REGISTRATION DOCUMENT
by
Nova Scotia Power, Inc.
in support of
REGISTRATION of TUFTS COVE 5
under the N.S. Environmental Act

April 6, 2004

April 6, 2004

Chris Daly
Nova Scotia Environment & Labour
5151 Terminal Road, 5th Floor
P O. Box 697
Halifax, Nova Scotia
B3J 2T8

Dear Mr. Daly

I am writing to formally Register the Tufts Cove #5 Generating Station project as a Class 1 Registration under the Nova Scotia Environment Act. In a letter from the Minister of Environment & Labour, the Honourable Kerry Morash, dated January 8th, 2004 we were informed that the project will be considered an extension of the existing power station at Tufts Cove and designated a Class 1 undertaking. We have carried out significant consultation for this project including two technical conferences and stakeholder commentary via the Utility and Review Board review of the project.

We now formally Register the project. I have provided the following consistent with the regulatory requirements:

- 30 copies of the covering letter, Registration form and supporting report
- A cheque to cover the $8946 registration fee
- A CD with a pdf copy of the submission

We will be advertising in a local and provincial paper within 7 days of Registration to give public notice of the registration and we will provide formal proof of the advertisement. In addition, two sites have been selected and approved by you for public viewing of the registration materials.

If you have any further questions or requirements regarding this project please contact me at your convenience.

Yours truly

Terry Toner
Senior Manager – Environment

REGISTRATION
in accordance with
Environmental Assessment Regulations
of
Nova Scotia Environment Act

Name of Undertaking:	Addition of 47.3 MW gas-fired Combustion Turbine Station to existing Tufts Cove Generating Station (TUC 5)
Location of Undertaking:	Tufts Cove Generating Station, Dartmouth, Nova Scotia
Proponent:	Nova Scotia Power Incorporated (NSPI) P. O. Box 910 Halifax, N.S., B3J 2W5 Chief Operating Officer – Ralph Tedesco General Manager, Power Production - James Taylor Contact Person - Terry Toner, Sr. Manager - Environment
Nature of Undertaking:	NSPI will build a 47.3 MW simple cycle combustion turbine plant on the existing Tufts Cove G.S. site. The plant will consist of the turbine/generator, accompanying control systems, an 80-foot stack, and required gas connections. The plant will make use of existing onsite infrastructure including water supply, wastewater treatment, plant amenities and transmission corridor.
Purpose of Undertaking:	The project is being constructed to meet the electricity needs of the province (including capacity) and to provide additional flexibility of operation.
Construction Schedule:	The project would be built with the following general dates: Start Construction – May 2004 Commission CT - August 2004 Begin Operation – Winter 2004/2005
Operation Schedule:	The units would begin operation as soon as construction and commissioning are complete. Operation will be variable but could be any time of the day or night.

Undertaking Description: Information in document entitled: “ Registration Document by Nova Scotia Power Incorporated in support of Registration of Tufts Cove 5 under the N. S. Environment Act

Required Approvals:

- Approval & Release from NS Environmental Assessment Process
- Construction Approval from NSL
- Amendment to Tufts Cove Industrial Operating Approval, N S Environment Act
- Fire Code, Fire Marshall

Public Funding: There is no public funding for this project.

“ Registration Document

by Nova Scotia Power Incorporated

in support of

Registration of Tufts Cove 5

under the N. S. Environment Act

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1 INTRODUCTION

Nova Scotia Power Incorporated (NSPI) is proposing to add a 47.3 MW Combustion Turbine Unit (Tufts Cove 5) to the existing Tufts Cove Generating Station in Dartmouth. The new Unit will burn natural gas.

In addition, NSPI has received confirmation from the Nova Scotia Minister of Environment and Labour that the proposed project will be reviewed under the N. S. Environment Act as a Class 1 project.

NSPI has Registered the project on April 6**,** 2004. This Report presents the detailed project description and environmental information supporting that Registration.

Section 2, *Project Description*, reviews the purpose and need for the project, outlines the environmental setting, describes the major components of the undertaking and presents basic schedule information.

Section 3, *Environmental Process*, describes the environmental process steps being followed by the project and summarizes public consultation activities, including issues raised and the associated response, as appropriate.

Section 4, *Environmental Issues*, presents more-detailed information outlining the key environmental issues associated with the project, describes the environmental study work carried out for the project, and summarizes the actions being taken to address any potential adverse effects.

Section 5 will summarize *Monitoring* for the station, including modifications for this project.

Section 6, *Synthesis*, summarizes the key environmental components of the project (including any proposed mitigation) and confirms the overall positive nature of this proposed undertaking.

2 PROJECT DESCRIPTION

2.1 Purpose and Nature of the Project

Figure 1 shows the location proposed for the 47.3 MW Combustion Turbine (CT) and its relationship to the existing four units, Tufts Cove 1 (100 MW), Tufts Cove 2 (100 MW), Tufts Cove 3 (150 MW) and Tufts Cove 4 (47.3 MW). The proposed Tufts Cove 5 project, which adds a second gas-fired unit with superior energy performance[1] to the three legacy units, will provide a more efficient means to produce electricity using some of the natural gas already available for potential use at the Generating Station. The Unit will add much needed peaking capacity to address the large electricity peaks seen this past winter. It will also provide additional flexibility for NSPI to meet the day-to-day electricity needs of Nova Scotians, while improving the overall environmental performance at the station. The proposed project will allow better cost management, which will help to ensure stable pricing for electricity customers. With the addition of this second combustion turbine unit, there now exists the possibility of subsequently adding a Heat Recovery Steam Generator (HRSG) at relatively low cost to create a combined cycle plant on this site. Such a combination would take advantage of increased energy efficiency and would represent a reasonable step for NSPI in its approach to addressing climate change emission reduction targets. Any such addition would be subject to requirements of the Utility and Review Board regarding competitive bid for new capacity.

The improved efficiency of use of natural gas in Tufts Cove 5 (TUC 5) will be consistent with the objectives outlined in the Nova Scotia Energy Strategy.

The Tufts Cove location was chosen because the gas infrastructure is already in place, and the site is close to a major customer load centre, with an existing network of transmission lines. This site also allows for use of other existing infrastructure, including water supplies, wastewater treatment, and plant amenities. A similar rationale was used in the siting of TUC 4. With the potential of developing a gas fired, combined cycle, high efficiency station, the advantages of installing this next unit at Tufts Cove are further enhanced.

Tufts Cove 5, like Tufts Cove 4, is being constructed for simple cycle operation at this time, but with the potential advantages outlined above, there is a real possibility of adding the HRSG in the near future (subject to regulatory and environmental approvals). As noted in the Registration Document for TUC 4, it is the practice for smaller power systems to reach a Combined Cycle operation in stages, increasing capacity as needed by system demand, until the capacity is large enough to support the added infrastructure to provide the Combined Cycle operation.

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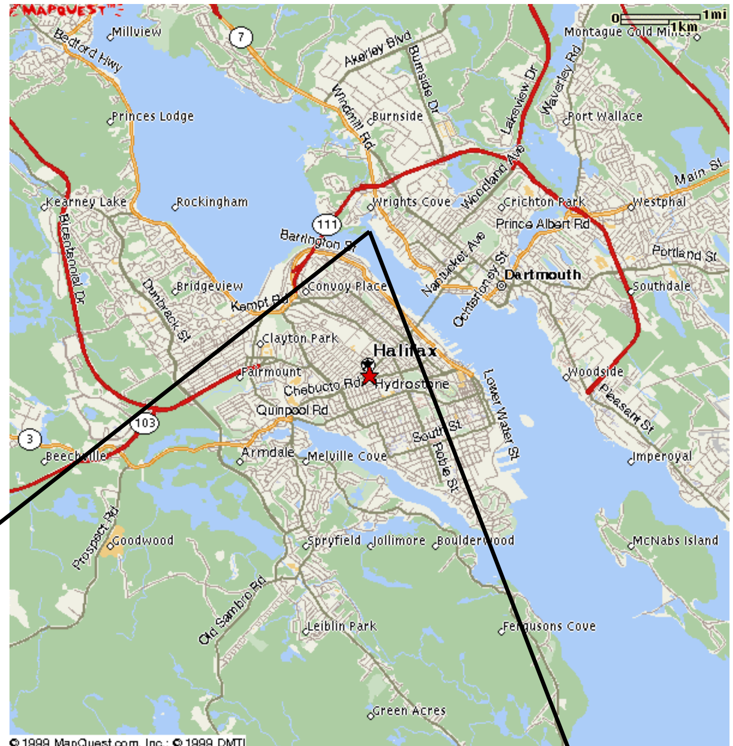
[1] The CT will have a lower Heat Rate than Tufts Cove 1-3. That is, it requires a smaller amount of thermal energy (input) to produce a unit of electrical energy (output). This can also be expressed as a higher efficiency.

Figure 1: Sketch of Tufts Cove Generating Station – showing existing and proposed Combustion Turbine units. TUC 5 is the rightmost of the two smaller units next to the powerhouse for Units 1-3 at the Tufts Cove Generating Station.

2.2 Land Use and Project Setting

The existing Tufts Cove Generating Station is located along 1000 m of shoreline in Dartmouth, Nova Scotia, between the two bridges spanning Halifax Harbour (Figure 2). Dating to the 1790s, this site has supported a variety of uses, including a plantation farm, shipping wharves, a rail mill, a barking mill, and a tannery. At one time, this site was the harbour crossing point for two bridges that preceded the construction of the existing Angus L. MacDonald bridge.



map credit: MAPQUEST.com, Inc.

Figure 2: Tufts Cove Generating Station – Dartmouth, N.S.

At the Generating Station, Unit No. 1 was commissioned in 1965, with a dual-fuel capability to burn coal and oil. In 1972, the unit was modified to fire only oil and Unit No. 2 was commissioned. Unit No. 3 was added in 1976. Improvements have continued over the years, including a new docking facility and storage tank in 1976 and 1977, a Magnesium Hydroxide injection system in 1986, a wastewater treatment facility in 1993, an electrostatic precipitator for Unit No. 2 in 1994-5, and, in 1999-2000, a modification to allow the burning of natural gas in TUC 1, 2 and 3. In 2003, TUC 4 was commissioned.

The existing station has nameplate capacity of approximately 397 MW. Units 1 to 3 can be fired on either No. 6 oil (Bunker "C") or natural gas, or any combination of those two fuels. TUC 4 is fired on natural gas only.

When TUC 1 was being constructed, most of the area immediately around the plant was undeveloped, with low density of residential dwellings (Figure 3). Over the past 35 years, the entire area has seen significant change. Today, the station is bounded by CFB Shannon Park to the North, and residential/commercial development to the East and South.

Figure 3: Tufts Cove Generating Station – March 1965

2.3 Description of Major Components of the Proposed Project

Figure 4 shows, by use of cross-hatching, the main components of the proposed project, including a General Electric LM6000 Enhanced SPRINT PC Engine, an air-cooled generator, a water injection module for NO_x control, and a generator/transformer (located in the Transformer Yard shown on the Figure).

The CT will require natural gas to be supplied at higher pressure than for the existing units. The gas pressure will be boosted downstream of the existing Tufts Cove Custody Transfer Station (shown on extreme left of Figure 4) to the pressure required by the LM6000 CT, nominally at 675 +/- 20 psig, by the installation of a motor-driven gas compressor. One compressor was installed for TUC 4. A second compressor will be installed in an expanded building providing some degree of redundancy for security of supply.

The natural gas piping system in the TUC yard was modified for the installation of TUC 4. The TUC 4 system modification provided the opportunity to move natural gas from the Custody Transfer Station to the compressor. The same common line will be used between the Custody Transfer Station and the compressor building. Another common line will leave that building and proceed to the coalescing filter[2] skid, and then via separate lines to the TUC 4 and TUC 5 units.

The Control and Auxiliary Services Building will be expanded (almost doubled). The motor control centre (Electrical room) will be expanded to accommodate the increased requirements. A second separate mechanical auxiliary skid will be constructed. The existing control room will obtain an additional control desk and related gear.

The water treatment facility built for TUC 4 (125 USGPM water treatment train) to provide demineralized water for the Combustion Turbine will be adequate to supply water for both combustion turbines but the capacity factor for the water treatment will obviously increase. Water use will be discussed more extensively later in this report.

General Site Preparation will include a modest amount of excavation to prepare building foundations and installation of any required sedimentation and erosion control measures.

2.4 Construction and Operating Schedules

Subject to UARB approval (already received) and further environmental approvals, the construction of the unit would begin as soon as EA and construction approvals are granted (May, 2004), with completion expected by winter 2004/2005. Since much of the system is delivered to site in pre-assembled components, some of the actual construction is more straightforward than would be normally associated with historical electricity

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[2] Outlet gas from the gas compressor will be filtered and any liquids, like oil mist, or dirt will be removed within a Natural Gas Coalescer system of two units. The Coalescer will be skid mounted and located outside the east wall of the Auxiliary Building.

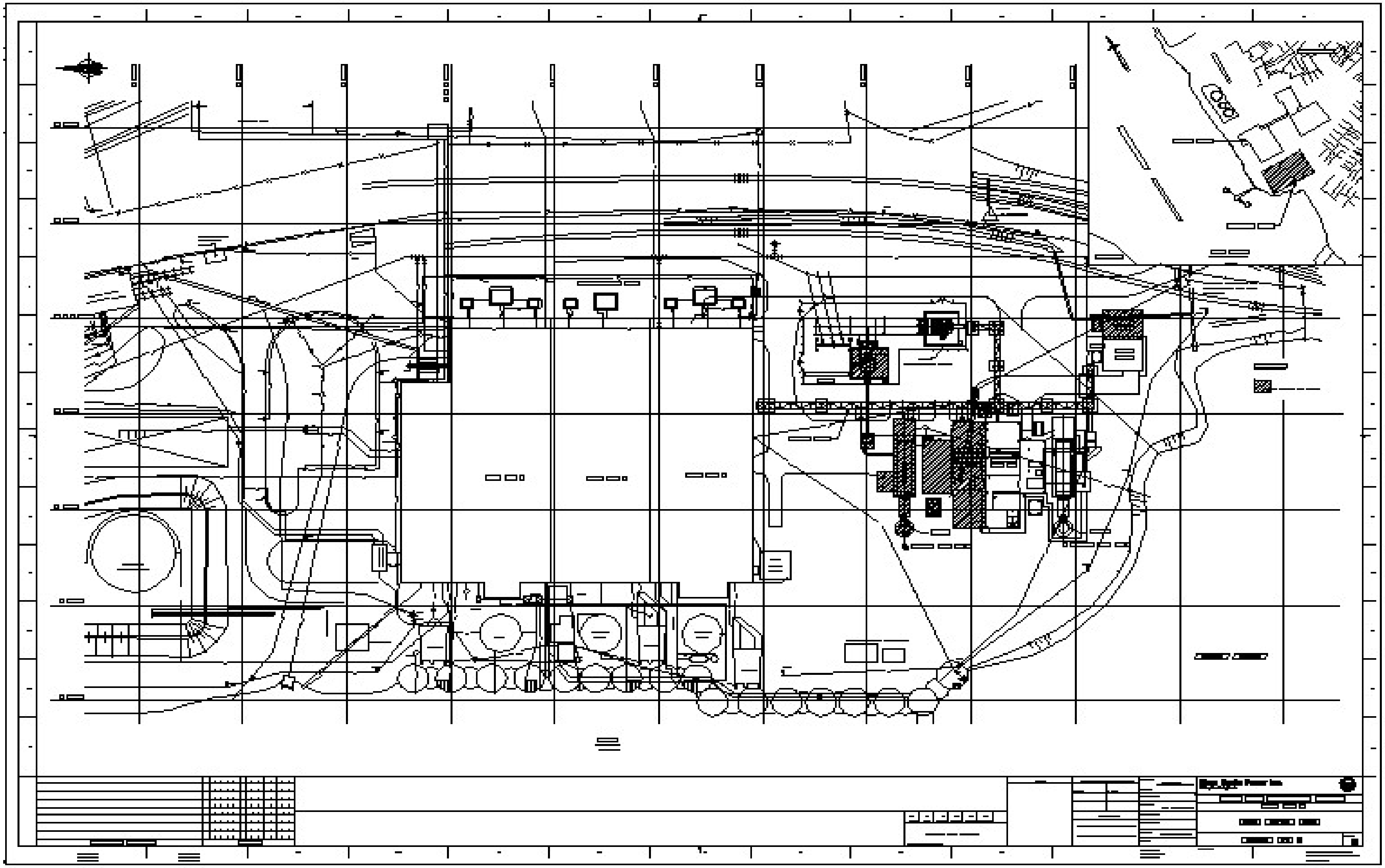

Figure 4: Plan View of Tufts Cove G. S. Showing TUC 5 Components in Hatching.

generation facility construction. However, there is still a need for preparation of building foundations and assembly of other civil structures, and there is considerable effort required for assembly of components and time is being scheduled for the commissioning of each system of the TUC 5 project.

Tufts Cove 5 is planned for use to meet additional capacity needs and is intended to serve as intermediate staging enroute to a combined cycle installation with its inherent efficiency improvement. In the initial years capacity factor will be variable.

A Construction Plan will be submitted for regulatory approval. The Plan will be consistent with the elements of a site-specific Environmental Management Plan, currently under development, and the information that was developed for both the construction planning for TUC 4 and the Environmental Site Assessment being completed for the South Yard at the TUC Generating Station. The Plan will also be consistent with NSPI's standard practices, as well as applicable regulations and guidelines. It will address the requirements for disposal of hazardous and non-hazardous waste from the site, if any; for the recycling and re-use of material where practicable; for prevention of, or clean up, including transportation of materials, and reporting, of environmental releases; for proper vehicle and equipment cleaning, re-fueling and maintenance; and the procedures for managing the excavation of materials, under all circumstances and conditions. The discussion of the adequacy of the Environmental Management Plan will occur with activity required to obtain permits for the actual construction and installation of the LM6000 (TUC 5).

Special attention will be given on an existing industrial site, like the Tufts Cove G.S. represents, to the management of possibly-contaminated areas that might be impacted by construction. Such management is part of standard practice for Nova Scotia Power, and, typically, the company will engage professional expertise to work with the personnel from the company and the regulators to assure that the requirements established for management of impacted materials are met. The contamination that might exist on power plant properties usually occurs as the presence of petroleum hydrocarbons and metals. Work done as part of TUC 4 project has provided information that indicates that there are relatively low levels of hydrocarbon and metals contamination in the South Yard. Standard methods will be used to address any potential contamination of the excavated soil.

2.5 Decommissioning

This proposed Unit will be constructed and operated in a manner that minimizes environmental impacts, thereby facilitating standard decommissioning activities at the end of the operating life. The modular nature of construction and the absence of fuel storage and associated combustion waste management facilities, reduce potential decommissioning activities. In any case, NSPI will carry out future decommissioning in a manner consistent with the standards and requirements of the day.

3 ENVIRONMENTAL PROCESS

3.1 Environmental Approval Process

NSPI inquired about, and received formal confirmation that, this proposed TUC 5 project would be designated as Class 1 for Environmental Assessment (EA) review, on the basis that it is a modification or extension of an existing facility with minimal potential impacts.

NSPI has also had some technical discussions with NSEL representatives, incorporating appropriate information into this registration package to address the main topics of concern.

NSPI registered this proposed project on April 6, 2004. Following a period of notification and public comment, a decision by the Minister of Environment and Labour is required within 25 days.

Subject to EA approval, NSPI will also obtain a construction approval for the project and will then negotiate an amendment to the Industrial Operating Approval for the Tufts Cove Generating Station.

3.2 Public Consultation

NSPI Registered a similar 47 MW combustion turbine unit in November 2002. At that time consultation had included meetings with regulatory and governmental officials, an Open House to provide information to the general public and of course the consultation opportunities included in the formal EA Process. More than 300 people attended the Open House and there were no significant negative concerns identified. The EA and other approvals were obtained and the unit was successfully constructed and commissioned in 2003. Since that time there have been no specific concerns identified from the public regarding the TUC 4 unit, nor were any expected since this type of unit runs very smoothly.

Based on the positive environmental performance of the TUC 4 unit, the lack of concerns expressed by the government and the public since its beginning operation, and aware that a second nearly identical unit was planned for TUC 5, the incremental environmental consultation steps planned for this proposed project were chosen to be more modest than for the first unit.

Over the past year, NSPI has begun a process to regularly engage with public stakeholders on regulatory matters. In addition, in the past year policy and rules governing regulatory approval of new generating capacity have begun to change as we move toward a more competitive process for wholesale generation of electricity. As such NSPI conducted two technical conferences (January 22, 2004 and February 11, 2004) prior to registration to present information on the proposed project to interested parties and to gather comments from those individuals and groups. While some questions were raised regarding this topic, no significant environmental concerns were raised via those meetings. Rather, questions focused on the potential effect of this project on future independent power producer co-generation projects.

The UARB solicited comments from the participants of the Technical Conferences and received 21 submissions. The submissions generally supported the application by NSPI, although we do note that some potential competitors questioned the timing of the projected need. Most comments were consistent with those of the Department of Energy (referred to by the UARB in its decision):

> "NSPI has an ongoing obligation to maintain supply adequacy for firm load, which also includes a 20% planning reserve requirement imposed by the Northeast Power Coordinating Council/North American Electricity Reliability Council... If this obligation cannot be maintained on a forecast basis, then capacity should be added as quickly as possible so that the supply adequacy requirement can continue to be met. In this regard, the Province notes that no other party has indicated that they are currently positioned to have capacity in place for next winter's peak, other than the new wind farm currently under construction in Pubnico, to the extent that its generation may be coincident with winter peaks."

The UARB concluded its review by authorizing NSPI to proceed with the project to ensure reliable service next winter.

Regarding this Environmental Assessment, NSPI is providing information to the elected officials and residents in the immediate area and will continue to liaise on this and other topics as appropriate.

The Class Registration process also provides a formal opportunity for the general public to review registration materials and provide comments to NSEL.

4 ENVIRONMENTAL ISSUES

In discussions with the public and government officials, it can be observed that most people view the construction of TUC 5 to be a "net-positive" project. Nonetheless, there was interest in understanding several topics in a more comprehensive manner. The following subsections provide some additional information regarding air emissions, noise, water use, soil management and some other miscellaneous topics such as archaeology and wildlife species.

4.1 Air Issues

The following subsections provide forecasted information for the worst-case situations for potential emissions to air from the proposed operation of the TUC 5 Unit.

The species likely to be emitted to air from the TUC 5 stack are known, since the combustion of natural gas in similar machines has been well-studied and documented. It can be shown that most substances exit at concentrations that can be eliminated from concern after careful consideration of the extent of possible impact. Essentially, the emissions are extremely low of Carbon Monoxide, Unburned Hydrocarbons, and Sulphur Dioxide from the burning of a non-sour natural gas in Combustion Turbines. Careful analysis showed that further study was necessary to define the potential impact of Nitrogen Oxide emissions from operation of the new CT. The results of these studies indicated that:

- potential changes in Ground-level Concentrations of Nitrogen Oxides (as NO_2) from worst-case operation of TUC 5 are small, compared to both existing background concentrations and levels specified in Nova Scotia's Air Quality regulations, and
- NO_x emissions will meet the existing *Guidelines* for Combustion Turbines.

These points represent the summary of the potential issues of possible concern for air emissions from the proposed Combustion Turbine. The remainder of this Section 4.1 will provide the support for those conclusions.

4.1.1 <u>Air Emissions and Ambient Air Quality</u>

Even before the power boost from an inter-cooling addition (see later), the LM6000 Combustion Turbine ("Gas Turbine") delivers more than 43 MW of electrical power and is advertised as "the most fuel-efficient, simple-cycle gas turbine-generator set in the world[3]." The unit can be operated for baseload power, showing manufacturer's claims of availability >96%. Part of the operating flexibility referenced at the outset of this Report occurs because the unit is further advertised to be capable, without maintenance penalty, to go "from cold steel to full power in 10 minutes."

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3 *LM6000 (Now with SPRINT Power Boost) Gas Turbine Generator Sets*, S&S Energy Products, Houston, TX.

For the TUC 5 installation, NSPI has purchased the power-boosting capability mentioned, above, by adding the SPRay INTer-cooling (SPRINT) option to the basic Combustion Turbine (CT). The LM6000 SPRINT option increases the power output by 9% for ISO[4] conditions. As the ambient temperature rises, the benefit from the SPRINT engine becomes more significant, reaching a 20% boost on days on which the ambient temperature reaches slightly more than 30°C.

The "nameplate" capacity of Tufts Cove Unit No.54 will be 47.3 MW.

Operation of TUC 5 will provide electricity from the high-efficiency combustion of natural gas from Nova Scotian offshore reserves. The natural gas supply contains Sulphur values at approximately 3-4 parts per million (volume) (ppmv) as Hydrogen Sulphide (H_2S) and smaller amounts of Carbonyl Sulphide (COS). On an annual basis, at "full load", this amounts to a total for Sulphur Dioxide (SO_2) emissions of about 1.3 tonnes, from an emission rate of approximately 0.05 g (SO_2)/s during full load operation. Before the addition of the option to burn natural gas at the Tufts Cove Generating Station (TUC G.S.), the SO_2 emission rate would have been 675 g/s or higher. In 2001, the SO_2 emission rate from Tufts Cove Units 1-3 was lower than the historical levels, near 320 g/s, reflecting an increasing use of natural gas. *Because the contribution of SO_2 emissions from TUC 5 to various environmental measures can be shown to be very small, at approximately 0.01% of the Y2001 station emissions, the estimated changes in Ground Level Concentrations of SO_2 will also be negligible. Hence, no modelling was carried out for Sulphur Dioxide as part of the studies for this Report. No mitigation activity would be necessary for SO_2 emissions from TUC 5 operation.*

Following similar analysis, the estimated emissions of Unburned Hydrocarbons from the LM6000 SPRINT at "full load" are about 2 ppmv (dry), producing about 0.1 g/s of emissions. Modern Combustion Turbines operate at high combustion efficiency. *The changes to the Ground Level Concentrations (GLCs) from 0.1 g/s emitted from TUC 5 at the design stack height and conditions are extremely small. Modelling of this level of emissions within an urban environment was not carried out. The marginal change in GLCs from dispersion of this emission rate of Unburned Hydrocarbons, where automotive traffic is prevalent, would be not quantifiable. Hence, there are no modelled results for GLCs of Volatile Hydrocarbons within this Report. No mitigation activity would be necessary for Unburned Hydrocarbons from this proposed installation of TUC 5.*

Among potential air emissions issues, the elimination of concern about Sulphur Dioxide and Unburned Hydrocarbons leaves, for discussion, issues of Climate Change, Particulate Matter, Carbon Monoxide, and Ground-level Ozone. The level of emissions of *primary* Particulate Matter ("soot") from natural gas combustion is small enough that it is not noticeable among the GLCs estimated from other local sources, eliminating the need for

[4] International Standards Organization conditions refer to a reference state of 288 Kelvins for ambient temperature, 60% relative humidity and 101.3 kiloPascals relative pressure.

mitigation of its potential impact. However, a linkage to PM and Ozone exists for TUC 5 because it emits low levels of Nitrogen Oxides (NO_x), which are among the precursors to the formation of secondary Fine Particulate Matter and Ozone, in the atmosphere. Hence, it was deemed necessary to determine the level of contribution of TUC 5 NO_x emissions (as NO_2) to the *existing* GLCs and compare the overall levels to the Air Quality Regulations (Table 1).

Natural gas is a fossil fuel, but the carbon dioxide released per unit of energy production from natural gas is much lower than for oil or coal. Further, the LM6000, in simple-cycle configuration, operates with possibly the highest available efficiency in the industry. For both these reasons – generally higher simple-cycle efficiency of the unit and lower carbon intensity of the fuel – the use of the LM6000 reduces the overall carbon intensity (mass CO_2 per unit energy produced) of emissions from the TUC G.S. and from Nova Scotia Power. To the degree that the LM6000 backs out marginal coal and/or oil use within NSPI's system, there will be further possible reductions in Carbon Dioxide emissions after its installation. Further, as discussed, the addition of the TUC 5 Unit provides the opportunity for further reduction in intensity of Carbon Dioxide emissions from the Tufts Cove Generating Station if the CT units will be operated as a Combined Cycle system.

After completing the engineering and environmental analyses of the performance of the LM6000, emissions of Nitrogen Oxides and Carbon Monoxide (CO) were not obviously eliminated as candidates for air dispersion modelling. Carbon Monoxide is produced at about 0.9 g/s from this unit, and *the modelling of GLCs for this level of emissions in an urban environment would conclude that there would be no significant change to the current background concentrations of CO. Thus, this Report focuses on the possible contribution to local GLCs of estimated NO_x emissions from the LM6000, in the context established by both the total emissions from the Tufts Cove Generating Station and the existing background concentrations surrounding the station.*

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4.1.2 Existing Air Quality – Nitrogen Dioxide

Data obtained[5] for the studies related to the TUC G.S. have been recently discussed with representatives from Nova Scotia Environment and Labour and are still considered to be relevant to this Report. These data indicate that the value over the decade, 1990-2000, for 1-hour Nitrogen Dioxide (NO_2) concentration in ambient air for Downtown Halifax averaged over the annual period is approximately 36 micrograms/cubic metre ($\mu g/m^3$), The annual average for 1-h concentrations at Shearwater over the same period was approximately 15 $\mu g/m^3$. Since the traffic density in the area of Tufts Cove is less than that in Downtown Halifax, but greater than traffic near the Shearwater monitor, a weighted average, biased toward the lower values from Shearwater, was used as representative of the *existing* Nitrogen Dioxide concentration near the Tufts Cove

[5] Pers. Comm. M. P. Hingston to J.D. Cousens by e-mail, 2002 08 18. Annual average 1-h Nitrogen Dioxide Concentrations for Shearwater and Downtown Halifax (1974-2000).

Generating Station. *The value used as "background" for analysis within this Report is estimated to be approximately 21 µg/m³. Table 1 shows that the Air Quality Regulations for N.S., establish the limit for this value to be 100 µg/m³.*

Under the existing Air Quality Regulations for Nova Scotia[6] the following information can be found (Table 1).

Table 1 – Air Quality Regulations
Province of Nova Scotia (partial list)

Air Contaminant	Averaging Period	Concentration (µg/m³)	Concentration (pphm)
Carbon Monoxide (CO)	1 hour 8 hours	34 600 12 700	3000 1100
Hydrogen Sulphide (H_2S)	1 hour 24 hours	42 8	3 0.6
Nitrogen Dioxide (NO_2)	**1 hour Annual**	**400 100**	**21 5**
Ozone (O_3)	1 hour	160	8.2

The context for discussion of ambient air quality is that a Multi-pollutant Emission Reduction Strategy (MERS) is under development as part of the Canada-wide Standard for PM and Ozone[7]. The Strategy will address sectoral approaches for managing air quality issues in Nova Scotia. Electricity generation is one of the sectors to which the MERS applied.

While the MERS had been scheduled for completion by the end of 2003, in Nova Scotia a MERS outcome will likely be developed under programs described in the Nova Scotia Energy Strategy. Even though the Canada-wide Standards for Particulate Matter and Ozone are stated in ambient air quality format[8], it is likely that the instruments used to achieve them will be implemented as reduction programs for the emissions of the pre-cursors to their formation.

For both secondary Particulate Matter and Ground-level Ozone, Nitrogen Oxides (NO_x) are among the pre-cursors, as noted. A lower NO_x emission rate from TUC 5, compared to the existing station average, will contribute to an improvement in the NO_x emission performance (intensity) of the Generating Station (mass (NO_x) per unit energy produced).

6 Air Quality Regulations made under Section 112 of the Environment Act, S.N.S. 1994-95, c. 1, Order in Council 95-294 (April 11, 1995), N.S. Reg. 55/95. Schedule "A" - Maximum Permissible Ground Level Concentrations.

7 http://www.ec.gc.ca/air/pdfs/200104_e.pdf

8 http://www.ccme.ca/assets/pdf/pmozone_standard_e.pdf

In any case, the modelling predicts that the actual contribution by the new Combustion Turbine (TUC 5) to local Ground-level Concentrations of NO_2 is small (see below).

4.1.3 <u>Air Dispersion Modelling</u>

The modelling for this Report used the Industrial Source Complex – Short Term (ISCST3) dispersion model from the U.S. Environmental Protection Agency (EPA), designed to support the EPA's regulatory modelling options, as specified in the Agency's *Guidelines on Air Quality Models (Revised).* This is a steady-state Gaussian plume model and was used in this study to estimate Ground-level Concentrations (GLCs) of Nitrogen Dioxide in the region surrounding the Tufts Cove Generating Station. Although AERMOD will likely replace the ISC model for regulatory studies (and AERMOD is available at NSPI), the work for TUC 5 continued to use the ISCST3 model to allow comparability to previous recent work at this site.

The study also used the U.S. EPA ISC3 Plume Rise Model Enhancement (PRIME), which was designed to incorporate two fundamental features associated with "downwash" of a plume because of the interference from turbulence of nearby structures. Figure 1 shows, at the corner of the powerhouse for TUC 1-3, a possible structure necessary for the proposed additions of ESPs at this station. These new structures were also considered for possible influence on stack behaviour for TUC 5.

The ISC3-PRIME model has capability to produce enhanced plume dispersion coefficients to reflect the local influence of the turbulent wake on stack behaviour. PRIME also accommodates reduced plume rise because of a combination of descending streamlines in the lee of a building near the stack and increased entrainment in the building wake. This model enhancement gives a more realistic representation of the situation at Tufts Cove G.S., where the height of the new stack is lower than the height of some features of nearby buildings and existing stacks.

The model was supported by an interface provided by Lakes Environmental Software.[9]
Meteorological data were obtained from Meteorological Service of Canada for years 1995-1999. The Surface data was from Shearwater (Station 25000) and the Upper Air data from Yarmouth (Station 23118). All five years of data were used in the modelling to assure that no unique meteorological situation might be missed during assessment. The windrose for Shearwater is shown in Figure 4A.

The initial objective for a typical modelling study is to define the worst-case scenario regarding emissions rate, meteorological conditions, and operating parameters, for comparison to desired air quality objectives. If, under such circumstances, the estimated impact does not exceed appropriate criteria, there is no need for more-detailed analysis. If, on the other hand, appropriate criteria were not met, the more-detailed analysis would

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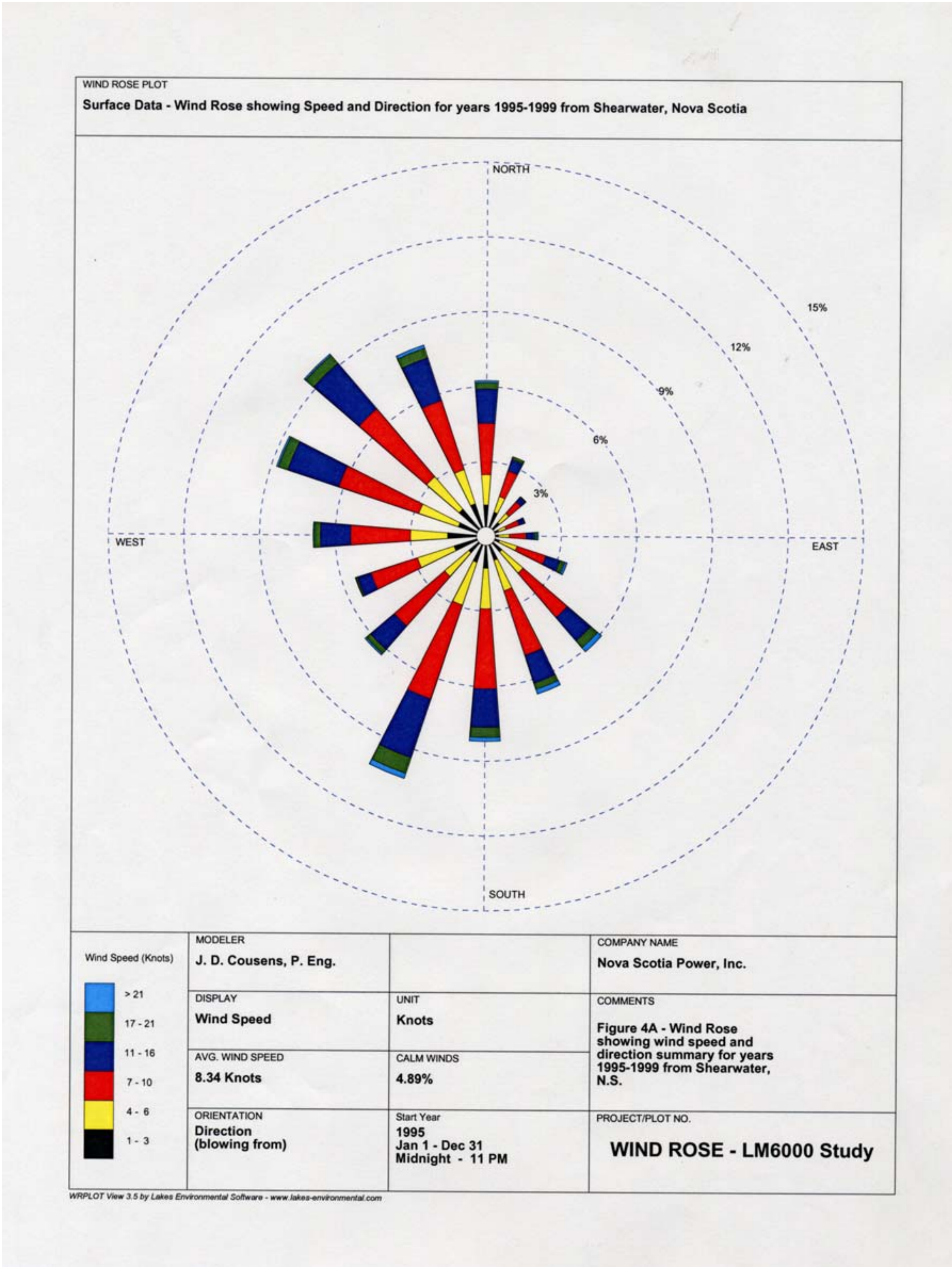
[9] http://www.lakes-environmental.com

be necessary to quantify the extent of the impact (within modelling limits) as the basis for mitigation activity. The worst-case modelling exercise can be thought of as a "screening assessment".

For this study, the worst-case scenario regarding NOx emissions did not produce exceedances of the relevant air quality criteria. Hence, the Ground-level concentrations reported below represent the *maximum* potential for impact from NO_x emissions, and these modelled estimates would be expected to be greater than any GLC that might be measured around the station during plant operation. As noted, the air quality guidance is provided by the current *Air Quality Regulations* (Table 1) from the Province of Nova Scotia.

The NO_x emission rate will meet the *National Emission Guidelines*[10] *for Stationary Combustion Turbines* of the Canadian Council of Ministers of the Environment (CCME). A Continuous Emission Monitoring System (CEMS) will be used to monitor the NO_x concentrations within the stack. As part of standard permitting protocols for operations, a ratification program will be defined for the CEMS, and a reporting program will be defined for its use.

[10] *National Emission Guidelines for Stationary Combustion Turbines,* Canadian Council of Ministers of the Environment, CCME-EPC/AITG-49E (ISBN: 0-919074-85-5), December 1992



WIND ROSE PLOT
Surface Data - Wind Rose showing Speed and Direction for years 1995-1999 from Shearwater, Nova Scotia
NORTH
SOUTH
WEST
EAST
3%
6%
9%
12%
15%
Wind Speed (Knots)
> 21
17 - 21
11 - 16
7 - 10
4 - 6
1 - 3
MODELER
J. D. Cousens, P. Eng.
COMPANY NAME
Nova Scotia Power, Inc.
DISPLAY
Wind Speed
UNIT
Knots
COMMENTS
Figure 4A - Wind Rose showing wind speed and direction summary for years 1995-1999 from Shearwater, N.S.
AVG. WIND SPEED
8.34 Knots
CALM WINDS
4.89%
ORIENTATION
Direction (blowing from)
Start Year
1995
Jan 1 - Dec 31
Midnight - 11 PM
PROJECT/PLOT NO.
WIND ROSE - LM6000 Study
WRPLOT View 3.5 by Lakes Environmental Software - www.lakes-environmental.com

4.1.4 Air Dispersion Modelling Results

The worst-case scenario for the Ground-Level Concentrations (GLCs) of Nitrogen Dioxide was established as the basis for analysis of the potential impact of the addition of TUC 5, as noted. Typically, not all of the NO_x emitted from any fossil fuel combustion system will exist as NO_2 in the near-field of the stack. For this study, *the total NO_x emissions from any of the four TUC units, operating at full load, were assumed to exist at the respective stack top as Nitrogen Dioxide. Thus, the predicted GLCs for NO_2 will be significantly conservative*[11]*, in part, because of this assumption.*

A receptor grid based on polar co-ordinates was used, centred on the existing stack for TUC 2. GLCs for NO_2 were predicted for each defined grid point within a 10-km radius, using a 16-point compass, with receptors at 0.5 km intervals along each radius. This produces 320 receptor points distributed uniformly over a circle with radius of 10-km. 10 additional discrete receptors were established in key locations of the segment of the community nearest to the Generating Station. The general area of coverage is shown in Figure 5.

The following characteristics were used as input for the conservative ("worst-case") modelling approach used in this study to estimate GLCs for NO_2.

Table 2
Attributes for Stacks – Model Input (Conservative Approach)

Attribute	TUC 1	TUC 2	TUC 3	TUC 4 (LM 6000)	TUC 5 (LM 6000)
Base Elevation (m)	**2.74**	**2.74**	**2.74**	**2.74**	**2.74**
Stack Height (m)	**152.4**	**152.4**	**152.4**	**24.38**	**24.38**
Exit Diameter (m)	**2.44**	**2.44**	**3.05**	**2.9**	**2.9**
Stack Gas (K)	**449**	**486**	**486**	**723**	**728**
Stack Gas Velocity (m/s)	**9.91**	**12.2**	**29**	**30.5**	**30.5**
NO_x Emission Rate (g/s)	**72.3**	**71.5**	**107.3**	**8.95**	**8.95**[12]

[11] Unless site-specific data are available, the default position is $NO_2/NO_x = 0.75$. On a short-term basis, the ratio would be lower. (Ref: Appendix W to Part 51 – *Guidelines on Air Quality Models.* 40 CFR 1 (7-1-01 Ed.))

[12] This rate (71 lb_m/h, 42 ppmv) represents the worst-case operating conditions for both the CT and ambient air temperature. The emissions limits for operation will be established at lower values as part of licensing.

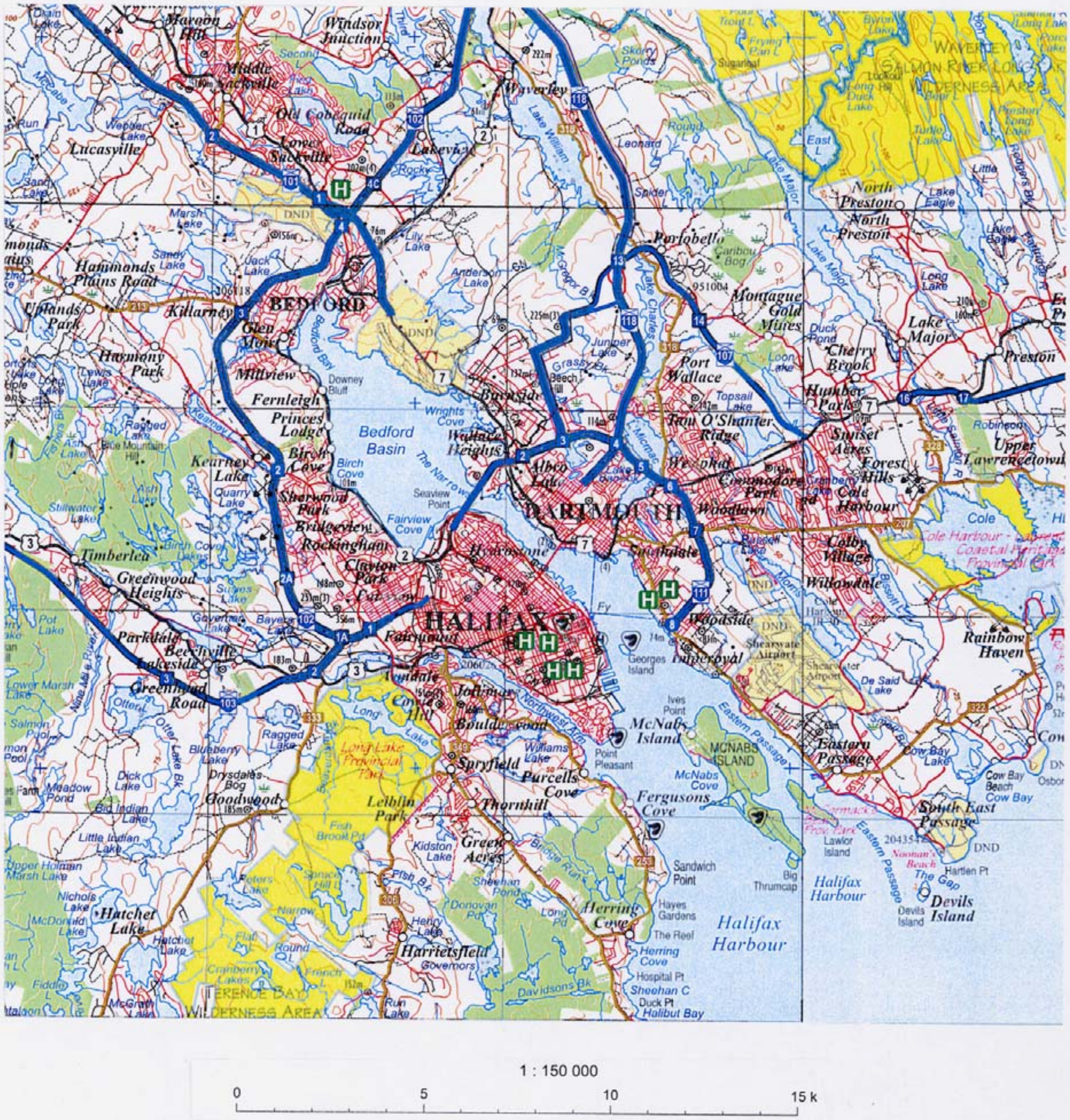


Figure 5 - Approximate Study Area – Air Dispersion Modelling (10 km from stack in all directions)

The area surrounding the plant can be conceptually divided into two unequal sub-areas for purposes of discussion. First, a very small, near-by, populated area, located between the plant fence and an artificial boundary just beyond Windmill Road, will be referred to in this Report as Region A (see Figure 5A sketch on next page). The characteristics of this region include the presence of residential properties, on land whose elevation is up to 40-50 m, much less than the height of the stacks for TUC Units 1-3 (approximately 150 m). Much of this region is within the "shadow" of those taller stacks, and the GLCs are influenced less from the emissions from Units 1-3, than are receptors that have elevations greater than about 50 m. In summary, Region A contains receptors which are within 1 km from the Generating Station, and whose elevations are within 1-2 times the stack height for Units No. 4 and No. 5.

Region A is part of the area of Dartmouth considered to experience existing annual GLCs for NO_2 of 21 $\mu g/m^3$. The Tufts Cove Generating Station, in its current configuration, would contribute some NO_2 to this existing GLC. After the addition of TUC 5, there may be an increase in the NO_2 GLCs at certain receptors. This may be thought of as "new NO_x" or "incremental NO_x" for purposes of discussion. Throughout the study region, this "incremental NOx" GLC was generally low. In Region A, however, considering only the component of the GLC that is contributed by the full operation of the TUC G.S., TUC 4 and TUC 5 provide the largest contribution of the TUC component, because the impact of the taller stacks is very small in this Region. Each of the CT units contributes about half of the local impact to this near-field region to the Generating Station.

That is, this area can be thought of as lying within "the shadow of the large stacks" and the plumes from the stacks of Units 1-3 do not usually come to ground in that region. The major influence from point sources would, therefore, come from the stacks associated with the CTs. Of course, the TUC CTs are not the only NO_x sources in the region.

Using this arbitrary definition for the sub-section of the study area, the entire region outside Region A, but within the 10-km radius circular study area, constitutes Region B. However, most of the relevant discussion for this Report will focus on a more-limited region approximately 500 m -1 km from the Generating Station on the Dartmouth side of the harbour. That is, all mentions of "Region B" in this Report, will be referring to this limited area with "Region B". This becomes, *de facto,* a second arbitrary sub-area, defined, in this case, because its elevations are greater than twice the height of the TUC 5 stack (that is, greater than 50 m). <u>Like Region A, Region B is simply a designation for convenience of discussion of the modelling results.</u>

Windmill Road provides a convenient geographical breakpoint between these two sub-segments of the larger study area, that have been selected for focused conversation about the estimated GLCs for NO_2 .

Figure 5A: Location of Modelling Region A

4.1.5 <u>Discussion of Results</u>

The following points summarize the modelling findings[13]:

1. As discussed in the Registration of TUC 4, an LM6000 CT is equipped with a 65-foot stack for many typical installations. CTs produce reasonably-high velocities, but are also characterized, especially in simple-cycle installation, by extremely-high exit gas temperatures compared to gases from combustion of fossil fuels in standard technology. The potential plume dispersion from a CT, when considering only the stack height, and comparing it to typical heights for other technologies, can easily be underestimated. The velocity and temperature enhance the potential plume rise, creating an "effective stack height" for CTs that is beneficial to the dispersion of the exit gases. Again, similar to the study of the TUC 4 unit, using a 65-foot stack height, the predicted GLCs (NO_2) for all receptors studied for the addition of TUC 5 remained within the ambient air quality limits applicable to the Tufts Cove facility. Nevertheless, NSPI has again undertaken the purchase of additional stack height for TUC 5, as well as to carefully select its on-site position. This was done:
    a. to reduce the potential influence of building downwash,
    b. to anticipate possible changes in recommended guidelines for NO_2, and
    c. to contribute to mitigation of the estimated stack noise from typical operation of this additional CT.

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[13] The "background" GLC for NO_2 is NOT INCLUDED in any GLCs listed in the succeeding section. The "background" value is estimated (Section 4.1.1) to be approximately 21 μg/m^3.

2. This "additional" stack height purchased for TUC 5 brings it, like the stack for TUC 4, to 80 feet. Enhanced by the normal high velocity and relatively high exit temperature (in simple-cycle operation[14]), means that the contribution to NO_2 GLCs from the added LM6000 SPRINT (TUC 5) in Region A remain, as shown in the study for TUC 4, generally small. By locating the stack as far as possible from the existing structures, the point of maximum possible influence from existing structures is avoided, further reducing its potential impact on "Region A" GLCs.

(<u>IMPORTANT</u>: The "actual", or measured, GLCs (NO_2), in the region surrounding the TUC G.S., will include contributions from a number of sources, including trans-boundary influences and local vehicles and oil-burning for heating. These contributions will vary as the meteorological conditions and contributing operations change. For discussion in this Report, the values of estimated GLCs and the relative contribution of those GLCs to measured "background" values refer to only that portion of the actual GLCs that can be attributed to the operations at TUC G.S. Further, the contributions assigned to the operations at the Tufts Cove facility occur from modelled estimation of its worst-case operating scenario, as chosen for this study.)

Because Region A (<50 m elevation, up to 1 km from G.S.) can be considered to lie in the "shadow" of the stacks from the legacy units (Unit Nos. 1-3), it does not receive a large contribution to GLCs for NO_2 from these older units and higher stacks. Any change in GLCs in this region, however small, is principally influenced ("new NOx") by the addition of the new LM6000 (TUC 5). Table 3 shows that the influence of this LM6000 is small, compared to both existing ("measured") GLCs and the regulatory limits for NO_2 GLCs, for all averaging periods shown in Table 1.

Table 3 shows that, for Region A, the emissions from TUC Units 4 and 5 contribute almost 100% of the small fraction from TUC operations for both the highest 1-h and the highest annual hourly average values for GLCs (NO_2). Each CT contributes approximately equally to the value for this GLC of NO_2.

To the South of the near-field region, at Windmill Road (Nivens Avenue), the contribution of the LM6000 is more than 90% of the NO_2 contributed by the TUC G.S. to the Annual hourly average and approximately 30% of the contribution from TUC G.S. to the highest 1-h GLC. At Windmill Road, to the North (Fernhill Drive), where the plume's travel distance is greater, the two LM6000 units contribute about 50% of the contribution from the TUC G.S. to the Annual hourly average GLCs, but only 5% of the contribution from the full TUC G.S. to the highest 1-h value of the GLCs.

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[14] The addition of TUC 5 provides enough unused thermal capacity to support possible installation of a Heat Recovery Steam Generator (HRSG) to generate additional electricity in a Combined Cycle (CC) system, incorporating both TUC 4 and 5. A new stack would likely be part of this CC system to accommodate the changed exit conditions from the respective simple-cycle operations.

3. The summary for Region B continues logically from the observations from Region A. That is, as the distance (and, to some degree, the elevation) increases from the generating station, the contribution to a given GLC from TUC G.S. is increasingly larger from the main stacks at the G.S., compared to that from TUC 4 and TUC 5. Of course, the TUC G.S. contribution to the absolute concentration diminishes with distance from the station. Considering the Dartmouth side of the 10-km grid, for receptors at about 1 km (and beyond) from the LM6000 stacks, it follows that TUC 4 and TUC 5 contribute a diminishing amount to the "Tufts Cove portion" of the GLCs. Eventually, at > 1 km from the stack, the two LM6000 units produce from 3-7% of the TUC fraction of the Annual hourly-based average values for GLCs (NO_2).

4. Among the highest-30 1-h GLCs linked to worst-case operation at the Tufts Cove G.S., the estimated values from the 15th –ranked GLC and below occur increasingly on the "Halifax side" of the harbour, notably in the region of Clayton Park at Dunbrack Street.

5. Within the whole grid, the Maximum value for the Annual 1-h GLC (NO_2) occurs at Juniper Lake, in the general direction of Albro Lake, but beyond Spectacle Lake in Burnside. At that receptor, the modelled value is conservatively estimated (TUC portion) at 3.7 μg/m^3, and the contribution from the LM6000 (TUC 5) at about 0.23 μg/m^3. The TUC 5 share represents about 6.2% of the GLC estimated from TUC 5 separately. Figure 6 illustrates this information as a fraction of the existing value from the N.S. Air Quality Regulations (Table 1).

6. The Maximum 1-h GLC (NO_2) for this study occurs on the Halifax side of the harbour, near Veith/Hanover Street, where the value of the estimation of the GLC, using worst-case assumptions, is approximately 300 μg/m^3, and the TUC 5 contribution, at approximately 9.2 μg/m^3, is about 3.0% of the estimated GLC contribution from the TUC G.S.

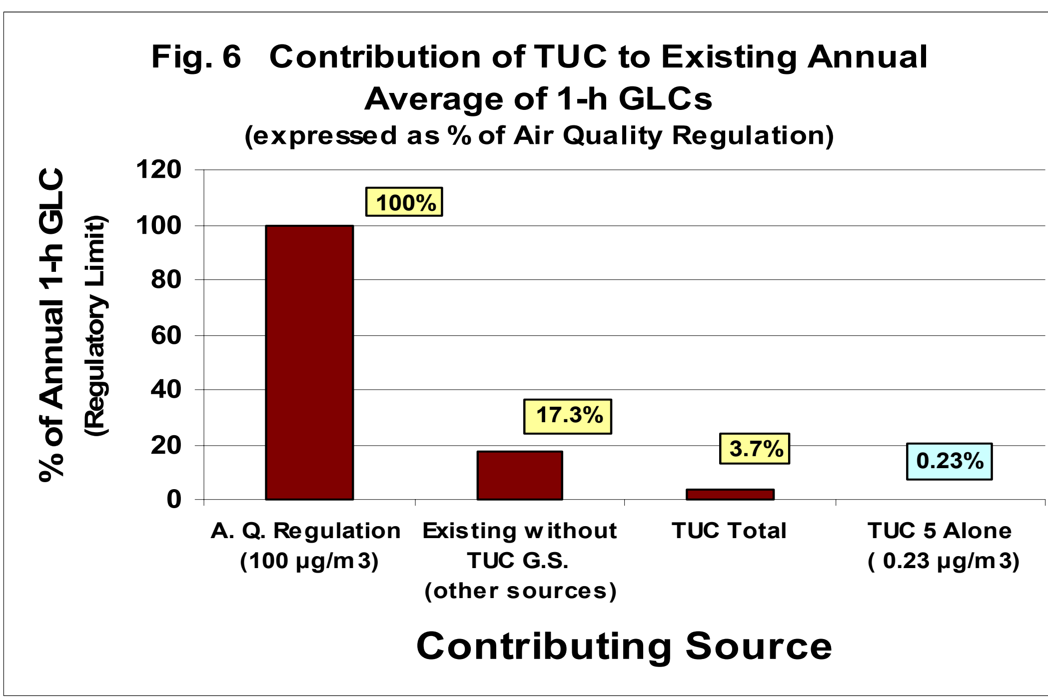


Fig. 6 Contribution of TUC to Existing Annual Average of 1-h GLCs

Figures 7 to 9 show the GLCs for Nitrogen Dioxide for the 1-h averaging period and for the Annual Period. The maximum value for the receptors illustrated is stated on each figure. Figure 8 shows the same contours in Figure 7, now illustrated as isopleths on local mapping, instead of a colour pattern to show areal distribution of GLCs. This Figure is intended to illustrate the location of key geographic features with respect to the modelled estimates of ambient air concentrations of NO_2. Common shapes can be matched between the lines and colours outlining the contours, respectively, between Figures 7 and 8.

Table 3 characterizes the NO_x contributions (as NO_2) to Ambient Air Quality from the LM6000 SPRINT (TUC 5) in full operation at its proposed location, burning natural gas.

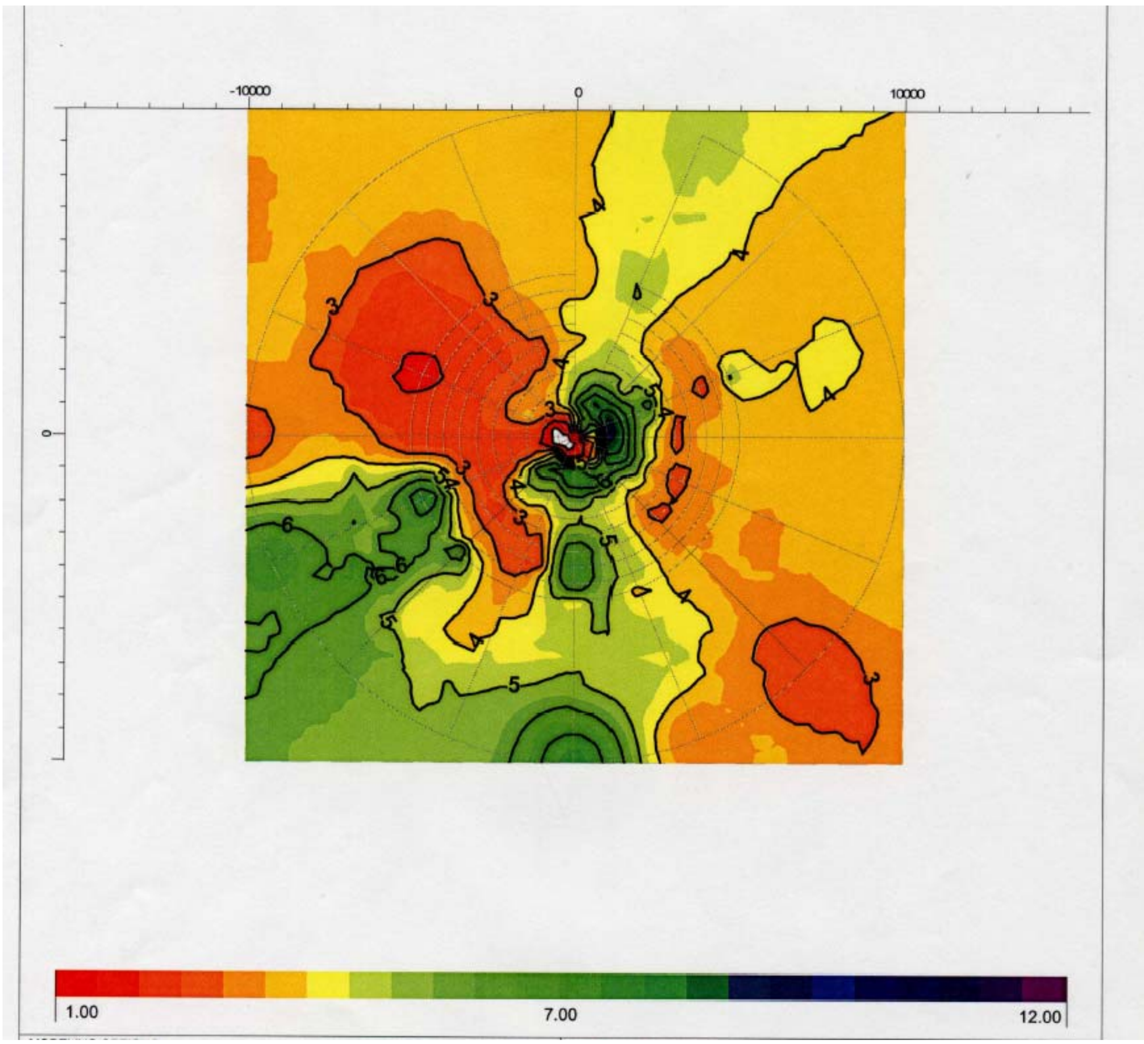
4.1.6 Conclusions - NO_2 Ambient Air Quality

- The estimated GLCs in Region A (that is, near-field to plant) are much lower than either the 1-h or Annual regulatory value shown in Table 1, but the relative contribution from the LM6000 SPRINT stack emissions *to that portion of the GLCs contributed by TUC G.S.* is dominant in Region A. The contribution represents an extremely small fraction of the TUC G.S. contribution for most of the receptors in Region B.
- **Even at this conservative ('worst case") modelling level, the contribution to the Annual average of the hourly GLCs in the near-field area (Region A) from operation of TUC 5 (LM6000 SPRINT), will range within approximately 0.1 - 0.2 µg/m^3, where the current background is approximately 21 µg/m^3. That is, the LM6000 SPRINT, under worst-case conditions, may add a "maximum" of 1% of current estimated background (Values range from 0.4 to 0.9%). This is less than the error band for modelled or measured GLCs in that area.**

Table 3
Screening Modelling Summary – Tufts Cove G. S.

Attribute **(Recall that the modelling represents a conservative (screening) approach – worst-case scenario)**	**GLC (NO_2) or %** **(as indicated by units)** **(Note: GLCs do not include average existing ("background") value of 21 μg/m^3.)**
LM6000 SPRINT alone (TUC 5) - Maximum **1-h** GLC (NO_2)	Approx. 19 μg/m^3 (See Appendix 1 for note on Persistence)
LM6000 SPRINT alone (TUC 5) - **Location** of Maximum 1-hour GLC	Intersection Sunnydale/Windmill
All stacks (TUC Unit Nos. 1-5) - Maximum 1-hour GLC (NO_2)	Approx. 302 μg/m^3
All stacks (TUC Unit Nos. 1-5) - Contribution of TUC 5 to TUC Portion of Maximum 1-hour GLC	Approx. 9 μg/m^3 (~3%)
LM6000 SPRINT alone (TUC 5) - Maximum **Annual** GLC Contribution (NO_2)	Approx. 0.3 μg/m^3
LM6000 SPRINT alone (TUC 5) - Location of Maximum Annual GLC (LM6000 alone)	Near Victoria/Highfield
All stacks (TUC Unit Nos. 1-5) - Maximum Annual GLC (NO_2) from TUC G.S.	Approx. 3.7 μg/m^3
All stacks (TUC Unit Nos. 1-5) Contribution of LM6000 (TUC 5) to TUC portion of Max. Annual GLC (NO_2)	Approx. 0.23 μg/m^3 (~6%)
For long- term averaging periods, progressive contribution of LM6000 to TUC portion of Maximum GLCs (i.e., Annual Period)	Approx. 3 - 7 %
Exceedances of Regulatory GLCs (NO_2) on Plant Site	**None**
Predicted Hours – Touchdown of plume with Condensation	**None**

FIGURE 7: Distribution of Highest 1st High 1-hour based Average Ground Level Concentration Contours (μg/m^3) for NO_2 from the worst-case operation of the proposed TUC 5 operating alone, for receptors within 10-km radius of the Tufts Cove Generating Station. The maximum value for the receptors shown is approximately 12.8 μg/m^3. Output from ISCST3 model (February 2004)



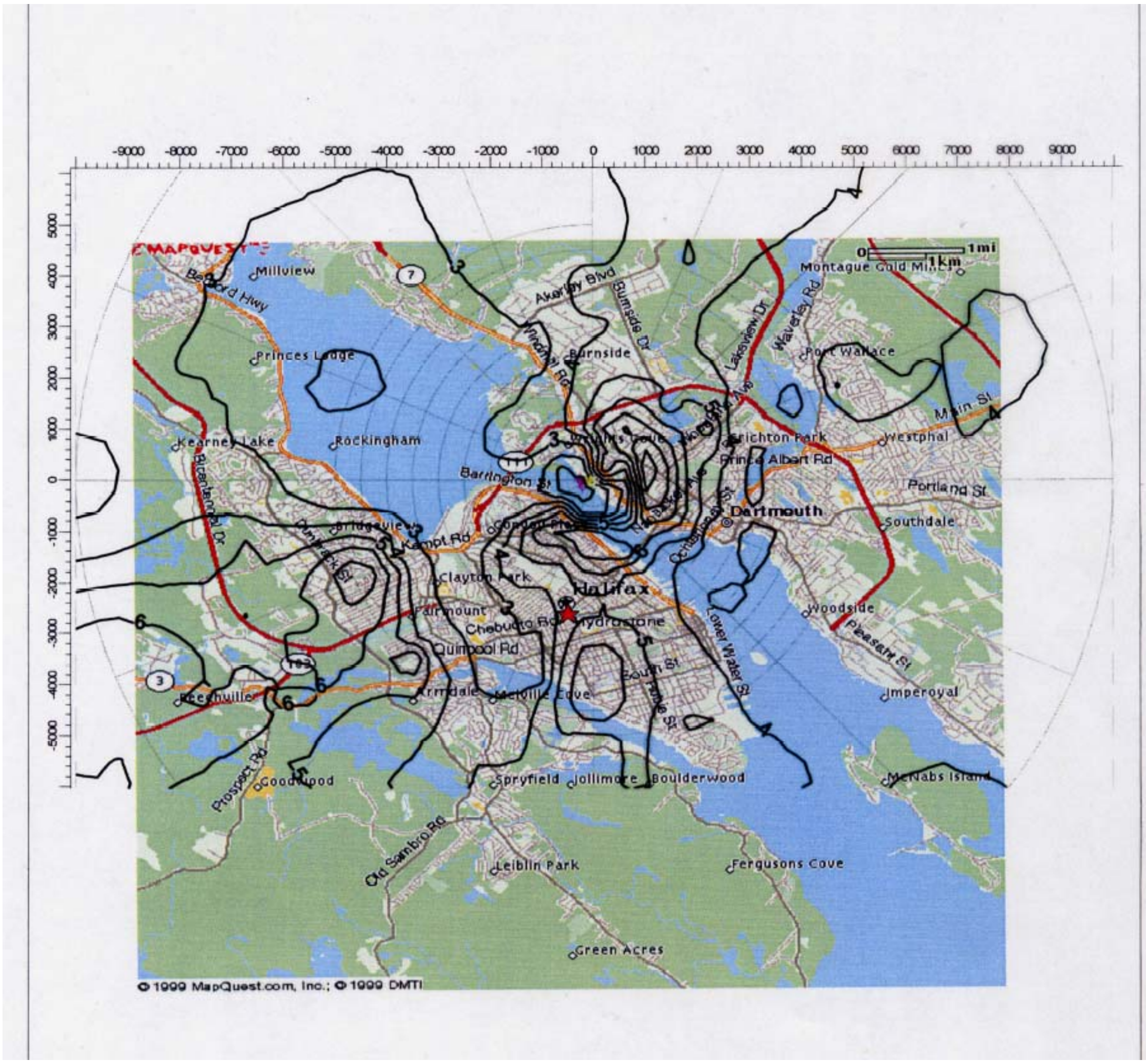


FIGURE 8: Isopleths for Highest 1st High 1-hour based Ground Level Concentration of Nitrogen Dioxide (NO_2) for worst-case operations of proposed Unit No. 5 (LM 6000) at the Tufts Cove Generating Station (Modelled 2004 using ISCST3 modelling software). Highest value for receptors shown is 12.8 µg/m^3.

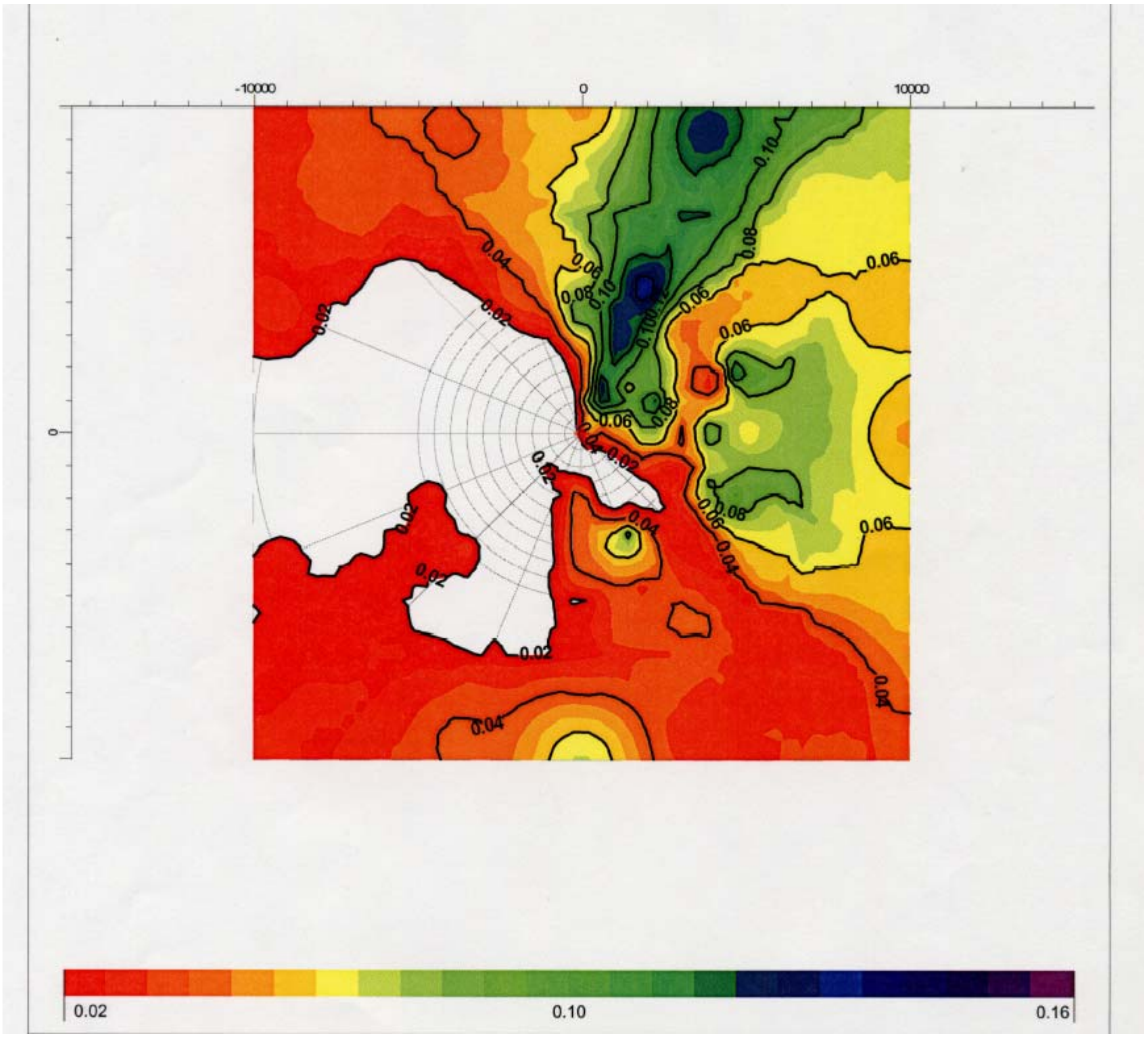


FIGURE 9: Distribution of Ground Level Contours for NO_2 for 10-km region surrounding Tufts Cove Generating Station representing worst-case operation of the proposed TUC 5 (LM 6000) operating alone. The maximum value for the receptors shown is approximately 0.16 µg/m^3. (Output from ISCST3 – February 2004).

4.2 Noise Overview

Noise was a topic of discussion in the TUC 4 Environmental Assessment registration documentation. Some information was presented on baseline conditions for the area with Units 1, 2 and 3 running. Noise mitigation design measures were outlined and a commitment was made to maintain noise levels (with the addition of TUC 4) within one 1 dBA of those baseline conditions.

As part of the TUC 4 project, many of the significant noise sources were housed within noise-reducing buildings. This included the compressor, the auxiliary skids for lubrication and water injection, and the SPRINT support skid. The extra height on the stack and the use of additional baffles in the stack also resulted in noise mitigation. Additional sound insulation was added to various structures and some pieces of equipment were relocated to further reduce noise for nearby residents. Two ventilation inlet louvers on the south wall of the Compressor Building were re-located to the west wall and noise attenuating dampers added, reducing noise and directing it away from the community.

Because of the nature of noise and the complex manner in which it becomes integrated, it was agreed that NSPI would include the identified mitigation features in the design and construction of the unit and would carry out testing under commissioning or early operating conditions to determine the actual resultant noise profile. Dependant on results, NSPI would fine tune the noise mitigation at that time, if required.

Baseline studies have been carried out over the last two years during operation of Tufts Cove 1,2, and 3. The focus has been on four points labelled Locations 7, 9, 10 and 11 as indicated in Figure 10. Measurements were also taken after the addition of Unit 4, for which results are presented in Table 4.

Baseline noise levels reportedwith three units in operation contain some levels higher than the guideline of 55 dBA. Such levels are a result of many noise sources in the vicinity including the plant itself. The intention in relation to TUC 4 was to keep noise level changes within 1 dBA of the existing plant levels (understanding that these exceeded current night time target of 55 dBA in some cases). These criteria were approximately met. However, some mitigation would be appropriate.

With the addition of this proposed TUC 5 project, computer modelling was used (with supporting information from the on site testing) to predict the likely noise levels resulting from having five units operating. In most locations the result was a further 1 dBA increase beyond results estimated fo the addition of TUC 4.

A review of possible mitigation measures determined that the best choices were not actually related to the combustion turbines. A site noise mitigation strategy was instead developed to address the most significant noise sources on the south yard site. NSPI is proposing an even more aggressive noise mitigation strategy that would bring the noise levels with the installation of Unit 5 to less than the current levels at site. The proposed measures would include those listed below with further study optimization still being carried out:

- Inclusion of all measures currently implemented on TUC 4 applied to Unit 5
- Nine acoustical louvres to replace existing Unit 1,2, and 3 building louvres on the east side of the existing plant
- Absorptive barrier to envelope the Unit 2 & 3 transformer area
- Acoustic seals to existing equipment doors on the south side of Unit 3

Calculations show that this will provide approximately 2 dBA reduction in most areas, restoring noise levels to conditions similar to the time before the installation of two CT units. Preliminary discussions with NSEL personnel indicate that this series of measures should be acceptable to address noise reduction requirements.

Figure 10: Locations of Noise Level Testing in the Vicinity of Plant

Source	Location 7	Location 9	Location 10	Location 11
Units 1,2,3 As Measured	**62**	**55**	**57**	**53**
Units 1,2,3,4 As Measured	**63**	**57**	**60**	**58**
Units 1,2,3,4,5 Computer Modelled Unmitigated	**64**	**58**	**61**	**58**
Units 1-5 Computer Modelled Mitigated	**62**	**56**	**60**	**58**

Table 4: Noise survey Information

4.3 Water Use

As part of the TUC 4 project, the water treatment plant was increased in capacity with a 125 USG/min Reverse Osmosis unit. That system was designed for two combustion turbines and therefore a further expansion at this time will not be required. The process did result in production of some wastewater of very good quality that is presently discharged to the ocean without treatment. The quality of this water meets TUC wastewater discharge criteria (See Table 5). As part of this TUC 5 project, a further addition of two reverse osmosis cells to the TUC WTP will take place to reduce the wastewater stream per unit water processed by more than 40%. The waste stream will still represent a water quality which is within the guidelines for direct release to the environment.

Parameters	Daily Grab Sample Limits	Wastewater Sample Results
pH	6.0 to 9.5 (continuous)	6.2
TSS	35 mg/L	n.d. to 2 mg/L
TPH	15 mg/L	
Fe	1.5 mg/L	n.d.
Cr (total)	0.5 mg/L	n.d.
Cu	0.5 mg/L	n.d.
Ni	0.5 mg/L	n.d.
Zn	0.5 mg/L	0.063

4.4 Soil Management

As part of the TUC 4 project, some lower level contamination (hydrocarbons and metals), typical of operation of an oil-fired power plant, was encountered. At that time NSPI put in place a soil testing setup, with clean soil and low level contaminated soil available for reuse on the site, and any higher concentration soil handled by licensed facilities. Generally the level of contamination turned out to be less than predicted by preliminary test pits.

To address the potential concern for the site during construction of TUC 5, an alternate approach is planned. A pre-testing program is proposed for the new construction areas to sample extensively, allowing a predetermination of the extent and manner of handling and disposal of the soil as encountered. Preliminary sampling has suggested a low probability of the existence of any new contamination in the South Yard. Details of the soil management will be presented in the construction plan associated with the Construction Approval.

4.5 Other Issues

During the TUC 4 Environmental Assessment process several other issues were raised and satisfactorily addressed. A summary of that information is presented here dealing with Archaeology, Historic Sites, Palaeontology, Botany and Biological Concerns.

4.5.1 Archaeology and Historical Sites and Remains

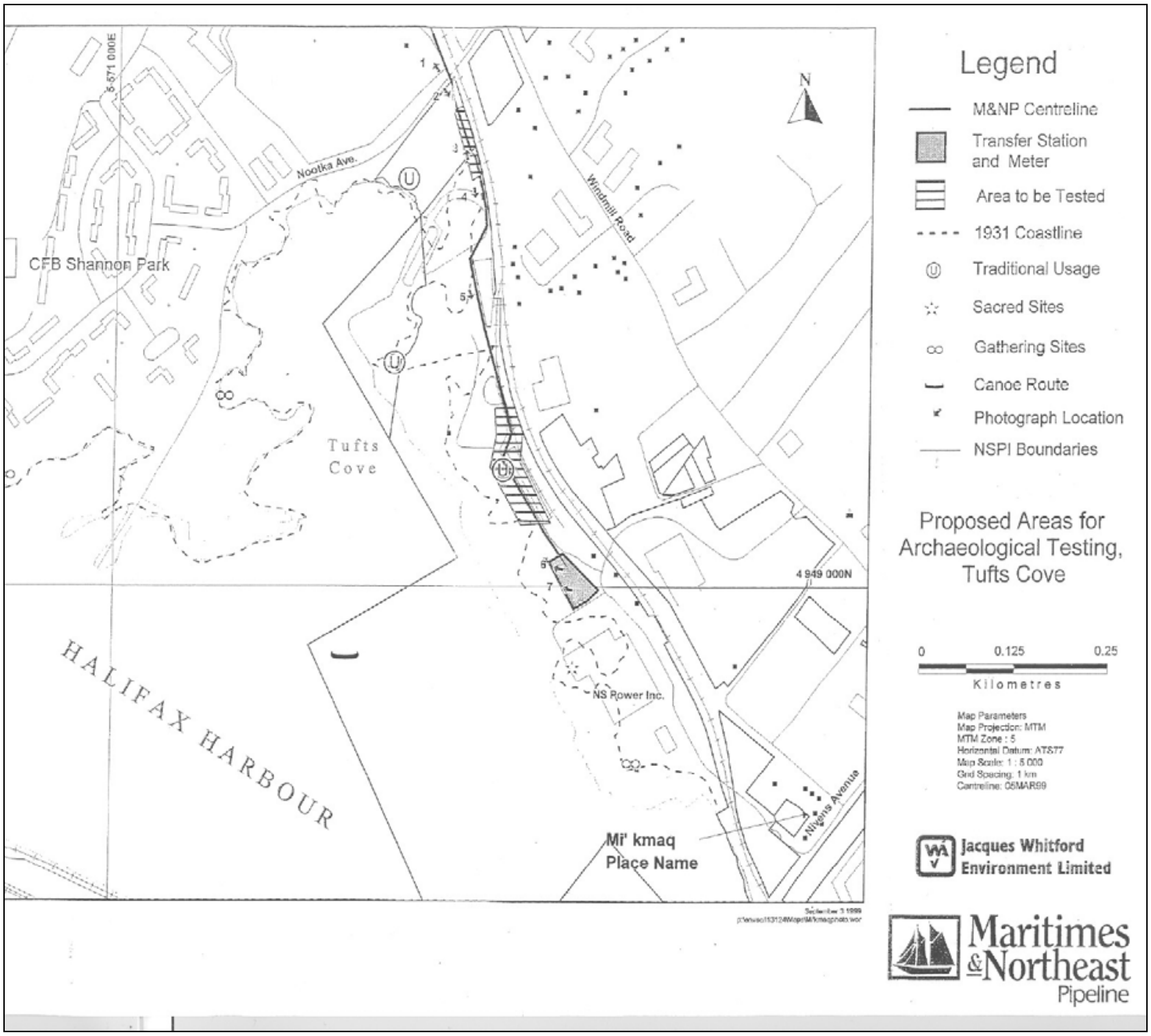
Figure 11 shows the existing Tufts Cove Generating Station structures and the proposed TUC 5 site in relation to the location of the original shoreline. The area proposed for the new unit was mostly all disturbed soil from the TUC 4 project. There is one possible Mi' kmaq gathering site at the edge of the shore but not in the immediate area of the project. A quick review of previous boreholes also reveals that the depth of previous fill in the area exceeds 10 metres and the excavation planned for the project is only 8 metres deep. The probability of excavating into undisturbed soil is considered low.

Therefore, in consideration of the low probability of encountering archaeological artifacts, we do not believe that any elaborate or extensive archaeological monitoring or investigation is warranted. We will be documenting construction progress via daily photo records and this will include some explicit photography of the excavation stages, possibly useful in confirming the presence/absence of artifacts.

4.5.2 Palaeontology

Review comments from the Tufts Cove 4 Environmental Assessment concluded that there were no significant palaeontological concerns with the project. Since this TUC 5 project is in the same area of the site, the same comments should apply. Therefore, NSPI is not planning any extra palaeontological actions.

Figure 11 Archaeological Drawing



4.5.3 Botanical Concerns

Review comments from the TUC 4 Environmental Assessment did not identify any significant botanical concerns. Since this is in the same general area, the same comments apply to the TUC 5 project.

4.5.4 Biological Concerns

During the review of the TUC 4 project, some concerns were raised regarding possible effects of noise on migratory birds and other species. Noise analysis for the site as a whole has shown that, with the mitigation already put in place or proposed, the resultant change in noise levels is predicted to be negligible. In addition, the unit transformer for the existing plant, a noise source with a particular frequency band, has been proposed as one of the mitigation areas. It is expected that with the mitigation in place, the noise will not present an incrementally adverse environment for migratory birds and other species.

4.6 Residual Effects

The project, using high efficiency combustion turbine technology, is inherently a positive one for the environment. Electricity generation by use of natural gas in this new unit will normally displace some other, less efficient electricity generation on the NSPI system, resulting in overall reductions in air emissions per kWh. In addition, the air modelling has shown that local area ambient air NO_x levels will be minimally-affected by the addition of the new CT. Noise levels will be kept within 1 dBA of existing levels using insulation, enclosing key components with buildings, and use of other measures as appropriate.

5 MONITORING

The Tufts Cove Station has an existing comprehensive monitoring program associated with Units 1-4.

All wastewater is treated, as required, and tested prior to discharge. No significant changes are planned for wastewater regarding TUC 5.

Stack emissions are already monitored for opacity and Nitrogen Dioxide for the existing units 1-3. The new stack will also get NOx monitoring, similar to that for TUC 4. A network of ambient air monitors is maintained in the Halifax/Dartmouth/Bedford area. The same network will still be valid for the addition of TUC 5.

Noise monitoring will be a part of the early operational days of TUC 5 to ensure that the planned mitigation results in the appropriate noise mitigation.

Other monitoring is carried out, as required.

Tufts Cove G.S. also has a well established public complaint process. The intention is to provide a straightforward way for the public to contact the plant and have their concerns addressed appropriately.

6 SYNTHESIS

The development of the TUC 4 project provided an excellent opportunity to construct, operate and evaluate the potential and real impacts of such a unit. The first few months of that unit's operation have confirmed that the incremental impacts associated with such technology are minimal.

The TUC 5 project proposal has been developed with a similar approach and is similarly low in impact. Air modelling results clearly show little or no significant effects in the area from the new unit. Noise level reduction measures have been proposed and a sensible plan is in place to deal with any potentially contaminated soil in the project area.

It is recommended that this project be approved for construction and operation.

APPENDIX

LETTER OF DECISION FROM UARB

April 2, 2004

Nova Scotia Utility and Review Board

MAILING ADDRESS:

Box 1692, Unit "M"
Halifax, Nova Scotia
B3J 3S3
E-mail: uarb.board@gov.ns.ca

OFFICE:

3rd Floor
1601 Lower Water St.,
Halifax NS B3J 3P6
Tel: (902) 424-4448
Fax: (902) 424-3919

April 2, 2004

Via Fax and Mail: 428-6990

Mr. Ralph R. Tedesco
Chief Operating Officer
Nova Scotia Power Inc.
PO Box 910
Halifax, NS B3J 2W5

Dear Mr. Tedesco:

Request for approval of LM6000 Gas Turbine Generating Unit - P-181

The Board has reviewed your letter of March 2, 2004, requesting that the Board approve the acquisition and installation of a LM6000 Gas Turbine Generating Unit.

The Board's understanding of your submission, as set forth in your letter, is as follows:

1. The requested approval is for the immediate purchase and installation of an ISO rated 47.3 MW LM6000 gas turbine generating unit manufactured by General Electric. The unit is owned by NSPI's corporate parent, Emera Inc., and is presently in storage. NSPI proposes to install the unit at its Tufts Cove Generating Station. Given the affiliate relationship between NSPI and Emera, NSPI will not be in a position to propose an appropriate transfer price for the unit until it has investigated the matter further. Consequently, NSPI has not finalized its estimate of the total project cost but, for purposes of its business case, has assumed a "proxy engine transfer cost" of $20 million for the unit and a final total project cost of $34.5 million.

2. The unit will be installed adjacent to an existing LM6000 at Tufts Cove and it will be economically advantageous to convert the two units to combined cycle operation at an early date.

3. NSPI experienced unprecedented and unanticipated peak demands in January of this year and this development has made it critical to install the second LM6000 before next winter. For the first time in its history, NSPI had to interrupt service to a number of interruptible customers due to supply shortfalls.

4. The peak experienced in the 2003/04 winter season exceeded the forecast by 171 MW or 8.3%. This peak demand was not predicted to occur before 2008.

5. There was very little opportunity to meet this demand by imports because the neighbouring utilities were experiencing similar conditions.

6. During the cold spell in January, 2004, NSPI's generating facilities performed very well and the majority of interruptions to interruptible customers were due to higher than anticipated demand.

7. Without the addition of new capacity, it is likely that there will be substantial increases in interruptions to interruptible customers next winter and there is a "very real risk" of having to interrupt service to firm customers.

8. With respect to the likelihood of more frequent and extended interruptions to industrial interruptible customers next winter, an undue number of interruptions to industrial customers would substantially interrupt their business operations and would be detrimental to "economic development in our province".

9. NSPI had anticipated the need to install an LM6000 in 2006 but, in view of the experience this past January, the installation must be completed by next winter. This is the only "technically and economically viable option" to obtain the necessary capacity in the time available.

NSPI requested that the Board approve this $34.5 million capital expenditure by March 12, 2004, seven working days after receipt of the application by the Board on March 3, 2004. The Board considers the suggested time frame to be unreasonable. While the Board can understand NSPI's desire to proceed without delay, the Board decided that, having regard to the significant capital cost of the LM6000 and the overall interest of the ratepayers, it should ensure that this application is analyzed in an appropriate manner. It also determined that it should solicit comments from the participants in the Technical Conferences convened by NSPI on January 22, 2004 and February 11, 2004.

The Board received letters and e-mails from 21 customers including individuals, companies and institutions. Several expressed concern about the effect this project could have on future independent power producer co-generation projects. Another writer expressed concern that NSPI had not explored the possibility of renting mobile generating units on a short term basis. For the most part, however, the tenor of the comments was similar to the following submission by counsel for the Department of Energy dated March 22, 2004:

> NSPI has an ongoing obligation to maintain supply adequacy for firm load, which also includes a 20% planning reserve requirement imposed by the Northeast Power Coordinating Council/North American Electricity Reliability Council . . . If this obligation cannot be maintained on a forecast basis, then capacity should be added as quickly as possible so that the supply adequacy requirement can continue to be met. In this regard, the Province notes that no other party has indicated that they are currently positioned to have capacity in place for next winter's peak, other than the new wind farm currently under construction in Pubnico, to the extent that its generation may be coincident with winter peaks.

Approval of the LM6000

The Board has carefully reviewed the information provided by NSPI and the comments made by participants in the Technical Conference process. The Board's review included issuing 102 information requests to NSPI along with numerous consultations between Board staff and NSPI staff. In addition, several participants issued information requests to NSPI.

To date, NSPI has been unable to explain why its system peak was 160 MW higher this past winter than the year before. This makes it very difficult to predict what may happen next winter. However, the Board is satisfied that, if peak firm demand were to increase next year at the average rate of the last five years and, if one or more of NSPI's base load steam generating units were to fail during a peak period, firm customers could well experience outages and interruptible customers would likely experience severe outages. NSPI has advised the Board that its reserve margin dropped to 15.3% during the peak on January 14, 2004, well below the 20% planning reserve requirement. In the Board's opinion, this situation poses an unacceptable risk and must be addressed before next winter's peak.

NSPI also sought to justify the LM6000 project on economic grounds. Its generation expansion planning model indicates that if, as originally intended, the unit were installed in 2006 and a steam turbine unit were added in 2007 to allow combined cycle operation, then NSPI customers would benefit from a present value savings of $20 million over a 20-year planning horizon. According to the model, advancing the unit to January 2005 and the steam turbine to 2006 would not decrease the present value savings to customers. In fact, it would increase savings by $100,000. While the Board takes some comfort from these results, it must be observed that NSPI compared a limited range of options in the modelling exercise. In particular, NSPI assumed that the required additional generating capacity must come from an LM6000. Hence, in assessing NSPI's request for approval of this project, the Board places much greater weight on reliability considerations than on NSPI's economic justification.

The Board is satisfied that there is no suitable alternative capacity which can meet potential demands next winter. While the Board hopes the Pubnico wind project will be in full operation by late this year, there is some question whether NSPI can rely on power from the project being available during peak periods. In order to ensure reliable service next winter, the Board finds that it is prudent to add the LM6000 at this time and, accordingly, directs NSPI to proceed with the installation of the LM6000 unit at its Tufts Cove site.

The Board would note that this application by NSPI has foreclosed the possibility of following the process outlined by NSPI in its letter to the Board dated December 3, 2003 and approved by the Board in its letter to NSPI dated December 23, 2003. That process contemplated that other potential suppliers would be given an opportunity to bid to provide the additional capacity required by NSPI. The peak demands experienced in January meant that, in order to get additional capacity in place by next winter, there would be insufficient time to implement a competitive bidding process. The Board observes that NSPI has committed to "continue customer and stakeholder consultation through further technical conferences later this year to consider capacity requirements beyond those presented in this application and how those might be addressed competitively".

Transfer Price of the LM6000

NSPI proposed in its March 2, 2004 letter to the Board that the LM6000 unit be "immediately" transferred to NSPI from its affiliated holding company, Emera Inc., at the original purchase price paid by Emera of $25.2 million. As indicated above, for purposes of developing its business case, NSPI assumed a "proxy engine transfer cost" of $20 million. NSPI went on to propose that "any excess between the machine's original purchase price and fair market value as determined by subsequent review of the Board" be deferred and amortized by NSPI outside of its revenue requirement. NSPI acknowledged that the final transfer price may be less than Emera's original purchase price. The Board does not have sufficient information before it to rule on NSPI's proposed accounting treatment at this time.

NSPI proposed to file additional information and to make further submissions as to the final transfer price. It suggested that this process be treated as "Phase II" of the approval process. The Board agrees with this approach and will determine at that time an appropriate transfer price and how the transfer should be dealt with in NSPI's books of account. The Board takes this opportunity to emphasize that, in dealing with these matters, it will consider the principles set out in the Nova Scotia Power Interim Code of Conduct which became effective September 16, 2001. Among the principles that the Board anticipates will be relevant to its inquiry are the following:

> 1.1 The primary purpose of this Code of Conduct is to ensure that the customers of Nova Scotia Power Inc. (NSPI) are not harmed by transactions between NSPI and its affiliates.
>
> 2.1 NSPI will neither subsidize, nor be subsidized by an affiliate's current or prospective activities. This means that, among other things, NSPI's customers will not be bear the risks nor share the rewards of an affiliate's activities.
>
> 6.8 NSPI will charge and be charged prices which reflect fair market value for all non-regulated utility goods and services provided to affiliates or purchased from affiliates, provided that in no case shall NSPI supply such goods and services at a loss.

Because the approval of a transfer price is occurring after the purchase date, it may be difficult for NSPI to provide definitive market value information and the Board will necessarily have to exercise judgement in determining the transfer price.

The Board intends to invite comment from the participants in the Technical Conference process prior to reaching any decision on these issues. NSPI is directed to provide copies of the materials it files with the Board in Phase II to such participants at the time it files them with the Board.

Load Forecasting

The Board understands that NSPI will be filing its 2005 Annual Load Forecast this spring. Its 2004 load forecast report was dated May 2003. In this regard, the Board would refer to two recommendations of the Electricity Marketplace Governance Committee (EMGC) which reported to the Minister of Energy in October, 2003:

Recommendation 7

The EMGC recommends that NSPI produce an annual long-range plan, with a horizon of at least 10 years. The plan should address both 18-month and 10-year horizons for the purpose of assessing system capacity and adequacy and for planning to maintain system adequacy.

Recommendation 8

The EMGC recommends that NSPI's annual plans be filed with the UARB, and that the UARB open a period for public comment on the plans.

The Board has some reservations about whether a 10-year horizon is sufficient for proper long-range resource planning. However, the Board is firmly of the view that a sound load forecast is an essential building block in constructing a reliable utility resource plan, whether viewed from a long or short term perspective.

The Board is concerned at the considerable variance between actual demand experienced by NSPI in January 2004 versus forecast demand for this period. NSPI has advised that it has not yet determined the reason for the 8.3% increase in actual system peak demand in 2003-2004 over its forecast peak. It is clear to the Board that the methodology underlying NSPI's load forecasting requires close examination. The Board hereby gives notice that it intends to subject NSPI's 2005 load forecast to careful scrutiny, which will quite likely involve the retention of external expertise in this specialized field. The Board directs that, either as part of its load forecast or in a separate document, NSPI provide a full explanation for the unanticipated peak demands in January 2004. In future years, the Board will require NSPI to provide an on-going reconciliation of actual demand and energy growth with forecast demand and energy growth. Also, consistent with Recommendation 8 of the EMGC Report, the Board will invite comments from members of the public on NSPI's 2005 Load Forecast.

Yours very truly,

John A. Morash, C.A.
Chair