# VOISEY'S BAY NICKEL COMPANY LIMITED
# ARGENTIA HYDROMETALLURGICAL DEMONSTRATION PLANT
# PROJECT REGISTRATION

VOISEY'S BAY NICKEL COMPANY LIMITED

A subsidiary of Inco Limited

# Voisey's Bay Nickel Company Limited
# Argentia Hydrometallurgical Demonstration Plant
# Project Registration

**Submitted**
**by**


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VOISEY'S BAY NICKEL
COMPANY LIMITED

A subsidiary of Inco Limited

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# 1.0 Introduction

Voisey's Bay Nickel Company Limited (VBNC), a wholly owned subsidiary of Inco Limited ("Inco"), is proposing to build a Hydrometallurgical (Hydromet) Demonstration Plant at Argentia, Newfoundland (Figure 1-1). This document is submitted by VBNC to the fulfill the requirements of a Project Registration under the ***Environmental Protection Act*** of Newfoundland and Labrador (the "Act") and a Screening Level Environmental Assessment (EA) under the ***Canadian Environmental Assessment Act*** ("CEAA"). The demonstration project will be screened under CEAA because funding will be provided by a federal department (Industry Canada). This document contains a complete Project Description and consideration of social, economic and environmental factors associated with this proposed project.

The proposed Demonstration Plant is a 'stand-alone' research facility that will test hydrometallurgical processes for ultimate use in commercial plants, including the one proposed for Argentia. This Registration/EA has been prepared for the small-scale demonstration facility only. The commercial plant at Argentia will undergo a separate Registration and EA.

## 1.1 Study Team

Under the direction of VBNC, the study team consisted of LGL Limited of St. John's as the lead consultant that assisted in the preparation of this document. McMillan/Rivers assisted in the preparation of the socio-economic sections of this document.

## 1.2 Definitions and Document Organization

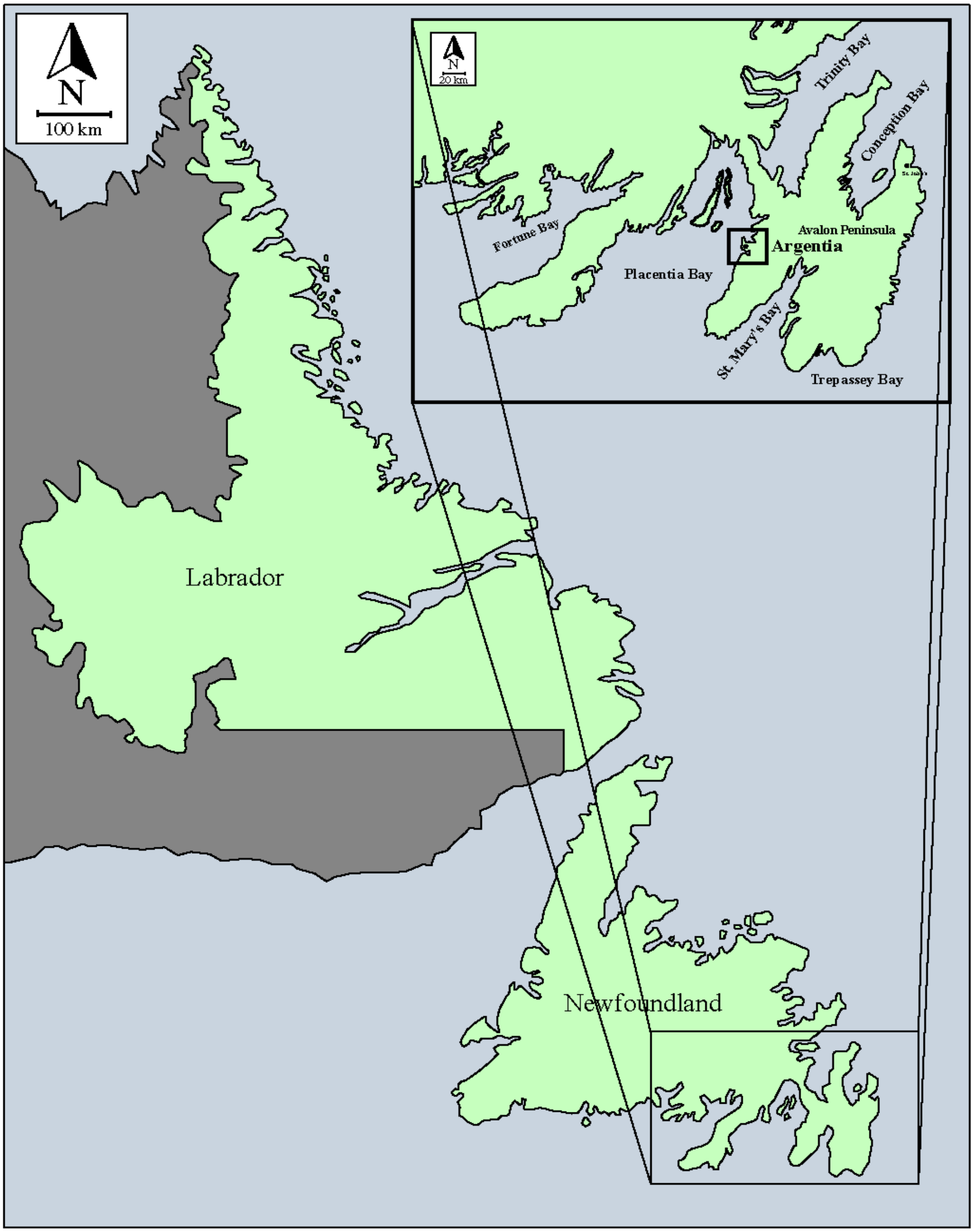
This section sets forth the principal definitions used in this Registration/Environmental Assessment.

### 1.2.1 Principal Definitions

**The Project** – The proposed Hydrometallurgical Demonstration Plant (also referred to as 'Facility') at Argentia.

**Scoping** – This is a first step in environmental assessment (EA) where all available sources of relevant information and people are consulted in order to determine the temporal and spatial boundaries of the Project, activities that might cause effects, and potential receptors for effects. Valued ecosystem components or **VECs** (important environmental, social or economic factors) are selected based on local, national, or international levels of human concern and some potential to be affected.

Figure 1-1. Proposed Project Location, Argentia, Newfoundland and Labrador.



**Project Phases** – The Project is a 'stand-alone' project in the sense that it is a demonstration project for hydrometallurgical technology. Its feasibility as a test facility is not predicated, or dependent upon, subsequent development of a commercial-level operation. The Construction Phase will last approximately 16 months and the Initial Operating Phase will last two to three years. In addition to the utilization of the Facility for purposes of developing, on a technically and economically feasible basis, hydrometallurgical process technology for processing concentrates or other intermediate feeds from Voisey's Bay, other business opportunities for the ongoing utilization of the Facility for the evaluation of other concentrates and intermediate feeds will be pursued by VBNC and Inco Limited. The Facility will be decommissioned according to government regulations in effect at the time.

**Regional Study Areas (RSA)** – A total of three areas are considered: (1) the Province, (2) the Avalon Peninsula for socio-economic factors, and (3) Placentia Bay for biophysical factors.

**Potential Effects Area (PEA**) – In the biophysical EA, Argentia Harbour is considered the potentially affected area as this area bounds the primary biophysical effects of the Project. In the socio-economic EA, the local communities within a 45 km radius are considered the primary affected area but the regional areas also could be affected.

**Project Area** – The actual 'footprint' of the Project on the Argentia Peninsula.

In addition to the above, there is a considerable amount of environmental assessment terminology used in this document; many of these terms have become relatively standard because of the CEAA. These terms are defined in the relevant sections set forth in this document.

### 1.2.2 Document Organization

The following document is organized into the following sections:

1.0 Introduction
2.0 Project Description
3.0 Existing Social Environment
4.0 Existing Physical Environment
5.0 Environmental Effects Assessment Methodology
6.0 Effects Assessment
7.0 VBNC Environmental Management System
8.0 Summary of Residual Effects
9.0 Literature Cited

# 2.0 Project Description

## 2.1 Project Overview

The Facility will be built on the property generally referred to as the north side of the of the former US Navy base at Argentia, Newfoundland. The property is owned by the Argentia Management Authority, a not-for-profit corporation duly incorporated under the laws of the Province of Newfoundland and Labrador.

The Facility will be built to evaluate the economic viability of hydrometallurgical processes and to test at least certain technical aspects of the technology. The Facility will be operated in a testing and trial mode much of the time to confirm process conditions and alternative designs. All unit operations will be included and operated on a fully integrated and continuous basis. Additionally, the Facility will be used to test certain alternative equipment or process configurations to determine optimal design criteria for potential full-scale hydrometallurgical processing.

The hydrometallurgical processes involve treatment of nickel-copper-cobalt sulphide concentrate using pressure oxidative leaching with the subsequent recovery of copper, cobalt, and nickel. Initial testing on some of the processes has been carried out, providing enough information to do a metallurgical simulation and mass balance model for the proposed flowsheet.

The Facility will follow the hydrometallurgical methods and process design criteria as defined in the laboratory and mini-pilot plant testing that will be ongoing at Inco Limited research facilities in Mississauga, Ontario. However, at a conceptual level, hydrometallurgical process technology has been generally defined and as such is described below. It is understood that certain variations may take place following the mini-pilot plant campaigns at Inco Limited's research facility and that the final plant processes to be tested at the Facility may differ somewhat from the description provided here. In developing the hydrometallurgical technology for Voisey's Bay, Inco will use a series of industry wide accepted developmental stages. The first stage is to prove that each separate chemical process works individually at a laboratory scale. This has been successfully completed. The second stage is to use this information to build and operate a "mini-pilot" plant to ensure that the steps can be interconnected into a continuous process. This will be done at Inco's laboratory facilities in Ontario. The results from the mini-pilot plant will then be used to define the overall process and equipment that will be tested at the demonstration facility at Argentia. While the hydrometallurgical process is generally defined at the laboratory stage, each level of testing reveals new requirements and improvements that are incorporated into the subsequent stage. Such variations have been accounted for in this EA, which has used a 'reasonable worst case' scenario approach.

Several scoping meetings have been held with government regulators and interested agencies. A presentation on the Project was given to government on 13 September 2002. A meeting with regulators was convened on 11 October 2002 and the general approach to the EA was presented. The following agencies were represented at these meetings.

- Newfoundland and Labrador Department of Mines and Energy
- Industry Canada
- Public Works and Government Services Canada
- Environment Canada
- Fisheries and Oceans
- Canadian Coast Guard
- Newfoundland and Labrador Department of Environment (Environmental Assessment Division)
- Newfoundland and Labrador Department of Environment (Water Resources Division)
- Newfoundland and Labrador Department of Environment (Pollution Prevention Division)
- Newfoundland and Labrador Department of Labour
- Newfoundland and Labrador Department of Government Services and Lands
- Transport Canada

## 2.2 Contacts

The Proponent is VBNC. VBNC's principal offices are located at

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Primary contacts at VBNC for this registration are

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## 2.3 Federal Involvement

Application has been made by VBNC's parent company, Inco Limited, for certain research and development funding from Technology Partnerships Canada (TPC) of Industry Canada to assist in the construction and operation of the Facility.

Contact:

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## 2.4 Purpose/Rationale/Need for the Undertaking

Inco Limited and VBNC have committed to construct and operate a commercial facility to produce refined nickel in the Province for sale. Inco Limited and VBNC have as part of this commitment agreed to evaluate whether such a commercial facility could utilize on a technically and economically feasible basis, hydrometallurgical processing technology, to produce refined nickel. Accordingly, the purpose of the proposed Facility will be, consistent with these commitments and agreements, to evaluate hydrometallurgical technologies and to develop procedures and facilities for a state of the art commercial processing plant to produce refined nickel. Life cycle inventory studies have indicated that the environmental impact of the hydrometallurgical processes is about one half of the impact of the more traditional pyrometallurgical processes in almost all categories.

It is expected that utilization of the process technology will result in a reduction in the release of airborne particulates and gaseous emissions and a reduction in energy consumption compared to conventional smelting and refining. The Project is consistent with VBNC's policy on sustainable development.

It is expected that utilization of the development of hydrometallurgical technology will have a positive impact on both the Argentia area and the Province of Newfoundland and Labrador.

## 2.5 Alternatives to the Project

As noted in Section 2.4, VBNC and Inco Limited have, in conjunction with the development of the Voisey's Bay project and pursuant to a Development Agreement dated October 7, 2002, with the Government of Newfoundland and Labrador, agreed to construct and operate the Facility in the Argentia Peninsula for the purpose of evaluating the technical and economic feasibility of hydrometallurgical processing technology to treat Voisey's Bay nickel-containing concentrates and other intermediate feeds and, accordingly, produce refined nickel products from such intermediates. Given this objective, there are no alternatives in terms of the purpose of and rationale for the Facility and for the location of the Facility. In connection with the consideration of hydrometallurgical processing technology to produce refined nickel products from Voisey's Bay nickel-containing concentrate and other intermediate feeds, VBNC did evaluate certain issues as discussed in the succeeding paragraphs in connection with the commitments and agreements it reached with the Government of the Province of Newfoundland and Labrador relating to the Facility and the Facility's location on the Argentia Peninsula.

VBNC has considered both pyrometallurgical and hydrometallurgical technologies to produce refined nickel product in the Province. The hydrometallurgical process was chosen for testing at the Facility in part because of the lower overall capital costs and potential environmental benefits. For example, these processes consume less energy and create only relatively small amounts of air emissions compared to more conventional pyrometallurgical processes.

Specific hydrometallurgical alternatives evaluated by the Proponent include bioleaching processes. Bioleaching was determined to not be technically feasible for Voisey's Bay concentrate because quantities of residues and neutralizing agents were large and the costs of such processes were considered too high.

Over the life of the Project a number of alternative hydrometallurgical processes will be tested to determine which would be the most appropriate taking into account all relevant factors. This approach has been taken into account in this EA through the use of reasonable 'worst case' scenarios in terms of effluents and emissions. The major process alternatives include lowering the operating temperature for certain steps in the process and changing (eliminating) the addition of chlorine in the leach. Also, the sulphur may be separated from the leach residue to make two distinct residue products. Other alternatives to be considered within the Project include copper sulphide precipitation versus copper metal electrowinning for copper recovery. Alternatives also will be considered for solvent extraction reagents and various additional purification methods. These alternatives within the Project will not alter the outcome of this EA.

The final alternative would be not to develop the Voisey's Bay deposit but to find other ore bodies or projects to satisfy market demand. This alternative was determined to not fit into Inco's long term plans given their commitment and investment to the Voisey's Bay Project.

## 2.6 Authorizations Required

The Project will be subject to the following primary environmental legislation.

Government of Canada

- ***Canadian Environmental Assessment Act***
- ***Canadian Environmental Protection Act***
- ***Fisheries Act***
- ***Navigable Waters Protection Act***
- ***Transportation of Dangerous Goods Act***

Government of Newfoundland and Labrador

- ***Environmental Protection Act***
- ***Water Resources Act***
- ***Occupational Health and Safety Act***
- ***Boiler, Pressure Vessel and Compressed Gas Act***
- ***Dangerous Goods Act***
- ***Public Health Act***
- ***Urban and Rural Planning Act***

A list of potentially required permits, licences and authorizations is contained in Appendix A.

## 2.7 Project Related Documents

There are no project-related documents that have been submitted to the Province as part of the registration process.

## 2.8 Project Components/Structures

The Facility will be based on mini-pilot plant operating results  to be undertaken in Mississauga, Ontario.  Since the expected hydrometallurgical processes to be evaluated at the Facility will be developed based on the mini-pilot plant work, the final design for the Facility will likely have some changes from the current plan.  However, we have used a scenario of maximum outputs to the environment in this EA.

A conceptual layout for the Facility is show in Figure 2-1.  As noted above, the Facility will be built to evaluate the technical and economic feasibility of the processes.  The Facility will be operated in a testing and trial mode much of the time to confirm process conditions and alternative designs.

### 2.8.1 Concentrate and Limestone/Lime Preparation Building

The Facility will be using intermediate feeds or concentrate for evaluation purposes.  The concentrate crushing and grinding, and limestone/lime preparation equipment is housed in a common, heated and ventilated, approximately 700 square metre building.  The building also includes areas for storing raw concentrate indoors, to facilitate thawing in the winter.  Concentrate will be received in enclosed shipping containers.

### 2.8.2 Process Building

The remainder of the process equipment will be housed in a common design/build type building with an area of approximately 4,000 square meters. Figure 2-2 shows a preliminary conceptual building layout.

Conceptually, the concentrate slurry will be pumped from the concentrate building to the process building through an overhead pipe gallery.  The building contains the concentrate leaching and filtration area, the purification (solvent extraction) area, the neutralization area, and the product recovery (electrowinning cells) area.

### 2.8.3 Plant Capacity

The Facility will be designed to operate at an instantaneous production rate of between 1/100 and 1/250 of the production capacity of a full-scale commercial plant.  However, as the Facility will be operated on a campaign basis for specified periods, with other periods of downtime for circuit modifications and equipment evaluations, the annualized throughput may vary down to 1/500 of a full-scale plant.  For planning purposes, the throughput is assessed at about 1:140 of a commercial plant size.  Outputs are shown in Table 2-1.

Figure 2-1. Conceptual Layout of Hydrometallurgical Demonstration Facility.

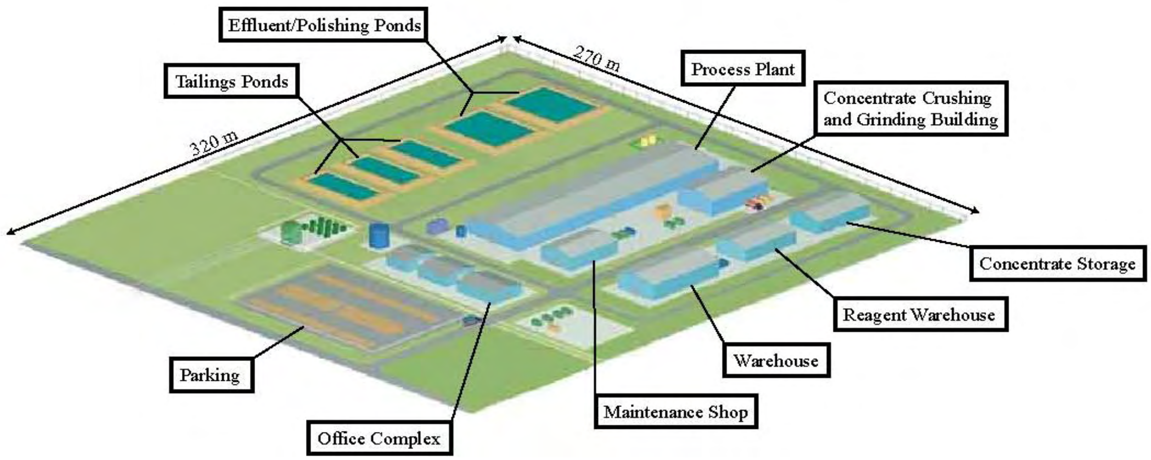


Figure 2-2. Process Plant Building.

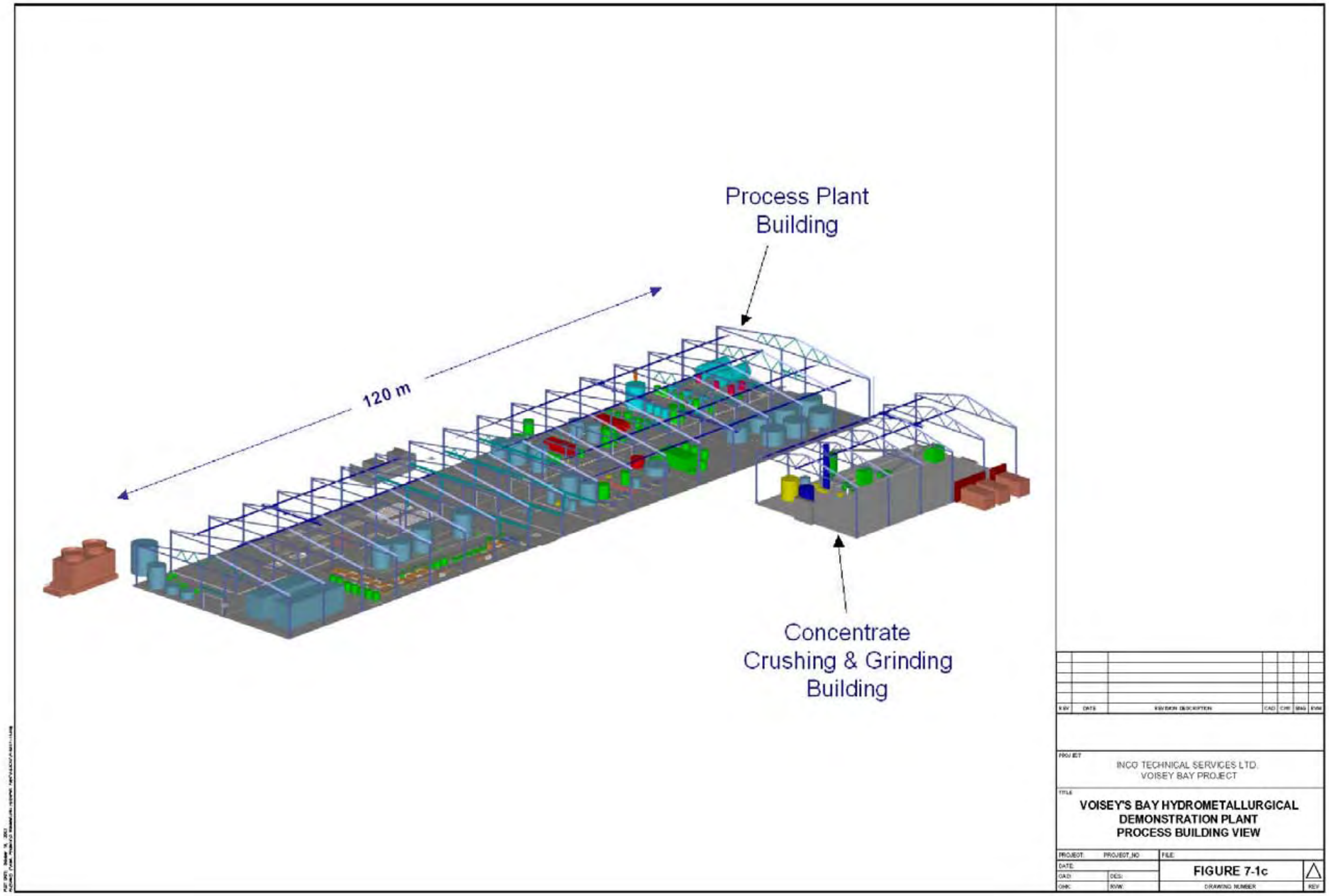


Table 2-1. Projected Capacity of the Facility.

| Component | Annual Capacity (tonnes) |
|---|---|
| Concentrate Feed | 2000 |
| Nickel in Feed | 400 |
| Copper in Feed | 28 |
| Cobalt in Feed | 19 |
| Leach Residue | 1800 |
| Gypsum Residue | 1700 |

## 2.9 Project Activities

The Project has two phases: (1) Construction Phase, and (2) Initial Operations Phase. Decommissioning will be conducted in the future according to government regulations in place at that time, and once there are no ongoing technically and economically uses for the Facility.

The Project is presently in the preliminary engineering stage and thus specific information is not yet available on the precise site plan, specific timing for the different activities or the specific types of construction equipment that will be utilized. Conceptual site plans, design details and requirements for off-site land use, as noted above, are contained in the relevant sections of this document (see Figures 2-1 and 2-2).

Scheduling will be based on an approximate 16-month period for the Construction Phase and a two to three year period for the Initial Operations Phase. This EA is based on a 16-month construction time and a three-year Initial Operations Phase. Decommissioning would occur at the end of the useful life of the Facility.

The scope of activities considered in the biophysical portion of the EA is the Project Area on the Argentia Peninsula and the Argentia Harbour as this is the extent of potential Project effects. The socio-economic portion of the EA concentrates on the local area but also extends across the Avalon Peninsula to St. John's as will some of the benefits of the Project. The Province as a whole is also considered from a socio-economic perspective.

## 2.10 Occupations

Construction capital cost is estimated at about $80 million. The construction labour component (various building trades) of this is about 20% over the sixteen-month construction phase. Construction labour make-up will be typical of a construction project of this nature and include heavy equipment operators, electricians, plumbers, pipefitters, welders, general labourers, and so forth.

Operating personnel will be up to about 200 people (up to 120 personnel on site at a time) including:

| | |
|---|---|
| • Engineering/technical | 22 |
| • Administrative | 14 |
| • General labour | 10 |
| • Operators | 98 |
| • Laboratory chemists and technicians | 26 |
| • Maintenance | 30 |
| | 200 |

The maintenance personnel breakdown includes:

| | |
|---|---|
| • Supervisor | 1 |
| • Mechanic/machinist | 10 |
| • Welder/pipefitter | 5 |
| • Electrician | 9 |
| • Instrumentation technician | 5 |
| | 30 |

These jobs include a portion that would be co-op or seasonal student jobs.

## 2.11 Resource/Material Requirements

### 2.11.1 Process Description

The following process description represents the flowsheet as currently envisioned following laboratory testing. Variations of this, including individual circuit modifications or replacements are likely based on the results of the mini-piloting that will take place over the next two years.

A conceptual process flowsheet is shown in Figure 2-3. The Facility is designed to treat nickel concentrate received from Voisey's Bay and other possible sources of concentrate and produce London Metal Exchange (LME) grade electro nickel product. The copper and cobalt contained in the concentrate will also be recovered to salable grade products. By the end of the Facility Initial Operating Phase, the overall recoveries are expected to be in the range of 95% for nickel and cobalt and 65% for copper.

In order to provide a suitable particle size for treatment, the concentrate will first be crushed, fine-ground, and stored in storage tanks for subsequent leaching.

Two leaching steps are to be carried out on the concentrate: an atmospheric pre-leach, and a pressure oxidative leach. A portion of the concentrate is to be leached at atmospheric pressure with spent nickel electrolyte solution and gases recovered from the nickel electrowinning circuit. The remaining concentrate is to be mixed with the pre-leached concentrate and added to the autoclave.

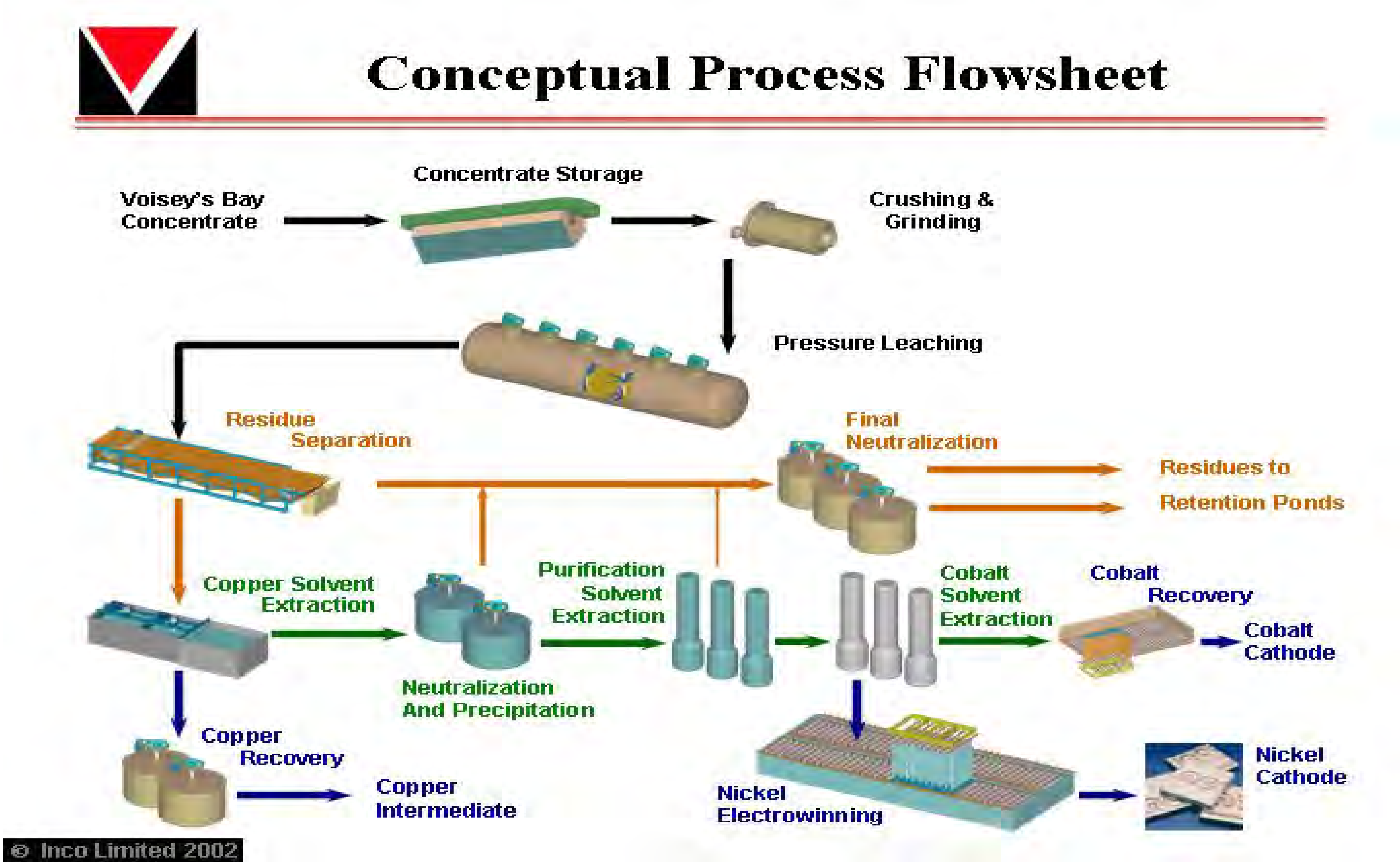
Pressure oxidative leaching is to be carried out in an autoclave at elevated temperature and pressure. Oxygen is to be injected in the autoclave and will react with the nickel, cobalt, and copper sulphide minerals to dissolve the metals as sulphate solution. The iron will form an insoluble oxide solid and most of the sulphur will form molten elemental sulphur. The remainder of the sulphur will react with oxygen to form sulphuric acid, which will be used in the leaching reactions.

The hot leached slurry will be discharged through a pressure let-down (flash) vessel to vent the steam to cool the slurry and allow the molten sulphur to solidify. The leach residue, containing stable iron and sulphur compounds, will then be thickened, filtered, and sent to a final neutralization stage for pH adjustment prior to impoundment. A portion of the clarified leach solution, containing the dissolved nickel, cobalt, and copper, will be cooled and returned to the autoclave for temperature control, while the remainder will be sent to downstream metal recovery.

In the first stage of the metal recovery section of the Facility, the leach solution will be sent through a copper solvent extraction circuit. In this circuit, the copper will be removed from the nickel and cobalt by selective extraction by organic extractant reagents. The copper will be subsequently stripped from the organic stream by a recirculating acidic copper solution, and will be sent to copper recovery.

In the copper recovery circuit, copper may be recovered in one of two methods. In the first method, the copper may be precipitated as an intermediate copper sulphide product by reaction with hydrogen sulphide. Alternatively, copper will be deposited onto charged cathode electrodes in electrowinning tanks to form copper metal. The technical and economic viability of each method will be assessed to determine the final configuration.

Figure 2-3. Conceptual Process Flowsheet.



The acidic copper-free leach solution together with a portion of the spent nickel electrolyte solution (produced below) will be reacted with limestone and lime to neutralize the solution and to precipitate gypsum. The gypsum solids will be filtered and sent to final neutralization and disposal.

The neutralized copper-free solution will be sent to a purification solvent extraction circuit to remove calcium, zinc, and other remaining trace impurities. This circuit uses an organic extractant to selectively remove the impurities, leaving a purified nickel plus cobalt sulphate solution. The impurities will be stripped from the organic using an acid solution and sent to final neutralization.

The purified nickel/cobalt solution will be sent to cobalt solvent extraction where another organic solvent selectively extracts cobalt. The cobalt will be stripped from the organic by an acidic solution, producing a concentrated cobalt solution, which will be sent to a cobalt recovery circuit. The cobalt will be recovered as cobalt cathode in a cobalt electrowinning circuit.

The cobalt-free nickel solution will be sent to nickel electrowinning where nickel metal will be deposited onto charged electrodes as nickel cathode. The majority of the spent (acidic) nickel electrolyte solution will be recycled to the pre-leach and pressure leach. Oxygen and chlorine gas, produced as part of the nickel electrowinning reaction, will be collected and returned to the pre-leach.

### 2.11.2 Infrastructure Needed

#### 2.11.2.1 Power

Electrical power is available from Newfoundland Power at their existing substation at Freshwater. Power will be taken from the primary side of the transformer. The following items have been included in the preliminary design:

- A 3 km long, 69,000 volt power line on wooden poles from the Freshwater substation to the proposed plant substation.
- A 2,000 kVA substation complete with distribution panel, and a 69kV/550V transformer at the plant site.
- A 600 kVA diesel electric generator complete with fuel tank at the plant site for emergency power.

#### 2.11.2.2 Raw, Process, and Potable Water

It is anticipated that water will be supplied via the existing municipal water supply system to the Argentia Peninsula. The condition, capacity, and viability of obtaining the water required from this source will be evaluated. The additional water-related items that will be built are:

- Distribution systems for fire water, fresh water, and potable water
- Process water storage tank (approximately 4.2 m dia by 4.7 m high)
- Hot water tank complete with heating coil (approximately 2.3 m dia by 1.2 m high)
- Cooling Tower

#### 2.11.2.3 Steam

Process steam will be produced on site by a package boiler system.

#### 2.11.2.4 Telephones

A telephone switchboard and distribution system will be installed and connected to existing service lines.

#### 2.11.2.5 Sewage Treatment Plant

A packaged above-ground sewage treatment facility (Rotating Biological Contactor or RBC, Filter Bed, or Contact Aeration type treatment plant) to handle 120 people will be installed for the operations phase. [Note that the Initial Operations Phase is expected to employ 200 people but that no more than 120 people would be on site at the same time.] During construction, workers (125 persons average, 250 peak) will be accommodated through local facilities and by 'porta potties.' The treatment plant will discharge effluent in compliance with regulatory requirements to Argentia Harbour.

#### 2.11.2.6 Propane

A propane storage tank will be supplied, installed, and maintained by a certified fuel supply company as part of a fuel supply contract. A propane distribution system will be built as part of the demonstration plant facilities.

#### 2.11.2.7 Office-Housing Complex

An office-housing complex to accommodate up to 120 people will be built. The office complex will include offices, lunchroom, first aid treatment, and wash/change rooms. The complex will be made up of a portable trailer complex and has an area of approximately 800 square meters.

#### 2.11.2.8 Assay Laboratory

A portable trailer complex of 20m x 10m will be built to function as a sample preparation facility and assay laboratory.

#### 2.11.2.9 Warehouse

A building of approximately 40m x 20m will be built for on site equipment storage.

#### 2.11.2.10 Reagent Warehouse

A building of approximately 20m x 20m will be built to store chemicals and process consumables.

#### 2.11.2.11 Product Storage and Maintenance Shop

A building of approximately 30m x 20m will be built to serve as a product storage building and a maintenance shop.

#### 2.11.2.12 Electrical Room

A 20m x 13.5m electrical room will be included within the process building, adjacent to the electrowinning area.

#### 2.11.2.13 Control Room

A control room will be included within the process building, located above the electrical room.

### 2.11.3 Resources Required

The quantities of resources required have not been finalized, as the process is still being developed at the mini-pilot plant stage. Preliminary engineering estimates of resources required are shown in Table 2-2.

Table 2-2. Preliminary Engineering Estimates of Resources Required.

| Item | Preliminary Estimated Quantity |
|---|---|
| Electrical Power | 1,000 kW |
| Fresh Water | 20,000 $m^3$/year |
| Diesel Fuel | 200 $m^3$/year |
| Gasoline | 100 $m^3$ year |
| Aliphatic Hydrocarbon Fluid (e.g., kerosene) | 2 $m^{3/}$year |
| Solvent Extraction Organics[1] | 1 $m^3$/year |
| Limestone | 400 tonnes/year |
| Lime | 400 tonnes/year |
| Soda Ash | 70 tonnes/year |
| Sulphuric Acid | 800 tonnes/year |
| Hydrochloric Acid | 150 tonnes/year |
| Oxygen | 800 tonnes/year |
| Hydrogen Sulphide | 10 tonnes/year |

[1]Most likely LIX84-1® (hydroxyoxime based organic solvent), D2EHPA® (phosphorus based organic solvent), Cyanex 272® (phosphinic acid based organic solvent), and lesser amounts of Exxal 10® (iso decanol) and BHT (butylhydroxyl toluene, a commod food additive).

## 2.12 Waste Management

Solid waste (non-hazardous) will be trucked by certified waste haulers to approved landfill sites. VBNC will have a waste reduction and recycling program during all phases of the Project in order to minimize waste. Sewage will be managed by existing facilities and 'port a potties' during the Construction Phase and by a packaged sewage treatment system during operations. The treatment plant (RBC type or equivalent) will release an effluent in compliance with regulatory requirements to the harbour on the order of 24 $m^3$/d.

The quantities of wastes produced at the Facility have not been finalized, as the process is still being developed at the mini-pilot plant stage. However, the preliminary engineering estimates of waste streams and quantities are shown in Table 2-3.

Table 2-3. Preliminary Engineering Estimates of Waste Streams.

| Item | Preliminary Estimated Quantity |
|---|---|
| Leach Residue | 1800 tonnes/year |
| Gypsum | 1700 tonnes/year |
| Process Liquid Effluent | 20,000 $m^3$/year |
| Total Liquid Effluent (including site run-off) | 108,000 $m^3$/year |
| Autoclave Vent Gas (steam + $O_2$) | 700 $m^3$/hour |
| Chlorine Scrubber Vent Gas (air with trace $Cl_2$) | 1000 $m^3$/hour |
| Hydrogen Sulphide Scrubber Vent Gas (air with trace $H_2S$) | 1000 $m^3$/hour |
| Process Tanks Vent Gas (air and water vapour) | 1000 $m^3$/hour |

### 2.12.1 Waste Containment

#### 2.12.1.1 Residue Storage Ponds

Three residue storage ponds and associated piping will be constructed to accommodate three years of residue storage. They will be sized (on the order of 7,000 $m^3$ each) and operated to contain precipitation from at least a 1 in 25 year storm. Emergency spillways will direct any excess to the polishing ponds.

The residues include the leach residue (iron oxide and sulphur) and gypsum. The ponds will be constructed with a liner system with a leakage detection and collection system. This will contain the liquid and prevent any seepage. The residue storage ponds will be located on the Argentia Peninsula adjacent to the Facility and will outflow to polishing ponds (see below). The effluent between the residue and the polishing ponds will be monitored and the pH adjusted as required.

#### 2.12.1.2 Site Run-Off and Effluent

All process plant areas will be built inside covered buildings. Outside equipment such as storage tanks will be on concrete pads or curbed pavement. Site runoff will be directed to gravel lined ditches and will be directed into the polishing ponds. Effluent or polishing ponds of approximately 12,000 cubic meters and associated piping and pumps will be constructed to receive site run-off and effluent overflow from the residue ponds. The ponds will be constructed with a liner system with a leakage detection and collection system. This will contain the liquid and prevent any seepage.

The ponds will be located on the Argentia Peninsula adjacent to the residue ponds. The polishing ponds will discharge treated effluent, in compliance with regulatory requirements, into Argentia Harbour via a pipe (6" diameter or less) with a diffuser on the end.

### 2.12.2 Effluent Treatment

#### 2.12.2.1 Gas Treatment

Vent steam from the pressure leach autoclave will be scrubbed in a commercial vent scrubber prior to release. Gases (mostly water vapour and $CO_2$) from the process tanks will be collected and vented through a common process scrubber. All tanks and equipment that handle chlorine gas will be vented through a separate vacuum and process scrubber system. Similarly, all tanks and equipment that handle hydrogen sulphide gas will be vented through a separate vacuum and process scrubber system. All gases will be treated to remove entrained particulates and noxious gases to below regulatory limits.

#### 2.12.2.2 Solids and Liquid Effluent Treatment

The various waste streams from the demonstration plant will be directed to the final neutralization circuit. In the final neutralization circuit the residue slurry will be treated in stirred reactors by pH adjustment and oxidation, if required, to neutralize the solutions, precipitate the trace metals, and stabilize the solids prior to discharge to the tailings pond.

### 2.12.3 Potential Accidental Releases

The Facility will store various compressed gases for instrumentation and welding uses. Propane may be stored for heating and for the package boiler fuel supply. Additionally, a small quantity of compressed chlorine gas and hydrogen sulphide gases will be stored for process make-up.

The pressure leach autoclave will be designed with an emergency vent line that may vent on autoclave over-pressure or other autoclave emergencies. The autoclave vent will be directed through a process scrubber that will remove any entrained solids and liquid to comply with regulatory requirements and allow the steam to vent freely. The autoclave size will be about 5000 liters at a pressure of about 150 psig.

## 2.13 Project Location

The Project will be located on Argentia Peninsula (see Figures 1-1 and 2-4) at the following approximate geographic coordinates:

47º 18' 15.8" N
53º 59' 30.7" W

The precise location of the Facility at North Side of the former US Navy base at Argentia, Newfoundland and Labrador, may change based on information collected both during the process design and during the definition of the Argentia site environmental baseline and specific location issues. Small location changes for the Facility would not affect the outcome of this EA. A Project conceptual layout is shown in Figures 2-1 and 2-4.

## 2.14 Environmental Features

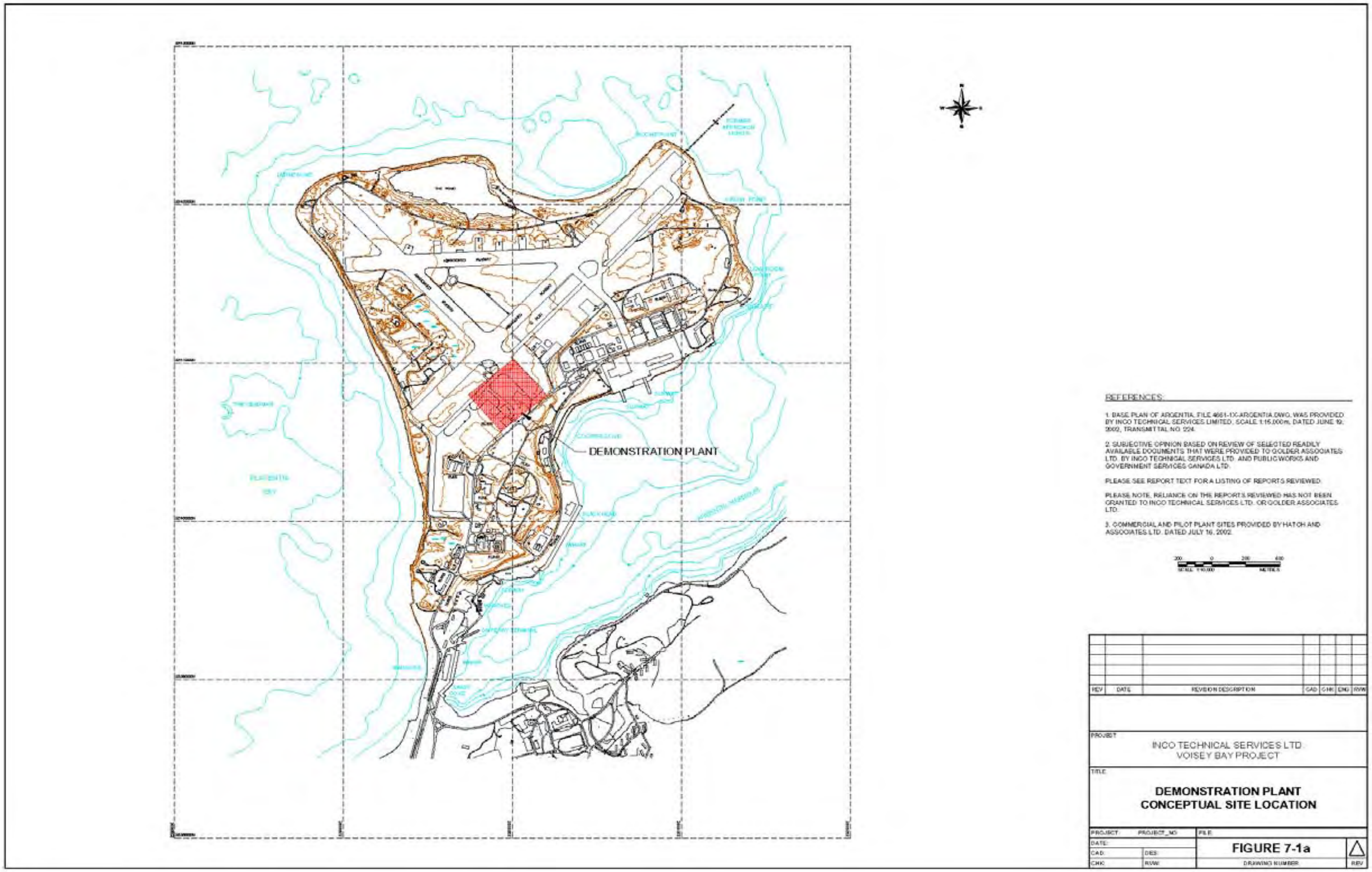
The Project will not interact with freshwater fish habitat or any special or unique areas. There will be small batch discharges through a six inch pipe (or smaller), equipped with a diffuser, into the marine environment of Argentia Harbour of treated process effluent (perhaps ranging up to 65 to 130 $m^3$/day during campaigns) after sampling. This discharge will satisfy applicable federal or provincial regulatory requirements for effluents.

The sewage treatment plant (RBC type or equivalent) will also discharge to the marine environment subject to regulatory approval. The estimated treated water discharge of a 120 person facility is about 24 $m^3$ per day.

The construction activities will disturb the local soil and vegetation on-site but this is not determined to be an environmental effect because the area is a "brownfield" site and intended for industrial use. Contaminated soil has been an issue at some sites at Argentia due to past activities. The former base has undergone considerable testing and remediation by Public Works and Government Services Canada (PWGSC). VBNC has chosen the location for the Facility based on existing information that indicates that there should be no undue effects on the environment or human health from a construction project on this site. Nonetheless, VBNC will ensure that the soil will be tested and monitored during construction.

There will be virtually no air emissions from the Hydrometallurgical Demonstration Facility and air quality will not be an issue.

Figure 2-4. Location of Demonstration Plant on the Argentia Peninsula.



The final engineering design for these emissions and effluents will be done in collaboration with government regulators and will satisfy all requirements.

## 2.15 Land Use

The Argentia Peninsula where the Project will be located is a "brownfield" site. As noted above, the Argentia Management Authority was incorporated in 1994 to acquire title to the former lands used by the United States and to promote economic activity on the site. Remediation of the site by PWGSC began in earnest in 1997.

There are a variety of industries currently present on both the North and South Sides of the Argentia Harbour, including the Marine Atlantic Ferry, Argentia Freezers (EIMSKIP), Collin's Contracting, Municipal Recyclers and Epoch Rock. These operations and others currently employ about 180 persons on the Peninsula.

A wide range of tourism, cultural and commercial and other business and personal services are available within the immediate area. Key cultural and tourism facilities include Castle Hill National Historic Park, the O'Reilly House Museum, and active archaeological digs in Placentia itself. In addition, there is the Heritage Trail, a significant component of which lies within the Argentia Backlands. It is immediately accessible to people using Argentia for business or pleasure.

Other major sites and features of importance are the St. Mary's Bird Sanctuary – 50 kilometres away, while 25 kilometres in the opposite direction lies Ship Harbour, the site of the signing of the Atlantic Charter in 1941.

An international airport, major cultural facilities, international hotels, and shopping and central government services are available in St. John's, 130 kilometres away.

There are no known historic resources issues associated with the Project Area.

## 2.16 Navigable Waters

The Project will have little interaction with navigable waters. During the course of the Project there will be approximately six trips by ship into the wharf in Argentia to unload small quantities of concentrate. The concentrate will be packaged in containers and the total amount transported is estimated to be 110 containers annually.

## 2.17 Effects of the Environment on the Project

The Project infrastructure and activities, which are primarily land-based, should not be unduly affected by the physical environment. As with all human activity on land in Newfoundland and Labrador, the Project can be affected by fog, wind, rain, snow and ice. Marine activities associated with the Project are extremely limited and located in the harbour. As such, extreme weather and/or wave events will not affect those aspects of the Project. Brief synopses of the physical features of the Argentia environment are provided in the following sections.

The residue storage ponds will be designed to avoid overflow from extreme events (1 in 25-year flood).

# 3.0 Existing Social Environment

The following section describes the existing socio-economic environment in the vicinity of the proposed Facility. Data collection and analysis was undertaken at three geographic scales (Figure 3-1):

1. the Argentia Region - Placentia, Colinet, Fox Harbour, Ship Harbour, Long Harbour, and Whitbourne - which are within a 45 kilometre radius from the Project at Argentia,
2. the Avalon Peninsula, and
3. the Province of Newfoundland and Labrador.

The focus of analysis is on the Argentia Region, in particular the community of Placentia.

Telephone and face-to-face meetings and interviews were conducted with persons representing groups and towns in the Argentia Region, departments in the Government of Newfoundland and Labrador, regional economic development boards, the school board and one private company.

The Project has the potential to impact the socio-economic environment through employment, the purchase of goods and services and as a source of revenue for the three levels of government. Given these facts, the following key socio-economic system components (socio-economic VECs) have been selected for description:

- economy and business;
- employment and income levels;
- infrastructure and services.

Demographic characteristics are not considered a VEC but changes in these characteristics may affect the VECs. The following tables illustrate the differences and similarities of the three impact areas, and lead into a consideration of the VECs (Table 3-1).

The population of the Province has been declining since 1991. Between 1996 and 2001 it dropped 7%. Most of this decline has been attributable to out-migration as people leave in search of employment opportunities elsewhere. However, declining birthrates have also played a role in this decline and are reflected in fewer school age children.

Figure 3-1. Hydrometallurgical Demonstration Facility, Socio-economic Impact Areas.

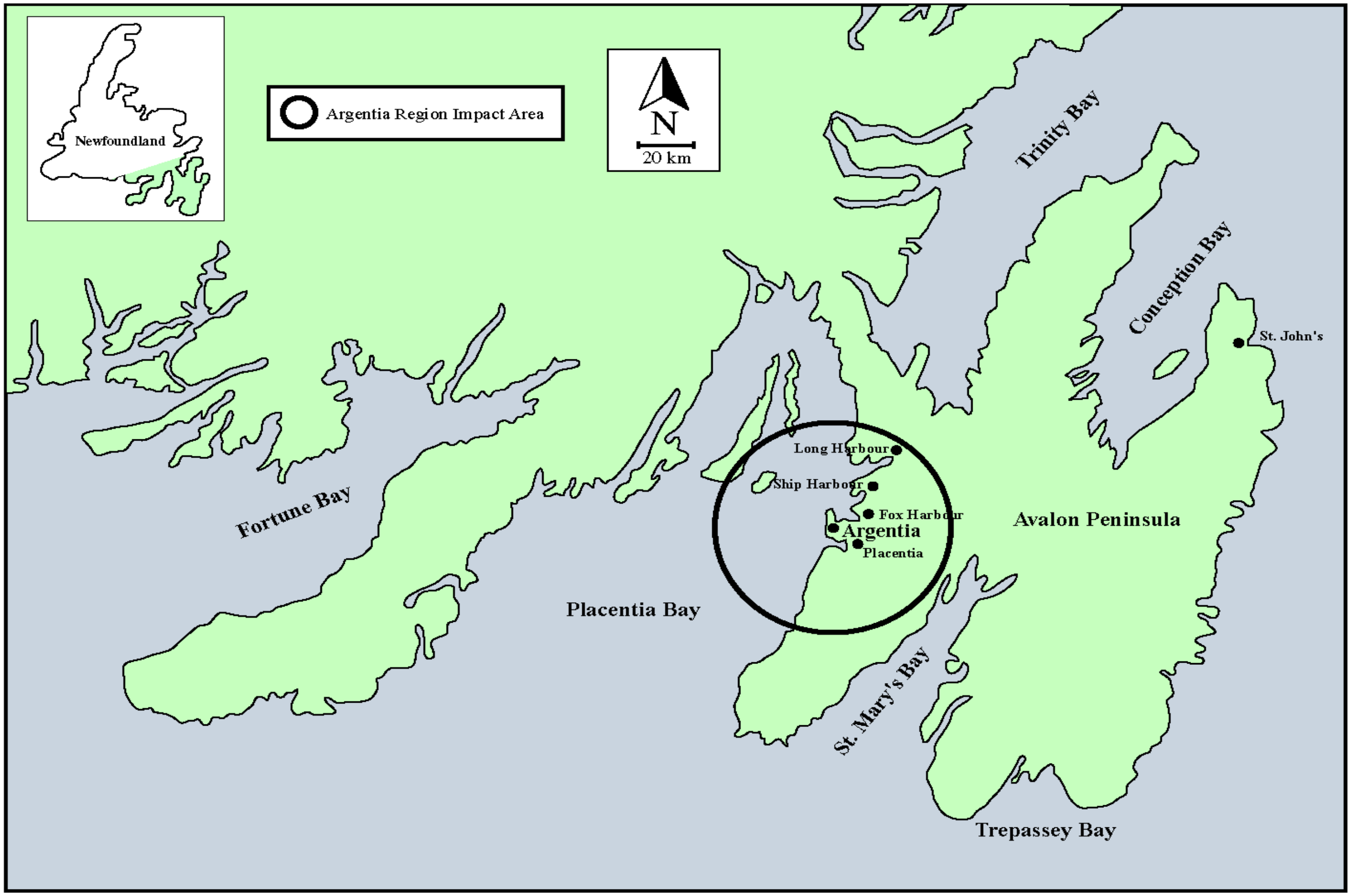


Table 3-1. Population by Community and Region: Argentia Impact Area, Avalon Region and Newfoundland and Labrador, 1996 and 2001.

| Community/ Region | 1996 | 2001 | % Change |
|---|---|---|---|
| Town of Placentia | 5013 | 4426 | -11.7 |
| Fox Harbour | 394 | 344 | -12.7 |
| CCSD 1B SUN | 493 | 450 | -8.7 |
| Colinet | 208 | 168 | -19.2 |
| CCSD 1X SUN | 526 | 510 | -2.9 |
| Whitbourne | 988 | 930 | -5.9 |
| CCSD 1Y SUN | 1154 | 1062 | -8.0 |
| Long Harbour- Mt. Arlington Heights | 472 | 362 | -23.3 |
| **Total Argentia Impact Area** | 9,248 | 8,252 | -10.7 |
| **Avalon Region** | 251,523 | 242,875 | -3.4 |
| **Newfoundland and Labrador** | 551,792 | 512930 | -7.0 |

Source: Statistics Canada, Census of Population, 1996, 2001
CCSD refers to Statistics Canada definition of a Consolidated Census Subdivision.
1B (Dunville area), 1X (Colinet area), 1Y (Whitbourne area)

Due to its more diversified economy, the Avalon Peninsula has been buffered from some of this population decline and in comparison lost only 3.4% of its population during the 1996-2001 period.

The lack of employment opportunities in the Argentia Region is reflected in the population trends there; the region lost 10.7% of its population between 1996 and 2001, while some communities, for example Long Harbour-Mt. Arlington Heights, lost 23.3% (Table 3-2).

Table 3-2. Population Change, Argentia Impact Area, 1971-2001.

| Year | Population | Population Change (%) |
|---|---|---|
| 1971 | 11,573 | - |
| 1976 | 11,609 | 0.3 |
| 1981 | 11,033 | -5.2 |
| 1986 | 10,727 | -2.9 |
| 1991 | 10,005 | -7.2 |
| 1996 | 9,248 | -7.6 |
| 2001 | 8,252 | -10.7 |

Source: Statistics Canada, 1972;1977;1982;1987;1992,1997;2002.

The provincial population is expected to continue to decrease due to continued out migration and a decrease in the birthrate. The Government of Newfoundland and Labrador's own projections, from the Department of Finance, Economics and Statistics Branch, show the 2002 population of 518,743 dropping by 2.3% to 506,972 by 2008. The same trends are apparent in the Avalon and Argentia Regions with the former having a lower rate of decrease than the Province and the latter having a higher rate. A projection completed for Avalon Gateway, Economic Zone 18 shows a 10% decrease in population from 8,785 in 2002 to 7,921 in 2008.

## 3.1 Economy and Business

The following section describes the baseline economic conditions of the three study areas.

At the Provincial level, primary resource production still forms the backbone of the economy with manufacturing only accounting for 7.8% of GDP (2001). Federal transfer payments make up 42% of provincial revenues. However, other sectors of the economy are growing in importance. Tourism grew for the fifth consecutive year in 2001; since 1998 the number of visitors has increased by 12% and associated expenditures by 22%. (Gov. Nfld. and Labrador, Economic Research and Analysis, 2002). The service sector has been boosted by the opening of new customer contact centres which combined created almost 800 new jobs in 2001. Retail sales grew by 8.5% in 2001 while housing starts were up by 22.5%.

The Avalon Peninsula has a more diversified economy than other regions of the Province as the greater St. John’s area is home to the headquarters of the provincial government, Memorial University, and many private sector businesses and other services on the Island. It has benefited significantly from offshore oil and gas development, from work at the St. John’s Dockyard and from increased tourist spending related to the new convention centre and its role as a port of call for cruise ships. As an example, cruise ship visits to the port have risen dramatically from three in the mid-nineties to 17 in 2001.

Argentia and Long Harbour-Arlington form part of a heavy industrial oriented group of Placentia Bay communities that extend from Argentia up around Arnold's Cove/Whiffen Head (natural gas) and Come By Chance (oil refining) and reaching to Marystown where the shipyard has been selected as a fabrication site for the White Rose project. Notwithstanding the initiatives of the Argentia Management Authority and other groups, there has been little new business since the loss of at least 1000 jobs in the 1990's due to the closures of the ERCO plant at Long Harbour, the Jerseyside fish plant, and the US Naval Base. However, the Argentia Management Authority has recently been successful in attracting several businesses to its fully serviced industrial park. Currently, nine out of 41 sites are occupied, and altogether about 180 persons are employed on the Argentia Peninsula, ranging in type from the Gulf Ferry Service to Epoch Stone, a granite finishing operation.

The provincial economy is expected to grow slowly with the construction and start of operations at the VBNC mine at Voisey's Bay, Labrador, a continued increase in tourism with the completion of the Trans-Labrador Highway to Cartwright and a third oil field, White Rose, coming into production.

It is expected that the Avalon Region will continue to weather any economic downturns better than some other parts of the Province due to the diversified employment base in the capital city. In addition, a recent announcement of funding from three levels of government for the St. John's harbour clean-up, is expected to boost the local economy. It is expected that this Project itself will be responsible for some $90 million being pumped into the local economy during its first four years.

In the Argentia Region, the economy is likely to continue in a relatively depressed state for the foreseeable future, although a new call centre slated for the region could provide employment for up to 300 people. The Argentia Management Authority will also continue to seek and attract new businesses to the area.

## 3.2 Employment and Income

Since 1997 the provincial unemployment rate has dropped from 18.6% to 15.3% while the size of the labour force has grown to 251,900, surpassing the previous record set in the early 1990's. Labour participation rates rose during this period from 52.5% to 57.3% (Table 3-3).

Table 3-3. Labour Force Characteristics, Newfoundland and Labrador, Annual Averages 1997-2001.

| Characteristics | Unit | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|
| **Population 15+** | (000,s) | 442.6 | 439.4 | 438.4 | 439.9 | 439.4 |
| **Labour Force** | (000's) | 232.5 | 237.0 | 246.7 | 245.6 | 251.9 |
| **Employment** | (000's) | 189.3 | 194.2 | 204.9 | 204.6 | 211.3 |
| **Unemployment** | (000's) | 43.2 | 42.7 | 41.7 | 41.0 | 40.6 |
| **Unemployment Rate** | (%) | 18.6 | 18.0 | 16.9 | 16.7 | 16.1 |
| **Participation Rate** | (%) | 52.5 | 53.9 | 56.3 | 55.8 | 57.3 |
| **Employment Rate** | (%) | 42.8 | 44.2 | 46.7 | 46.5 | 48.1 |

Source: Statistics Canada, Labour Force Survey, January 2002.

The Avalon Region has the highest concentration of people in the Province. According to the Newfoundland Statistics Agency, Labour Force Survey, 2002, the unemployment rate is 13%, lower than that for the Province. Employment levels in the St. John's area and the Avalon Peninsula set new highs in 2001.

There is no recent data available for the Argentia Region but in 1996(Statistics Canada data) the unemployment rate stood at 31%.

The Labour Market Survey done by Newfoundland Statistics Agency in 1999 for the Province's Economic Zones shows an unemployment rate of 22.2% for Zone 18, Avalon Gateway which most closely approximates the Argentia Region. This high unemployment rate is accompanied by lower than average income levels for persons in the region. While the average income for those aged 15 and over in the Province in 1996 was $19,695, for those reporting income in the Argentia Region it was 15% lower at $16,695. Differentials between males and females are marked with the latter having lower average incomes (Table 3-4).

Table 3-4. The 1996 Average Total Income.

| Community | Total | Male | Female |
|---|---|---|---|
| Long Harbour/Mt. Arlington Heights | $18,105 | $21,371 | $13,865 |
| Whitbourne | $19,785 | $23,023 | $16,207 |
| Division 1 Subd.Y | $13,626 | $17,412 | $9,768 |
| Fox Harbour | $14,957 | $20,214 | $9,607 |
| Colinet | n.a. | n.a. | n.a. |
| Division 1, Subd. X | $18,421 | $21,055 | $14,497 |
| Division 1, Subd. B | $15,903 | $20,595 | $10,140 |
| Placentia | $15,925 | $20,136 | $11,579 |
| **Argentia Region (Average)** | **$16,675** | **$20,544** | **$12,238** |
| **Newfoundland and Labrador** | **$19,710** | **$24,602** | **$14,529** |

Source: Statistics Canada, 1996 Census. Data is for persons over 15 years reporting income.

The provincial unemployment rate is expected to continue to fall as developments mentioned above generate additional employment opportunities. The Avalon Region will continue to have a lower unemployment rate than the Province due to its more diversified economic base, while the Argentia Region will continue to have higher rates than the provincial average. The continuing relatively high unemployment rate will mean that average incomes in the Argentia Region will remain below the provincial average.

## 3.3 Public, Commercial and Industrial Infrastructure and Services

Baseline data for this section is presented for the Argentia Region only since this is the principal area where any Project impacts will be experienced.

## 3.4 Education and Training

The decline in population has been reflected in school enrolments. Since 1997, two schools have closed in the Argentia Region - St. Francis Xavier in Long Harbour and Whitbourne High School. There are now four schools remaining in the region - St. Anne's Academy, St. Edwards, Laval High and Whitbourne Elementary. Since 1998 total enrolment at these schools has dropped by 220.

Enrolments are expected to continue to decline for the foreseeable future. Space in the system is not an issue, instead it is quality of accommodation. There are proposals to build a new high school to replace Laval which is physically deteriorating.

The Placentia campus of the College of the North Atlantic specializes in heavy industrial and mechanical trades. It has the capability throughout its system of responding quickly to changing industrial demands, including those arising from the Project.

## 3.5 Health Services

Health services are provided at the Placentia Health Centre, a small hospital, and major medical services are provided in St. John's.

## 3.6 Public Safety

The RCMP has 15 detachment personnel in Placentia and Whitbourne. There is a volunteer fire department with stations in Dunville, Freshwater, and Placentia.

## 3.7 Municipal Infrastructure

All major areas of Placentia are provided with municipal water and sewer. The farther reaches of South East Placentia are still on private systems.

Major new development in Dunville is constrained by the need to eliminate the nine sewer outfalls into the North East Arm and to either treat the sewage, or pump it to Jerseyside where the effluent can be dispersed into Placentia Bay.

The Argentia Management Authority has a fully operational industrial park in place, with nine out of 41 sites currently occupied. In addition, Long Harbour has land available in a major industrial park.

In Placentia, roughly seventy single dwelling building lots in conventional residential subdivisions can be quickly put on the market. Subject to the resolution of the sewage disposal issue, another 120 dwelling lots could be generated under a proposal in Dunville. Thorne's Trailer Court in Dunville has approximately 15 vacant mobile home lots.  Whitbourne has potential for 60 more building lots.

## 3.8 Solid Waste Management

The solid waste of Placentia and surrounding communities is disposed of at the Villa Marie Landfill on the Fox Harbour Road. In the Argentia Region, as well as throughout the Province, systems of solid waste are being reviewed under the Province's Solid Waste Management Strategy.

# 4.0 Existing Physical Environment

## 4.1 Geology and Topography

The surficial geology and landform classifications of the Argentia area compiled by the Newfoundland and Labrador Department of Mines and Energy (NLDME) (Map 92-11, 1992), shows the landform classification for the Argentia Peninsula as they appear on Map 92-11. The Argentia Peninsula can be classified with the generic category, Marine (M) and the morphology, terrace (t).

The genetic category (Marine) has the following material characteristics: clay, silt, gravel and diamicton. Sand is present in some places and is generally moderately to well sorted and commonly stratified, but may be massive. The areas occur as beach ridges, deltas, terraces and bars deposited in a marine environment. Gravel and sand are deposited by shoreline wave action and may also include shells, clay and silt which is deposited from suspension and turbidity currents. The gravel is generally a wave-washed lag (NLDME 1992).

The morphology terrace is defined as a long, narrow, level or gently inclined step-like surface, bounded along one edge by a steeper descending slope or scarp and along the other by a steeper ascending slope or scarp. Materials are either till, glaciofluvial, alluvial or lacustrine sediments which are generally formed by fluvial and glaciofluvial erosion and marine wave action (NLDME 1992).

The bedrock geology of Newfoundland (Coleman-Sadd et al. 1990) is mapped as Late Proterozoic in age, and consists of shallow marine siliclastic sedimentary rocks, including minor unseparated limestone and bimodal volcanic rocks. The Argentia area bedrock is further mapped as part of the Gilbert Hill Formation, made up of thick-bedded light gray sandstone with thin-bedded green gray sandstone, siltstone and tuff. Underlying this formation is the Bull Arm Formation of volcanic basaltic or felsic flows and pyroclastics (Gale et al. 1984).

A well monitoring program conducted on the Argentia Peninsula for the Argentia Northside Environmental Site Assessment (ARG 1995) did not encounter bedrock during the drilling phase which penetrated the surface materials to depths up to 11 metres below ground surface. Subsequent deeper drilling to elevations of up to 25 metres below sea level have not encountered bedrock at the Argentia Peninsula (NGL 1997a ).

The peninsula consists of broad, undulating landforms with the highest elevation approximately 24 metres above sea level (masl). The majority of the land area on the Peninsula has been previously disturbed with the construction of the US Naval Air Station facilities.

## 4.2 Climate

The Atlantic Provinces have a climate that is heavily influenced by the ocean and predominating westerly winds resulting in relatively cool springs and summers and relatively mild winters (Environment Canada 1994). The principal factors which determine the climate of Newfoundland are:

- Its location with respect to major features of the atmospheric circulation system. In this respect the whole Province lies within the zone of prevailing westerly winds which dominate the northern hemisphere mid latitudes. This zone is characterized on the whole by considerable seasonality and short-term variability of weather patterns.

- The geographical situation of the Province with respect to the Canadian mainland, resulting in distinct onshore and offshore airflow characteristics.

- The proximity to an extensive body of cold ocean water, including the Labrador Current System, has a direct bearing upon climate and weather. The distinctly warmer Gulf Stream-North Atlantic Drift System, encountered some 600-700 km to the southeast, also influences the properties of air arriving from the south and east.

- At a more local scale the finer details of climate and weather often result from the influence of topographic features in the area such as prominent uplands or mountain ranges and sheltered valleys and lowlands (Banfield 1993).

These factors make the climate of the region distinct from that of mainland North America and give the region a modified continental climate. The Argentia site is in an area that is quite flat in contrast to the characteristically rugged Newfoundland coastline and is surrounded by the waters of Placentia Bay, Placentia Sound and the Argentia Harbour. The open waters of the Atlantic Ocean lie only 60 km to the south-southeast and 100 km to the east (Environment Canada 1985). The site is in the zone where the ocean and its currents have the greatest impact on a modified continental climate. The result is more changeable weather systems, ample precipitation in a variety of forms, higher humidity, more cloud cover and fog, and stronger winds than would be found in a continental climate (Environment Canada 1990). Extremes are moderated by the ocean, resulting in mild winters and cool summers.

The geographical location of the site with respect to the rest of North America means that many of the storms that cross the continent during the year from west to east, or that develop and intensify off the East Coast of the United States, pass by as they move out to the North Atlantic. At all times of the year Newfoundland is near one of the principal storm tracks. The severity and frequency of storms is greatest between November and March, although they may occur at any time of the year. Winter cyclones, fast-moving storms up to 80 km/h, with winds that often mount to gale and sometimes hurricane force, usually occur from three to four times each winter.

Throughout the year mature cyclones may stall in the region for a week or more and result in cool, cloudy, and rainy weather. The weather is typically less stormy during the summer and early fall. However, tropical storms spawned near the equator may bring windy, wet weather while they pass the island on their way to the North Atlantic. Over the past 35 years, an average of one tropical storm per year passed within 300 km of Newfoundland (Environment Canada 1990).

Newfoundland as a whole has the strongest winds of all the Canadian provinces. Generally, coastal areas have stronger winds than inland locations. The average annual wind speed for Argentia is recorded at 21.7 km/h with the prevailing direction being south-southwest. The maximum recorded wind speed in a gust is 129 km/h blowing from the southwest.

The temperature range (the difference between the average temperatures of the warmest and coldest months) for Newfoundland is 20°C with Argentia having a temperature range of 22.6°C. This is based on an average temperature of 17.7°C for August (the warmest month) and an average temperature of -4.9°C for February (the coldest month). The mean annual temperature for Argentia is 5.8°C.

The frost free period for Newfoundland is longest for areas of the southern coasts extending to the eastern shores of Placentia Bay. Historically, the earliest last spring frost day has been March 25 and the latest last spring frost day has been June 10. The earliest first fall frost day has been October 21 and the latest first fall frost day has been December 7 (Environment Canada 1990). The yearly precipitation total for Argentia is 1,359 mm including an average annual snowfall of 163 cm. Although precipitation is well distributed throughout the year it has been heaviest in the fall and winter. The wettest month has been September with a total precipitation of 139.3 mm, which includes no measurable snowfall. The extreme snowfall for a month in a 24 hour period is 82.0 cm, which occurred in the month of January (Atmospheric Environment Branch 1997). Each year there is an average of 164 days with measurable precipitation, i.e. 45% of the year.

The Argentia area is prone to prolonged periods of freezing precipitation that last for several hours or intermittently over a period of days. Freezing rain or drizzle occurs an average of 150 hours each winter, with March being the worst month (Environment Canada 1985).

The meeting of the Labrador Current with the warm humid air from the south produces fog that is prevalent in the Argentia area. Argentia has on average 206 days of fog a year with the low monthly average of 12 days occurring in February and December and a high of 25 days in July. These fogs are often accompanied by strong winds. Normally, the fog would be dispersed by the winds but the fog is so dense and widespread in the area that the winds have very little clearing effect (Environment Canada 1990).

## 4.3 Vegetation

The Argentia Peninsula consists primarily of large exposed areas, often lacking in vegetative cover and reflecting high levels of disturbance. Because of the previous military development, a large part of the peninsula is asphalt or concrete covered with the remaining area principally gravel or grass covered (JWEL 1996). Vegetation is patchy and consists predominately of stunted spruce ("tuckamore") mixed with shrubs and grasses. There are no forested areas on the Peninsula.

The region surrounding the Argentia Peninsula lies within the Southeastern Barrens subregion of the Maritime Barrens Ecoregion (Damman 1983). This ecoregion is characterized by extensive barren areas consisting of dwarf shrub heaths, bogs and shallow fens. Damman (1983) states that a peculiar characteristic of the ecoregion is the overlap of southern (Coastal Plain) species and Arctic species; the former are usually found in bogs and valleys, whereas the latter are restricted to exposed sites without snow cover during most of the winter.

Balsam fir *(Abies balsamea)* and black spruce *(Picea mariana)* dominate the forested sections of the surrounding region with eastern larch *(Larix laricina)* scattered throughout (Thompson et al. 1979). A scrub forest of less than 5m height of these three species covers approximately a third of the region. Ground vegetation is characterized by heath shrubs such as *Kalmia angustifloria, Rhododendron canadense* and *Vaccinium angustifloria*, with *Empetrum nigrum* and *Vaccinium vitis-idaea* on the rocky bluffs along the shoreline and exposed areas.

Lichens occur in several different habitats in the region adjacent to the Argentia Peninsula. In particular, epiphytic lichens are associated with undisturbed balsam fur stands (60+ years). The lichen species in these stands include predominant species *Usnea* spp, *Alectoria* spp, H*ypogymnia physodes, Lobaria pulmonaria,* and *Parmelia* spp. Other species present include *Erioderma pedicellatum, Coccocarpia palmicola, Lobaria scrobiculata* and *Pannaria ahlneri. Erioderma pedicellatum* is considered rare with the largest stands in the world occurring in the Avalon Forest ecosystem. It has been reported from stands in the southeast section of the region (E. Conway pers. comm., 1997) and near Rattling Brook Big Pond. Other lichens occur in the coastal *Empetrum* heaths and inland on the ground in the *Kalmia* heaths.

## 4.4 Freshwater Resources

The Argentia Peninsula has one water body, The Pond. The Pond is approximately 800 m long, 300 m wide, and 10 m deep with a surface area of approximately 15 hectares. It is elongated in the east-west direction. The water in The Pond is brackish and probably has seawater intrusion from Placentia Bay through the gravel ridge between the pond and the ocean, and by waves and spray overtopping the gravel divider during severe storms or high tide events (ARG 1995 ).

There appear to be few, if any, marine or freshwater fish species present in this water body, as indicated by lack of success during sampling efforts. Aquatic plants and freshwater invertebrates typical of freshwater ponds in the area are not present in The Pond (JWEL 1996).

There are several ponds in the area just south of the isthmus and a number of rivers and ponds in the region surrounding the peninsula. Most notable are the Northeast River and the Southeast River which drain into Northeast Arm and Southeast Arm, respectively, and Placentia Bay at the town of Placentia. Both of these rivers are scheduled salmon rivers. It has been estimated that these two scheduled rivers account for less than 1% of the annual salmon catch in Newfoundland (ADC 1983).

Apart from an annual run of Atlantic salmon *(Salmo salar)*, other common species in these streams are brook trout *(Salvelinus fontinalis)*, brown trout *(Salmo trutta Linnaeus)* and American eel *(Anguilla rostrata)*.

## 4.5 Birds and Wildlife

### 4.5.1 Birds and Mammals

Numerous species of birds and mammals inhabit the Argentia Peninsula and surrounding waters. In summer, gannet-alcid-gull nesting and shearwater foraging communities characterize the inshore zone of Placentia Bay, and in winter, a significant waterfowl population occurs in the nearshore waters. Most marine mammals, including baleen and toothed whales that occur in Placentia Bay are seasonal visitors that forage upon species like capelin during the summer. Few terrestrial mammals are found on the Argentia Peninsula near the location of the Facility.

#### 4.5.1.1 Terrestrial Mammals

Moose (*Alces alces*) were introduced to Newfoundland in the early 1900s and have since occupied most of the island. Although there is a moose population in the Argentia area off the Peninsula, they do not tend to occur on the Argentia Peninsula. The peninsula does not provide optimal habitat to moose, since it provides little or no food and cover because of the lack of vegetation. Their preferred habitat is coniferous forest, especially near swamps and lakes in areas of secondary growth (Northcott 1974).

There are very few furbearing species that inhabit the Argentia Peninsula because of the lack of cover and protection and previous industrial use of the peninsula. The species that might be found on the Argentia Peninsula are small rodents like rats and mice (ADC 1983), and recent evidence suggests that voles may be abundant (B. Mactavish, LGL Ltd., pers. comm.). In the areas adjacent to the Peninsula there are Meadow Voles *(Microtus pennsylvanicus)*, Snowshoe Hares *(Lepus americanus)*, mink *(Mustela vison),* foxes *(Vulpes vulpes)* and masked shrews (*Sorex cinereus)*. Otter *(Lutra canadensis)* and muskrat *(Ondatra zibethicus)* may also frequent the Regional Study Area (ARG 1995).

#### 4.5.1.2 Marine Mammals

Thirteen species of marine mammals are known to occur in the Regional Study Area, including ten species of whales and three species of seals. Several additional species may occur, but because of their rarity in the area are not considered in this document. Although most species are seasonal inhabitants, the waters of Placentia Bay and surrounding areas are important feeding grounds for some. There are no known resident populations of marine mammals in Placentia Bay.

**Mysticetes (Baleen Whales)**

Five species of baleen whales or mysticetes occur in the Regional Study Area: humpback (*Megaptera novaeangliae*), blue (*Balaenoptera musculus*), fin (*B. physalus*), sei (*B. borealis*), and minke whales (*B. acutorostrata*). Based on surveys conducted in 1993 and 1994, it appears that humpback, minke, and fin whales occur regularly in Placentia Bay and that sei and blue whales occur less frequently (Marques 1996). Humpback and fin whales are listed as special concern and the blue whale is listed as endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2002).

Each summer, whales arrive in Placentia Bay in May or June and the more abundant species remain until September or October. They feed primarily on capelin, but also feed on krill, squid, herring, and sand lance. The whales follow the migration of capelin and are common around inshore Newfoundland during the summer. The arrival of capelin to the head of Placentia Bay generally occurs in June and July and it is likely that baleen whales would be most abundant during these months. Most whales have moved offshore and have begun to migrate south by late October (Lien 1985).

**Odontocetes (Toothed Whales)**

Five species of odontocetes or toothed whales have been regularly sighted in the Regional Study Area: harbour porpoise (*Phocoena phocoena*), long-finned pilot whale (*Globicephala melaena*), Atlantic white-sided dolphin (*Lagenorhynchus acutus*), white-beaked dolphin (*Lagenorhynchus albirostris*), and striped dolphin (*Stenella coeruleoalba*). It appears that harbour porpoises, Atlantic white-sided dolphins, and white-beaked dolphins are sighted more regularly in Placentia Bay than pilot whales and striped dolphins. The harbour porpoise is listed as threatened and the remaining odontocetes in Placentia Bay have been categorized by COSEWIC as 'not at risk' (COSEWIC 2002).

Most odontocetes occur seasonally in the Regional Study Area and little is known regarding their distribution and population size in Placentia Bay. Some species may remain in waters of southern Newfoundland throughout the autumn and winter, but the seasonal movement patterns of most species are unknown. Most toothed whales that occur in Placentia Bay are known to eat squid, fish (capelin, cod, sand lance, herring, mackeral), and/or amphipods. It is likely that the distribution patterns of most odontocetes are related to the occurrence of their prey.

**Phocids (Seals)**

Three species of seals are known to occur near the Regional Study Area: harbour (*Phoca vitulina*), grey (*Halichoerus grypus*) and harp seals (*Phoca groenlandica*). Little is known about their distribution and abundance within Placentia Bay. Harbour seals are year-round residents along the south coast of Newfoundland. In 1973, approximately 930 harbour seals were estimated to be present in coastal areas in St. Mary's and Placentia Bay (Boulva and McLaren 1979). Small numbers of harbour seals are known to breed on the Island of Miquelon, just south of Placentia Bay (Renouf et al. 1983). In general, harbour seals have a varied diet, including pelagic and demersal fish as well as cephalopods and crustaceans (see, for example, Boulva and McLaren 1979; Bowen and Harrison 1996).

Grey seals that may occur in the Regional Study Area are migrants from the Sable Island and Gulf of St. Lawrence breeding populations. The number of grey seals that migrates into the Regional Study Area is unknown, but is believed low. This species may occur in the Regional Study Area year-round, but most commonly in July and August (Stenson 1994). The food of grey seals in the western North Atlantic includes at least 40 species, some of which are commercially important (for example, Atlantic cod, herring, and capelin) (Benoit and Bowen 1990; Hammill et al. 1995).

Harp seals in Placentia Bay are migrants from the Gulf of St. Lawrence and the "Front" breeding populations. The number of harp seals that migrates into the Regional Study Area is unknown, but numbers may be increasing as the range of this species appears to be expanding southward (McAlpine et al. 1999; Lucas and Daoust 2002). Harp seals would likely be most common in autumn and winter as individuals summer in the Arctic. Harp seals eat a variety of prey; on the Grand Banks, capelin predominate, followed by sand lance, Greenland halibut and other pleuronectids (Wallace and Lawson 1997; Lawson et al. 1998).

**Otters**

Another important mammal in the Placentia Bay area, although strictly speaking not a marine mammal, is the northern river otter (*Lutra canadensis*), which is a year-round resident. River otters in Placentia Bay are unusual because they spend a great deal of time in marine environments (Petro-Canada 1980). Placentia Bay supports one of Newfoundland's largest river otter populations, with the greatest numbers occurring on the small islands west of Merasheen Island and in northern Placentia Bay (Chevron et. al. 1996). These otters inhabit local bays throughout the year and move inland during March and April to give birth to their young (Chevron et. al. 1996).

#### 4.5.1.3 Birds

Placentia Bay provides important habitat for many species of birds, including important breeding sites. The following paragraphs provide brief overviews of the species of birds that occur in the Regional Study Area. There are few site-specific data on birds near the Project Area. Table 4-1 provides a list of the species known or expected to occur in Argentia Harbour, the time periods when the birds occur in the area, and their foraging habits.

**Breeding Seabirds**

Major seabird colonies are located near the mouth of Placentia Bay and smaller colonies are located along the inner islands and coastlines of the bay. The most significant breeding habitat is at Cape St. Mary's Seabird Ecological Reserve (also classified as an Important Bird Area), which is located at the mouth of Placentia Bay. In the late 1980's, there was an estimated 5,485 breeding pairs of Northern Gannets, which is the fourth largest concentration in the world. In addition, there are estimated to be 10,000 breeding pairs of Black-legged Kittiwakes; 10,000 pairs of Common Murres; 1,000 pairs of Thick-billed Murres; 100 pairs of Razorbills; and an undetermined number of Black Guillemots, Great Cormorants, Double-crested Cormorants, Herring Gulls and Great Black-backed Gulls (Cairns et. al. 1989) (Table 4-1).

Table 4-1. Sea-associated Birds Known or Expected to Occur in the Argentia Harbour Area.

| Common Name | Scientific Name | Feeds on Infauna & Epifauna | Feeds on Nekto-benthos | Feeds on Intertidal Prey | Feeds at Water Surface | Period Present |
|---|---|---|---|---|---|---|
| Red-throated Loon | *Gavia stellata* | | yes | | | spring and fall migrant |
| Common Loon | *Gavia immer* | | yes | | | all seasons, potentially breed in nearby f/w ponds |
| Red-necked Grebe | *Podiceps grisegena* | | yes | | | early spring, late fall and winter visitor |
| Great Cormorant | *Phalacrocorax auritus* | | yes | | | late spring, summer, fall feeding visitor |
| Double-crested Cormorant | *Phalacrocorax carbo* | | yes | | | late spring, summer, fall feeding visitor |
| Canada Goose | *Branta canadensis* | | | yes | | all seasons but winter, breeds in area |
| Green-winged Teal | *Anas crecca* | | | yes | | spring,summer, fall |
| Black Duck | *Anas rubripes* | | | yes | | all seasons, summer (in fresh water) and early spring, fall and winter (in intertidal zone) |
| Northern Pintail | *Anas acuta* | | | yes | | all seasons, summer (in fresh water) and early spring and fall (in intertidal zone) |
| Greater Scaup | *Aythya marila* | yes | yes | yes | | spring, fall |
| Common Eider | *Somateria mollissima* | yes | yes | yes | | fall, winter,spring |
| King Eider | *Somateria spectabils* | yes | yes | yes | | fall, winter, spring |
| Oldsquaw | *Clangula hyemalis* | yes | yes | yes | | fall, winter, spring |
| Black Scoter | *Melanitta nigra* | yes | yes | yes | | occasional spring and fall migrants, winter visitors |
| Surf Scoter | *Melanitta perspicillata* | yes | yes | yes | | occasional spring and fall migrants, winter visitors |
| White-winged Scoter | *Melanitta fusca* | yes | yes | yes | | occasional spring and fall migrants, winter visitors |
| Common Goldeneye | *Bucephala clangula* | yes | yes | yes | | spring, summer,fall |
| Red-breasted Merganser | *Mergus serrator* | | yes | | | all seasons |
| Osprey | *Pandion haliaetus* | | | | yes | spring, summer, fall diving for fish near surface of fresh and salt water |
| Bald Eagle | *Haliaeetus leucocephalus* | | | yes | yes | all seasons, scavenging on al shorelines, catching some fish in shallow water |
| Black-bellied Plover | *Pluvialis squatarola* | | | yes | | late summer/fall, visitor in the intertidal zone |
| American Golden Plover | *Pluvialis dominica* | | | yes | | late summer/fall visitor, upland |
| Semipalmated Plover | *Charadrius semipalmatus* | | | yes | | spring, summer, fall intertidal zone breeds in area |
| Greater Yellowlegs | *Tringa melanoleuca* | | | yes | | spring, summer, fall intertidal zone, breeds in area |
| Spotted Sandpiper | *Actitis macularia* | | | yes | | spring, summer, fall intertidal zone, breeds in area |

| Common Name | Scientific Name | Feeds on Infauna & Epifauna | Feeds on Nekto-benthos | Feeds on Intertidal Prey | Feeds at Water Surface | Period Present |
|---|---|---|---|---|---|---|
| Whimbrel | *Numenius phaeopus* | | | yes | | late summer and fall, upland and intertidal zone |
| Ruddy Turnstone | *Arenaria interpres* | | | yes | | late summer, fall visitor in the intertidal zone |
| Sanderling | *Calidris alba* | | | yes | | late summer, fall visitor in the intertidal zone |
| Semipalmated Sandpiper | *Calidris pusilla* | | | yes | | late summer, fall visitor in the intertidal zone |
| Least Sandpiper | *Calidris minutilla* | | | yes | | probably breeds in area, late summer/fall, intertidal visitor |
| White-rumped Sandpiper | *Calidris fuscicollis* | | | yes | | summer, fall visitor |
| Pectoral Sandpiper | *Calidris melanotos* | | | yes | | uncommon late summer/fall visitor |
| Dunlin | *Calidris alpina* | | | yes | | uncommon late summer/fall visitor |
| Short-billed Dowitcher | *Limnodromus griseus* | | | yes | | uncommon late summer/fall visitor |
| Black-headed Gull | *Larus ridibundus* | | | yes | yes | uncommon, all seasons |
| Ring-billed Gull | *Larus delawarensis* | | | yes | yes | spring, summer, fall, breeds in area |
| Herring Gull | *Larus argentatus* | | | yes | yes | year round, breeds in area |
| Iceland Gull | *Larus glaucoides* | | | yes | yes | fall, winter, spring, visitor |
| Glaucous Gulls | *Larus hyperboreus* | | | yes | yes | winter, spring visitor |
| Great Black-backed Gull | *Larus marinus* | | | yes | yes | all seasons, breeds in area |
| Black-legged Kittiwake | *Rissa tridactyla* | | | | yes | all seasons, breeds in area |
| Common Tern | *Sterna hirundo* | | | | yes | spring, summer, fall, breeds in area |
| Arctic Tern | *Sterna paradisaea* | | | | yes | year round, breeds in area |
| Dovekie | *Alle alle* | | yes | | | late fall and winter visitor |
| Black Guillemot | *Cepphus grylle* | | yes | | | all seasons, (breeds in area) |

There are numerous seabird colonies located along the inner islands and coastlines of Placentia Bay which range considerably in size and diversity. Great and Double-Crested Cormorants are known to nest in small numbers at three colonies located in the southeastern portion of Placentia Bay. Cormorants are rare on the east and south coasts of Newfoundland and are known to breed at only five sites in total (Lock et. al. 1994). All other colonies along the east coast of Placentia Bay, with the exclusion of Cape St. Mary's, are used mainly by breeding pairs of Herring Gulls, Great Black-backed Gulls, and Common or Arctic Terns (Cairns et. al. 1989). There are also a limited number of Leach's Storm Petrels, Ring-billed Gulls, and Black Guillemots found breeding along the east coast. Some shorebird species may breed near Argentia including Semipalmated Plovers, Greater Yellowlegs, and Spotted Sandpipers.

The composition of most of the colonies found along the west coast of Placentia Bay are similar to those on the eastern side of the Bay. The colonies include Herring Gulls, Great Black-backed Gulls, and Common or Arctic Terns. The colonies along the west side of the Bay also include Ring-billed Gulls and Black Guillemots (Cairns et. al. 1989). Several colonies closer to the mouth of the Bay contain large numbers of Leach's Storm Petrels and breeding populations of Black-legged Kittiwakes; including colonies at Iron Island (1,000 pairs), Corbin Island (100,000 pairs), and Middle Lawn Island (26,313 pairs). Middle Lawn Island has also been identified as a breeding site for 100 pairs of the Manx Shearwater.

**Non-Breeding Sea-associated Birds**

The coastal and nearshore waters of Placentia Bay provide summering habitat for non-breeding waterfowl and summer feeding and overwintering habitat for large numbers of seaducks and seabirds. Placentia Bay, and in particular Cape St. Mary's, is a significant wintering site for alcids, including Thick-billed Murres, Dovekies, and Common Murres. There are several gull species that not only breed in colonies near the head of the bay, but also spend all or part of the winter in this area. These include Herring, Great Black-backed, and Ring-billed Gulls. Iceland Gulls, Glaucous Gulls, Black-legged Kittiwakes and Dovekies also occur during the winter months. Many waterfowl species overwinter in Placentia Bay, most notably at Cape St. Mary's, including Harlequin Ducks (listed as special concern by COSEWIC 2002), Common Eider, King Eider, Black Scoter, White-winged Scoter, Surf Scoter, and Oldsquaw. Concentrations of several thousand Common Eiders have been observed at Cape St. Mary's during winter (Goudie 1981). The most common locations for eiders are around Cape St. Mary's and the Virgin Rocks, and the east side of the Burin Peninsula, north of Marystown.

Many seabird species are present in the northern region of the bay during the summer months. Northern Gannets are abundant throughout the Bay during the summer, but are absent in the winter. Northern Gannets, Northern Fulmars, Common Murres, Atlantic Puffins and Double-crested Cormorants are all occasional summer feeding visitors in the northern region of Placentia Bay (P. Ryan, CWS, pers. comm.). There are relatively low concentrations of feeding Greater Shearwaters, Sooty Shearwaters, and Manx Shearwaters in the northern region of Placentia Bay during the summer, while greater concentrations are found farther south (LeGrow 1995). Indeed, the eastern half of Placentia Bay from Argentia to Cape St. Mary's, extending from the shoreline to 25 km offshore has been designated an Important Bird Area of global significance in large part to the high numbers of shearwaters that feed there. The concentrations of Greater Shearwaters are closely related to the movement of spawning capelin. The area between Argentia Harbour and Iona Islands and around Ship Harbour can host concentrations of Shearwaters (Greater and Sooty) depending on weather conditions (ADC 1983). Numbers of waterfowl in the area during the summer are generally low. Those present are most often found in sheltered bays and inlets and include migrants, transients and non-breeding summering birds.

Species which may be present in the head of the bay during the summer months include Canada Goose, Black Duck, Ring-necked Duck, Greater Scaup, Common Goldeneye, Common Merganser and Red-breasted Merganser. Some shorebird species likely occur in the Argentia Harbour area but the area does not provide optimal habitat that would support large numbers of shorebirds.

**Raptors and Other Birds**

It is noteworthy that the Placentia Bay area is one of the most productive areas for Bald Eagles (*Haliaeetus leucocephalus*) on the island of Newfoundland, where they occur year round. Osprey (*Pandion haliatus*) are also fairly common, but are only present in the Regional Study Area from spring to early fall. The Provincial Wildlife Division estimated that there were 50 to 60 breeding pairs in Placentia Bay in 1997. Most of these pairs are found in the inner/central portion of the bay and along the eastern shore of the bay. The portion of the bay around Merasheen Island has been designated as an "experimental area" for raptors and waterfowl.

Grassland birds such as Savannah Sparrows, plovers, and Horned Larks, have been identified on the grassy areas of the Argentia Peninsula and American Robins are plentiful in the area (B. Mactavish, LGL Ltd., pers. comm.).

#### 4.5.1.4 Rare and Endangered Species

There are no known critical nesting, feeding, staging or overwintering areas of rare and endangered bird and mammal species in the immediate vicinity of the Argentia Peninsula and Argentia Harbour (ADC 1983).

### 4.5.2 Marine Environmental Setting

#### 4.5.2.1 Bathymetry

Argentia Harbour is approached from the open sea via Placentia Bay with vessel traffic management controlled from the Canadian Coast Guard Marine Communications and Traffic Services facility in Argentia. The traffic routes are along the line of the deepwater channel which enters the bay from the Atlantic and continues up the east side of the Bay between Argentia and Red Island.

The harbour is naturally well-sheltered with a maximum recorded wave height of 1.22 m. Typical Argentia Harbour bathymetric data are presented in Table 4-2.

Table 4-2. Bathymetric Data – Argentia Harbour.

| Physical Feature | 10 m depth | 12 m depth |
|---|---|---|
| Channel width | 1,250 m | 1,000 m |
| Approach width | 300 m | 275 m |
| Turning basin diameter | 730 m | 640 m |

Source: ARG (1995).

At present vessels in Placentia Bay use the Canadian Hydrographic Survey charts, which were revised in 1989 for navigation in the Bay. These charts are available in printed format and at present there is no known source of electronic chart available for navigation in Placentia Bay. The current charts have been found to be adequate and no problems have been encountered relating to inadequate information on these charts (Burge, H. 1997)

There are no tidal gauges in Placentia Bay. However, tide tables for the Bay are calculated and available to shipping using the area. Again, no problems have been encountered and oversized ships entering Argentia Harbour are preceded by a survey which ascertains the safety and requirements for safe movement within the harbour (Burge, H. 1997).

#### 4.5.2.2 Physical Oceanography

Placentia Bay is ice free and capable of year-round operation (LeDrew and Gustajtis 1979). The maximum mean ice edge for the period 1960 to 1984 did not extend into the bay (Seaconsult 1985).

Three water types have been distinguished in Placentia Bay: a deep water layer with limited seasonal variation (temperature of -2 to 0.0 °C; salinity of 32.8 to 33.0 ppt), a surface water layer with seasonal variability (temperature of -1.5 to 15 °C; salinity of 30.5 to 32.5 ppt), and a surface/freshwater mixture which is seasonally variable (temperature of -1.5 to 15 °C; salinity of 28.0 to 31.5 ppt). A thermocline develops in the warmer months at a depth of 50 to 60 metres. This results in a stable water column with little vertical mixing during the summer. More extensive mixing occurs during the winter due to winter storms. Salinities in the Western Channel are lower than those of the Eastern Channel as a result of fresh water input from Swift Current, which is the major source of freshwater into Placentia Bay (Willey 1976).

The general circulation pattern in Placentia Bay is counterclockwise, flowing north along the Eastern Channel and south through the Western Channel (Hodder, Parsons and Pippy 1972). The current direction in Placentia Bay is significantly influenced by prevailing winds rather than tidal currents (Fisheries and Oceans Canada 1986). Current intensity and direction are considered variable, indicating a lack of any well developed current system (Trites 1969; Lawrence et al., 1973).

#### 4.5.2.3 Fish and Fish Habitat

**Fish Habitat in the Potential Effects Area**

Fish habitat in Argentia Harbour, considered the potential Effects Area (PEA) in the biophysical EA has been relatively well surveyed.

In June 1998, eight transects throughout Argentia Harbour were sampled using photography and videography (Christian and Lee 1998). This benthic survey indicated that substrates within the harbour are predominantly soft in nature, composed primarily of silt, mud and sand. A narrow band of bedrock/coarse particle substrate does occur along sections of the harbour coastline. Other transects sampled around the Argentia Peninsula outside of the harbour indicated harder, more stable substrates composed of gravel, cobble and boulders.

Habitat surveys within Argentia Harbour in 1997 (JWEL 1997) concluded that sand-silt substrate with little algal cover dominated Argentia Harbour at depths greater than 15 m. Steep rocky slope with bedrock, boulder and cobble was continuous along the northwestern shore of the harbour in the shallow subtidal zone between Cooper Cove and Low Room Point. Other than cunners, no fish were observed in this habitat type. At the base of this rocky slope was a silt-sand substrate region with moderate to dense algal cover. This habitat type provides cover and feeding grounds for several species of finfish and shellfish. Beyond this area with algal cover was the predominant sand-silt substrate without cover habitat that dominates the harbour.

The June 1998 transects within the harbour were characterized by sea stars, sand dollars and winter flounder. Other animals observed on the transects included sea urchins, toad crab, rock crab, hermit crab, mussels, sea scallops, ocean pout, sculpin, cunner and whelks (Christian and Lee 1998).

Snow crab, including some mating pairs, were observed during Argentia Harbour transect surveys in February/March 1997 (JWEL 1997). Snow crab were most abundant on a transect located at the mouth of Argentia Harbour at depths between 20 and 30 m.

**Important Species in the Potential Effects Area**

**Snow crab**

Water depth and substrate type relating to snow crab occurrence is quite variable. They may be found on both soft and hard substrate and at depths ranging from 60 to over 400 m. Bottom water temperature is a critical factor since these animals are stenothermal, preferring water temperatures between –1 and 4 ºC. Mating and larval hatch in this species typically occurs in late spring/early summer. While these crab are opportunistic feeders, prey often include polychaetes, bivalves and echinoderms. Snow crab will also scavenge on dead fish and other organisms (LGL 2001a).

**Cod**

Cod are known to conduct inshore spawning in Placentia Bay. Timing of the spawning is variable but generally occurs in late spring/early summer. Inshore cod feed on zooplankton until they attain a length of 8 to 10 cm and then shift to feeding on benthic and epibenthic invertebrates, primarily crustaceans such as amphipods and mysids. As they grow larger, cod shift their prey preferences to fish, crabs, shrimp and euphausiids. Important fish prey include capelin, herring and smaller cod (LGL 2001b).

**Lobster**

Except for immediate post-settlement stages, American lobsters tend to prefer areas with substantial boulder and cobble cover to provide them with means for shelter. The substrate may be soft or hard although areas with boulders and cobble tend to have harder substrates. Around Newfoundland, lobsters tend to occupy a narrow band of rocky bottom in a depth range of 2 to 40 m. Mating and larval hatch occur during the summer months when water temperatures are favourable for development. These decapod crustaceans are very opportunistic feeders. Prey of lobsters include crabs, dead fish, mussels, sea stars, sea urchins, polychaetes and algae (LGL 2001a).

**Lumpfish**

These semipelagic fish spend much of their time far from land except during the spring and summer when they move inshore to spawn. The males move in before the females and tend to seek out potential nest sites in rocky, hard-surface substrate. The male lumpfish often establish nests in the same habitat where lobster occur. Prey of the lumpfish while inshore include various zooplankton (ctenophores, amphipods, fish eggs and larvae) as well as polychaetes, molluscs and dead fish (LGL 2001b).

**Atlantic herring**

Atlantic herring is primarily pelagic and often schools, particularly prior to spawning when large schools are formed. Spring spawning in May and June dominates most of the herring stocks in the Newfoundland region. Herring stocks on the south and east coasts of Newfoundland are best defined during the spring spawning when each of the large bays, including Placentia Bay, contains its own discrete spawning group. Atlantic herring are demersal spawners and they deposit their adhesive eggs on stable bottom substrates. Herring are visual feeders and they consume plankton during daylight hours. Planktonic prey of Atlantic herring include euphausiids, copepods, amphipods, mysids, fish eggs, fish larvae and invertebrate larvae (LGL 2001b).

**Capelin**

Capelin exhibit inshore-offshore migrations associated with spawning. They overwinter in offshore areas and move shoreward in early spring to spawn in the spring/summer. While often associated with beach spawning, capelin also exhibit spawning behaviour in the shallow subtidal and on shoals. The size of the substrate on a beach will determine its suitability for capelin spawning. Capelin appear to prefer gravel 5 to 15 mm in diameter but will spawn on substrate as small as 2 mm diameter and as large as 25 mm diameter. Larval hatch typically occurs 2 to 4 weeks after fertilization. Capelin feed on planktonic organisms, mainly copepods and pelagic amphipods. Feeding is seasonal, intensifying in late winter/early spring and decreasing to nil during spawning in the late spring/early summer. Capelin has traditionally been a very important forage species for numerous fish species (LGL 2001b).

**Winter flounder**

These flounder exhibit a seasonal depth-related migration in inshore waters, probably in response to water temperature fluctuation. In Newfoundland, winter flounder generally move into shallow nearshore waters (< 20 m) in the spring in order to spawn, remain in the shallow areas for the summer, and then return to the deeper coastal waters (20 to 60 m) in the fall. Spawning tends to occur over sand and mud bottoms resulting in demersal and adhesive fertilized eggs. Depending on water temperature, time to larval hatch can range from 1 to 5 weeks. The diet of winter flounder changes with the growth of the fish. Common prey of this species include polychaetes, algae, chitons, limpets, sea anemones, sea urchins, brittle stars, amphipods, fish remains and fish eggs. Winter flounder have been identified as major predators on Atlantic herring eggs. These flounder tend to feed heaviest in spring and summer (LGL 2001b).

**American plaice**

This flatfish occurs both inshore and offshore in the Newfoundland region but it generally occurs in deep waters ranging from 90 to 250 m and with water temperatures between 0 and 1.5 ºC. Spawning typically occurs in the spring/early summer. Adult American plaice feed on primarily echinoderms (sand dollars, sea urchins, brittle stars) and fish including sand lance and capelin (LGL 2001b).

**Sea scallop**

In Newfoundland, sea scallops tend to occur in shallower water depths of less than 20 m where substrates are sand-gravel or gravel-pebble in nature. They are often associated with habitat characteristics that include warm summer water temperatures and minimal exposure to wave energy. In Newfoundland, sea scallops typically spawn in September and October. Adult sea scallops filter feed on plankton and detritus (LGL 2001a).

#### 4.5.2.4 Fisheries

**Regional Study Area (RSA)**

For the purposes of this study's fish/fishery review, the Regional Study Area (RSA) of Placentia Bay corresponds to NAFO Unit Area 3PSc (Placentia Bay). Between 2000 and 2002, approximately thirty animal species were commercially landed in the RSA, seven of which were invertebrates (DFO 2002). In 1995, approximately forty-six commercial species were harvested from the same Unit Area (Canning and Pitt 1997).

The RSA commercial fishery landings values in 2000 and 2001 were primarily based on snow crab and cod landings. Lobster and lumpfish roe also contributed significantly during both years. The landings value of snow crab exceeded $10 million during both of those years while the landings values of cod were $12.5 million in 2000 and $7.7 million in 2001. The annual landings values of lobster and lumpfish roe during the two years ranged from $1.2 million to $1.4 million, and $0.8 million to $1.0 million, respectively. The Iceland scallop fishery also proved valuable during 2000 ($775,000) and 2001 ($100,000). The only other species whose landings value exceeded $100,000 during either year was American plaice ($127,000 in 2001) (Table 4-3).

During the first nine months in 2002, snow crab, cod and lobster again ranked first, second and third, respectively, in RSA landings value. Snow crab landings are valued at over $10 million in 2002 while just over $5 million worth of cod had been harvested as of October 2002. Approximately $1 million of lobster was harvested in the Regional Study Area during 2002. Other species whose landings are valued at more than $100,000 in 2002 but were not included in the ten most valued species during 2000 and 2001 include monkfish ($428,000), Atlantic halibut ($134,000), Greenland halibut ($122,000) and white hake ($105,000). American plaice, sea urchins and herring landings in the RSA have also exceeded $100,000 thus far during 2002 (Table 4-3).

Benthic invertebrate species have accounted for the majority of the commercial fishery landings values in the Regional Study Area between 2000 and October 2002. Five invertebrate species in each of 2000 and 2001 (snow crab, lobster, Iceland scallop, sea scallop and sea urchin) accounted for 52% and 57%, respectively, of the total landings value of the top ten species (Table 4-3). During the first nine months of 2002, only three invertebrate species (snow crab, lobster and sea urchin) had accounted for 65% of the total landings value of the top ten species (Table 4-3).

Table 4-3. Fish Species with Highest Landings Values in Regional Study Area, 2000-2002.

| Rank | 2000 | | | 2001 | | | 2002 | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Species** | **Weight (t)** | **Value ($)** | **Species** | **Weight (t)** | **Value ($)** | **Species** | **Weight (t)** | **Value ($)** |
| **1** | Snow crab | 2,699 | 13.0 M | Snow crab | 2,614 | 10.1 M | Snow crab | 2,760 | 10.6 M |
| **2** | Cod | 8,759 | 12.5 M | Cod | 5,557 | 7.7 M | Cod | 3,783 | 5.3 M |
| **3** | Lobster | 113 | 1.2 M | Lobster | 114 | 1.4 M | Lobster | 94 | 1.1 M |
| **4** | Lumpfish roe | 396 | 956 K | Lumpfish roe | 165 | 778 K | Monkfish | 260 | 429 K |
| **5** | Iceland scallop | 531 | 775 K | American plaice | 158 | 127 K | American plaice | 195 | 159 K |
| **6** | Winter flounder | 158 | 80 K | Iceland scallop | 69 | 100 K | Sea urchin | 24 | 154 K |
| **7** | Herring | 490 | 76 K | Sea urchin | 42 | 79 K | Atlantic halibut | 23 | 134 K |
| **8** | American plaice | 92 | 75 K | Herring | 478 | 76 K | Greenland halibut | 129 | 122 K |
| **9** | Sea scallop | 31 | 50 K | Winter flounder | 121 | 73 K | Herring | 741 | 122 K |
| **10** | Sea urchin | 25 | 43 K | Sea scallop | 32 | 46 K | White hake | 163 | 105 K |

M denotes million
K denotes thousand

**Timing of Harvests**

Over 97% of the landings value of snow crab in the RSA during 2000 to 2002 was harvested between May and August (DFO 2002) (Table 4-4).

Slightly more than 42% of Atlantic cod landings value in RSA during 2000 to 2002 was taken in July and November. Other than the March to May period, the remainder of the landings value of cod was harvested relatively evenly among the remaining seven months (DFO 2002) (Table 4-4).

Almost 84% of all lobster landings value in RSA between 2000 and 2002 was taken in May and June. The remainder was harvested in April and July (DFO 2002) (Table 4-4).

Just under 90% of the lumpfish roe landings value in RSA during 2000 to 2002 was caught in May. The remainder was taken primarily during June month (DFO 2002) (Table 4-4).

Table 4-4. Primary Harvest Times of Most Valuable Species in RSA, 2000-2002. Black shading indicates times of highest catches.

| Species | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Snow crab | | | | | | | | | | | | |
| Atlantic cod | | | | | | | | | | | | |
| Lobster | | | | | | | | | | | | |
| Lumpfish roe | | | | | | | | | | | | |
| Iceland scallop | | | | | | | | | | | | |
| Monkfish | | | | | | | | | | | | |
| American plaice | | | | | | | | | | | | |
| Sea urchin | | | | | | | | | | | | |
| Winter flounder | | | | | | | | | | | | |
| Herring | | | | | | | | | | | | |

Ninety-two percent of the Iceland scallop landings value in RSA between 2000 and 2002 was harvested from April to September (DFO 2002) (Table 4-4).

June and July landings accounted for almost 90% of the monkfish commercial value in RSA during 2002. The remainder was caught in August and September (DFO 2002) (Table 4-4).

Seventy-five percent of American plaice landings value in RSA during 2000-2002 was caught between June and August. Catches were reported during all other months as well although values between January and April were quite low (DFO 2002) (Table 4-4).

February (66% of total landings value) was the primary harvest month for sea urchins in the RSA during 2000-2002. Harvests in December, January and March accounted for about 32% of the total landings value for this invertebrate species (DFO 2002) (Table 4-4).

Between 2000 and 2002, winter flounder landings in the RSA were reported during every month except March and April although most of the landings occurred between June and August (DFO 2002) (Table 4-4).

Almost 95% of all herring landings value in RSA during 2000 to 2002 was made in March and April and the remainder was taken in May (DFO 2002) (Table 4-4).

**Potential Effects Area (PEA)**

Based on 1997 consultations with local fishers, species commercially harvested in Argentia Harbour during 1996 included snow crab, lobster, lumpfish, herring and capelin (Canning and Pitt 1997). In addition to these five species, flounder were also caught in the waters immediately outside of Argentia Harbour (Placentia Sound, Ship Harbour, and area delineated by Fox Island-Isaac Point-north side of Argentia Peninsula). Fishers also indicated the locations of cod trap berths but these were not within either Argentia Harbour or Placentia Sound.

In 1997, local fishers indicated that snow crab are fished in the deeper waters of Argentia Harbour and Placentia Sound, as well as in Placentia Bay north of Isaac Point. They also reported that lobsters are fished on a continuous band of habitat around the coastline of the Argentia Harbour, the Argentia Peninsula, Placentia Sound, and along some coastal areas in Placentia Bay north of Isaac Point. Fishers said that lumpfish occur on the same habitat as lobster. Fisher consultations also indicated that herring and capelin occur within Argentia Harbour. Locals reported that herring often spawn in Argentia Harbour during March and April and that harvesting of this species occurs within the harbour and in Placentia Sound. It was also reported that capelin spawn on particular beaches located in Argentia Harbour. Other traditionally commercial species that occur in Argentia Harbour, according to local fishers, included scallops and winter flounder. They also spoke of underutilized species in the area including sea urchins, squid, shrimp and whelk (Canning and Pitt 1997).

According to the DFO Fisheries Officer in Placentia (A. Griffiths, pers. comm. 2002), the only fisheries recently prosecuted in Argentia Harbour were directed at lobster (pot) and herring (purse seine). Both of these fisheries within the Argentia Harbour are insubstantial relative to other areas in Placentia Bay. In the waters immediately outside of Argentia Harbour, other species commercially landed during 2000-2002 include cod, winter flounder, skate and American plaice (A. Griffiths, pers. comm. 2002; DFO 2002).

#### 4.5.2.5 Industrial Setting

Argentia is an existing brownfield site given its history as the site of the former US Naval Base. It has been subject to a large scale decommissioning and remediation effort by PWGSC. There are now a number of companies presently operating on the Argentia Peninsula (north side of harbour), including:

- **EIMSKIP Newfoundland**: EIMSKIP offers bi-weekly container shipments from Halifax, Boston, New York, and Norfolk to destinations such as Hamburg, Helsinki, Copenhagen and Rotterdam.
- **Marine Atlantic**: Marine Atlantic has a terminal in Argentia and operates a seasonal passenger/vehicle ferry service between North Sydney, Nova Scotia and Argentia. The ferry accommodates 1,200 passengers and consists of 4 vessel movements per week from mid-June to September.
- **Argentia Freezers and Terminals**: Argentia Freezers and Terminals act as agents for EIMSKIP, and are responsible for that company's wharf handling and stevedoring. Argentia Freezers are also wholesalers of frozen fish products which they import from world-wide sources.
- **Municipal Recycling**: Municipal Recycling collects raw materials for recycling from across the Province, shreds the material at its location in Argentia, and prepares it for shipment to mills world-wide.
- **Canadian Coast Guard**: The Canadian Coast Guard's Marine Communications and Traffic Services facility monitors the shipping traffic in Placentia Bay, which includes vessels enroute to the oil refinery in Come by Chance, the Marystown Shipyard and the harbour at Argentia (Argentia Management Authority).

Other activity in the area includes small businesses, and commercial fishing for groundfish, herring, lumpfish, crab and lobster.

Vessel activity at Argentia (north side) from October 2001 to October 2002 included about 185 vessel trips (A. McMillan, pers. comm.).

# 5.0 Environmental Effects Assessment Methodology

## 5.1 Scoping

Scoping for this EA, involved the following steps:

- Review of existing VBNC documents and environmental background reports

- Guidance was also obtained from other recent EAs that have undergone various levels of federal and provincial assessments (e.g., White Rose Offshore Oil Development, Gisbourne Lake Water Export Project, Husky Jeanne d'Arc Basin Exploratory Drilling, Whiffen Head Transhipment Terminal, Trans Labrador Highway Phase II, and others)

- Internal Study Team meetings

- Teleconference with PWGS and the provincial Department of Environment and Labour on harmonization issues

- Meetings with government agencies and departments with a potential interest in the Project, including the key environmental regulators of Environment Canada, Fisheries and Oceans and the Department of Environmental (Assessment Division, Water Resources Division, and Pollution Prevention Division)

- In addition, meetings will be undertaken with interested stakeholders and the public in St. John's, Whitbourne, and Placentia subsequent to the submission of this document in order to gain additional input

The main conclusions of these scoping activities were:

The Argentia Peninsula is a disturbed area and the intended use of the area is for commercial or industrial activity.

The Facility is a small scale test facility that will occupy a relatively small footprint. Once operational it will employ about 200 people, and other than small fugitive emissions or accidental events, will have very limited emissions or effluents into the environment.

All waste streams will be small and within all existing government regulations and guidelines. The only effluents will be to the marine environment for the treated sewage effluent (maximum of 24 $m^3$ per day from sewage treatment plant) and for the process effluent (maximum batch release of 130 $m^3$ per day).

Accidental events during transport of hazardous chemicals is of concern from both a human and ecosystem health perspective but transport will be by certified carriers and total amounts will be relatively small and trips infrequent (see Section 2.0). Transport of such materials will likely be within the 'envelope' of volumes and types of chemicals and material routinely moved through or near the local communities for other industrial activities in Newfoundland. As a result, government and industry (including VBNC) emergency equipment and procedures in the area are expected to be sufficient to deal with any accidental chemical spills.

## 5.2 Valued Ecosystem Components (VECs) Selection

In a biophysical assessment, Valued Ecosystem Components (VECs) include the following major groups:

- Rare or threatened species or habitats;
- Species or habitats that are unique to an area, or are valued for their aesthetic properties; and
- Species that are harvested by people.

In an EA that incorporates social factors, VECs may include such factors as employment, infrastructure, human health, historic resources, and so forth. This approach, originally designed by Beanlands and Duinker (1983), allows the EA to focus on those components of the ecosystem that are determined to be the most important socially, ecologically or economically. In recent years, there has been a trend by some regulators to a more ecosystem-based approach to EA. This is accommodated within the VEC approach by at least some consideration of other components of the ecosystem that may directly affect the VEC in question. For example, the EA would consider effects on the food chain leading to an important species or group of species that form the VEC when evaluating effects on the VEC.

Based on the scope and nature of the Project, the scoping exercise, potential public concerns and perceptions, and the existing environment at Argentia, the following VECs were selected.

### 5.2.1 Biophysical VECs

Potential terrestrial VECs have not been considered because Argentia is a brownfield site and any terrestrial effects would be confined to the site and within the scope of normal regulated industrial activity. Air quality has not been considered because the Facility will have little or no air emissions. Therefore, the focus of this EA is on the marine environment and fisheries because these VECs would be the receptors of the only effluents produced by the Facility.

**Fish and Fish Habitat** (includes consideration of water and sediment quality, plankton and benthos). Rationale for selection is that they are of prime concern from a public, ecological, commercial and scientific perspective. It is probably the VEC most commonly considered in EA in Canada.

**Commercial Fisheries**. The fisheries are considered a VEC because of their economic and cultural importance in Newfoundland and Labrador.

**Nearshore, Sea-associated Birds**. They are a typical VEC in Newfoundland and Labrador and are of aesthetic, cultural, ecological, and scientific importance not only locally but also nationally and internationally. May include seabirds, migratory waterfowl, or fish eating raptors (e.g., eagles and osprey).

**Marine Mammals**. This VEC is unlikely to be affected by the Facility but has been included because of potential rare and endangered status and potential interest locally, nationally and internationally. It is a typical VEC for any project with potential interactions with the marine environment.

### 5.2.2 Social VECs

**Employment and Income**. Judging from local community feedback to the Proponent and the consultants, this issue may be the one of most interest.

**Economy and Business**. This is a common VEC in socio-economic EAs.

**Infrastructure and Services**. This is a common VEC in local EAs considering social issues.

## 5.3 Boundaries

There are a number of potential boundaries to a Facility including temporal, administrative (i.e., legislative), and technical (e.g., data constraints, zones of influence, etc.).

The temporal boundary is the initial four-year time frame for the Facility, including the 16 months for the Construction Phase, and two to three years for the Initial Operations Phase. As noted above, it is expected that the Facility will be used for other purposes after the Initial Operations Phase.

The key boundaries for the proposed project are provided below.

#### 5.3.1.1 Biophysical Boundaries

**Regional Study Area** – Placentia Bay (Figure 5-1).

**Project Area** – area covered or the 'footprint' of the Facility on the Argentia Peninsula.

**Potentially Affected Area** – the maximum area within which all biophysical effects could occur, based upon consideration of worst case scenarios and potential zones of influence. This is considered to be the Argentia Peninsula plus Argentia Harbour (Figure 5-2).

### 5.3.2 Social Boundaries

There are three socio-economic boundaries:

1. the Argentia Region (45 km radius from Argentia),
2. Avalon Peninsula, and
3. the Province (see Figure 3-1).

## 5.4 Classifying Effects

Assessment of the potential effects of each phase of the Facility involved three major steps:

1. preparation of interaction (between project activities and the environment) matrices;
2. identification and evaluation of potential effects including description of mitigation measures and residual effects; and
3. preparation of residual effects summary, including evaluation of cumulative effects.

### 5.4.1 Preparation of Interaction Matrices

An interaction matrix was prepared that identifies all possible project activities that could interact with any of the VECs (Table 5-1). The matrix includes times and places where interactions could occur. The interaction matrix is used only to identify potential interactions; the matrix makes no assumptions about the potential effects of the interactions.

Figure 5-1. Hydrometallurgical Demonstration Facility Regional Study Area

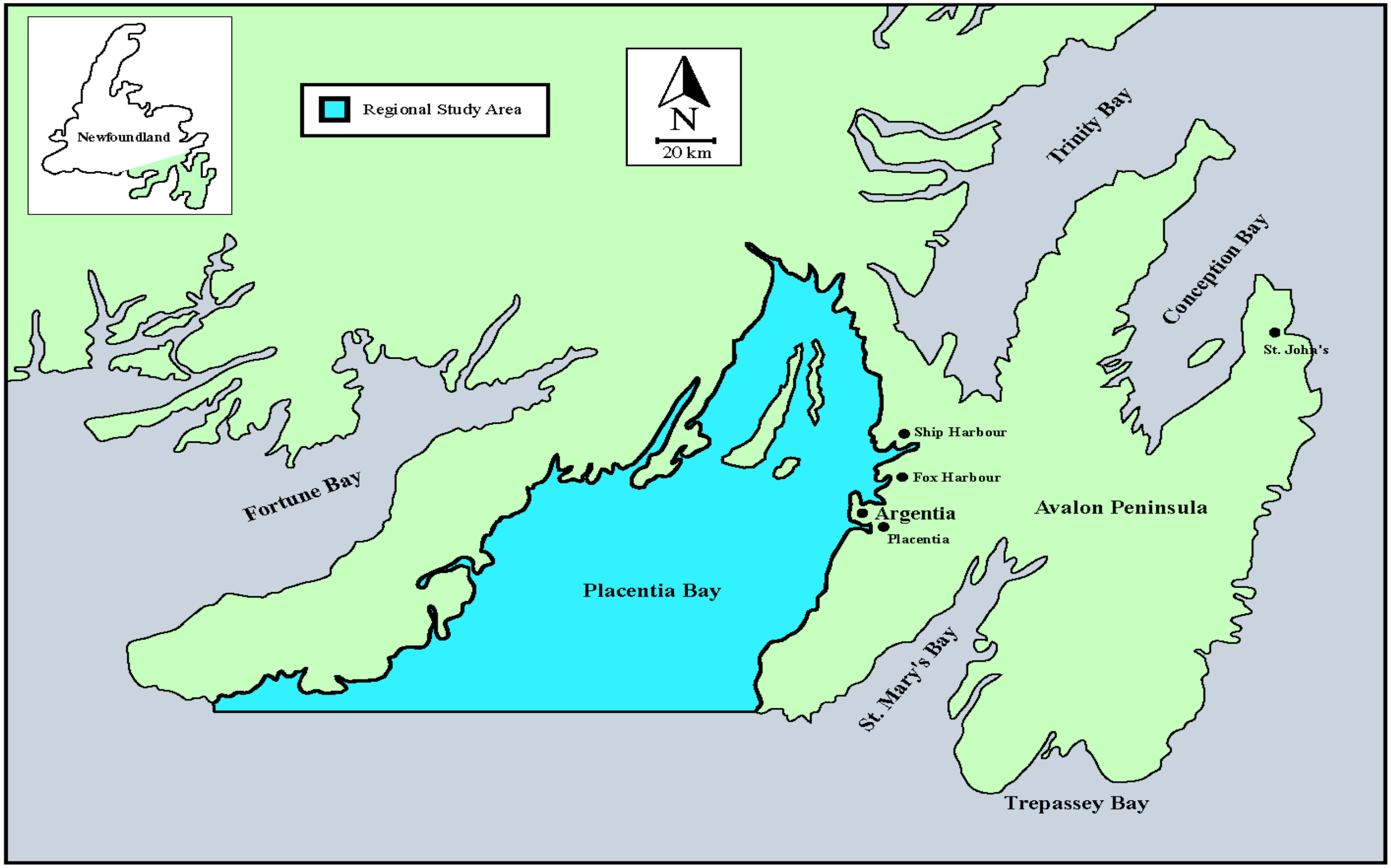


Figure 5-2. Hydrometallurgical Demonstration Facility Project Area and Potential Effects Area.

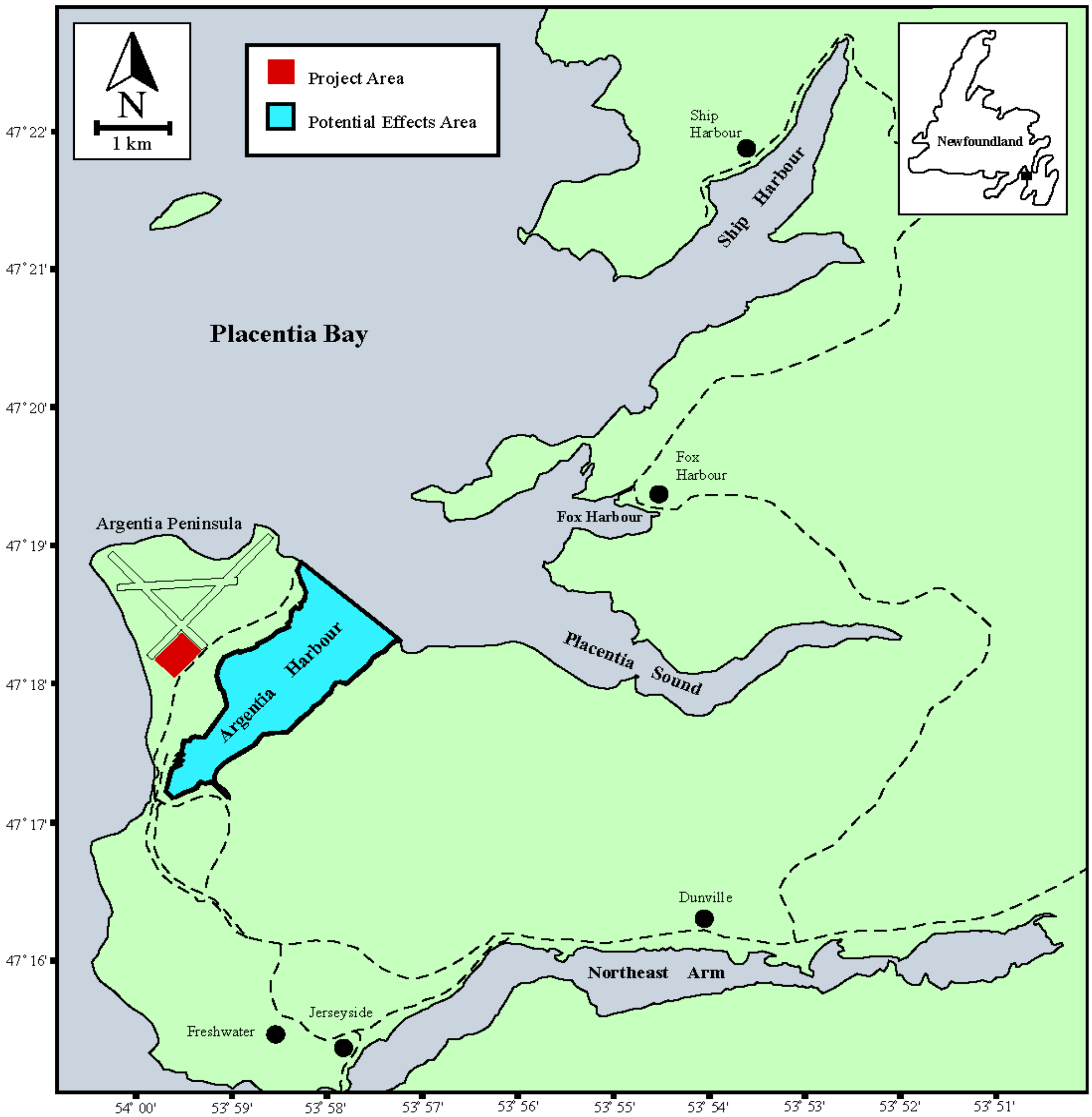


Table 5-1. Matrix of Interactions Between Project Activities and VECs.

| Project Physical Works/Activities | Fish and Fish Habitat | Fisheries | Nearshore Birds | Marine Mammals | Economy and Business | Employment and Income | Infrastructure and Services |
|---|---|---|---|---|---|---|---|
| **Construction** | | | | | | | |
| Site preparation | | | | | √ | √ | √ |
| Facility construction | | | | | √ | √ | √ |
| Powerline | | | | | √ | √ | √ |
| Waterline | √ | | | | √ | √ | √ |
| Effluent line | √ | √ | √ | √ | √ | √ | √ |
| Vehicle traffic | | | | | √ | √ | √ |
| Waste disposal | | | | | √ | √ | √ |
| **Operation** | | | | | | | |
| Water use | √ | | | | | | √ |
| Fugitive emissions | | | √ | | | | |
| Process effluent | √ | √ | √ | √ | | | |
| Sewage effluent | √ | √ | √ | √ | | | |
| Ship traffic | √ | √ | √ | √ | √ | √ | √ |
| Vehicle traffic | | | | | √ | | √ |
| **Decommissioning** | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **Accidental Events** | | | | | | | |
| Gas releases | | | √ | | | | |
| Chemical spills | √ | √ | √ | √ | √ | √ | √ |
| Fuel spills | √ | √ | √ | √ | √ | √ | √ |

Notes: N/A = Not applicable
Terrestrial issues such as vegetation not considered because it is a brownfield site and effects will not extend beyond the site.

### 5.4.2 Identification and Evaluation of Effects

Interactions identified in the matrix were then evaluated for their potential to cause effects. In instances where the potential for an effect of an interaction was deemed impossible or extremely remote, these interactions were not considered further. In this way, the assessment could focus on key issues and the more substantive environmental effects.

An interaction was considered to be a potential effect if it could change the abundance or distribution of VECs, or change the prey species or habitats used by VECs. The potential for an effect was assessed by a discipline expert who considered:

- the location and timing of the interaction;
- 'Zone of Influence' and modelling exercises;
- the literature on similar interactions and associated effects;
- when necessary, consultation with other experts; and
- results of similar effects assessments and especially, monitoring studies done in other areas.

When data were insufficient to allow certain or precise effects evaluations, predictions were made based on professional judgement. In such cases, the uncertainty is documented in the EA. For the most part, the potential effects of waste streams are reasonably well known. The effects are presented as predictions based on the literature. In some cases, the predictions were also examined by modelling.

Effects were evaluated for the Facility, which includes many mitigation measures that are mandatory or have become standard operating procedure in the industry.

The concept of classifying environmental effects simply means determining whether they are adverse or positive. The following includes some of the key factors that are considered for determining adverse environmental effects, as per the CEA Agency guidelines (CEAA 1994):

- negative effects on the health of biota;
- loss of rare or endangered species;
- reductions in biological diversity;
- loss or avoidance of critical/productive habitat;
- fragmentation of habitat or interruption of movement corridors and migration routes;
- transformation of natural landscapes;
- discharge of persistent and/or toxic chemicals;

- toxicity effects on human health;
- loss of, or detrimental change in, current use of lands and resources for traditional purposes;
- foreclosure of future resource use or production; and
- negative effects on human health or well-being.

## 5.5 Mitigation

Most significant effects can be mitigated by additions to or changes in equipment, operational procedures, timing of activities, or other measures. Mitigation measures appropriate for each effect predicted in the matrix were identified and the effects of various project activities were then evaluated assuming that appropriate mitigation measures are applied. Residual effects predictions were made taking into consideration both standard and project-specific mitigations.

## 5.6 Application of Evaluation Criteria for Assessing Environmental Effects

Several criteria were taken into account when evaluating the nature and extent of environmental effects. These criteria include (CEAA 1994):

- magnitude;
- geographic extent;
- duration and frequency;
- reversibility; and
- ecological, socio-cultural and economic context.

Magnitude describes the nature and extent of the environmental effect for each activity. Negligible effects were also identified. Geographic extent refers to the area affected by a specific activity of the Facility. Duration and frequency describe how long and how often a project activity and/or environmental effect will occur. Reversibility refers to the ability of a VEC to return to an equal, or improved condition, at the end of the project life cycle (for example, reclaiming habitat area equal or superior to that lost during construction). The ecological, socio-cultural and economic context describes the current status of the area affected by the project in terms of existing environmental effects. Effects predictions for accidental events are provided in Section 6.0 for all VECs.

Magnitude was defined as:

Negligible (0) An interaction that affects a portion of the habitat in such a way to cause a change in the habitat component and therefore a change in the population or a specific group of individuals in the potentially affected area (PEA) over a short period of time in such a way as to be similar to small random changes in the population due to natural variations by having no detectable environmental effect on the population as a whole.

Low (1) Affects a portion of the habitat in the potentially affected area to cause a change in the habitat component and therefore causes a change to a specific group of individuals in a population at a localized area and over a short period of time (one generation or less) but not affecting other trophic levels or the integrity of the population itself.

Medium (2) Affects a portion of the habitat in the potentially affected area in such a way to cause a change in the habitat component and therefore a change in the abundance and distribution or a portion of a population over one or more generations of that portion of the population or species dependent upon it but does not change the integrity of any population as a whole; it may be localized.

High (3) Affects a portion of the habitat in such a way as to cause the change in the habitat component and therefore a change in abundance or distribution of a whole stock or population of species beyond which natural recruitment (reproduction and immigration from unaffected areas) would not return that population or any population or species dependant upon it to its former level within several generations.

Definitions of magnitude and duration as described above and used in this EA have been used previously in environmental assessments under CEAA (e.g., VBNC mine/mill).

## 5.7 Cumulative Effects

Cumulative effects are those that occur within the Facility and with other industrial and human activities in the area that have the potential to overlap with, multiply or simply add to the potential effects of the Facility.

Cumulative environmental effects are addressed for each project activity within each VEC section in varying levels of detail, depending upon the amount of information available, the results of issue scoping sessions, and potential for interaction of the activity with the VECs. The projects and activities considered are those which are ongoing or likely to proceed, and have therefore been issued permits, licenses, leases, or some other form of approval, as specified by the CEA Agency in the "Reference Guide: Addressing Cumulative Effects" included in the "Responsible Authority's Guide" (CEAA 1994) and the updated Practitioner's Guide (CEAA 1999).

This EA has considered cumulative effects within the Facility within the effects predictions. Cumulative effects considered outside the Facility included consideration of other industries and activities, specifically:

- Commercial fisheries
- Waterfowl and turr hunting
- Marine transportation (e.g., ferry, tankers, and container shipping)

## 5.8 Residual Effects

Residual effects are those that remain after mitigations are employed. All effects in this EA can be considered residual effects.

Upon completion of the evaluation of environmental effects, the residual environmental effects (effects after project-specific mitigation measures are imposed) are assigned a rating of significance for:

- each project activity or accident scenario;
- the cumulative effects of project activities within the Project; and
- the cumulative effects of combined projects in Argentia.

These ratings are presented in a summary of residual environmental effects. The last of these points considers all residual environmental effects, including project and other-project cumulative environmental effects. As such, this represents an integrated residual environmental effects evaluation.

The analysis and prediction of the significance of environmental effects, including cumulative environmental effects, encompasses the following:

- determination of the significance of residual environmental effects;
- establishment of the level of confidence for prediction; and
- evaluation of the scientific certainty and probability of occurrence of the residual impact prediction.

## 5.9 Significance Ratings

Significant environmental effects are those that are considered to be of sufficient magnitude, duration, frequency, geographic extent, and/or reversibility to cause a change in the VEC that will alter its status or integrity beyond an acceptable level. Establishment of the criteria is based on professional judgement, but is transparent and repeatable. In this EA, a *significant* biophysical effect is defined as:

> *Having a high magnitude or medium magnitude for a duration of greater than one year and over a geographic extent greater than 100* $km^2$

In the socio-economic EA, given the small size of the Facility, a significant impact is defined as one that causes some noticeable, either directly measurable or not measurable, change in the existing socio-economic environment.

Under CEAA, an effect can be considered *significant*, *not significant*, or *positive*. Under the ***Newfoundland Environmental Protection Act***, provision is made for *significant positive effects* (B. Cleary, NDOE, pers. comm.).

## 5.10 Level of Confidence

The significance of the residual environmental effects is based on a review of relevant literature, consultation with experts, and professional judgement. In some instances, making predictions of potential residual environmental effects is difficult due to the limitations of available data (for example, technical boundaries). Ratings are therefore provided to indicate, qualitatively, the level of confidence for each prediction.

## 5.11 Determination of Whether Predicted Environmental Effects are Likely to Occur

Under CEAA, the following criteria for the evaluation of the likelihood of predicted effects are used.

- probability of occurrence; and
- scientific certainty.

These have been used in previous EAs such as the White Rose Development EA (Husky 2000).

## 5.12 Monitoring/Follow-Up

Monitoring/follow-up is a requirement of CEAA. Compliance monitoring (a.k.a. 'end of pipe') will be conducted as required for any regulated discharges. In addition, VBNC will also continue the Marine Environmental Baseline/Environmental Effects Monitoring Program that already has amassed three years of data.

# 6.0 Effects Assessment

## 6.1 Potential Interactions Between the Project and VECs

An important first step in any EA is an evaluation of interactions between the Project and associated activities and the VECs and/or important elements of the biophysical and social environment. Interactions between the Facilities activities during the two phases (Construction and Initial Operations Phases) and VECs are shown in Table 5-1. Accidental events are also included here. It should be noted that the table contains potential interactions only and does not imply an effect.

## 6.2 Fish and Fish Habitat

Fish and fish habitat have been described in Section 4.0. The following sections describe baseline conditions in terms of potential containment.

### 6.2.1 Existing Conditions

#### 6.2.1.1 Water

General water conditions have been described in Section 4.0. VBNC has conducted a number of baseline studies. In summary, surface seawater samples collected from Argentia Harbour in 1998 tended to have higher concentrations of cadmium, cobalt, copper, lead, manganese, nickel and zinc than those collected outside of the harbour. Maximum Allowable Levels (MALs) in marine water (MacDonald et al. 1992) were available for only ten of the inorganic analytes as well as for changes in pH, total suspended solids (TSS) and salinity. The only inorganic MAL exceeded was for cadmium and it was only slightly exceeded at a station at the mouth of Argentia Harbour (Christian and Lee 1998).

#### 6.2.1.2 Sediment

Some inorganic and organic chemical levels in Argentia marine sediments collected in 1998 by VBNC were higher within Argentia Harbour than outside the harbour. MALs in marine sediments (MacDonald et al. 1992; Environment Canada 1995) were available for thirteen inorganic analytes and four organic analytes. Those MALs exceeded by concentrations in Argentia samples included arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel and zinc. Generally, inorganic analyte concentrations were highest in sediments collected from within the harbour, particularly those from the head of the harbour. Some of the organics were also highest in sediments from Argentia Harbour sites.

At the same time, sediment samples from within the harbour tended to have finer particle size and higher total organic carbon levels. Both of these characteristics would promote the inorganic and organic loading of the sediment (Christian and Lee 1998).

#### 6.2.1.3 Biota

Mussels and rock crab were sampled in 1998 by VBNC from both Argentia Harbour stations and locations outside the harbour. Many of the inorganic analyte concentrations in the mussel soft tissue was highest in animals collected from stations in the head of Argentia Harbour. No differences in organic loading between stations were observed. Only eight of the inorganic analytes had MALs associated with them (FAO 1983). The only blue mussels with lead levels above the MAL were from the two stations at the head of Argentia Harbour. With respect to rock crab skeletal muscle tissue, there was not any distinct spatial trend in analyte loading. The only MAL exceeded by crab skeletal muscle analyte concentrations was that for arsenic and that occurred in crab tissue collected both inside and outside of the harbour. Rock crab hepatopancreatic tissue analysis also did not show any clear spatial trend in inorganic loading although animals from the head of Argentia Harbour had higher levels of organics in their hepatopancreatic tissue (Christian and Lee 1998).

Lobster skeletal muscle collected at Cooper's Cove within Argentia Harbour in 1995 did not contain inorganic or organic concentrations that exceeded any of the available MALs (ARG 1995). On the other hand, skeletal muscle of lobsters collected outside the harbour in 1995 (ARG 1995) and 1996 (JWEL 1996) had arsenic and/or mercury concentrations that exceeded the respective MALs.

### 6.2.2 Effects of Construction

Most construction activities during the Construction Phase will not be in or adjacent to areas of fish and fish habitat and thus no interactions are anticipated with site preparation, facility construction, or powerline construction. Similarly, vehicle traffic will not impinge upon fish and fish habitat unless there is an accidental event (see below). Sewage will be handled at existing facilities and 'port-a-potties'. Waste disposal will be only at government-approved waste disposal sites. Thus, effects from these activities on fish and fish habitat can be considered non-existent.

The waterline installation has some potential to affect fish habitat either at the reservoir end or if the line crosses any streams. However, given that the reservoir's intended use is for water consumption and the fact that VBNC will specify in contractor documents that any activities with the potential to affect fish habitat will be conducted under the appropriate federal and provincial permits; such potential effects will be fully mitigated and monitored. Thus, effects, if any, on fish and fish habitat from waterline construction will be negligible.

The installation of the effluent pipe has the potential to affect fish and fish habitat by physical disturbance and sedimentation. Effects will be minimized or avoided by locating the pipe on the harbour side rather than the more erodable ocean side and by stabilizing the shoreline during the Construction Phase. Issues examined during specific site selection will include presence of any potentially sensitive fish habitat or spawning times (e.g., local lumpfish spawning sites) or known anchorages. The pipe will be installed under the appropriate government permits and subject to those conditions. It also should be noted that the pipe is small diameter (6" or less) and will likely be simply laid on the bottom as ice scour is not normally an issue in Argentia Harbour. If there is any danger of the pipe being disturbed by ship or boat anchors, the pipe may be armoured and a notice to mariners posted. All of these factors lead to the conclusion that the effects of the installation of the pipe in Argentia Harbour will result in negligible effects of the Construction Phase on fish and fish habitat.

### 6.2.3 Effects of Initial Operations Phase

Water use, effluents and ship traffic have the potential to affect fish and fish habitat (Table 5-1). Fugitive gaseous emissions (small amounts of gas such as chlorine released into the atmosphere) and vehicle traffic do not.

Water will be drawn and accommodated from existing municipal water supplies at Argentia and thus there should be no undue effects on fish and fish habitat from the existing reservoir. Any effect the Initial Operations Phase on fish and fish habitat within an existing reservoir will be within normal operations for such a facility and can be considered negligible.

Sewage from the estimated number of 120 persons during the Initial Operations Phase is estimated to produce about 24 $m^3$ of treated water per day. The sewage will be treated in an above-ground packaged sewage treatment plant with capacity for 120 people. As per government permit, the effluent will be released into Argentia Harbour after treatment to government-approved specifications. Treatment and adequate placement and diffusing, checked by monitoring and remedied if necessary, should minimize any effects. Thus, any effects on fish and fish habitat will range from zero to minor but in any event be not significant.

Ship traffic may disturb fish habitat through physical presence, noise, prop wash, and discharges. Because it is estimated that any ship traffic associated with the Facility will be minimal, i.e., on the order of one or two trips per year to deliver packaged concentrate for a total of about 110 containers annually, any effects on fish habitat will be negligible. Furthermore, the chartered ships to be utilized for such shipping will be subject to Canadian shipping regulations and VBNC will require strict compliance with all environmental legislation.

The process effluent will be a total of about 20,000 $m^3$ per year plus site run-off but the daily rate will vary from zero to higher amounts depending upon activities at the test facility, will go into several settling and polishing ponds and be discharged through the effluent pipe (6" diameter or less) at levels equal to or lower than the current provincial regulations ***(Water Resources Act)***. Nonetheless, the effluent will contain metals that could accumulate in the sediment and potentially affect marine animals that are more or less resident to the area and are closely associated with the sediments. Example species include flounder, crab or lobster and some of their food organisms.

The maximum concentrations of metals that could be discharged under the provincial ***Environmental Control Water and Sewer Regulations (Water Resources Act)*** are shown below.

| | |
|---|---|
| Arsenic | 0.5 mg/l |
| Copper | 0.3 mg/l |
| Lead | 0.2 mg/l |
| Nickel | 0.5 mg/l |
| Zinc | 0.5 mg/l |
| TSS | 30 mg/l |

It should be noted that it is VBNC's goal to demonstrate better results than the values specified in the current regulations. Also, the Facility will be discharging in batches and not be discharging every day.

A modeling study was conducted by VBNC in support of the originally proposed Smelter/Refinery, a much larger project with larger effluents than the proposed Facility. That report predicted that water quality changes due to a much larger effluent (at least by a factor of 100 to 250) over a 25 year period would be essentially non-detectable and that deepwater sediment levels would increase slightly and more or less equally in Argentia Harbour, Argentia North Shoal and Ship Harbour Deep if the effluent was discharged at the north end of the peninsula (NGL 1997b). They predicted an incremental increase over 25 years in sediment levels of 72.4 mg/kg for nickel, 306 mg/kg for iron, 57.6 mg/kg for copper, and 28.16 mg/kg for lead. That report also predicted that if the effluent was discharged into the harbour that most of the metals would become incorporated into the sediments and not be flushed outside the harbour. Thus, it is predicted that the small Facility operations over a two to three year period will not produce measureable increases of metals in the water or sediments of Argentia Harbour except perhaps in proximity of the outflow. This prediction is based on the following rationale:

- Facility effluent will be released into the harbour and not into Placentia Bay.
- Facility effluent will be significantly smaller than the amounts that were modeled.
- The modeling study predicted that much larger amounts of inputs over a much longer time would not result in contaminants ‘migrating’ outside the harbour.
- The same modeling study predicted no significant build-up of contaminants from a much larger plant than the proposed Facility.

There will be no effects outside the harbour. VBNC has re-instituted their marine baseline sampling of sediments and thus this prediction will be monitored before and during operation of the test facility.

There are a variety of sublethal and lethal effects of metal contamination on fish and their food organisms reported in the scientific literature, mostly for metals in water. The behaviour of metals in water and sediments is complex and subject to a number of variables such as pH, organic content, sorbent capacity, the presence of complexing agents, and other factors (Jezierska and Witeska 2001).

Metals have been reported to affect fish behaviour, reproduction and physiology, and may accumulate in various tissues. Some toxicity to fish rankings for the metals of interest include: Cu>Zn>Pb>Ni (Jones 1964; Hellawell 1989).

The relevant issues in assessing the effects of metals on fish and fish habitat in Argentia Harbour are not so much the absolute quantity of metals but their bioavailability to marine organisms, the amount of time the organism is exposed to the contaminant, and the number of organisms involved. High levels of metals in sediments do not necessarily translate into high levels in the biota. For example, a detailed study of metal levels in sediments, flounder, mussels, crab, and starfish at Botwood (a heavily impacted ore loading site) and Point Leamington (a control site) showed that while mussels, starfish and flounder had higher levels of copper, lead and zinc in tissue at Botwood than the control, they were still within acceptable FAO levels for human consumption. The crab sampled appeared unaffected by the very high loads in the sediments (Buchanan and Cross 1990). Detailed studies of metal levels in clams in the cold marine environment have also been conducted near the Nanisivik ore loading site in the Canadian Arctic. No apparent relationships were found between the health of the clams and proximity to air borne and water borne lead and zinc (Thomas et al. 1984). Alice Arm, Hastings Arm and Observatory Inlet in British Columbia have been subject to large amounts (millions of tonnes) of mine tailings containing metals such as copper, lead, zinc and cadmium. Numerous studies have been conducted of various parts of the ecosystem with a variety of results. No metal uptake was found in a local species of smelt (Futer and Nassichuk 1983) or algae, crustaceans or other species of fish, and only benthic bivalves showed increased levels of copper, lead and zinc in their tissues (Burling et al. 1983; Brand et al. 1984). Farrell and Nassichuk (1984) found some elevated levels of most metals in deposit feeding bivalves but not in crabs.

The effluent will be small in amount but more or less continuous (albeit in batch releases) over the two or three years of operation. The effects on fish and fish habitat are judged to be of low magnitude with a small geographic extent (probably less than 1 $km^2$) and medium duration (i.e., two years). Any effects will diminish with time and be ultimately reversible. The present sediment environment has been impacted by previous activities and the site cannot be considered pristine. Any effects can be considered not significant in light of likely magnitude, geographic extent, and duration determinations.

### 6.2.4 Effects of Decommissioning

The Facility will be decommissioned at the end of its useful life according to government regulations in place at the time and thus any effects should be within acceptable levels.

### 6.2.5 Accidental Events

Accidental events outside the Project Area and the adjacent harbour are considered beyond the scope of this EA. Accidental events within the Project Area may include releases of gases (e.g., chlorine or hydrogen sulphide), chemical or fuel spills. Any reasonable worst case scenario for gaseous releases would not be great enough to affect fish and fish habitat as the gases would quickly disperse into the atmosphere. Chemical or fuel spills could affect fish and fish habitat if they reached water bodies. The effects will depend on the quantity and type of material spilled, the timing and location of the spill, the counter-measures employed, and other factors.

## 6.3 Commercial Fisheries

Potential interactions are shown in Table 5-1. Several aspects of the Facility have the potential to interact with commercial fisheries: (1) installation and operation of the process effluent pipe, (2) installation and operation of the sewage effluent pipe (if applicable), and (3) project-associated ship traffic. All of these interactions, if they occur at all, are expected to be very small compared to the scale of the fisheries.

### 6.3.1 Existing Conditions

Since the cod moratorium in 1993, snow crab, winter flounder, lumpfish, and American lobster have been the most important species for local fishers operating out of Fox Harbour and Ship Harbour (Canning and Pitt 1997). For the most part, winter flounder and lumpfish are caught in shallow water gillnets, flounder mostly in 15 m and lumpfish within 55 m, lobster in shallow traps (up to about 30 m depth), and crab in pots set at about 180 m depth. Herring may also be caught near Argentia as an important bait fish. Lobster is probably the primary species of concern as they are fished in shallow water of Argentia Harbour (Canning and Pitt 1997). Flounder may be of some concern because of their close association with the sediments if they are fished in the harbour.

### 6.3.2 Effects of Construction

There is some potential for interaction between the fisheries and installation of the process and sewer effluent pipes. This interaction could be in the form of short-term physical displacement of the fish or the fishers. The interaction, if it occurs, would likely be with lobster fishers who may place their pots in shallow water in the harbour in spring. Because most of the fisheries occur outside the harbour and because any potential conflicts can be eliminated by coordination with fishers in terms of timing, any potential effect between construction activities and the fisheries has been rated as negligible.

### 6.3.3 Effects of Operations

There is some potential for interaction between the fisheries and operation of the process and sewer effluent pipes. The interaction, if it occurs, would likely be with lobster fishers who may place their pots in shallow water in the harbour in spring. Lobster are mobile and live over rocky substrates and are less likely to bioaccumulate metals than some other species such as deposit-feeding infauna (see above).

The effluent will be small in amount but more or less continuous over the two or three years of operation, the effects on fish and fish habitat were judged to be of low magnitude, small geographic extent (probably less than 1 $km^2$) and medium duration (i.e., two years). Any effects will diminish with time and be ultimately reversible. The present sediment environment has been impacted by previous activities and the site cannot be considered pristine. Any effects were considered not significant in light of likely magnitude, geographic extent, and duration determinations, and thus any effect on the fishery from effects on fish and fish habitat would not exceed this rating. As stated previously, effluent will not exceed the effluent regulations, and biota will be monitored for metals. In the unlikely event that metals in fisheries species (with lobster being the most likely candidate from a fishery perspective) were exceeded and these were attributable to the Facility, then the fishery would be compensated for any closures that were shown to be a direct result of actions related to the demonstration plant.

There are well over 200,000 vessel movements per year in Placentia Bay, mostly fishing boats; in 1996, 45 different vessels utilized Argentia Harbour (Canning and Pitt 1997). During October 2001 to October 2002 there were 185 vessel trips into the Argentia Harbour (north side) (A. McMillan, pers. comm.). There is regular traffic associated with the Marine Atlantic Ferry and with container traffic (EIMSKIP). The Facility traffic of a limited number of shipments per year will constitute a negligible amount of total traffic. Any effect on the fishery will be negligible.

### 6.3.4 Effects of Decommissioning

The Facility will be decommissioned according to government regulations in place at the time and thus any effects on the fisheries should be within acceptable levels.

## 6.4 Sea-associated Birds

As discussed in Section 4.0, a variety of nearshore raptors, marine birds and migratory birds may occur within the Regional Study Area. Of these, at least 45 of these could occur at various seasons within the Potential Effects Area of Argentia Harbour (see Table 4-1). The only species that might be present year-round include the Common Loon, Canada Goose, Red-breasted Merganser, Bald Eagle, Great Black-backed Gull, Black-legged Kittiwake and, and Black Guillemot. All of these could feed to varying degrees in the harbour.

### 6.4.1 Effects of Construction

Construction activity will have little interaction with sea-associated birds. The installation of the outflow pipes may cause some very small disturbance or displacement of birds in the immediate area. This is considered a negligible effect.

### 6.4.2 Effects of Operations

Operational activities will also have very little potential to interact with sea-associated birds. The only potential for effect other than incidental disturbance from a ship passage would be if a bird eats some metal-contaminated food. Any effect would be subject to many variables such as the bird's previous contaminant load, present health, amount ingested, time spent feeding in the area, the amount of time eating contaminated food, and so forth. The potential for fish and fish habitat (the major source of food for sea-associated birds) to become contaminated is low (see Section 6.2.3) and will be monitored during the life of the Facility.

If birds are drawn to the settling ponds, there are very effective deterrent measures that would reduce this effect to 'no effect.'

### 6.4.3 Accidental Events

Accidental events could affect seabirds if certain materials such as fuel impacted a shoreline or entered a waterbody. As stated previously, all handling, storage and transporting of dangerous materials will be with small amounts where feasible, kept away from waterbodies as much as possible, stored in lined or dyked areas according to government regulations and strict protocols within the VBNC EMS. Emergency plans and trained personnel will be available to deal with any potential mishap.

Any accidents are predicted to be small scale and thus not significant.

### 6.4.4 Cumulative Effects

At present, probably the largest effect on sea-associated birds in Placentia Bay is from illegal dumping of oily bilges. All ships utilized by VBNC will be required to follow all applicable international and Canadian regulations and will not dump oil bilges at sea. Thus, there will be no cumulative effect from that.

VBNC personnel will not hunt on site or in the harbour and there will be no other mortality associated with the Facility and thus there will be no cumulative effect from the Facility.

## 6.5 Marine Mammals

Marine mammals are always of concern with any project that may impinge on the marine environment because of the rare and endangered status of some species and because of their high public profile. There are no marine mammals resident in the Potential Effects Area (PEA) and none are known to feed on benthic fauna in the PEA. While there is some potential for interaction with the Facility from ship traffic or from ingesting contaminated food, any interactions will be so limited in magnitude, geographic extent and duration as to be determined not significant.

## 6.6 Socio-economics Assessment

The Facility has the potential to impact the existing socio-economic environment through the take-up of associated employment opportunities, the procurement and transportation of goods and services, and the contribution of taxes at the three levels of government. Several assumptions are made with respect to these three areas in order to arrive at a "most likely" scenario for project impacts. These assumptions include:

- that local firms will be involved in the construction (subject to a competitive bidding process)
- that there will be a high degree of commuting to work enhanced by the improved road network on the Avalon Peninsula (already noted in previous studies)

- that the expected life of the Facility could influence the willingness of people to invest in either new homes or businesses. Persons currently with jobs who have then deferred intention to invest may now begin to do so at an increased level and this in turn may trigger certain commercial investment decisions.

Given the small size of the Project, a significant impact is defined as one that causes some noticeable, either directly measurable or not measurable, change in the existing socio-economic environment. It should be noted that no negative impacts have been detected.

### 6.6.1 Economy and Business

The provincial economy will benefit from the Project through expected increases in GDP, taxation revenue, consumer spending and reductions in Social Assistance payments. Given the numbers employed, these benefits are not expected to be significant at the provincial level.

It is expected that much of the revenue associated with the Facility will be captured within the Avalon Region. Businesses will benefit from supplying goods and services to the Facility while retail outlets and services will benefit from increased demand. Given the relative scale of the Facility, the impacts will be small but positive.

The economy of the Argentia Region will be impacted more than the other regions by the Facility. While new businesses may not set up, existing businesses will benefit if they can supply goods and services to the Facility. Increased consumer spending in the region will have a positive impact on local businesses. Given the recent history of local business closures, the Facility is expected to have a stabilizing influence on the region.

### 6.6.2 Employment and Income

The impact of the Facility on employment levels at the provincial level will be positive but insignificant.

In the Avalon Region, the impact will be positive and combined with the impact of other developments, including tourism, the harbour clean-up, and offshore oil and gas, could lead to a significant drop in unemployment levels. It is expected that the Avalon Region may capture more of the jobs from the Facility during the Initial Operations Phase as the workforce changes from construction jobs to technical, engineering and scientific ones.

In the Argentia Region, depending on how many local people get jobs on the Facility, the impact could be significant and positive. In addition, there will be positive impacts during both phases of the Project caused by multiplier effects. With a multiplier of 1.4 for indirect effects and 1.3 for induced effects (Data provided by Newfoundland Statistics Agency for construction of non-residential buildings), a 150 construction related jobs could create an additional 123 jobs. There would also be indirect and induced effects during the operations phase.

The impact of the Facility on average wage levels in the Province and in the Avalon Region will be positive but insignificant.

In the Argentia Region the Facility could have a significant positive impact on average income levels particularly if multiplier effects discussed above are realized locally.

Cumulative Impacts: During both the Construction and Initial Operations Phases of the Project there could be cumulative positive impacts on the Argentia and Avalon regions should other employment opportunities be created there. The proposed call centre which may employ up to 300 people and other new businesses which may set up in the Argentia industrial park could collectively lead to a drop in the local unemployment rate. This is unlikely to lead to a shortage of labour; large businesses which have operated in the region have never had difficulty finding a labour supply and the situation is not likely to be any different this time.

### 6.6.3 Education

At the most minimal level of impact, the Facility may help maintain the viability of schools in the Argentia Region by retaining people with school age children in the local communities or attracting new ones to move in. This would be a positive impact.

The College of the North Atlantic will experience a positive impact as training programs are expanded or developed to meet the needs of the Facility. This will be reflected in hiring more staff or increased hours for existing staff.

### 6.6.4 Public, Commercial and Industrial Infrastructure and Services

Demands for services by the Facility are not expected to outweigh the capacity of local systems to supply these services.

### 6.6.5 Residual Impacts

Residual impacts are summarized in Table 6-1.

Table 6-1. Significance of Socio-economic Impacts.

| VEC | Phase | Argentia Region | Avalon Region | Province |
|---|---|---|---|---|
| Economy and Business | Construction | Significant (Positive) | Significant (Positive) | Insignificant (Positive) |
| | Operations | Significant (Positive) | Insignificant (Positive) | Insignificant (Positive) |
| Employment and Income | Construction | Significant (Positive) | Insignificant (Positive) | Insignificant (Positive) |
| | Operations | Significant (Positive) | Insignificant (Positive) | Insignificant (Positive) |
| Infrastructure and Services | Construction | Negligible | No impact | No impact |
| | Operations | Negligible | No impact | No impact |

## 6.7 Accidental Releases of Contaminants

Accidental releases of contaminants could include varying amounts of gases or liquids that will be stored on site. The gases of most concern are chlorine and hydrogen sulphide both of which are toxic to people and biota. The liquids of most concern are diesel fuel, two types of acid, organics and a small amount of caustic soda. All are common industrial chemicals for which precautions and methodology for packaging, transportation, storage, use and clean-up are well known and regulated.

The probability of releases of toxic substances will be very low because of the attention that will be paid by VBNC because of both human and environmental health concerns. The following general precautions will be strictly observed.

Amounts to be transported to site and stored on site will be minimized. Only a maximum of about four weeks' supply will be kept on site and only small amounts will be transported to site in any one shipment.

Gases will be containerized in such a manner as to minimize the amount that could be released during any one uncontrolled event.

All liquids hazardous to the environment will be stored in certified containers within containment facilities or dykes designed to handle a minimum of 110% of the volume of the largest tank.

All transportation, handling and storage of hazardous substances will be conducted according to current government regulations and VBNC health and safety polices and procedures.

VBNC will have environmental protection and contingency plans, and an on-site emergency response team for managing accidental events. Also, it should be noted that the Argentia area has very strong emergency response capability because of their past and present activities.

Any accidental releases to the environment from the Facility will be low in probability, small in size and quickly controlled. As a result, the frequency will be very low, magnitude will be low, the geographic extent small, and the duration will be short. Any effects from accidental releases on terrestrial or aquatic environments will be reversible, other than at the individual level, after cleanup, and the effects will be not significant.

## 6.8 Cumulative Effects

This EA has considered cumulative effects within the Project within the effects predictions. The effects assessment, in an integrated manner, has considered effects within the Project that could be additive or multiplicative, and these considerations have been included in the significance ratings (summarized below under 'Residual Effects'). All biophysical effects were rated no greater than low magnitude, short duration, and small geographic extent, and thus not significant. All socio-economic effects were rated negligible to positively significant.

Cumulative effects (biophysical) considered outside the Project included consideration of other industries and activities, specifically:

- Commercial fisheries
- Waterfowl and turr hunting
- Marine transportation (e.g., ferry, tankers, and container shipping)

Interactions with the fisheries, if they occur, would likely be with a small lobster fishery that occurs within the harbour. These interactions (disturbance by one or two ship passages per year; potential contamination from outfalls) were all rated as negligible and thus will not add to any cumulative effects on the lobster populations or the fishery.

There are large numbers of turrs and waterfowl killed during the annual bird hunting season. Little, if any, of this hunting occurs in the Project Area or Argentia Harbour (the Potential Effects Area). As VBNC and its workers will not contribute to any bird mortality at or near the site, there will be no cumulative impact on bird mortality. Sublethal effects are possible if any waterfowl or nearshore seabirds happen to feed on contaminated biota (e.g., eiders commonly feed on blue mussels) originating from the Facility or other past or present industrial activities in the harbour. As discussed in Section 6.2.3, contamination of biota from the Facility is very unlikely with the possible exception of small numbers of infaunal benthos in the immediate vicinity of the outlet pipe. The VBNC marine monitoring program will test this prediction. Any effects would likely be limited to a small proportion of the population; furthermore, none of the benthic feeding birds are resident in the harbour and thus do not conduct all of their feeding there. Again any cumulative sublethal effects on nearshore migratory bird populations would be negligible.

There will be very little potential for marine transportation associated with the Facility to interact with the local VECs as there will only be one or two ship arrivals per year into Argentia Harbour. The harbour routinely receives hundreds of boat and ship passages per year and thus Project-associated vessels would increase this activity by a negligible amount.

## 6.9 Residual Effects

It was determined during the scoping exercise that the marine environment would be the most likely avenue of any environmental effects from the construction and operation of the Facility at Argentia. Effects on air quality will be minimal because of the focus on the evaluation of technologies which are largely waterborne. Effects on the terrestrial environment are possible but unlikely given that the area is a previously impacted brownfield site and that all construction will be conducted by qualified contractors conforming to all government building codes and environmental permits. VBNC will require contractors to operate within their Environmental Management System (see Section 7.0). There is potential for interactions between the Facility and activities in respect to fish and fish habitat, the fishery, nearshore sea-associated birds (including migratory birds), and marine mammals. All of these potential interactions were analysed and the following determinations were made.

- Fish and fish habitat – negligible to low magnitude, not significant effects
- Commercial fishery – negligible effects
- Nearshore sea-associated birds (including migratory birds) – negligible to low magnitude, not significant effects
- Marine mammals – negligible effects and little chance for interaction
- Socio-economic factors – negligible negative impacts and several positive significant impacts

## 6.10 Significance of Effects

The significance of potential biophysical effects on VECs is summarized in Table 6-2.

Table 6-2. Significance of Effects.

| VEC | Phase | Prediction |
|---|---|---|
| Fish and Fish Habitat | Construction | Not significant |
| | Initial Operations | Not significant |
| Commercial Fishery | Construction | Not significant |
| | Initial Operations | Not significant |
| Marine and Migratory Birds | Construction | Not significant |
| | Initial Operations | Not significant |
| Marine Mammals | Construction | Not significant |
| | Initial Operations | Not significant |

The only significant effects predicted in this EA were positive effects on economy and business, and employment and income.

## 6.11 Follow-up and Monitoring

Compliance monitoring (a.k.a. 'end of pipe') will be conducted as required for any regulated discharges. In addition, VBNC will also continue the Marine Environmental Baseline/Environmental Effects Monitoring Program that already has amassed four years of data. Potential contaminants will be monitored in sediments and key biota (e.g., mussels, lobster, and flounder).

Continuing and regular communication with local communities and stakeholders, including local fishers, will be conducted to identify and correct any potential conflicts or developing problems.

# 7.0 VBNC Environmental Management System

## 7.1 The Company's Environment and Safety Policy

VBNC has pledged to develop the Facility in a manner that is sensitive to the natural and human environment. The Company will use cost-effective best management practices and recognized standards in engineering and environmental management. VBNC plans to reduce impacts on the environment and provide a safe workplace. This plan will affect all phases of the Facility from design through to the end of the useful operating life.

## 7.2 The EM System

The role of the Environmental Management System (EMS) is to ensure that environmental effects are identified and managed effectively. These effects would include such items as health, safety, public awareness, and emergency response. The EMS sets out VBNC's policies, requirements and administrative procedures. It is made up of five parts:

- commitment;
- Environmental Management Plan (EMP);
- implementation and operation;
- future monitoring and compliance; and
- management review.

One of the first policy statements issued by VBNC was its Environmental, Health and Safety Policy. This policy states the commitment of VBNC on these issues. It states:

> *VBNC endorses the principle of sustainable development. It is recognized that sustainable development includes commitments to health, safety and the environment through a balanced approach to economic, technical and social issues. Accordingly, this Policy is intended to set forth VBNC's ongoing commitment to health, safety and the environment.*
>
> *VBNC will assess, plan, construct, operate and decommission all projects and facilities in compliance with all applicable legislation. We will seek not only to meet but, when possible, surpass standards set by applicable legislation through the diligent application of technically proven and economically feasible measures.*

The EMS will also include an Environmental Management Plan (EMP). The EMP will cover all phases of the Facility from design to closure. It sets out the tasks that VBNC must undertake to implement the EMS. This plan reflects the commitment of VBNC towards such issues as education, training and communication. Another role of the EMP is to ensure that negative impacts on nearby communities are minimized. It also provides for the protection of the natural environment. The implementation and operation part of the EMS sets out the steps to ensure the plan works. It includes such items as:

- who is responsible for what activities;
- what needs to be done to make sure the plan is always up to date;
- how to let the public know of issues that involve them; and
- periodic testing to make sure the plan works.

The future monitoring and compliance part of the EMS provides a way of tracking the plans performance. This will include testing of such things as gas emissions and wastewater from the Facility. Among the items to be monitored are air, water, fish, plants, animals and health. Monitoring will be done at all stages of the Project.

The management review portion of the EMS will ensure that the plan is updated to continuously improve performance. This review will be done at regular time intervals. It will also make sure that changes in the plant are reflected in documents such as safety procedures, control measures and response plans. Updating will be necessary throughout the life of the Project.

## 7.3 Environmental Protection Plans

The Environmental Protection Plans (EPPs) are documents which give detailed steps to avoid or minimize negative impacts through all phases of the Project. The EPPs will address potential impacts on VECs for construction and operations phases. They will include detailed procedures to prevent these impacts and reduce their effect should they occur. An example of a specific plan during construction would be steps to prevent siltation of the harbour during installation of the effluent pipe.

## 7.4 Emergency Response

VBNC will prepare an ERP to set out policies and procedures to for all operations associated with the Project. Operations will include such things as the transportation and handling of materials as well as the operation of the facility. This plan will be developed based on existing plans from other smelter and refinery operations owned by Inco. It will address unplanned events or accidents. It will also deal with hazards identified during the design of the plant. Some items that will be included in the emergency plan are:

- person to call in case of an emergency and alternates if applicable;
- the steps to take to reduce the time of the event and its impact;
- roles of the persons to be involved;
- means of communication (such as telephones and radios) and 24-hour contact numbers;
- type of protective equipment to be used;
- plans to protect surrounding communities;
- safe assembly areas; and
- evacuation plans.

## 7.5 Health and Safety Plan

VBNC will prepare and implement a comprehensive Health and Safety Plan for all phases of the Project in accordance with the ***Occupational Health and Safety Act***.

# 8.0 Summary of Residual Effects

This EA identified potential interactions between the Facility and selected VECs. After analyzing the Facility Construction and Operation Phases and facilities considering all generic and project-specific mitigations, it was determined that the proposed Facility at Argentia will bring important social and economic benefit to the Argentia area and to the Province as a whole. While the Project may have some effects on the marine environment such as a small increase in metal levels in sediments within close proximity to the outfall, the residual effects were all deemed to be not significant. Environmental effects monitoring will be conducted in order to confirm the predictions. Decommissioning will not create significant effects on the environment as it will be conducted according to government regulations in place at the time.

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# Appendix A - Table 1. Legislation Relevant to the Project

Appendix A Table 1. Legislation Relevant to the Project.

| Administering Department | Legislation |
|---|---|
| **Government of Newfoundland and Labrador** | |
| Environment | Environment Protection Act<br>Water Resources Act |
| Labour | Occupational Health and Safety Act<br>Pesticides Control Act<br>Radiation Health and Safety Act |
| Forest Resources and Agrifoods | Forestry Act<br>Wildlife Act |
| Government Services and Lands | Boiler, Pressure Vessel and Compressed Gas Act<br>Buildings Accessibility Act<br>Corporations Act<br>Crown Lands Act<br>Dangerous Goods Transportation Act<br>Elevators Act<br>Food and Drug Act<br>Lands Act<br>Public Health Act<br>Urban and Rural Planning Act<br>Waste Material Disposal Act<br>Well Drilling Act<br>Smoke Free Environment Act<br>Tobacco Control Act |
| Industry, Trade and Technology | Industries Act |
| Mines and Energy | Quarry Materials Act<br>Mineral |
| Municipal and Provincial Affairs | Municipalities Act |
| Tourism, Culture and Recreation | Historic Resources Act |
| **Government of Canada** | |
| Environment Canada | The Canadian Environmental Assessment Act<br>The Canadian Environmental Protection Act |
| Fisheries and Oceans Canada | Fisheries Act<br>The Navigable Waters Protection Act |
| Transportation Canada | The Transportation of Dangerous Goods Act |

| Permit, Approval or Authorization | Activity | Administrator |
|---|---|---|
| **Newfoundland Department of Government Services and Lands** | | |
| Asphalt Plant Operation and Asphalt Plant Certificate of Approval | Paving of Roads On-Site | Operations Division |
| Boiler, Pressure Vessel:<br><br>Contractor's Specifications for Registration of Pressure Piping Systems<br><br>Contractor's License to perform work on pressure piping systems<br><br>Certificate of Inspection<br><br><br><br>Install or Alter a Pressure Piping System (Permit)<br><br><br>Manufacturers' Specifications for all Types of Boilers (Registration)<br><br>Propane Gas Installation Examination for Propane System Installation Cert.<br><br>Certificate of Plant Registration - power, heating, refrigeration, compressed gas or combined plant<br><br><br>Boiler Pressure Vessel Fittings Fabricated in Newfoundland Statutory Declaration for Registration<br><br>Liquid Propane Gas Plant License is required for storing or distributing propane or operating a gas dispensing unit for filling portable cylinders | <br><br>Piping<br><br><br>Piping<br><br><br>Piping<br><br><br><br>Piping<br><br><br>Operation<br><br><br>Operation<br><br><br>Operation<br><br><br><br>Piping<br><br><br>Operation | <br><br>Engineering Services<br><br>Engineering Services<br><br>Mechanical/ Building Inspections<br><br>Engineering Services<br><br>Engineering Services<br><br>Engineering Services<br><br>Mechanical/ Building Inspections<br><br>Engineering Services<br><br>Engineering Services |
| Building Plans Commercial - Approval under the National Building/Fire/Life Safety Code | Site Buildings | Engineering Services |
| Building Accessibility Design Registration - Public Buildings (Approval) | Site Buildings | Engineering Services/Operations Division |

| Permit, Approval or Authorization | Activity | Administrator |
|---|---|---|
| **Newfoundland Department of Government Services and Lands (con't)** | | |
| Building Accessibility - Exemption Registration | Site Buildings | Engineering Services/Operations Division |
| Crown Lands - Application for Grant Pursuant to Lease/Permit to Occupy Crown Land | Water Supply | Customer Services |
| Develop Land:<br><br>Application to Construct Extension or Accessory Buildings alongside all Protected Roads or Development Control Areas in the Province<br><br>Protected Road Zoning and Development Control Regulations:<br><br>Primary Application to Develop Land | <br><br>Water Supply Pumphouse<br><br><br><br>Water Transmission Line | <br><br>Operations Division<br><br><br><br>Customer Services |
| Building Specifications are required for a Permit to Develop | Pumphouse | Customer Services |
| Electrical:<br><br>Electrical Contractor's Registration Certificate - is required to obtain Electrical Permit<br><br>Electrical Permit - Permit to Install or Repair Electrical Equipment or Inspection Work | <br><br>Electrical Work<br><br>Electrical Work | <br><br>Engineering Services<br><br>Customer Services/Operations |
| Electrical continued:<br><br>Electrical Maintenance Permit - Approval is required to maintain a building's electrical system | <br><br>Operations | <br><br>Mechanical/ Buildings Inspections |
| Elevators:<br><br>Approval is required for drawings and specifications before installation of, or major alterations to, an elevator | <br><br>Hydromet Facility | <br><br>Engineering Services |

| Permit, Approval or Authorization | Activity | Administrator |
|---|---|---|
| **Newfoundland Department of Government Services and Lands (con't)** | | |
| Certificate of Inspection | Operations | Mechanical/ Building Inspections |
| Permit to Transport Dangerous Goods | Operations | Manager of Regulation Enforcement |
| Food Establishment License:<br><br>Temporary Facility Permit is required for any individual or group proposing to operate/establish a temporary food operation<br><br>Is required for the sale, production, manufacturing, preparation, storage and/or distribution of food | <br><br>Construction Camp<br><br><br>Construction Camp | <br><br>Operations Division<br><br><br>Operations Division |
| Fuel Storage and Handling:<br><br>(GAP) Regulations - A Certificate of Approval is required for the storage and handling of gasoline and associated products (underground or above ground)<br><br>Temporary Storage Remote Locations | <br><br>Operations<br><br><br>Water Supply/Construction Camp | <br><br>Operations Division<br><br><br>Operations Division |
| Fuel Storage and Handling cont'd.<br><br>A permit is required for flammable and combustible liquid Storage and for dispensing (above or below ground) and for bulk storage (above ground only) under the Fire Prevention Act | <br><br>Hydromet Facility | <br><br>Operations Division |
| Sewage Treatment System Commercial - Certificate of Approval forc systems > 4,500 L per day - in an unserviced area and not covered under a Municipality | Hydromet Facility Construction Camp | Engineering Services |

| Permit, Approval or Authorization | Activity | Administrator |
|---|---|---|
| **Newfoundland Department of Government Services and Lands (con't)** | | |
| Waste Management System, Certificate of Approval | Hydromet Facility Construction Camp | Operations Division |
| **Newfoundland Department of Tourism, Culture and Recreation** | | |
| Archaeological Research Permit - Archaeological investigations on land or under water | Water Supply/Residue Disposal Area | Historic Resources Division |
| **Newfoundland Department of Environment** | | |
| Construction (Site Drainage) Certificate of Approval | Site Work | Water Resources Division |
| Culvert Installation, Certificate of Approval | Site Work | Water Resources Division |
| Dams and Appurtenant Structures, Certificate of Approval | Water Supply | Water Resources Division |
| Industrial Processing Works, Certificate of Approval | Hydromet Facility Operations Control of Air Emissions, Effluent Discharges and Residue Storage | Pollution Prevention Division Water Resources Division |
| Well drilling | Geotechnical investigations | Water Resources Division |
| Water and Sewer Works for private and municipal, Certificate of Environmental Approval | Site Water and Sewer Installation | Pollution Prevention Division |

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| **Newfoundland Department of Environment (con't)** | | |
| Water Resources:<br><br>Water Course Alterations, Certificate of Environmental Approval to Alter a Body of Water<br><br>Water Course Crossings, Certificate of Environmental Approval<br><br>General Application for Water Use Authorization - for all beneficial uses of water from any source | Water Supply<br><br>Water Supply<br><br>Water Supply | Water Resources Division<br><br>Water Resources Division<br><br>Water Resources Division |
| **Newfoundland Department of Forest Resources and Agrifoods** | | |
| Operating Permit - Fire Season - Crown or private land for a company or individual to operate during a forest fire season | Water Supply/Residue Disposal | Newfoundland Forest Service |
| Permit to Cut Crown Timber - A permit is required for commercial or domestic cutting on Crown Land | Water Supply/Residue Disposal | Newfoundland Forest Service |
| Permit to Burn | Water Supply/Residue Disposal | Fire Protection Specialist |
| Sod Cutting Permit | Final Site work | Soil and Land Management Division |
| **Newfoundland Department of Mines and Energy** | | |
| Quarry Development Permit -<br>Exploration Permit for Geotechnical Drilling | Site Work/ Residue Disposal Area | Mineral Lands Division |
| **Newfoundland Department of Labour** | | |
| Smoking in the work place | All work | Occupational Health and Safety Division |

| Newfoundland Department of Labour (con't) | | |
|---|---|---|
| Blaster's Safety Certificate | Water/ Residue Pipelines & Dams | Workplace Safety Programs Division |
| Health & Safety Program | Hydromet Facility Construction and Operations | Occupational Health and Safety Division |
| **Fisheries and Oceans Canada** | | |
| Fish Habitat, Authorization for Works or Undertakings Affecting Fish Habitat (HADD) | Water Supply and Transmission Main Residue Disposal Effluent | Area Habitat Co-ordinator |
| Application for Construction within Navigable Waters | Hydromet Facility | Canadian Coast Guard |
| Application for Water Lease | Hydromet Facility | Canadian Coast Guard |
| Vessel Safety Inspection Certificate | Hydromet Facility | Canadian Coast Guard |
| **Other Federal Departments** | | |
| Approval for Vessel Admission | Hydromet Facility /Operations | Canada Customs and National Revenue |
| Magazine License, Temporary | Water Supply and Transmission Main | Mines and Energy Canada, Regional Explosives Inspector |

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|---|---|---|
| **Municipal** | | |
| Approval for Waste Disposal | Hydromet Facility Operations | Town/ Community Council |
| Construction/Development Permit | Hydromet Facility | Town Clerk |
| **Environmental Assessment Legislation** | | |
| Environmental Assessment Regulations | Hydromet Demonstration Project | Newfoundland Minister of Environment |
| CEAA | Hydromet Demonstration Project | Federal Minister of Environment |