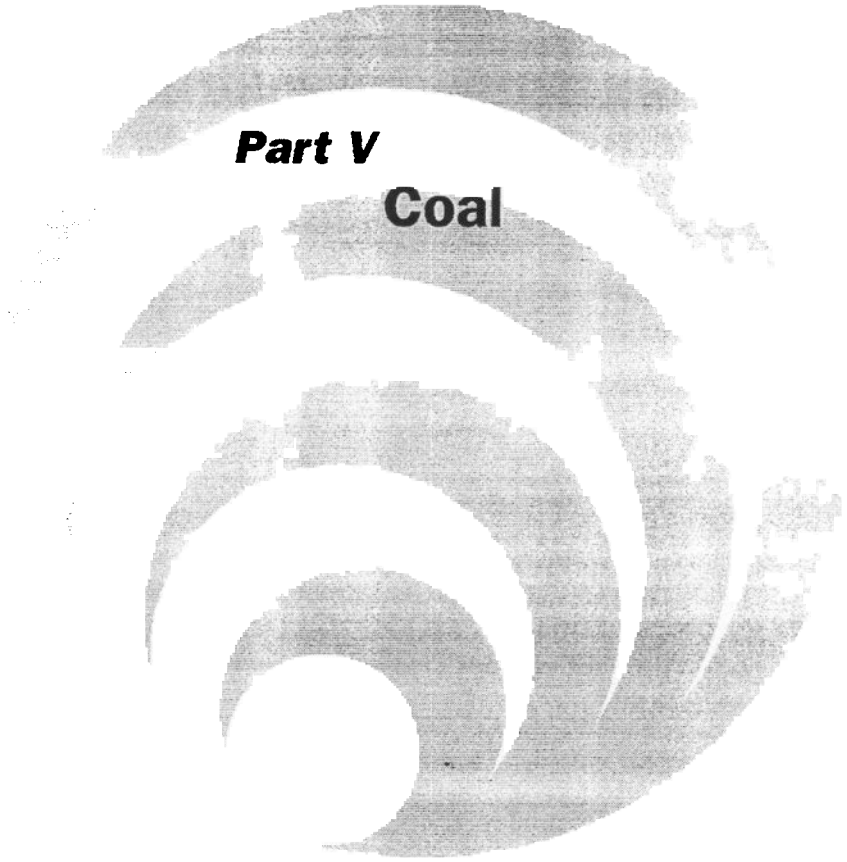
APPENDIX E

NOVA SCOTIA ENERGY STRATEGY
"SEIZING THE OPPORTUNITY" PART V COAL



Seizing the Opportunity

Volume 2

Nova Scotia's Energy Strategy

NOVA SCOTIA

Part V Coal

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Coal

Statement of Principle

Recognizing that coal will remain the principal fuel for electricity generation in the near term, Nova Scotia will encourage the use of indigenous coal where environmentally and economically appropriate, promote reclamation mining in lands previously disturbed by mining, and encourage development of clean coal technologies.

Coal will continue to be a primary fuel source for North America and Nova Scotia in the foreseeable future. The current coal-fired thermal plants in Nova Scotia have a remaining economic life of between 5 and 20 years, and it is economically preferable that they continue to operate for the duration of their economic lives if this can be achieved in the context of environmental constraints. However, additional coal-generating capacity will depend on the development of economically feasible and technically efficient forms of clean coal technology that deal with concerns about both air pollutants and greenhouse gas emissions.

Nova Scotia still has significant reserves of coal in the ground. Coal mining, when done in an environmentally responsible manner, can provide significant economic benefits to the province and to the communities near the resource. Nova Scotia will continue to support the development of indigenous sources of coal where environmentally and economically feasible, and will encourage responsible surface coal development projects, particularly those that assist in the reclamation of land affected by historical mining.

Burning coal to produce electricity has environmental impacts. Technology can significantly reduce the emission of some harmful substances, and development work is underway to increase the scope and efficiency of these technologies. Nova Scotia will encourage and support research and development related to clean coal technologies that can lead to better environmental performance and increased cost efficiency.

Government Role and Responsibility

The province owns the coal resources in Nova Scotia. It acts as promoter of the resource to the private sector, maintains a geoscience database and resident expertise in matters related to coal geoscience, manages the exploration, development and mining of coal under a system of licences and leases, and collects royalties on coal production, all under the authority of the Mineral Resources Act. The province also regulates the environmental performance of coal mines through the Environment Act and matters related to occupational health and safety in mines through the Occupational Health and Safety Act, with the exception of the Cape Breton Development Corporation (CBDC) operations which are subject to federal regulations for occupational health and safety.

The province has a role to play in helping to provide for the reclamation of lands disturbed by coal mining, including enforcing reclamation, establishing and holding reclamation bonds, and encouraging

reclamation mining, which can restore large tracts of land in Nova Scotia coalfields from an unsafe, variably derelict state to a productive state that can benefit the community.

The federal and provincial governments share responsibility for environmental standards related to air pollution through the Canadian Environmental Protection Act (federal) and the Environment Act (provincial). The federal government also has responsibilities under international agreements, such as the 1991 Canada-U.S. Air Quality Agreement, the 1994 UN-ECE Second Sulphur Protocol, and the Kyoto Protocol on climate change, as well as federal-provincial initiatives such as the Canada-wide Acid Rain Strategy Post-2000. The federal government is moving toward national standards for most air pollutants and is engaged with provinces and territories in a national process to determine the costs and benefits of ratifying the Kyoto Protocol and implementing its provisions. The province has a role to work with Ottawa in developing these standards and implementation plans.

Strategy Objectives

- To meet environmental air quality standards in economically efficient ways that minimize stranded costs.
- To support the development of indigenous coal sources for use in Nova Scotia where economically feasible and environmentally appropriate.
- To encourage land reclamation in present and former coal mining areas through reclamation mining, recovery of coal from previously disturbed mine sites, and restoration of the land following removal of the coal.
- To support the development of clean coal technology to enhance opportunities for coal use while managing environmental impacts on the atmosphere.

Actions to Achieve Objectives

2001-2005

- Work with Nova Scotia Power Inc. (NSPI) on its plans to meet environmental targets and on establishing the role for indigenous coal in future electricity generation in Nova Scotia.
- Work within the national climate change process to ensure that Nova Scotia's interests with respect to coal-fired thermal electrical generation are taken into account.
- Maintain an up-to-date, publicly available inventory of the province's coal resources, including available information on coal quality and parameters affecting its use and environmental impacts.
- Inform the public, through a public awareness campaign, of the value of coal mining and the opportunities it presents for land reclamation in and around communities, and local economic development.
- Ensure the orderly surrender of the CBDC mining lease.

- Establish a development plan for surface coal in the Cape Breton coalfield and a process to licence or lease the coal resources to new private sector operators.
- Work with CBDC to establish a reclamation plan for CBDC lands with environmental liabilities.
- Work with NSPI and Nova Scotia universities to monitor the existing technology and new developments in clean coal technology, and opportunities for research and development in Nova Scotia.
- Provide research and development credits for clean coal technologies that address environmental issues.

2006-2010

- Monitor research, and implement developments in clean coal technology.
- Monitor developments in alternate or unconventional means of coal utilization (e.g. *in situ* gasification).
- Encourage indigenous coal production, including reclamation mining in previously disturbed lands.

Links to Energy Strategy Themes

Developing clean coal technology, including methods to reduce CO_2 emissions, will allow Nova Scotia to meet environmental standards while continuing to maintain coal as a component in an increasingly diverse energy mix, thereby helping to **Secure our Future**. Requiring any new coal-fired plants to use clean coal technology to reduce emissions of pollutants and greenhouse gases, and encouraging reclamation mining to restore damaged lands to productive use and correct environmental problems related to past mining practices, will help **Improve the Environment**. By encouraging development of indigenous coal resources, we provide for continuing economic opportunity for our coal mining areas and reduce the export of jobs and money to offshore coal producers. In doing these, we help to **Power the Economy**.

Background

Nova Scotia's Coal Mining Industry

Coal is the dominant fuel for electrical power generation in North America and in the world. It is an abundant energy source, safe, often domestically produced, relatively stable in price, easily transported, and widely distributed and available. It is a lower-cost energy source than any other fossil or nuclear fuel alternative, and is thereby particularly suited for base-load power generation.

Coal mining is conducted in five provinces in Canada (British Columbia, Alberta, Saskatchewan, New Brunswick and Nova Scotia), with a total annual production of 75 million tonnes (t). In 2000, Nova Scotia produced approximately 1.1 million t, or 1.5% of coal production in Canada. Coal is consumed in

each of the five producing provinces; Ontario and Manitoba, which do not produce coal, also consume significant quantities.

Nova Scotia's abundant coal resources have been used to fuel the industrial and economic growth of the province since coal mining started in Cape Breton in the 1720s. Between 1863 and 2000, more than 400 million t have been produced from the major coalfields of Nova Scotia which include:

- Sydney coalfield (Port Morien district, Glace Bay district, New Waterford district, Sydney Mines district, New Campbellton district),
- Inverness County coalfields (Port Hood, Mabou, Inverness, St. Rose-Chimney Corner),
- Pictou coalfield (Westville, Thorburn, Coalburn, Stellarton),
- Cumberland County coalfields (Springhill coalfield, Joggins-River Hebert coalfield),
- Kemptown-Debert coal area,
- Richmond County coal area, and
- Glengarry (Loch Lomond) coal area.

Between the early 1900s and the mid 1960s, Nova Scotia's annual coal production was between 4 and 6 million t, reflecting a strong demand from robust iron and steel, transportation, and energy industries within the province, as well as a significant coal export market. Although traditional markets declined in the 1960s, by the early 1970s a world oil crisis resulted in significant increases in fuel oil prices and renewed demand for coal. Concerns over the price and security of fuel supply for electrical power generation in the province led the provincially owned electrical utility to construct new coal-fired power generating plants, which provided increased coal markets for Nova Scotia's mining industry. The development of new mines in the Cape Breton coalfield (Prince, Lingan, Phalen) led to a strong coal supply in the province between 1975 and 1995. However, by the early 1990s, the original CBDC mines had closed or were approaching the end of their planned economic life. The corporation's newest mine, Phalen Colliery, experienced serious technical difficulties and eventually closed in 1999. In 2001 CBDC announced that it would close its last remaining underground coal mine, Prince Colliery, by the end of the year. These mine closures have resulted in a steady decline in the province's coal production since 1995. In 1996 NSPI started importing coal to meet its fuel requirements, only the second time in a century that coal was imported into Nova Scotia.

Nova Scotia depends on coal to fuel approximately 80% of its electricity generation. The value of coal mining to the province in 1999 was $103.5 million and the industry provided approximately 1,000 jobs. NSPI currently has the capacity to generate 1,238 MW from coal-fired generators in four locations (Table 1) that collectively represent an annual demand for about 2.8 million tonnes of coal. Coal generators typically are considered to have a useful life of about 40 years, and capital costs are amortized over this time period. The oldest units of the current NSPI coal generators have a remaining useful life of about 5 years (Trenton 5); the youngest, approximately 30 years (Point Aconi).

Table 1. NSPI Thermal Generation Capacities

NSPI power generating stations	No. units	Net Operating Capacity (MW)	Coal Consumed (t) *
Trenton #5 (coal)	1	150	400,0000
Trenton #6 (coal)	1	155	430,000
Point Tupper #2 (coal)	1	148	426,000
Point Aconi (coal) (petroleum coke)	1	165	189,000 (coal) 213,000 (coke
Lingan #1, 2, 3, 4 (coal)	4	620	1,663,000
Tufts Cove (heavy fuel oil/natural gas)	3	332	n/a
Total		1,228 (coal/coke) 332 (HFO/gas)	3,108,000 (coal)* 213,000 (coke)

*Coal consumption in 2000 was higher than normal (2.5-2.8 million t) due to high fuel oil costs to NSPI.

Nova Scotia's coal industry currently comprises seven small-scale, privately owned surface mines with a combined annual production of 300,000-400,000 t. The province's last underground coal mine, Prince Mine, closed in November, 2001 (Table 2).

Surface coal mines in Nova Scotia are typically small-scale operations. They provide jobs and economic activity for the community in which they operate, as well as the opportunity to remediate and reclaim lands that have previously been disturbed by mining. In many areas previous mining activities, both legal and illegal, have left a legacy of mine openings, subsidence, waste that can produce acid drainage, and abandoned infrastructure that render the land derelict. In many historically mined areas, there is a coal resource remaining near the surface that can be recovered by small surface mines. When the land is reclaimed after mining, this reclamation corrects not only the impacts of the recent mine but also the impacts of historical activities. Reclamation mining projects have the potential to reclaim large tracts of land disturbed by historical coal mining, and because the reclamation is carried out by the operator as part of the project cost, there is little or no cost to the province or the municipality.

Coal Resources

After 250 years of coal mining Nova Scotia still has significant indigenous coal resources that could be developed by conventional mining methods to supply the provincial coal demand. Some of these resources are identified in Table 3. This listing is not an exhaustive inventory. The largest single coal resource remaining in the province that can be mined by underground methods is the Donkin resource. A large number of available surface coal resources remain, many of which are in historically mined areas and provide opportunities for reclamation mining. Opportunities for reclamation mining are particularly prevalent in the Sydney coalfield, most of them areas included in the CBDC mining lease. These resources will return to the Crown when the corporation surrenders its lease, expected in late 2001 or 2002.

Table 2. Nova Scotia Coal Production, 2001.

Company	Mine	Operation Type	Ann. Capacity (t)
CBDC	Prince Mine (closed Nov. 2001)	underground colliery	1,500,000
Pioneer Coal Company (and related companies)	Stellarton Mine	reclamation open pit	210,000
	Evans Mine	reclamation open pit	50,000
	Coalburn Mine	open pit	50,000
	Thorburn	reclamation open pit	final reclam
Brogan Mining Limited	Little Pond	reclamation open pit	50,000
Cape Crushing Limited	Cape Crushing	reclamation open pit	24,000
Hill Reclamation Limited	Springhill	reclamation Railbed	14,000
Total			1,898,000*

*This value represents the cumulative annual capacity of all mines, not annual production.

It is possible that research now underway into unconventional methods of mining coal, such as *in situ* gasification, may in the future render feasible the development of coal resources that are too deep or of too low a quality to be considered for conventional mining. These coal resources could also be prospective for coal-bed methane. In the event that new mining technologies are developed that can exploit such resources, there are potentially much larger reserves in Nova Scotia than those summarized in Table 3.

Royalty

Nova Scotia's royalty rate for coal, prescribed in section 174 of the Mineral Resources Regulations (SNSN 1990 c.18) at $0.25/ton ($0.276/tonne), is the second-lowest in Canada. The province also collects revenue in the form of an annual mining lease rental fee, which mining companies pay for the privilege of maintaining "exclusive right" to the lease area for some specified period of time (usually 20 years). The mining lease rental rate in Nova Scotia is currently set in the Mineral Resources Regulations at $80/claim/year (1 claim = 40 acres, or approx. 16 ha).

Environmental Impacts

The use of any hydrocarbon for power generation carries an environmental cost. Specifically, burning coal produces emissions of sulphur dioxide (SO_2), particulates, nitrogen oxides (NO_x), carbon dioxide (CO_2), and trace metals that may include mercury, lead, and cadmium, depending on the composition of the coal. SO_2 and NO_x emissions contribute to acid rain, particulate matter and NO_x contribute to smog, and CO_2 is a greenhouse gas (GHG) believed to be a cause of global climate change. Trace metals (mercury in particular), NO_x, and particulates affect air quality and pose health concerns.

Table 3. Selected Nova Scotia Coal Reserves Suitable for Conventional Mining.

Coal Resources	Mining Method	Status	Reserves (million tonnes)	Sulphur (approx. %)	Ash (approx. %)
Prince Colliery (Point Aconi)	Underground	inactive, CBDC	15	3.5	12
Donkin Resource Block	Underground	inactive, resource available	>200	4.5	12
Sydney Coal Field	Surface (reclamation)	2 active, resource available	11.5	3-6	8-18
Pictou Coal Field	Surface (reclamation)	2 active, 1 complete resource available	5.3	0.8-3	12-30
Western Cape Breton	Surface (reclamation)	inactive	1.2	1-7	6-15
Springhill Coal	Surface (reclamation)	inactive, resource available	>2	1-3	10-15
Total underground			>215		
Total surface			>20		

The GHG emissions issue is currently being addressed by Canada's National Climate Change Process, by which the Canadian federal and provincial governments are assessing the opportunities and costs of ratifying the Kyoto Protocol. There are two opportunities for the release of GHG during the coal cycle: methane trapped in coal can be released to the atmosphere during mining, and burning coal emits CO_2. The continued use of coal for electricity generation may be affected by any steps that Canada eventually takes to address global climate change, or by any fiscal instruments that are enacted nationally to encourage GHG emission reductions.

Coal mining can create environmental benefits, including site reclamation and positive socio-economic impacts. It can also cause negative environmental impacts, including changes to surface water and groundwater, terrestrial and aquatic habitat loss, air pollution, noise pollution, and archaeological impacts. These environmental impacts can be minimized through proper planning and design.

Clean Coal Technology

Coal accounts for 38% of the electricity generated worldwide (more than double any other single fuel source) and more than half (56%) of the electricity generated in the United States, a figure that has remained fairly consistent over the last five years. Recent reports from the U.S. Department of Energy (DOE) suggest that by 2020 the United States may consume about 22% more coal than today. The recently released U.S. energy strategy includes the construction of 1,900 new power plants, many of which will be fired by coal.

The resurgence in coal generation in the United States, and the expected continued increase in demand for coal worldwide, is expected to encourage research and development of clean coal technologies. "Clean coal technology" is defined by the World Coal Institute as "technology designed to enhance both the efficiency and environmental acceptability of coal extraction, preparation and use."

Many of these technologies are commercially viable and in use worldwide; others are still in research and development stages.

The scope of research into clean coal technology is worldwide and substantial. The U.S. DOE has leveraged funding of over US$5.3 billion for research into clean coal technology in the last 15 years, and the recent American energy strategy commits a further $2 billion in funding over the next 10 years. Clean coal technology research programs are prominently featured at a number of universities, and many developed countries that include coal in their energy mix sponsor clean coal technology programs. Industry associations also recognize the need for new clean coal technologies and are sponsoring research and development to improve existing technologies and develop new methods for meeting the environmental challenges of burning coal.

In general there are three types of opportunities for reducing emissions from conventional coal-fired generating plants:

- pre-combustion (e.g. using low-impurity coal and treating coal to remove sulphur, moisture, ash, and other impurities),
- combustion (e.g. high-efficiency burners and low-NO_x burners reduce emissions during combustion), and
- post-combustion (e.g. flu gas treatment using sulphur scrubbers or electrostatic precipitators to contain particulates).

Flue gas treatment methods and cleaner combustion technology have led to the substantial reduction of emissions from coal-fired power generation in the last 30 years. In the United States emissions of SO_2 have been reduced by 40% since 1970, even as coal consumption tripled. The unit emissions of sulphur pollutants have been reduced by more than 80%. This has been achieved by burning low-sulphur coals, using scrubbers to remove sulphur from the stack (flue-gas desulphurization), and increasing generating unit efficiency. Emission of particulates and other gases that affect air quality has also been reduced substantially.

The electricity generation industry has made significant gains in efficiency, which reduce the quantity of coal required to produce a unit of power, and consequently reduce emissions. Most of today's power plants burn pulverized coal, and achieve 33-38% thermal efficiency. Recently developed closed-cycle processes recover heat previously lost in exhaust gases and can increase efficiency to the 45% range. Generating unit designs using supercritical steam temperature technologies operate at efficiencies in the 42-45% range. In the future, the use of new advanced materials in coal-fired generating plants may enable efficiencies up to 55%.

Along with treatment methods to control emissions of conventional coal-fired plants, advanced coal combustion technologies have been developed. Fluidized-bed combustion, for example, in which the coal is mixed with a sorbent (usually limestone dust) prior to combustion in a bed fluidized on a stream of hot air, is the method used by the NSPI Point Aconi plant. Another promising technology is Integrated Coal Gasification Closed Cycle (IGCC), in which the coal is turned into a gas (syngas), which is combusted in

a gas turbine. Heat is recovered from the gas turbine exhaust gas and used in a steam turbine generator, thus forming a combined cycle. The IGCC process substantially reduces emissions and operates at higher efficiency (approaching 45%) than typical pulverized-coal generating plants. Advances in gas turbine technologies have the potential to increase efficiency to levels above 50%. There are three commercial-scale IGCC demonstration plants now operating in the United States and four in Europe.

Research is also underway into the development of a closed cycle coal-coal gas hybrid system, in which the residual "char" after gasification of the coal is burned to produce steam. Efficiencies of over 50% may be achievable using this technology.

Significant research is being carried out to reduce greenhouse gas emissions from coal combustion. Increasing the thermal efficiency substantially reduces CO_2 emissions (an increase from 35% to 45% in thermal efficiency can typically reduce CO_2 emissions by 20-30%). Alternatives for reducing greenhouse gas emissions include capturing and storing CO_2 emissions from coal-fired generating stations and sequestering the gas, for example in geological formations.

Gasification of coal may eventually provide a source of hydrogen for fuel cell applications. As well, there has been some work done on *in situ* gasification of coal, primarily in Russia where the method is successfully employed. This may ultimately provide a means of recovering coal resources that are either too deep or too low quality to be recovered by conventional mining methods.

One interesting research program is the Zero Emission Coal Plant currently being researched by the Los Alamos National Laboratory and the Zero Emission Coal Alliance. The process involves the anaerobic production of hydrogen gas from a coal/water slurry, the hydrogen then being used to produce electricity in a solid oxide fuel cell. Excess CO_2 is captured and sequestered. Mercury, lead, arsenic, and cadmium are of concern in coal-fired flue-gas emissions. Concentrations of these and other metals vary substantially by coal seam and by coalfield. Electrostatic precipitators can recover over 95% of cadmium and arsenic, but are less effective for mercury. Fabric filters (baghouses) are effective in controlling some trace metals, particularly when sorbents are used. Wet scrubbers, in combination with sorbents, can also be effective in mercury capture. Cleaning coal before burning can also reduce the emissions of heavy metals.

The installation of clean coal technologies to reduce emissions and improve efficiency generally comes at a price: additional operating and/or capital costs. These costs may limit the use of the technologies in applications where cleaner burning fuels such as natural gas are available at a competitive cost. There will always be a trade-off between cost and emissions; however, expectations are that the next generation of clean coal power plants will cost significantly less than the early pioneers and, depending on the cost of other energy sources, the application of even the more expensive clean coal technologies may be economically viable.

Public Advice

Nova Scotians are aware of the importance of coal to our economy. The majority of respondents to

questions about the future of coal in Nova Scotia's energy mix expressed the opinion that coal is still a competitive alternative to other fuel sources and that as long as environmental standards can be met, coal should remain part of the province's energy mix. Arguments included the desirability of maintaining a diversity of energy sources and the need to keep electricity costs stable. Many respondents also felt that we should attempt to maximize the use of local coal resources and look for alternative methods of using coal-as a source of coalbed methane for example. The importance of research and development in the field of clean coal technology was emphasized.

A number of respondents and submissions were not in favour of the continued use of coal to generate electricity, mainly because of the impacts of coal burning with respect to air pollution and greenhouse gas emissions. They pointed out that if one considers full life-cycle environmental and health costs, then coal may not be the most economic fuel.

Analysis

Worldwide, coal is by far the most abundant source of fossil-fuel energy. Proven global coal resources are widely dispersed geographically, and are estimated to hold more than 200 years' reserves at present production rates. In contrast, some 70% of oil and gas reserves are in the Middle East and the former Soviet Union, and can provide 45 to 60 years at current production rates. Coal prices are typically among the lowest of hydrocarbon fuels, and the widespread and abundant coal reserves provide for both price stability and long-term price efficiency.

Clean Coal Technology

Coal is likely to be a fuel of choice in many parts of the world for the foreseeable future, and it will continue to present significant environmental challenges for the planet. Recognizing the importance of coal to future energy needs, many countries have initiated measures to mitigate the environmental impacts by investing significantly in clean coal technology. Clean coal technology may be particularly important to Nova Scotia, because of the relatively high sulphur contents of some of our coal, and the possibility of future requirements to reduce greenhouse gas emissions from electricity generation. Application of clean coal technology could potentially allow indigenous fuel sources to continue to contribute to our energy future. Generating at least some of our electricity from coal-fired plants will contribute to the diversity and overall price efficiency of our generation sources.

The downside of implementing clean coal technology at present is cost and, in some cases, incomplete technology development. Installing new clean coal technology on an existing plant can represent a significant capital investment in a plant that may have a limited life span. In Nova Scotia, additional capital costs would have to be recovered through the utility's rate base, putting upward pressure on the price of electricity.

It is recognized that technological solutions for one problem can exacerbate another. For example, installing SO_2 scrubbers in a plant such as Lingan may decrease the overall efficiency of the unit, thereby

increasing CO_2 emissions. Current action to reduce SO_2 emissions in such a facility might, therefore, conflict with future actions to reduce CO_2 emissions, potentially stranding the costs of the SO_2 scrubbers, with attendant overall cost to the utility and, eventually, to consumers.

Technology to clean up the pollutants is available and, though currently expensive, likely to become cheaper as the technology finds increasingly wider application. For example, the Point Aconi plant is a fluidized-bed unit that can burn high-sulphur fuel with minimal SO_2 emissions. Clean coal technology is currently the subject of intensive research and testing, particularly in the United States, Japan, and Europe, and several large plants are under construction. However, technology to capture and sequester the greenhouse gasses is not as advanced, and economic solutions to the release of GHG are probably still some distance in the future. Proven, cost-competitive technology will be required to address all air issues related to coal-fired generation, both pollutants and GHG. For Nova Scotia to meet its environmental goals, new coal-fired generation in the province will require such technology.

Alternatives

The most economically efficient option for the existing coal-fired generation plants is to allow them to operate to the end of their economic life cycle. Early retirement of any coal-fired unit would result in stranded costs, the magnitude of which would depend on the size of the unit and the length of its remaining life. Any such action would also require early capital costs for construction of new generation capacity to replace the lost units. Adding these costs to the utility's rate base would translate into upward pressure on electricity rates. Similarly, converting coal-fired units to alternative fuels such as natural gas would be both capital intensive and potentially more expensive with respect to the fuel source. Natural gas is most competitive when it is used in specially designed and built combined-cycle plants rather than converted coal plants. Therefore, even a staged and planned move from coal to natural gas would result in additional costs rather than savings to energy consumers.

Nonetheless, action is required with respect to air emissions from coal-fired thermal plants. The measures in the energy strategy will make a real difference to our environmental performance, providing a clear signal that Nova Scotia takes its responsibilities seriously and expects other jurisdictions to do the same. The targets can be met without forcing either early closure or major new capital expenditures on the utility. Reductions in air contaminants can be accomplished by a combination of switching to cleaner-burning gas where feasible and using imported coal that contains less sulphur and generates lower levels of air contaminants than many indigenous coals.

The principal uncertainty in this scenario is the national climate change process which may mandate actions to meet national greenhouse gas emission-reduction targets. Any actions to reduce GHG in Nova Scotia will necessarily involve significant changes to the way we generate our electricity. Any steps that the federal government takes to reduce GHG emissions nationally will certainly affect the Nova Scotia economy, because generation of electricity by coal burning is a significant emitter of GHG. It is critical that the province continue to work within the national climate change process to ensure that the burden of

national targets for GHG reductions is shared fairly across jurisdictions, and that Nova Scotia's interests are protected in any such process. Actions to reduce GHG emissions should, if possible, be staged so as to take full advantage of the natural economic cycle of the current coal-fired generation plants and, to the extent possible, minimize upward pressure on utility electricity rates.

Research and Development

Nova Scotia is unlikely to be a major player on the global stage of clean coal technology. However, any long-term future for coal in the Nova Scotia electricity industry, particularly new investment in coal generation (whether re-powering of existing generators or construction of new capacity), will depend on the development and implementation of appropriate technology to allow the industry overall to meet the province's economic and environmental goals. In the short term, the province should develop and support a capability in targeted research areas that can contribute to the development of these technologies, particularly areas that can directly benefit Nova Scotia. This could be done through making use of existing expertise in Nova Scotia universities, supported by public and private sector partnering, and incentives for clean coal research and development. In the longer term, the province must continue to monitor international efforts in this area and promote the use of any new technology that can contribute to environmental goals. To ensure opportunities to maintain coal as part of a diverse energy mix, our longer-term goals must allow for the flexibility to incorporate new technology when it is environmentally and economically feasible.

Indigenous Coal

Until fairly recently, Nova Scotia was self-sufficient in coal. This is no longer the case. Nonetheless, there are still opportunities for coal mining to contribute to the province's economy and to community development over the short and medium terms. Environmental targets should not be relaxed in favour of indigenous coal, nor should government financially support non-economic mining operations. However, where coal mining can provide a net benefit to the province and to the communities where it occurs, and where it is economically feasible and environmentally appropriate, the province will facilitate business opportunities in this sector.

An important factor in planning for the optimum utilization of the coal resource in the province is knowledge of its extent, quality, and characteristics. The province already has developed a significant geoscience database and in-house expertise on its coal resources. This database will be maintained, enhanced where necessary, put in digital format to the extent practical, and made available to any member of the public who requires information on the province's coal resources.

A second important factor is public acceptance of the continuation of a coal mining sector in Nova Scotia. The general public and community development agencies should be aware of the opportunities and benefits offered by coal mining. To this end, the province will renew public education and awareness initiatives.

Any future coal mining industry needs a regulatory regime that is fair, efficient, and non-discriminatory. The Department of Natural Resources already works cooperatively with the Department of Environment and Labour through the one-window process to expedite the processing of permits for mining operations. Government will continue to try to find ways to ensure that the regulatory regime meets the needs of industry, while protecting the environment and the safety of workers and the general public. The province has a role in this process to address public concerns with unbiased advice and technical information.

Probably the most significant opportunity for change in the mining sector will occur when the CBDC mining leases are surrendered to the province, expected in late 2001 or 2002. One significant remaining coal resource remains that can be mined by underground methods (the Donkin Block) and a number of coal seams could be recovered through surface mining. The province will develop a strategic plan and manage the process by which exploration licences and mining leases for the former CBDC lands can be granted. The plan will aim for maximum utilization of the remaining resource.

With the cessation of operations by CBDC, significant environmental liabilities will remain throughout the coalfield. The province is determined that CBDC and the federal government address these liabilities as part of their closure of CBDC operations. The parties have been meeting to reach agreement on which sites require remediation, and the extent of CBDC's responsibility. The province will continue to work to ensure that remediation of these lands is done properly, and to standards acceptable to the province.

Nova Scotia coal producers currently pay among the lowest coal royalties in Canada. In a national context, there is room for increasing coal royalties to a level that would give the province a return on the resource in line with other provinces. Increasing coal royalties to levels currently in place in Alberta and British Columbia (i.e., doubling the current Nova Scotia rate) would result in a net increase in revenue to the province of about $75,000 at anticipated (2002) production rates. Increasing them to comparable levels for Saskatchewan (quadrupling the Nova Scotia rate) would increase revenue by about $225,000.

It is recognized that most coal mined in Nova Scotia is sold to NSPI for electricity generation and increases in royalties can be passed on to the utility. Because the Utility and Review Board has traditionally considered such costs to be valid components of the utility's rate base, significant extra royalties on coal could result in upward pressure on electricity rates. As well, an increase in the royalty rate for domestic coal might result in a price disadvantage compared with imported coal, which currently supplies about half of Nova Scotia's demand. The higher royalties could return significant revenue to the province. If a significant coal industry with export potential develops, this policy should be reconsidered.

The legacy of 250 years of coal mining in Nova Scotia includes a large number of sites that have been left in a non-productive state following cessation of mining. In some cases, the land is not only derelict but hazardous, as a result of openings, acid-generating or metal-bearing waste, and near-surface subsidence. Whether legal or "bootleg" many operations have left land that cannot be used productively in its present state. There are now good examples of surface mining, where a company has recovered a

remaining coal resource and in the process of reclaiming the land after mining, has returned derelict land to a productive state. This is a good model for environmental remediation. Everyone gains: the operator is able to recover a coal resource that would otherwise not contribute to the province's and the community's benefit, with accompanying direct and indirect jobs and spin-off economic activity; the community gets newly productive land and is relieved of the liability of potential hazards; and government gets royalties for the recovered mineral.

The province encourages reclamation mining, will facilitate this activity where economically, socially, and environmentally appropriate, and will consider reclamation potential as a determinant when processing tenders for coal resources in the province.

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The International Energy Agency's Clean Coal Centre website. http://www.iea-coal.org.uk/

United States National Energy Policy; Report of the National Energy Policy Development Group, May, 1990. http://www.whitehouse.gov/energy/

Coal in Nova Scotia

One of the Greatest Treasures - The Geology and History of Coal in Nova Scotia, J. H. Calder, K. S. Gillis, R. D. Naylor, and N. W. Campbell. Nova Scotia Department of Natural Resources, Information Circular ME 25, 1993. http://www.gov.ns.ca/natr/meb/ic/ic25.htm#01a

History of coal mining in Nova Scotia, with links to other related sites of interest. http://eagle.uccb.ns.ca/mining/

Nova Scotia Department of Natural Resources, Minerals and Energy Branch. http://www.gov.ns.ca/natr/meb/index.HTM

Clean Coal Research

IEA Coal Research Centre. http://www.iea-coal.org.uk/

The European Commission Clean Coal Technology Programme. http://www.euro-cleancoal.net/

Clean Coal Technology Compendium, U.S. Department of Energy. http://www.lanl.gov/projects/cctc/

Australian Coal Association research program. http://www.acarp.com.au/

British Government Department of Trade and Industry site on Clean Coal Technology. http://www.dti.gov.uk/cct/

APPENDIX F

NOISE AND DUST ASSESSMENT

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nsulting Engineers

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18 January 2002

Mr. Paul White ..... #012503
Pioneer Coal Limited
P.O. Box 929
Westville, Nova Scotia
B0K 2A0

Dear Mr. White:

RE: Stellarton Open Pit Coal Mine – Noise & Dust Assessment

As per your request of December 3, 2001, CBCL Limited conducted a noise and dust site assessment of the Pioneer Coal Limited's Stellarton open pit mine site. At the time a highwall continuous miner was operating at the site. You indicated that under your present operating permit (Nova Scotia Dept. of Environment and Labour Approval No. 2001-023478-A01 Highwall Mining Method: Hours of Operation) that the highwall miner may operate only between the hours of 7 AM and 10 PM. You also indicated that it is desired by Pioneer Coal Ltd. that the current approval restriction on the mine operating hours of operation be removed to allow 24 hour per day mine operation.

A condition of the operating approval is the installation and operation of 4 noise and dust monitoring stations which are located around the perimeter of the mine site. The noise monitor locations are identified as numbers N1,N2,N3 and number N4. In addition on Dec 17 two additional monitoring stations N5 and N6 were installed with N5 being located on the bench above the highwall miner and N6 being installed near the feeder. The dust monitoring stations are identified as D1,D2,D3and D4 (See the attached Drawing No. 1 showing the noise and dust monitor locations).

On December 18, and 19, 2001 Kevin Beaton of CBCL Limited made inspections of the Stellarton open pit mine site. On December 18 the highwall miner was operating along with other equipment (loader, dozer, coal trucks). On December 19 the highwall miner was not operating but the other earth moving equipment noted above was operating as normal. In addition on both days the coal loadout was in normal operation.

The highwall miner was located at the bottom of the open pit, with the mine side walls extending upwards at an angle of 51 degrees. The highwall miner was located about 260 vertical feet below the bermed side walls (200 feet below the original land contour, with a 60 foot high berm). The open pit walls and berm act as a sound barrier. The highwall miner location is as shown in the attached Drawing No. 1.

Noise Monitoring Stations

The approval requirement for noise levels as required in the approval is as follows:

Day	65 dBA (0700 hours to 1900 hours)
Evening	60 dBA (1900 hours to 2300 hours)
Night	55 dBA (2300 hours to 0700 hours)

The required four monitor locations as proscribed in the approval are N1, N2, N3, and N4 as shown in Drawing No. 1. The noise level reports for a two-week period in December, 2001 were reviewed.

In addition from Dec. 17-21 two additional monitoring stations, N5 and N6, were installed in a location where CBCL Limited personnel determined they would be of the most use for this evaluation. The location of the N5 and N6 monitoring stations are also as shown in Drawing No. 1

Review of Pioneer Coal Limited Noise Data

The noise data as collected by Pioneer Coal Limited from December 7 to 21 was reviewed (a two week period was thought to be representative for data analysis). Data from stations N1, N2, N3 and N4 was reviewed. Based of a review of the noise emission data it is evident that Pioneer Coal Limited is within the noise emission requirements as specified in the approval.

Based on a review of the noise emission data it was determined that 99% of the cases where noise emission levels were being exceeded was during the 11 PM to 7 AM period (limit 55dB) when the mine was not operating. It is thought that noise emissions during the 11 PM to 7 AM period are the result of vehicles travelling on the public roads that border the mine site or other noise sources off the mine site.

In addition to the monitoring stations required in the approval, data from stations N5 and N6 was analysed. The N5 monitor was located on the bench above the highwall miner and N6 was located near the feeder. Noise emissions at the N5 and N6 locations were in general higher than at the perimeter N1, N2, N3 and N4 monitor locations but were within the approval noise emission limits. Noise emission limits were exceeded on occasion at the N5 and N6 monitor locations, but these instances were almost exclusively limited to the time between 11 PM and 7 AM when the mine was not in operation.

Site Noise Monitoring December 18-19, 2001

During the 2 days when the mine site was inspected, noise emission readings were taken at various times and locations using a hand held Quest Sound Level Meter (Model #2400) in the following locations:

- In various areas within the open pit
- At various locations along the top of the mine highwalls and berms
- At various locations around the perimeter of the site, along the roads that border the property and adjacent to the 4 monitoring stations

High noise levels of 80 to 85 dB were found in the areas adjacent to where the highwall miner was operating, in the load out area, and in the areas above the berms

where heavy equipment was operating. As distances increased from the point of noise emission and the location where the noise emission was measured the noise levels dropped. At the noise monitoring locations (N1, N2, N3, N4) the operation of the highwall miner within the open pit was not a factor in the generation of noise emissions.

Noise emission measurements were taken in many areas along the public roads, adjacent to the monitoring stations, in these areas the largest generator of noise were the vehicles that pass along the public roads. In most instances near the monitoring stations the noise emission levels were 45 – 60 dB but when a vehicle would pass by the noise emission level would spike to 80 dB. These noise emissions along the site perimeter highways are a common occurrence that are independent of the mine working or not.

It is interesting to note that noise emission readings taken from other areas than at the mine site produced similar results. Readings taken in other areas of Stellarton or along nearby rural roads also produced noise emission levels of 45 – 60 dB with spikes of 80 dB.

Particulate Emissions (Dust)

The approval requirement for dust emissions is that the daily average for dust emissions be a maximum of 120 ug/m3. Four dust monitors, D1,D2,D3 and D4 were required to be installed at the locations shown in Drawing No. 1. The monthly dust level reports for Sept., Oct. and December of 2001 were reviewed. The highest dust level for any individual sample taken at any of the four recording stations was 54.1 ug/m3 (Station #3, Reekie October 27/01), an amount which is less than half of the allowable limit. If the mine operated on a 24 hour per day basis a pro rated increase of 50% for the dust emission levels to 81.2 ug/m3 (based on an increase of 50% of operating time) would still be well within the allowable limit of 120 ug/m3.

Summary and Conclusion

Based on my analysis of the existing data and my testing of Dec. 18 and Dec 19 I have made the following observations:

- Pioneer Coal Limited is at present within the required noise limits as set out in the Approval No. 2001-023478-A01.
- Pioneer Coal Limited is at present within the required dust limits as set out in the Approval No. 2001-023478-A01.
- During the period from 11PM to 7PM the noise emissions are usually greater around the perimeter of the mine site than within the mine itself, this could be due to vehicle activity along the roads at this time.
- Based on previous data it is expected that noise level emissions will continue to exceed the present allowable limit of 55dB during the 11 PM to 7 AM period. It

will be important for Pioneer Coal Ltd. to continue to monitor noise emissions in order to ascertain that the frequency of noise level emissions do not increase during this time if work activities are ongoing.

- Hand held noise level readings indicate that nuisance noise from vehicles travelling along the public highways that border the mine site result in high peak noise readings.
- The activity of the highwall miner and associated equipment within the open pit cut has little impact of the noise levels around the perimeter of the mine site property.

Recommendations

Based on the information that has been gathered and reviewed with regard to noise emissions it is expected that Pioneer Coal Ltd. can operate between the hours of 10 PM and 7 AM with no increase in current noise emissions. With regard to dust emissions Pioneer Coal Ltd. can operate between the hours of 10 PM and 7 AM and run on a 24 hour per day basis and still be under the limits required by the approval.

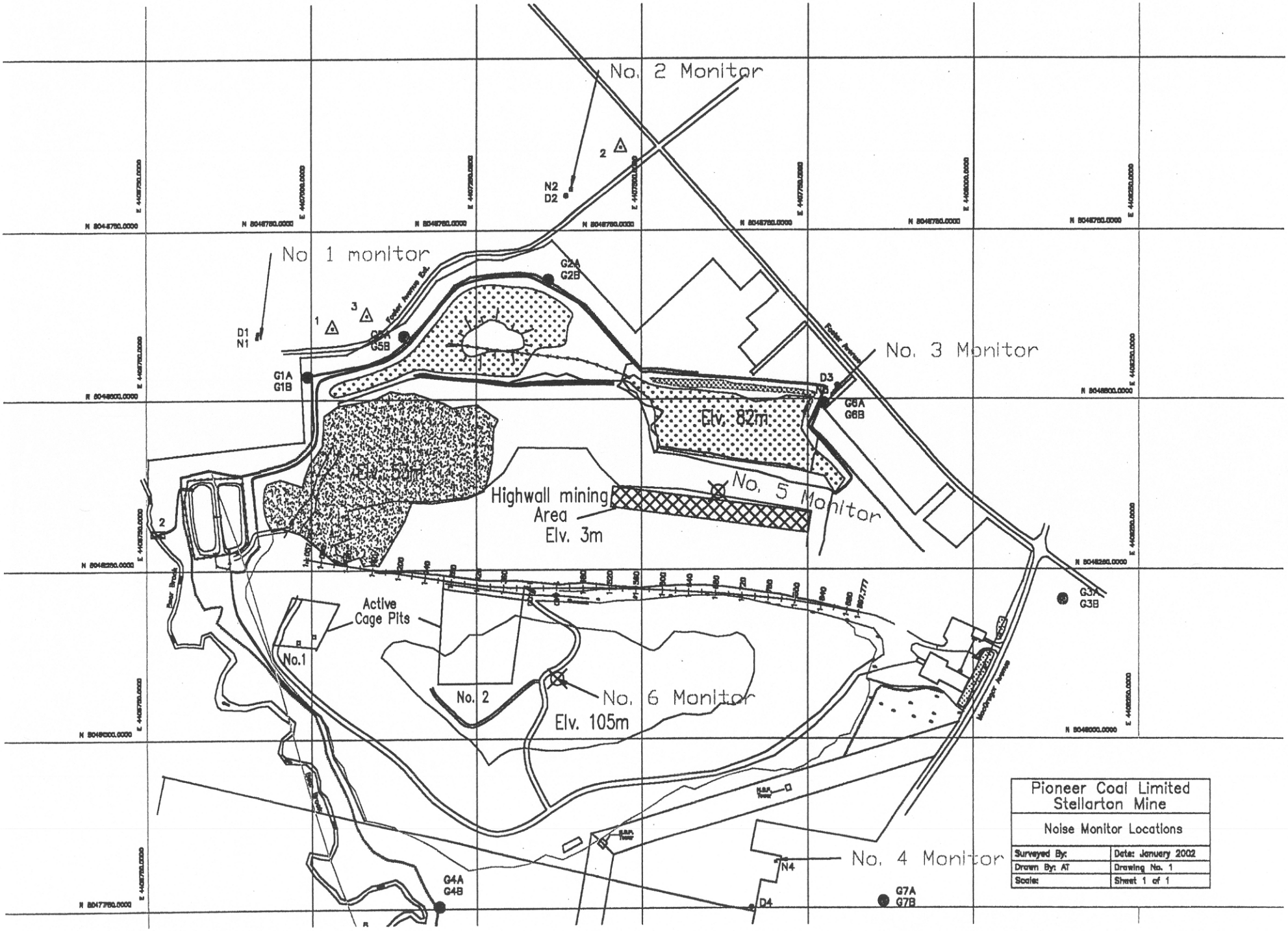
Noise and dust monitoring should of course be continued on a 24 hour per day basis in order to compare future noise emission readings with previously recorded information. The four existing noise level monitors (N1,N2,N3 and N4) should continue to operate on a 24 hour basis. In addition the two noise level monitors N5 and N6 should be located in optimum locations between operating equipment and the mine site boundaries to provide additional noise emission data. If Pioneer Coal Ltd. operates the mine site on a 24 hour per day basis the noise and dust emission data should be reviewed after one or two months time to ascertain that existing dust and noise emission levels are within allowable limits.

Mine site work activities not directly associated with the operation of the highwall miner (shop operation, loadout, heavy equipment operation above the berms) should be scheduled so as to minimise noise emissions during the 10 PM to 7 AM period. One item that could be further investigated is the replacement of the mobile equipment backup alarms with an alternate arrangement that provides an equivalent level of safety (See section 58, Part 7, Hoists and Mobile Equipment of the Occupational Safety General Regulations).

If you have any questions, or require any additional information regarding this report, please do not hesitate to contact my office.

Yours very truly,
CBCL Limited

Kevin Beaton, P.Eng.
Manager, Port Hawkesbury
Direct: (902) 625-3465 E-Mail: kevinbe@cbcl.ca


No. 2 Monitor
N2
D2
No. 1 monitor
D1
N1
G2A
G2B
G5A
G5B
G1A
G1B
No. 3 Monitor
D3
G8A
G8B
Elv. 82m
Elv. Dump
Highwall mining
Area
Elv. 3m
No. 5 Monitor
Active
Cage Pits
No.1
No. 2
No. 6 Monitor
Elv. 105m
G3A
G3B
No. 4 Monitor
N4
D4
G4A
G4B
G7A
G7B
Foster Avenue
Foster Avenue Ext.
Meadowgate Avenue
Pioneer Coal Limited
Stellarton Mine
Noise Monitor Locations
Surveyed By:
Date: January 2002
Drawn By: AT
Drawing No. 1
Scale:
Sheet 1 of 1