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

Location of Undertaking: Tufts Cove Generating Station, Dartmouth, Nova Scotia

Proponent:
Nova Scotia Power Inc.
P. O. Box 910
Halifax, N.S., B3J 2W5
Chief Operating Officer - Chris Huskilson
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 and to provide additional flexibility of operation.

Construction Schedule: The project would be built with the following general dates:

Start Construction - Fall 2002
Commission CT - Spring/Summer 2003
Begin Operaton - Spring/Summer 2003

Operation Schedule: The units would begin operation as soon as construction and commissioning are complete. This stand-alone CT will be used as a baseload unit.

Undertaking Description:	Information in document entitled: “Registration Document by Nova Scotia Power Inc. in support of Registration of Tufts Cove 4 under the N. S. Environment Act”
Required Approvals:	Release from NS Environmental Assessment Process Amendment to Industrial Operating Approval , N S Environment Act Gas, Adjustment to Custody Transfer Station Fire Code, Fire Marshall
Public Funding:	There is no public funding for this project.

REGISTRATION DOCUMENT
by
Nova Scotia Power, Inc.
in support of
REGISTRATION of TUFTS COVE 4
under the N.S. Environmental Act

November 5, 2002

Table of Contents

1 INTRODUCTION

Nova Scotia Power, Inc. (NSPI) is proposing to add a 47.3 MW Combustion Turbine Unit (Tufts Cove 4) to the existing Tufts Cove Generating Station in Dartmouth. The new Unit will burn natural gas.

The Nova Scotia Utility and Review Board (UARB) has approved the project. 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 November 5, 2002. 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 required.

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 three units, Tufts Cove 1 (100 MW), Tufts Cove 2 (100 MW) and Tufts Cove 3 (150 MW). The proposed Tufts Cove 4 project, which adds a unit with superior energy performance[1] to the existing 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 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.

The improved efficiency of use of natural gas in Tufts Cove 4 (TUC 4) 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 supply, wastewater treatment, and plant amenities.

Tufts Cove 4 is being constructed for simple cycle operation at this time, but flexibility is being maintained at the station for future expansion. The additional capacity that a combined cycle would provide is not required. It is common for smaller power systems to install a combined cycle operation in stages, increasing capacity as needed.

2.2 Land Use and Project Setting

The existing Tufts Cove generating station is located along 1000 m of shoreline in Dartmouth, Nova Scotia, midway 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.

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, most recently (1999-2000), a

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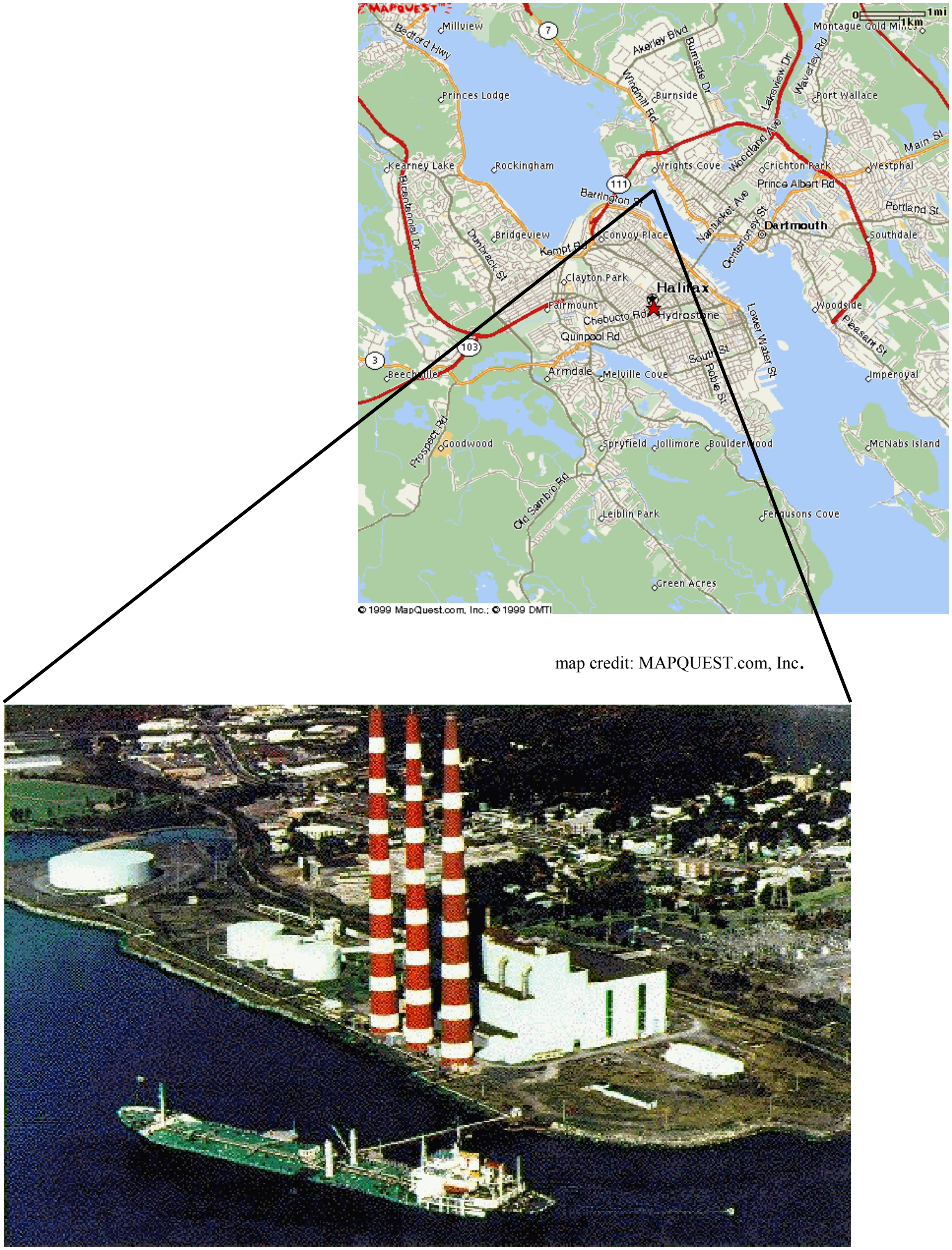
[1] The CT will have a smaller heat rate than Tufts Cove 1-3. That is, it requires a smaller amount of thermal energy (input) to produce a unit of electrical energy (output). This can also be expressed as a higher efficiency.

Figure 1: Sketch of Tufts Cove Generating Station – showing LM6000



map credit: MAPQUEST.com, Inc.

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

modification to allow the burning of natural gas in TUC 1, 2 and 3.

The existing station has 350 MW of capacity, fired on either No. 6 oil (Bunker "C") or natural gas, or any combination of those two fuels.

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, housed in a separate building.

A piping system will be installed under a separate construction project by others. The system will move natural gas from the Custody Transfer Station to the compressor, the coalescing filter[2] skid, and then to the Combustion Turbine.

The Control and Auxiliary Services Building will house the switchgear room, the control room, the auxiliary service skids and the demineralized water head tank for the Combustion Turbine.

An addition will be made to the existing North Annex Building to accommodate the water treatment plant expansion of a new 125 USGPM water treatment train to provide demineralized water for the Combustion Turbine.

General Site Preparation will include grubbing of overgrown areas, removal of scrap debris, adjustment to drainage/ditching, and grading, as required. The South Yard water line will be re-located on the TUC 4 site. An existing, old holding tank will be removed.

2.4 Construction and Operating Schedules

Subject to UARB approval already received and further environmental approvals, the construction of the unit would begin in Fall 2002, with completion expected by Spring/Summer 2003. 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 electricity 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 4 project.

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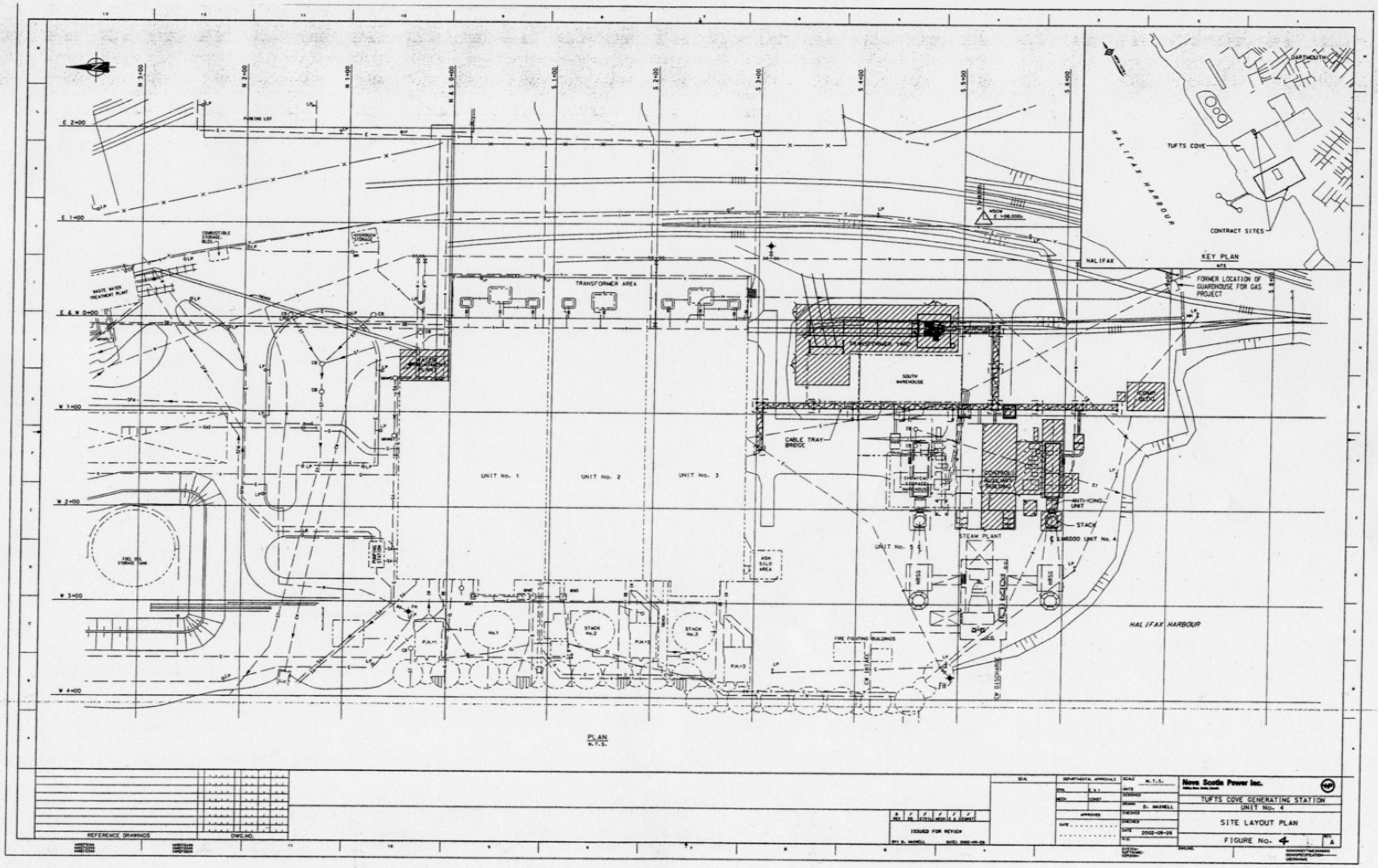
[2] Outlet gas from the gas compressor will be filtered and any liquids, like oil mist, or dirt will be removed within a Natural Gas Coalescer system of two units. The Coalescer will be skid mounted and located outside the east wall of the Auxiliary Building.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W 4+00
PARKING LOT
COMBUSTIBLE STORAGE BLDG.
HYDROGEN STORAGE
WASTE WATER TREATMENT PLANT
TRANSFORMER AREA
TRANSFORMER YARD
SOUTH WAREHOUSE
CABLE TRAY BRIDGE
CHEMICAL STORAGE WAREHOUSE
CONTROL AUXILIARY BUILDING
ANTI-ICING UNIT
STACK
℄ LM6000 UNIT No. 4
STEAM PLANT
UNIT No. 5 ℄
HRSG
HRSG
ASH SILO AREA
UNIT No. 1
UNIT No. 2
UNIT No. 3
FUEL OIL STORAGE TANK
PUMPING STATION
P.H.1
STACK No.2
STACK No.3
P.H.3
FIRE FIGHTING BUILDINGS
COMP. BLDG.
HALIFAX HARBOUR
FORMER LOCATION OF GUARDHOUSE FOR GAS PROJECT
HALIFAX
DARTMOUTH
TUFTS COVE
HALIFAX HARBOUR
CONTRACT SITES
KEY PLAN
NTS
PLAN
N.T.S.
REFERENCE DRAWINGS
DWG.NO.
ISSUED FOR REVIEW
SEAL
DEPARTMENTAL APPROVALS
APPROVED
SCALE N.T.S.
DRAWN D. MAXWELL
DATE 2002-09-26
Nova Scotia Power Inc.
TUFTS COVE GENERATING STATION
UNIT No. 4
SITE LAYOUT PLAN
FIGURE No. 4
REV. A

Tufts Cove 4 is planned for use as a baseload unit with an expected capacity factor occurring at least in the range of 70 – 80%. A baseload unit is one that contributes to the component of the demand for electricity that is not changed by the time of day or the season of the year. In contrast, the units which contribute for the short durations of high demand are called "peaking units". A baseload unit will usually produce at its full generating capacity, for a large number of hours during a year. The usage of a unit is expressed as its "capacity factory", reflecting both the amount of generation and the time of use. A capacity factor will not reach 100% because a certain amount of time must be committed to normal maintenance programs. The capacity factor for a "peaking unit" will be, typically, less than 15%.

Construction will be carried out under a site-specific Environmental Management Plan, consistent with NSPI's standard practices and relevant regulations and guidelines. The Plan will address the requirements for disposal of hazardous and non-hazardous waste from the site; for the recycling and re-use of material where practicable; for prevention, 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 conditions. The discussion of the adequacy of the Environmental Management Plan will occur with activity required to obtain permits for the actual construction of the LM6000.

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 contaminated materials are met. The usual contamination on power plant properties is from the presence of petroleum hydrocarbons and metals.

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 4 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 registered this proposed project on November 5, 2002. Following a period of notification and public comment, a decision by the Minister of Environment and Labour is required within 25 days.

NSPI will also obtain, or require, all of the necessary approvals for initiating and implementing this project.

3.2 Public Consultation

In advance of formal Registration, NSPI conducted an Open House at the Tufts Cove Generating Station (GS) to provide information on the proposed project to the public, and to seek comments or questions from them. The Open House was held on Friday, August 2, 2002 from 3:00 to 8:00 p.m. and continued Saturday, August 3, 2002 from 12:00 to 6:00 p.m.

The advertising for the session included the following:

Print Ads:

- Saturday, July 27 - Chronicle Herald (5"x 7") and Daily News (6"x 8")
- Tuesday, July 30 - Chronicle Herald and Daily News
- Wednesday, July 31 – Daily News
- Thursday, August 1 - Chronicle Herald

Radio Ads:

- Wednesday, July 31 - Country 101: 12 – 6 p.m., one spot per hour
- Thursday, August 1 - Country 101, Q104 and C100: 12–6 p.m., one spot per hour on each station
- Friday, August 2 - Q104 and C100: 12–6 p.m., one spot per hour on each station

"Nova Scotia Power invites you to attend an Open House at the Tufts Cove Generating Station at 315 Windmill Road in Dartmouth. Join us on Friday, August 2nd from 3 to 8 p.m. and Saturday, August 3rd from 12 to 6 p.m. Learn

about the exciting proposal to add a new combustion turbine, fuelled by natural gas, to our electricity-generating mix. We look forward to seeing you there!"

Burnside Business Watch:

- Recorded telephone message to 700 North-end Dartmouth residences on July 30th.

"This is a message from Nova Scotia Power inviting you to attend an Open House at the Tufts Cove Generating Station. Learn about the exciting proposal to add a new combustion turbine, fuelled by natural gas, to our electricity-generating mix. Join us on Friday, August 2nd from 3 to 8 p.m. and Saturday, August 3rd from 12 to 6 p.m. The open house will be held at the Tufts Cove Generating Station located at 315 Windmill Road. We look forward to seeing you there!"

Media coverage:
(Media advisory issued Friday, August 2nd)

- Chronicle Herald (Judy Myrden) – Tuesday, July 30th
- Daily News (Jerry West) – Tuesday, August 6th

In addition, several key stakeholders were offered a briefing including:

- John O'Brien - HRM Communications
- Jerry Pye, Councillor North-end Dartmouth
- Jim Smith, MLA Dartmouth North
- Sackville Rivers Association, Clean Nova Scotia and Ecology Action Centre.

Notice of the Open House was also provided to NSDEL Bedford and to the EA Administrator.

More than 300 people attended the Open House. There were no significant concerns raised. Most of their questions are included below. Although indicative "answers" are offered in this Section for completeness, the information provided to attendees is, for the most part, included throughout this Report.

- How long has gas been used at the existing plant?
    - *TuC 1-3 have had the capability of burning natural gas since 2000.*
- Where is the gas line into the plant?
    - *Natural gas is currently delivered to Tufts Cove G.S. This project will require the extension of the existing gas line from the Custody Transfer Station at the G.S. site, along the back of the current power house to the South Yard, where the LM6000 will be located. The extension of the*

existing natural gas pipeline will be done by those responsible for managing the existing pipeline.

- Where will the new unit be located?
    - *The new unit will be located in the South yard of the existing Tufts Cove site.*
- Will the CT be noisy?
    - *There can be noise from operation of any industrial equipment. Nova Scotia Power has engaged consultants to develop a appropriate programs for treatment of noise from the LM6000.*
- When will it start operating?
    - *Pending timely approvals, and no unforeseen construction issues, the unit is expected to be ready for commercial use in Spring/Summer 2003.*
- How will this project affect emissions from the plant?
    - *The LM6000 will make very small contributions near to the station in the Ground-level Concentrations of Nitrogen Oxides. Natural gas is a comparatively-clean burning fuel among the other fossil options.*
- How high will the stack be and how large is the new Unit?
    - *The top of the stack for the LM6000 will be slightly less than 25 m above the ground. The nameplate capacity for TUC 4 is 47.3 MW.*
- How will the unit be delivered to the plant site?
    - *The unit will arrive in modules by barge and be off-loaded at the Tufts Cove G.S.*
- How does this unit compare with the existing CTs in Burnside?
    - *The LM6000 has a larger capacity than the CTs at Burnside, and operates more efficiently. The main difference is that the CTs at Burnside use No. 2 (Diesel) oil, while the LM6000 will burn Natural Gas. The Burnside CTs are "peaking units", while the LM6000 will be operated as a baseload unit.*

NSPI staff was able to address these questions to the satisfaction of the people who attended the session. As noted, much of the information presented to visitors is contained in the following sections of this Report.

4 ENVIRONMENTAL ISSUES

In discussions with the public and government officials, most people view this as 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, and gas use at the site.

A number of air emissions will be listed in the complete and detailed flue gas analysis, as might be expected when burning a fossil fuel. It will be shown below that most of these are at concentrations that can be eliminated from concern after careful consideration of the extent of possible impact. Essentially, the emissions of Carbon Monoxide, Unburned Hydrocarbons, and Sulphur Dioxide are extremely low. It will be shown that further study was necessary to define the potential impact of both Nitrogen Oxide emissions and noise from operation of the CT. The results of these studies indicated that:

- potential changes in Ground-level Concentrations of Nitrogen Oxides (as NO_2) from TUC 4 are small, compared to both background and regulatory levels, and
- NO_x emissions will meet the existing *Guidelines* for Combustion Turbines, and
- noise mitigation is required and will be implemented to meet the objective proposed by NSPI, that the noise from normal operation of the station, including TUC 4, will not differ by more than 1dBA[3] from the historical, measured baseline.

These points represent the summary of the potential environmental impacts. The remainder of this Report will provide the support for those conclusions.

4.1 Air Emissions and Ambient Air Quality

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[4]." The unit can be operated for baseload power, as intended at TUC G.S., 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."

For the TUC G.S. 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

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[3] dBA represents "decibels" on a special weighting network ("A"), chosen to better reflect human hearing. A "decibel" measures the size of the changes in (sound) pressure intensity, much like a "Pascal (Pa)" would be used to measure the much larger changes in atmospheric pressure intensity.

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

9% for ISO[5] conditions. As the ambient temperature rises, the benefit from the SPRINT engine becomes more significant, reaching a 20% boost on days that reach slightly more than 30°C.

The "nameplate" capacity of Tufts Cove Unit No. 4 will be 47.3 MW.

Operation of TUC 4 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. 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 and higher. In 2001, the SO_2 emission rate from Tufts Cove Units 1-3 was near 320 g/s, reflecting an increasing use of natural gas. *Because the contribution of SO_2 emissions from TUC 4 would be very small, at approximately 0.01% of the Y2001 station emissions, the estimated changes in Ground Level Concentrations of SO_2 will be negligible. Hence, no modelling was carried out for Sulphur Dioxide as part of the studies for this Report. Mitigation activity would not be necessary for SO_2.*

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 Ground Level Concentrations (GLCs) from 0.1 g/s are extremely small. Modelling of this level of emissions within an urban environment was not carried out for dispersion of Unburned Hydrocarbons for this Report. Mitigation activity would not be necessary for Unburned Hydrocarbons from this proposed installation.*

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 low level of emissions of *primary* Particulate Matter ("soot") eliminates the need for modelling or mitigation of its potential impact. However, a linkage to PM and Ozone exists for TUC 4 because Nitrogen Oxides (NO_x) are a precursor to the formation of secondary Fine Particulate Matter and Ozone, in the atmosphere. Hence, it was necessary to determine the level of impact on the *existing* GLCs and compare the 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 – higher efficiency of the unit and lower carbon intensity of the fuel –

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

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.

After completing the engineering and environmental analyses of the performance of the LM6000, emissions of Nitrogen Oxides and Carbon Monoxide (CO) were the remaining 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 significance of estimated NO_x emissions from the LM6000, in the context of the emissions from the full Tufts Cove Generating Station and the existing background concentrations surrounding the station.*

4.1.1 Existing Air Quality – Nitrogen Dioxide

Data obtained[6] from Nova Scotia Department of Environment and Labour indicates 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 Generating Station. *The value used as "background" for analysis for this Report is estimated to be approximately 21 $\mu g/m^3$. Table 1 shows that the Air Quality Regulations for N.S., establish the limit for this value to be 100 $\mu g/m^3$ (see Table 1, below).*

Under the existing Air Quality Regulations for Nova Scotia[7], the following information can be found (Table 1).

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[6] 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).

[7] 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.

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

Air Contaminant	Averaging Period	Concentration ($\mu g/m^3$)	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[8]. The Strategy will address sectoral approaches for managing air quality issues in Nova Scotia, and is scheduled for completion by the end of 2003. Electricity generation is one of the sectors under discussion. The Canada-wide Standards for Particulate Matter and Ozone are stated in ambient air quality format[9], but 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 for TUC 4 will contribute to an improvement in the NO_x emission performance (intensity) of the Generating Station (mass (NOx) per unit energy produced). In any case, the modelling predicts that the actual contribution by the new Combustion Turbine (TUC 4) to local Ground-level Concentrations of NO_2 is small (see below).

4.1.2 Air Dispersion Modelling

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, used in this study to estimate Ground-level Concentrations (GLCs) of Nitrogen Dioxide in the region surrounding the Tufts Cove Generating Station.

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[8] http://www.ec.gc.ca/air/pdfs/200104_e.pdf

[9] http://www.ccme.ca/assets/pdf/pmozone_standard_e.pdf

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. The ISC3-PRIME model has capability to produce enhanced plume dispersion coefficients because of the turbulent wake from local influence on stack behaviour. It 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.[10] 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 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*[11] *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

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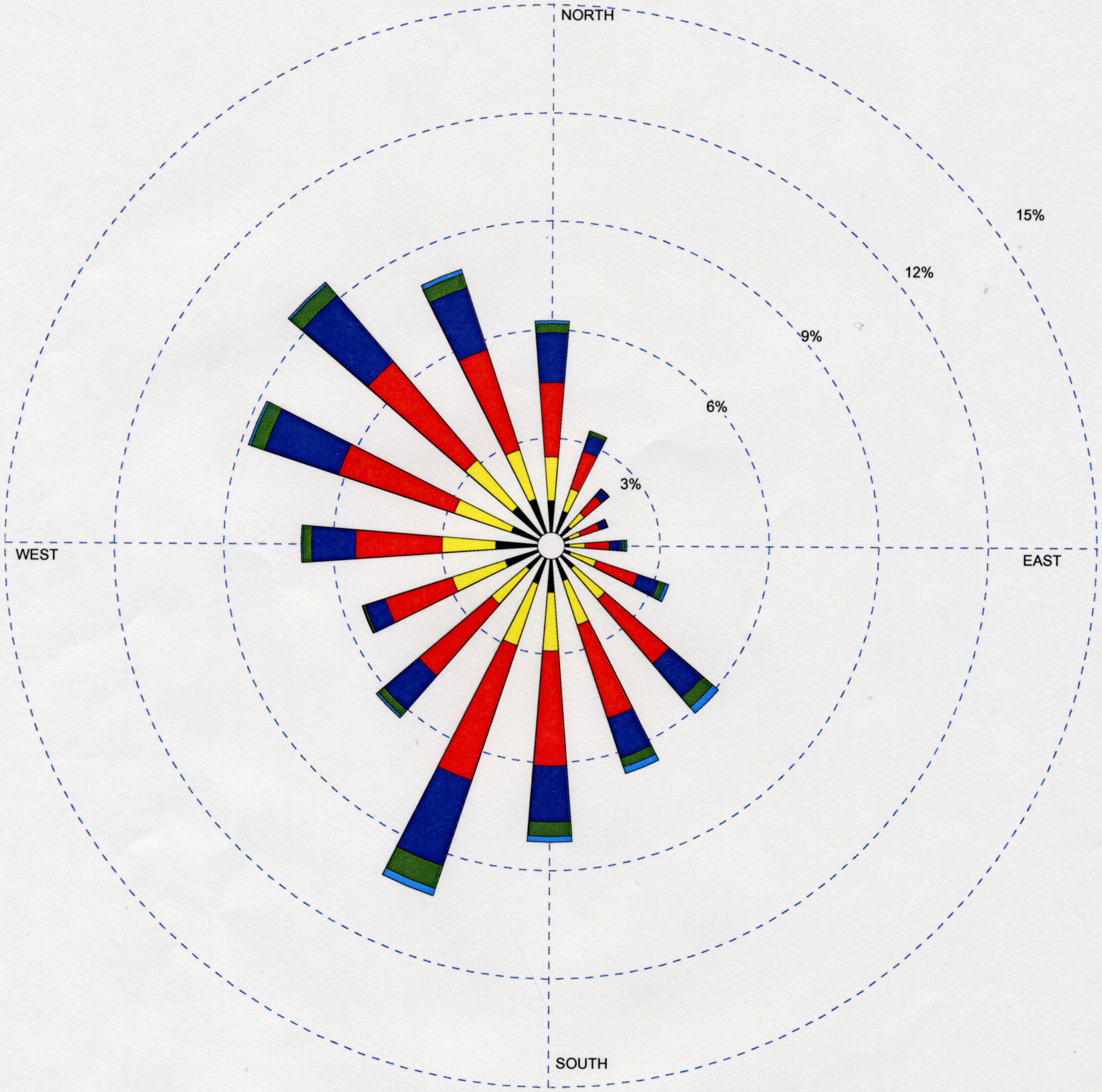
[10] http://www.lakes-environmental.com

[11] *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



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 ratification program will be defined for the CEMS, and a reporting program will be defined for its use.

4.1.3 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 4, as discussed. Typically, not all of the NO_x emitted from any fossil fuel combustion system will exist as NO_2. For this study, *the total NO_x emissions from all four TUC units, operating at full load, were assumed to exist at the respective stack tops as Nitrogen Dioxide. Thus, the predicted GLCs for NO_2 will be conservative*[12]*, 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)
Base Elevation (m)	**2.74**	**2.74**	**2.74**	**2.74**
Stack Height (m)	**152.4**	**152.4**	**152.4**	**24.38**
Exit Diameter (m)	**2.44**	**2.44**	**3.05**	**3.6 – 4.3**[13]
Stack Gas (K)	**449**	**486**	**486**	**723**
Stack Gas Velocity (m/s)	**9.91**	**12.2**	**29**	**30.5**
NO_x Emission Rate (g/s)	**72.3**	**71.5**	**107.3**	**8.95**[14]

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[12] 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.))

[13] A series of stacks with different attributes are under bid submission from contractors. It is expected that eventual bids will show a range of diameters from 12 – 14 feet. The choice of any diameter within or near this range will not change any of the conclusions of the modelling exercise completed and reported herein.

[14] 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.

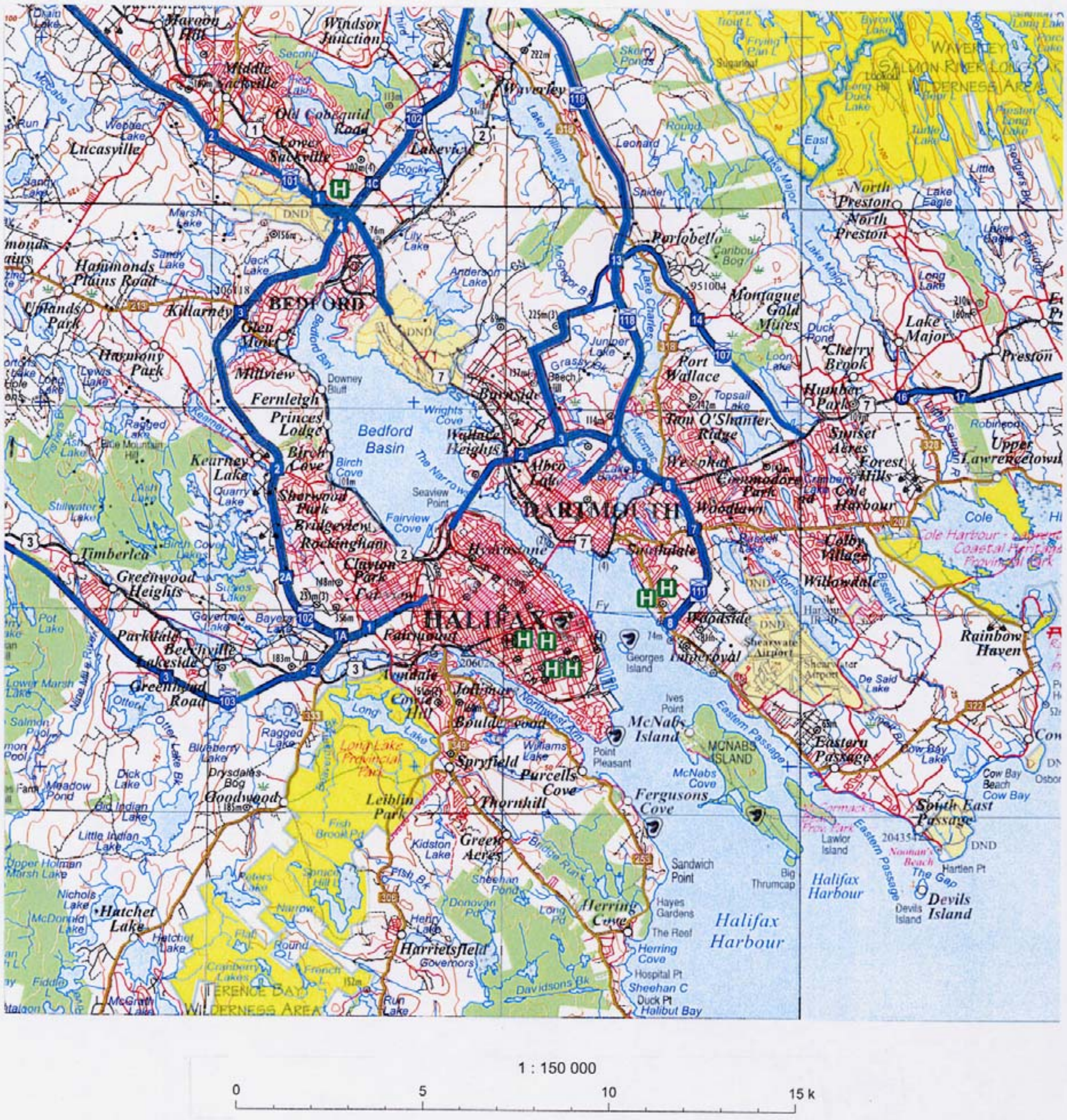

Figure 5 - Approximate Study Area – Air Dispersion Modelling (10 km from stack in all directions)

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 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 Unit No. 4.

Region A is part of the region considered to experience existing 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 4, 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 provides the largest contribution of the TUC component, because the impact of the taller stacks is very small in this Region.

In effect, 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. This limited area will be referred to as Region B.

It is a second artificial sub-area, defined, in this case, because its elevations are greater than twice the height of the TUC 4 stack (that is, greater than 50 m). Like Region A, Region B is simply a designation for convenience of discussion of the modelling results. Windmill Road provides a convenient geographical breakpoint between the two segments of the larger study area, which are selected for focused conversation about the estimated GLCs for NO_2 .

4.1.4 Discussion of Results

The following points summarize the modelling findings[15]:

1. An LM6000 CT is equipped with a 65-foot stack for many typical installations. CTs produce reasonably-high velocities, but have, especially in simple cycle installation, extremely-high exit gas temperatures compared to gases from other fossil fuel combustion. The dispersion capability from a CT, when considering only the stack height, can be easily underestimated. The velocity and temperature produce large plume rise, creating an "effective stack height" for these units that is beneficial to the dispersion of the exit gases. Using a 65-foot stack height, the predicted GLCs (NO_2) for all receptors studied for this project were within the ambient air quality limits applicable to this facility. Nevertheless, NSPI undertook to purchase additional stack height, and to carefully select its on-site position:
    a. to minimize 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 noise from typical operation of the CT.

2. This "additional" stack height purchased for TUC 4 to bring it to 80 feet, enhanced by the normal high velocity and extremely high exit temperature, means that the contribution to NO_2 GLCs from the LM6000 SPRINT in Region A is 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.

    (Important**: 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, which, of course, vary as the meteorological conditions and contributing operations change. For discussion in this Report, the values of GLCs and the relative contribution to those GLCs** refer to only that portion of the actual GLCs that can be attributed to the operations at TUC G.S. under its worst-case operating scenario 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 main stacks (Unit Nos. 1-3), it does not receive a large contribution to GLCs for NO_2 from the older units. Any change in GLC, however

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[15] All GLCs listed in the following section DO NOT include the "background" NO_2 GLC, estimated (Section 4.1.1) to be approximately 21 μg/m^3.

small, is principally influenced ("new NOx") by the LM6000. Table 3 shows that the influence of the LM6000 is small, compared to both existing ("measured") GLCs and the regulatory GLCs, for all averaging periods shown in Table 1.

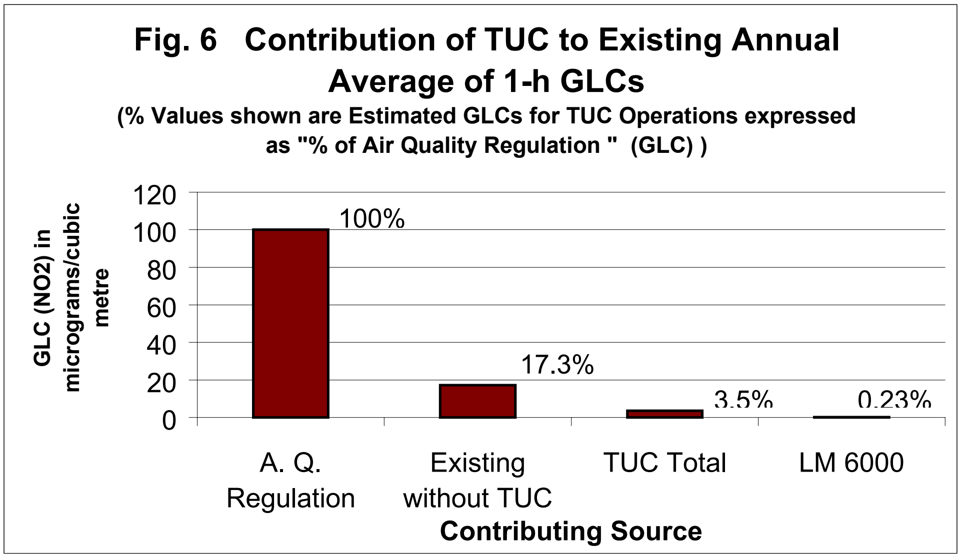
Table 3 shows that, for Region A, the emissions from the LM6000 contribute almost 100% of the fraction from TUC operations for both the highest 1-h and the highest annual hourly average values for GLCs (NO_2). To the south, at Windmill Road (Nivens Avenue), the contribution of the LM6000 is about 94% of the NO_2 contributed by the TUC G.S. to the Annual hourly average and approximately 30% for 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 LM6000 contributes about 50% of the contribution from the TUC G.S. to the Annual hourly average GLCs, but only 5% of the contribution from the TUC G.S. to the highest 1-h value of the GLCs.

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. 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 stack, it follows that TUC 4 contributes a diminishing amount to the "Tufts Cove portion" of the GLCs. Eventually, at > 1 km from the stack, the LM6000 produces from 3-7% of the TUC fraction of the Annual hourly average values for GLCs (NO_2).

4. Among the highest-30 1-h GLCs, 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 3.5 $\mu g/m^3$, and the value from the LM6000 at about 0.23 $\mu g/m^3$, representing about 6.6% of the GLC estimated. Figure 6 illustrates this information.

6. The Maximum 1-h GLC (NO_2) 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 293 $\mu g/m^3$, and the LM6000 contribution, at 9.2 $\mu g/m^3$, is about 3.2% of the estimated GLC contribution from the TUC G.S.



Figures 7 and 8 show the GLCs for Nitrogen Dioxide for the 1-h averaging period and for the Annual Period. The maximum value within the modelled region is stated at the top of each figure. The regulatory value for comparison is shown in Table 1. Figure 7A shows the same contours in Figure 7 as line, with GLCs, instead of a colour distribution. 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 the two Figures.

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

4.1.5 Conclusions - NO_2 Ambient Air Quality

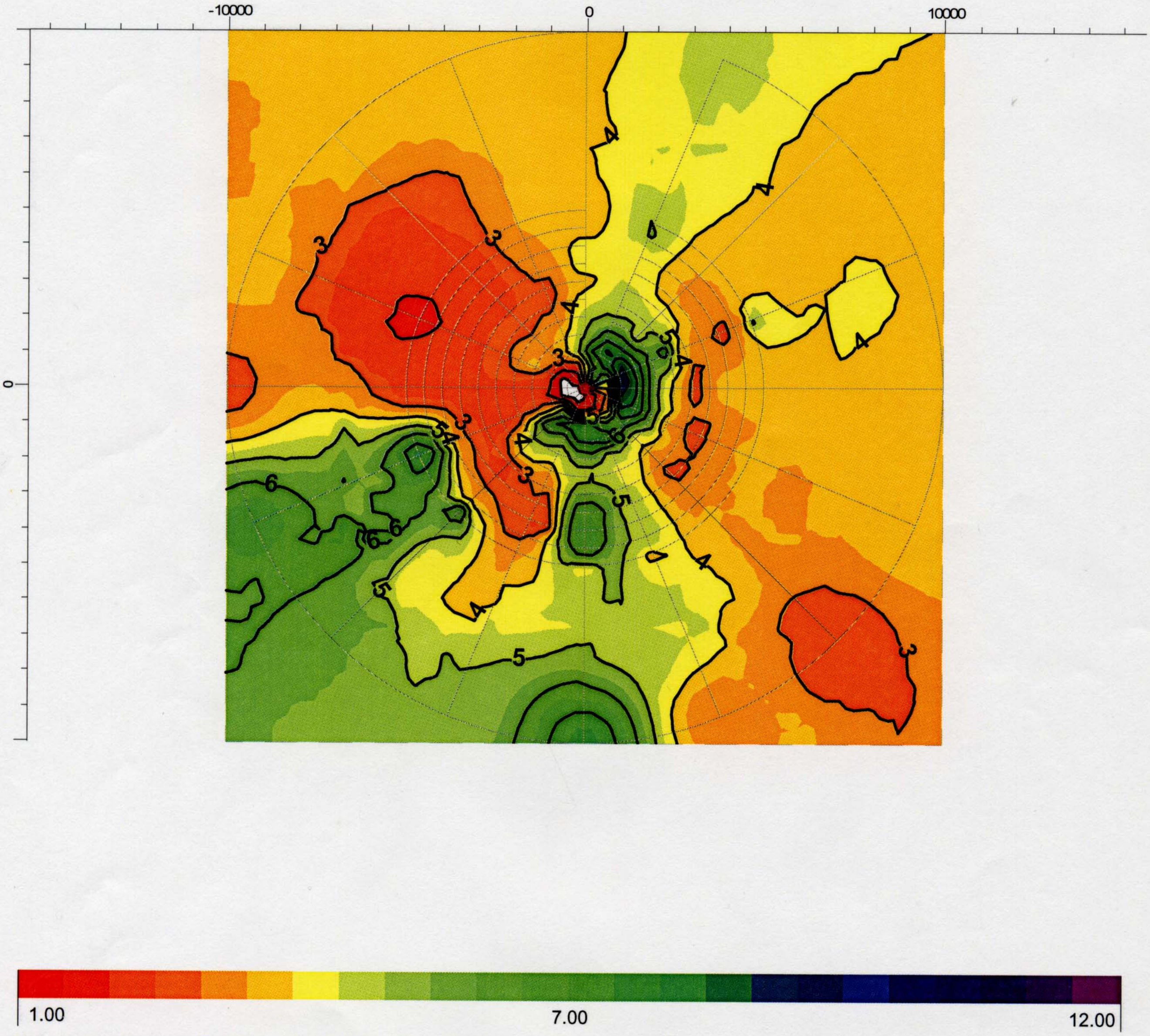
- The estimated GLCs in Region A (that is, near-field to plant) are much lower than either the 1-h or Annual regulatory value shown in Table 1, but the relative contribution from the LM6000 SPRINT stack emissions *to that portion of the GLCs contributed by TUC G.S.* is dominant in Region A, but an extremely 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 the 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 value of 21 $\mu g/m^3$.)**
LM6000 SPRINT alone - Maximum **1-h** GLC (NO_2)	Approx. 19 $\mu g/m^3$ (See Appendix 1 for note on Persistence)
LM6000 SPRINT alone - **Location** of Maximum 1-hour GLC	Intersection Sunnydale/Windmill
All stacks (TUC Unit Nos. 1-4) - Maximum 1-hour GLC (NO_2)	Approx. 293 $\mu g/m^3$
All stacks (TUC Unit Nos. 1-4) - Contribution of LM6000 to TUC Portion of Maximum 1-hour GLC	Approx. 9 $\mu g/m^3$ (~3%)
LM6000 SPRINT alone - Maximum **Annual** GLC Contribution (NO_2)	Approx. 0.3 $\mu g/m^3$
LM6000 SPRINT alone - Location of Maximum Annual GLC (LM6000 alone)	Near Victoria/Highfield
All stacks (TUC Unit Nos. 1-4) - Maximum Annual GLC (NO_2) from TUC G.S.	Approx. 3.5 $\mu g/m^3$
All stacks (TUC Unit Nos. 1-4) Contribution of LM6000 to TUC portion of Max. Annual GLC (NO_2)	Approx. 0.23 $\mu g/m^3$ (~7%)
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**

PROJECT TITLE :

TUC4 Preliminary Modelling June 2002
PLOT FILE OF HIGH 1ST HIGH 1-HR VALUES FOR SOURCE GROUP: LM6000



MODELING OPTIONS :

CONC, RURAL, ELEV, DFAULT

COMPANY NAME :

Nova Scotia Power, Inc.

OUTPUT TYPE :

CONC

RECEPTORS :

210

COMMENTS : Figure 7

Figure 7 - Highest 1-h
Ground Level
Concentration for
Nitrogen Dioxide
(TUC 4 alone)

MODELER :

J. D. Cousens, P. Eng.

SCALE :

0 5 km

MAX :

12.77683

UNITS :

ug/m3**

DATE :

10/1/02

PROJECT NO. :

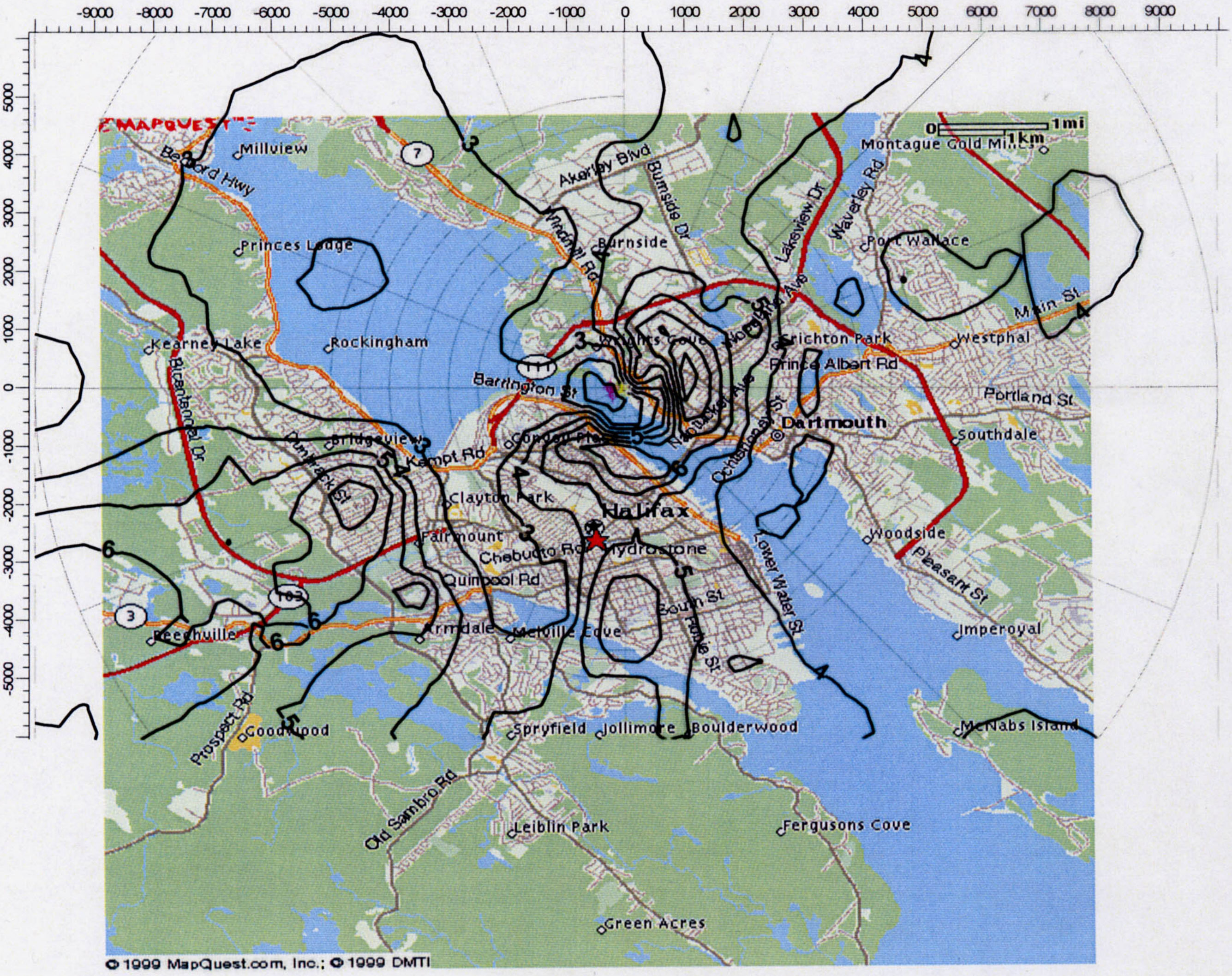
TUC 4 (LM 6000)

POST View - Lakes Environmental Software

C:\ISCVIEW4\TUC4CTJUNE2002\TUC4JU02.PR\01H1G002.PLT

PROJECT TITLE :

TUC4 Preliminary Modelling June 2002
PLOT FILE OF HIGH 1ST HIGH 1-HR VALUES FOR SOURCE GROUP: LM6000



MODELING OPTIONS :
CONC, RURAL, ELEV, DFAULT

COMPANY NAME :
Nova Scotia Power, Inc.

OUTPUT TYPE :
CONC

RECEPTORS :
210

COMMENTS : Figure 7
Figure 7A - Highest 1-h Ground Level Concentration for Nitrogen Dioxide (TUC 4 alone)

MODELER :
J. D. Cousens, P. Eng.

SCALE :
0 4 km

MAX :
12.77683

UNITS :
ug/m3**

DATE :
10/1/02

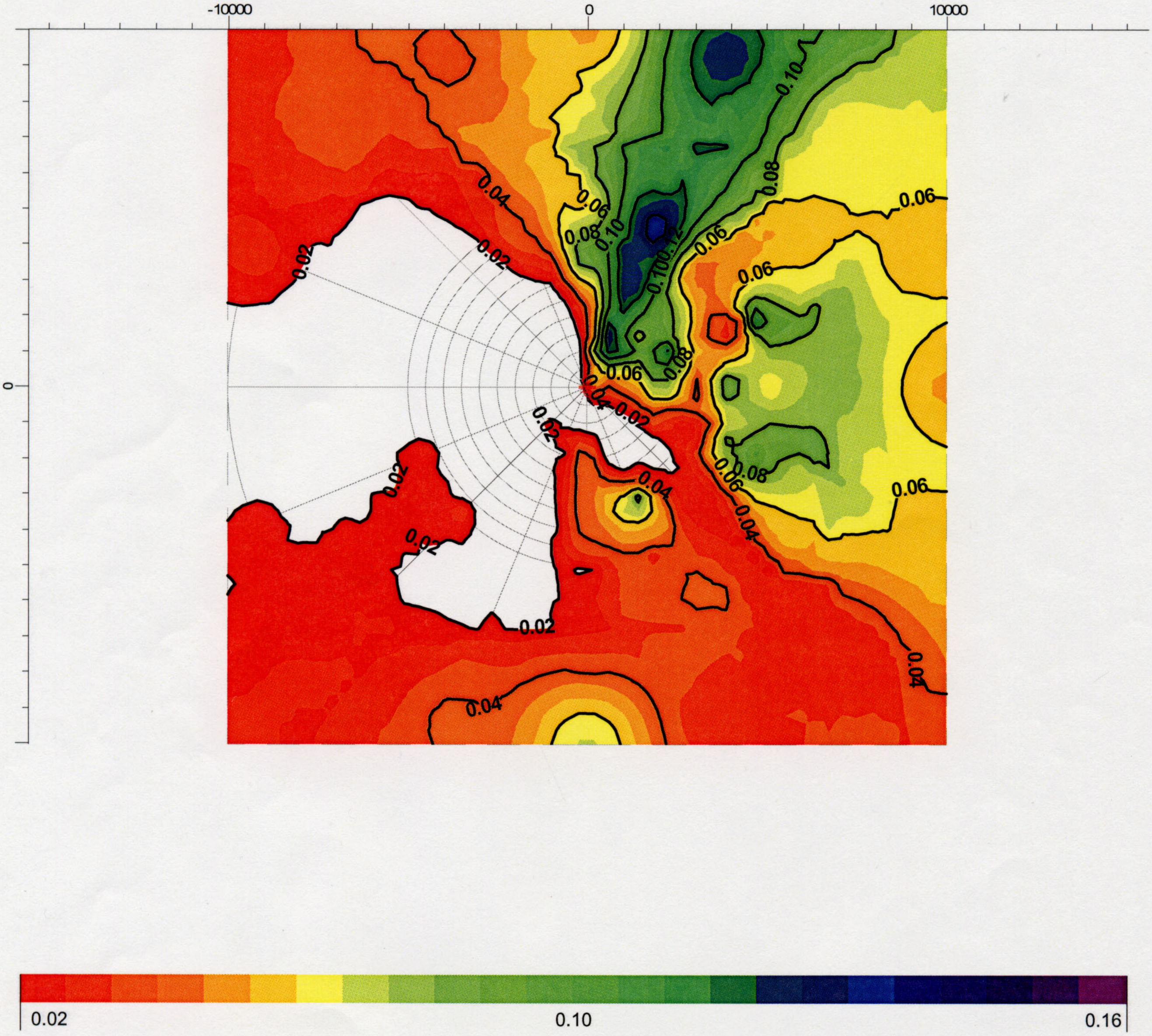
PROJECT NO. :
TUC 4 (LM 6000)

POST View - Lakes Environmental Software

C:\ISCVIEW4\TUC4CTJUNE2002\TUC4JU02.PR\01H1G002.PLT

PROJECT TITLE :

TUC4 Preliminary Modelling June 2002
PLOT FILE OF PERIOD VALUES FOR SOURCE GROUP: LM6000



MODELING OPTIONS :
CONC, RURAL, ELEV, DFAULT

COMPANY NAME :
Nova Scotia Power, Inc.

OUTPUT TYPE :
CONC

RECEPTORS :
210

COMMENTS : Figure 7

Figure 8 - Highest Annual
Average of 1-h Ground
Level Concentrations for
Nitrogen Dioxide
(LM6000 alone)

MODELER :
J. D. Cousens, P. Eng.

SCALE :
0 5 km

MAX :
0.15881

UNITS :
ug/m3**

DATE :
10/1/02

PROJECT NO. :
TUC 4 (LM 6000)

POST View - Lakes Environmental Software

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4.2 Noise Overview

Sound is a pressure wave travelling in air, or water. The wave speed in air is dependent upon conditions, but is approximately 340 metres/second. The frequency of sound is the number of waves that pass by, or through, a fixed location in a unit time period. The frequency of sound produces its distinctive tone.

The human ear does not hear all frequencies with the same effectiveness. In fact, the response of the human ear depends upon the sound frequency (measured in Hertz, Hz, (=1 cycle/sec)) and the sound pressure, measured in "decibels", dB. A young, healthy ear can hear sounds from 20 Hz to 20000 Hz.

Unwanted sound is called noise.

The decibel (dB) scale is logarithmic measurement scale that allows us to cope with the huge range of sound pressures that can be heard by humans. The weakest sound the human ear can hear is about 20 millionths of a Pascal (Pa). This is used as the zero for the decibel scale of measurement. Most continuous noise sources emit sound between 0 and 150 dB. Noise levels of 150 dB, equivalent to a jet aircraft take-off, are greater than the accepted threshold for pain (140 dB). Conversational speech is measured at about 55 dB.

The decibel scale doesn't replicate what the human ear actually hears. This occurs because the human ear is more sensitive to sound frequencies between 1000 and 5000 Hz, and less sensitive to higher and lower frequency sounds. To produce a more-representative scale for human hearing, the A-weighted, or dbA scale is used. A correction factor has been derived for various frequencies to change the unweighted decibels (dB) from a linear to non-linear A-weighted scale. Other weighting networks are used for other reasons. A C-weighted scale, for example, is used when low frequency noise is of concern, while the D-weighted scale is used with high frequencies.

Because of the different sensitivity of humans to the frequency of sound, a 50 Hz tone, for example, must be 15 dB higher than a 1000 Hz tone at 70 dB to be perceived as having the same "loudness". As a general rule, a doubling of the loudness of the sound occurs with every increase of 10 dB in sound pressure. Similarly, the "loudness" is cut in half when the sound would decrease by 10 dB.

A more familiar "guideline" when discussing industrial noise is that a doubling of sound pressure results in a 3 dB increase in the noise level. However, this "3 dB rule" applies only when identical noise sources are added or subtracted. That is, if a piece of equipment were recorded at 120 dB, and a second identical piece of equipment were added at the same location, the resulting measurement would be 123 dB. Noise treatment is further complicated because noise valuation ("nuisance") is interpreted differently by different individuals.

4.3 Noise and the LM6000

The LM6000 SPRINT CT is derived from the core of General Electric's CF6-80C2 high-thrust, high-efficiency aircraft engine. The design is common and the two products share about 90% of the same parts. It is a high-speed piece of equipment, operating normally at 3600 rpm, supported by low-pressure and high-pressure compressors. There are, then, several sources of noise from the operation of the CT, including the stack, which can add its inherent operating noise to the overall profile.

Nova Scotia Power will house many of the noise sources from the LM 6000 in its Control and Auxiliary Building, thus reducing their potential impact. For example, the compressors, auxiliary skids for lubrication and water injection (NO_x control), as well as the SPRINT support skid will be located inside this structure. Part of the benefit considered in purchasing the extra height for the stack was to improve the noise profile from its operation in the region very near to the stack. The stack, itself, has been modified by the addition of baffles to reduce its noise contribution.

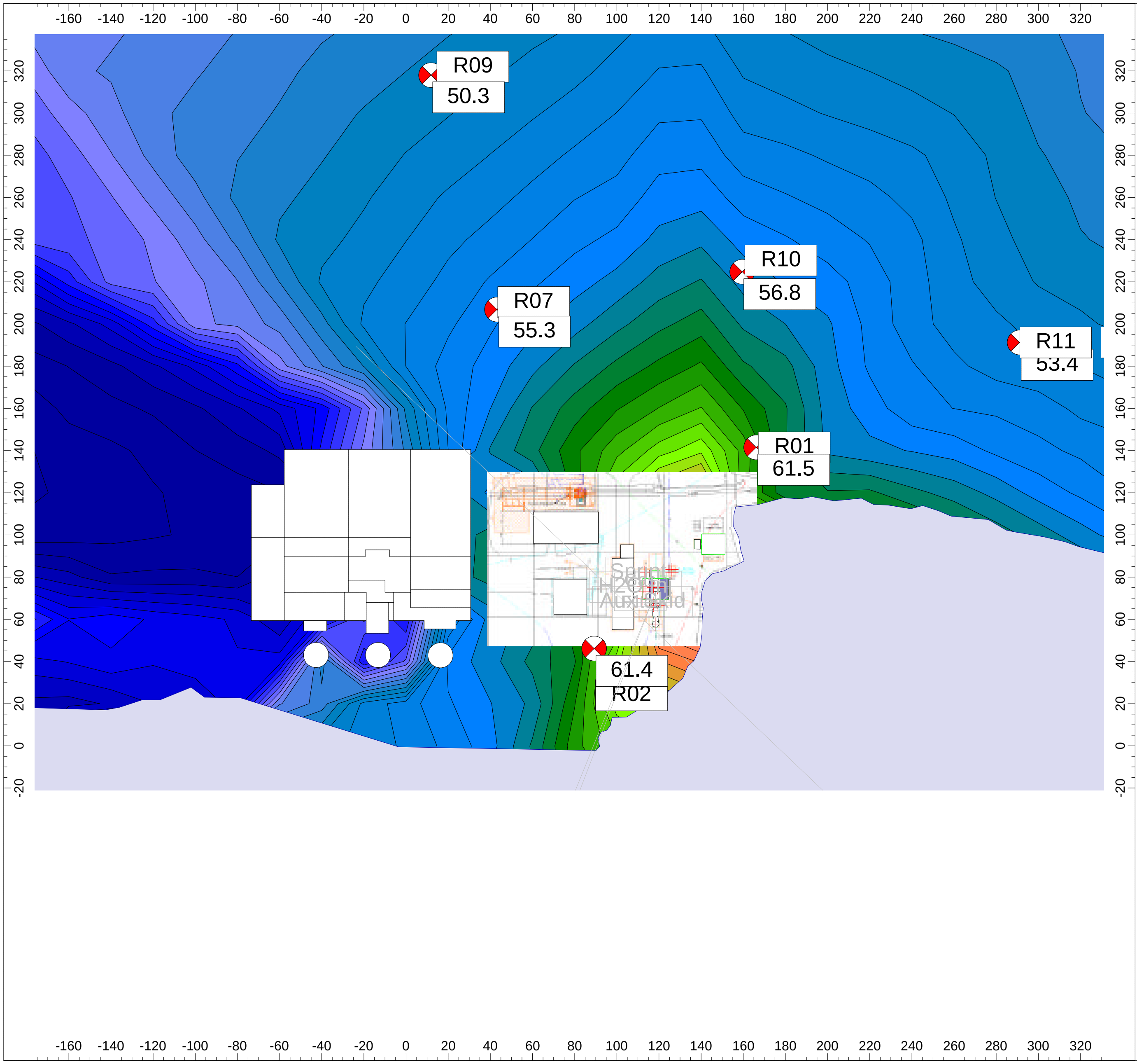
The commitment from NSPI regarding noise from the TUC G.S. is that steady operation of the LM6000 CT, when operating with TUC 1-3, will not increase noise levels more than 1 dBA above background levels established by measurement as baseline for this project.

4.4 Noise Study – ATCO Noise Management

NSPI has recorded its recent noise measurements, following standard protocols, from full operations, including with natural gas, of the existing TUC G.S. (See results, below). This information provided the design baseline for the mitigation, or treatment, of noise from operation of the LM6000. It also provides the baseline and identifies the "compliance points", against which measurements recorded during operation of the LM6000 will be compared.

The treatment program for noise was designed for NSPI by ATCO Noise Management. Figures 9 and 10 show the modelled contours for the untreated noise from full load operation of TUC 4, as well as the contours associated with the highest noise condition – synchronization idle. This situation occurs when the unit is running up to load or coming down from load. Since this will be an unusual condition during operation of the LM6000 as a baseload unit, the noise treatment actions or programs are focussed on the full-load operating condition. The possible intermittent noise from typical operations of the LM6000 can be managed within the treatment programs being designed for this unit.

Figure 11 shows the location of points at which noise has been measured in tests conducted over time by NSPI. While the street names are not clearly discernable in the Figure, the identified points will be seen to trace the property boundary of NSPI with its nearest neighbours. R09 is at the NSPI fence at Sunnydale Avenue, while R07 is at the NSPI fence, near the corner of Sunnydale and India Avenues. R10 lies at the NSPI property where it reaches India Avenue, and R01 is at the Nova Scotia Power fence and



Tufts Cove
Generating Station
Nova Scotia Power

FIGURE 9

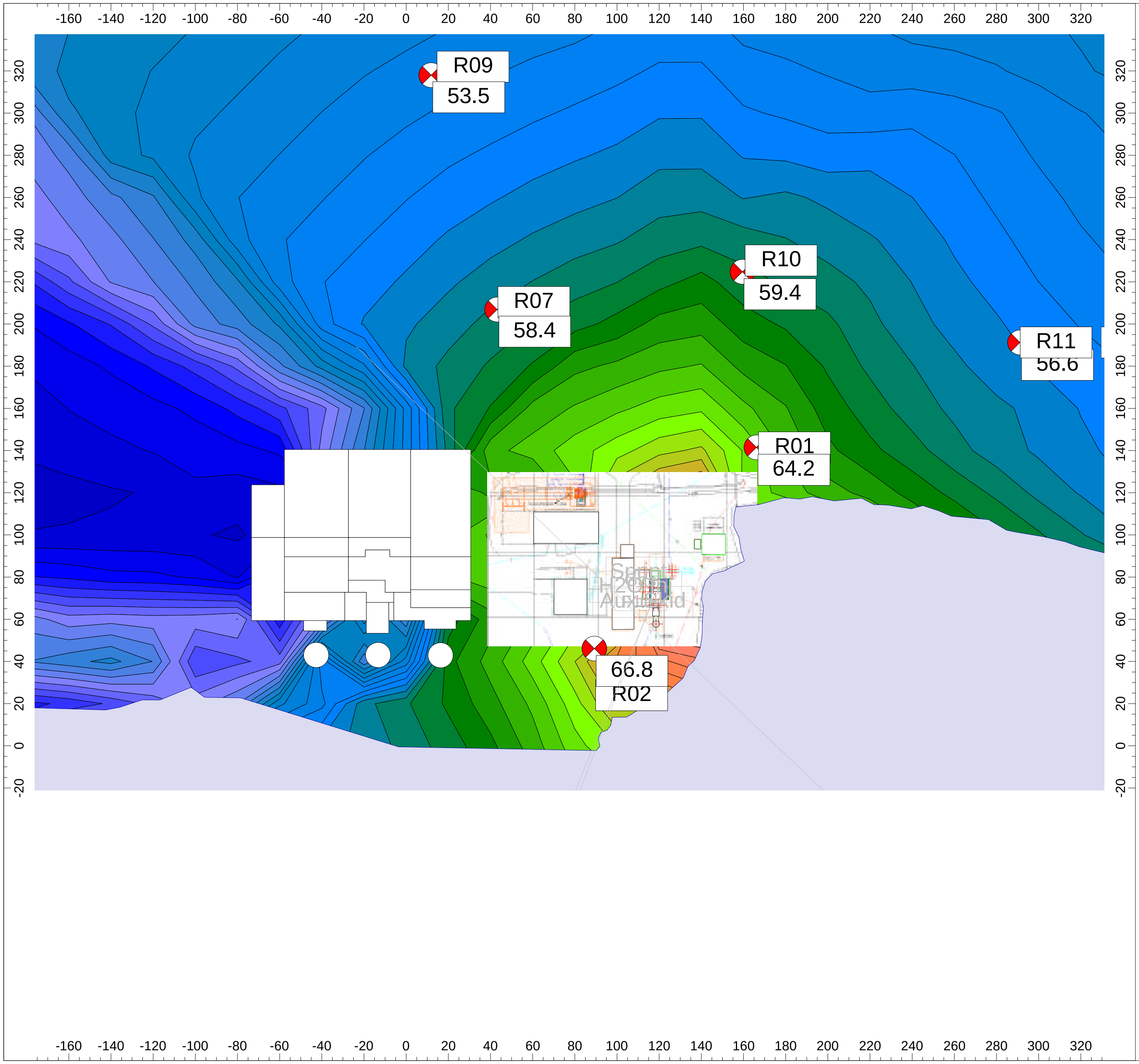
Noise Contours showing Untreated Full Load Conditions

■	> -99.0 dBA
■	> 35.0 dBA
■	> 40.0 dBA
■	> 45.0 dBA
■	> 50.0 dBA
■	> 55.0 dBA
■	> 60.0 dBA
■	> 65.0 dBA
■	> 70.0 dBA
■	> 75.0 dBA
■	> 80.0 dBA
■	> 85.0 dBA

ATCO Noise Management

Cadna/A

Untreated_ver3.cna
01.10.02



Tufts Cove
Generating Station
Nova Scotia Power

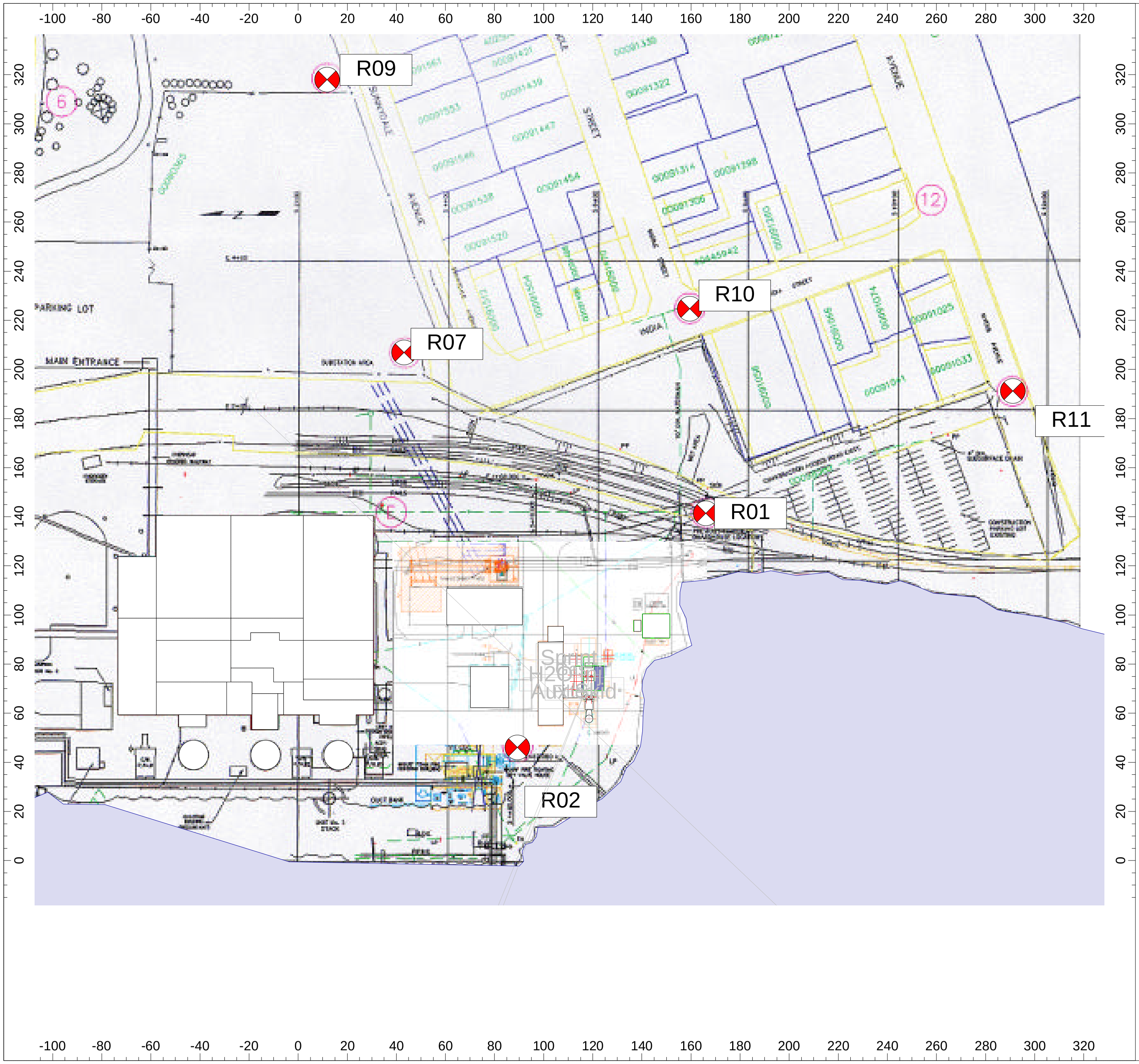
FIGURE 10

Noise Contours showing Untreated Sync Idle Conditions

■	> -99.0 dBA
■	> 35.0 dBA
■	> 40.0 dBA
■	> 45.0 dBA
■	> 50.0 dBA
■	> 55.0 dBA
🟩	> 60.0 dBA
🟩	> 65.0 dBA
🟧	> 70.0 dBA
■	> 75.0 dBA
🟥	> 80.0 dBA
🟫	> 85.0 dBA

Cadna/A

Untreated_ver3.cna
01.10.02



Tufts Cove
Generating Station
Nova Scotia Power

FIGURE 11

Noise Receiver
Test Locations

Cadna/A

Untreated_ver3.cna
30.09.02

the corner of a private property fronting on India Avenue. R11 completes the transect along the NSPI property line, meeting the end of Nivens Avenue.

These sample points and the associated measured values were used as baseline information for the studies to support the design of noise treatment actions. Locations numbered 7, 9, 10 and 11 were selected as the points of "compliance" for NSPI's commitment to not exceed, by more than 1 dBA during full operation of TUC 1-4, the measured noise value recorded at those points during recent studies.

The baseline noise values include steady operation of TUC 1-3 at full load.

Table 4
Baseline Noise Measurements including Full Load Operation of TUC 1-3

Reference[16]	Measured Level (dBA)	Comment
7	**56.9**	**Based on available information – Y2000 measurements**
9	**57.7**	**Based on available information – Y2000 measurements**
10	**52.4**	**Based on available information – Y2000 measurements**
11	**52.7**	**Calculated[17] from measured value – Y 1998 measurements.**

Using noise baseline information, and applying the 1 dbA limit for change to noise during steady operation of the LM6000, a number of actions were defined by the contractor to treat the noise sources from the LM6000. These actions are expected to provide the noise commitment made by NSPI for this Project.

Because of the nature of noise, and the complex manner in which it becomes integrated, it is difficult to guarantee the actual noise performance within the range committed to by NSPI from a pre-construction design. Hence, minor tuning of the operation, modifications to background noise sources from TUC 1-3, or additions and changes to the LM6000 to provide other noise treatment options, may be necessary during commissioning and early operation. For example, NSPI is accommodating, within its civil engineering design for the CT, the possible need for further noise treatment by incorporating lateral steel in locations where, say a attenuating wall may later be placed. Noise monitoring will be an important early activity after operation begins, and NSPI will make whatever tuning operations, or further additions, will be necessary to meet its commitment to noise management for the operation of the LM6000.

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[16] See Figure 11 for location of key points for measurement.

[17] Data obtained from Y1998 study where no night time reading was available. Based on analysis of data from nearest location, it was determined that the difference between daytime and night time was 3.6 dBA. The night time, or lowest reading, was calculated to be 56.3 dBA (day time) – 3.6 dBA (difference day to night) = 52.7 dBA.

A number of noise treatment actions are now part of the installation plan. NSPI relocated certain pieces of equipment, and, as noted, supplied a concrete building to cover process skids. Additional sound insulation was added to various structures, Two ventilation inlet louvers on the south wall of the Compressor Building have been re-located to the west wall, directing noise away from the community. The noise from the "taller" stack for the LM6000 is reduced in the near-field, simply because of the extra height beyond the minimum that might have been supplied with the unit. In addition, NSPI has added baffles at the base of the stack, in the flue gas stream, to reduce the inherent noise from fluid flow and associated harmonics. This changes the stack noise from 59 dBA to 50 dBA at 400 feet from the stack. The treated noise profiles are reduced to those shown in Figures 12 and 13.

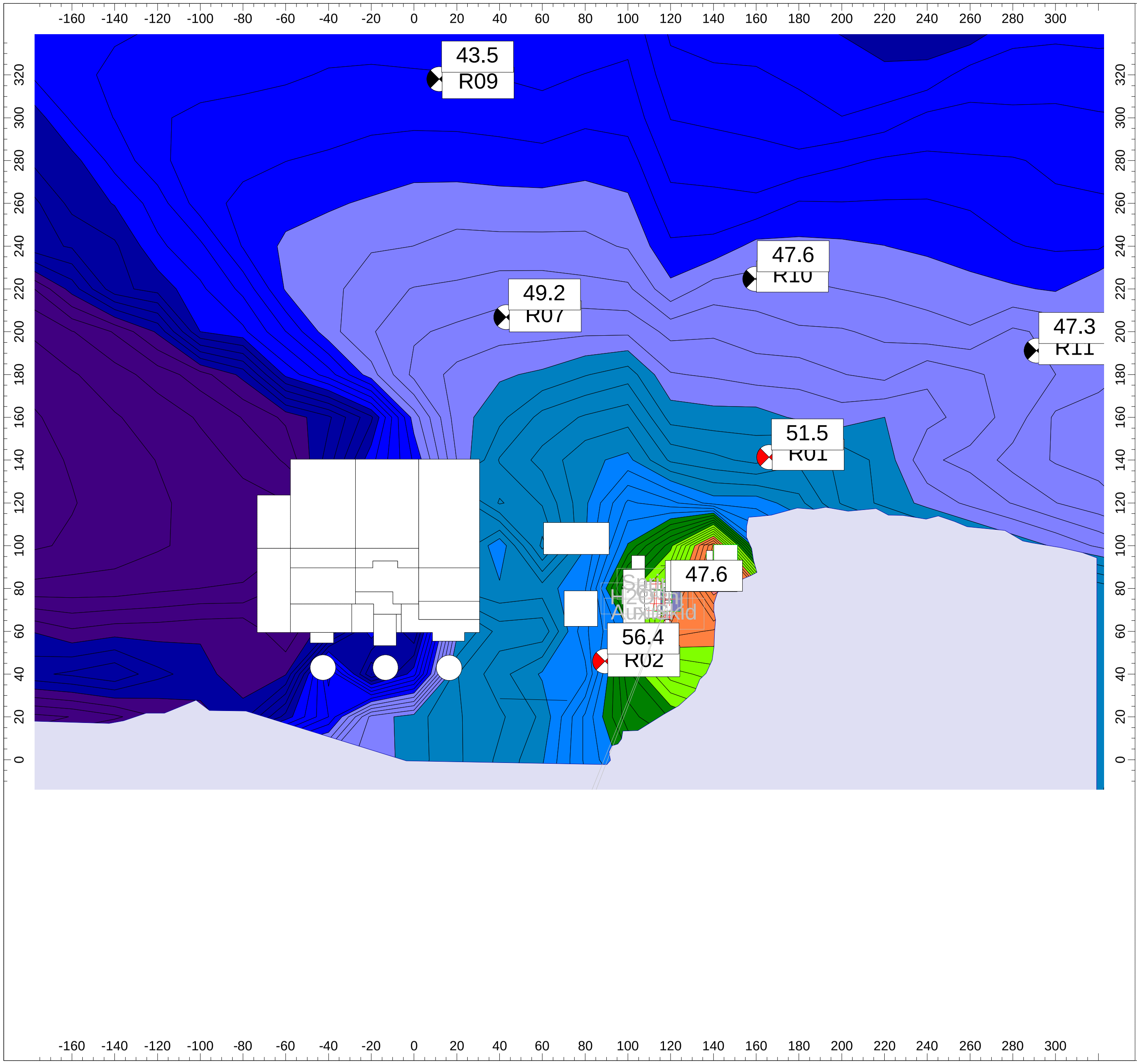
4.5 Gas Use Effects on Existing Tufts Cove Station

At this time, the existing Tufts Cove station is capable of, and has operating approval for, firing oil or natural gas. Operation in the previous 12 months has been primarily based on use of natural gas. Full capacity would use approximately 90 MMcfd. The new unit uses up to 12 MMcfd per day and makes use of the gas in a more efficient manner. Since additional capacity is not required for domestic load at this time, the proposed unit, TUC 4, will displace some less-efficient power production, possibly one of the existing units at the TUC G.S.

Therefore, in the early years following the start-up of TUC 4, it is the intention that natural gas will continue to be used at Tufts Cove (as long as there is availability of cost-competitive supply), but the basis for long-term natural gas use will be the management of overall system costs and maintaining secure and reliable electricity supply. In cases of short-term need (to meet peaks in domestic load or to take advantage of export opportunities) additional gas may be obtained, or part of the required electricity production could be carried out using oil. As load requirements increase in the future, additional gas will be obtained, dependent on price and availability of supply. However, the existing three units have been approved for dual fuel use and, as required, oil will be used in any and/or all three of the existing units. Oil will not be burned in TUC 4.

4.6 Residual Effects

The project, using high efficiency combustion turbine technology, is inherently a positive one for the environment. Use of natural gas in this new unit will normally displace some other, less efficient unit 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 construction of deflector walls.



Tufts Cove
Generating Station
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FIGURE 12

Noise Contours showing Treated to Allowable Limit for Full Load Conditions

■	> -99.0 dBA
■	> 35.0 dBA
■	> 40.0 dBA
■	> 45.0 dBA
■	> 50.0 dBA
■	> 55.0 dBA
■	> 60.0 dBA
■	> 65.0 dBA
■	> 70.0 dBA
■	> 75.0 dBA
■	> 80.0 dBA
■	> 85.0 dBA

ATCO Noise Management

Cadna/A

Treated_Case3_rev3.cna
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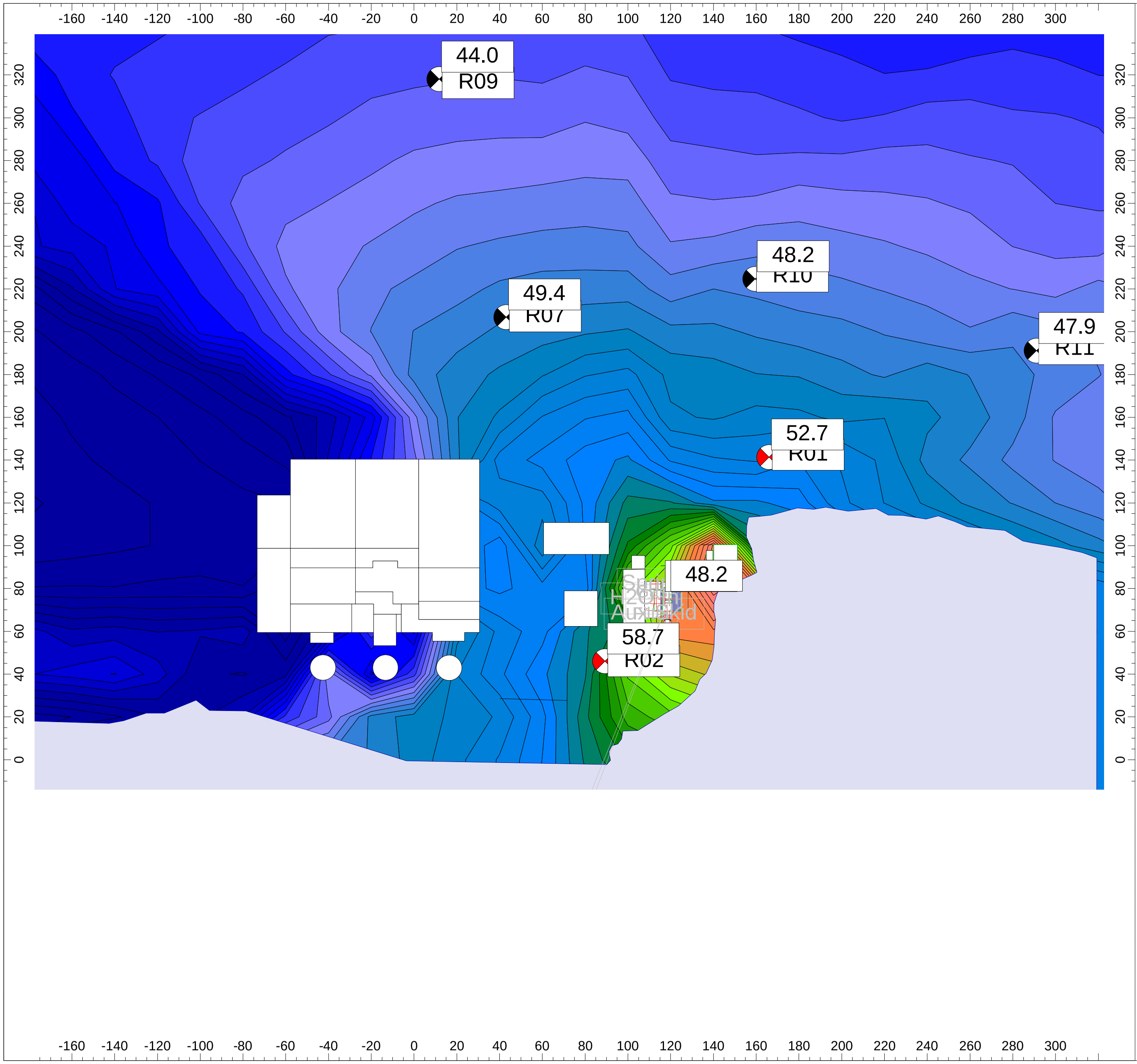

Tufts Cove
Generating Station
Nova Scotia Power

FIGURE 13

Noise Contours showing Treated to Allowable Limit for Sync Idle Conditions

🟪	> -99.0 dBA
🟦	> 35.0 dBA
🟦	> 40.0 dBA
🟦	> 45.0 dBA
🟦	> 50.0 dBA
🟦	> 55.0 dBA
🟩	> 60.0 dBA
🟩	> 65.0 dBA
🟧	> 70.0 dBA
🟥	> 75.0 dBA
🟥	> 80.0 dBA
🟫	> 85.0 dBA

ATCO Noise Management

Cadna/A

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Therefore, this project will have minimal residual environmental effects and, in the early years of operation, will likely result in a net improvement in effects from the whole NSPI generation fleet.

5 MONITORING

The Tufts Cove Station has an existing comprehensive monitoring program associated with Units 1-3. All wastewater treated, as required, and tested prior to discharge. Stack emissions are monitored for opacity and Nitrogen Dioxide. A network of ambient air monitors is maintained in the Halifax/Dartmouth/Bedford area. Other monitoring is carried out, as required.

Consistent with the minimal effects likely to result from the addition of TUC 4, additional monitoring will come from the operation of a Continuous Emission Monitoring System (CEMS) for Nitrogen Dioxide in the new stack.

6 SYNTHESIS

From this Report, the following information summarizes the situation for the addition of TUC 4.

Item 1 (p. 11)

NSPI inquired about, and received formal confirmation that, this proposed TUC 4 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.

Item 2 (p. 12)

More than 300 people attended the Open House. There were no significant concerns raised.

Item 3 (p. 25)

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, but 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 the 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.

Item 4 (p. 31)

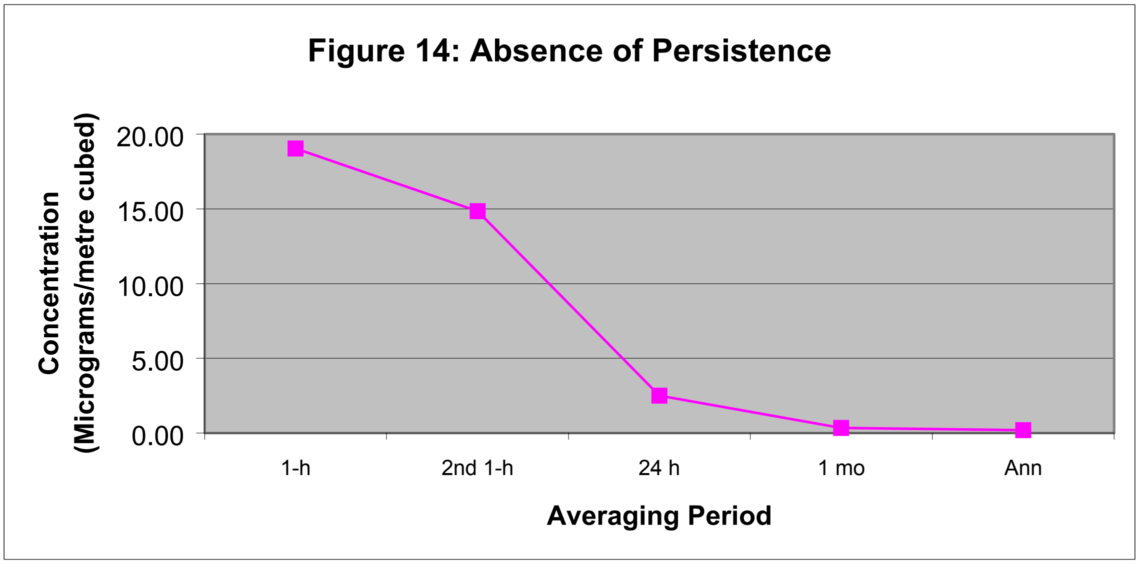
The commitment from NSPI regarding noise from the TUC G.S. is that steady operation of the LM6000 CT, when operating with TUC 1-3, will not increase noise levels more than 1 dBA above background levels established by measurement as baseline for this project.

Item 5 (p. 40)

Consistent with the minimal effects likely to result from the addition of TUC 4, additional monitoring will come from the operation of a Continuous Emission Monitoring System (CEMS) for Nitrogen Dioxide in the new stack.

7 APPENDIX 1

Note on Absence of Persistence



In Figure 14, we have used the point (see Table 3) in Region A (LM6000-only impact) where the highest 1-h GLC occurs (C/L Sunnydale and Windmill) – near the corner of the Plant Fence. This value is about 19 µg/m^3. As the first point in the discussion of persistence, note that the 2nd highest 1-h value is approximately 14.8 µg/m3 – illustrating the “fall-off” (or absence of occurrence of values near the highest value).

Now, if a large number of GLCs near 19 µg/m^3 occurred in a short period of time (persistence), then the 24-hour value would start to approach a value close to 19. Here, the maximum value of the average of the 24 consecutive hourly values falls to about 2.5 µg/m3.

Similarly, if there were a large number of days with 24-h averages close to 2.5, a monthly maximum might approach this value. It does not. The monthly average value is about 0.35 µg/m3.

Now, as the number of periods decreases, the averages will tend to a limit. But even for the annual period, the average of the twelve monthly values falls to about 0.19 µg/m3, meaning that the maximum value for the annual period is still representative of approximately twice the monthly average value.

This diminishing average GLC value with increasing length of averaging period argues for the “absence of persistence” for any relatively-high GLC.