Nova Scotia Offshore Labour Demand Model
Final Report

Prepared for
Petroleum Research Atlantic Canada

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- Atlantic Canada Opportunities Agency (ACOA)
- Petroleum Research Atlantic Canada (PRAC, formerly Atlantic Canada Petroleum Institute)
- Enterprise Cape Breton Corporation (ECBC)
- EnCana (formerly PanCanadian Energy)
- Nova Scotia Department of Energy (formerly NS Petroleum Directorate)

In addition we would like to thank the steering committee for their guidance. This committee was comprised of representatives from each of the funding partners in addition to representatives from the following organizations:

- Dalhousie University (Faculty of Engineering)
- Human Resources Development Canada
- Nova Scotia Community College (Customized Training Oil and Gas Sector)
- Nova Scotia Department of Economic Development (Strategic Management & Rural Development Strategic Services)
- University College Cape Breton (Center of Excellence in Petroleum)

DISCLAIMER

This report was prepared for PRAC by representatives of Canmac Economics, Memorial University and Indeva Energy Consultants Ltd. While it is believed that the information contained herein is reliable (subject to the limitations set out in the document), none of the consulting partners nor PRAC can fully guarantee its accuracy. The use of this report or any information contained will be at the user’s sole risk, regardless of any fault or negligence on the part of the consulting partners or PRAC.
1.0 INTRODUCTION

1.1 Background

With 59 active exploration licenses and over $1.5 billion in committed expenditures within the next five years, Nova Scotia is experiencing an unprecedented level of interest in its offshore petroleum resources. This upsurge can be attributed to the industry’s view of the resource potential, the infrastructure resulting from the Sable Offshore Energy Project (SOEP) and the Maritimes and Northeast Pipeline, as well as the region’s proximity to the rapidly growing gas market of the northeast United States (US).

With the development of tier II of the Sable Project and EnCana’s Deep Panuke Project, Nova Scotia’s production levels could increase significantly from the current level of approximately 500 MMcfd (millions of cubic feet per day) to over 1000 MMcfd within the next five years. The expansion of the existing transportation infrastructure and the development of new pipelines to reach US and Canadian markets will further support these developments and increase the likelihood of further expansion of the offshore industry in Nova Scotia. In fact, the provincial government recently-released Nova Scotia’s Energy Strategy Seizing the Opportunity (2001) notes that production from Nova Scotia’s offshore could increase to 2 – 2.5 bcf/d (billions of cubic feet per day) by the end of this decade.

This potential expansion of exploration, development and production activity could result in a significant increase in the demand for human resources in the oil and gas industry. This demand increase would involve many different groups ranging from skilled trades and technicians, to mariners and aviators, to engineers, medics and other professions. The primary issue facing governments, educational and training institutes, as well as the petroleum industry, is how to assess the likely demand for these various types of human resources, both in terms of numbers of employees and competencies, in order to facilitate the provision of the training and education needed to satisfy this demand.

While previous work has been undertaken to assess labour demand, the most recent by CAPP in the late 1990s (CAPP; 1999a, 1999b), these past works are now either dated or fail to consider labour demand during the development phase. Nonetheless previous work within the region, together with similar work undertaken elsewhere, provided a starting point for this research project.

1.2 Study Purpose

The purpose of this study was to develop a framework model for estimating human resource requirements for Nova Scotia’s offshore oil and gas sector. As such, the model is not intended to provide a forecast of exploration and development activity. Rather, it is designed as a simulation model that can forecast the human resource requirements associated with different levels or types of offshore activity. In addition to the model allowing the user to define scenarios, the model includes five different scenarios for the estimation of human resource demands. These scenarios were defined based on current
levels of exploration commitments, historical success rates, typical cycle times for discovery to production, assumptions about the distribution of field sizes and possible levels of new exploration activity. Additional details concerning these scenarios can be found in section 4.2 of this report.

A secondary purpose of this study was to report on our findings with respect to a literature review, interviews with key stakeholders in Atlantic Canada and experience elsewhere as they relate to labor demand issues affecting the Nova Scotia offshore oil and gas sector.

The framework model generated in this study represents a significant advancement in our understanding of the human resource requirements associated with Nova Scotia’s offshore oil and gas sector. The model provides demand estimates for over 70 occupations and specifies the core competencies (defined here as the knowledge, skills, abilities, education and experience) needed to effectively perform the occupation. Perhaps, more importantly, the flexibility of the model provides users with useful planning tools that industry, education, and government stakeholders can use to develop human resource strategies for Nova Scotia’s offshore oil and gas sector.

While this model represents a significant advance in our knowledge, it is still very much a preliminary model. As such, it should be viewed as a first step in enabling a comprehensive assessment of human resource planning for Nova Scotia’s offshore. Potential limitations of the model in its current form include the high level of uncertainty associated with forecasting, particularly with respect to development activities; the impact of any new technology on labour demand; the procurement location of components; the continuity of activity versus discontinuous “boom or bust” cycles; the competitiveness of local labour in a broad sense; and government policies in such areas as local benefits.

1.3 Study Team

The multi-disciplinary study team consisted of three people: Travor Brown (Memorial University), Michael Foster (Canmac Economics), and Micheal Whiteside (Indeva Energy Consultants). This team was guided by Carey Ryan (PRAC) and the previously mentioned steering committee.

1.4 Report Outline

This report has six chapters, including the Introduction. Chapter two presents the overall methodology used in this study. This includes a discussion of the methods used in the key informant interviews, literature review, best practices interviews and model development phases of this work. Chapter three provides an examination of the major human resource requirements for the model. Specifically, the requirements for three activity areas are examined: current activity, seismic and exploration drilling activity, as well as development and production activity. Chapter four provides a detailed description of the model. This includes an overview of the model, a discussion of the
scenarios, as well as information concerning the use of the model. Chapter five presents the major findings and recommendations resulting from the literature reviews, interviews and model developed as part of this research project. Chapter six provides reference and appendices information relevant to the report.

2.0 METHODOLOGY

Chapter two presents the approach and methodology used in this study. In the first section, we discuss the overall approach. In the second section, we provide details concerning the data collection methodology used in the key informant interviews, literature review, best practices interviews and model development.

2.1 Approach

The overall approach to the study involved an integrated, multi-disciplinary effort in data collection, analysis and model development. Data collection involved both primary and secondary sources. Primary data collection involved interviews with key industry stakeholders. Secondary data sources included information on current and future technology from publications and the previous experience of the consultants, a literature review on past studies, and an extensive literature review concerning competency-based human resource systems used in the offshore. The data from these sources was then analyzed primarily as input into the simulation model. In addition, this data allowed more qualitative assessments of the human resource issues facing industry (i.e. best practices, areas of concern, turnover etc.). The next component of the approach involved the development, testing and verification of simulation framework model to project labour demand under alternative scenarios. Lastly, based on the preceding elements of the approach, conclusions and recommendations were developed.

2.2 Detailed Methodology

2.2.1 Key Informant Interviews

Primary data collection involved conducting a set of key informant interviews of major industry stakeholders in the Atlantic offshore oil and gas sector. In all, 29 useable interviews were conducted (11 in Newfoundland and 18 in Nova Scotia). The interview population consisted of a broad base of industries currently active in the Atlantic offshore ranging from seismic/exploration firms to development and production firms. The primary purpose of the interviews was to collect information on human resource characteristics concerning occupations in the offshore oil and gas industry (i.e. occupation types, employees per occupation, core competencies). Additional information was also collected on the major human resource issues faced by the industry (i.e. challenges, occupations difficult to find in the local market, etc).

As shown in Appendix A, a semi-structured interview process containing mostly open-ended questions was used. The advantage of this interview structure is that it ensured that all interviewers captured the key elements needed for the model and the report, while
ensuring that the interviewees were sharing their knowledge and experiences rather than being forced to ‘choose’ from a set of alternatives. At the end of the interviews, national occupation classification codes (NOC) were assigned to the human resource codes identified and used in the simulation model. A detailed summary of the NOC assignment procedure is outlined in Appendix B.

2.2.2 Literature Review

A general literature review was carried out by PRAC in conjunction with the Sexton library (Dalhousie University) and the entire consulting team. It included regional, national and international studies concerning labor demand studies, human resource (HR) planning issues and offshore human resource requirements. In addition, a more comprehensive review was specifically carried out to examine past research concerning competencies.

The competency-based literature review served three functions. First, it was designed to assess past works in the areas of competencies and competency models as they related to the offshore sector. Specifically, data concerning previous research and best practices was sought in the following areas: core, industry-wide competencies by offshore occupation, competency models developed for the offshore, and competency-based training programs used in the offshore. Second, this review was designed to ensure that the data captured in the interviews (and included in the model) was representative. Third, it was designed to discover best practices as they related to competency models, competencies, selection and training.

An in-depth search was done for this review using numerous scientific databases from the business, engineering, sciences and social sciences disciplines. Specifically, the following key words and databases were used:

- keywords: skills, knowledge, competencies, best practice, oil, gas, offshore and petroleum

In addition, government (StatsCan, HRDC), industry (i.e. oil company, industry trade organizations, etc.) and ACOA web sites were searched.

2.2.3 Best Practice Interviews

Unfortunately, there were few ‘best’ practices that could be gleaned through a literature review. Therefore, three in-depth interviews and an analysis of interview data were conducted as part of this report. The interviewees included an editor of an industry-based publication, a representative from a large industry organization based in UK, and researcher who has extensively researched North Sea labour relations and occupational health and safety issues. These best practice interviews consisted of open-ended questions focusing on best (and worst) practices that the interviewees had observed take
place in the North Sea, with special emphasis on selection and training practices. Given the similarities between the Atlantic offshore (i.e. harsh environment, etc.), and the fact that the North Sea offshore has been active for over 20 years, the goal of these interviews was to tease out best practices that could be transferred from the North Sea to the Atlantic region.

2.2.4 Model Review

A key aspect of this project was the development of a model able to forecast human resource requirements for the exploration, development and production of present (future) hydrocarbon resources discoveries in the Nova Scotia offshore. The model was designed as a modular “framework” model that can be easily expanded to reflect future knowledge. The framework computer model not only provides a current assessment of human resource requirements under various future scenarios, but also represents a living model that can be extended and enhanced as new knowledge is obtained, and as the focus of the future studies changes to reflect the most productive avenues of investigation.

The future human resource requirement in the Nova Scotia offshore will be very largely determined by the success of exploration for new resources, and if that exploration is successful, by the technologies required to develop the resources. As with any natural resource opportunity there is considerable uncertainty concerning the amount, timing and location of future hydrocarbon discoveries, and the future technologies that could be used to develop these resources. These possible new technologies will not only have differing human resource requirements but will also influence the economic threshold for development. Thus, the activity scenarios will be intimately linked to the available technologies with the possibility of subsequent expansion.

The framework model has been designed to be utilized and enhanced beyond the timeframe of the proposed study. The activity level scenarios will be influenced by new knowledge from actual exploration success and shifts in market demand. New technologies will emerge and others will become less favoured and greater detail about human resource requirements will become available in the most promising technologies. As such, the model has a modular design that allows its basic assumptions to be updated as new information is obtained. A full presentation of the model is provided in section 4 of this report.

3.0 HUMAN RESOURCE REQUIREMENTS

3.1 Current Activity

The Nova Scotia offshore continues to represent an area of significant interest for the oil and gas industry. As noted previously, the area has over $1.5 billion in committed expenditures over the next five years. According to statistics provided by the Canada-Nova Scotia Offshore Petroleum Board (as of October 15, 2002), 2002 exploration and development activities consisted of:
• SOEI Production – Average 535 MMcf/d Sales Gas
• SOEI Drilling – 1 Development Well
• EnCana – 1 Exploration Well
• Marathon – 1 Deep Water Exploration Well
• Shell – 1 Exploration Well
• Canadian Superior – 2 Exploration Wells
• Chevron – 1 Deep Water Exploration Well
• Deep Panuke Development Plan Submission and Regulatory Review

Moving forward, the CNSOPB projects the following project activity for 2003:
• SOEI Tier II - Alma topsides in place with production starting end 2003
• Continued regulatory review of EnCana’s Deep Panuke Development
• 7 Exploration Wells
• 4-5 seismic projects

3.2 Seismic and Exploration Drilling

The human resource requirements template for seismic and exploration drilling were estimated by Canmac Economics Ltd. These estimates were based on the experience of existing key stakeholders in the Nova Scotia and Newfoundland offshore oil and gas industry. Key informant interviews were conducted with firms that had a variety of experience in various phases of seismic and exploration activities. Data was assembled and callbacks were made for any areas requiring clarification. As human resource requirements differ from firm to firm, the estimates developed for the model are representative of the industry; they are not specific to any one firm. These estimates were developed based on person years (i.e., persons employed full-time for a year for the job in question).

3.2.1 Seismic Activity

Seismic activity involves the analysis of below-seabed formations as a means of identifying potential petroleum–bearing structures beneath the seabed in question. A critical element of this analysis is geophysical surveying. This surveying process applies the principles of physics to the study of geology and is the means by which nearly all offshore drilling locations are found.

Seismic Surveys
Seismic surveying uses ‘echoes’ to provide petroleum geologists with accurate details concerning the depths and thickness of layers of sedimentary rock. The essence of this process is that different rock types respond, absorb, and reflect sound waves differently. As such, the analysis of the ‘echoes’ sent back by the rock formations provide a more detailed picture of the subsurface formations as compared to other geophysical surveying methods. A more detailed explanation follows.

An offshore seismic survey (see Figure 1) is conducted by a seismic survey vessel towing two separate cables. The first cable, called a streamer, is several hundred feet long and
towed at a depth of several feet below the surface. The second cable is called a recording cable, or hydrophone cable. This cable can be two or three miles in length and is towed just below the surface. The streamer consists of an array of many different sized compressed-air guns called ‘sleeve exploders’ that produce a powerful burst of acoustic or sound energy in a different frequency band to its neighbours.

If they are all fired at the same instant, they produce an extremely strong sonic pressure wave for a very short duration.

**Figure 1: Seismic Surveying**

The pressure wave travels down through the water and into the underlying sediments and rock structures thousands of feet below the seabed. Some of the wave energy is reflected directly back to the recording cable from the rock layers, while some is refracted as it enters or leaves a layer before returning to the surface.

The recording cable is fitted with numerous sensitive hydrophones that detect these returning pressure waves. It also contains transducers that convert the pressure energy into electrical impulses that are transmitted along wires inside the towed cable to recording instruments on the ship. These instruments measure the time taken for each energy pulse to return and then relate this to the distance from the energy source (i.e. the exploder) to the receiving hydrophone. The voltages received from the numerous channels in the cable are then processed by a computer that converts them to data that can be written on magnetic tape.

When the sea survey is complete, the magnetic tapes are usually sent to an onshore processing center containing mainframe computers that can efficiently handle large
amounts of data\(^1\). After processing the tapes, a seismogram (i.e. a cross-sectional view through the earth below the line of the shoot) is produced, and from this interpreters build up contour maps of the structures under the seabed. These maps are used, like field maps, to pinpoint the positions of potential hydrocarbon-bearing structures.

These maps are usually presented in 3-D or 2-D. 3-D surveying is more expensive than conventional 2-D surveying, but the cost of the survey is normally a relatively small part of the overall exploration budget of the oil company. As ships are not normally able to carry the powerful mainframe computer equipment necessary to process 3-D data, 3-D processing usually has to be done onshore.

In the present model, human resource requirements for 3-D seismic and 2-D seismic activities are separated. Although the level of human resource requirements for 3-D and 2-D seismic activity are similar, the principle difference is that 3-D requires more onboard analysts than does 2-D. The major sub-activities associated with the seismic template housed in the model include:

- seismic survey vessel navigation and survey activities
- logistic activities including a supply boat and/or stand by boat
- geological/geophysical activity including sub-contractor data analysis and company data analysis
- onshore management and associated activities including operations management and quality control

3.2.2 Exploration

Presently, there are three main methods of exploration: (1) self-elevation (Jack-up) rigs that are typically used for shallow water, (2) fully dynamically positioned semi-submersibles (DPSs), usually used for deep water and, (3) drill ships, also used for deep water. In the present study, exploration activity is modeled under the first two major categories. Drill ships were not modeled due to a lack of available data. However, indications are that the human resource requirements for drill ships are similar to DPSs.

Self-Elevating (Jack-up) Platforms

‘Jack-ups’ comprise about half of all the mobile rigs in the world and are used for shallow-water drilling. They are self-contained platforms resembling a flat-bottomed barge hull with three or more vertical legs fitting through openings on the outer edges of the hull. These legs have ‘teeth’ notched into them and can be raised or lowered by a jacking mechanism on the deck that usually employs a hydraulic or electric rack and pinion arrangement.

On arrival at its location, these legs are jacked down until they touch the seabed. When the hull is high enough to be clear of the highest waves expected at the location, the legs are locked and remain in this position until the well has been completed. Thus, in its

\(^1\) Note: some vessels are now able to carry out processing onboard, enabling interesting ‘lines’ to be re-shot without delay
drilling mode the barge hull is raised on its legs well out of the water and serves as the drilling, storage and living platform. As it is well above the water, it is firm and stable, experiencing none of the sea motions that affect DPSs.

While conventional jack-ups have vertical legs, several designs incorporate legs that slant outwards at the bottom to obtain a wider standing ‘spread’ and improved stability. The legs are all independently jacked, and their position can be adjusted so that the barge stands horizontal on a sloping seabed. The legs can be fitted with a large, flat steel frame at their lower ends, called a ‘mat’. This affords better stability on some bottom soil types and reduces the danger of capsize.

Semi-submersibles
Because they can operate in deep or relatively shallow water, semi-submersibles are probably the most versatile of all drilling platforms. For this reason they have become a hallmark of the marine drilling industry. The semis considered in this report are fitted with ‘dynamic positioning' (DP) equipment. DP units are more expensive to build and operate, but are sought after for drilling in deep water far beyond the reach of either a jack-up rig or a conventionally moored semi. With a DP system, the rig, by means of computer-controlled thruster propellers, can maintain a fixed position relative to the seabed without the use of anchors. These vessels can, therefore, be used for drilling in very deep water where an anchored unit would experience problems staying on location.

Drill Ships
Several marine drilling contractors operate drill ships as well as semis and jack-ups. Because of its conventional ship-shaped hull, the drill ship is more prone to movement in a seaway than the semi-submersible. Therefore, they are subject to longer periods of downtime due to wind and wave action. For this reason, drill ships are typically used in calmer waters of the world, whereas, semis can drill in the most hostile environments. This drill ship disadvantage is partially offset by its ability to move from one location to the next rapidly and under its own power, with considerable economic advantage.

Human resource requirements for exploration activity are modeled as two separate activities: (1) shallow water exploration using jack-up rigs and, (2) deep water exploration using DPSs. The major sub-activities for both shallow water and deep water exploration include:

- drilling rig operation (i.e. the drilling contractors’ major activities of operating the unit and drilling operation)
- drilling services (i.e. on-board client staff and various special operations associated with the drilling program that is sub-contracted out to other than the drilling rig operator)
- logistics (i.e. supply vessels, stand by vessels, helicopter support and dock loading activity)
- geological/geophysical (i.e. data analysis in real time as well as past exploration activity)
- on shore management (including operations management and associated on shore activity)
3.3 Development and Production

Indeva Energy Consultants estimated the human resource requirements for the development and production phases of the PRAC HR model. These estimates were based on experience in environments similar to the Nova Scotia offshore, and in particular from the North Sea sector of the United Kingdom (UK) which has similar labour laws and environmental conditions. Where experience of actual human resource requirements in Nova Scotia is available, these took precedence over the North Sea estimates. Data was collected from a variety of sources as appropriate including Indeva’s in-house database of worldwide projects, recent UK and Nova Scotia projects and the UK’s Department for Trade and Industry (DTI).

It should be noted that there is often considerable variation in human resource requirements between apparently very similar projects in the oil and gas industry. This is due to a variety of factors, including different reservoir conditions (pressures, temperature, sweet/sour etc.), contracting strategies and market conditions in the contracting industry itself at the time of project execution. The numbers included within the templates of this labour demand model are based on average project requirements.

3.3.1 Development of Human Resource Estimates and Technology Scenarios

Human resource estimates were developed for each of the 14 technology scenarios considered to be representative of potential infrastructure and incremental developments for the expected water depths and field sizes relating to the main exploration plays offshore Nova Scotia.

The technology scenarios selected are the most likely, at present, for the respective discovery types. Other technologies may be technically and economically feasible, but would be less likely to be employed. For example, deepwater oil discoveries are most likely to be developed using either a FPSO (Floating Production Storage and Offloading) or a Spar, although there may be cases where a TLP (Tension Leg Platform) would be more appropriate (e.g. where dry trees\(^2\) are preferable). All technologies with the exception of the FPSO are considered feasible for both oil and gas; FPSO is only feasible for oil.

A summary comparison of the 14 technology scenarios follows. A brief description of each technology option is provided in section 3.3.2.

\(^2\) A ‘tree’ or ‘Christmas tree’ is the assemblage of valves that is used to cap and control the flow of production from a well.
Table 1: Summary of the 14 Technology Scenarios

<table>
<thead>
<tr>
<th>Name</th>
<th>Gas or Oil</th>
<th>Water Depth (m)</th>
<th>Pipeline (km)</th>
<th>Reserves (tcf)</th>
<th>Reserves (mmbbls)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Lower</td>
<td>Upper</td>
<td>Lower</td>
<td>Upper</td>
</tr>
<tr>
<td>Staffed Platform</td>
<td>gas/oil</td>
<td>25</td>
<td>100</td>
<td>200</td>
<td>0.20</td>
</tr>
<tr>
<td>(small/shallow)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staffed Platform</td>
<td>gas/oil</td>
<td>25</td>
<td>100</td>
<td>200</td>
<td>1.00</td>
</tr>
<tr>
<td>(large/shallow)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staffed Platform</td>
<td>gas/oil</td>
<td>100</td>
<td>200</td>
<td>200</td>
<td>0.40</td>
</tr>
<tr>
<td>(small/deep)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staffed Platform</td>
<td>gas/oil</td>
<td>100</td>
<td>200</td>
<td>200</td>
<td>1.00</td>
</tr>
<tr>
<td>(large/deep)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unstaffed Platform</td>
<td>gas/oil</td>
<td>25</td>
<td>100</td>
<td>100</td>
<td>0.10</td>
</tr>
<tr>
<td>(shallow)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unstaffed Platform</td>
<td>gas/oil</td>
<td>100</td>
<td>200</td>
<td>100</td>
<td>0.20</td>
</tr>
<tr>
<td>(deep)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FPSO (small)</td>
<td>oil</td>
<td>100</td>
<td>1500</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>FPSO (large)</td>
<td>oil</td>
<td>100</td>
<td>1500</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>TLP (small)</td>
<td>gas/oil</td>
<td>200</td>
<td>1500</td>
<td>200</td>
<td>0.30</td>
</tr>
<tr>
<td>TLP (large)</td>
<td>gas/oil</td>
<td>200</td>
<td>1500</td>
<td>200</td>
<td>0.60</td>
</tr>
<tr>
<td>Spar (small)</td>
<td>gas/oil</td>
<td>200</td>
<td>2000</td>
<td>N/A</td>
<td>0.30</td>
</tr>
<tr>
<td>Spar (large)</td>
<td>gas/oil</td>
<td>200</td>
<td>2000</td>
<td>N/A</td>
<td>0.60</td>
</tr>
<tr>
<td>Subsea Tieback (shallow)</td>
<td>gas/oil</td>
<td>25</td>
<td>400</td>
<td>20</td>
<td>0.10</td>
</tr>
<tr>
<td>Subsea Tieback (deep)</td>
<td>gas/oil</td>
<td>400</td>
<td>3000</td>
<td>50</td>
<td>0.20</td>
</tr>
</tbody>
</table>

It is assumed that for each basin or play, the initial discovered reserves would need to be of a sufficient size to justify installation of the initial infrastructure. Depending on water depth and reserves size, this initial infrastructure would consist of a floating or bottom-founded structure together with a trunk pipeline to shore and an onshore pipeline. Subsequent smaller finds in the same area are assumed to be incremental developments using either subsea or unstaffed platform technology. With the exception of the FPSO, transport to shore would be via the initial infrastructure, which would have included an element of pre-investment in process and pipeline capacity. In the case of the Sable basin, the initial infrastructure is in place through the SOEI development and further infrastructure will be available if the Deep Panuke development proceeds.

A typical initial infrastructure and incremental development using a platform and a subsea tieback is illustrated below on the following page.

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3 Definition of abbreviations used: m=meters, km=kilometers, tcf=trillion cubic feet of gas
For each of the 14 technology scenarios, the most likely contracting strategy was defined in order to identify each of the main contractors and employers for both the development and production phases. For example, for the platform scenario, the following main contractors and employers were identified.

**Development phase**

- conceptual engineering contractor - topsides, jacket, pipeline and terminal
- engineering contractor – topsides
- engineering contractor – jacket
- engineering contractor – pipeline
- engineering contractor – onshore terminal
- fabrication contractor – topsides
- fabrication contractor – jacket
- fabrication contractor – pipeline
- process plant constructor – onshore terminal
- installation contractor – topsides
- installation contractor – jacket

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4 Commissioning and testing are assumed to be performed by the main fabrication contractor.
• installation contractor – pipeline
• drilling contractor – production wells
• project management team – client team overseeing the complete development

**Production phase (life of field)**

• oil company asset management team – mainly onshore
• offshore operations contractor – daily operations offshore
• plant operator - daily operations at onshore plant
• standby vessel operator – also during installation phase
• supply boat operator – also during installation phase
• air logistics (helicopters) - also during installation phase
• onshore supply base (warehousing/port facilities) – also during installation phase
• IMR contractors – inspection, maintenance and repair of offshore facilities
• IMR contractors – inspection, maintenance and repair of onshore facilities
• drilling contractor – well work-overs

Conceptual engineering was assumed to occur in the first year after project start. Detailed engineering was assumed to start at the beginning of year two, with fabrication starting at the end of year two. First oil/gas was assumed to be accomplished in 3 to 3 ½ years after project start depending upon the complexity of the development technology. The producing life of the field was estimated according to the expected reserve volumes and product type (oil or gas). No allowance has been made for person-hours prior to conceptual engineering. In terms of overall person-hours, these are typically small and vary enormously from project to project. However, it should be noted that considerable time can elapse between initial discovery and project start, due to problems appraising the discovery, and gaining regulatory and partner approval.

For each technology scenario, the total person-hours per contract or per year for the production phase were estimated using norms based on UK North Sea experience and adjusted where appropriate for Nova Scotia. These were mainly based on tonnage estimates derived from throughput capacities consistent with the reserves volumes. For drilling related hours, the number of wells was first estimated based on the reserves volume, and then multiplied by an appropriate number of days per well. The main occupational categories were then identified for each contract, and an approximate split in percentage terms estimated, again based on North Sea experience. Person-hours per year relative to project start were then estimated for each job category and then converted into person-years, assuming 2000 person-hours per person-year.

No attempt was been made in the model to identify where engineering and fabrication would take place, although it is considered unlikely for example, that spar hull fabrication would be performed in Nova Scotia.

For all long duration offshore work, it was assumed that any crew would work two weeks on and two weeks off. Thus, if a platform required a permanent operations crew of 35, the total person-years of employment associated with the activity would be 70.
It should be noted that all person-year estimates are for direct employment on any particular project. This is deemed to include all oil company personnel (excluding non-operating partners), prime contractor personnel employed at the main fabrication sites (i.e. topsides and jacket fabrication) and all offshore employment. They do not include person-years associated with equipment manufacturers or other vendors, or any other indirectly created employment. Typical equipment that is excluded from the estimates includes pressure vessels, process equipment (i.e. hydro-cyclones) and rotating machinery (i.e. pumps, compressors, switchgear, wellheads, trees, umbilicals, flexible risers). These items require specialized skills and equipment during their manufacture, and have historically been sourced for oil and gas projects on a global basis from a number of niche manufacturers. It is extremely rare for local manufacturing facilities to be established for these items.

3.3.2 Technology Scenarios Defined

The technologies included in this report are based on five differing production facilities: platforms (staffed and unstaffed), floating production storage and offloading units (FPSOs), tension leg platforms (TLPs), spars and subsea tiebacks. The two major components of permanent production facilities are the topsides and the substructure. The topsides form the upper part and house the processing plant and utilities/accommodation. These were originally constructed as individual modules and consisted of process, power generation, utilities drilling and living quarter modules. However, with the advent of large crane vessels in the late 1980's, some of which are able to lift loads in excess of 10,000 ton, modules have been combined to form so called ‘integrated decks.’ These integrated decks can be largely commissioned onshore, thus, saving expensive offshore person-hours and reducing risk. Topsides usually have a very high density of plant and equipment and are a major component in terms of person-hours of a facility.

The substructure basically provides the support to the topsides and may be in the form of a platform founded on the seabed or a floating vessel. Platforms, which can only be used in relatively shallow water, allow wellheads to be positioned on the surface in the dry. This has a number of advantages including easier maintenance of the wellhead and ‘christmas tree’, and the possibility of having a permanent drilling facility for development well drilling and workover. By contrast, floating vessels are very often incompatible with surface wellheads due to motion characteristics thereby necessitating the need for a mobile drilling rig for development drilling or well workover.

For new field developments close to existing facilities, another option exists in the form of a subsea tieback. Tiebacks are discussed in more detail at the end of this section.

Generally, the type of permanent facilities selected will depend on a number of key variables. These include the oil/gas type, production rate, reservoir life, water/reservoir depth, nature of the seabed, storage requirements, preference for wet or dry wellheads, and the proximity to other existing infrastructure (e.g., platforms and pipelines).
Platforms (staffed/unstaffed)

Platforms (often referred to as jackets) are three dimensional space frames fabricated from steel tubular sections, which support the topsides. Steel piles are driven into the seabed to provide stability. Approximately 80% of offshore fields are developed using steel platforms. They are suitable for oil or gas, and can be used in any water depth up to approximately 200 meters. A major advantage of this technology is that surface (dry) trees can be used, reducing initial well and subsequent workover costs. Product export is always via a pipeline, either to shore or to an offshore loading buoy. Unstaffed platforms are often used if there are existing staffed facilities nearby. Process equipment is then controlled remotely without the need for accommodation and associated utilities. It is possible to replace the steel jacket with a concrete cellular type structure, which sits directly on the seabed with no requirement for piles. These are called Gravity Base Structures (GBSs). However, the use of GBSs is the exception rather than the norm as they very rarely exhibit lower costs. Where they are used, it is usually for unusual technical reasons (i.e. iceberg resistance or poor seabed conditions that preclude the use of a piled structure). The oil storage capacity of the cellular structure was originally an attraction before the acceptance of FPSOs as proven technology.

Figure 3: Sample Platform Installation
Floating Production Storage and Offloading Unit (FPSO)

The FPSO is similar in design to the standard mono-hulled oil tanker and thus offers integrated production, storage and offloading facilities. To date FPSOs have not been used on gas fields due to technical problems associated with large diameter flexible gas risers. The major downside for the FPSO is that wellheads have to be located on the seabed due to the motion of the vessel. As such, the initial drilling and subsequent workover costs are higher in comparison to surface wellheads. A major advantage is the storage capacity, which can negate the need for a pipeline if shuttle tankers are used.

Process modules for installation on the deck of an FPSO are commonly called pre-assembled units (PAUs). Generally smaller than the topsides modules used for fixed platforms, they are designed to be lifted or wheeled on board while the vessel is moored at a dockside.

It is probable that an FPSO hull would be designed and constructed outside Nova Scotia, although the PAUs could be designed, fabricated and installed in the province. Even with suitable dry-dock facilities, at present it is not considered feasible to compete economically with Far East shipyards for hull fabrication. Engineering and human resource requirements are, therefore, lower than for an equivalent platform and topsides.

Figure 4: Sample FPSO Installation
Tension Leg Platform (TLP)

The TLP concept consists of a rectangular deck supported by large diameter columns, in turn supported on submerged pontoons. The hull structure is positively buoyant and pulled down to its operating draught by rigid tethers. The virtual absence of vertical motion permits the use of surface wellheads. Process facilities and utilities can be provided in the form of PAUs on the deck or incorporated within the hull.

With very limited storage capacity, the TLP requires pipeline export. TLPs are well suited to either oil or gas fields in water depths up to 1500 meters.

The TLP hull could be designed and fabricated in Nova Scotia or elsewhere. However, specialized fabrication skills and equipment will be required. Topsides, tethers and piles could also assumed to be engineered and fabricated in the province, with installation offshore using a crane barge.

Figure 5: Sample TLP Installation
Spar

The production spar unit consists of a single large diameter cylindrical hull moored with its axis of symmetry vertical. The conductors and risers pass through an opening in the center of the hull (moonpool) situated on the axis of symmetry. Typically a production spar would be around 200 m high and 25 m to 40 m in diameter. It is ballasted to provide the required draught and remains free to move in all six degrees of freedom.

The spar is moored using catenary moorings attached to its circumference in the region of the pitch center well below the water or at the bottom. As pitch motion contributes little to the line loads, a taut mooring system may be used as an alternative to keep the spar within a tight watch circle, hence reducing loads on the risers.

The spar offers similar features to the FPSO, but with the added advantages of surface wellheads and the possibility of using large diameter gas export risers. They are thus suitable for oil and gas developments in water depths up to 2000 meters.

The hull could be designed and fabricated in Nova Scotia or elsewhere. Fabrication will require specialist skills and equipment; to date most spar fabrication has been performed at specialist yards in Finland. It is most likely that the hull and topsides are assumed to be engineered and fabricated in the province with installation taking place offshore using a crane barge.

Figure 6: Sample Spar Installation
Subsea Tieback

The subsea tieback is an alternative development option when there are existing production facilities nearby. In their simplest form, they consist of the subsea well being ‘tied back’ to a platform or vessel by a flowline and umbilical.

Although subsea installations have been around since the early 1970s, there has been a rapid increase in their use over the last 10 to 15 years. Their attraction lies in their relatively low cost and the short timescales within which they can be designed and installed, particularly as there is now a large degree of standardisation in the components and tools used.

A subsea tieback normally consists of the following six elements:

1. the wellhead and ‘christmas tree’ equipment on the seabed,
2. the protective structure/template around the wellhead to prevent damage from falling objects or entanglement of fishing nets and to provide support for valves and control equipment,
3. flowlines (pipelines that carry the well products to the host facility and provide gas-lift and water injection facilities),
4. umbilicals (hydraulic or electrical cables that permit remote control and monitoring of the wellhead valves from the host facility),
5. risers that connect the seabed flowlines and umbilicals with the surface facility (on a fixed platform these will be rigid pipes running up the legs of the structure and on a floating vessel highly engineered flexible tubes that can withstand the relative motions between vessel and seabed), and
6. a host facility (fixed platform or floating vessel or even the shore)

Subsea tieback can be used on both oil and gas fields, and for water depths in excess of 2000 metres. The major disadvantage of tiebacks is that initial drilling and subsequent workovers need to be performed by a mobile drilling rig, thereby increasing the unit cost with respect to platform wells that can be drilled and accessed by a dedicated platform drilling rig.

Engineering, assembly and manifold/template fabrication could be performed in or out of Nova Scotia. Manufactured equipment (i.e. wellheads, trees, control systems, umbilicals) is assumed to be assembled outside the province. Human resource requirements (engineering and fabrication) are, therefore, low due to the extensive use of manufactured components.
Figure 7: Sample Subsea Tieback Installation

4. HUMAN RESOURCE MODEL DESCRIPTION

As previously stated a key aspect of this project was the development of a model of the future human resource requirements for exploration, development and production of currently discovered and yet to be discovered hydrocarbon resources in the Nova Scotia offshore. In this section, we present an outline of the model, discuss the scenarios, provide an overview of how the model can be used and outline potential extensions of the model.

4.1 Human Resource Model Outline

The following schematic (Figure 8) represents the structure of the human resource (HR) model.
Figure 8: Outline of the Human Resources Model

- Technology Selection by Exploration Play
- Exploration & Market Scenario Definition
  - Activity Model
    - Exploration Appraisal and Seismic Schedule
      - Exploration HR
      - Nova Scotia Exploration HR by Year and Scenario
    - Development Production and Infrastructure Schedule
      - Technology HR
      - Nova Scotia Development and Production HR by Year and Scenario
        - Existing Project HR
      - Nova Scotia Total HR by Year and Scenario
The user specifies Exploration and Market Scenarios, which describe possible scenarios for the future exploration success on the Nova Scotia offshore and relate these to possible evolution of the gas market. Additionally the development and production technologies to be used in each exploration play are selected from the available technology templates. For each exploration play, a technology is selected for the initial infrastructure development (where appropriate, this includes a pipeline and onshore gas processing) and for incremental developments once the main infrastructure is in place.

Once the scenarios have been developed and technology selection rules defined, the results are fed into an activity model. Based on these inputs, the activity model determines the schedule and timing of exploration activities for each play. This includes exploration and appraisal wells drilled, as well as 2-D and 3-D seismic programs. The model then determines when and where (i.e. in which basins) discoveries are made and the size of these discoveries. A ‘tank’ model determines the timing and type of development in each play. This tank model also selects to develop infrastructure once sufficient threshold reserves have been discovered in a basin. Once the initial infrastructure is in place in a basin, incremental fields are developed as they are discovered until the capacity of the infrastructure is exceeded. At this point, further development must wait until sufficient reserves are discovered for additional infrastructure development. This type of model results in ‘spikes’ in HR requirements that are typical of offshore development.

Once the activity schedule has been determined, it is combined with the exploration and technology templates that describe the HR requirements by occupational category for each activity. This provides an estimate of the total Nova Scotia exploration, development and production HR requirements by year and scenario. Finally, these projections are combined with the HR projections from existing projects to derive a total forecast of HR requirements for the Nova Scotia Offshore.

4.2 Exploration and Market Scenarios

The human resource model has been set up to allow users to define multiple scenarios for future progress in the Nova Scotia offshore. In so doing, we have tried to recognize that there is considerable uncertainty with regard to the number, size and location of future discoveries in the offshore. Therefore, we have allowed users maximum flexibility in defining scenarios and in ‘fine-tuning’ rules for such factors as exploration drilling pace. The following represents an input screen for the definition of a scenario.
For each scenario, the user is able to define a Market Scenario, which is defined separately and affects the pace of exploration and development. The user is also able to define up to 10 exploration basins/plays that can be varied by scenario if desired. The preceding five-play split (see Figure 9) was derived from discussions with the Nova Scotia Department of Energy. It represents the breakdown of committed licence blocks by water depth and by play type. For a number of scenarios and additional play, the Laurentian basin has been added.

For each defined play, the model requires the user to specify whether the play is oil or gas, the total potential reserves for the play (BCF for gas, MMBBLS for oil), the average success rate for wildcat exploration wells and the average discovery size. These are the main parameters that affect the pace of development.

The user is also able to define the type of exploration well and the type of technology for new infrastructure development and incremental development within the play, together with reserve threshold and capacities for the technologies.

The model as supplied has five scenarios defined by PRAC in conjunction with various other knowledgeable bodies in Nova Scotia. These scenarios span the likely range of exploration, development and production that may take place in Nova Scotia. The first is the most pessimistic scenario. It assumes no additional development in the near term.
beyond tier 2 of Sable, coupled with weak markets and disappointing drilling results. Three intermediate scenarios reflect varying degrees of drilling success, market strengths and development activities. The fifth scenario is extremely optimistic and assumes strong market growth and pricing, high rates of drilling success, as well as higher than expected reserves. In addition to these five scenarios, users have the ability to construct any scenario that they desire.

4.3 Using The Model

We have designed the model to be as user-friendly as possible. The following section provides a brief overview of the model and how it can be used. A more detailed user guide is also available in Appendix F.

The model is founded on a pre-calculated spreadsheet, making navigation of the model relatively simple. When the model is first loaded, it appears with a navigation map screen as shown in the following image.

Figure 10: Navigation Map Screen

This Navigation Map provides a description of each screen of the model and a hotlink to that screen. Once at a particular screen, the user can navigate back to the map either by selecting control (Ctrl) and H, or by selecting the appropriate tab in the model.
The following Summary screen allows the user to change the current scenario in the model, and displays the total HR by lifecycle category graphically. An example follows.

Figure 11: Summary Screen

The following six screens show a tabular breakdown of HR requirements by year and by category for the selected scenario; the next two provide the competency database and NOC HR categories.

The Compare Scenarios screen allows the user to compare HR requirements for different exploration and market scenarios. As shown in the following image, the top chart shows the total HR requirement by scenario.
By selecting Page Down the user can choose to see a chart for individual lifecycle and labour categories and by scenario. A sample follows.
Figure 13: HR Requirements: Lifecycle and Labour Categories and by Scenario

The next screen is the Define Scenarios screen as described earlier in the Exploration and Market Scenarios section. The screen following this one allows the advanced user to adjust some of the Model Rules. These rules govern the frequency of appraisal and seismic, as well as the pace of exploration under different market conditions. The user is also able to adjust the technology learning factor that impacts the HR requirements over time according to the percentage specified. All fundamental assumptions of the model can be adjusted in this screen or within the individual scenarios.
The Activity Model Screen (last tab on bottom menu) shows the exploration and development schedule, by year, play and technology, together with the discovered reserves by play and year. It is followed by three screens for user input of HR projections by year and labour categories for existing projects. The final unhidden screen shows the available development technologies and their range of applicability as described in Section 3.3.

In addition to these screens, there are a large number of hidden screens that contain the development and production and exploration templates together with calculations relating to them. Advanced users can, if they wish, modify the HR requirements by labour category and project year for each template.

4.4 Model Applicability and Potential Extensions

As previously stated, the HR model is intended to be a framework model that can be easily extended to meet future requirements. The present model has been designed to cater to the current state of knowledge about the future exploration potential of the Nova Scotia offshore. This has been characterized by a very large increase in interest in exploration on the shelf subsequent to the SOEP development and a large number of licences being issued in previously unexplored areas. Further, much of the previously
explored areas have not been drilled since the early 1980s and exploration techniques and particularly 3-D seismic have significantly improved since that time. As a consequence of these factors, the range of possible reserves in the offshore is very large at the current time. At this point it is not possible to quantify either the expected reserves or the probability of achieving a particular reserves level. For this reason, the current model is designed around a deterministic scenario approach where the user defines discrete scenarios for possible future exploration success, and is able to compare those scenarios. However, no probabilities are attached to the scenarios themselves.

As a significant number of exploration wells are drilled over the next one or two years, it may become possible to quantify the range (probability distribution) of possible reserves within each identified play, as well as the probability (i.e. statistically significant chances) of success for each play. At that time it would be appropriate to look at extending the activity part of the model to incorporate a probabilistic approach. This refinement would provide a much higher confidence in the expected HR requirements and would be able to quantify the probability of the upper and lower case HR estimates. Such an approach would also be able to accommodate the effects of price fluctuations over the life of the model and their affect on the ‘spikes’ in HR requirements over the lifecycle of the basin, which can be particularly significant for exploration activity.

5.0 MAJOR FINDINGS AND RECOMMENDATIONS

5.1 Literature Review and Best Practices

5.1.1 Literature Review

As previously mentioned, a general literature review was first conducted. It provided details concerning past regional, national and international research related to labor demand issues, human resource planning issues and offshore human resource (HR) requirements. These studies were used to help develop the model and interview guide. In total, over 15 past studies were found. A summary of these studies is provided in Appendix C. In addition, the in-depth literature review focusing on competencies found over 45 relevant articles. A detailed summary of these competency-based articles including author, publication data, occupation, methodology and competencies identified can be found in Appendix D. Several themes emerged from the competency-based literature review. First, while earlier works focused on experience and educational competencies, more recent works have included the ‘softer’ competencies (i.e. teamwork, interpersonal skills, etc.). Second, in terms of occupational groupings, most of the competency research conducted has focused on the professional occupations (i.e. engineering, geology, geophysical sciences). That being said, there was evidence of competency models in the non-professional domains. Third, there is growing consensus of a ‘core’ industry set of competencies with many models including the dimensions of teamwork, computer literacy and communication skills. Fourth, many models used offshore experience and/or years of service as the key differentiator between levels (i.e. junior, intermediate, and senior) of an occupation or as requirements to progress from one job to another. Fifth, while most competency models have been developed for selection and development programs, there is limited evidence of training programs designed to
develop these competencies. Those that do exist, tend to be apprenticeship in nature or tend to focus on offshore safety.

A secondary purpose of this review was to assess the relative fit of the competencies identified by the literature review with those identified by our interview process. Consistent with the literature review, we did see the emphasis on a core set of industry competencies (i.e. teamwork, computer literacy, communication skills). We also found the emphasis on years of service and years of offshore services as the key differentiator between levels of the same occupation. However, in contrast with the literature review, we saw a growing emphasis on the non-professional roles with many companies moving to competency based-training and selection practices for all occupations.

5.1.2 Best Practices

By its very nature, a summary of best practices seeks to identify unique practices that can be modified to fit different environments. As such, this analysis produced a small number of themes as well as a limited number of singular best practices. As one interviewee with over 25 years of offshore experience stated, “we continually research this area and the same issues arise….there are a shortage of key skill sets…we never seem to get ahead of that (shortage).”

The most significant theme was the movement to competency-based training and selection systems. As outlined in the previous literature review, there has been significant focus on the use of competencies to better understand the skills, knowledge, experience and education levels needed to effectively perform in the offshore environment. This theme was echoed by key informant interviewees who used behavior-based interviews to assess these competencies and interviewees who tracked training progress using a competency-based assessment tool to track skill acquisition while offshore. OPITO\(^5\) (see http://www.opito.com) uses competencies extensively to track progress for their training programs and for the selection processes. This would suggest that the competencies developed as part of this study, as well as the previous works by CAPP, should now be used as the foundation of key stakeholders’ training and selection processes.

A sub-theme here was the importance of non-technical competencies. As stated by one interviewee, “technical skills don’t mean managerial skills…we have had to find ways to develop managerial skills.” As such, one key informant interviewee discussed how all managers had to take the role of a safety representative before taking a management role. This experience allowed them to develop managerial competencies (i.e. leadership, project management and communications) before the company would move them into a management role.

A second theme that emerged was the concept of partnerships. This theme emerged in two ways. First, union-management-government partnerships. One of the unique

\(^5\) OPITO is the UK-based National Training Organisation for Oil &Gas Extraction, formerly British Offshore Petroleum Industry Training Organisation
features of the offshore environment in the UK and Norway is the collaboration of union and management stakeholders, particularly in the area of offshore safety training (Hart, 2000a, 2000b). For example, OPITO uses a process where unions and employers are involved in the needs analysis for training programs, definition of training objectives and evaluation of training programs. In fact, the union is in partnership with the employers in all aspects of the training process. These partnerships ensure that training programs incorporate the experience and expertise of employees, via their union, into the training process (Hart, 2000a). There has been a long history of partnerships in the North Sea, dating back to the 1980’s. These partnerships were driven by the global marketplace, particularly in the oil crisis of the late 1980’s, when all three parties realized that they needed to work together to ensure that the North Sea was a competitive, and safe, player in the global marketplace. The success of these partnerships suggests that similar partnerships between employees (and their unions where employees are unionized), employers and governmental bodies could be beneficial in Canada.

The second form of partnerships consisted of the formation of non-profit organizations designed to advance the needs of offshore employees, employers and communities. A good example is OPITO. This government-sanctioned organization is designed to meet the needs of the industry. Some of its key activities include: industry-wide training, career road shows demonstrating the value of offshore careers to school-aged students (i.e. near the grade 6-7 level), as well as labour market analyses to assess the current labour force and identify potential shortfalls at an industry level. The use of a common organization conducting this research over the longer term also helps ensure consistency in methodology, learning from the strengths and weaknesses of past studies, as well as ensuring a sole location of historical data.

A third theme in reviewing best practices was the movement to apprenticeship and internship programs. In both the literature review conducted on competencies as well as the best practices interviews, there is evidence in the UK of a movement to sponsor apprenticeships for technicians to help minimize the potential shortage of skilled-technicians. For example, OPITO manages a four-year program where they select apprentices, with the assistance of training college networks, place them in training programs for two years and then place them on two year apprenticeships with member companies. During this entire four-year period they are paid by OPITO. These apprenticeships help ensure an ongoing flow of qualified technicians. Similarly, one interviewee discussed how an oil production company in the UK has moved to a technician apprenticeship program. However, these apprentices are given a generalist skills set (electrical, mechanical, etc) rather than a true journeyperson apprenticeship program. Similarly, several of the interviewees have moved to interns and coop students in engineering, geology and business. The advantage of these programs is that they provide students with valuable experience (a key competency found in this study) as well as exposure to offshore careers.

While not themes, several best practices were also captured. Each of these practices could be implemented by Atlantic Canadian firms. First, ‘targeted’ Emergency Response Training (ERT). At one time, all employees were given identical ERT. This
resulted in excessive training. Now, they have developed an analysis of all jobs and
employees are only trained for the skills, knowledge and abilities required for their job.
This has resulted in better training utilization. While this has focused on safety training,
clearly the concept of training targeted to the roles of employees rather than generic
training for all employees is important and has been highlighted as a key factor in
successful training programs (Tannenbaum & Yukl, 1992).

Second, OPITO has a clearly defined process for assessing post-training performance.
All training participants are assessed based on the competencies and outcomes that
should have been learned in training. Trained assessors, who were not the trainers of the
original program, conduct this assessment and a record of the assessments is kept. A
cumulative decision is then made based on this assessment. In fact, one of the companies
interviewed also uses a similar competency-based evaluation process.

Third, one interviewee discussed that there is growing evidence of employers moving to
multi-skilling. The rigs of today require far fewer people than those of 10 years ago,
thus, there has been a movement to a multi-skilled workforce. In addition to the
‘generalist’ apprenticeship program highlighted above, many of the participants
interviewed for the present study discussed the movement to a broadening of the skills
set. For example, seeking welding skills in the role of deck hands.

Fourth, OPITO emphasizes the need for effective delivery of training programs. As such,
all trainers must pass an internal training standard before they can deliver a training
course. This ensures a consistent standard of training and trainers across the industry.

Fifth, given the difficulties associated with shift work on the North Sea, one interviewee
mentioned that some oil production companies are moving to alternative work
arrangements such as working from home and telecommuting for offshore workers when
possible. This is also consistent with the general movement towards ‘family-friendly’
policies found in Canadian workplaces (Brown, 2000; Templer et al., 1999).

Sixth, non-traditional training formats such as e-learning are now being used (see www.
BBP Offshore.com). Given the nature of the offshore environment, traditional stand-up
delivery may not be feasible. Nor do many employees wish to be away from their
families on their ‘off’ time to take training courses. As such, e-learning could be well
suited to the offshore environment where traditional ‘stand-up’ delivery may not be
possible. Moreover, combining this training method with modular training units could be
an effective way to train offshore employees who work on shifts.
5.2 Key Informant Interviews

5.2.1. Human Resource Issues

During the course of key informant interviews, companies were queried on a number of human resource related issues. This section provides a summary of the major responses to the interviews.

First, the Atlantic oil and gas sector’s labour dynamics are characteristic of an active labour force. The key indicators of labour force dynamics for the last year are as follows:

- 955 new employees hired for an average hire rate per firm of 32.9. These new hires consisted of new graduates from University (49), new graduates from Technical School (493), and experienced hires (413)
- 188 contractors, defined here as people employed for less than six months, were hired (average = 6.5 per firm)

Second, over the past year, the total number of employees that left the East Coast operation totaled 323 or 11 per firm. The major reasons cited for leaving the East Coast operations varied from firm to firm. Among the most cited reasons included:

- completion of activity and moving on to other work (14 responses)
- employee unsuitable for work (9 responses)
- other reasons (i.e. retirement) (3 responses)

5.2.2 Key Human Resource Issues

Company representatives were asked to identify, in their opinion, the main human resource (HR) issues facing the company over the next three to five years as well as their experience hiring employees in Atlantic Canada. In terms of the significant HR issues, respondents’ comments varied but could be collapsed into three themes:

1. difficulty in attracting qualified people, particularly senior people due to worldwide competition for labour (13 responses),
2. small local firms find it difficult to compete with large multinational firms for labour when these large firms have better compensation packages (8 responses), and
3. difficulty attracting new entrants due to nature of work, (i.e. short term not sustained employment opportunities) (5 responses)

Firms were also asked to specify if they had any difficulty hiring professional labour in the East Coast. Only two firms stated that they had no difficulty. For those firms experiencing difficulty, some positions listed as difficult to fill included: safety manager, medics, persons with contract administration skills, processing engineers, subsea engineers, control engineers, IT specialists, rig supervisor, drilling engineer, drilling superintendent and on-shore people with geo-technical skills (i.e. geologist, geophysicist, reservoir engineers).
Similarly, only two firms indicated that they had no difficulty hiring technical labour in the East Coast. However, in these cases, firms usually did not specify a specific occupation but rather commented on the general lack of technical labour because of the nature of the work (i.e. short term, difficult environment, large scale operation). The only technicians specifically mentioned were instrumentation and electrical technicians.

5.3 Model Simulations

As noted in section 1.2 of this report, the primary objective of the work was to develop a simulation model that would allow users to assess the implications of various levels of future offshore exploration, development and production activities on the demand for human resources. A further aspect of the work was to use the results from the five activity scenarios defined within the model to conduct a limited analysis to better understand the model’s capabilities and limitations. Specifically the intent of the analysis was threefold:

- to determine if there are notable trends or findings from the simulations that would benefit HR planners and institutions
- to identify limitations in the type of analyses that can be conducted with the current model
- to identify areas that would benefit from additional work beyond the scope of this project and, hence, enhance the ability to answer key research questions

This section of the report describes in more detail the scenarios that have been included in the model and the results of the initial analysis. It needs to be emphasized that this model was developed to examine issues related to the demand for human resources, and that effective planning requires complementary work on labour supply. Therefore, while this model represents an important addition to the tools available for examining education, training, skills development and human resource planning issues, its capabilities are somewhat limited when supply data is not considered. Consequently, so is the depth of analysis that can be conducted on particular research questions.

5.3.1 Scenarios

The model has five different scenarios that have been defined and that are the basis for the analysis that has been conducted. The five scenarios were selected with input from the Nova Scotia Department of Energy, the Canada Nova Scotia Offshore Petroleum Board and the Canadian Association of Petroleum Producers in Halifax. They are not a forecast of future activity, but rather, are intended to provide a broad range of potential activity levels offshore Nova Scotia and to bracket what might actually happen. Model users can define their own scenarios to reflect their views of what the future might hold and to further test the sensitivity of the demand for particular occupations to activity levels.

The following table (Table 2) summarizes the five scenarios in the model. Each of the five cases is briefly discussed to provide a sense of the underlying conditions that might give rise to the scenario as well as general implications that may result from the scenario.
Table 2: Scenario Comparison

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Reserves BCF</th>
<th>Average Pool Sizes BCF</th>
<th>Drilling Success Rates Percent (%)</th>
<th>Commitment Wells</th>
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Scenario 1: Low (“Disaster”) Case

This case could arise as a result of sustained poor gas market conditions, disappointing early drilling results from existing licenses, a poor business climate and a restrictive policy environment. It assumes that Sable tier 2 developments would proceed, however, Deep Panuke would not move forward within the currently planned timeframe. Rather, it would proceed at a later date as conditions warrant. This has the effect of dampening future exploration licensing and limiting new development activity until quite late in the planning period.

Scenario 2: Base Case

This scenario is not as pessimistic as the first one, but is still quite conservative. All of the Sable tier 2 fields are assumed to proceed with some modest increase in production. Deep Panuke also moves forward consistent with the current Development Plan. This case is characterized by moderate gas market growth and average pricing conditions in the US northeast, but somewhat mixed early drilling results that cause companies to be conservative in both their drilling programs and subsequent licensing of new lands.

Scenario 3: Moderate Case

The moderate case is characterized by relatively strong market growth in the US northeast, attractive gas pricing, and reasonably good early drilling results that cause companies to be somewhat more aggressive in their drilling programs and licensing of new lands. In this scenario, both Sable tier 2 and Deep Panuke proceed as in the base case. Reserves are higher than in the previous two cases and close to the current consensus on recoverable reserves. Drilling success rates are approximately those that have historically been encountered in the Sable Basin.

Scenario 4: High Case

The high case will be driven by strong growth in gas markets in the US northeast and attractive prices. This growth could arise from a rapid expansion in gas fired electricity demand in the northeast and competition from other market regions for gas supplies from other major North American supply basins. Another characteristic of this scenario will be
early drilling success with a sustained reasonably good rate of discoveries over the period. Overall, companies will be aggressive in their exploration and development activities. Reserves will be somewhat higher than current thinking as new exploration plays yield success. A case such as this would result in sustained exploration and development activity and the creation of a significant, sustained petroleum industry rather than sporadic project activity.

Scenario 5: Extreme Case

This scenario is extremely optimistic and assumes that everything that could go right actually does. Market conditions are strong with high prices and well above average growth due to the requirement to reduce greenhouse gas emissions. There is early drilling success and deepwater discoveries are large, leading to early development. Reserves in each basin are at the upper end of what is considered possible.

5.3.2 Analysis

One of the primary uses of the model will be to assist post-secondary institutions and private training organizations with their planning to ensure that the proper courses and programs are available. This will enable them to better prepare for the future demand for various occupations, while at the same time better understanding the impact of the uncertainties surrounding future levels of offshore activity on human resource requirements. Our analysis examined the base, moderate and high case scenarios since these cover the most likely range of future activity. The analysis and results are described more fully in the subsections that follow.

Specifically, the following analysis concentrated on four particular groupings of occupations: professional engineers, technicians and technologists, skilled trades and marine-related occupations. Professional engineers are the most significant professional group included in the model because of their numbers, the potential impact of their demand on local university programs, and the influence of engineering design on both the offshore technology used and local benefits. Technicians and technologists are another relatively large occupation group whose demand impacts the programs and courses offered at the community college level within the region. The skilled trades are the dominant occupation category during the development phase of activity and are critical to issues involving local employment and training, particularly by the trade unions. The marine occupations represent almost a quarter of total employment across all phase of activity.

Professional Engineers

The model incorporates seventeen engineering disciplines and occupation categories ranging from more traditional branches of engineering (civil, electrical and mechanical) to more specialized engineering areas of pipeline, instrumentation, and reservoir. As would be expected, the demand for engineers will vary considerably depending on the particular scenario. The simulation results provided in Table 3 further reveal that the
demand for engineers varies with the phase of activity, with significant peaks related to development activities. What is apparent is that there is a far greater degree of stability during the exploration and production phases due to the expected sustained amount of exploration activity and the longer term nature of employment resulting from production as new projects come on stream. This is further illustrated in the following two graphs (see Figures 16 and 17) for the base and moderate cases.

Figure 15: Total Engineering Demand

![Figure 15: Total Engineering Demand](image)

Table 3: Demand for Engineers by Phase and Scenario

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The next graph depicts the degree of variability in demand according to both the phase of activity and the scenario being considered.
Not only does the demand for engineers vary with the phase of activity, but so do the particular disciplines of engineers. During exploration, most of the engineers required are drilling, reservoir, sub-sea and well engineers. Development activities draw upon the full range of engineering disciplines represented in the model including a strong demand for civil, instrumentation, mechanical, pipeline and structural engineers. Demand during the lengthy production phase is more restricted with a concentration in engineering management, facilities, instrumentation, process and pipeline engineers, and reservoir, sub-sea and well engineers.

**Technicians and Technologists**

Occupations that fall into the broad categories of technicians and technologists are of particular interest to the Nova Scotia Community College and to the University College of Cape Breton. These institutions provide much of the training available within Nova Scotia for these occupations, particularly entry-level positions and skills upgrading. Included within this general grouping are aircraft, drilling, maintenance, production and well technicians, draftspersons, engineering technologists, materials and site inspectors, and ROV pilots.
The demand for technicians and technologists depends on both the phase of activity and the particular scenario. Table 4 provides a summary of the total expected demand for technicians and technologists for each of the three scenarios being examined and by phase of activity.

**Table 4: Technicians and Technologists**

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In the base case the demand is concentrated in both the exploration and production phases of activity, with the exception of sporadic development activity associated with tier 2 of Sable, Deep Panuke and a development late in the planning period. Total demand in this case shows relative stability ranging between 102 and 192 person years for all but the last year. During exploration the bulk of the demand is concentrated amongst drilling technicians, engineering technologists, ROV pilots and aircraft technicians with the majority in the first two occupation classes.
The production phase is dominated by maintenance and production technicians (almost 80%), with most of the remainder being aircraft technicians required to support helicopter operations for transporting offshore workers. While development activity is relatively limited for this scenario, there are sharp demand spikes in 2003/04 associated with tier 2 of Sable, and again in the last 5 to 6 years of the planning period as a result of Deep Panuke and a subsequent development. Demand during this phase is dominated by draftspersons, drilling technicians, well technicians and materials/site inspectors.

The moderate case (Figure 20) indicates substantial growth in demand relative to the base case (Figure 19) beginning in 2007 and suggests a doubling of demand beyond 2008. While this growth is spread across all phases of activity, it is most significant during the development and production phases as a consequence of more discoveries at an earlier point in the planning cycle, leading to more development activity and a ramping up of production. This limited growth in the early years is important from the perspective of the educational institutions since there is, in theory, sufficient time to train additional people to meet this demand increase. It is again worth noting that regardless of the case being considered, the mix of specific occupations depends on the particular phase of activity. In addition, the mix remains relatively stable.
Figure 20: Technical Occupations – Moderate Case

As might be expected, the demand for technicians and technologists increases substantially in the high case (Figure 21), particularly in 2005 and beyond. This sharp growth in demand is driven by early incremental development activity starting in 2005, followed by new production around 2008. Thereafter both continuing new development and production growth contribute to a relatively steady growth in demand. This is somewhat dampened by a decrease in the demand for technical occupations associated with exploration during the last four years of the planning period. This is explained by aggressive exploration during the earlier years driven by strong markets and good prospectivity leading to a more rapid maturation of the offshore region. As with the moderate case there is time for training institutions to respond to this potential increase; however, there remains considerable uncertainty as to whether or not this level of future activity will actually occur, or if people will seek out such opportunities in sufficient numbers.
Skilled Trades

The occupations that make up the grouping referred to as “skilled trades” are generally members of trade unions. Many of the unions provide training for their members, as well as influence the overall supply of these trades through the membership requirements and labour agreements with major contractors and project proponents. Included in this grouping in the model are electricians, mechanics, painters, pipefitters, platers, riggers, scaffolders and welders. It should be noted that there has been some aggregation of trades within the model with the result that the occupations do not directly correspond to trades represented by a number of trade unions. Therefore, some disaggregation or refinement of terminology may be necessary for planning purposes.

Numerically the total demand for skilled trades, broken down by scenario and phase of activity, is shown in Table 5. The variability from year to year is again clear. For example, the demand for skilled trades occurs primarily during the development phase of projects and hence tends to show considerable variation over time, particularly for the base and moderate cases when development activity is sporadic compared to the high case. For all three cases examined, the development phase represents between 86.4% and 89.4% of the employment of skilled trades for the 15-year period. There is some limited demand when exploration is taking place, but this tends to be concentrated on electricians, mechanics and welders. This ranges between 3.6% (high case) and 7% (base case) of the total person years of employment provided by the skilled trades. During the production phase the percentage is stable at between 6% and 7% of the person years for the scenario. In addition to three trades for which demand occurs during the exploration phase, there is also some limited demand for painters, pipefitters and scaffolders.
Table 5: Total Demand for Skilled Trades

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The following three charts (Figures 22-24) illustrate graphically the demand for skilled trades for each of the three cases. The degree of annual variability in demand and the concentration of demand during the development phase are evident. Relatively sustainable levels of employment occur only in the high case when there is a continuum of projects under development throughout the planning period. For the other cases, the trades will be subjected to periods of under employment related to oil and gas activity which might be somewhat mitigated by other construction activity within the province, or give rise to out-migration for at least a period of time.

Figure 22: Skilled Trades - Base Case
Figure 23: Skilled Trades - Moderate Case

![Skilled Trades - Moderate Case](image)

Figure 24: Skilled Trades - High Case

![Skilled Trades - High Case](image)
Not surprisingly, the distribution of the demand for trades during the development phase is roughly the same regardless of the scenario examined. On average about 27.5% of the demand is for welders, followed by riggers at 20% and platers at 16%. Scaffolders, electricians and pipefitters are all in the 8% to 9% range. Because the demand for these same trades arises from a variety of construction activities outside the oil and gas sector, the question of the adequacy of supply and the need for training cannot be looked at in isolation from these other activities. Possible labour shortages can be dampened somewhat depending on the timing of oil and gas projects relative to other activities, or alternatively could be exacerbated if planning ignores other sources and timing of demand.

Marine Occupations

The demand for marine occupations represents a sizeable proportion of total employment related to offshore oil and gas activities, regardless of the phase or scenario. It ranges between 23% and 24.4% of total human resource demand, with the highest percentage in the base case scenario where exploration activity is the most dominant. For the purposes of this model, marine occupations include captains, barge engineers, dynamic positioning operators, engine room operators, marine engineers, seapersons and ships officers. The following table shows the total demand for the marine occupations by scenario and the phase of activity.

Table 6: Demand - Marine Occupations

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Although the marine occupations maintain a relatively constant share of total employment over the fifteen-year planning period, the mix between phases of activity changes substantially depending on the particular scenario being considered. This is the result of the low case having limited development and production activity compared to the high case, with the moderate case providing a more balanced mix. The fact is that marine operations are required to support all types of activity: exploration drilling and seismic programs; development drilling; certain construction activities; rig support; and well workovers during production. This provides greater continuity of demand and therefore employment stability over the planning period, compared to some other occupation groups, most notably the skilled trades and professional engineers. The following figure shows the total demand for marine occupations.
The next two figures (Figure 26-27) show the breakdown between the phases of activity for the base and high cases in order to illustrate that while there can be significant variability between the phases, there is far less when total demand is considered.
In terms of specific occupations, the greatest demand is for seapersons (42.6% to 47.2%), marine engineers and engine room operators (27.6% to 30.1%), and ships officers of various levels (14.8% to 16.1%). These are positions that offer good opportunities for Nova Scotians given the rich supply of people with basic nautical skills and the availability of training and skills upgrading within the province.

5.3.3 Analytical Limitations Arising From the Model

The analyses described in the previous section have focused on the demand for particular occupation groups arising from three of the scenarios that are contained within the model. While understanding the possible range of demand over time is a useful starting point for planning, it provides little insight into whether or not the capacity exists to satisfy this demand now and in the future. In order for those public and private sector organizations involved in education and training to assess what changes, if any, they should be making in the programs and courses being offered, and the number of places available, there are several additional pieces of information that are required. The most obvious is the need for an understanding of the current supply of various occupations, coupled with demographic and other information that will enable a forecast of potential future supply. The significant factor for education and training providers is the gap that may exist and what is necessary to fill that gap.

A second limitation arises from data availability. This affects the human resource templates in the model, the occupations that have been selected, the pre-defined scenarios that are included and the omission of some technologies (i.e. drill ships and common-user pipelines or processing facilities). The relative immaturity of the offshore petroleum industry in the Canadian East Coast means that for certain technologies there is no regional operating experience; hence, the data used in the model is from other parts of the
world that may or may not be transferable. Furthermore, some companies operating locally were unwilling to provide certain relevant human resource data leaving gaps that had to be estimated. Data gaps and modeling issues also led to the aggregation of some occupations (i.e. certain skilled trades and general labour). This has an impact on some of the analysis that can be conducted and limits the usefulness of the results in certain circumstances such as for trade unions. With the lack of drilling outside of the Sable Basin, good data is not available for other basins on such factors as potential reserves, pool sizes, drilling success rates and other parameters that are used to define the scenarios. This results in an extremely broad range of possible activity levels being reflected in the scenarios. This same limitation affects the way in which the model operates by necessitating an assumption that all fields in a given basin have the same average pool size, rather than including a distribution of pool sizes for each basin. This in turn affects the timing of developments and the selection of technologies.

The occupations in the model do not provide an indication of how many of the people required will be at an entry, intermediate or senior level. This information is vital for planning education and training activities. However, the competency database that is included in the model provides a general sense of the education, experience and broad competencies expected for the different levels in each occupation, as well as the finer occupational breakdowns for certain occupations. Education programs at the university and community college level are largely focused on preparing students to join the workforce in entry level positions. To an increasing extent, they are also offering continuing education and skills upgrading to prepare people to secure more senior or advanced positions. Clearly the model is of limited use at this point in providing the type of analysis required to support decisions regarding the required program capacity to meet future demand for people at various experience and skills levels.

Many of the occupations included in the model are not exclusive to the offshore oil and gas sector. Any potential gap between the supply of and demand for these occupations should consider the total demand, rather than just that represented by the offshore oil and gas activities. Perhaps the most critical area to consider is the demand for skilled construction trades, as well as technicians and technologists. The model’s modular construction allows the incorporation of templates for significant new construction projects that might have the greatest impact on the overall supply and demand situation. This would provide planners with a more complete picture before making decisions on the need for additional training capacity to increase future supply.

Another consideration when using the results of any analysis from this model is that no attempt was made to determine either the source of human resources or where work would be carried out, most notably during the development phase. For those projects undertaken in the region to date, a sizeable portion of development expenditures and employment have taken place in other parts of Canada and elsewhere in the world. Attempting to predict where work will be undertaken in the future is fraught with difficulty and has purposely been avoided in this project. Nonetheless, this cannot be ignored in any decision to expand education and training capacity within the region. In addition, there is a need to consider whether or not the lack of properly trained people
with insufficient experience was an important factor affecting past procurement decisions. If so, then taking steps to increase the supply of certain occupations could have a positive impact on the overall benefits flowing to the region from oil and gas activity. As such, judgment will be required when using demand estimates from the model. For example, users must take account of the reality that not all goods, services and jobs will be sourced locally, and that the adequacy of trained and experienced people will affect procurement decisions to some extent.

Notwithstanding inherent limitations, the model provides a reasonably good order-of-magnitude picture of future human resource requirements. It is a flexible, comprehensive, dynamic and robust tool that to date has been lacking. As such, the model can assist with human resource planning for Nova Scotia’s offshore industry. However, it has to be viewed as a starting point; the full capabilities of the model will only be realized by dealing with the limitations that have been discussed in this section of the report. In that regard, there are a number of areas for additional work that have been identified in order to maintain the model’s currency and usefulness, and to address many of the limitations that have come to light as a result of the analysis that has been conducted thus far. These are the subject of a number of recommendations that are presented in the next section of the report.

5.4 DISCUSSION AND RECOMMENDATIONS

As noted in the introduction of this report, the primary purpose of the study was to develop a human resources labour demand simulation model that various industry stakeholders could use in their planning and policy considerations. The secondary purpose was to document any major education/training recommendations that may have resulted from our analysis. In the following section we present industry-wide recommendations, occupational-based recommendations and future model development recommendations.

5.4.1 Industry-wide Recommendations

As stated throughout this study, the focus of this project was on labour demand. As such, the issues concerning where labour would be sourced and the current supply of local labour (both in terms of quantity and competencies) were not examined. Thus, the human resources requirements model developed in this study, and the resulting analyses, only examined demand-related issues. Moving forward, there is a need to incorporate the results of this study with data concerning labour supply, such as the current study on construction trades being conducted by APEC. Once this step has been taken, there is a need to categorize occupations in a manner similar to the Newfoundland gap analysis conducted by the Petroleum Industry Human Resources Committee (2002, February). This would facilitate the carrying out of a similar gap analysis that would enable the identification of those occupations requiring the most in-depth gap analysis as well as those occupations that represent the ‘best’ choices for value-added educational programs.
Recommendation 1: The data collected in this study should be coupled with relevant labour supply data to enable a more complete picture of the human resources requirements for the Nova Scotian offshore.

Recommendation 2: An occupational-based gap analysis should be conducted to help educational institutions identify the occupations that represent the ‘best’ choices for value-added educational programs.

As discussed earlier in this report, there was a lack of information concerning the competencies that differentiated levels (i.e. junior, intermediate and senior) of many occupations. Perhaps the only competency that differentiated levels in the current study was years of experience (i.e. years of experience increased as occupational level increased). In order to facilitate the appropriate development of training programs geared to entry versus intermediate versus senior positions, further investigation is needed to determine which specific competencies, beyond years of service, differentiate occupational levels.

Recommendation 3: Additional research must be conducted to improve our knowledge of the numerical breakdown between levels and competencies to determine which key competencies differentiate levels of the same occupation.

The scope of this study was limited to labour demand for the Nova Scotian offshore. Yet throughout the key informant interviews and literature review, there was ample evidence that the labour market for certain occupations was beyond the local market. Concurrently, educational institutions are being faced with funding cuts that require that they carefully weigh the advantages and disadvantages of new program offerings. This would suggest the need to look at regional versus local educational programs.

Recommendation 4: Any new educational programs should be investigated, developed and implemented on a regional basis to meet regional needs.

A clear theme throughout the key informant interviews, the literature review and the competency database, was the expressed desire for new hires to have ‘relevant’ offshore experience. As such, the challenge facing employers is finding these experienced people. This experience competency requirement may prove to be a challenge moving forward. As such, there is a need for closer collaboration between industry and educational stakeholders to find innovative ways to couple educational programs with work experience programs (i.e. experiential educational opportunities, internships, coop placements, etc.).

Recommendation 5: Industry and educational stakeholders should partner to develop and implement creative methods of developing ‘relevant offshore experience’ components in educational programs.

Building on the preceding recommendation, there is a need to examine alternative labour supply routes to meet the forecasted labour demand in the Nova Scotian offshore. For
example, there is the potential of ‘new recruits’ into the oil and gas field from fringe and supply industries (i.e. accounting, logistics, contract administration, etc.). As such, there is a need to provide training programs that would allow the ‘bridging’ of these ‘traditional’ skill sets with the relevant competencies required for the offshore, resulting in a broader labour supply base.

Recommendation 6: Industry and educational stakeholders should develop and implement training and educational programs designed to bridge traditional occupational skill sets with the competencies unique to the offshore.

An analysis of the competency-based literature review and the competency database developed in this study suggest that there are three industry-wide core competencies required in the offshore: teamwork, computer literacy and communication skills (oral/written).

Recommendation 7: Education stakeholders should ensure that these three competencies are included in course design and curriculum.

Recommendation 8: Industry and educational stakeholders should develop industry-wide training programs that focus on the development of these key competencies.

As noted in the best practices section of this report, OPITO was recognized by several sources as an effective mechanism to address training, on-going research and public awareness issues at the industry-level. One of the reasons why this organization was seen as being successful in the North Sea environment was that it represented the views of all key stakeholders: government, employee (and labour) and employer. Given the effectiveness of OPITO, it is recommended that a similar, multi-stakeholder organization be created that would focus on three human resources areas critical to the long-term development of the industry: training, on-going research and public awareness. As a first step, a workshop should be convened with representatives from industry, labour, education and government to understand industry needs, identify key human resource issues in the region, establish research priorities and reach a consensus concerning the most appropriate vehicle for maintaining on-going dialogue concerning these industry-wide issues.

Recommendation 9: PRAC create a multi-stakeholder forum with the purposes of:

a) identifying industry-wide human resource issues and research priorities,
b) promoting the industry in the media and through career fairs, and
c) discussing the appropriate vehicle for on-going dialogue concerning industry-wide issues

Building on recommendation 9, this study has resulted in an extensive volume of research being collected from multiple sources and disciplines (see section 6.0). This information represents relevant employment information for job seekers and valuable human resources information for industry, government and educational stakeholders. As such, a searchable reference database should be developed and maintained. This database is
valuable to those interested in research and can form the springboard for future research. As a starting point, there are numerous research questions that can be identified from these informational resources. However, prior to addressing any of these research questions, it is necessary for stakeholders to identify the key priorities moving forward while maintaining and building upon the resources gathered to date.

Recommendation 10. As a multi-stakeholder organization, PRAC, or a similar organization, be identified as a neutral forum that can advance and maintain a searchable database related to the educational and training needs of the region.

Recommendation 11: The multi-stakeholder organization that results from recommendation 10 should serve the following functions:
   a) a resource for research information,
   b) the identification of research needs and the facilitation of this research through proposal calls and contracted research,
   c) the identification, planning and facilitation of training programs designed to meet industry needs, and
   d) the running of ongoing labour supply and demand studies at the industry level.

Upgrading skills can be challenging in the offshore environment. First, the work schedules in the offshore often require people to be away from their families for weeks at a time. As such, providing training during ‘off-time’ can be challenging as employees wish to remain with their families. Second, traditional stand-up delivery of information can be time consuming and costly given the rotation of employees. The best practices research indicated that some organizations are examining alternative methods of delivering training material to facilitate learning (i.e. self-paced e-learning while offshore) while minimizing training costs and addressing the work-family balance issue. Moreover, this training material could potentially be exported to similar industries outside the region.

Recommendation 12: Educational stakeholders should examine alternative methods of course content delivery to facilitate remote learning, particularly with regard to skills upgrading.

5.4.2 Occupation-based Recommendations

As discussed throughout this study, the current model only examines issues related to labour demand. In order to identify the group of occupations that will be most significant for the region, there is a need to categorize similar occupations and then conduct a gap analysis to identify those that represent the ‘biggest value-add’ for the region. In addition to the industry-wide issues contained in the previous recommendations, the results of this study, in particular the analyses conducted in section 5.3, suggest that four occupational groupings require special focus moving forward: engineering, technicians/technologists, skilled trades and marine.
Engineering

The analysis conducted in section 5.3 points to a significant demand for professional engineers. There is a direct relationship between where the design work is performed and where the procurement is conducted. To have design work performed locally, the right skill sets must be available locally. This points to a supply analysis at the regional level for engineers (including competencies) to ensure that Nova Scotia can meet the future demand and thereby, potentially, generate increased local benefits.

Recommendation 13: Stakeholders should conduct a labour supply study directly aimed at determining the availability of locally based engineers and their associated competencies.

Recommendation 14: Upon completion of recommendation 13, a gap analysis must be conducted to determine appropriate educational and training programs to ‘bridge’ any gaps uncovered by this analysis.

Technicians/Technologists

As discussed in section 5.3, it is anticipated that technicians/technologists will represent between 7 and 10% of the total demand for labour in the offshore. This analysis further revealed that there would be an anticipated four-year time lag prior to the sharp increase in demand for these technicians/technologists. Assuming that this shortage of technicians/technologists does indeed exist, there is time for educators to modify and develop programs to meet this demand. This clearly points to the need for educators to: (a) determine the relevant supply (and competencies) of the current labour, (b) conduct a gap analysis, and (c) examine ways to develop and modify programs to address any gaps in numbers and/or competencies. In addition, apprenticeship programs similar to that managed by OPITO should be considered to help address any potential technician/technologist shortages.

Recommendation 15: Stakeholders should conduct a labour supply study directly aimed at determining the availability of locally-based technicians/technologists and their associated competencies.

Recommendation 16: Upon completion of recommendation 15, a gap analysis must be conducted to determine educational and training programs that can be developed to meet the local need.

Recommendation 17: Key stakeholders should consider the development of an apprenticeship program similar to that managed by OPITO

Skilled Trades

Section 5.3 also pointed out the potential for a strong demand for skilled trades. In addition, the literature review and best practices interviews highlighted a potential
shortfall in the availability of skilled tradespersons as a result of the aging population. Moreover, an additional concern is that these skilled tradespersons are also required in other, non-oil/gas industries. Hence, supply side data (some of which is currently being investigated by APEC) is needed to anticipate and prepare for these shortages as well as develop mechanisms to address any gaps that may exist.

Recommendation 18: Stakeholders should conduct a labour supply study directly aimed at determining the availability of locally-based skilled trades and their associated competencies.

Recommendation 19: Subsequent to the completion of recommendation 18 and the skilled trades labour supply study by APEC, a gap analysis should be conducted to determine appropriate education and training programs that can be developed to meet the local demand.

Marine

There is a surplus of people with general marine skills currently displaced from the Atlantic fishing industry. While there has been a pilot project, steps should now be taken to determine: (a) whether this displaced labour supply can be utilized in the offshore, and (b) ways that the general marine competencies which exist in this population can be augmented to meet the needs of the offshore oil and gas industry.

Recommendation 20: Key stakeholders should examine the current labour supply of marine occupations and subsequently conduct a gap analysis.

Recommendation 21: Educational stakeholders should determine the best way to bridge traditional marine competencies with those competencies required for the offshore industry.

5.4.2 Model Updating and Future Model Development

As noted earlier in this report, our goal was to develop a user-friendly model that would aid in the development of scenarios, both system-defined and user-defined, for estimating human resource requirements associated with different levels or types of offshore activity. The model was not designed to predict where work would be performed nor was it intended to provide a forecast of exploration and development activity. As such, the Nova Scotia Offshore Labour Demand Model represents a first, albeit important, step in developing a useful simulation model for the Nova Scotian offshore. Moving forward, it is critical that this foundation is built upon to reflect:

(a) key research questions facing the industry,
(b) success rates from the current exploration activities,
(c) changes in technologies and technology success rates,
(d) more realistic scenarios and increased modular designs based on the likelihood of work being completed in the region,
(e) daily and cumulative production to allow comparison to other studies,
changes in the labour market conditions, and
any increased specificity of the occupations (especially that of general labour) to
allow more accurate estimates of human resources requirements, and any
anomalies that may be present in the current model

The initial analyses provided in section 5.3 indicates how the model can be used to better understand human resources requirements trends related to various offshore activity levels. These analyses demonstrated that there is a broad range of human resources requirements depending on the scenario chosen. As such, human resource planners must ensure that the model is maintained and updated to help minimize the potential sub-set of viable scenarios, thus, increasing both the accuracy and effectiveness of the model.

Recommendation 22: HR Planners should use the model with the goal of providing feedback to ensure that the model, and the associated scenarios, are maintained and updated.

One potential way to address these issues is the development of an ongoing users’ forum, consisting of people trained in the use of the model, where these issues can be raised and ways to address them be planned. Three specific recommendations for this users’ forum follow.

Recommendation 23: PRAC should offer training to facilitate the use of the labour demand model.

Recommendation 24: A users’ forum consisting of trained users of the model be formed.

Recommendation 25: Members of the proposed users’ forum should be tasked with providing feedback and information to PRAC to facilitate:
(a) keeping the model current by ensuring that the data be updated on an annual basis,
(b) refining the simulation rules to allow for more realistic scenarios and greater modular design so that activities like fabrication can be separated out if the work is not done locally, and
(c) disaggregating human resource requirements in future work to allow for more accurate estimates of human resource requirements
6.0 REFERENCES


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Right skills, right image. Newcastle City Council, Engineering Magazine.


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Satter, A. (1997, June). Directions in upstream training, the leading edge.


APPENDIX A
Interview Guide
Interview Guide
Human Resources in the Offshore

Canmac Economics Ltd.
Dr. Michael Foster
(1-902-864-3838)

Dr. Travor Brown
Memorial University
(1-709-737-2615)

November 16th, 2001
Interview Guide

Interviewer Instructions

The purpose of this interview is to obtain reliable data and qualitative information on the offshore oil and gas industry’s current human resource requirements, and their views on key issues they expect will affect them in the future. The information we are seeking goes beyond mere numerical data collection. We want to probe what is important to industry with respect to job definition, core competencies (i.e., skills, knowledge, abilities, education and experience) and their experiences in the local labour market.

Given the purpose of the interview, the interview guide is designed primarily in a semi-structured, open-ended format. The interview questions begin with general questions to assist the interviewee in getting in the right framework before responding to the more focused research questions. The over-riding issue for the interviewer is to guide the responses and not “force fit” responses as if one was conducting a closed end survey. To help respondents who may be reserved, several probing questions are included to encourage a more accurate response.

Introduction

Hello, my name is ____________________________. I am conducting interviews on the human resource requirements in the offshore oil and gas sector. The Atlantic Canada Petroleum Institute is pleased to sponsor this study in response to requests by industry and government officials.

Your information will be extremely helpful to the success of this project. Some senior industry executives have expressed concern about potential future shortfalls of properly trained and experienced human resources to support the east coast oil and gas industry. Clearly it is in the interest of the industry, government, education and training institutions, and labour to gain a better understanding of what the future human resource requirements might be, and to plan how best to meet that demand while recognizing the high degree of uncertainty about future petroleum industry activity levels.

Participation in the interview is voluntary. However, your cooperation is important for the study to be useful and valuable to industry representatives such as yourself. Please be assured that individual business information is fully confidential. At no time will we report company specific data. The only data that will be made public is the aggregate, industry data.
Section 1 - Human Resources

1.1 Company Name

1.2 Respondent Name
    Position
    Phone Number

1.3 Please describe your firm and its role in the offshore oil and gas sector
    *(Probe but don’t lead responses).*

    **Respondent’s Description**
    *(We require a description that can help us link the firm’s activity at a level of
detail to assist the model building exercise, eg. Jack-up rig for exploration.)*

    ________________________________________________________________
    ________________________________________________________________
    ________________________________________________________________
    ________________________________________________________________
    ________________________________________________________________

1.4 Now, if I could ask some specific questions concerning the firm, could you tell me:

    **Products**

    **Length of time in offshore activity on the East Coast**

    **Offshore Areas**
    N.S.    NFLD.    Other

1.5 You have mentioned a number of activities that your firm undertakes, what are
    the major services that you contract for? *(Here, we are looking for things like
catering services, etc. The purpose of this question is to determine if there are
particular aspects to this firm’s activity that are sub-contracted out. Note that
the services here are not contract employees but rather purchases/services from
firms.)*

    ________________________________________________________________
    ________________________________________________________________
    ________________________________________________________________
    ________________________________________________________________
    ________________________________________________________________
    ________________________________________________________________
    ________________________________________________________________
    ________________________________________________________________
    ________________________________________________________________
Section 2 - Human Resources Requirements

Interview Notes: This is perhaps the most important question in the survey. Its purpose is to elicit from the respondent’s perspective what are the important human resource characteristics for the various offshore jobs and the number of persons required in each job. Accordingly, the format is open-ended to allow the respondents to express accurately what is important to them. If you find the respondent is not distinguishing clearly the core competencies necessary for the job then probe for a clearer response. A separate sheet should be completed for each job description.

Now that I have a clear understanding of the range of your activities and scope of your business, I would like to discuss the specific human resource requirements you have for jobs in the offshore oil and gas sector. What I would like to do is begin with each type of offshore activity, document the job duties, knowledge, skills and experience. Then, I will begin again with the next major type of offshore activity. So lets start with exploration activity. (Interview note: This comment refers only to those firms whose activities are in different offshore activities. When all exploration jobs are documented move to development. When all development jobs are documented move to production.)

2.1 Job Title

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

2.2 How many persons are in this job?

_________ Full Time _________ Part Time _________ Contracted

2.3 What are the key duties of this job?
(Ensure that the job duties are specific enough to allow us to code the specific sub-activity (exploration rig, supply ship) the employee is engaged in. Otherwise avoid detailed descriptions so that we don’t have respondent fatigue.)

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
2.4 As we discussed earlier, we are interested in both the number of employees required for this job as well as the competencies required to effectively perform this role. The next few questions will focus directly on competencies, defined here as the education, skills, knowledge, and experience necessary to effectively perform a job. One way to help identify important competencies is to think of people who have been effective in this job and what they brought to the job that made them effective. Another way is to think of people who have not been effective in this role and why they were ineffective. Remember, we are not interested in names—only the competencies that made employees effective or ineffective. Let’s start with educational competencies. What level of formal education do you feel is needed to function effectively in this role? (Note: Focus on formal education: High School, University, Professional Designation etc.)

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

2.5 Are there other training requirements that you feel are critical for the job? (Note: Focus here is non-formal training such as on-the-job, job specific skills training, etc. Repeat the phrase “Thinking of people who have been effective in the role” if necessary)

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

2.6 In addition to the training and education requirements you have just discussed, what skills and knowledge do you see as necessary to effectively perform this job? (Note: Repeat the phrase “Thinking of people who have been effective in the role” if necessary)

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

2.7 What experience is necessary to effectively perform this job? (Probe for years and “experience” in terms of previous assignments, company specific experience and/or industry experience. Repeat the phrase “Thinking of people who have been effective in the role” if necessary)

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

Nova Scotia Offshore Labour Demand Model Final Report
2.8 Are there other elements that we have not discussed that you feel are needed to effectively perform this job? *(Repeat the phrase “Thinking of people who have been effective in the role” if necessary)*

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

2.9 We have documented the number of existing jobs in your organization, now I would like to get information on how you see the number of persons that are in these jobs changing over the next few years and the reason for these changes.

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Describe the reasons for these changes.
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

2.10 Do you see the education, training, skills, knowledge, and experience necessary to effectively perform this role, changing over the next 3-5 years? Please explain.
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

*(Interviewer Note: Return to 2.1 and repeat as needed)*

2.11 Great, do you foresee any new occupations required over the next few years? Could you please specify these. *(Note: If the new occupations are not going to be covered in other interviews then document 2.1 to 2.8 inclusive)*
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

* Nova Scotia Offshore Labour Demand Model Final Report *
Section 3 - Human Resource Issues

This section solicits opinions on what, in the opinion of the respondent, are the key human resource issues the client will face over the medium term. We specifically test for their views and experience in acquiring human resources from the local market. The interview format is open-ended to allow the respondent freedom of expression.

As I mentioned at the start of the interview, we are interested in your views regarding some of the key human resource issues facing the offshore petroleum industry in the region over the next 3-5 years as well as your experiences with the local, East Coast, labour market.

3.1 Let me first start with your experience hiring new employees. Can you tell me how many new hires, defined here as full-time employees working for six months or more, you have hired in your East Coast operation this year?________

3.1.1 How many of these new hires were new graduates with university degrees? __________

3.1.2 How many of the new hires were new graduates with technical school diplomas? __________

3.2 Could you tell me the total number of contract employees, defined here as people hired for periods of less than 6 months, you retained in your East Coast operation this year? __________

3.3 Now I would like to ask you a few questions concerning turnover. Could you please tell me the number of employees who have left your East Coast operations over the past year? __________

3.3.1 In your opinion, what are the top three reasons for this turnover?______________________________________________________________
____________________________________________________________________________________________________________________
____________________________________________________________________________________________________________________

____________________________________________________________________________________________________________________
____________________________________________________________________________________________________________________
____________________________________________________________________________________________________________________
____________________________________________________________________________________________________________________
____________________________________________________________________________________________________________________
3.4 Over the next 3-5 years, what do you see as the most significant issues facing your company in obtaining and/or retaining a high quality workforce in your East Coast operation? *Probe but do not lead, some issues the respondent may identify include: demographics, technology, flexible job descriptions.*

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

3.5 For the issues you have mentioned above, what are the implications for your firm and how do you hope to address them?

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

3.6 When seeking to hire professionals, how difficult is it to find suitable employees in the East Coast?

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

3.6.1 Can you tell me if some positions are more difficult to fill? If so, which positions?

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

3.6.2 In your opinion, what are some of the reasons why these positions are difficult to fill?

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
3.6.3 In your opinion, what could be done to improve the situation?

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

3.7 When seeking to hire technical/trades, how difficult is it to find suitable employees in the East Coast?

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

3.7.1 Can you tell me if some positions are more difficult to fill? If so, which positions?

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

3.7.2 In your opinion, what are some of the reasons why these positions are difficult to fill?

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

3.7.3 In your opinion, what could be done to improve the situation?

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
3.8 Finally, do you have any further comments you would like to make with respect to the human resource requirements for the offshore oil and gas sector?

__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________
__________________________________________________________________

THANK YOU!
APPENDIX B
Coding NOC Linkage
Methodology: Assigning National Occupation Classification Codes (NOC) to identified offshore occupations.

Through industry interviews and input from the steering committee the project team was able to identify occupations employed in offshore exploration, development and production on Canada’s east coast.

Tasked with coding these occupations for linkage with the labour demand model the project team employed Human Resource Development Canada (HRDC) publication National Occupation Classification (NOC) 2001, Canadian Government Publishing Catalogue #: MP53-25-200IE.

The National Occupation Classification (NOC 2001) contains the classification structure and descriptions of 520 occupational unit groups that constitute the Canadian labour market. As well this publication contains a poster size NOC matrix, which graphically illustrates the entire classification; and an index of over 30,000 occupational titles. We also utilized the HRDC web site http://cnp2001noc.worklogic.com/e/welcome.shtml.

Many of the offshore occupations were standard occupations that were easily identifiable and coded from the occupation descriptions contained under the NOC major groups (0-9). Occupations such as Civil Engineer (NOC 2131) and Crane Operator (NOC 7371) were listed directly under the appropriate major group that contained an occupation description.

Other less common occupations (e.g. Seismic Gun Mechanic, Rigger and even Structural Engineer) were less obvious and, hence, harder to classify. To classify those occupations that were not clearly identifiable from the occupation listing of the major groups we used the electronic version of the NOC that contained an index of titles which link back to the major groups four digit NOC. For a title such as Structure Engineer we enter “Structural Engineer”. This occupation title was listed twice, one as a sub-title of NOC 2131 - Civil Engineers and a second as a sub-title of NOC 2146 - Aerospace Engineers. At this point the consultant made a judgment as to the appropriate NOC based on which four digit NOC best reflected the occupation involved in the offshore oil and gas activity, in this particular case NOC 2131 - Civil Engineers was selected.

This preceding methodology was employed for all occupation titles that were not directly listed in the four digit NOC titles list under each of the ten major groups.
### National Occupation Classification

#### NOC Major Groups

<table>
<thead>
<tr>
<th>Group</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Management Occupations</td>
</tr>
<tr>
<td>1</td>
<td>Business, Finance and Administration Occupations</td>
</tr>
<tr>
<td>2</td>
<td>Natural and Applied Sciences and Related Occupations</td>
</tr>
<tr>
<td>3</td>
<td>Health Occupations</td>
</tr>
<tr>
<td>4</td>
<td>Occupations in Social Science, Education, Government Service and Religion</td>
</tr>
<tr>
<td>5</td>
<td>Occupations in Art, Culture, Recreation and Support</td>
</tr>
<tr>
<td>6</td>
<td>Sales and Service Occupations</td>
</tr>
<tr>
<td>7</td>
<td>Trades, Transport and Equipment Operators and Related Occupations</td>
</tr>
<tr>
<td>8</td>
<td>Occupations Unique to Primary Industry</td>
</tr>
<tr>
<td>9</td>
<td>Occupations Unique to Processing, Manufacturing and Utilities</td>
</tr>
</tbody>
</table>

#### Natural and Applied Sciences and Related Occupations

##### Major Group 21

**Professional Occupations in Natural and Applied Sciences**

<table>
<thead>
<tr>
<th>Group</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>211</td>
<td>Physical Science Professionals</td>
</tr>
<tr>
<td>2111</td>
<td>Physicists and Astronomers</td>
</tr>
<tr>
<td>2112</td>
<td>Chemists</td>
</tr>
<tr>
<td>2113</td>
<td>Geologists, Geochemists and Geophysicists</td>
</tr>
<tr>
<td>2114</td>
<td>Meteorologists</td>
</tr>
<tr>
<td>2115</td>
<td>Other Professional Occupations in Physical Sciences</td>
</tr>
<tr>
<td>212</td>
<td>Life Science Professionals</td>
</tr>
<tr>
<td>2121</td>
<td>Biologists and Related Scientists</td>
</tr>
<tr>
<td>2122</td>
<td>Forestry Professionals</td>
</tr>
<tr>
<td>2123</td>
<td>Agricultural Representatives, Consultants and Specialists</td>
</tr>
<tr>
<td>213</td>
<td>Civil, Mechanical, Electrical and Chemical Engineers</td>
</tr>
<tr>
<td>2131</td>
<td>Civil Engineers</td>
</tr>
<tr>
<td>2132</td>
<td>Mechanical Engineers</td>
</tr>
<tr>
<td>2133</td>
<td>Electrical and Electronics Engineers</td>
</tr>
<tr>
<td>2134</td>
<td>Chemical Engineers</td>
</tr>
</tbody>
</table>
APPENDIX C
General Literature Review Summary
General Literature Review

The general literature review focused on searching and reviewing studies that would have direct relevance to the project. The literature review build on recent literature reviews provided by ACPI.

The major studies that were found that had direct relevance to the study are as follows:

A) General Background Studies

Studies provide overall view of East Coast Sector and documents the major issues facing the sector. Useful as backgrounder to formulation of base case scenario.

1. CAPP - “Drilling an Offshore Well in Atlantic Canada”. Good overview for basic terminology and key activities. Too preliminary for any modeling parameters.


3. CAPP - “Outlook for the Natural Gas Industry in Atlantic Canada”. Some of the basic data on revenues provided. Data is of recent vintage.


6. Petroleum Communication Foundation - “Canada’s East Coast Offshore Oil and Gas Industry - A Backgrounder”. Good introductory on basic east coast oil and gas main parameters.

B) Human Resource Studies

Previous human resource studies provide a frame of reference for interview guide and analysis.

1. Employment and Immigration Canada - “Human Resources in the Upstream Oil and Gas Industry” - Volume I - Report and Volume II Appendices.
   Useful study but limited in applicability. Study a little dated and Canada wide. Some occupation demand, supply forecasts but too old to be of direct use. Surveys useful for development of interview guide.

   Fairly general strategy report rather than human resource study. Heavy use of focus groups to develop study conclusions.

   Solid study. Useful as a frame of reference for ACPI work. Study excludes construction, production. Contains occupation forecasts at four digit NOC out to 2010.

   Good study on engineering and related needs. Good reference study for ACPI work. Contains detailed breakdown of the occupations for offshore sector with special emphasis on offshore.

C) Specific Gas Studies

1. U.S. Department of Commerce - Oil and Gas - Extraction
   Nice introductory overview of industry from an economic and labour demand perspective. Although U.S. based, the industry characteristics would be similar to Canada. Some conclusions are:
   - Most establishments employ fewer than 10 workers
   - About 60 percent of the industry’s workforce is concentrated in 4 states
   - Although technological innovations has expanded exploration and development, worldwide, employment is expected to decline

   Paper presents a econometric model to forecast industry employment. Useful approach for total industry but East Coast too small to use economic approach. Main conclusions are:
   - The number of wells drilled is one of the most significant factors affecting
upstream employment in the oil and gas extraction industry. Drilling is affected in turn by prices, costs, taxes and technology. The share of successful wells accounted for by natural gas, the share of total U.S. oil production accounted for by operations in Alaska, and the share of total U.S. oil and gas production accounted for by offshore activity also have significant impacts on upstream employment. “Service” jobs in the oil and gas extraction industry, including drilling and geological services, are more responsive to drilling levels than “production” jobs. The leading oil and gas producing States are less affected by changes in drilling and production than are States with many marginal wells. This paper shows that oil and gas extraction jobs are becoming less important to the State and national economies.

Useful reference document for development model scenarios.

Listing of Models used by Department of Energy. General reference only.

5. Strategic Concepts Inc. – “Harnessing the Potential - Atlantic Canada’s Oil and Gas Industry”
Good Study. Gives useful background information on specifics of East Coast. Good value chain matrix. Also provides an industry outlook scenario but this is getting dated.
APPENDIX D
Competency-based Literature Review Summary (by Job Title)
<table>
<thead>
<tr>
<th>Job</th>
<th>Source</th>
<th>Methodology</th>
<th>Competencies Noted</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>All major jobs included</td>
<td>Electronic Labour Exchange (ELE- a HRDC Data Base) <a href="http://www.ele-spe.org/">http://www.ele-spe.org/</a></td>
<td></td>
<td>Extensive Database with significant details concerning minimum competencies required for the job</td>
<td></td>
</tr>
<tr>
<td>Drilling</td>
<td>Boykin (1998)</td>
<td>Non-empirical /descriptive</td>
<td>Well trained (no specified training besides “in areas of high activity so they can apply latest technology”), innovation, mobility, degree (PE),</td>
<td>Key challenges facing drilling over next 5 years: 1- Global industry 2- Shortage of human resources. Large void of people with between 0-10 years experience, most have 20+ years. 3- Demographics- aging of the population 4- Flatter organizations make motivation through traditional means difficult 5- Need to expand recruiting beyond North America</td>
</tr>
</tbody>
</table>

**NOTE:** The North Sea Drilling Group is said to develop and share best practices across organizations in Norway, UK, and the Netherlands
| Drilling Crews       | Goddy (2000) | Non-empirical / descriptive | Discusses increase in pay due to large increase in number of rigs. Nice summary of:  
1- Mobile offshore drilling unit utilization (as of Aug 17, 2000) broken into: Gulf of Mexico, Europe/Mediterranean, West Africa, Asia/Australia, World  
2- Top 50 Producers (with # of wells etc)  
3- Utilization of top 25 drilling contractors |
|---------------------|--------------|-----------------------------|--------------------------------------------------------------------------------------------------|
| Drilling Rig Operators (Entry Level) | Karmous, Clyne, McLean (1998) | Non-empirical / descriptive | General Competencies identified:  
1- Communication  
2- Versatility  
3- Self-motivated  
4- Creativity  
Health, Safety and Environment Competencies  
1- Emergency Response  
2- HSE Management  
3- Marine Operations  
4- Drilling Operations  
5- Electrical  
6- Mechanical  
7- Subsea  
8- Helicopters  
Also provides a break down of HSE responsibilities by roles: OIM, Rig Super, Assistant Rig Super, Barge Engineer, Crane Operator, Driller, Chief Electrician, Chief Mechanic, Subsea Supervisor, HLO, Fire Team Leader |
<table>
<thead>
<tr>
<th>Role</th>
<th>Source(s)</th>
<th>Methodology</th>
<th>Health, Safety and Environment Competencies</th>
<th>Other Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drilling Rig Operators (experienced)</td>
<td>Karmous, Clyne, McLean (1998)</td>
<td>Non-empirical/descriptive</td>
<td>1- Emergency Response&lt;br&gt;2- HSE Management&lt;br&gt;3- Marine Operations&lt;br&gt;4- Drilling Operations&lt;br&gt;5- Electrical&lt;br&gt;6- Mechanical&lt;br&gt;7- Subsea&lt;br&gt;8- Helicopters</td>
<td>Also provides a break down of HSE responsibilities by roles: OIM, Rig Super, Assistant Rig Super, Barge Engineer, Crane Operator, Driller, Chief Electrician, Chief Mechanic, Subsea Supervisor, HLO, Fire Team Leader</td>
</tr>
<tr>
<td>Engineer Specialist</td>
<td>Lindgren (1995)</td>
<td>Non-empirical/descriptive</td>
<td>No specific competencies provided. Basic Skills- less advanced than the Engineer Analysts</td>
<td>Discusses reorganization at one company</td>
</tr>
<tr>
<td>Engineering (various) and some support</td>
<td>CAPP Report (1999)</td>
<td>Simulation</td>
<td>Competencies identified:&lt;br&gt;1- Education&lt;br&gt;2- Experience (Relevant/Offshore)&lt;br&gt;3- Special Skill Sets (Recruitment, Employee benefits, compensation and training; facilities; accounting; IT, Project Management, Document Management, Reproduction; Software (Database, spreadsheet, JD Edwards; Engineering, Design).</td>
<td>Extensive list of jobs and competencies for engineering roles and some support in similar target group</td>
</tr>
<tr>
<td>Engineering Analyst</td>
<td>Lindgren (1995)</td>
<td>Non-empirical/descriptive</td>
<td>No specific competencies provided. Complex skills (more so than Eng Specialist).</td>
<td>Discusses reorganization at one company</td>
</tr>
<tr>
<td>Professionals</td>
<td>Skills Shortage Threatens Oil and Gas Growth (1998)</td>
<td>Non-empirical /descriptive</td>
<td>Authors eludes to the need for a broader range of capabilities including: - Innovation - Communication - Interpersonal - Awareness of ‘business’ issues</td>
<td>Skills shortage issues discussed – concerns that the labour supply will not meet demand</td>
</tr>
<tr>
<td>---------------</td>
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</tr>
<tr>
<td>Exploration (jobs not specifically identified as focus is on exploration as a whole)</td>
<td>Koen (1995)</td>
<td>Descriptive and trend statistical data</td>
<td>Competencies are at the organizational level and include: 3D Seismic abilities, balanced programs (projects with immediate cash flow and projects that will take years to generate cash).</td>
<td>Good overview of exploration activity in the US from 1980-1994</td>
</tr>
<tr>
<td>Extensive List of jobs (approximately 50)</td>
<td>CAPP (1999) Estimation of Direct Human Resource Requirements Offshore Exploration and Production Newfoundland and Nova Scotia</td>
<td>Simulation</td>
<td>Classifies jobs by title and core duties</td>
<td>Extensive list of offshore oil jobs included</td>
</tr>
<tr>
<td>Gas Installers</td>
<td>“Oil Shortage risks skills shortage” (1996)</td>
<td>Non-empirical /descriptive</td>
<td>None provided</td>
<td>Highlights skills and labour shortages and the need for training</td>
</tr>
<tr>
<td>Geologist/ Geophysicist</td>
<td>Neff and Thrasher (1993)</td>
<td>Non-empirical /descriptive</td>
<td>Computer skills (3D mapping and interpretation), teamwork skills</td>
<td>Overviews interdisciplinary teams used by Philips Petroleum Co.</td>
</tr>
</tbody>
</table>
| Geoscientist (Geologists and Geophysicists) (Entry Level) | Heath (2000) | Survey analysis of 29 firms employing over 6000 geoscientists | Key competencies include:  
1- Minimum of Honor’s Bachelor’s degree with clear movement to Masters degree as minimum  
2- Previous industry experience or exposure  
3- Technical skills (i.e., sedimentary geology, subsurface mapping, etc)  
4- Computer skills (word processing, e-mail, desktop systems (windows), spreadsheet, presentations, PC or Unix hardware)  
5- Geostatistics course  
6- Some business skills (project mgt, planning/strategy and economic analysis)  
7- ‘Soft’ skills: initiative, ethics. Adaptability, teamwork, communication (oral) | Extensive competency classification including 40 geoscience skills, 30 computer competencies, and more than 35 non-technical and soft skills |
<table>
<thead>
<tr>
<th>Geoscientists</th>
<th>Hopkins (1999)</th>
<th>Non-empirical /descriptive</th>
<th>Competencies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1- Computer/Software skills (Data fusion, mining and fusion)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2- Environmental laws and issues awareness</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3- Teamwork</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4- Leadership skills</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5- Problem solving</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6- Business direction</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Also new technology skills</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1- Data fusion</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2- Adaptive Modeling</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3- Well optimization</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4- NMR</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5- Microdrilling</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6- Swept-Frequency Acoustic Interferonmetry</td>
</tr>
<tr>
<td>Industry wide data largely used such as Exploration, Production, Field, Plant, Sales, Admin, geophysical, drilling, service &amp; supply.</td>
<td>Employment and Immigration Canada (1992).</td>
<td>Analysis limited to percentages</td>
<td>Very few competencies identified. The only two discussed were: 1-Education (in particular university degree and industry-specific diplomas/certificates) 2- Industry sponsored training such as the Petroleum Industry Training Service (PITS) courses – none specified</td>
</tr>
<tr>
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</tr>
<tr>
<td>Some high level data by occupational category (Land, Earth Sciences, Engineers, Technicians, Trades, Labour)</td>
<td>“Oil Shortage risks skills shortage” (1996)</td>
<td>Non-empirical /descriptive</td>
<td>None provided</td>
</tr>
<tr>
<td>Maintenance Engineer</td>
<td>Fraser (1989)</td>
<td>Non-empirical /descriptive</td>
<td>None specifically identified</td>
</tr>
<tr>
<td>Source</td>
<td>Methodology</td>
<td>Competencies Identified</td>
<td>Focus/Highlights</td>
</tr>
<tr>
<td>---------------------------------------------</td>
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</tr>
</tbody>
</table>
| None specified Tuedor, Osisanya, and Cuviller (2001) | Non-empirical/descriptive   | 1. Well Control  
2. Well Design  
3. Rig Operations  
4. Production Issues  
5. Loss Avoidance  
6. Project Management  
7. Environmental issues | Focuses on Deep Water Drilling Environments. Suggests that 5,000-6,000 people may be needed to operate the new 5th generation ultra-deepwater rigs. Highlights a competency-based training method. |
<p>| None specified Basic Education and Training. E. Hay. Electrical Safety in Hazardous Environments | Non-empirical/descriptive   | Electrical Equipment Safety                                                            | Focus is on skills shortage.                                                     |
| None specified Gilleland (2001)             | Non-empirical/descriptive   | None specified - eludes to the need for broader skill sets including computer skills and business savvy | Focus is on skills shortage.                                                     |
| None specified- Article discusses exploration and production staff McMillian and Montgomery (1998) | Non-empirical/descriptive   | Discusses incentive programs to attract, retain, and motivate E &amp; P professionals (i.e., stock options, pool plans, etc). Evaluates the pros and cons of plans using factors such as: encourages teamwork, provides ‘golden handcuffs’, rewards company-wide results, etc. | Discusses incentive programs to attract, retain, and motivate E &amp; P professionals (i.e., stock options, pool plans, etc). Evaluates the pros and cons of plans using factors such as: encourages teamwork, provides ‘golden handcuffs’, rewards company-wide results, etc. |
| None specified | Davis and Hulette (1999) for ACOA | Summary of CAPP studies | Not specified | Highlights skills gaps but is not specific in terms of which skills are in short supply or high demand |
| None specified | “Coastal Programs Aim to Improve Spill Skills is US” (1990) | Non-empirical/descriptive | Ability to prevent and manage oil spills |
| Offshore Installation Managers | O’Dea &amp; Flin (2001) | Survey of 200 Offshore Installation Managers from 157 installations belonging to 36 organizations | Competencies identified: 1- Leadership 2- Safety knowledge and experience | Focus is on safety issues |
| Oil and gas (No positions specified) | Woodyard, Hall, &amp; Kendrick (1993) | Non-empirical/descriptive | Focus here is core competencies of the firm such as subsurface exploration, reservoir exploitation, production/project engineering, gas lift technology, fluid flow simulation, and computer modeling. Only individual competency eluded to in the paper is teamwork | Company level not job level |
| Oil and Gas Engineers (Senior Level) (Gained engineering qualification more than 5 years ago) | Connelly and Middleton (1996) | Survey issued to 109 oil and gas companies in the UK- response rate 53 (49%) | Top 5 Personal and Professional Skills - Teambuilding - Coaching/Development of Others - Financial Skills - Information Technology and systems - Time management | Very thorough competency list |</p>
<table>
<thead>
<tr>
<th>Role</th>
<th>Author(s)</th>
<th>Methodology</th>
<th>Top 5 Personal and Professional Skills</th>
<th>Additional Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil and Gas Engineers (Entry Level)</td>
<td>Connelly and Middleton (1996)</td>
<td>Survey issued to 109 oil and gas companies in the UK- response rate 53 (49%)</td>
<td>Top 5 Personal and Professional Skills  1- Communication (Oral) 2- Time management 3- Communication (Written) 4- Team-building 5- Financial skills</td>
<td>Very thorough competency list</td>
</tr>
<tr>
<td>Oil and Gas Engineers (Overall)</td>
<td>Connelly and Middleton (1996)</td>
<td>Survey issued to 109 oil and gas companies in the UK- response rate 53 (49%)</td>
<td>Personal Skills 1- Communication (Written) 2- Communication (Oral) 3- Teamwork (Lesser important: decision making, time management, manage/participate meetings, presentation skills, leadership, delegation, coaching/development of others)</td>
<td>Very thorough competency list</td>
</tr>
<tr>
<td>Paramedics</td>
<td>“Remote Paramedics Have High Level of Training” (1998)</td>
<td>Non-empirical/descriptive</td>
<td>Basic trauma and life support; suture skills; treatment of ears, nose, throat &amp; upper respiratory problems; treatment of eyes; advanced pharmacology; clinical assessment, cardiac arrest; EKG interpretation; IV usage; basic airway management; CPR; extrication/rescue.</td>
<td>Great chart comparing Remote Paramedics to Registered Nurses and EMT paramedics (i.e., Ambulance) in terms of skill sets.</td>
</tr>
</tbody>
</table>
| Petroleum Engineer | Olson (1994) | Non-empirical /descriptive | Computer Skills (3 levels)  
1- Basic: manipulate and retrieve data  
2- Competency: Understand how software works  
3- Excellence: Leverage skills to enhance productivity of others |  |
<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>Petroleum Engineer</td>
<td>McCullum (2001)</td>
<td>Non-empirical /descriptive</td>
<td>None</td>
</tr>
</tbody>
</table>
| Petroleum Engineer | Satter (1997) | Non-empirical /descriptive | Competencies identified:  
1- University degree  
2- Post-degree training in earth sciences, chemical or mechanical engineering | Note that the focus of the article is training and training methods—few competencies discussed |
| Petroleum Engineer | Fattahi, & Riddle (2001) | Non-empirical /descriptive | Five broad competencies  
1- General knowledge/skills (i.e., industry terminology, compliance, design standards)  
2- Production Engineer knowledge (Nodal Analysis, Tubing Design, Artificial lift)  
3- Reservoir Engineering (PVT analysis, flow analysis, basic and special core analysis)  
4- Formation Evaluation Knowledge (Design well testing program, determine lithology from well logs)  
5- Drilling Engineering Knowledge (design casing, select mud program, develop solids control program)  
6- Leadership  
7- Teamwork  
8- Self-Awareness | Extensive list of behavioral competencies by breadth and depth—also identifies above minimum competence |
<table>
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</thead>
<tbody>
<tr>
<td>Petroleum Engineers</td>
<td>Price (1991)</td>
<td>Non-empirical /descriptive</td>
<td>Adaptability, flexibility, transfer of technology from US to emerging markets, environmental awareness/issues</td>
</tr>
<tr>
<td>Role</td>
<td>Skills Shortage to be Tackled by North Sea Players (2001)</td>
<td>Non-empirical /descriptive</td>
<td>Only one specifically mentioned was a college certification</td>
</tr>
<tr>
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<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>Production Technicians</td>
<td>Skills Shortage Threatens Oil and Gas Growth (1998)</td>
<td>Non-empirical /descriptive</td>
<td>Authors eludes to the need for a broader range of capabilities including: - Innovation - Communication - Interpersonal - Awareness of ‘business’ issues</td>
</tr>
<tr>
<td>Project Managers</td>
<td></td>
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</tr>
<tr>
<td>Reservoir Engineer</td>
<td>Hopkins (1999)</td>
<td>Non-empirical /descriptive</td>
<td>Competencies 1- Computer/Software skills (Data fusion, mining and fusion) 2- Environmental laws and issues awareness 3- Teamwork 4-Leadership skills 5- Problem solving 6- Business direction Also new technology skills 1- Data fusion 2- Adaptive Modeling 3- Well optimization 4- NMR 5- Microdrilling 6- Swept-Frequency Acoustic Interferometry</td>
</tr>
<tr>
<td>Role</td>
<td>Author</td>
<td>Research Approach</td>
<td>Competencies</td>
</tr>
<tr>
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<td>-----------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Reservoir Engineer (Senior Level) | Adams (1998)         | Non-empirical / descriptive | 1- Outcomes (i.e. planning and goal setting)  
2- Managing Issues (i.e., root cause)  
3- Managing Complexity  
4- Creating Value (i.e., CI)  
5- Establishing a productive climate (Teams, communication, conflict mgt.)  
6- Managing Uncertainty (risk management and dilemmas)  
7- New thinking (change, being an open thinker) |
| Rig Supervisors             | Nordt & Stone (1992) | Non-empirical / descriptive | Duties and Competencies identified:  
1- Operational Knowledge such as Well Geometry, Well Control, Downhole and surface equipment and Logistics  
2- Optimization Concepts (such as mud system, hydraulics, drill string, bit selection, bit weight and rotary speed, and kick tolerance)  
3- Safety and Environment (such as air/water quality, hazardous chemical management, waste management, reserve bit management and spillage prevention)  
4- Leadership  
5- Communication |
| Skilled Manual Labour (Derrickperson, Roustabouts, Roughnecks) | Fraser (1989) | Non-empirical /descriptive | Competencies identified: 1- Survival 2- Firefighting | Focus is on training for a typical rig. Presents typical breakdown of a 43 person rig crew by job |
| Supervisors (Drillers/Assistant Drillers); | Fraser (1989) | Non-empirical /descriptive | Competencies identified 1- Industry based experience/exposure 2- Technology-based courses in drilling hardware and operations, well planning, well evaluation, drilling economics and drilling operations management | Focus is on training for a typical rig. Presents typical breakdown of a 43 person rig crew by job |
| Supervisory | Hensen (1998) | Non-empirical /descriptive | Some specific competencies identified 1- Stress Management 2- Ability to respond to crisis 3- Knowledge of safety procedures 4- Business knowledge 5- Leadership 6- Critical Thinking 7- Teamwork | Here the focus is on supervisors (and senior staff) with safety management responsibilities. A detailed list of competencies is included |
| Technician | McCullum (2001) | Non-empirical /descriptive | None | Aging population, recent decline in graduates from Petroleum Engineering programs, and a technical training apprenticeship program with the goal of delivering qualified people by 2003. |
| Trades for offshore fabrication and construction | Knott (1996) | Non-empirical /descriptive | Project management | Brief article- highlights upcoming skills shortages for future project managers and the need to increase use of training to bridge skills gaps. |
| Well Engineers | Stuart & Baley (1997) | Non-empirical /descriptive | Three broad competency levels identified- personal, business, and technical. Some specific competencies identified for the training program 1- Understanding of rig equipment and operation 2- Optimization 3- Planning 4- Performance Improvement 5- Teamwork | Focus is on training. Very detailed progression charts and skills charts |
APPENDIX E
Brief Job Descriptions
Brief Job Descriptions

This appendix provides brief job descriptions for the various job categories contained in the Nova Scotia Offshore Labour Demand Model. As the majority of the information was obtained from interviews with industry representatives, the data is of varying quality. In some cases the data was complemented by secondary sources.

The attached is presented as a summary of the main occupations. Each one-page summary includes job code, job title, main duties, educational requirements, experience requirements, previous roles as well as competencies. Given that many job titles have several levels (i.e. junior, intermediate and senior engineer), the attached job descriptions list the minimum experience. For higher-level positions, additional experience is needed. As a general guideline, the professional occupations require 2-3 years experience for intermediate and 5-10 years of experience for senior. For the skilled trades, intermediate (i.e. journey person) require 2-4 years and senior require 5-10 years. As this appendix is not designed to be a bank of extensive job descriptions, the following are suggested as sources for more detailed job descriptions:


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6 Job Codes are model-specific and represent a sequential listing of jobs shown in model templates. These codes do not fall under the National Occupation Classifications (NOCs) system described in Appendix B.
Job Code: 001

Job Title: Aircraft Technician

Examples of Jobs Classified in this Occupation:
- Aircraft Maintenance Engineer
- Aircraft Mechanic
- Aircraft Maintenance Apprentice

Main Duties:
- Maintain aircraft to specifications and established procedures
- Repair any damaged parts of aircraft (i.e., hydraulic, mechanical, or structural)
- Perform preventative maintenance

Educational Requirements (Formal and On-the-Job):
- College Diploma (Aviation Mechanics)
- Certification for the aircraft in question
- Aircraft Maintenance Engineer license (AME)

Experience Requirements:
- Experience working with the aircraft in question
- Completed apprenticeship (for all non-apprentice roles)

Previous Roles:
- Apprentice (Aviation Mechanic)

Competencies:
- Teamwork
- Flexibility/Adaptability
- Safety Assurance
- Procedures Compliance
Job Code: 002

Job Title: Barge Engineer

Examples of Jobs Classified in this Occupation:
- Barge Engineer
- Barge Master

Main Duties:
- In charge of marine department
- Ensure adequate number of marine crew
- Ensure stability and ballast control

Educational Requirements (Formal and On-the-Job):
- Master Mariner Certificate
- Company training

Experience Requirements:
- 10 years offshore experience
- Experience with rig operation

Previous Roles:
- First Mate

Competencies:
- Teamwork
Job Code: 003

Job Title: Captain

Examples of Jobs Classified in this Occupation:
- Captain (Marine)

Main Duties:
- Chief in command of vessel
- Manage ship’s resources (crew, financial, etc)
- Responsible for the safe and efficient operation of the ship and crew

Educational Requirements (Formal and On-the-Job):
- Master Mariner Certificate (Transport Canada)
- Diploma from a community college
- Dynamic Positioning Certificate (preferred)

Experience Requirements:
- 5-10 years of marine vessel experience
- Completed apprenticeship (for all non-apprentice roles)

Previous Roles:
- Marine Officer (Chief Officer, First Mate)

Competencies:
- Communication (oral/written)
- Computer Literacy (Office, purchasing software)
- Leadership
- People Management
Job Code: 004

Job Title: Caterer

Examples of Jobs Classified in this Occupation:
- Chief Stewart
- Caterers

Main Duties:
- Manage catering department
- Keep accommodations habitable
- Assist in galley and elsewhere per chief stewart’s requirements

Educational Requirements (Formal and On-the-Job):
- High School
- Company specific training

Experience Requirements:
- 1 year general and offshore experience

Previous Roles:
- Caterer
- Entry Level

Competencies:
- Leadership
- Communication (oral/written)
Job Code: 005

Job Title: Civil Engineer

Examples of Jobs Classified in this Occupation:
- Senior
- Intermediate
- Junior

Main Duties:
- Design of civil engineering aspects
- Review of contractor work
- Supervise staff

Educational Requirements (Formal and On-the-Job):
- Bachelor Engineering (Civil)

Experience Requirements:
- Experience with rig construction
- 3 years or more general and offshore experience

Previous Roles:
- Intermediate Civil Engineer
- Junior Civil Engineer
Job Code: 006

Job Title: Clerical

Examples of Jobs Classified in this Occupation:
- Secretary
- Administrative Assistant
- Receptionist
- Logistics Clerk
- Storeperson
- CADD operator

Main Duties:
- Perform duties related to discipline (e.g., typing, filing, CADD design, etc.)

Educational Requirements (Formal and On-the-Job):
- Diploma from a community college (preferred)
- High School (minimum)

Experience Requirements:
- 2 or more years experience

Previous Roles:
- Varies but can include: secretary, data entry, receptionist, administrative assistant

Competencies:
- Communication (oral/written)
- Computer Literacy (Office)
Job Code: 007

Job Title: Communications Engineer

Examples of Jobs Classified in this Occupation:
- Intermediate Communications Engineer
- Junior Communications Engineer

Main Duties:
- Supervise Communications (oral/written) staff
- Perform Communication (oral/written) engineering aspects of offshore

Educational Requirements (Formal and On-the-Job):
- Bachelor Engineering (Mechanical, Petroleum)

Experience Requirements:
- General knowledge of Communications engineering.

Previous Roles:
- Junior Communications Engineer (Intermediate)

Competencies:
- Teamwork
- Communication (oral/written)
Job Code: 008
Job Title: Corrosion Engineer

Examples of Jobs Classified in this Occupation:
- Senior
- Intermediate
- Junior

Main Duties:
- Supervise staff
- Perform corrosion engineering tasks

Educational Requirements (Formal and On-the-Job):
- Bachelor Engineering (Mechanical)

Experience Requirements:
- General corrosion engineering knowledge
- 2-3 years general and offshore experience (Intermediate)

Previous Roles:
- Intermediate (Senior)
- Junior (Intermediate)

Competencies:
- Communication (oral/written)
- Teamwork
**Job Code:** 009

**Job Title:** Crane Operator

**Examples of Jobs Classified in this Occupation:**
- Crane Operator

**Main Duties:**
- Load and unload materials
- Read paperwork associated with materials to be moved

**Educational Requirements (Formal and On-the-Job):**
- High School (preferred)
- Crane Operators Certificate
- Forklift Certificate
- Training concerning safe rigging and slinging practices

**Experience Requirements:**
- NA

**Previous Roles:**
- General Laborer

**Competencies:**
- Teamwork
Job Code: 010

Job Title: Diver

Examples of Jobs Classified in this Occupation:
• Divers

Main Duties:
• Perform diving construction work
• Dive
• Inspect work

Educational Requirements (Formal and On-the-Job):
• High School
• Diver’s Certificate

Experience Requirements:
• Ability to work in harsh environments
• 1 year general and offshore experience

Previous Roles:
• NA

Competencies:
• NA
**Job Code:** 011

**Job Title:** Dynamic Positioning (DP) Operator

**Examples of Jobs Classified in this Occupation:**
- Dynamic Positioning Operation

**Main Duties:**
- Ensure rig is stable
- Operate dynamic positioning equipment

**Educational Requirements (Formal and On-the-Job):**
- High School
- Second Mate Ticket
- Company Training

**Experience Requirements:**
- 5 years offshore experience

**Previous Roles:**
- First Mate

**Competencies:**
- NA
Job Code: 012

Job Title: Draftsperson (Senior)

Examples of Jobs Classified in this Occupation:
- Draftsperson
- Designer

Main Duties:
- Operate CADD software
- Design and interpret blueprints

Educational Requirements (Formal and On-the-Job):
- College Diploma in Drafting
- CADD training

Experience Requirements:
- 5-7 years experience
- Previous experience with offshore fabrication projects
- Some project management experience

Previous Roles:
- NA

Competencies:
- Computer Literacy (CADD)
- Teamwork
Job Code: 013

Job Title: Drilling Engineer

Examples of Jobs Classified in this Occupation:
- Drilling Engineer (Senior, Intermediate, Junior)

Main Duties:
- Monitor and direct drilling operations
- Develop drilling programs including selection of sites, and specification of drilling fluids.

Educational Requirements (Formal and On-the-Job):
- Bachelors of Engineering ( Mechanical or Petroleum)
- Professional Engineering Designation (preferred)
- Company-specific training (equipment, processes, procedures)

Experience Requirements:
- 2-3 years general and offshore experience (Intermediate)
- 3-5 years general and offshore experience (Senior)

Previous Roles:
- Intermediate Drilling Engineer (Senior)
- Junior Drilling Engineer (Intermediate)

Competencies:
- Communication (oral/written)
- Computer Literacy (Office products, Company-specific programs)
- Teamwork
- Leadership
Job Code: 014

Job Title: Drilling Superintendent

Examples of Jobs Classified in this Occupation:
- Well Services Manager
- Drilling Supervisor
- Drilling Superintendent
- Drilling and Completions Manager
- Drilling Coordinator
- Toolpusher
- Rig Manager

Main Duties:
- Supervise safe and efficient operation
- Manage and schedule activities of staff
- Coordinate materials needed by staff
- Interface with other departments as needed

Educational Requirements (Formal and On-the-Job):
- Bachelors or Diploma in Engineering preferred (Mechanical or Petroleum)
- Company-specific training (equipment, processes, procedures)

Experience Requirements:
- Seven or more years petroleum and offshore experience
- Previous managerial experience (Toolpusher, Drilling Coordinator, Rig Manager)

Previous Roles:
- Drilling Engineer (Senior) or Drilling Technician (Senior)
- Driller (Drilling Coordinator, Toolpusher)
- Drilling Coordinator (Rig Manager, Senior Toolpusher)

Competencies:
- Communication (oral/written)
- Computer Literacy (Office products, Company-specific programs)
- Teamwork
- Leadership
- People Management
- Problem-solving
- Conflict Resolution (Rig Manager, Toolpusher, Drilling Coordinator)
- Safety Assurance
**Job Code:** 015

**Job Title:** Drilling Technicians

**Examples of Jobs Classified in this Occupation:**
- Directional Driller
- Driller/Assistant Driller
- Drilling Technician (Senior, Intermediate Junior)
- Control Technician
- Drilling Specialist

**Main Duties:**
- Operate company-specific equipment, tools and software
- Maintain records related to drilling activities
- Determine the direction of the well (Directional Driller)
- Provide guidance to more junior staff

**Educational Requirements (Formal and On-the-Job):**
- Diploma in Engineering (Mechanical or Petroleum) (Drilling Technician)
- Company-specific training (equipment, processes, procedures)

**Experience Requirements:**
- 10-13 years experience petroleum and offshore experience (Driller)
- 7-10 years petroleum and offshore experience (Directional Driller, Control Technician, Derrickperson, Assistant Derrickperson, Assistant Driller)
- 3-5 years petroleum and offshore experience (Senior Technician)
- 2-3 years petroleum and offshore experience (Intermediate Technician)
- Past experience with lengthy, highly deviated wells (Directional Driller)

**Previous Roles:**
- Drilling Technician or Driller or Toolpusher (Directional Driller)
- Assistant Driller (Driller)
- Control Technician (Derrickperson)
- Drilling Technician or Roustabouts (Control Technician)
- Intermediate Drilling Technician (Senior Technician)
- Junior Drilling Technician (Intermediate Technician)

**Competencies:**
- Communication (Oral/Written)
- Computer Literacy (Office products, Company-specific programs)
- Teamwork
- Leadership
- People Management (Driller, Assistant Driller)
Job Code: 016

Job Title: Electrical Engineer

Examples of Jobs Classified in this Occupation:
- Senior
- Intermediate
- Junior

Main Duties:
- Supervise engineering staff
- Undertake engineering aspects of offshore

Educational Requirements (Formal and On-the-Job):
- Bachelor Engineering (Electrical)

Experience Requirements:
- 3-5 years general and offshore experience

Previous Roles:
- Intermediate
- Junior

Competencies:
- Problem solving
- Teamwork
- Communication (oral/written)
**Job Code:** 017

**Job Title:** Electrician

**Examples of Jobs Classified in this Occupation:**
- Electrician
- Instrumentation (Intermediate, Senior/Supervisor)

**Main Duties:**
- Install, maintain and repair electrical equipment according to plans
- Follow procedures, diagrams and drawings related to electrical equipment
- Guide more junior electricians (Senior/Supervisor)

**Educational Requirements (Formal and On-the-Job):**
- Industrial Electrician Certification
- Hydraulics training
- Vendor-specific training for equipment in question

**Experience Requirements:**
- 7 or more years experience (Senior)
- 5 or more years experience (Intermediate)
- Experience working with large equipment in heavy industries (mining, hydro, etc.)

**Previous Roles:**
- Electrician in heavy industry (mining, hydro, etc)
- Electrician in offshore (Senior/Supervisor)

**Competencies:**
- Computer Literacy (Office and SAP)
- Leadership Skills (Senior)
- Hydraulics
- People Management
Job Code: 018

Job Title: Engine Room Operator

Examples of Jobs Classified in this Occupation:
- First Engineer

Main Duties:
- Maintain vessel engines and motor
- Repair and damage to motor and engines
- Complete work under direction of Chief Engineer

Educational Requirements (Formal and On-the-Job):
- Second Class Engineer Certificate (Transport Canada)
- Diploma from a community college

Experience Requirements:
- Sufficient experience for Certificate
- Experience with similar vessels and engines (preferred)

Previous Roles:
- None required

Competencies:
- Communication (oral/written)
- Computer Literacy (Office, purchasing software)
- Knowledge of control systems
- Safety Assurance
Job Code: 019

Job Title: Engineering Management

Examples of Jobs Classified in this Occupation:
- Engineering Manager
- Senior Engineering Manager (Subsea Engineering Manager, Topsides Engineering Manager, Turret Engineering Manager, Hull Engineering Manager, Subsea Engineering Manager)

Main Duties:
- Manage engineers and staff in department
- Manage financial resources
- Ensure compliance

Educational Requirements (Formal and On-the-Job):
- Bachelors of Engineering (with specialist relevant to the area)
- Professional Engineering Designation (preferred)

Experience Requirements:
- 10 or more years in senior management position petroleum experience and 2 years offshore experience
- Experience with multiple-project integration
- Experience working on multiple installations in different environments

Previous Roles:
- Engineering Manager
- Senior Engineer

Competencies:
- Communication (oral/written)
- Multi-project Integration
- Teamwork
- Negotiation Skills (Senior)
- Contract Administration (Senior)
- Problem Solving
Job Code: 020

Job Title: Engineering Technologist

Examples of Jobs Classified in this Occupation:
- Engineering Technologist

Main Duties:
- Perform duties related to engineering discipline

Educational Requirements (Formal and On-the-Job):
- Engineering Diploma (Mechanical, Petroleum)

Experience Requirements:
- NA

Previous Roles:
- NA

Competencies:
- NA
**Job Code:** 021

**Job Title:** Environmental Observer

**Examples of Jobs Classified in this Occupation:**
- Environmental Observer

**Main Duties:**
- Ensure environment safeguards
- Observe environmental activities

**Educational Requirements (Formal and On-the-Job):**
- Bachelor Arts

**Experience Requirements:**
- 3 years general experience, 1 year offshore experience

**Previous Roles:**
- NA

**Competencies:**
- Communication (oral/written)
Job Code: 022

Job Title: Facilities Engineer

Examples of Jobs Classified in this Occupation:
- Facility Engineer

Main Duties:
- Supervise staff
- Undertake facilities engineering duties

Educational Requirements (Formal and On-the-Job):
- Bachelor Engineering (Civil)

Experience Requirements:
- 5 years general facilities engineering management.

Previous Roles:
- Civil Engineering

Competencies:
**Job Code:** 023

**Job Title:** General Labour

**Examples of Jobs Classified in this Occupation:**
- Roustabouts
- Roughneck
- Stevedores
- Derrickperson/Assistant Derrickperson

**Main Duties:**
- General laborers on the drilling floor (Roustabouts, Roughneck)
- Maintain drilling equipment (Roustabouts, Roughneck)

**Educational Requirements (Formal and On-the-Job):**
- Rough Neck Training (Roustabouts, Roughneck)

**Experience Requirements:**
- 3 or more years experience in oil field (Roughneck, Roustabouts)
- Some offshore oil experience (preferred) (Roughneck, Roustabouts)
- 7-10 years petroleum and offshore experience (Derrickperson, Assistant Derrickperson)

**Previous Roles:**
- Land-based Roughneck (Roustabouts, Roughneck)
- Derrickperson (Assistant Driller)
- Assistant Derrickperson (Derrickperson)

**Competencies:**
- Interpersonal Skills
- Conflict Management
- People Management (Assistant Derrickperson/Derrickperson)
Job Code: 024

Job Title: Geologist

Examples of Jobs Classified in this Occupation:
- Geologist (Senior, Intermediate, Junior)

Main Duties:
- Collect core samples, rock samples, and drillings (Junior)
- Analyze core samples, rock samples, and drillings to identify composition and report findings to senior Geologist (Intermediate)
- Make final recommendations based on the analyses conducted (Senior)

Educational Requirements (Formal and On-the-Job):
- Bachelor’s degree in Geology
- Geology software package training

Experience Requirements:
- Past experience with similar reservoirs
- 5-7 years general and offshore experience (Senior)
- 2-3 years general and offshore experience (Intermediate)

Previous Roles:
- Intermediate Geologist (Senior)
- Junior Geologist (Intermediate)

Competencies:
- Communication (oral/written)
- Computer Literacy (Office products, Geological software packages (3D), database)
- Teamwork
- Database Management
- Customer Service
Job Code: 025

Job Title: Geophysicist

Examples of Jobs Classified in this Occupation:
• Geophysicist (Senior, Intermediate, Junior)

Main Duties:
• Collect core samples, rock samples, and drillings (Junior)
• Analyze core samples, rock samples, and drillings to identify composition and report findings to senior Geologist (Intermediate)
• Make final recommendations based on the analyses conducted (Senior)

Educational Requirements (Formal and On-the-Job):
• Bachelor’s degree in Geophysics
• Geology software package training

Experience Requirements:
• Past experience with similar reservoirs
• 5-7 years general and offshore experience (Senior)
• 2-3 years general and offshore experience (Intermediate)

Previous Roles:
• Intermediate Geophysicist (Senior)
• Junior Geophysicist (Intermediate)

Competencies:
• Communication (oral/written)
• Computer Literacy (Office products, Geological software packages (3D), database)
• Teamwork
• Database Management
• Customer Service
**Job Code:** 026

**Job Title:** Gun Mechanic

**Examples of Jobs Classified in this Occupation:**
- Gun Mechanic

**Main Duties:**
- Maintains seismic survey equipment.

**Educational Requirements (Formal and On-the-Job):**
- Bachelor of Science
- Company training

**Experience Requirements:**
- Experience working with seismic equipment

**Previous Roles:**
- Entry

**Competencies:**
- Teamwork
Job Code: 027

Job Title: Helicopter Pilot

Examples of Jobs Classified in this Occupation:
- Helicopter Captain
- Helicopter Co-Pilot
- Aircraft Base Manager
- Aircraft Assistant Base Manager

Main Duties:
- Fly twin-engine helicopters to transport people and small freight
- Maintain safe flight operations
- Responsible for flight logistics
- Manage base and flight crew (Base Manager, Assistant Base Manager)

Educational Requirements (Formal and On-the-Job):
- Department of Transportation License (ATPL(H))
- Experience rating for aircraft in question
- Instrument Flight Rating (IFR)
- Visual Flight Rating (VFR)

Experience Requirements:
- 1000 hours flying experience (Pilot), 500 hours (Co-Pilot)
- Previous experience with large, multi-engine helicopters (preferred)
- Experience operating in an offshore environment

Previous Roles:
- Co-Pilot
- Pilot (Assistant Base Manager)
- Assistant Base Manager (Base Manager)

Competencies:
- Safety Assurance
- Quality Assurance
- Customer Service
- Teamwork
- People Management (Base Manager/Assistant Base Manager)
Job Code: 028

Job Title: HSEQ

Examples of Jobs Classified in this Occupation:
- Health
- Safety
- Environment Quality Officer

Main Duties:
- Train staff on health and safety and environmental regulations.
- Ensure regulations are adhered to.

Educational Requirements (Formal and On-the-Job):
- Bachelor Arts
- Safety
- Environment

Experience Requirements:
- 3 years general health safety experience, 3 years offshore experience

Previous Roles:
- NA

Competencies:
- Communication (oral/written)
Job Code: 029

Job Title: Installation Management

Example of Jobs Classified in this Occupation:
- Installation managers
- Construction managers

Main Duties:
- Supervise staff
- Manage installation

Educational Requirements (Formal and On-the-Job):
- Bachelor Engineering
- Company specific training

Experience Requirements:
- 7 years general experience

Previous Roles:
- Management positions

Competencies:
- Leadership
- Communication (oral/written)
- Teamwork
Job Code: 030

Job Title: Instrumentation Engineer

Examples of Jobs Classified in this Occupation:
- Instrumentation Engineer (Junior, Intermediate, Senior)

Main Duties:
- Supervise staff
- Undertake instrumentation engineering

Educational Requirements (Formal and On-the-Job):
- Bachelor Engineering (Electrical)

Experience Requirements:
- 5 years general and offshore experience

Previous Roles:
- Intermediate (Senior)
- Junior (Intermediate)

Competencies:
- Teamwork
- Communication (oral/written)
**Job Code:** 031

**Job Title:** Logistics Superintendent

**Examples of Jobs Classified in this Occupation:**
- Logistics Manager

**Main Duties:**
- Track and coordinate the movement of materials
- Manage staff and financial resources
- Liaise with internal company employees and suppliers concerning status of materials

**Educational Requirements (Formal and On-the-Job):**
- High School
- Diploma or undergraduate degree in business or materials management (preferred)

**Experience Requirements:**
- 5-10 years experience and five or more years offshore experience (Senior Coordinator)

**Previous Roles:**
- Materials Clerk or Coordinator

**Competencies:**
- Communication (oral/written)
- Computer Literacy (Office products)
- Planning/Organizational Skills
- Problem-solving skills
- Cargo Loading Practices
- Tracking
Job Code: 032

Job Title: Maintenance Technician

Examples of Jobs Classified in this Occupation:
- Maintenance Support Technician (Drilling)

Main Duties:
- Generate purchase orders for drilling needs
- Assist drilling area with coordination of maintenance needs

Educational Requirements (Formal and On-the-Job):
- High School
- Mechanical journeyperson background (preferred)

Experience Requirements:
- 2-3 years experience in maintenance planning
- 7-8 years general and offshore experience
- Experience working with similar equipment (preferred)

Previous Roles:
- None

Competencies:
- Computer Literacy (Office and SAP)
- Communication (oral/written)
Job Code: 033
Job Title: Marine Engineer

Examples of Jobs Classified in this Occupation:
- Chief Engineer
- Engineer Second Class
- Engineer Third Class
- Engine Room Assistant
- Wiper

Main Duties:
- Supervise marine engineering staff
- Undertake marine engineering activities on rig, supply boat and/or seismic vessels

Educational Requirements (Formal and On-the-Job):
- First Class Motor
- Second Class Motor Certificate
- Third Class Motor Certificate
- Fourth Class Motor Certificate

Experience Requirements:
- 2 years of general marine experience

Previous Roles:
- Engineer Second Class
- Engineer Third Class

Competencies:
- Leadership
- Teamwork
Job Code: 034

Job Title: Materials Inspection

Examples of Jobs Classified in this Occupation:
- Materials coordinator

Main Duties:
- Track and coordinate the movement of materials
- Establish delivery schedules
- Liaise with internal company employees and suppliers concerning status of materials

Educational Requirements (Formal and On-the-Job):
- High School
- Diploma or undergraduate degree in business or materials management (preferred)

Experience Requirements:
- Five or more years general and offshore experience

Previous Roles:
- Materials Clerk (Coordinator)

Competencies:
- Communication (oral/written)
- Computer Literacy (Office products, purchasing and tracking software)
- Cargo loading practices and knowledge
- Effective tracking skills
**Job Code:** 035  

**Job Title:** Mechanic  

**Examples of Jobs Classified in this Occupation:**  
- Millwrights  
- Industrial Mechanics (Intermediate and Senior)  

**Main Duties:**  
- Install, maintain and repair equipment according to plans  
- Follow procedures, diagrams and drawings related to machinery  
- Guide more junior mechanics (Senior/Supervisor)  

**Educational Requirements (Formal and On-the-Job):**  
- Industrial Millwright or Mechanic Certification  
- Hydraulics training  
- Vendor-specific training for equipment in question  

**Experience Requirements:**  
- 5-7 years general and offshore experience (Senior)  
- 3-5 years experience (Intermediate)  
- Experience with large equipment in heavy industries (mining, hydro, etc.)  

**Previous Roles:**  
- Mechanic/Millwright in heavy industry (mining, hydro, etc)  

**Competencies:**  
- Computer Literacy (Office and SAP)  
- People Management Skills (Senior)  
- Leadership (Senior)
Job Code: 036

Job Title: Mechanical Engineer

Examples of Jobs Classified in this Occupation:
- Completions Engineer
- Production Engineer (Senior, Intermediate)

Main Duties:
- Conduct research regarding design, operation and performance of mechanisms, components and systems
- Supervise technicians and technologists

Educational Requirements (Formal and On-the-Job):
- Bachelors of Engineering (Mechanical)
- Professional Engineering Designation (preferred)

Experience Requirements:
- 12-15 years general experience and 5 or more years offshore experience (Senior)
- 5 or more years petroleum and offshore experience (Intermediate)
- Experience in harsh environments
- Previous experience using same technology (FPSO, Jack-Up rigs etc)

Previous Roles:
- Intermediate Mechanical Engine (Senior)
- Junior Mechanical Engineer (Intermediate)

Competencies:
- Communication (oral/written)
- Computer Literacy (Office products, company-specific programs)
- Problem-solving
- Teamwork
Job Code: 037

Job Title: Medic

Examples of Jobs Classified in this Occupation:
- Nurse
- Paramedic
- Medic
- Physician’s Assistant

Main Duties:
- Respond to emergency situations (includes the assessment, stabilization and transportation of injured persons)
- Facilitate the rehabilitation of injured workers at the workplace
- Responsible for wellness programs
- Some heli-administration duties in terms of helicopter greeting, assignment of people to rooms etc.

Educational Requirements (Formal and On-the-Job):
- Nursing degree or diploma (Nurse, Physician’s Assistant)
- Paramedic diploma (Paramedic)
- ABS certificate
- ACLS certificate
- Basic Trauma certificate
- Remote nursing course desirable (Nurse)

Previous Roles:
- Contract Nurse, Critical Care Nurse, Industrial/Occupational Health and Safety Nurse (Nurse)

Experience Requirements:
- 5 years general experience in critical care areas (emergency, trauma, advanced cardiac, or intensive care)
- 2 years working in an occupational/industrial setting
- Previous experience working in remote or isolated environments
- 1 year offshore experience

Competencies:
- Communication (oral/written)
- Ability to multi-task
- Work Independently
- Computer Literacy
- Customer Service
Job Code: 038

Job Title: Naval Architect

Examples of Jobs Classified in this Occupation:
- Naval Architect

Main Duties:
- Estimate bid packages
- Consult staff engineers
- Design marine components
- Liaise with clients
- Certify of marine design

Educational Requirements (Formal and On-the-Job):
- University degree - Professional architect (marine/naval)
- Engineering degree
- Company specific training

Experience Requirements:
- 10 years of related experience
- 2 years senior management

Previous Roles:
- Staff Architect
- Junior Management

Competencies:
- Attention to detail
- Communication (oral/written)
- Professional attitude – working with clients
**Job Code:** 039

**Job Title:** Dimensional Control Technician

**Examples of Jobs Classified in this Occupation:**
- Dimensional Control Technician

**Main Duties:**
- Operate company-specific equipment, tools and software

**Educational Requirements (Formal and On-the-Job):**
- Engineering degree

**Experience Requirements:**
- 10 years of related experience and experience with FPSO commissioning

**Previous Roles:**
- FPSO commissioning

**Competencies:**
- Communication (oral/written)
- Interpersonal skills
- Problem-solving skills
Job Code:   039

Job Title:   Pipe Deck Coordinator

Examples of Jobs Classified in this Occupation:
- Pipe Deck Coordinator

Main Duties:
- Load and unload materials
- Read paperwork associated with materials to be moved
- Direct laborers

Educational Requirements (Formal and On-the-Job):
- High School (preferred)
- Crane Operators Certificate

Experience Requirements:
- 5 years general and offshore experience

Previous Roles
- Crane Operator
- Roustabout

Competencies:
- Leadership
- People Management
Job Code: 039

Job Title: Document Control

Examples of Jobs Classified in this Occupation:
- Document Control

Main Duties:
- Manage documents

Educational Requirements (Formal and On-the-Job):  
- Secretarial Diploma

Experience Requirements:
- 9 years of related experience

Previous Roles:
- Records management

Competencies:
- Teamwork
- Problem-solving skills
Job Code: 039

Job Title: FPSO Manager

Examples of Jobs Classified in this Occupation:
- FPSO Manager

Main Duties:
- Manage engineers and staff in department
- Manage financial resources
- Ensure compliance

Educational Requirements (Formal and On-the-Job):
- Bachelors of Engineering (with specialist relevant to the area)

Experience Requirements:
- 25 years petroleum experience with 15 years offshore experience (Senior Manager)
- Managing complex projects

Previous Roles:
- Engineering Manager

Competencies:
- Negotiation Skills
- Contract Administration
- Problem-solving
- Teamwork
- Communication (Oral/Written)
- Computer Literacy (Office products, Company-specific programs)
**Job Code:** 039

**Job Title:** Senior Operations Engineer

**Examples of Jobs Classified in this Occupation:**
- Senior Operations Engineer

**Main Duties:**
- Manage engineers and staff in department
- Manage financial resources
- Ensure compliance

**Educational Requirements (Formal and On-the-Job):**
- Bachelors of Engineering (with specialist relevant to the area)

**Experience Requirements:**
- 30 years petroleum experience with 20 years offshore experience (Senior Manager)
- Managing multiple projects

**Previous Roles:**
- FPSO operations an asset
- Experience in harsh environments

**Competencies:**
- Communication (Oral/Written)
- Problem-solving
- Teamwork
**Job Code:** 039

**Job Title:** Senior Operations Consultant

**Examples of Jobs Classified in this Occupation:**
- Senior Operations Consultant

**Main Duties:**
- Manage staff in department
- Manage financial resources
- Ensure compliance

**Educational Requirements (Formal and On-the-Job):**
- Diploma of Engineering (with specialist relevant to the area)

**Experience Requirements:**
- 10-13 years petroleum experience with 10 years offshore experience (Senior Manager)

**Previous Roles:**
- FPSO operations an asset

**Competencies:**
- Communication (Oral/Written)
- Problem-solving
- Teamwork
Job Code: 039

Job Title: Machinist

Examples of Jobs Classified in this Occupation:
- Machinist (Junior, Intermediate, Senior)

Main Duties:

Educational Requirements (Formal and On-the-Job):
- Community College/Trades School

Experience Requirements:
- 5 years general experience, 2 years offshore and 1 year heavy industry (Senior)
- 2 years general experience, 1 years offshore and 1 year heavy industry (Intermediate)

Previous Roles:
- Quality Assurance/Quality Control (Senior)

Competencies:
- People Skills (Senior)
- Communication (Oral/Written)
- Attention to detail
- Well organized (Senior)
Job Code: 039

Job Title: Plumber

Examples of Jobs Classified in this Occupation:
- Plumber

Main Duties:
- Maintain and repair plumbing

Educational Requirements (Formal and On-the-Job):
- Community College/Trades School
- Company specific

Experience Requirements:
- 2 years general experience (preferred)
- Experience in industrial setting (preferred)

Previous Roles

Competencies:
- Communication (Oral/Written)
- Well organized
- Ability to work independently
**Job Code:** 040

**Job Title:** OIM

**Examples of Jobs Classified in this Occupation:**
- Offshore Installation Manager

**Main Duties:**
- Overall management of offshore installation rig
- Ensure all operations and equipment are all done by suitable qualified persons
- Ensure the safe operation of the installation

**Educational Requirements (Formal and On-the-Job):**
- High School
- Company training
- MODV/Surf NA

**Experience Requirements:**
- Offshore experience

**Previous Roles:**
- Tool Pusher

**Competencies:**
- Communication (oral/written)
- Leadership
Job Code: 041

Job Title: On Shore Project Administration

Examples of Jobs Classified in this Occupation:
- Accounting
- Customer Service Managers,
- Quality Manager
- HR Manager
- Safety Manager

Main Duties:
- Administrative duties related to discipline
- Supervise staff

Educational Requirements (Formal and On-the-Job):
- Bachelor of Arts or
- Bachelor of Commerce or
- Engineering Diploma

Experience Requirements:
- Varies greatly by discipline (generally minimum 2-3 years experience in discipline)

Previous Roles:
- Administrative Support

Competencies:
- Communication (oral/written)
- Computer Literacy
- Leadership
- Problem solving
- Teamwork
- Conflict Resolution
- Interpersonal skills
Job Code: 042

Job Title: Onshore Manager

Examples of Jobs Classified in this Occupation:
- Operations Manager

Main Duties:
- Manage on-shore office
- Coordinate offshore activity

Educational Requirements (Formal and On-the-Job):
- Bachelor of Engineering

Experience Requirements:
- 10 years general and offshore experience

Previous Roles:
- Senior Industrial Engineer

Competencies:
- Leadership
- Teamwork
Job Code: 043

Job Title: Painter

Examples of Jobs Classified in this Occupation:
- Painter

Main Duties:
- Painting

Educational Requirements (Formal and On-the-Job):
- 2 years general and 1 year offshore experience

Experience Requirements:
- NA

Previous Roles:
- NA

Competencies:
Job Code:  044

Job Title:  Petrophysicist

Examples of Jobs Classified in this Occupation:
• Petrophysicist

Main Duties:
• Offshore rock structure
• Deposit analysis

Educational Requirements (Formal and On-the-Job):
• Masters of Science

Experience Requirements:
• 5 years general and offshore experience

Previous Roles:
• NA

Competencies:
• Communication (oral/written)
Job Code: 045

Job Title: Pipefitter

Examples of Jobs Classified in this Occupation:
- Pipefitter (apprentice, journeyperson, senior, supervisor)
- Tubefitter
- Industrial plumber

Main Duties:
- Install, maintain and repair piping
- Cut/thread pipe according to plans
- Guide more junior pipefitters (senior/supervisor)

Educational Requirements (Formal and On-the-Job):
- Industrial pipefitter certification
- Company specific training

Experience Requirements:
- 10 years industrial pipefitting (supervisor)
- 5-7 years industrial pipefitting (senior)
- 2-5 years industrial pipefitting (journeyperson)

Previous Roles:
- Heavy industrial setting
- Offshore industrial setting
- Hazardous environment

Competencies:
- Leadership skills (supervisor/senior)
- Organizational skills (supervisor/senior)
- Communication (oral/written)
- Attention to detail
Job Code: 046

Job Title: Pipeline Engineer

Examples of Jobs Classified in this Occupation:
- Pipeline Engineer (Senior, Intermediate, Junior)

Main Duties:
- Perform pipeline engineering

Educational Requirements (Formal and On-the-Job):
- Bachelor of Engineering (Mechanical/Petroleum)
- Company specific training

Experience Requirements:
- 3-5 years general experience

Previous Roles:
- Intermediate
- Junior

Competencies:
- Communication (oral/written)
- Teamwork
Job Code: 047

Job Title: Piping Engineer

Examples of Jobs Classified in this Occupation:
- Piping Engineer (Senior, Intermediate, Junior)

Main Duties:
- Perform pipe engineering activities

Educational Requirements (Formal and On-the-Job):
- Bachelor of Engineering (Mechanical)
- Company specific training

Experience Requirements:
- 5 years general and offshore experience

Previous Roles:
- Intermediate
- Junior

Competencies:
- Communication (oral/written)
- Teamwork
**Job Code:** 048

**Job Title:** Planner

**Examples of Jobs Classified in this Occupation:**
- Logistics specialist
- Estimator
- Human Resource Planner
- Job Scheduler

**Main Duties:**
- Layout workflow for specific job
- Determine human resource schedule/requirements
- Liaise with procurement for materials flow
- Liaise with procurement for equipment requirements

**Educational Requirements (Formal and On-the-Job):**
- High school (minimum)
- College diploma or university degree (preferred)
- Company specific training

**Experience Requirements:**
- 5-10 years planning experience
- 5-10 years directly related trade experience

**Previous Roles:**
- Planning Assistant
- Trades/procurement experience
- Large/heavy industrial setting

**Competencies:**
- Team work
- Communication (oral/written)
- Computer skills
- Ability to handle stress
Job Code: 049

Job Title: Platter

Examples of Jobs Classified in this Occupation:
- Iron worker
- Steel fabricator
- Fitter
- Burner (metal cutter/placement)

Main Duties:
- Metal/steel plate fabrication and fitting
- Liaison with machinists and millwrights
- Operate cutting and rolling equipment

Educational Requirements (Formal and On-the-Job):
- College diploma
- Company specific training

Experience Requirements:
- 5 years in trade (intermediate/senior)
- 1 year (apprentice)

Previous Roles:
- 2 years marine/heavy industrial
- Management experience (senior/foreperson)

Competencies:
- Leadership (senior/foreperson)
- Communication (oral/written)
- Planning/organizational skills (senior/foreperson)
- Attention to details
Job Code: 050

Job Title: Process Engineer

Examples of Jobs Classified in this Occupation:
• Process Engineer (Senior, Intermediate, Junior)

Main Duties:
• Performs duties related to process engineering

Educational Requirements (Formal and On-the-Job):
• Bachelors of Engineering (Petroleum)
• Professional Engineering Designation (preferred)

Experience Requirements:
• 5 years petroleum and 3-5 years offshore experience (Senior)

Previous Roles:
• Intermediate Process Engineer (Senior)
• Junior Process Engineer (Intermediate)

Competencies:
• Communication (oral/written)
• Computer Literacy (Office products, Company-specific programs)
• Teamwork
• Leadership
Job Code: 051

Job Title: Procurement

Examples of Jobs Classified in this Occupation:
- Purchasing Manager
- Purchasing Officer
- Inventory Clerk
- Buyer
- Purchasing Agent

Main Duties:
- Source out materials and supplies
- Arrange delivery according to schedule
- Negotiate purchase/supply contracts
- Verify products/materials specifications

Educational Requirements (Formal and On-the-Job):
- High School
- Company specific training

Experience Requirements:
- 3 years procurement experience

Previous Roles:
- Sales/purchasing in related field

Competencies:
- Communication (oral/written)
Job Code: 052

Job Title: Production Technician

Examples of Jobs Classified in this Occupation:
- Production Technician

Main Duties:
- General production duties related to the operation of offshore rig and related facilities

Educational Requirements (Formal and On-the-Job):
- High School/Trade
- Company specific training

Experience Requirements:
- 2 years offshore experience
- 2 years industry experience

Previous Roles:
- NA

Competencies:
- Teamwork
Job Code: 053

Job Title: Project Management

Examples of Jobs Classified in this Occupation:
- Project Manager
- Cost-Control Engineer
- Asset Manager
- Cost-Planning Engineer

Main Duties:
- Ensure safe and profitable development of offshore projects
- Analyze technical and financial elements of the projects including budgeting, estimating and project control functions
- Interface between the company and the group managing assets

Educational Requirements (Formal and On-the-Job):
- Undergraduate degree in Engineering (Petroleum preferred)
- Masters of Business Administration (desirable)
- Professional Engineering designation (desirable)

Experience Requirements:
- 8+ years of project management experience and 5+ years working in offshore environments (Project/Asset Manager)
- 5-7 years of project management experience and 3-5 years working in offshore environments (Cost Control Engineer)
- Knowledge of company, company policies, and company staff (Asset Manager, Project Manager)

Previous Roles:
- Cost Control Engineer (Project/Asset Manager)

Competencies:
- Communication (oral/written)
- Contract Administration
- Project Management
- Teamwork
- People Management (Project Manager, Asset Manager)
**Job Code:** 054

**Job Title:** Radio Operator

**Examples of Jobs Classified in this Occupation:**
- Radio Operator

**Main Duties:**
- Radio Communication (oral/written)

**Educational Requirements (Formal and On-the-Job):**
- High School
- Communications Diploma
- Company specific training

**Experience Requirements:**
- 2 years general and offshore experience

**Previous Roles:**
- NA

**Competencies:**
- Communication (oral/written)
**Job Code:** 055

**Job Title:** Reservoir Engineer

**Examples of Jobs Classified in this Occupation:**
- Reservoir Engineer (Senior, Subsurface Manager)

**Main Duties:**
- Determine probable quantity and quality of oil and gas in the field
- Determine probable recovery
- Determine how to best manage and source oil and gas in the field

**Educational Requirements (Formal and On-the-Job):**
- Bachelors of Engineering
- Bachelors degree in Geology
- Professional Engineering Designation (preferred)

**Experience Requirements:**
- 10-12 years general and offshore experience, 5+ years with similar reservoir (Manager)
- 7-8 years general and offshore experience, 2-3 years with similar reservoir (Senior)
- Past experience with probability-based calculations concerning oil and gas in place and probable recovery

**Previous Roles:**
- Senior Reservoir Engineer (Manager)
- Intermediate Reservoir Engineer (Senior)

**Competencies:**
- Communication (oral/written)
- Teamwork
- People Management (Manager)
**Job Code:** 056

**Job Title:** Rigger

**Examples of Jobs Classified in this Occupation:**
- Rigger

**Main Duties:**
- General labour activities rig

**Educational Requirements (Formal and On-the-Job):**
- UK course if available
- Company specific training

**Experience Requirements:**
- 1 year offshore experience
- 5 years general experience

**Previous Roles:**
- Utility Man

**Competencies:**
- Communication (oral/written)
- Attention to detail
**Job Code:** 057

**Job Title:** Remote Operated Vehicle (ROV) Pilot

**Examples of Jobs Classified in this Occupation:**
- Remote operated vehicle pilot

**Main Duties:**
- Operate remotely operated vehicle for inspection, construction activity.

**Educational Requirements (Formal and On-the-Job):**
- Company specific training

**Experience Requirements:**
- 3 years general experience

**Previous Roles:**
- NA

**Competencies:**
- Communication (oral/written)
- Teamwork
Job Code: 058

Job Title: Scaffolder

Examples of Jobs Classified in this Occupation:
- Carpenter
- Jointer
- Staging specialist

Main Duties:
- Construct scaffolding of wood to meet job requirements
- Assemble metal staging
- Train junior scaffolders (senior/foreperson)

Educational Requirements (Formal and On-the-Job):
- College diploma
- 160 hours staging course

Experience Requirements:
- 10 years carpenter/staging (senior/foreperson)
- 4 years carpenter/staging (intermediate)
- 1 year carpenter/staging (apprentice)

Previous Roles:
- Scaffolding/staging
- Industrial/commercial experience
- Management (senior/foreperson)

Competencies:
- Communication (oral/written)
- Leadership (senior/foreperson)
Job Code: 059

Job Title: Seaperson

Examples of Jobs Classified in this Occupation:
- Seaperson
- Deckhands
- Cook

Main Duties:
- Operate deck equipment as required (Deckhands)
- Maintain vessel (paint, clean, chip, weld) (Deckhands)
- Stand watch under the direction of ship officers (Deckhands)
- Prepare and cook meals (Cook)

Educational Requirements (Formal and On-the-Job):
- Cook’s Certificate (Cook)
- Bridge Watch Ratings Certificate (Deckhands)
- Marine Emergency Duty (MED) Certificate
- Advanced First Aid Certificate (preferred)
- Fast Rescue Course (preferred)

Experience Requirements:
- 3-5 years general experience
- Welding or Mechanical experience (Seaperson -preferred)

Previous Roles:
- None required

Competencies:
- Teamwork
Job Code: 060

Job Title: Seismic Interpreter

Examples of Jobs Classified in this Occupation:
- Seismic Interpreter

Main Duties:
- Interpretation of seismic data

Educational Requirements (Formal and On-the-Job):
- Bachelor of Science
- Company specific training

Experience Requirements:
- 2 years offshore experience

Previous Roles:
- NA

Competencies:
- Teamwork
**Job Code:** 061

**Job Title:** Seismic Navigator

**Examples of Jobs Classified in this Occupation:**
- Seismic Navigator

**Main Duties:**
- Navigation coordination for seismic surveys

**Educational Requirements (Formal and On-the-Job):**
- Bachelor of Science
- Company specific training

**Experience Requirements:**
- 2 years offshore environment experience

**Previous Roles:**
- NA

**Competencies:**
- Teamwork
Job Code: 062

Job Title: Seismic Observer

Examples of Jobs Classified in this Occupation:
- Seismic Observer

Main Duties:
- Coordinate seismic lines
- Ensure quality seismic fieldwork
- Operate equipment that records seismic data

Educational Requirements (Formal and On-the-Job):
- Bachelor of Science
- Company specific training

Experience Requirements:
- 2 years offshore experience

Previous Roles:
- NA

Competencies:
- Teamwork
Job Code: 063

Job Title: Seismic Processor

Examples of Jobs Classified in this Occupation:
- Seismic Processor

Main Duties:
- Organize layout of survey
- Coordinates survey activities

Educational Requirements (Formal and On-the-Job):
- Bachelor of Science
- Company specific training

Experience Requirements:
- 2 years offshore experience

Previous Roles:
- NA

Competencies:
- Teamwork
Job Code: 064

Job Title: Seismic Supervisor

Examples of Jobs Classified in this Occupation:
- Seismic Supervisor

Main Duties:
- Supervise seismic survey
- Coordinate and supervise seismic staff

Educational Requirements (Formal and On-the-Job):
- Bachelor of Science
- Company specific training

Experience Requirements:
- 4-6 years offshore experience

Previous Roles:
- NA

Competencies:
- Leadership
- Teamwork
**Job Code:** 065

**Job Title:** Ships Officers

**Examples of Jobs Classified in this Occupation:**
- Chief Officer
- First Officer/ First Watch
- Chief Engineer

**Main Duties:**
- Manage the safe and efficient operate of the vessel
- Manage and direct crew
- Maintain necessary records
- Follow directives of the Captain

**Educational Requirements (Formal and On-the-Job):**
- Appropriate Transport Canada Certification for position

**Experience Requirements:**
- 5-7 years experience (Chief Officer)
- 3-5 years experience (First Officer)

**Previous Roles**
- First Officer (Chief Officer)
- Engineer (Chief Engineer)

**Competencies:**
- Communication (oral/written)
- Computer Literacy
- Leadership
- People Management
Job Code: 066

Job Title: Structural Engineer

Examples of Jobs Classified in this Occupation:
- Structural Engineer (Senior)

Main Duties:
- Structural engineering related to offshore
- Supervise engineering staff

Educational Requirements (Formal and On-the-Job):
- Bachelor of Engineering (Mechanical)

Experience Requirements:
- 3-5 years general and offshore experience

Previous Roles:
- Intermediate Structural Engineer

Competencies:
- Communication (oral/written)
- Teamwork
- Computer Literacy
- Leadership
Job Code: 067

Job Title: Subsea Engineer

Examples of Jobs Classified in this Occupation:
- Pipeline Engineer
- Trees Engineer
- Controls Engineer
- Glory Hole Engineer (Senior)

Main Duties:
- Design, develop and coordinate the installation, maintenance and operation of subsea equipment in specialty area

Educational Requirements (Formal and On-the-Job):
- Bachelors of Engineering
- Professional Engineering Designation (preferred)

Experience Requirements:
- 10-15 years experience and 10 or more years experience in the offshore (Senior)
- Previous experience with multiple installations

Previous Roles:
- Junior Engineer (Intermediate)
- Intermediate Engineer (Senior)

Competencies:
- Communication (oral/written)
- Problem-solving skills
- Contract Administration
- Quality Assurance
Job Code: 068

Job Title: Warehouse Supervisor

Examples of Jobs Classified in this Occupation:
- Warehouse Supervisor
- Yard Supervisor
- Warehouse General Manager

Main Duties:
- Supervise the warehouse staff
- Manage the coordination of loading and unloading of materials
- Complete necessary documentation for the movement of goods

Educational Requirements (Formal and On-the-Job):
- High School
- Diploma or degree in business or materials management (preferred)
- Degree in business (preferred)

Experience Requirements:
- 10 or more years of warehouse experience

Previous Roles:
- Previous warehouse positions (Supervisor)
- Previous management positions (General Manager)

Competencies:
- Communication (oral/written)
- Computer Literacy (Office)
- Planning/Organizational skills
- Knowledge of Rigging Practices
- People Management
- Customer Service
Job Code: 069

Job Title: Welder

Examples of Jobs Classified in this Occupation:
- Electric Arc Welder
- Gas Welder
- Spot Welder
- Cutter/Burner

Main Duties:
- Join metals using welding techniques
- Inspect completed welds
- Cut metal using electric or gas cutting techniques
- Train junior/apprentice welders (senior only)

Educational Requirements (Formal and On-the-Job):
- College diploma / trade certificate
- 1 year apprenticeship training
- 4 years journeyman welder

Experience Requirements:
- 10 years (senior/foreman/supervisor)
- 4-5 years (Intermediate/journey person)
- 1 year (apprentice)

Previous Roles:
- Senior welder
- Junior Management (supervisor)
- Hazardous environment
- Heavy Industrial / Marine experience

Competencies:
- Leadership skills (senior/supervisor)
- Attention to detail
- Communication (oral/written)
**Job Code:** 070

**Job Title:** Well Engineer

**Examples of Jobs Classified in this Occupation:**
- Well Services Engineer
- Testing Engineer
- Field Engineer
- Wireline Engineer (Senior, Intermediate, Junior)

**Main Duties:**
- Direct and monitor the completion and evaluation of wells, wells testing, and well surveys
- Provide guidance to Well Technicians
- Monitor, analyze performance and make recommendations that optimize well performance

**Educational Requirements (Formal and On-the-Job):**
- Bachelors of Engineering (Mechanical or Petroleum)
- Professional Engineering Designation (preferred)
- Company-specific training (equipment, processes, procedures)

**Experience Requirements:**
- 5 years petroleum and 3-5 years offshore experience (Senior)
- 2-3 years petroleum and offshore experience (Intermediate)

**Previous Roles:**
- Intermediate Engineer (Senior)
- Junior Engineer (Intermediate)

**Competencies:**
- Communication (oral/written)
- Computer Literacy (Office products, Company-specific programs)
- Teamwork
- Leadership
Job Code: 071

Job Title: Well Technicians

Examples of Jobs Classified in this Occupation:
- Well Services Technician
- Testing Technician
- Field Technician
- Wireline Technician
- Well Operator (Senior, Intermediate, Junior)

Main Duties:
- Operate company-specific equipment, tools and software necessary for well serving and testing
- Maintain records related to service and testing

Educational Requirements (Formal and On-the-Job):
- Diploma in Engineering (Mechanical or Petroleum)
- Company-specific training (equipment, processes, procedures)

Experience Requirements:
- 5 years petroleum and 3-5 years offshore experience (Senior)
- 2-3 years petroleum and offshore experience (Intermediate)

Previous Roles:
- Intermediate (Senior)
- Junior (Intermediate)

Competencies:
- Communication (oral/written)
- Computer Literacy (Office products, Company-specific programs)
- Teamwork
- Leadership
- Customer Service
Detailed Instructions for Using the Labour Demand Model

System Requirements

The labour demand model is designed to run using Microsoft Excel. Before starting to install and use the model, please note that the following minimum requirements are necessary for this model to operate on your computer:

- Software: Microsoft Excel 2000 or later
- Memory: 64MB
- Hard drive space: 1GB
- Processor: Pentium III 800 MHz or equivalent

Summary

The labour demand model designed for PRAC is a pre-calculated Excel-based spreadsheet, designed to be simple to navigate and use. It has the built-in flexibility that allows users to create model scenarios and change input data and assumptions. As such, the model has been designed for three modes of operation.

Mode 1: Viewing Data and Comparing Scenarios

For users who only wish to view data and compare different, existing scenarios, there are four key screens:

- Outline page screen with hyperlinks (or hotlinks) to navigate the model
- Summary page screen that allows the user to view the HR requirements by year and activity category for a chosen scenario
- Tabular HR Requirements by Category Screen for the scenario selected on the Summary screen as well as links to the competency database
- Compare Scenarios Screen that allows the user to simultaneously compare the yearly total HR requirements for any 3 scenarios as well as the HR requirements for a single activity category across these 3 scenarios. (NOTE: You may need to scroll across using the scroll buttons on the left-hand bottom to find the tab or this function).

Mode 2: Changing Model Scenarios and Other Model Settings

In addition to viewing data and comparing scenarios with the screens listed above, users can define new scenarios in the model and change the market scenario and model rules using the following screens:

- Define Scenarios Screen to adjust variables regarding reserves potential, discovery sizes, technologies etc. for existing projects and potential future developments
- Market Scenarios & Model Rules Screen to adjust pricing, exploration success rates and other general assumptions in the model
Mode 3: Creating Customized Scenarios: Changing Data Inputs and Assumptions

Users can define more detailed aspects of the model. It is important to note that any changes made by the user will only impact his/her version of the model and not copies used by other users. A customized scenario can be created using the following screens:

- **Existing Project HR Screen** may be used for defining HR requirements on existing projects
- **Development (Devel) Technologies Screen** can be used to change details of, or define, new infrastructure development technologies
- **Hidden Screens** defining the HR requirements for exploration and development activities used in the model may be unhidden and, subsequently, reviewed or changed to meet the user’s needs

In addition, the **Activity Model Screen**, which cannot be modified, is also provided for viewing the details of the active model scenario

General Information

The model contains numerous hyperlinks, user input cells, read only cells and drop-down menus.

- **Hyperlinks.** By clicking on hyperlinks (similar to hot buttons) the model will take you directly to the screen specified by the hyperlink text. Throughout the model, hyperlinks are shown in bolded blue underlined text. The following is an example of a hyperlink.

  **Example of Hyperlink**

- **User Input Cells.** Text in the model that is coloured red on a white background represents items that can be entered or changed by the user – either as text or, in some cases, the model provides a drop-down menu for cell entries. The following is an example of a user input cell.

  **Example of User Input**

- **Read Only Cells.** All other cells in the model contain black text and are "read only." As such, they represent labels and model results that are locked and cannot be changed by the user.

- **Drop Down Menus.** These menus ‘appear’ when requested by the user and allow the user to choose from the list of items provided in the menu. To access a drop down menu, the user should:
  - click on the box - an arrow will appear to the right
  - click on the downward-pointing (↓) arrow to display the drop down menu
At any time, the user can:
- select desired choice by using the scroll buttons and hitting on the desired choice from menu
- return to the outline screen by hitting the Ctrl (Control) and H keys on the keyboard
- activate the Summary screen, by selecting the Ctrl and S keys
- view the Compare Scenarios screen by clicking on the Ctrl and P keys

Outline Screen

The first screen in the model provides the user with hyperlinks to the screens in the model, a list of the model contents, information on the source of the sheet information, and whether data is available on the screen for user modification.

This sheet can be activated at any time by selecting:
- Ctrl and H
- the appropriate tab for the screen from the menu located on the button of the screen

Figure 1: Example of an Outline Screen
Summary Screen

The Summary screen allows the user to view yearly HR requirements (in person-years) by category for the scenario selected by the user. The scenario is selected using the drop down menu at the top of the screen from the defined scenarios available. When the user selects a scenario, the description of the specified scenario is displayed at the top of the screen. The graph and table are updated to display the yearly data by category for the selected scenario.

This sheet can be activated at any time by selecting:
- the Ctrl and S keys,
- the appropriate hyperlink from the Outline screen, or
- the appropriate tab for the screen

Figure 2: Example of a Summary Screen
Tabular HR Requirements by Category Screen and Links to the Competency Database

The screens in the model following the Summary screen show the detailed data for the HR requirements. Each screen represents one category (Total HR, Existing Project Development HR, Development HR, Existing Project Production HR, Production HR, Exploration HR) and provides the HR requirements for each individual occupation for that category for each year in the model for the active scenario selected on the Summary screen. There is also a screen that provides the Total HR requirements by NOC Category in a similar fashion. The name of the active scenario is displayed at the top of each screen.

Also available are hyperlinks from each page for each HR occupations which activate the Competency Database worksheet corresponding to the linked HR category. Click on the hyperlink to activate the database. The user can navigate back to any of the tabular HR requirements sheets by clicking on the hyperlinks to the sheets located at the top of the Competency database worksheet.

An example of a tabular HR requirements screen, in this case the Total HR screen, and the Competency Database follow. The HR sheets can be activated by:
- using the hyperlinks on the Outline screen, or
- selecting the appropriate tab from the bottom of the screen

Figure 3: Example of Tabular HR Requirements by Category Screen
Figure 4: Example of Competency Database

<table>
<thead>
<tr>
<th>Job Title</th>
<th>Level</th>
<th>Formal Education</th>
<th>Other Training</th>
<th>General Experience</th>
<th>Offshore Experience</th>
<th>Experience Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aircraft Technician</td>
<td>Senior</td>
<td>Aviation Mechanics Certificate, Aircraft Certificate</td>
<td>NA</td>
<td>NA</td>
<td>Aircraft Technician</td>
<td></td>
</tr>
<tr>
<td>Aircraft Technician</td>
<td>Apprentice</td>
<td>Aviation Mechanics Certificate, Aircraft Certificate</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Engineer</td>
<td>Master Engineer Certificate</td>
<td>Company Training</td>
<td>NA</td>
<td>1.0</td>
<td>Project Lead</td>
<td></td>
</tr>
<tr>
<td>Captain</td>
<td>Diploma, Master Mariner Certificate</td>
<td>NA</td>
<td>7.5</td>
<td>7.5</td>
<td>Chief Off</td>
<td></td>
</tr>
<tr>
<td>Captain</td>
<td>Captain</td>
<td>NA</td>
<td>5</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Captain</td>
<td>Major</td>
<td>NA</td>
<td>5</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Civil Engineer</td>
<td>Senior</td>
<td>B Eng (Civil)</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Civil Engineer</td>
<td>Intermediate</td>
<td>B Eng (Civil)</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Civil Engineer</td>
<td>Junior</td>
<td>B Eng (Civil)</td>
<td>NA</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Compare Scenarios Screen

The Compare Scenarios screen allows the user to compare the yearly total HR requirements for three different scenarios both in a bar chart and a data table. The user can select any of the scenarios that have been defined in the model from the drop-down lists in the left hand column of the data table. The data table and bar chart will update automatically when the drop down list selections are changed.

The user can also compare the yearly HR requirements for three different scenarios for a single HR category and activity phase by pressing PgDn to get to the second graph and data table contained in the screen. The user should select an HR category and an activity phase from the drop-down lists at the top left of the data table as well as three scenarios in the drop down lists in the left hand column. The data table and bar chart will update automatically when the selections are changed.

This screen can be activated at any time by:
- holding the Ctrl and P keys, or
- selecting appropriate hyperlink from the Outline screen or appropriate tab for the screen

Figure 5a: Example of Compare Scenarios Screen (part 1)

Selecting Pg-Dn from this view will reveal the second chart and data table (see Figure 5b).
Define Scenarios Screen

The Define Scenarios screen allows the user to actually define and name new scenarios or alter the existing scenarios. A summary of this screen follows and a more detailed, step-by-step procedure is located on the following page of this guide.

A total of nine scenarios can be defined in the model. Four of these scenarios can be defined by the user; five are already defined in the model. The scenarios are numbered automatically, however, the user can define the name of the scenario and provide a description. Selecting the PgDn key on your keyboard will allow the user to scroll through the scenario definition tables; selecting PgUp will allow the user to scroll back through the scenario definition tables.

All of the non-numeric data required to define the scenarios is provided in a drop-down menu. When the cell is selected, descriptions of the data appear to advise the user on the type of data and units required. The user can define all of the required data for the available fields in the model as well as select whether each field is active or not for the scenario.

This screen can be activated by:

- using the hyperlink on the Outline screen, or
- by selecting the appropriate tab

An example of one of the scenario definition tables follows.
Figure 6: Example of Define Scenarios Screen

- **Define variables for each field**
- **Define Scenario name & description and market scenario**
- **Drop Down Lists or numerical entries for each variable**

Note: PgDn and PgUp will allow the user to scroll through the nine scenario definition tables.
To Define a Scenario:
1. Assign a name to the scenario
2. Provide a description for the scenario
3. Select the market scenario, this influences the pace of exploration following the initial commitment phase (see Market Scenarios and Model Rules)
4. Decide on the number of exploration basins to be included in the scenario. Assign a name to each basin horizontally across the screen
5. For each basin, set the status to “on” or “off”
6. For each basin, enter the expected principle product (oil or gas)
7. Enter the total reserves potential for each basin (BCF for gas, MMBBLs for oil)
8. Enter the average expected wildcat (i.e. first well on structure) exploration prospect chance of finding commercial hydrocarbons for each basin
9. Enter the average expected discovery size for each basin (BCF for gas, MMBBLs for oil)
10. Specify the initial discovery rate relative to the long run average for each basin (see Market Scenarios and Model Rules)
11. Specify whether to use the shallow or deep exploration template for exploration well HR requirements by basin
12. Specify the reserves capacity of existing infrastructure in the basin to provide transportation (and possibly processing) facilities for additional discoveries in the basin (BCF for gas, MMBBLs for oil)
13. Specify the total reserves handling capacity of assumed additional infrastructure in the basin (BCF for gas, MMBBLs for oil)
14. Specify the threshold economic reserves required for new infrastructure development once existing infrastructure has been utilized (BCF for gas, MMBBLs for oil)
15. Specify the development template required for a new infrastructure development (see sheet Devel Technologies)
16. Specify the reserves developed by each incremental development (BCF for gas, MMBBLs for oil)
17. Specify the development template required for each incremental development (see sheet Devel Technologies)
18. Specify the number of wildcat wells and 3D and 2D seismic programs during the initial commitment phase
Market Scenarios & Model Rules Screen

The user may also want to review or change the items on the Market Scenarios & Model Rules screen. As with the Define scenarios screen, description of the data required for each cell is provided as a comment when the cell is selected.

The user will need to define five key areas. Specifically, the user must:

- Define & Describe Market Scenarios. Here the user can enter up to three different market scenarios and provide a description of each in the cells at the top of the sheet. The market scenarios are used to define the pace of exploration post commitment wells.
- Define Model Rules. The user can then define various model rules regarding seismic activity and appraisal well rates per discovered volume of oil or gas. Note these rules will apply to all activity scenarios and market scenarios in the model.
- Define Exploration Success vs. Average Success Rate. Here, the user defines three exploration success rates as a percentage of the average rate determined from the average success rate defined by scenario. These three rates will be given as options in the drop down list for Discovery Rate on the Define Scenarios screen.
- Define Yearly Technology Learning Factor. The user can specify a yearly technology learning factor, which will be applied to all scenarios in the model, and adjusts the HR requirements according to the percentage defined by year.
- Define Post-Commitment Exploration for Each Market Scenario. For each of the three market scenarios specified at the top of the screen, the user can enter post-commitment exploration rates in three time periods as a percentage of the early phase rate.

Figure 7: Example of Market Scenarios and Model Rules Screen
Existing Project HR Requirements Screens

There are three worksheets provided for definition of existing project HR requirements. These worksheets allow the user to directly enter yearly HR requirements by category for existing producing projects or those currently under development. Two are specified in the model and there is also a spare worksheet provided for an additional existing project if needed. The figures entered into these worksheets are automatically incorporated into the model calculations.

Development (Devel) Technologies Screen

The Devel Technology screen provides details of the development and production technology options that are provided in the Define Scenarios screen for the New Infrastructure and the Incremental Development Infrastructure variable for each field. Details include gas and oil reserve limits, infrastructure size and water depth limits for each technology. These details are provided for reference when defining scenarios and cannot be changed by the user. If changes are required or additional development technologies need to be added to the model, the screen will have to be unlocked using the password in order to make changes.

Hidden Screens

There are several hidden screens in the model that the user should not need to reference or make changes to. However, if the user does need to access these screens, they can be “unhidden” by:

- selecting Format/Sheet/Unhide from the menu, and
- specifying which sheet should be revealed

The hidden sheets provide details of development and production HR requirements for each of the 20 possible development and production technologies (defined on the Devel Technologies screen as DPHR 1 through 20) as well as details of the HR requirements for exploration activities (2D Seismic, 3D Seismic, Shallow Well, Deep Well and a Spare). Also in the hidden screens is map of the NOC HR categories and the corresponding categories and link numbers in the model.

Activity Model Screen

The Activity Model screen allows the user to scroll through the calculated activity forecast for the active scenario used to calculate the HR requirements. None of the cells can be changed on this screen, it is provided for reference only.