundland offer sufficient quayside space and water depth, craneage and considerable physical plant support to outfit and commission a production semi-submersible, but a detailed evaluation would be necessary as the facilities have generally been designed for the retrofit of smaller drilling semi-submersibles. Temporary laydown space for integrated modules dockside would be a primary concern, however, this problem can be addressed by employing barges.

The Irving facilities at Saint John Shipbuilding may offer the potential for outfitting a semi-submersible production platform but again, a detailed evaluation of this potential would be necessary

5.6 Offshore Installation

As indicated in Section 4.6, the physical work associated with offshore subsea installation and mooring systems will be handled with crane vessels and barges, anchor handling vessels or construction lay/diving support vessels. ROVs may be required for inspection purposes, and survey vessels will also be employed to prepare for and verify aspects of the installation. These highly specialized vessels, together with their technical equipment and core crewing, will all be leased on the world market. Many of these vessel contractors will, however, employ locally available crew to supplement their personnel.

Associated with these preliminary offshore operations will be the fabrication and procurement of various civil and marine items, including steel piles or drag anchors, mooring chain, connection hardware, wire rope leads, concrete riser bases (clump weights) and mattresses. With the exception of concrete products and steel piles, these items are currently manufactured for the offshore almost exclusively outside Canada. These civil and marine items are, for the most part, represented by vendors and suppliers in Newfoundland.

Offshore survey systems specialists with a comprehensive array of equipment and computer software to enable acoustic positioning, installation support, monitoring and post-installation inspections will be required for various aspects of the offshore installation. These services are available both in Newfoundland and elsewhere in Canada, usually through joint ventures with international partners.

5.7 Production Drilling

Production drilling will be undertaken by contractors using foreign-sourced drilling rigs. However, rigs leased on the international market will have to meet C-NOPB and Transport Canada regulations, and this may necessitate refit and/or modification. These services are available in Newfoundland from Friede Goldman Halter's facility at Cow Head, or at major Atlantic Canadian shipyards, such as Saint John Shipbuilding. Bull Arm could potentially also provide the infrastructure for major rig refits.

Drilling support services (both exploratory and now production) have been supplied to operators on the Grand Banks by Canadian firms for many years, either directly or through their association with foreign companies that provide them globally. These services include measurement while drilling (MWD), logging while drilling (LWD), directional drilling, mud logging, fishing, cementing, fracturing, matrix stimulation, sand control, water control, coiled tubing services, design and evaluation.

Hardware such as drill bits, downhole completion equipment and liner equipment, and bulk commodities such as drilling fluids, cement, and drill tubing and casing, are not manufactured in the province, but are available from suppliers in Newfoundland and elsewhere in Canada.

5.8 Subsea Fabrication and Installation

There is a significant procurement component associated with the subsea installation. Wellheads, christmas trees, flowlines, control umbilicals, flexible risers and subsea control systems are all of proprietary design, developed over many years by specialist engineering companies, and are manufactured using precision machining and manufacturing processes. A high level of quality control is required in order to ensure that subsea equipment is reliable under the most extreme environmental conditions. Only a limited number of international companies offer these products.

5.8.1 Subsea Trees

The valves and hydraulic connectors of the subsea tree are of specialized proprietary design, demanding precision machining processes. However, conventional subsea trees (and the tools to run the subsea trees) use non-specialized structural steel guidance frames. Some tree manufacturers will design these frames and subcontract their manufacture to qualified sub-manufacturers. The frames could then be integrated with the tree valves and connectors in Newfoundland or elsewhere in Canada at a location offering:

- fabrication yard with indoor shop facilities;
- covered materials handling and storage capabilities, with segregation between different materials;
- machine shop, metal cutting, welding (in accordance with American Society of Mechanical Engineers (ASME) Standard 1X) heat treating and non-destructive testing facilities, and a skilled workforce capable of working to exacting tolerances;
- shot blasting (to white metal specification) and painting facilities;
- small bore pipe fitting facilities, and a skilled workforce capable of making up small bore pipework for the assembled tree;
- hydraulic pump facilities suitable to interface with either a water-based or oil-based hydraulic fluid;
- overhead craneage suitable to lift 40 t; and
- test facilities for underwater testing.

NEWDOCK and Friede Goldman Newfoundland are local companies that offer all or most of the above, and it is therefore possible that, given sufficient technology transfer (similar to NEWDOCK's arrangement with FMC/Kongsberg Offshore for template and manifold systems manufacture), kit assembly of proprietary components, fabrication of structural frames and connectors, and systems integration testing could all be performed in Newfoundland. International competitiveness is again a key challenge.

5.8.2 Templates and Manifolds/System Integration Testing

Subsea templates and manifolds will be designed specifically in accordance with the depletion strategy adopted for White Rose. Of the seven template/manifold combinations designed for Terra Nova, four have been fabricated in Grenland Offshore in Norway and the final three are under fabrication at NEWDOCK in St. John's. Ten NEWDOCK employees worked in Grenland's fabrication facility on the first templates and manifold systems. These employees returned to NEWDOCK in the spring of 1999, bringing with them the technological expertise necessary to carry out the fabrication in St. John's. The fabrication facilities at NEWDOCK have been upgraded considerably, including a new building erected specifically for systems integration testing. As a result of past successful technology transfer strategies, capabilities exist to carry out fabrication of White Rose templates and manifolds in Newfoundland.

5.8.3 Subsea Installation

The field installation of subsea systems will demand a range of specialized vessels and equipment. These may include:

- suction dredgers to excavate glory holes using trailer hopper suction dredging technology;
- multi-purpose offshore construction vessels or construction lay/diving support vessels employed for the installation of subsea flowlines, risers and umbilicals (some state-of-the-art vessels are equipped to trench and lay flowlines simultaneously);
- diving support vessels (DSVs) with ROVs to install flowline jumpers and perform manifold/ template, flowline/riser, riser/disconnect buoy connections; and
- crane vessels or MODUs to deploy templates, manifolds, risers bases and protective mattresses.

These vessels will be secured on a competitive basis on the international market.

5.9 Operations/Production

It is currently anticipated that the operations phase for development of the White Rose South Avalon pool will last approximately 12 years. This is compared to Terra Nova's production life of between 15 and 18 years. During this stage of the project, there will be a continuous domestic demand for goods and services required for vessel operation and subsea maintenance. This phase represents the best opportunity to maximize Canada-Newfoundland benefits on a competitive basis by promoting, building and sustaining a growing domestic offshore support industry.

The operations/production phase will involve a continuous demand for the following services:

- bonded services;
- bulk fuel and water supply/storage;
- catering and cleaning;
- communications equipment supply and service;
- computer services;
- core storage;
- cranes, trucking and vehicles;
- customs brokerage;
- diving and diving support;
- environmental monitoring, weather forecasting and ice monitoring;
- helicopter services;
- instrument repair and maintenance;
- insurance;

- laboratory analyses;
- machinery repair and valve servicing;
- materials handling;
- medical services;
- non-destructive testing and inspection;
- offshore equipment maintenance;
- painting;
- pump servicing;
- standby, supply, anchor-handling vessels;
- subsea equipment, inspection, servicing and repair;
- subsea flowline inspection and maintenance;
- specialized equipment maintenance (turbines, generators, etc.)
- warehousing, shore-based and materials storage;
- well workover and servicing; and
- wharfage and berthing.

The demand created by White Rose for these services will have a long-term impact upon the local economy of Newfoundland and, in particular, the St. John's area. Husky Oil will explore the possibility of synergy with existing operations for the provisions of some services.

5.10 Bulk Materials

5.10.1 Fabrication Demands

Bulk materials are those goods that will be required in large quantities, such as steel plate, tubular goods, wire and cable, protective coatings, insulation and so forth. Bulk material requirements for the fabrication, construction and assembly of the White Rose production system are mainly associated with the FPF and its topsides. The fabrication of an FPF hull structure will create considerable demand for bulk materials, but it is unlikely that any of these will be supplied from Canada. Typical bulk material requirements for a vessel hull are provided in Table 5.10-1.

Table 5.10-1 Typical Bulk Materials Requirements (tonnes) for Vessel Hull

Production Option	Plate and Structural Steel	Piping	Electrical	Instrument	Coatings	Passive Fire Protection
FPSO	27,500	970	180	70	110	115
Semi-Submersible	13,850	540	70	10	120	-
Source: Petro-Canada (1996)						

The range of bulk materials for a floating production facility is estimated as follows:

- Piping — Carbon steel, 1.5 – 24 inches
  Low temperature carbon steel, 1.5 – 24 inches
  Stainless steel, 1.5 – 14 inches"
  Duplex, 6 to 8 inches
- Valves — Ball, gate and butterfly valves, various sizes
- Electrical — Fire retardant cable
  Explosion proof junction boxes
  Junction boxes for non-hazardous areas
  Stainless steel cable tray and fittings
  Galvanized carbon steel cable tray and fittings
  Cable markers
  Motor control centres
  Transformers
  Switch gear, 500 v to 4.15 kV
- Instrumentation — Pressure, temperature and flow gauges
  Control valves
  DCS systems
- Structural — Plate, beams and sections of varying grade, size and strength
- Fireproofing — Cementitious and epoxy based

Although it only represents approximately one-fifth the requirements (in total weight) for an FPSO, and less than one-half that required for a semi-submersible, topsides fabrication will nonetheless generate significant demands on manufacturers of bulk materials. Typical bulk material requirements for topsides are provided in Table 5.10-2.

Table 5.10-2 Typical Bulk Material Requirements (tonnes) for Topsides

Production Option	Plate and Structural Steel	Piping	Electrical	Instrument	Insulation	Passive Fire Protection
FPSO	5,125	2,600	300	145	25	900
Semi-Submersible	2,995	2,435	300	135	25	1,060
Source: Petro-Canada (1996)						

Sub-sea systems will require approximately 600 t of structural steel/steel plate, and approximately 150 t of steel pipe. Some 10,000 t of flexible flowlines and risers will also be required. (Petro-Canada 1996)

5.10.2 Production Drilling and Operations Demands

Production and injection wells for White Rose will be drilled from a MODU. Based on a 4,000-m deep (average), directionally drilled well, the anticipated bulk materials are provided in Table 5.10-3.

Table 5.10-3 Bulk Materials Requirements (tonnes) for Well Drilling

Material	Base Quantity (1 Well)	18 Wells	25 Wells
Tubular Goods	630	11,340	15,750
Drilling Muds:			
Gelling Agents	50	900	1,250
Weighting Materials	220	3,960	5,500
Other Chemicals	30	540	750
Cement and Additives	400	7,200	10,000
Diesel Fuel	2,300	41,400	57,500
Aviation Fuel	25	450	625
Drilling Water	7,000	126,000	175,000

Bulk material demands for operations will typically include maintenance materials, marine fuels, aviation fuels, catering supplies, lubricants and chemicals.

5.11 Equipment Requirements

The following equipment demands are based on concept evaluation engineering performed on the White Rose project by KSLO for an FPSO solution. These are presented according to system.

• Crude Oil Separation and Export	Crude oil heaters, 8,900 and 2,350 kW
	Test oil heater, 5,000 kW
	1st stage separator
	2nd stage separator
	Crude oil electrostatic coalescer
	Test separator
	Crude pig launcher/receivers,
	Crude transfer pumps, 14,308 m^3
	Produced water pumps, 795 m^3
	Test separator pump, 3,577 m^3
• Gas Compression and Treatment	1st stage flash gas suction cooler, 3,510 kW
	2nd stage flash gas suction cooler, 4,210 kW
	2nd stage flash gas suction cooler, 5,220 kW
	1st stage injection gas suction coolers, 2,145 kW
	1st stage injection gas discharge coolers, 10,890 kW
	2nd stage injection gas discharge cooler, 20,200 kW
	1st stage flash gas compressor, 1,500 kW
	2nd stage flash gas compressor, 1,000 kW
	1st stage injection gas compressor, 15,500 kW
	2nd stage injection gas compressor, 20,200 kW
	LP flash condensate pumps
	1st stage flash gas suction scrubber
	2nd stage flash gas suction scrubber
	2nd stage flash gas discharge scrubber
	1st stage injection gas suction scrubber
	1st stage injection gas suction scrubber
• Produced Water	Produced water hydrocyclone package
	Produced water flash drum
	Recovered oil pump
• Flare and Vent	HP flare KO drum
	LP flare KO drum
	Flare ignition package
	HP flare pumps
	LP flare pumps
• Seawater Lift	Seawater lift pumps, and service water pump
	Hypochlorination package
	Seawater coarse filter

• Water Injection	Seawater fine filter package
	Seawater booster pumps
	Deaerator
	Deaerator vacuum package
	Seawater injection pumps
• Cooling Medium	Cooling medium cooler
	Cooling medium circulating pumps
	Cooling medium surge drum
	Cooling medium make-up pump
	Cooling medium make-up tank
• Heating Medium	Heating medium heater
	Heating medium circulating pumps
	Heating medium surge drum
	Heating medium dump cooler
	Heating medium filters
• Glycol Regeneration and Storage	Glycol regeneration package
	Glycol storage tank
	Glycol transfer pump
• Hazardous and Non-Hazardous Drains	Hazardous open drains tank pump
	Hazardous open drains tank
	Separated oil pumps
	Non-hazardous open drains tank
	Non-hazardous open drains pump
• Aviation Fuel Package	Helifuel storage package
	Helifuel dispenser package
• Methanol Injection	Methanol injection pump package
	Methanol storage drum
• Instrument/Plant Air	Air compressor package
	Air dryer package
	Instrument air receiver
• Inert Gas Generator	Inert gas generator package
• Power Generation	Main power generation package
• Emergency Power Generation	Emergency power generator
	Emergency generator diesel day tank
• Chemical Injection	Chemical injection package (oil/gas)
	Chemical injection package (water)
• Hydraulic Power	Hydraulic power package
	Wellhead hydraulic package
	Wellhead hydraulic control package

- Firewater
  - Firewater pumps
  - Firewater pump filters
  - Firewater pump diesel day tanks
- Power Distribution
  - Transformers
- Safety
  - Deluge skids
  - Monitors
  - Hose reels
  - Hydrants
  - Foam skids
  - Safety showers
- Mechanical Handling
  - Deck cranes
  - Miscellaneous handling equipment

5.12 Consumables and Contracted Services Summary

A summary of requirements for consumables is presented in Table 5.12-1. Competitive bidding and market demand will be important factors affecting the source of supply.

Table 5.12-1 Consumables Requirements Summary

Consumable	Tonnes			Potential Source of Supply		
	FPSO	Semi	Drilling & Operations	NF	CAN	INT
Plate & Structural Steel	32,625	16,845			X	X
Piping & Tubulars	3,570	2,975	11,340		X	X
Electrical	480	370		X	X	X
Instrumentation	215	145		X	X	X
Coatings & Insulation	135	145			X	X
Passive Fire Protection	1,015	1,060				X
Drilling Muds			5,400	X	X	
Cement & Additives			7,200	X	X	
Marine Diesel Fuel	33,600	33,600	41,400	X	X	
Aviation Fuel	2,250	2,250	450	X	X	
Lubricants & Chemicals				X	X	
Maintenance Materials				X	X	X
Catering Supplies				X		
Potable Water				X		

A summary of requirements for contracted services is provided in Table 5.12-2. Competitive bidding and market demand will be important factors affecting the source of supply.

Table 5.12-2 Contracted Services Requirements Summary

Service	Phase Requirement		Potential Source of Supply		
	Construction & Installation	Operations	NF	CAN	INT
Aviation		X	X	X	X
Catering	X	X	X		
Communications	X	X	X		
Crewing	X	X	X		
Customs Brokering	X	X	X		
Diving	X	X	X	X	X
Engineering	X	X	X	X	X
Equipment Rentals	X	X	X	X	X
Glory Hole Construction	X				X
Instrumentation	X	X	X	X	
Legal	X	X	X	X	
Marine Installation	X	X			X
Maintenance		X	X	X	X
Supply Base	X	X	X		
Supply Vessels	X	X	X	X	X
Surveys	X	X	X	X	X
Testing	X	X	X	X	X
Trucking	X	X	X		
Environmental Services	X	X	X	X	

6 LABOUR REQUIREMENTS

This chapter describes the labour requirements for different components of the White Rose Project. The availability of Newfoundland residents and Canadians to work on the Project is also assessed.

Husky Oil believes that growth in Newfoundland's offshore oil industry must evolve in a way that will eventually result in continuous work for Newfoundland residents, in engineering, fabrication and operations. This can be achieved if proven and cost-effective advancing technologies are readily adopted, leading to a cross-section of labour expertise familiar with production scenarios that offer the greatest possibility of being repeated in the future. By training a workforce that can best respond to "most likely" demands, quality of work will accrue through experience, and a procurement chain that supports their activities can be forged. The status quo wherein local industry, procurement and design continuously gears up and winds down as projects pass through the development stage, must give way to a new vision of a *sustained* petroleum economy.

6.1 Management, Engineering, Procurement and Administrative Support

The management, engineering and procurement aspects of an offshore development project are substantial, and figure prominently in discussions of Canada-Newfoundland benefits.

Person-hours expended by management, engineering, procurement and administrative support functions are typically included in project implementation as opposed to design. It is the design portion of the engineering effort - the actual decision-making activities of the engineering process - that requires careful consideration. The newly acquired skills that accrue from direct participation in the design and coordination of an offshore project offer tangible benefits to the local design community in terms of newly acquired expertise. Only a sustained petroleum economy will keep this expertise in the region.

Husky Oil endorses the Offshore Petroleum Engineering Task Force Report (OPETF) (1999) recommendation that:

> *"In the short term, the local consulting engineering community and the oil and gas industry focus on enhancing the existing capability to carry out "front-end" project-related engineering work (conceptual engineering, feasibility studies and preliminary engineering), and supporting Hibernia and Terra Nova production. Establishment of a full capability in the Province to execute this work would better position the local engineering community to participate in detailed engineering phases of offshore projects, both for add-on and stand-alone projects.*

For future stand-alone projects, the oil and gas industry and the local consulting engineering community ensure that overall project management and engineering decision-making are located in the Province."

Husky has awarded its FEED component for subsea engineering to KSLO, based in St. John's. This group performed the production screening analysis/concept engineering for White Rose, completed in April 2000, out of their offices in St. John's. This represents the first time such key work has been performed in Newfoundland and Labrador. Estimates of the labour requirements for management, engineering, procurement and administrative support to be expended within the Husky Oil organization during design and construction are presented in Table 6.1-1.

Table 6.1-1 Labour Demand, Husky Integrated Management Team (IMT)

NOC Code	NOC Unit Group Title	Labour (Person-hours)*	Percentage of Total Labour Effort (%)
0811	Primary Production Manager	10,800	3.64
0111	Financial Managers	54,000	18.18
1111	Accounting	43,200	14.55
1121	Human Resources	10,800	3.64
1215	Supervisors (Logistics)	21,600	7.27
1225	Purchasing Agents and Officers	10,800	3.64
1214	Secretaries (Administrative Support)	16,200	5.45
2100	Engineers	108,000	36.36
8222	Supervisors, Oil and Gas Drilling and Services	21,600	7.27
TOTALS		**297,000**	**100**
* Based on three-year design and construction period.			

In addition, it is estimated that management, engineering, procurement and administrative support to be expended by major contractors will total 755,000 person hours, including 184,000 person hours of project management.

6.2 Hull Fabrication

As discussed previously in Section 5.2, current infrastructure and capability at fabrication sites throughout eastern Canada is insufficient to undertake the construction of major steel hull components. Previous studies have estimated that approximately 3.0 million hours is required for fabrication of an FPSO. However, at that time, only a limited number of FPSOs had been constructed worldwide, and design technologies were still rapidly evolving. In addition, the Norwegian NORSOK and British CRINE initiatives to reduce costs associated with offshore engineering and fabrication, were just beginning.

In recent years, many contractors have become very familiar with FPSO technology, to the point where it is generally regarded to be the preferred option for cost-effective offshore development. Numerous international companies such as Maersk, Navion and Bluewater now offer turnkey solutions based on FPSO technology. The average construction time for a newbuild FPSO project is now less than 30 months. It is estimated that the White Rose FPSO hull construction will require approximately 1.2 million person hours of labour.

Previous experience with steel semi-submersible projects has resulted in projections of 1.0 to 1.5 million person-hours for their fabrication. Recently, there has not been a substantial demand for semi-submersible production platforms in the Northern Hemisphere, and it is reasonable to assume that the labour projections have reduced somewhat, but not substantially.

Saga Petroleum's *Snorre B*, a steel semi-submersible scheduled to come on stream in August 2001, with production rates of 17,488 m^3 of oil per day, is one recent exception to the popularity of FPSOs. This is largely based, however, on the fact that a storage tanker will not be required, as the processed product will be sent to the Statfjord B platform for storage and export. This aspect of the development serves to make the semi-submersible production platform an economically attractive option for further Snorre field production (Saga Petroleum 1998).

6.3 Turret Fabrication

Depending upon various aspects of the disconnect design, mooring requirements, and the quantity of risers and umbilicals to be accommodated, the manufacture of an internal turret system will require approximately 680,000 person hours of labour including engineering and project management.

6.4 Topsides Module Fabrication

Husky Oil has reviewed data for a number of offshore fabrication projects. This analysis indicates that hours of work associated with the fabrication of topsides modules would generally be expected to range as follows:

Activity	Person-hours per tonne
Labour – direct and indirect	175-225
Management and Supervision	25-75

On this basis, and assuming a total White Rose topsides design weight of some 7,300 tonnes, White Rose will generate 1.4 to 2.2 million hours of topsides fabrication work.

The topsides fabrication component of the facilities represents the largest labour requirement of the development. Using NOC category codes, the level of effort among the various major skilled trades can be projected (Table 6.4-1).

Table 6.4-1 Labour Demand for Topsides Module Fabrication

NOC Code	NOC Unit Group Title	Labour (Person-hours)	Percentage of Total Labour Effort (%)
7231	Machinists and Machining and Tooling Inspectors	26,280	1.80
7242	Industrial Electricians	332,150	22.75
7252	Pipefitters	464,280	31.80
7261	Sheet Metal Workers	6,570	0.45
7262	Boilermakers	13,140	0.90
7263	Structural Metal and Platework Fabricators and Fitters	199,290	13.65
7265	Welders	332,150	22.75
7293	Insulators	26,280	1.80
9496	Painters and Coaters	59,860	4.10
TOTALS		**1,460,000**	**100.00**

6.5 On-shore/At-shore Hook-Up and Commissioning

The actual physical work associated with hook-up (crane loading and unloading, installation of modules on the weatherdeck, piping, electrical, and instrumentation connections), and finishing (paint, coatings, insulation, drop protection, etc.) signals the commencement of a much more intensive commissioning process, which requires the involvement and expertise of discipline-specific commissioning specialists, operations engineers and technical personnel, and vendor representatives. Using an array of pre-established protocols under strictly controlled conditions, they will perform:

- inspection, testing, mechanical completion, quality control checks;
- calibration;
- simulated start-up;
- equipment preservation; and
- status tagging.

Hook-up and commissioning activities for White Rose are estimated to take approximately 43 weeks and will commence almost immediately upon the arrival of the FPSO. This concurs with earlier estimates provided by Petro-Canada both in the original Development Application (Petro-Canada 1996) and in their subsequent Supplement (Petro-Canada 1997). Labour effort breakdown by major skilled trade is indicated in Table 6.5-1.

Table 6.5-1 Labour Demand for On-shore Hook-up

NOC Code	NOC Unit Group Title	Labour (Person-hours)	Percentage of Total Labour Effort (%)
7231	Machinists and Machining and Tooling Inspectors	2,500	0.55
7242	Industrial Electricians	200,000	44.45
7252	Pipefitters	165,000	36.65
7261	Sheet Metal Workers	500	0.10
7263	Structural Metal and Platework Fabricators and Fitters	20,500	4.55
7265	Welders	46,000	10.25
7293	Insulators	2,000	0.45
9496	Painters and Coaters	13,500	3.00
TOTALS		**450,000**	**100.00**

Engineers, inspectors and technicians involved in commissioning will add considerably to the labour effort at the hook-up site during the commissioning period. Many will have already been working on the project in previous design and inspection capacities. Others, such as offshore and on-shore operations personnel, will represent a permanent position throughout the field life of the project. Still others will come from a transient core of international expertise devoted to platform commissioning work. This multi-discipline, multi-interest, effort may represent approximately 175,000 person-hours.

6.6 Offshore Installation

The offshore installation component of the project will be relatively brief compared to the intensive planning and engineering that will take place a year or more in advance of the FPSO or semi-submersible production platform locating on the field. As indicated in Section 4.6, various short duration tasks will be performed at different times, in preparation for the vessel hook-up, including:

- surveying;
- anchoring and/or pile installation;
- setting out mooring lines;
- inspection and testing; and
- placing and securing the lower disconnect portion of the turret (FPSO scenario only; reference to the riser buoy).

The Terra Nova Project has demonstrated that although the work associated with offshore installation will likely be performed by experienced international maritime companies, the prospects for Newfoundland and Canadian marine workers gaining employment on the vessels required are favourable. The vessel *Maxita*, used to install the moorings and concrete riser bases, employed 83

personnel on board, 40 percent of whom were residents of the province or other parts of Canada. The *Arctic Kalvik*, used to deploy the Terra Nova riser buoy, employed 30 personnel on board, 65 percent of whom were residents of Newfoundland and other Canadians (Terra Nova 1999a).

The labour component for this phase of the project will be largely split between engineers (NOC 2100) and technicians (NOC 2200) working both on-shore and offshore, together with commercial divers (NOC 7382), marine deck crews (NOC 7433) and engine room crews (NOC 7434). The engineering and technical aspect will require approximately 20,000 person-hours and the marine operations will demand approximately 32,000 hours.

6.7 Production Drilling

Drilling of the production and injection wells will commence prior to the installation of the production vessel and continue until the entire drilling program of up to 18 to 25 wells (up to 11 of which will be injection) is completed. These wells will each take 50 to 80 days to drill and complete, depending on depth drilled. Assuming an average drill time of 65 days, and the use of a single semi-submersible MODU, this field development drilling program would last approximately 4.5 years.

Despite the fact that these drill rigs have not been fabricated in Canada, and are owned and leased by world-wide drilling contractors, the hiring and deploying of Newfoundland residents for both drilling and marine crews has been considerable. This is attributable to a combination of factors:

- there is a long history of exploratory drilling operations off the coast of Newfoundland (since the mid-1960s);
- post-secondary institutions have placed considerable emphasis on training individuals for offshore employment, and have kept pace with evolving technologies in their course offerings;
- many residents of Newfoundland have availed themselves of post-secondary education for the offshore sector, and have garnered many years of practical experience in western Canada and abroad; and
- the collapse of groundfish stocks offshore has contributed to the availability of highly skilled marine personnel in the province.

The number of wells required to economically deplete the White Rose field currently ranges from up to 18 to 25. At an average of approximately 65 days per well, and with the 75-person crew working a 12-hour shift, it can be estimated that the total offshore labour for White Rose production drilling will range from 1.05 million to 1.46 million person-hours. The NOC breakdown for labour for up to 18 and 25 wells is indicated in Table 6.7-1.

Table 6.7-1 Labour Demands for Production Drilling

NOC Code	NOC Unit Group Title	Labour (Person-hours) 18 wells	Labour (Person-hours) 25 wells	Percentage of Total Labour Effort (%)
1475	Radio Operators	28,000	39,000	2.67
2100	Engineers	42,000	58,500	4.00
2114	Forecasters	28,000	39,000	2.67
2232	Mechanical Engineering Technician	42,000	58,500	4.00
2243	Instrument Technicians	28,000	39,000	2.67
2273	Deck Officers	28,000	39,000	2.67
2274	Engineer Officers	28,000	39,000	2.67
3234	Medics	14,000	19,500	1.33
6641	Food Service	168,000	233,500	16.00
6661	Light Duty Cleaners	56,000	78,000	5.33
7242	Industrial Electricians	28,000	39,000	2.67
7433	Deck Crew	56,000	78,000	5.33
7434	Engine Room / Marine Crew	56,000	78,000	5.33
7371	Crane Operators	14,000	19,500	1.33
8222	Supervisors, Oil & Gas Drilling	28,000	39,000	2.67
8232	Well Drillers, Testers	210,000	292,000	20.00
8412	Drilling Workers	28,000	39,000	2.67
8615	Drill Workers, Labourers	154,000	214,000	14.66
9232	Petroleum, Gas and Chemical Process Operators	14,000	19,500	1.33
TOTALS		**1,050,000**	**1,461,000**	**100.00**

6.8 Subsea Fabrication and Installation

Labour demands associated with subsea equipment can be subdivided into two main aspects; fabrication of field-specific templates and manifolds, and installation offshore. As suggested previously, the former holds considerable potential for the employment of Newfoundland residents. Based on a projection of subsea design demands similar to those of the Terra Nova project, the labour demands by NOC unit can be predicted as shown on Table 6.8-1.

Table 6.8-1 Labour Demands for Subsea Template and Manifold Fabrication

NOC Code	NOC Unit Group Title	Labour (Person-hours)	Percentage of Total Labour Effort (%)
0016	Senior Manager	7,500	1.10
0711	Construction Manager	15,000	2.20
1111	Accounting	6,800	1.00
1214	Secretaries (Administrative Support)	15,000	2.20
1215	Supervisors (Logistics)	15,000	2.20
1225	Purchasing Agents and Officers	15,000	2.20
2100	Engineers	59,000	8.70
2261	Nondestructive Testers and Inspectors	15,000	2.20
7214	Supervisors, Metal Forming, Shaping and Erecting	29,000	4.30
7231	Machinists and Machining and Tooling Inspectors	110,000	16.30
7242	Industrial Electricians	15,000	2.20
7252	Pipefitters	66,000	9.80
7265	Welders	80,000	11.90
7263	Structural Metal and Platework Fabricators & Fitters	58,700	8.70
9496	Painters and Coaters	169,000	25.00
TOTALS		**676,000**	**100.00**

Detailed design of White Rose field depletion strategies could lead to changes in the number of wells required. The overall labour demand would be adjusted accordingly.

Subsea installation will demand on-shore engineering and experienced offshore crews from the international market, although these crews may have a significant number of Newfoundland residents. The *Queen of the Netherlands*, used to excavate glory holes for the Terra Nova Project over a three to four-month period, for example, had a large domestic contingent: of the 40 personnel on board, 40 percent were residents of Newfoundland and other Canadians (Terra Nova 1999b).

The labour component for this phase of the project will, similar to offshore installation work, be largely split between engineers (NOC 2100) and technicians (NOC 2200) working both on-shore and offshore, together with commercial divers (NOC 7382), marine deck crews (NOC 7433) and engine room crews (NOC 7434). The engineering and technical aspect will require approximately 60,000 person-hours and the marine operations will demand approximately 90,000 person-hours.

6.9 Operations/Production

The following labour breakdown for FPSO or semi-submersible operations/production phase of the White Rose Project assumes a 12-year field depletion plan with little or no multi-tasking among the personnel. Predicted production vessel labour demand is shown in Table 6.9-1.

Table 6.9-1 Production Vessel Labour Demand

NOC Code	NOC Unit Group Title	Labour (Person-hours)	Percentage of Total Labour Effort (%)
1215	Supervisors (Logistics)	52,560	2.17
1475	Radio Operators	105,120	4.35
2114	Forecasters	105,120	4.35
2232	Mechanical Engineering Technician	52,560	2.17
2243	Instrument Technicians	210,240	8.70
2273	Deck Officers	52,560	2.17
3234	Medics	52,560	2.17
6641	Food Service	315,360	13.04
6661	Light Duty Cleaners	157,680	6.52
7216	Contractors and Supervisors (Maintenance)	52,560	2.17
7242	Industrial Electricians	157,680	6.52
7252	Pipefitters	52,560	2.17
7265	Welders	52,560	2.17
7433	Deck Crew	210,240	8.70
7434	Engine Room / Marine Crew	105,120	4.35
7371	Crane Operators	52,560	2.17
8222	Supervisors, Oil & Gas Drilling	315,360	13.04
9232	Petroleum, Gas and Chemical Process Operators	315,360	13.04
TOTALS		**2,417,760**	**100.00**

Both the FPSO and semi-submersible production options require up to three support vessels. The labour demand for these vessels, based on the 12-year field depletion plan, is presented in Table 6.9-2.

Table 6.9-2 Supply and Standby Vessel Labour Demand

NOC Code	NOC Unit Group Title	Labour (Person-hours)	Percentage of Total Labour Effort (%)
2273	Deck Officers	144,000	20.00
2274	Engineer Officers	144,000	20.00
6641	Food Service	144,000	20.00
7433	Deck Crew	144,000	20.00
7434	Engine Room Crew	144,000	20.00
TOTALS		**720,000**	**100.00**

Based on the White Rose demand on helicopter services, an additional two pilots (NOC 2271), two helicopter mechanics (NOC 2244) and one baggage/freight handler (NOC 7437) would be required in St. John's, creating an approximate 72,000 additional person-hours over the life of the field.

Finally, both a semi-submersible option and an FPSO would typically require the services of shuttle tankers over the life of the field. The semi-submersible would also require a storage tanker permanently moored approximately 2 km away from the semi-submersible. A tanker crew will generally consist of a master, three mates, a chief engineer, three engineers, one electrical officer, four general-purpose seapersons, four general purpose engine room assistants, a chief cook, second cook, and a ship's clerk. The labour demand for tanker crews, based on an approximate 12-year life-of-field projection, is presented in Table 6.9-3.

Table 6.9-3 Tanker Labour Demand

NOC Code	NOC Unit Group Title	FPSO: Labour (Person-hours)	Semi: Labour (Person-hours)	Percentage of Total Labour Effort (%)
1413	Records and Files Clerk	48,000	72,000	5.00
2273	Deck Officers	192,000	288,000	20.00
2274	Engineer Officers	192,000	288,000	20.00
6641	Food Service	96,000	144,000	10.00
7242	Industrial Electricians	48,000	72,000	5.00
7433	Deck Crew	192,000	288,000	20.00
7434	Engine Room Crew	192,000	288,000	20.00
TOTALS		**960,000**	**1,440,000**	**100.00**

In addition to the above, there will be an on-shore support requirement. Estimates of the labour requirements for management, engineering, procurement and administrative support during production are presented in Table 6.9-4.

Table 6.9-4 Labour Demand for Onshore Support

NOC Code	NOC Unit Group Title	Labour (Person-hours)*	Percentage of Total Labour Effort (%)
0811	Primary Production Manager	43,200	3.85
0111	Financial Managers	21,600	1.92
1111	Accounting	172,800	15.38
1121	Human Resources	43,200	3.85
1215	Supervisors (Logistics)	86,400	7.69
1225	Purchasing Agents and Officers	43,200	3.85
1214	Secretaries (Administrative Support)	64,800	5.77
1475	Radio Operators	43,200	3.85
2100	Engineers	432,000	38.46
7371	Crane Operators	21,600	1.92
7611	Construction Trades Helpers and Labourers	64,800	5.77
8222	Supervisors, Oil and Gas Drilling and Services	86,400	7.69
TOTALS		**1,123,200**	**100**
* Based on 12-year production.			

6.10 Labour Requirements Summary

A summary of project labour requirements for the major work components, as described above, is presented in Table 6.10-1. It also identifies the potential location of work for each component. The following will be critical factors in determining the amount of work performed in any specific area:

- successful competitive bidding;
- labour and skills availability;
- the effect of competing major projects; and
- stable and equitable labour relations.

Table 6.10-1 Total Labour Requirements

Work Component	Total Person-Hours	%	Potential Work Location		
			NF	CAN	INT
Management, etc.	1,052,000	8.60	X	X	X
Hull Fabrication	1,200,000	9.81			X
Turret Fabrication	680,000	5.56	X	X	X
Topsides Fabrication	1,460,000	11.93	X	X	X
Hook-Up and Commissioning	625,000	5.11	X	X	
Offshore Installation	52,000	0.42	X		
Production Drilling	1,050,000	8.58	X		
Subsea	826,000	6.75	X	X	X
Operations/Production	5,293,000	43.25	X		
TOTALS	**12,238,000**	**100.00**			

6.11 Labour Supply

6.11.1 Introduction

The potential for Canadian and Newfoundland involvement in the White Rose project may be constrained by labour capability and capacity. If appropriately skilled and experienced workers are not available, whether because they do not exist, are otherwise engaged, and/or cannot be trained in time, the work will necessarily go to non-Newfoundland and non-Canadian workers.

There is a high level of awareness, within the federal government, provincial government, industry, and training institutions, of the need to plan and prepare for future labour requirements. This is reflected in such reports as: 'Offshore Petroleum Engineering Task Force Report' (OPETF 1999) and 'Estimation of Direct Human Resource Requirements, Offshore Exploration and Production, Newfoundland and Nova Scotia' (CAPP 1999). The Government of Newfoundland and Labrador has also recently completed draft reports on the exploration and production labour supply and related training. The Newfoundland Department of Human Resources and Employment is in the process of developing a construction labour supply database to assist all stakeholders in planning for major projects.

Memorial University and the College of the North Atlantic in Newfoundland, and similar institutions elsewhere in Atlantic Canada, are involved in many of these studies. They, as well as private colleges and unions, are paying close attention and responding to such reports and developments in the oil industry. For example, Memorial University has recently developed an ambitious new strategy to become a centre of excellence for oil-related education, training and R&D, with the Faculty of Engineering and Department of Earth Sciences playing major roles. Memorial University's Fisheries and Marine Institute and the College of the North Atlantic are involved in similar, ongoing, planning processes.

These reports and training institution responses indicate that, assuming there is no critical overlap between White Rose and other major projects (see Section 6.10.5), there will be no substantial shortage of Newfoundland labour able to work on the Project, although it should be noted these analyses sometimes do not evaluate skill levels and experience. The rest of this section provides further discussion of this topic related to development and operations activity. This includes a separate discussion of the ability to respond to engineering requirements.

6.11.2 Development

The ability to meet labour requirements for construction, fabrication and related activities builds on the description of labour requirements, with separate discussion of topsides module fabrication, on-shore/at-shore hook-up, offshore installation and subsea fabrication and installation (see Sections 6.4 to 6.6 and 6.8). Production drilling requirements are included in the discussion of operations (Section 6.10.3). The

assessment is based on the peak labour requirements for each of the NOC occupational categories identified.

Census of Canada 1996 labour force and employment data and February 2000 HRDC data on the numbers of active Employment Insurance claimants for each NOC category are presented in Table 6.11-1. This provides a baseline against which the current and potential availability of Newfoundland workers in Newfoundland has been assessed, with the potential availability being based on the current and likely future capacity of the training institutions. On the basis of this assessment, it is concluded that most positions could potentially be filled by Newfoundland residents and returning Newfoundland workers, with the exceptions discussed below. Conditions dictating the success of local staffing initiatives include the successful competitive bidding by Canadian and Newfoundland facilities, competition for workers from other major projects, successful recruitment efforts by project contractors, and a stable and equitable labour relations environment.

Table 6.11-1 Development Labour Force and Employment Data by NOC Category

NOC Code	NOC Unit Group Title	Total - Labour Force Activity[1]	Labour Force[2]	Employed	Unemployed	EI Claims
0016	Senior Manager	260	235	235	0	16
0711	Construction Manager	560	520	470	50	93
1111	Accounting	1,160	1,140	1,105	35	76
1214	Secretary (Admin Support)	370	340	325	15	28
1215	Logistics	240	210	195	20	38
1225	Purchasing	160	160	165	0	34
1413	Document Control	400	375	325	50	30
2243	Instrument Technicians	145	150	130	15	26
2261	Inspectors NDT	15	15	10	0	23
7214	Supervisors, Metal Forming, Shaping and Erecting	145	140	100	40	77
7216	Contractors and Supervisors, Maintenance	240	240	225	15	25
7231	Machinists and Machining and Tooling Inspectors	155	145	115	30	0
7242	Industrial Electricians	790	755	680	80	170
7261	Sheet Metal Workers	235	225	140	85	156
7263	Structural/Plate Fabricators	285	240	115	125	121
7293	Insulators	95	90	85	0	100
7371	Crane Operators	230	210	160	50	102
9496	Painters and Coaters	220	205	140	65	44

[1] The Total Labour Force Activity includes all persons in the occupational category.

[2] The Labour Force are those within the occupational category who are either in, or actively seeking, employment.

6.11.3 Production

Estimates of human resource requirements for offshore exploration and production, including production drilling, are provided in CAPP (1999). Under the moderate case scenario, which applies given the development of White Rose in addition to Hibernia and Terra Nova, the total Newfoundland requirement increases from 1,101 in 2000 to 1,591 in 2004 and stabilizes for the rest of the decade. This represents a total new requirement of 490 workers. Total regional (Newfoundland and Nova Scotia) requirements under the moderate case scenario rise steadily from 1,880 in 2000 to 2,899 in 2009, an increase of 1,019 workers over nine years. The report notes that these modest increases result, in part, from different projects sharing vessels and onshore management personnel.

The 1996 Census of Canada labour force and employment data and February 2000 HRDC data on the numbers of active Employment Insurance claimants is presented in Table 6.11-2 for each NOC category. Discussions with government officials and representatives of industry and educational institutions indicate that, given the existing supply of such workers, together with the ability and willingness of training institutions to respond to expected demands, there should be no significant difficulties in meeting these requirements.

Table 6.11-2 Production Labour Force and Employment Data by NOC Category

NOC Code	NOC Unit Group Title	Total - Labour Force Activity[1]	Labour Force[2]	Employed	Unemployed	EI Claims
1111	Accounting	1,160	1,140	1,105	35	76
1214	Secretary (Admin Support)	370	340	325	15	28
1215	Logistics	240	210	195	20	38
1225	Purchasing	160	160	165	0	34
1413	Document Control	400	375	325	50	30
1475	Radio Operators	345	310	285	20	66
2114	Forecasters	20	20	20	0	1
2232	Maintenance	85	80	65	10	26
2243	Instrument Technicians	145	150	130	15	26
2244	Aircraft Mechanics	55	50	45	0	14
2271	Air Pilots	155	155	150	0	59
2273	Deck Officers	465	420	365	55	143
2274	Engineer Officers	320	305	290	15	63
3234	Medics	290	270	235	35	75
6641	Food Service	2,740	2,225	1,800	425	164
6661	Cleaners	2,450	1,985	1,580	400	455
7242	Industrial Electricians	790	755	680	80	170
7371	Crane Operators	230	210	160	50	102
7382	Commercial Divers	100	105	75	30	41
7433	Deck Crew	950	890	595	290	526

NOC Code	NOC Unit Group Title	Total - Labour Force Activity[1]	Labour Force[2]	Employed	Unemployed	EI Claims
7434	Engine Room Crew	145	125	100	25	69
7437	Baggage/Freight Handler	430	415	370	45	48
8222	Supervisor Oil & Gas Drilling	45	40	30	0	5
8232	Well Drillers/Servicers/Testers	80	75	50	20	46
8412	Drilling Workers	40	25	10	10	30
8615	Drilling Servicing	220	190	95	95	103
9232	Process Operators	95	90	85	0	25

[1] The Total Labour Force Activity includes all persons in the occupational category.

[2] The Labour Force are those within the occupational category who are either in, or actively seeking, employment.

6.11.4 Engineering

The Offshore Petroleum Engineering Task Force 1999 indicates that:

> "*The current capability is also sufficient to form the nucleus of the project team for one additional major project (in addition to Hibernia and Terra Nova), such as the development of the White Rose or Hebron field. However, further significant staffing up would be required. This could be provided, to some extent, by combining the resources that already exist in consulting engineering firms and other industries locally, but it would still be necessary to bring in some personnel from other petroleum centres world-wide. Some stand-alone components… could still be engineered elsewhere, even though the project is managed and the engineering executed locally…(however, this is) current practice in the industry no matter where the main project engineering is located*."

It goes on to note that Newfoundland has established a strong educational environment to support offshore engineering, and to recommend expanded engineering and technology programs MUN and the College of the North Atlantic in order to meet future demand. As has been described above, Memorial University and the College are actively responding to such recommendations.

Given the current capacity and institutional responses, it is expected that Newfoundland will be able to provide considerable engineering support to meet White Rose-related positions in the future.

6.11.5 Effects of Major Projects

The potential for Canadian and Newfoundland involvement in the White Rose Project construction and operations activity may be constrained by industrial and labour capability and capacity. If suitable infrastructure and other industrial capacity are not available, whether because they do not exist, are otherwise engaged or cannot be developed in time, the work will necessarily take place outside

Newfoundland and/or Canada. Similarly, if suitably skilled workers do not exist, are otherwise engaged, and/or cannot be trained in time, the work will go to non-Newfoundland and non-Canadian workers.

The assessment of industrial and labour capacity must therefore take into account not only existing resources and how they might be increased or enhanced, but also other demands on them. Other major construction projects may draw on the same industrial capacity and workers as will White Rose development activity.

In Newfoundland, for example, major potential projects include the Terra Nova oilfield development project, the Voisey's Bay mine/mill, the Voisey's Bay processing facility, the Churchill River Power Project and, perhaps, the Hebron development. The potential interactions between each of these projects and the White Rose Project are determined by the project characteristics including, critically, their timing. These characteristics are, in most cases, highly uncertain. However, consultation with government and industry sources suggests the following:

- Terra Nova – As is discussed elsewhere, the White Rose and Terra Nova oilfield projects will use a large range of identical or similar industrial and labour capacity. However, given current Terra Nova project timing, there should be little or no overlap in these demands, because Terra Nova activity will be ending just prior to White Rose starting. Indeed, one of the great merits of the White Rose project is that, if current project timelines are achieved, it may provide continuity in the use of these resources, minimizing booms and lulls in activity.

- Voisey's Bay – The $1.7 billion Voisey's Bay mine/mill, on the North Labrador Coast, and the associated $1.5 billion processing facility, proposed for Argentia on the west side of the Avalon Peninsula, are currently on hold. Were they to proceed, they would require some specialist mining and minerals processing capabilities, however, they would also draw on some construction facilities and labour that might be used for the White Rose Project. Thus, for example, the mill could be made up of modules that could be built in Bull Arm. However, it currently appears unlikely that work on the Voisey's Bay projects will start before 2003 and hence, no demand conflicts are anticipated.

- Churchill River Power Project – This $6 billion to $7 billion project could see the construction of dams and dykes to divert the Romaine River, the Gull Island Dam, powerhouse and switchyard on the Churchill River, and associated power-lines. There is ongoing consideration of a dam at Muskrat Falls, but the economics are not yet proven, and a transmission line to the island is uncertain due to financing problems. It may employ, at peak (likely the third year of construction), 2,500 to 5,000 workers. A large part of the work will involve dam construction, which employs concrete construction equipment and skills quite different from those construction resources required by White Rose. Furthermore, while other work might draw on common industrial and labour capacity to that required for White Rose, it currently appears unlikely that work on the Churchill River Power Project will start before 2004 and hence, no demand conflicts are anticipated.

- Hebron – The proponents of this offshore oilfield development project have yet to indicate that they wish to proceed, and hence, it seems likely that there would only be resource conflicts with the latter stages of White Rose. Such overlap is likely to be minor; indeed, if the proponents do decide to proceed, it may provide continuity of demand for facilities and labour after the end of White Rose work.

There are few other major projects in the Maritimes. The most recent Atlantic Provinces Economic Council Major Projects Inventory identifies only three projects that are greater than low probability projects, have a capital value of $500 million or more, and are expected to extend into the White Rose construction period. They are:

- Scotian Shelf Development - Further development on the shelf to 2007 is seen as being worth approximately $750 million. Such development is regarded as being of high probability.

- Natural Gas Distribution - This $600 million to $1100 million project in Nova Scotia is seen as being of medium to high probability for the period to 2004. It would generate between 1,500 and 2,300 construction jobs.

- Strait Area Petro-Chemical Plant – This medium to low probability $600 million project would see the construction of an ethylene/polyethylene plant, with work completed by 2002. It would require 1,500 construction workers.

This analysis suggests that, given the current White Rose schedule, there will be only limited conflicts between industrial and labour requirements of White Rose and those of other major projects. However, this would change were there to be substantial delay in the start of White Rose work. This could result in a lull in resource demands between current project and White Rose construction, which might lead to some loss of capacity (as, for example, Newfoundland fabrication workers move to other projects in Newfoundland or elsewhere in Canada). It may result in construction work on White Rose occurring coincident with that on one or more of these other major projects. This would produce a 'boom' in activity that might well exceed local capacity, resulting in a loss of industrial and employment benefits to Newfoundland and, perhaps, Canada.

There will similarly be other demands on infrastructure and labour required for operations. Hibernia, Terra Nova, White Rose, together with any subsequent fields, will all need the same or similar shore-base facilities and related industrial and labour support. This is not viewed as problematic, given that such demand provides longer-term employment opportunities, justifying investments in infrastructure, training, etc. This conclusion was supported by the White Rose Pre-Development Application Filing consultation, where neither key informants nor the general public expressed concern about the ability to meet these requirements. In terms of infrastructure, for example, both the St. John's Port Corporation and St. John's International Airport Authority are currently expanding facilities in advance of new oil-

related demand (while there are also supply base options in Bay Bulls), and St. John's, Mount Pearl and Paradise are actively responding to potential further demand for industrial space.

Similarly, there is a high level of awareness, within the federal government, provincial government, industry and training institutions of the need to plan and prepare for future labour requirements. This is reflected in such reports as:

- Estimation of Direct Human Resource Requirements, Offshore Exploration and Production, Newfoundland and Nova Scotia (CAPP 1999) - This provides demand forecasts for base, moderate and high case scenarios, identifying the requirements for some 50 NOC occupations involved in exploration and production.

- OPETF 1999 - This uses the same base, moderate and high scenarios to identify future requirements for engineering companies and trained personnel in Newfoundland. It also makes a number of recommendations as to how the industry, government and training institutions should respond to these requirements.

As has been noted above, MUN, the College of the North Atlantic and private colleges in Newfoundland, and similar institutions elsewhere in Atlantic Canada, are paying close attention to, and responding to, such reports and developments in the oil industry.

7 CONCLUSION

The White Rose project represents the next stage in the evolution of Newfoundland and Labrador's, and Canada's, offshore oil and gas industry. In moving forward with the development of the White Rose oilfield using a FPSO, Husky Oil is committed to the development of a sustainable industry through all stages of the oilfield cycle. In particular:

- Husky Oil believes that benefits to petroleum companies, Newfoundland and Labrador, and Canada as a whole, will be substantially increased through the simultaneous pursuit of a variety of projects in an exploration, delineation, development and production context.
- The proposed project builds on past industry development, and in particular the Hibernia and Terra Nova projects, and provides continuity in future local procurement and labour requirements.
- The benefits beliefs, principles and process described in Chapter 2 provide a proactive framework for success in maximizing the benefits derived from the Project and industry in all their phases. The policies and procedures in Chapter 3 provide a rigorous mechanism for ensuring there is an effective delivery of benefits within the framework of these beliefs and principles.
- The development and production scenarios described in Chapter 4 spell out the opportunities afforded to Newfoundland, Labrador and Canada. Husky Oil's preferred development option, an FPSO, will allow Newfoundland and Labrador, on a competitive basis, to develop and expand on cutting-edge skills and technologies that present growth opportunities in Canada and internationally.
- The procurement requirements, as described in Chapter 5, are such that a wide range of consumables and contracted services can be acquired in Newfoundland and Labrador and in Canada as a whole.
- The labour requirements (Chapter 6) are substantial, totalling approximately 12.2 million person-hours over the life of the project, the great majority of which will be located in Newfoundland and Labrador. The largest components are operations/production (43 percent of the total labour requirement) and topsides fabrication (12 percent), hull fabrication (10 percent), management (9 percent) and production drilling (9 percent).
- These procurement and labour requirements are such that the Project will make a very substantial contribution to the economy and society of Newfoundland and Labrador (for further details on this, see the Socio-Economic Impact Statement (Comprehensive Study Part Two)).
- However, the total benefits accruing to Newfoundland and Labrador, and to Canada, will be dependent on the ability of companies to be internationally competitive. This is the key to success not only in respect to the White Rose project but also the development of a sustainable domestic offshore oil industry.

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9 DEFINITION OF ABBREVIATIONS, ACRONYMS AND TERMS

10^3. The abbreviation for thousand.

10^6. The abbreviation for million.

10^9. The abbreviation for billion.

abandonment. The decommissioning of facilities and removal of offshore structures following exhaustion of reserves.

APEGN. Acronym for Association of Professional Engineers and Geoscientists of Newfoundland.

ASME. Acronym for America Society of Mechanical Engineers.

as spent. Value at the time incurred.

bbl. The abbreviation for barrel.

best value. A blend of total cost, quality, technical suitability, delivery and continuity of supply and service.

BOPD. Abbreviation for barrels of oil per day.

Capex. Acronym for capital expenditure.

CAPP. Acronym for Canadian Association of Petroleum Producers.

CCDO. Acronym for Canada Classification and Dictionary of Occupations.

C-CORE. Acronym for Centre for Cold Ocean Resources Engineering.

CEAA. Acronym for *Canadian Environmental Assessment Act*.

C-NOPB. Acronym for Canada-Newfoundland Offshore Petroleum Board.

COPS. Acronym for Cougar Offshore Personnel System.

Development (White Rose Oilfield Development). "Development" refers to all phases of the project, from the decision to go ahead with construction through to abandonment of the field.

Development Application. The official title of the documentation submitted in support of the White Rose oilfield development. The Development Application includes: Project Summary; Canada-Newfoundland benefits Plan (Volume 1); Development Plan (Volume 2): Environmental Impact Statement (Comprehensive Study Part One); Socio-Economic Impact Statement (Comprehensive Study Part Two); and Concept Safety Analysis/Safety Plan (Volume 5).

DFO. Acronym for federal Department of Fisheries and Oceans.

direct effects. The expenditure, income and employment created by Terra Nova construction and operation.

direct employment. Individuals involved in the design, construction, installation, operation and maintenance of all main field components during the development and production stages.

DITT. Acronym for the Newfoundland Department of Industry, Trade and Technology.

DSV. Abbreviation for diving support vehicle.

DWT. Abbreviation for dead weight tonnage.

EPIC. Acronym for engineer, procedure, install and construct.

FEED. Acronym for front end engineering and design.

First Oil. Milestone achieved when the first shuttle tanker has been filled with oil from the White Rose production system and the shuttle tanker disconnects from the offloading system. The entire production system is handed over to operations personnel at this point. This is the first quantity of oil to be delivered from the reservoir through the complete production and offloading system, including fiscal metering.

floating production system. A monohull or semi-submersible vessel with equipment suitable for producing hydrocarbons.

FPF. Acronym for floating production facility.

FPSO. Acronym for floating production, storage and offloading facility.

FSU. Acronym for floating storage unit.

HRDC. Acronym for Human Resources Development Canada.

indirect employment. Individuals employed in the offsite manufacture and supply of material inputs required by oil-related activities.

IMT. Acronym for Integrated Management Team.

KSLO. Acronym for Kvaerner-SNC Lavelin Offshore.

LWD. Acronym for logging while drilling.

m. The abbreviation for a) metre or b) earthquake magnitude.

m^2 . The abbreviation for square metre.

m^3. The abbreviation for cubic metre.

MODU. Acronym for mobile offshore drilling units.

monohull. A ship-shaped vessel.

MUSIC. Acronym for Memorial University Seismic Imaging Consortium.

MWD. Acronym for measurement while drilling.

NOC. Acronym for National Occupation Classification; a category of codes of various major skilled trades.

NOIA. Acronym for Newfoundland Offshore Industries Association.

Operations Phase. The period following First Oil until cessation of all oil production from the White Rose oilfield. Includes post-First Oil development drilling, offshore installation activities, production, operations, maintenance, well abandonment, decommissioning and removal from the White Rose oilfield of all facilities, equipment and vessels used in the production system.

Operator. When capitalized in the Development Application, refers to Husky Oil.

Opex. Acronym for operating expenditure.

OTANS. Acronym for Offshore Technologies Association of Nova Scotia.

OTTF. Acronym for Offshore Technology Transfer Fund.

Owner/Operator. When capitalized in the Development Application, refers to Husky Oil.

PAU. Acronym for pre-assembled unit.

POB. Acronym for persons on board.

Pre-Engineering. All of the engineering work undertaken before the Project Phase to determine the preferred floating production system for White Rose. Begins with the invitation to submit alliance qualification proposals through selection of the three alliance groups, through selection of the preferred production system and alliance. Includes further definition engineering work with the preferred alliance up to the commencement of the Project Phase.

Project Phase. The period beginning with regulatory approval of the Development Application and the Proponent's authorization to execute the White Rose oilfield development, up to the production and offloading of First Oil. Includes detail engineering, procurement, construction, commissioning, installation and development drilling up to First Oil. Does not include development drilling after First Oil.

R&D. Acronym for Research and Development.

Regulatory Phase. The period and activities associated with the regulatory review of the Development Application. Commences with the filing of the Development Application and ends upon receipt of approval.

reserves. That part of an identified resource from which a usable mineral or energy commodity can be economically and legally extracted at the time of determination.

reservoir. A subsurface, porous, permeable rock body in which oil or gas has accumulated; most reservoir rocks are limestones, dolomites, sandstones, or a combination of these.

resource. An initial volume of oil and gas that is estimated to be contained in a reservoir.

ROV. Acronym for remotely operated vehicle.

semi-submersible. A drilling or production vessel that has the main buoyancy chambers (pontoons) below the active wave zone to provide enhanced vessel stability.

shuttle tanker. A ship with large tanks in the hull for carrying oil or water back and forth over a short route.

t. The abbreviation for tonne (a metric ton).

topside (or topsides) facilities. The oil- and gas-producing and support equipment located on the top of an offshore structure.

turret. A low, tower-like structure capable of revolving horizontally within the hull of a ship and connected to a number of mooring lines and risers. It allows the ship to rotate with the weather while maintaining a fixed mooring system.

White Rose Development. "Development" refers to all phases of the project, from the decision to go ahead with construction through to abandonment of the field.

WRDC. Acronym for Women in Resource Development Committee.

APPENDIX A

Harnessing the Potential
NOIA Ocean Industries Association
Section 3: Atlantic Canadian Capabilities

Section Three - Atlantic Canadian Capabilities

This section provides an analysis of Atlantic Canada's capabilities with respect to the goods, services and expertise required for upstream and downstream oil and gas activities. In this analysis, the value chain for the oil and gas industry is segmented into the categories of exploration, development, production, transportation and storage, refining and distribution.

In addition to requiring goods and services, the oil and gas industry requires expertise, skilled labour, research and development institutions, training institutions, and infrastructure such as fabrication, marine support and other support facilities. Each of these requirements is discussed in terms of Atlantic Canada's ability to provide the goods or services.

3.1 The Oil and Gas Value Chain

Figure 2 on the following page illustrates the oil and gas value chain and delineates the major value chain components in greater detail. A more detailed analysis of some of the major product and service categories as illustrated in Figure 2 is attached as Appendix C. This analysis describes in greater detail some of the specific goods and services required in the value chain and the capabilities of Atlantic Canadian companies to supply them. It is not intended to be exhaustive, but representative of some of the more significant value chain activities. It is also important to observe that many of the goods and services are required in various sectors of the value chain: remote communication services, for example, are used throughout the value chain.

Each of the supply chain requirements for the oil and gas industry is discussed in terms of Atlantic Canada's supply capability, labour force, training institutions, and research and development capabilities.

3.2 Supply Capabilities

Exploration

Atlantic Canadian companies have been providing exploration support services, supplies and equipment to the offshore and onshore oil and gas industry for over 30 years. As a result, the region has developed a supply capability for exploration support services, materials and equipment. However, the largest single expenditure for exploration – rental of seismic vessels and drilling rigs – has typically leaked from the regional economy. Most of the other supplies and services are readily available within the Atlantic Canadian economy.

Development

The experience acquired from the development of the Hibernia field has assisted Atlantic Canadian industry to acquire expertise and skills applicable to other development projects. While the Hibernia platform is unique, the Terra Nova Floating Production, Storage and Offloading (FPSO) production system is considered a model for future developments. The Terra Nova project should transfer technology to Atlantic Canadian firms in the fastest growing field of offshore oil production – subsea technology. The acquisition of local expertise in this area is critical to the long-term development of the region's industry. This is not only true for subsea technology, but also for other construction and development techniques such as advanced slipforming, fabrication and welding. The successful transfer of such technology will facilitate the participation of Atlantic Canadians in the next generation of frontier offshore oil and gas developments, at home and around the world.

The Sable Offshore Energy Project is another example of utilization of leading-edge technology. The Sable gas fields will be developed through a series of four interconnected production platforms designed to extract gas from six different fields. The project is being developed over a 23-month period, 6 months less than the industry standard for similar projects. Hundreds of Nova Scotian and Canadian firms have won contracts for various components of the Sable Project in all phases of the project from the fabrication of jackets to the construction of the pipelines and onshore processing facilities.

The development of offshore production facilities involves greater financial outlays than the development of onshore fields. Consequently, there is great potential for significant employment and industrial benefits to Atlantic Canada. The vast scale of these projects also introduces the possibility – if not probability - that very large components of development projects will be sourced from elsewhere in the world. As the region's capabilities increase, however, Atlantic Canadian businesses should be able to take advantage of their geographic proximity to secure contracts without compromising the "best value" principle. With development projects anticipated to occur regularly throughout the next two decades, it is critical for local firms to develop further expertise and experience in designing, engineering, fabricating, constructing and supplying components for offshore production facilities.

The region has solid base of offshore fabrication facilities, shipyards, deep-water ports, marine repair facilities and other heavy industrial infrastructure to support the development of future projects. For example, Newfoundland's Bull Arm site, where Hibernia's Gravity Base Structure was built and mated to the platform's topsides, has undertaken fabrication work for two of Terra Nova's topsides modules. Similarly, yards in Nova Scotia are fabricating various components for the Sable Offshore Energy Project. The St. John Shipyard in New Brunswick has produced components for the Hibernia project, as well as for offshore platforms and for drilling and supply vessels.

However, without access to the engineering, design and procurement operations associated with East Coast oil and gas developments, Atlantic Canada's resident capability is set at a serious disadvantage. The importance of developing heavy industrial infrastructure in the region goes beyond direct

employment of skilled workers; it provides Atlantic Canadian suppliers with opportunities to compete for a vast range goods and services contracts. Location of engineering, design and procurement operations within the region will enhance networking and enable Atlantic Canadian businesses to develop relationships with key project functions and personnel, improving their chances of success in the bidding process.

Production

By their nature, many production-related business opportunities are captive to the regional economy. Many day-to-day requirements (catering, for example) are most economically provided from the local economy. While these activities can provide positive economic impacts, mechanisms must be put in place to ensure that more than just geographically captive supplies are provided locally. Where the servicing contracts require outside expertise, local firms have formed joint ventures or strategic partnerships with foreign companies. This combination of local experience and technical expertise has proven to be a win-win situation for many Atlantic Canadian companies.

The goal of government and industry should be to ensure that more value-added and knowledge-based business opportunities are captured locally. Such opportunities are often highly profitable and reasonably secure, because competitive advantage lies in knowledge and expertise that is acquired slowly through experience and can not be readily or easily substituted. Furthermore, these skills will endure and are adaptable beyond the producing life of any one particular project.

Downstream

In addition to crude oil, refineries require a wide variety of goods and services including energy, chemicals, maintenance and repair services, equipment, support services and transportation services. Atlantic Canada has been supplying refineries for many years and capability exists to supply most of the goods and services required to support the operation of oil refineries.

The Maritimes and Northeast Pipeline will tremendously increase the region's downstream capabilities in the distribution of natural gas. The project owners estimate that over 40percent of expenditures will be incurred in Nova Scotia and New Brunswick. In addition, lateral pipelines are being considered and plans are being made to convert thermal power plants to natural gas. The planned $600 million upgrade to Irving Oil's New Brunswick Refinery will enable it to utilize natural gas from the Sable Offshore Energy Project. These developments will form part of a fully integrated natural gas industry in the region.

3.3 Labour Capabilities

A broad range of skills are required throughout the oil and gas value chain. These range from geologists, to chemical engineers, to production supervisors, to drilling rig workers. Indirectly, the industry supports

other workers, including welders, pipefitters, accountants, environmental scientists and lawyers. In addition, for each direct and indirect job created, induced employment is created as those employed directly and indirectly spend their income on food, housing, entertainment, personal services and other activities. When all of the potential impacts are considered, the industry can be expected to provide an additional 3 to 4 jobs for every direct job created.

Atlantic Canadian workers generally have the skills required for most upstream and downstream activities. However, on the Hibernia development project, some specialized labour, including senior engineering and project management personnel, was brought in from elsewhere. The need to import these high-level skill sets will diminish over time, as the total range of skills necessary to sustain a regional upstream and downstream oil and gas industry becomes resident in the region.

The experience to date on the Cohasset-Panuke and Hibernia projects indicates that Atlantic Canada has the ability to supply most of the labour required. The Hibernia project, for example, employed over 6,000 people in Newfoundland at its peak during September 1995. This illustrates that Atlantic Canada can provide the majority of the workers required for any development project. For the entire project, over 66percent of the direct labour used on the Hibernia project was from Newfoundland and another 12percent from Canada, for a total Canadian content of 78percent. Now in its operations phase, the Hibernia project team consists of 700 direct workers, 85percent of whom are Newfoundlanders. This percentage is expected to increase toward 100percent as succession plans are implemented, moving Newfoundland employees into senior management positions.

The Sable and Terra Nova projects will also employ many local people. As with Hibernia, some expertise will be brought in from outside the region to oversee the development and transfer expertise and skills to the local labour force. The long-term goal, however, must remain to train people and transfer technology to the region.

3.4 Training Capabilities

Industry-specific and general trades training is offered at colleges and universities throughout Atlantic Canada. Some of the course offerings have recently been developed, while others have been in existence for many years. This section reviews some of the more relevant college and university programs available in Atlantic Canada.

College of the North Atlantic

The College of the North Atlantic is Newfoundland’s public college system and offers offshore-related programs at a specialized offshore campus located near St. John's. This facility has a full-size refurbished drilling rig and a well control simulator used for certification training. Through its affiliation with the Petroleum Industry Training Service (PITS) of Alberta, this facility will be developing certification training programs in other areas. The College’s main oil-and-gas-specific offering is a

three-year Petroleum Engineering Technology Diploma course, which trains students in all aspects of the oil and gas industry.

Memorial University of Newfoundland

Memorial University of Newfoundland (MUN) has faculties, research facilities and training centres whose activities directly relate to the offshore oil and gas industry.

The *Faculty of Earth Sciences* offers bachelors, masters and doctoral degrees in geology and earth sciences. It is also home to the *Centre for Earth Resources Research* (CERR). This $27 million facility was built with a grant from the Canada-Newfoundland Offshore Development Fund. It houses the Faculty's research labs and equipment used by both the academic community and the private sector.

Memorial University's *Faculty of Engineering* is well known throughout Canada as a pioneer in co-operative education. The co-op education program was established in the late 1960s, and since that time over 1,500 students have participated in oil and gas related work terms in civil, mechanical, electrical and environmental engineering. The Faculty has worked in close cooperation with the oil and gas industry through its work term placements and has provided many of the skilled engineers working in the region's oil and gas industry.

Memorial University's *Marine Institute* also offers oil-related courses through its *Centre for Marine Simulation* (CMS). Utilizing the Centre's six simulators (see Section 3.5 for an overview), the CMS offers courses in areas such as Bridge Resource Management, Advanced Maneuvering, Tanker Loading and Crude Oil Washing techniques. With applications in all marine industries, these courses provide Atlantic Canadians with the skills necessary to ensure the development of an integrated oil and gas industry.

Dalhousie University

Dalhousie University has had a long commitment to Ocean Studies with programs in oceanography, marine affairs, and marine and environmental law. Building on its Ocean Studies experience, the University has formed The Centre for Petroleum Engineering. It combines the expertise of the University's Civil Engineering, Oceanography and Earth Sciences departments to undertake basic research and development, to train practicing professionals and to train students to meet the ongoing and future demands of the industry. DalTech - a division of the Department of Civil Engineering - is offering a graduate diploma program in Petroleum Engineering. This program offers university and college graduates an opportunity to learn about the oil and gas industry for employment in any upstream or downstream sector.

Nova Scotia Community College

The Nova Scotia Community College (NSCC) system, working in close consultation with industry and regulatory agencies has recently announced a new Gas Technician training program. This nationally accredited program has been developed to the highest standards for training in North America. It will produce skilled technicians who will become an integral component of Nova Scotia's transition to a natural gas producing and consuming region. The College also has a specialized *College of Geographic Sciences* providing post-secondary and post-graduate courses in geographic information systems, mapping, surveying, and remote sensing.

The NSCC is also building a new training facility for training in electrical technologies. The *Atlantic Canada Centre for Electrical Technologies* (ACCET) will provide training in the installation and maintenance of electrical equipment and systems in hazardous environments. The NSCC is working in partnership with a division of Aberdeen College - Aberdeen Skills and Enterprise Training Ltd. - to build this $1.2 million facility and establish the training programs.

University of New Brunswick

The University of New Brunswick has an *Ocean Mapping Group*, which has developed proprietary technology allowing for 3-D images to be generated from sonar and other sensors. This system was used to investigate the ocean floor where the Hibernia GBS is now secured. It has also been employed for the Sable Project to map the route for the subsea pipeline.

Safety Training Centres

The region is also home to two safety training centres.

Survival Systems Ltd. of Dartmouth Nova Scotia provides training in Basic Survival Training, Sea Survival, Offshore Survival Craft Training and other marine-related safety training programs. Since its establishment in 1982, the company has trained in excess of 10,000 offshore workers. The company has developed its proprietary Modular Egress Training Simulator (METS) which simulates marine aircraft crashes and has sold 14 units of the system around the world.

The *Offshore Safety and Survival Centre* (OSSC) is a division of Memorial University of Newfoundland's Marine Institute. The Centre offers offshore safety and emergency response training for industrial and government clients.

3.5 Research and Development Capabilities

This section assesses the institutional capability within Atlantic Canada to support the oil and gas industry. Institutional capability refers to public and private research and development facilities and

institutes. A well-developed R&D capability is critical to the development of a sustainable world-class oil and gas industry in Atlantic Canada. The development of oil fields in a harsh marine environment requires a significant amount of basic – as well as applied - research for both in Atlantic Canada and in the next generation of frontier oil and gas developments.

Table 11 below lists the facilities within Atlantic Canada that provide these critical research and development support services. Further information on each can be found in Appendix D.

Table 11 Atlantic Canadian Research and Development Institutions

Name	Location	Description
Centre for Cold Ocean Resources Engineering (C-CORE)	St. John's, Newfoundland	Applied engineering research institute of Memorial University of Newfoundland (MUN) that undertakes research which "contributes to the economic development of Canada's marine resources".
Bedford Institute of Oceanography (BIO)	Dartmouth, Nova Scotia	Canada's largest centre for ocean research, BIO is the federal government's first dedicated oceanography research centre. It undertakes government-mandated research, advises on marine environments, including hydrocarbon resources, and provides navigational services through the Canadian Hydrographic Service.
Institute for Marine Dynamics (IMD)	St. John's, Newfoundland	Engineering research lab established in 1985 by the National Research Council as Canada's national centre of excellence for ocean technology research and development.
Ocean Engineering Research Centre	St. John's, Newfoundland	Part of Memorial University's Faculty of Engineering and Applied Sciences providing R&D and consulting services focused on offshore and ship-building industries and ice interaction research.
Ocean Mapping Group (OMG)	Fredericton, New Brunswick	Based at the University of New Brunswick, the OMG develops 3-D visualization and other technologies to support marine activities.
Alliance for Marine Remote Sensing (AMRS)	Bedford, Nova Scotia	AMRS is an international not-for-profit association that develops and promotes marine applications of remotes sensing technology, including offshore oil and gas applications. It has over 600 members from 28 countries and provides an important international link in the field of remote sensing.
The Nova Scotia Innovation Corporation (InNOVAcorp)	Dartmouth, Nova Scotia	This provincial crown corporation provides scientific, engineering and business support services to Nova Scotian-based technology companies.
Canadian Centre for Marine Communications (CCMC)	St. John's, Newfoundland	Identifies advanced communications technology with potential marine applications and assists industry in developing technology into commercial marine equipment and services.

Name	Location	Description
Centre for Offshore and Remote Medicine (MEDICOR)	St. John's, Newfoundland	Part of Memorial University's Faculty of Medicine, established in 1982 to carry out R&D related to health aspects of offshore oil, marine, diving and other remote environmentally stressful or hazardous industries.
Centre for Marine Simulation	St. John's, Newfoundland	Based at Memorial University's Marine Institute, the CMS has six marine simulation facilities: Ship Bridge Simulator, Ballast and Cargo Control Simulator, Propulsion Plant Simulator, Navigation and Blind Pilotage Simulator, Global Maritime Distress and Safety System Simulator, and Dynamic Positioning Simulator.
Centre for Earth Resources Research (CERR)	St. John's, Newfoundland	A unit of Memorial University's Earth Sciences Department that partners with industry on basic research, collaborates on international contracts and provides companies with access to equipment and expertise on fair market value basis.

As illustrated in Table 11 above, Atlantic Canada has a sound base of research and development institutions focused primarily on marine-related industries. In the past, these facilities were devoted to other marine areas such as the fishery, or general ocean research. The greater emphasis placed on the offshore oil and gas industry represents the next logical progression in the further development of this world-class marine-related R&D expertise. If leveraged appropriately, this impressive array of research and development capability can be critical to the long-term success of the industry.

APPENDIX B

Offshore Fabrication Facilities in Eastern Canada

FABRICATION FACILITIES IN EASTERN CANADA

This Appendix is included to provide a high level indication of fabrication and construction facilities in Eastern Canada that offer specific capabilities and capacity for work associated with the construction phase of the White Rose development. This information was obtained by Husky Oil in response to a written survey distributed to all the respondents in February, 2000.

1.0 FRIEDE GOLDMAN NEWFOUNDLAND LIMITED

1.1 Company Description

Friede Goldman Newfoundland Limited (FGN) is owned and operated by Friede Goldman Halter Incorporated. FGN offer construction, fabrication and engineering services for offshore, heavy industrial fabrication, shipbuilding and repair, with separate offshore fabrication (Cow Head) and shipyard facilities. FGN have experience in offshore module fabrication for the Hibernia and Terra Nova projects, as well as rig conversion projects for the Gulf of Mexico. FGN maintains the highest national structural welding accreditation for steel (to CSA W47.1, Div.1) and expertise in the manufacture of pressure vessels, fittings and piping supported by ASME U-stamp certification.

The normal combined workforce of the Cow Head Fabrication and Marystown Shipyard sites is 997 persons, including management, administration and skilled labour, with a peak work force of 1,200.

FGN's project management system is based on a customized in-house system of integrated software systems using Visual Basic, MS Access, Powerhouse and MS Project. The company's quality assurance/quality control system is compliant with ISO 9002:1994.

In the past five years, FGN has completed:

- fabrication of structural modules for the semi-submersible *Glomar Celtic Sea* for Amfels Inc.;
- fabrication of structural modules for the semi-submersible platforms *Bingo 9000-1* and *9000-2* for FGO East;
- fabrication of structural modules for EVA 4000 conversions of semi-submersibles *Max Smith, Jim Thompson, Paul Romano* and *Amos Runner* for FGO West; and
- construction, test and trial of two fire fighting, docking and escort tugs for the Newfoundland Transshipment Terminal.

The company's offshore project list also includes:

- three topsides-mounted structures for Hibernia: two drilling modules and one pipe rack;
- mooring pontoons, permanent ballast system, soffit panels, deformation tubes, bailey brackets, access towers and permanent embedment plates for the GBS of Hibernia;
- two offshore support vessels, the *Maersk Norseman* and the *Maersk Nascopie*, for Hibernia;
- refit and upgrade of the *Glomar Grand Banks* and the *Henry Goodrich* semi-submersibles for the Terra Nova project;
- super-duplex pipe spools and pile guide support frame for the Terra Nova Project; and
- refit of the semi-submersible Seco 714 for the White Rose delineation drilling program.

1.2 Facilities Description

1.2.1 Cow Head Offshore Fabrication Facility

This facility, completed in the early 1990s, covers a land area of 8.1 ha and includes a fabrication building of 1.4 ha and an "L" shaped dock of 44 m length along the front face, and 78 m along the inner face. Water depth at the outer dock is 15 m lowest low low tide (LLT). There is also an adjacent load-out wharf built primarily for skidding large assemblies directly onto barges. The wharf face is 30 m long, and the minimum water depth is 6.9 m. The dock is rated at 10 t/m^2. The facility allows MODUs with a maximum draft of 15 m to be towed directly alongside docking areas so repair and service work can be performed from land.

The offshore fabrication facility consists of several interconnected buildings, the largest of which is the outfitting and assembly building at 3,360 m^2. This building contains two 50-t and one 20-t, cab-controlled cranes with 17 m under the hook, one computer numerically controlled flame cutting machine, two automated submerged arc welding machines, twenty shielded metal arc welding machines, eight sets of rollers for large diameter pipe, 52 gas metal arc/flux welding machines with 15-m extended push-pull feeders systems and two portable plasma arc cutting machines.

There are separate high alloy pipe and carbon pipe prefabrication areas, each 672 m^2 in area. These are paired with high alloy pipe and carbon pipe fabrication areas, each 705 m^2 in area. All are equipped with handling and fabrication equipment, 5 t cranes with 5 m under the hook and 1-t jib cranes. The high alloy pipe fabrication area is air conditioned for proper control of temperature and humidity to facilitate welding of titanium.

The main fabrication shop for cutting steel is 1,960 m^2 in area, with a 15 and 10-t crane, each with 5 m under the hook and configured to travel directly into the main outfitting and assembly area. This building features (among a wide range of equipment) a 1,000 mm capacity cold cut saw complete with stockyard, infeed and discharge conveyors and side transfer systems, eight portable flame cutting machines, and a CNC plasma marking/oxyfuel cutting and bevelling machine with a cutting area of 9 m x 19 m.

The facility at Cow Head also includes a 1,200 m^2 maintenance and electrical shop/administration building, a 17.6 m x 20 .5 m shot blast and painting hall, an X-ray bunker designed to Canadian Atomic Energy Authority specifications, and various stores, office, control room, and fabrication related areas.

Recent acquisitions include a 750 t Manitowoc crawler crane with ringer configuration, a 300-t Lima crawler crane, an ESAB Avenger 2 CNC profile cutting machine, 600-t multi-wheel transporters, and open end rolls. Since 1996, increased capacity has been achieved in the fabrication shop and the paint shop has undergone an extension.

1.2.2 FGN Shipyard Facility

The principal fabrication and assembly building is 116 m by 32 m, with 17 m under the crane hook. The crane capacity in the building is 2 x 53 t. There are 15 shops and buildings on the site, including a 22 m x 9 m blasting and paint shop, a 61 m x 24 m joiner's shop, and machine, pipe fitting and sheet metal shops.

The yard also includes a Syncrolift® and side transfer system consisting of a platform 76 m in length by 19.6 m wide, with a lift capacity of 3,000 t. There are several docks, the longest of which is 137 m and the minimum water depth alongside is 9 m.

2.0 PCL INDUSTRIAL CONTRACTORS (BULL ARM)

2.1 Company Description

While the Bull Arm Site Corporation is the owner of the asset, the present lease with PCL Industrial is for the duration of the Terra Nova project and expires on December 31, 2000. However, this lease has provision for a six-month extension if required, for the Terra Nova project.

PCL Industrial has a joint venture with Brown & Root and Energy Services and ConPro Group Ltd., called Bull Arm Fabricators. This joint venture operates the Bull Arm site, having negotiated with Bull Arm Site Corporation for its use.

As part of the Terra Nova development, PCL Industrial is responsible for the fabrication of all topsides modules for the FPSO, with the exception of the upper turret. At the inshore hook-up phase, PCL is responsible for the lifting and installation of all topsides modules, including the upper turret, hook-up, and to assist with commissioning at the Bull Arm site. The two process modules for Terra Nova, known as M03 and M05, were fabricated in BARMAC's yard in Ardersier, Scotland. PCL is coordinating the sea transportation to Bull Arm using a piggyback barge arrangement. The utility modules, known as M02 and M04, along with the main generation module, M09, were fabricated at Bull Arm. In addition, the 100-m high flare as well as loose fabricated items at the stern of the vessel and piperack were also fabricated at this site. The total fabricated weight for the Terra Nova project at Bull Arm is approximately 4,800 t.

The Terra Nova Alliance also uses Bull Arm as a staging area for some of its marine operations. This includes the receipt and fit-up of the spider buoy, receipt and preparation for main mooring chains, fabrication of fifteen gravity bases for flowlines, and receipt and final assembly of the main taurus connector for the base of the lower turret. During the fabrication phase of the work, the unionized workforce peaked at approximately 900 people. It is anticipated that the peak during the hook-up phase in July-August, 2000, will be approximately 1,000 people, working two 60-hour/week shifts.

2.2 Facilities Description

As part of the lease arrangement with the Bull Arm Site Corporation, PCL Industrial has control, care and custody of the entire Bull Arm site, which comprises of approximately 2,833 ha of land, as well as the water lot lease contained in the area of Bull Arm. The site is located at the head of Great Mosquito Cove on the west side of Trinity Bay, Newfoundland. This cove is 1.5 km long and has an average width of 500 m. Water depth in the cove's inner section varies from 15 to 35 m, while the water at the outer section is 150 to 180 m deep. The site has a 14-km paved internal roadway.

Essentially, the Bull Arm site infrastructure remains the same as was developed and used for the Hibernia project, with the following exceptions:

- The Bull Arm Site Corporation has dismantled the camp, and all of the accommodations have been sold. Some accommodation units remain on site, but are ready for shipment. Under the sales agreement, the Bull Arm Site Corporation will have these units removed from the site by June 2000.
- The kitchen facility has been completely dismantled by the Bull Arm Site Corporation and remains a shell building not used by PCL. The recreation building, gymnasium and pool are intact and remain unused. The fire hall/medical clinic is intact, however, it is essentially unused with respect to the Terra Nova project.
- The Back Cove area of the site, which was used for access to the deep-water area for Hibernia, again is unused. The portable cabins and locker rooms in this area have been dismantled and removed.

The small wharf facility constructed for the shuttle ferries to and from the GBS remains. The large building in this area used for pre-stress storage is intact and is used by PCL for dead storage.

- The topsides area of the site (formerly known as the PASSB area) has essentially been in full operation for the Terra Nova project. The one exception is the 5,575 m^2, two-storey administration building that has remained closed for this project. All staff, administrative functions, and engineering functions have been accommodated in the general shops building, second floor area.

Various pieces of portable automated equipment have been purchased by PCL for the Terra Nova project to enhance production of the site. The Terra Nova project required considerable more pipe spooling than was previously required for Hibernia. In fact 5,500 pipe spools have been fabricated for the project. This comprises approximately 65 percent alloys and 35 percent carbon steel.

The topsides pier and quay area have remained intact for the Terra Nova project and are used as the main staging area. The large module supports for the Hibernia project, located on top of the pier, have been removed to facilitate load-outs.

In the drydock area, all of the upper buildings remain intact and are used for dead storage. The major exception in this area is the 18,580 m^2 rebar building that was converted into a large pipe fabrication facility. This building accommodates up to 150 workers fabricating all types of alloys for the Terra Nova project, including the duplex, super duplex, copper-nickel, titanium and stainless steel. This building was upgraded electrically, and gas distribution systems were added to accommodate this work, along with the installation of automated sub-arc equipment and rotators.

The major investment made by the Terra Nova project at the Bull Arm site was the extension to what was formerly known as the NODECO quay. This quay, approximately 100 m in length, has been extended by an additional 75 m. It is in this location that the Terra Nova FPSO hull will be moored for the installation and hook-up phase of the work. Considerable excavation and rock removal was required in order to maintain a 50-m wide service area to the vessel. The minimum water depth is now 10 m, sufficient to receive an FPSO vessel. This facility is now complete with stair access towers; lifts; and temporary power, both for construction and 10 mva for commissioning power.

During the hook-up and commissioning phase at Bull Arm, the topsides facility will be shut down and all staff will be relocated to the drydock area. The former NODECO office building will house approximately 200 staff members for this phase. The rebar shop will then be further converted into a staging area for hook-up and warehousing.

3.0 ST. JOHN'S DOCKYARD LIMITED (NEWDOCK)

3.1 Company Description

In April 1997, the Canadian Government divested itself from Newfoundland Dockyard Corporation. The new company, St. John's Dockyard Limited (NEWDOCK) assumed operations of the facilities and resources at the former shipyard. NEWDOCK is a member of the Burry and Penney Groups of Companies.

NEWDOCK's Project Management tool for scheduling and progress is Microsoft 98. Labour budgets and tracking of person-hours is with the use of Shopclock (time keeping) and Syspro Impact Encore (budget allocation). Tracking of person-hours for each project and work order is currently done with Access. NEWDOCK is currently developing the user interface between Grand Master Suite (payroll), Impact Encore and Shopclock for allocation and tracking of actual person-hours for each project and work order. Performance measurement is with the aid of Access and Impact Encore downloaded into a spreadsheet format report, providing various levels of performance and efficiencies for each task.

NEWDOCK maintains a quality assurance department responsible for quality assurance and quality control for each individual contract and for liaison activities with customers and representatives of regulatory authorities. Quality control procedures assure in-process and final inspections. Policies and procedures are certified to ISO 9002 and in addition, meets or exceeds the requirements of CSA.Z. 299-3, AQAP-4 and MIL-1-452084. The company also maintains a Provincial Certificate of Authorization for Pressure Piping and is certified by the Canadian Welding Bureau.

Recent offshore projects completed at NEWDOCK include:

- HOST systems (subsea templates and manifolds) for the Terra Nova Development;
- tether connection device, flowline anode fabrication, and intermediate connection collars for Coflexip Stena International;
- offshore service support for both FMC Energy Systems and the Hibernia Management and Development Company; and
- offshore loading system bases and batch plants for Hibernia.

3.2 Facilities Description

NEWDOCK occupies 7.5 ha at the west-end of St. John's harbour, including 6,550 m^2 of interior production space. The current workforce is 280 persons, and the yard capacity is approximately 30 t of steel per week.

A new subsea service hall has recently been erected and occupies a space of 1,010 m^2. It is serviced by one 60-t and one 13.5-t overhead crane, each with 16 m under the hook. This hall accommodates all major subsea assembly, stacking, integration and test activities.

A prefabrication shop occupies 1,285 m^2 of area and is serviced by two 5-t overhead cranes. This area furnishes all major fabrication equipment including automatic burning equipment, numerically controlled plasma-arc cutting table, plate rollers (7. 925 m in width and 32 mm rolling), power rollers, punch and shears.

A fabrication shop occupies 520 m^2 of area and is serviced with two 5-t overhead cranes. This building is equipped with minor fabrication equipment such as shears, drills, iron workers, saws, bed jointers and spindle shapers.

A sub-assembly is 340 m^2 and is serviced by two 5-t overhead cranes. An assembly/machine shop occupies 530 m^2 of area, and is designed to accommodate all major assembly and machining projects. It is serviced with one 80-t overhead crane and one 15-t overhead crane.

A stainless steel pipe shop is environmentally controlled with an area of 338 m^2 and serviced by a 2-t overhead crane. A hydraulic/pipe testing shop of 340 m^2 is used to execute construction, flushing and testing procedures pertaining to hydraulic systems and installations. This shop is also environmentally controlled and serviced with a 2-t overhead crane.

A blast and paint shop of 570 m^2 in area is serviced with two 5-t cranes. This facility is complete with a blast room enclosure, climate controlled painting areas and designated storage.

A machine shop occupying an area of 335 m^2 can handle up to 1,500 mm boring and is designed specifically for small machining projects. There are also separate electrical and maintenance shops at 380 m^2 and 313 m^2, respectively.

Additional craneage includes 20, 40, 70 and 80-t mobile cranes. Specialized production equipment includes automatic orbital welding machines GTAW (TIG), sub-arc welding machines complete with turning rolls (25-t rolls capacity), CNC controlled Froriep floor boring machine, CNC controlled Poreba lathe, digital TOS horizontal boring mill, CNC controlled Ann Yang lathe, CNC controlled Topwell TW 50 milling machine (5-t capacity) and a CNC controlled Topwell TW 60 milling machine (6-t capacity).

NEWDOCK has a 4,000 t capacity Syncrolift® marine elevator with a platform of 20 m x 86.5 m and three 100-m repair berths. There is a graving dock with an internal length of 174 m, an entrance depth of 24 m and a depth of 10 m. A north pier is 150 m x 16 m x 9 m draught (LNT) and a south pier is 140 m x 10 m x 9 m draught (LNT). Immediately adjacent to all yard facilities is a 2 ha laydown area, which has been proposed for future development specifically for the offshore.

4.0 SAINT JOHN SHIPBUILDING

4.1 Company Description

Saint John Shipbuilding is a division of Irving Shipbuilding Inc. (ISI), a member of the privately-owned Irving group of companies. ISI owns and operates six fabrication and shipbuilding facilities ranging from small to very large, including Halifax Shipyard, East Isle Shipyard at Cardigan Bay in Prince Edward Island, Dartmouth Marine Slips and Shelbourne Ship repair, both in Nova Scotia.

ISI make widespread use of Primavera (P3) scheduling systems for project management. Both Saint John and Halifax facilities employ a common system for performance measurement based on Workpack, a system that allocates labour budgets and measures performance in terms of actual cost of work performed against budgeted cost of work scheduled and budgeted cost of work performed. ISI can claim valuable recent experience in complex project management derived from its role as Prime Contractor and Program manager for the $6.2 billion Canadian Patrol Frigate Project.

A quality assurance/quality control program is in effect, administered by Atlantic Quality and Technical Services (AQTS), an affiliate of Irving Shipbuilding Inc. that is registered to ISO 9001 standards by KPMG Quality Registrar. Saint John Shipbuilding is registered to ISO 9001:1994. Other current certifications are ASME Section VIII Division 1, CSA B51, ASME B31.1 and B31.3.

Recent offshore projects completed at Saint John Shipbuilding include:

- major components for *Marine 700* rig for Marine Drilling Companies Inc.; and
- drilling modules for the Hibernia platform.

4.2 Facilities Description

Saint John Shipbuilding occupies 28 ha on the shores of the harbour of Saint John in New Brunswick. The deep water, ice-free approaches of the Bay of Fundy provide year-round access. The average work force at the yard has typically been approximately 1,900 people, including management and administrative staff. The peak labour force at the yard is approximately 3,500. The current work force is 295 persons, owing to the completion of a contract to Container Ships with delivery scheduled for May 2000. As a result, the workforce is depleted. This rundown coincides with a very large refinery upgrade for Irving Oil that has seen the transference of much of the yard's workforce to this project, along with skilled labour from much of eastern Canada.

Ample fabrication shops and layout areas support the modular construction approach employed at the shipyard. Steel is progressively worked and assembled through the steel and outfitting shops, with erection of very large modules being completed either in the Panamax size graving dock or large

laydown areas. At present, modules up to 1,100 t can be transported and erected using Scheurle Transporters in tandem (two at 180 t and two at 350 t) and heavy lift Manitowic Ringer cranes (two at 580 t with 21-m radius). The yard has ample berthage for the offloading and loading of barges or for final outfitting of modules afloat.

There is a total of 41,000 m^2 of indoor fabrication area. The fabrication capacity is up to 850 t of steel per week.

The fabrication and assembly shop measures 287 m x 63 m and varies in height from 11 m to 26 m. It is divided into four main areas, including panel line, curved assembly, sub-assembly and main assembly. Ahead of the panel line are two CNC burning machines, each with dual plasma underwater cutting heads, one bevelling, capable of cutting 16 m x 3.6 m plates. The panel line is capable of producing flat panels up to 16 m wide x 18 m long. The panel line consists of one-sided welding machines, panel flame planers, automatic stiffener positioners, web fitting gantries, web welding gantries, workstations with ultra heavy lift systems, and a 280-t loadout station. The curved assembly area incorporates mobile pin jigs serviced with stiffener and welding gantries.

The sub-assembly area consists of a semi-automatic line served by two semi-portal 10-t cranes and a 20 t overhead hook crane. The main assembly area, where the smaller sub-assemblies are joined to form shaped units, is served by two 75-t cranes and one 10-t crane. The fabrication and assembly shop also features 1,500-t hydraulic rolls, a 500-t hydraulic press and guillotine shears.

The module hall is 110 m long x 43 m wide x 33 m in height, and is where modules of up to 1,000 t are fabricated under cover, in fully controlled conditions. A 2,013 m^2 steel shop produces a variety of small steel fabrications such as ladders and gratings, independent tanks, equipment foundations and ventilation trunks, etc. The 1,674 m^2 machine shop can be employed for large or small machining using a range of lathes, saws, planers and boring mills. The 3,080 m^2 pipe shop features a KASTO-CNC band saw and sorting machine that handle pipe from 25 to 250 mm in diameter. Two CNC bending machines process pipe up to 150 mm in diameter. A T-drill is capable of extruding tees on pipe up to 250 mm in diameter.

The yard also features an electrical/electronic workshop for the repair, calibration and testing of electrical equipment and for the fabrication of cable and connections.

The main graving dock is 455 m long (gate removed), 38.1 m wide, with a draft over sill of 12.8 m. This is a combination of inner, middle and outer docks with lengths of 146, 133, and 136 m respectfully. There is also a tidal graving dock 134 m long, 18.3 m wide with a draft over sill height of 6.7 m.

There are two piers and a Burma wharf at Saint John Shipbuilding. Pier 19 is 100 m x 7.3 m, with a water depth of 7.32 m. Piers 18 and 19 are continuous, and feature a total length of 222 m. The water

depth is 6.09 m. The Burma wharf is 176 x 8.2 m, with a water depth of 8.23 m at LLT and an extension length of 65 m.

5.0 HALIFAX SHIPYARD

5.1 Company Description

Halifax Shipyard is also a division of Irving Shipbuilding Inc. (ISI), a member of the privately owned Irving group of companies. As indicated previously, ISI owns and operates six fabrication and shipbuilding facilities ranging from small to very large, including Saint John Shipbuilding described previously in Section 4.

A quality assurance/quality control program is in effect, administered by Atlantic Quality and Technical Services (AQTS). Halifax Shipyard is registered to ISO 9002:1994.

Recent offshore projects completed at Halifax Shipyard include:

- caissons for drill rig contract through Marine Drilling Companies Inc.; and
- two AHTS vessels through offshore contract for Atlantic Towing.

5.2 Facilities Description

Halifax Shipyard occupies 18.2 ha of land on the south side of Halifax Harbour in Nova Scotia. There is an outdoor assembly area of 10,200 m^2, and additional storage and miscellaneous/laydown of 28,000 m^2. The yard underwent modernization in the early 1990s, which included a substantial extension to the assembly hall to support joining and erection of major pre-outfitted sub-assemblies. The yard's fabrication capacity is up to 250 t of steel per week.

The average work force at the yard has typically been approximately 380 people, including management and administrative staff. The labour force at the yard has peaked in previous years at 1,125.

The sub-assembly/module shop at the shipyard is 162 m x 30 m in plan, and is 22 m in height. It is fully equipped to support shielded metal arc, flux cored arc and submerged arc welding on steel and welding of aluminium, along with cutting, burning, bending, grinding, shaping and pressure welding. The shop adjoins a lifting and turning pad and slipway with a 3,500-t capacity. The entire unit and ship transfer system allows for fabrication of modules of up to 90 m in length in a controlled environment. The module shop features 50 and 44-t gantry crane with 4.8 and 13.4 m under the hook, respectively. There are also two overhead cranes, each with 10-t capacity and one 5-t overhead crane. All feature 6 m under the hook.

There is a 183 m x 23 m x 12 m plate shop with a fully automated panel line system. A burning shop at the rear of the module, and plate shops, is equipped with an N/C underwater plasma burning machine and an N/C optical oxyfuel burning machine. The yard also features project management offices, a central administration building with a attached electrical and maintenance shops, a sheet metal and paint shop, a 1,530 m^2 machine shop, a 690 m^2 pipe shop, and a 400 m^2 joiner shop.

The yard has two floating docks: a 257 m x 38 m Panamax floating drydock (with 9 m draft over keel blocks), capable of lifting up to 36,000 t displacement, and a 183 m x 30.5 m dock with 8 m draft over keel blocks. The Panamax drydock has a gate width of 38 m. Both docks feature 15-t wing wall cranes at either side, combining for a 30-t capacity at the centre.

The yard's graving dock has a 173 m length and a 23.5 m width. There is a 8 m clearance over the sill, and the dock can accommodate vessels up to 25,000 t. The graving dock gate width is 24 m.

There are two fully services piers with a combined length of 388 m and a quayside depth of 7.6 m LLT. In addition, there are 100 m of wharf frontage adjacent to the machine shop, with a 7.6 m depth.

6.0 MM INDUSTRA

6.1 Company Description

MM Industra Ltd. is a Nova Scotia company, wholly owned by American Eco Corporation, a public company traded on both the NASDAQ and Toronto Stock Exchanges, and having its main offices in Houston, Texas and Toronto, Ontario.

Between 350 and 470 persons are employed at MM Industra, with a peak labour force of 650. The company's quality assurance/quality control program is certified ISO 9002. Other current certifications include ASME U, U2, S and H stamps, and CWB 47.1 Div 1 and 2, plus W59.

Recent offshore projects completed at MM Industra include:

- two drilling jackets, 1,500 t, for Sable Offshore Energy Project;
- *North Triumph Platform*, 1,099 t, for Sable Offshore Energy Project;
- production separators for Sable Offshore Energy Project; and
- nine utility shaft module decks for Hibernia.

MM Industra also fabricated two production platforms for Panuke and Cohasset, Canada's first offshore development (1980s).

6.2 Facilities Description

MM Industra is located in Dartmouth on Halifax Harbour. Its facilities consist of a number of fabrication buildings associated, with both its main plant and an offshore assembly plant. The latter plant features a main assembly hall 90.7 m long and 29.9 m wide, with a split ceiling height of 23.8 m and 12.2 m. Fabricating equipment includes press brake, plate rolls, shears, and a CNC plasma burning table. There is a 35 m x 27.4 m marshalling area, blast and paint shops measuring 46.1 m x 18.5 m and various stores. The yard's fabrication capacity is up to 400 t of steel per week.

Craneage consists of two 36.3-t units with 9.8 m under the hook, and five 0.9-t jib cranes, all located in the main assembly shop.

Office facilities occupy approximately 750 m^2, and there are approximately 4 ha of open laydown and storage area. A common user dock approximately 230 m long and fronting 1.2 ha adjacent to the plant is used for marine loadout. Water depth at quayside is 12 m at LLT.

7.0 E.S. FOX LIMITED

7.1 Company Description

E.S. Fox Limited, established in 1934, is a privately owned all-Canadian multi-trade company. They are a pressure vessel and custom plate manufacturer, modular constructor, and pipe spool manufacturer, with main fabrication plants at Niagara Falls and Port Robinson, Ontario. The company has experience in working with a wide variety of materials, including copper, aluminium, stainless steel, carbon steel, nickel, chrome-moly steel and exotic alloys such as titanium, inconel and hastelloy, as well as fiberglass pipe and vessels, and lined pipe vessels.

E.S. Fox has developed a computer-based (D.E.C. VAX 3600) project management system that plans, schedules and monitors projects from inception to completion, reporting on schedule, manpower requirements, manpower efficiency analysis, manpower forecast, percentage completion and material costs.

A quality assurance/quality control program is in effect based on Canadian Standards Association Z299.2, 3 and 4 and ISO 9001:1994. Other current certifications include:

- ASME Section I and VIII, U, S and R stamps;
- ASME B31.1 and B31.3; and
- CWB W47.1 and W47.2.

Recent offshore projects completed at E.S. Fox include:

- fabrication/supply of water flood injection system for Chevron's *Cabina* platform off the Coast of Angola, including deaerator module (280-t), chemical injection skid, and water filtration skid; and
- twelve deluge skids for the fire protection system at Hibernia.

The company can also claim considerable relevant experience in providing services and modules to petro-chemical and energy industries, including a pre-packaged chemical plant for Puerto Esperanza Argentina, South America. Marine construction projects include construction of two 125-t marine shunters for the St. Lawrence Seaway Authority, conversion of a 143-m double-hull, tanker barge/tug combination to a cement powder/clinker self unloader for St. Mary's Cement, and fabrication of two tubular, ship unloading booms (43-t) for Kleaven Mek Verkstad A/S, Norway.

7.2 Facilities Description

The E.S. Fox module and pipe fabrication plant is located adjacent to the Welland Canal on a 70 ha industrial business park, and has in excess of 3,700 m^2 of fabrication floor space. This facility is serviced by rail and highway, and has direct water access to the Welland Canal, allowing movement of loads via barge or ship through the Great Lakes and the St. Lawrence Seaway. E.S. Fox has used its loadout facility at Port Robinson to transport vessels up to 7.6 m in diameter x 25.4 m in length. A heavy barge loading dock extends into the canal turning basin providing 3-m draught and 400-t capacity. There is also a heavy lift RO/RO dock of 800-t capacity, with 145 m of dock face and 7.6 m draught. The dock can accommodate maximum Seaway length vessels.

The fabrication shop is divided into a south bay 106.7 m x 22.8 m in plan and a north bay 64.0 m x 22.8 m. Each bay features a clear inside height of 15.2 m. The average manpower load is 60 persons, but the shop can accommodate a peak labour load of 120. Five 25-t cranes with 5-t auxiliaries are employed, with 20-m spans and 9.7 m under the hook. Equipment includes a high speed cut-off saw with automatic feed, a pipe-cutting/burning table for cutting and bevelling, two wall mounted 1-t jib cranes with 5.4-m span, and 25 welding machines, including a programmable TIG orbital welder.

A 40 m x 9 m storage building is also available on the site, as well as office premises.

The sheet metal and plate fabrication shop located on an 8 ha site in Niagara Falls offers 11,150 m^2 of indoor fabrication with a predominant height of over 9 m. A grit blasting and paint shop is included in a separate climate-controlled, 930 m^2 building serviced by bridge cranes. Docking facilities for barge and ocean going vessels are located 5 km from this plant, which is also serviced by road and rail.

8.0 VERRAULT NAVIGATION INC.

8.1 Company Description

Located near the mouth of the St. Lawrence River in Les Méchins, Quebec, Verrault Navigation Inc. is a wholly-owned subsidiary of Groupe Maritime Verreault. The focus of business activities for this division is ship repair and vessel conversion. The total workforce at Les Méchins currently stands at 166 persons, but the facilities have accommodated a peak workforce of 438. The company employs MS-Project and Excel for project management, and maintains a quality assurance/quality control system based on ISO 9002 standards. The company has a valid thickness measurements certificate from Lloyd's Register and two accredited inspectors for CWB 47.1 and 47.2 welding as part of the permanent work crew.

The company has not been involved with oil and gas projects but its recent (since 1997) marine works history includes:

- conversion of a stripped out Russian ship (*Burin Sea*) into a supply vessel;
- conversion of six ISO 6-m containers into scientific labs for the Canadian Coast Guard;
- conversion of the *Len Speer* submarine maintenance ship into an optic fibre laying ship for C.S. Agile;
- conversion of 32 ISO containers into offices, workshops, lodging, school, kitchen, freezer, generators, electric distribution, sanitaries, etc. for Cirque de Soleil; and
- conversion of the ferry *John Hamilton Gray* into a luxury casino cruise ship for Contessa.

8.2 Facilities Description

Verrault Navigation maintain 1,486 m^2 of fabrication shop area recently equipped (1999) with a 500-t Pacific press brake, a 50 mm x 19 mm Cincinnati shear, and an eight point flame cutting machine with 3 m x 6 m capacity. There are four overhead cranes, two with 25-t capacity and two with 10-t capacity. The site also has a 32 m x 24 m paint shop with 12 m height, and a 37 m x 15 m mechanical and machine shop with 7.5 m height, completely outfitted for a full range of shipbuilding operations. A new 410 m^2 office building is also located on the site.

The total yard area is 12,567 m^2, with a drydock measuring 252 m x 27.4 m and a draught of 6.7 m. The gate width is 27.4 m. A semi-submersible drydock is also available that is 36.6 m x 12.8 m, with a lifting capacity of 500 t. The yard is serviced by a 50-t Whirley crane on rails and a mobile PH crane with 90-t capacity. Total berthage at quayside is 335 m, with a water depth of 6.7 m LLT.

9.0 ATLANTIC SEABOARD INDUSTRIES LIMITED

Atlantic Seaboard Industries Limited (ASIL) is a subsidiary of Engineering Power Systems Limited in Toronto. Engineering Power Systems did not respond to the Fabrication Capability and Capacity Survey that formed the basis for this assessment. It was subsequently learned that the ASIL fabrication facilities at Port aux Basques, Newfoundland have been shut down, with all employees laid off, and all equipment either sold or removed by other EPS subsidiaries. The property is not strictly up for sale, but the understanding is that EPS would entertain offers to that affect.

10.0 MIL DAVIE INC.

MIL Davie Inc. is located in Levis, Quebec, but closed its gates late in 1998. At that time, it was a subsidiary of Dominion Bridge. Dominion Bridge filed for bankruptcy in October of 1998. As recently as September of 1999, Syntek Technologies and Transnational Capital Ventures were in a due diligence period to purchase Davie Industries. This company is out of Arlington Texas and claim to be vigorously pursuing new work for the yard. The Syntek buyout was completed based on an improved proposal to Davie creditors. Groupe Ocean of Quebec City were a minor partner in this deal.

11.0 PORT WELLER DRYDOCKS

This facility, located in St. Catherine's, Ontario, is a division of Canadian Shipbuilding and Engineering Limited. The following is an excerpt from their website (www.pwdd.com) regarding their facilities:

> *"Our extensive machine shop is equipped with modern CNC controlled machinery, including a CNC vertical machining centre, CNC lathe, and a variety of conventional machine shop equipment including lathes to 84" diameter by 40 ft. between centres, milling machines to 75" by 16" table. 175,000 sq.ft. of undercover fabrication and manufacturing facilities.*
>
> - *Large material handling complex, 3 storage yards with truck and water loading/unloading capabilities.*
> - *Automated shot blasting and prime painting building.*
> - *Large assembly halls for construction of modules.*
> - *1,200 ft. long shipping wharf with one 120 ton and one 55 ton travelling jib crane at a maximum outreach of 150 ft.*
> - *Assorted mobile cranes of up to 200 tons.*

Our steel stock yard, mechanical blasting/priming equipment, NC plasma and oxy-propane plate cutting machines, plate forming equipment, welding and assembly shops are fully integrated and capable of producing 400 tons of custom steel fabrication weekly. Our large cranage capacity and strategic location on the Welland Canal section of the St. Lawrence Seaway provides easy access for the shipment of construction modules too large for land transportation."

However, Port Weller Drydocks declined to respond to the Fabrication Capability and Capacity Survey that formed the basis for this assessment.

APPENDIX C

Canada - Newfoundland Benefits Monitoring Programme

ATTACHMENT 2

CANADA - NEWFOUNDLAND BENEFITS MONITORING PROGRAMME

(To be implemented upon award of the contract)

1.0 BENEFITS PHILOSOPHY

The White Rose Owners recognize that the development of the White Rose oilfield represents a significant industrial opportunity for Canada and, in particular, the Province of Newfoundland. Consistent with the legislative requirements of the Canada-Newfoundland Atlantic Accord Implementation Acts (the legislation) and the commitments contained in the White Rose Development Application Canada-Newfoundland Benefits Plan, the Owners are committed to enhancing the opportunities for Canadian and, in particular, Newfoundland, participation in the development within the framework of internationally competitive bidding processes.

All proposals for the provision of goods and services will be evaluated on the basis of "best value", where best value is further defined as the combination of total cost, quality, technical suitability, delivery, continuity of supply and service; and on benefits to Canada and Newfoundland. Where bids are essentially equal on a competitive basis, first choice will be given to goods manufactured in and services provided from the Province of Newfoundland.

1.2 Introduction

Section 45 of the Canada-Newfoundland Atlantic Accord Implementation Acts (the legislation) requires that the White Rose co-venturers (COMPANY) and their contractors, subcontractors and suppliers (CONTRACTOR) provide a Full and Fair Opportunity to Newfoundland and other Canadian manufacturers, contractors, consultants and service companies to participate, on a competitive basis, in the supply of goods and services to the White Rose Project. The legislation further requires that within this context of full and fair opportunity, First Consideration be given to goods manufactured in, and services provided from within, the Province of Newfoundland where those goods and services are competitive (in terms of "best value").

In compliance with the legislation, the White Rose Development Application will include a Canada-Newfoundland Benefits Plan which outlines the statutory requirements and benefits commitments to which the COMPANY and CONTRACTOR are compelled to comply. Appendix 2A following seeks to solicit CONTRACTOR's compliance with these and information respecting how CONTRACTOR will achieve these commitments.

CONTRACTOR must understand that the benefits legislative requirements, commitments and obligations undertaken by COMPANY are likewise binding upon CONTRACTOR. CONTRACTOR's compliance with these commitments is of critical importance, not only to the evaluation of this bid, but also to COMPANY's achievement of its stated obligations and commitments in the area of Canada and Newfoundland Benefits. CONTRACTOR is therefore required to represent the level of CONTRACTOR's Canadian and Newfoundland Benefits by completion of this monitoring programme. The monitoring programme includes a standard procedure for calculating Canadian and Newfoundland content. Examples are attached.

CONTRACTOR's commitment to Canada-Newfoundland Benefits, as determined by the information provided in response to this monitoring program, will be one of the criteria used in the overall evaluation of the bid. Therefore, information requested in Sections 1 & 2 of this document must be completed, where applicable. Failure to provide the information requested will result in the assumption that CONTRACTOR's commitment to Canada-Newfoundland Benefits in that area is zero and bid will be evaluated accordingly.

When CONTRACTOR is preparing tender, the information requested in Section 2.3 of this monitoring program should be contained in a separate section of the bid document dealing solely with Canada-Newfoundland Benefits and should be organized along the same format as this monitoring program.

1.2 Canadian and Newfoundland Content

The calculation of Canadian and Newfoundland content is based upon a value added concept and is simply a representation of the value of the various components of CONTRACTOR's tender expressed as a percentage of CONTRACTOR's total cost.

1.2.1 Content Table

CONTRACTOR must complete the following table. **If a figure is not provided it will be assumed that the Canadian and Newfoundland content for that item is 0%.** Accurate information, consistent with generally accepted accounting principles, is important as verification of figures may be requested by COMPANY during the bid evaluation process.

CONTRACTOR is required to complete the following Content Table indicating the estimated percentages for each category where applicable, e.g., when tender takes the form of a purchase order, then content percentages for Labour would not be applicable and should be entered as zero%. NOTE: LEFT COLUMN AND BOTTOM ROW SHOULD SUM TO 100%.

Total Cost: $ _____	**Content As A % Of Total Cost**			
	Newfoundland	**Other Canadian**	**Non Canadian**	**Total**
Labour (Management/Staff/Labour)	%	%	%	%
Materials	%	%	%	%
Equipment	%	%	%	%
Services	%	%	%	%
Transportation (within Canada)	%	%	%	%
Other (taxes, overhead & profits)	%	%	%	%
Total Content	%	%	%	100 %

Note: See Appendix 2A of this monitoring program for the definition of Canadian and Newfoundland Content and examples of how to calculate these percentages.

1.2.2 Sub-Contractors (and/or Suppliers) Table

CONTRACTOR shall provide, where applicable, a list of its major sub-contractors/suppliers and a description of the goods and/or services provided, or to be provided, by them in relation to this bid:

Description of Goods/ Services	Sub-contractor/supplier Name	Location of Work	% of Total Cost	% Content of Bid			
				NF %	OC %	NC %	Total
Total			**100%**				**100%**

1.2.3 Employment Table

CONTRACTOR shall provide, where applicable, the total estimated number of persons and the corresponding estimated number of person-hours anticipated to be utilized in completing this scope of work, categorized as follows: **(Not applicable for Purchase Order tenders)**

Occupation	Newfoundland Residents	Other Canadians	Non Canadians	Number of Positions	Number of Person Hours
Management & Administration					
Engineers & Technicians					
Skilled Trades					
Labourers					
Marine Crew					
Other					
TOTAL					

Note: If the occupation categories are not appropriate, CONTRACTOR may add categories accordingly.

Appendix - 2A -

CALCULATION OF CANADIAN & NEWFOUNDLAND CONTENT

Definition and Examples of Content Calculation

Definition of Terms: To be supplied in all matters selected to Canada/Newfoundland content.

Directly Imported Material Cost. The cost of an electric motor bought directly from a firm producing it outside Canada. The cost of import includes all duties paid and the transportation cost to the Canadian place of importation.

Directly Imported Labour Cost. The labour cost of sewing a glove from leather and other materials supplied from Canada but sewn in a facility outside Canada.

Directly Imported Service Cost. The cost of design work performed outside Canada.

Indirectly Imported Material Cost. The labour cost to a CONTRACTOR, with manufacturing facilities in Canada, of testing products in facilities outside Canada.

Indirectly Imported Service Cost. The computer costs, to a Canadian firm that provides computer services, but uses a computer outside Canada.

Canadian Content The definition of Canadian content as provided by the Canadian General Standards Board, is generally accepted by both government and industry. Canadian content is expressed as a percentage figure and is that portion of the selling price of a product or service associated with the work performed in Canada. In simple terms Canadian content is the value added to a product or service in Canada; (see CGSB Examples 1 and 2 included in section 5.6). For clarification purposes, White Rose related examples have also been included for your information; (see Attachment 2B).

Newfoundland Content The same definition as "Canadian Content" applies except that "imported costs" refer to costs incurred in all areas outside the province (e.g. section 5.6, CGSB Examples 1 and 2, imported costs include other Canadian costs, as well as foreign costs).

Canadian Citizen A Canadian citizen is a person who was born in Canada and has not relinquished his/her Canadian citizenship; or, a person who has been granted Canadian citizenship; or, a person who has been granted landed immigrant status).

Newfoundland Resident A Newfoundland Resident is a Canadian citizen or landed immigrant who meets the residency requirements for voting in a Provincial Election, as defined by The Election Act of Newfoundland i.e. a Canadian citizen or landed immigrant who has resided in the province for the immediately preceding six month period.

CANADA GENERAL STANDARDS BOARD EXAMPLES:

Example 1: Calculation Based on Knowledge of Imported Costs:

A.	Total Net Selling Price		$287,000
Less:			
B.	Imported Costs: (Costs related to directly and indirectly imported materials, labour, services and overhead):		
	Materials (including duty)		
	Direct	$35,000	
	Indirect	18,000	
	Labour		
	Direct	20,000	
	Indirect	3,000	
	Services		
	Direct	3,000	
	Indirect		
	Transportation (to place of importation)	4,000	
	Overheads	16,000	99,000
C.	Canadian Content (line A minus line B)		188,000
D.	Percentage Canadian Content: (line C) / (line A) x 100%		**66%**

Example 2: Calculation Based on Knowledge of Domestic Costs:

A.	Total Net Selling Price		$287,000
B.	Canadian Content: (Costs related to domestic materials, labour, services, overheads, taxes and profits):		
	Material	$60,000	
	Labour	40,000	
	Services	3,000	
	Transportation (within Canada)	5,000	
	Overheads (including profit)	42,000	
	Federal and Provincial Taxes	38,000	188,000
D.	Percentage Canadian Content (line B) / (line A) x 100%		**66%**

WHITE ROSE PROJECT EXAMPLES

The purpose of the following examples is to discuss the application of the Canadian General Standards Board "Definition of Canadian Content" in the context of the White Rose Development Project.

Labour:

Classification of labour charges (including engineering manpower) as Newfoundland content or Other Canadian content depends on where the work is physically performed, regardless of nationality or residency status of the workers. Work performed in Newfoundland is considered Newfoundland content; work performed elsewhere in Canada is considered Other Canadian content; and, work performed outside of Canada is considered non-Canadian content.

For example, costs associated with a Newfoundland resident, a Canadian citizen and a U.K. citizen working full-time in a contractor's office in Calgary are considered 0% Newfoundland content, 100% Other Canadian content and 0% Non-Canadian content. Conversely, the costs associated with these same people working 50% in St. John's, 30% in Calgary and 20% in London (U.K.) are considered 50% Newfoundland content, 30% Other Canadian content and 20% non Canadian content.

Materials:

Materials content classification depends on the country where the materials used in final processing were obtained. For example, consider a Newfoundland cement plant which obtains its materials (limestone and additive requirements) as follows, 20% from the United States, 30% from elsewhere in Canada and 50% from within Newfoundland; Further assume that materials comprise 70% of the cost of the finished product, and the labour, services and overhead, (which are assumed as 100% Newfoundland), comprise the other 30% of the cost of the finished product. The finished product would be 65% Newfoundland content, 21% Other Canadian content and 14% Non-Canadian content.

[% Newfoundland = (5 x .7) + (1 x .3) = 65]
[% Other Canadian = (3 x .7) + (0 x .3) = 21]
[% Non-Canadian = (2 x .7) + (0 x .3) = 14]

Equipment:

Equipment content classification depends on the country where the main components of the finished product were obtained. For example, consider a Canadian plant (located outside of Newfoundland) which produces a diesel driven pump set; and, assume that the main components of this pump are sourced and costed as follows; the diesel engine is 100% U.K. content and comprises 35% of the finished cost; the centrifugal pump is 100% Japanese content and comprises 25% of the finished cost; and, the pipework, skid and other materials, labour and overhead are 100% Other Canadian content and comprises 40% of the finished product cost. This completely assembled equipment (pump set) is then shipped to the White Rose construction site in Newfoundland for installation in a Module by another contractor. In this case the Newfoundland content of this equipment is 0%; Other Canadian content of the equipment is 40%; and, Non-Canadian content of this equipment is 60%.

[% Newfoundland = (0 x.35) + (0 x .25) + (0 x .40) = 0]
[% Other Canadian = (0 x .35) + (0 x .25) + (1 x .40) = 40]
[% Non-Canadian = (1 x .35) + (1 x .25) = (0 x .40) = 60]

Services:

Services, which include such things as pipe inspection, leased equipment, major marine transportation contracts, cleaning services etc., are classified according to the location of the supplier's service office. For example, if a U.K. manufactured compressor is leased from the active, staffed office, located in Newfoundland, of a Norwegian incorporated company, the profit portion of the compressor lease charges are considered overhead (and classified, as described in the section on Overhead Charges on the following page), and the remaining portion of the charges are considered Newfoundland content. (It should be noted that the source of the leased equipment is not a factor in a leasing/renting situation).

Transportation Charges:

Transportation charges follow the classification of the labour, materials or services which are being shipped. (Note that major marine transportation contracts are classified as Services; see above)

Overhead Charges:

Overhead charges refer to costs such as supplier mark-ups, carrying charges, restocking costs and profit margins which are included as part of the cost of labour, materials or services. The content classification of this portion of the cost depends on the country of incorporation of the contractor/supplier. For example, if a U.S. manufactured valve is supplied from a Canadian distributor whose cost is $800 and mark-up etc. is $200 for a total of $1000. This Canadian distributor then supplies this valve to a Newfoundland distributor whose cost is $1000 and a mark-up etc. of $100 ; the final cost to the White Rose Project is $1,100; in this case the Newfoundland content is 09%; the Other Canadian content is 18%; and, the Non-Canadian content is 73%.