Thermal Power Plant Inspection Report

CA-17 (n)
Attachment B

February, 1996

NEWFOUNDLAND POWER
A FORTIS COMPANY

NEWFOUNDLAND POWER

THERMAL POWER PLANT INSPECTION REPORT

FEBRUARY, 1996

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1. INTRODUCTION

This report summarizes the results of field inspection and a general review of selected thermal power plants owned and operated by Newfoundland Light & Power Co. Limited (Newfoundland Power) which was carried out during January and February, 1996 as part of a depreciation study. The main purpose was to estimate the remaining life of the property and assess other factors which might affect the life of plants.

The study consisted of field inspection of the selected plants together with discussions with Newfoundland Power staff to assess the general condition of the property, the level of operation and maintenance and any other factors affecting the service life of the property. The points considered were the remaining physical life of the basic plant elements such as boiler, turbine generator, cooling system, switchgear, transformers, controls and buildings. The findings from the plants inspected were considered typical of all Newfoundland Power thermal plants and were used to estimate their remaining service lives.

A listing of current Newfoundland Power thermal power plants is shown on Table 1.

TABLE 1

NEWFOUNDLAND POWER

THERMAL POWER PLANTS

Plant Type	Location	Unit No.	kW Capacity	Date Commissioned	Manufacturer
Steam	St. John's	1	10,000	1956	B&W/MetroVic
	St. John's	2	20,000	1959	B&W/MetroVic
Gas Turbine	Grand Bank	1	25,000	1975	Curtiss Wright
	Salt Pond	1	14,700	1969	AEI
	Mobile	1	7,300	1974	Orenda
Low Speed Diesel	St. John's	1	2,500	1953	Nordberg
	Aguathuna	1	1,200	1962	Harland & Wolff
	Salt Pond	1	500	1963	Worthington
	Salt Pond	2	500	1963	Worthington
	Salt Pond	3	500	1963	Worthington
	Gander	1	1,000	1949	Atlas-Polar
	Gander	2	1,000	1957	Nohab-Polar
	Gander	3	1,000	1953	Nohab-Polar
High Speed Diesel	Mobile	1	700	1973	Caterpillar
	Mobile	2	670	1976	Caterpillar
	Port aux Basques	1	350	1945	Caterpillar
	Port aux Basques	2	250	1953	Caterpillar
	Port aux Basques	3	350	1954	Caterpillar
	Port aux Basques	4	209	1958	Caterpillar
	Port aux Basques	5	250	1965	Caterpillar
	Port aux Basques	8	250	1965	Caterpillar
	Port aux Basques	10	2,500	1969	G.M.
	Port Union	1	500	1962	Caterpillar

2. UTILIZATION OF THERMAL POWER PLANTS

Newfoundland Power thermal plants are used for emergency service or as reserve capacity for power generated by Newfoundland and Labrador Hydro and purchased by Newfoundland Power.

This status has existed for 29 years and during this period the plants have been required to run on relatively few occasions. Such circumstances have been the outage of transmission lines due to ice storms or in the extremely unusual occasion where lack of water for hydro generation coincided with a forced outage at the Newfoundland Hydro Holyrood Thermal Plant.

The availability of mobile generating capacity, one 700 kW diesel generator set and one 7.3 MW gas turbine plant, provides the advantage of flexibility and backup to the emergency capacity. The mobile diesel sets have been rented frequently by Newfoundland and Labrador Hydro during maintenance of their transmission facilities.

3. OPERATION AND MAINTENANCE

Because of the extremely low utilization of the Newfoundland Power plants most operating and maintenance staff have principal duties beyond the thermal plants. A centralized mechanical maintenance section is responsible for heavy maintenance at both thermal and hydro plants. Electrical and civil maintenance is handled in a similar manner. Day to day maintenance activities are the responsibility of Plant Supervisors and their staff who are also responsible for hydro plant operation. A computerized maintenance system is in the process of being established to control all maintenance activities associated with the power plants.

4. CONDITION OF THERMAL POWER PLANTS

4.1 GENERAL

The inspection of plants generally consisted of a tour of the property including powerhouse plant and equipment, cooling systems, stacks, principal buildings, fuel storage and electrical substation, followed by discussions with plant personnel on the operating and maintenance history and present practices.

The physical inspection was external only and as such is limited as a means of determining the condition of equipment. An accurate assessment of the condition of the plant is only possible by opening up turbines and diesels to assess wear, clearances, wall thicknesses and other critical parameters.

It is still possible to assess the general condition of a plant from a review of the operating and maintenance history together with the general condition of the equipment.

The following is an overall comment on the general condition of each of the four main types of plant.

Steam Plant

This plant was taken out of service December 31, 1994 and is in the process of being mothballed. It is proposed, should load growth and economics dictate, to refire the plant in the future as a combined cycle.

Gas Turbine Plant

The gas turbine plant properties are in good condition and maintained in good operating order.

Low Speed Diesels

The low speed diesel properties, with the exception of the St. John's property, are in fair condition. The St. John's Plant is generally in good condition and in good operating order.

High Speed Diesels

The high speed diesel properties are in good condition and the equipment is maintained in good operating order.

4.2 INSPECTION REPORTS

The condition of each plant is covered in an individual report in this section of the report. Where no comment is made it can be assumed that the component of system is satisfactory and has given no indication of potential problems.

GREENHILL GAS TURBINE

Plant: **Greenhill Gas Turbine** **Inspected by:** **M. Hunter**
Location: **Grand Bank** **Date:** **1996-01-31**

Description: Plant consists of a Rolls Royce Olympus Gas Generator, Curtiss Wright Power Turbine, Brush Electrical Generator, lube oil heat exchanger, generator switchgear, transformer, fuel storage, fuel handling equipment and service building. The package was assembled by Curtiss Wright. The unit is nominally rated at 25 MW but it has been derated to 20 MW due to power turbine casing limitations.

Specifications: See Technical Data Sheet in Appendix A1.

Year Installed: 1975

Operational Duty: Peak load requirements and emergency generation in the event of transmission line or system outages.

Operating Hours:

Total Since New (TSN):

Base Load: 1141.3 hrs
Peak Load: 377.7 hrs
Synchronous Condenser: 336.9 hrs
Generation: 1388.5
Starts: 1966

Total Since Generator Overhaul (TSO):

Base Load: 0
Peak Load: 0
Synchronous Condenser: 0
Generation: 0
Starts: 0

Recent Operating Pattern:

Year	Generation (Kwh)
1991	433,000
1992	172,000*
1993	238,000
1994	666,000
1995	29,000*

* Gas Generator Repairs & Overhaul

Operation for Relibility Check: 1 "black" start per month
1 normal (AC) start per month, synchronized and operated at full load for 1 hour.

General Condition: Plant is in very good condition. Unit remains derated as the replacement power turbine casing installed in 1995 is susceptable to the same problems as the old one. The derating will prolong the life of the component. The lube oil cooler is deteriorated. The internals of the exhaust stack and exhaust volute are deteriorated due to corrosion, air intake hoods exhibit corrosion damage. The switchgear enclosure has some corroded areas. Building in good condition except for minor leaks around eves.

Recent Maintenance:

1995

- Replacement power turbine casing installed.
- Critical internal power turbine bolting replaced.
- Gas Generator repaired due to oil leak and unit overhauled.
- Air intake inertial filters removed.
- New air intake disposable filters installed.
- New generator air filters installed.
- Minor structural repairs to air intake house and exhaust stack.
- Minor repairs to lube oil cooler.
- Air receiver internals sandblasted, cleaned and inspected, new relief valve installed.
- Exhaust stack to volute expansion joint replaced.
- Complete power turbine lube oil change.
- AC and DC lube oil pumps overhauled.
- Replaced hinges and seals on intake plenum loading doors.

1994

- Unused 800,000 L fuel tank removed.
- Remaining 800,00 L fuel tank painted.
- Steps on fuel tank replaced.

1993

- New engine to power turbine bellows installed.
- Plant AC compressor replaced.

1992

- Gas generator repaired due to blading damage.

1991

- Unit monitoring system modernized.
- Minor repairs to switchgear enclosure.

Required Maintenance:

- Lube Oil Cooler replacement (Budgeted - 1997)
- Air dryer for plant compressed air system (Budgeted - 1997)
- Exhaust stack external painting
- Air intake hood refurbishment
- Governor calibration (Scheduled - 1997)
- Protection and control relay maintenance (Scheduled - 1998)
- Exhaust volute repair or replacement with next 5 - 7 years
- Power turbine casing may need replacement within next 5 - 7 years dependent upon inspections.
- Switchgear enclosure repair or replacement within next 10 years.
- Service building roof repair within next 3 - 5 years.

Required Inspections:

- Air receiver and system require annual inspection and certification by Department of Labour.
- Gas generator requires hot section inspection on a bi-annual basis.
- Power turbine requires annual inspection for casing cracks and internal fits.
- Halon fire control system requires annual inspection.

Spare Parts:

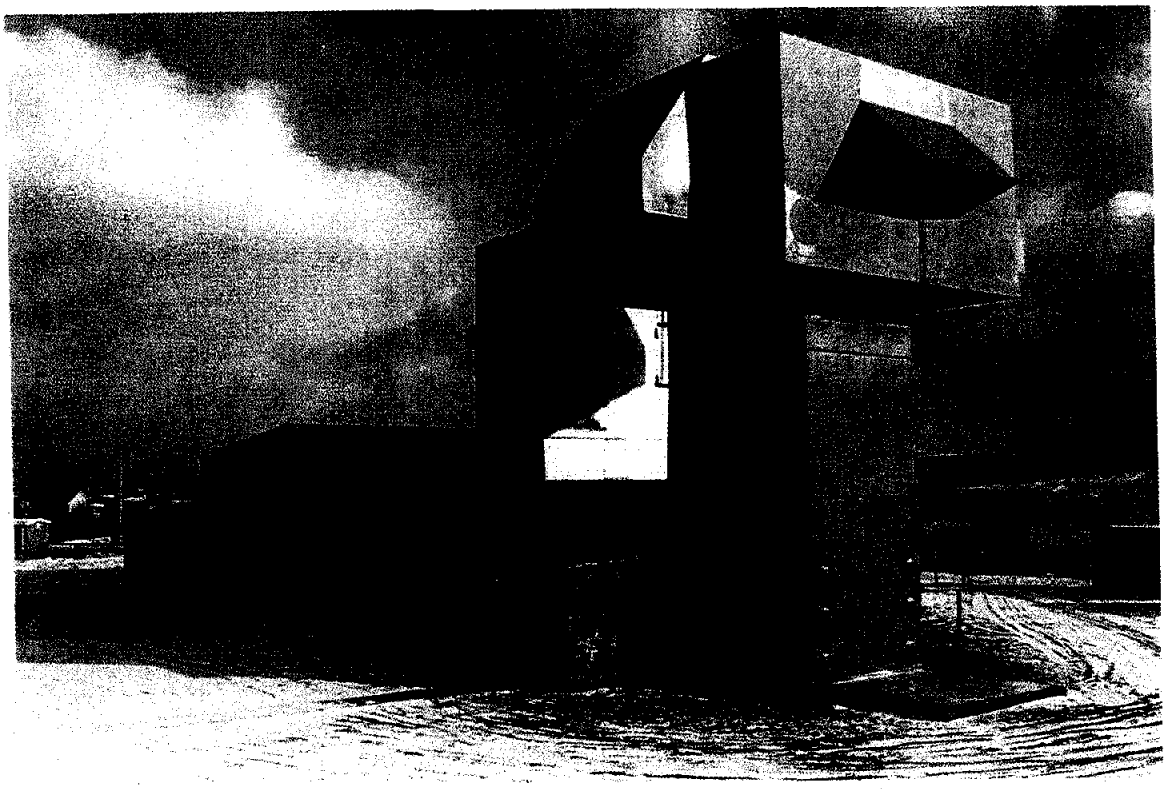
Stock shared with Newfoundland Hydro. Engine spares are available from Rolls Royce and Rolls Wood. Power Turbine spares are available from Fern Engineering who have taken our service of the Curtiss Wright equipment. Other parts are easily obtained or replaced.

Environmental Restraints: None

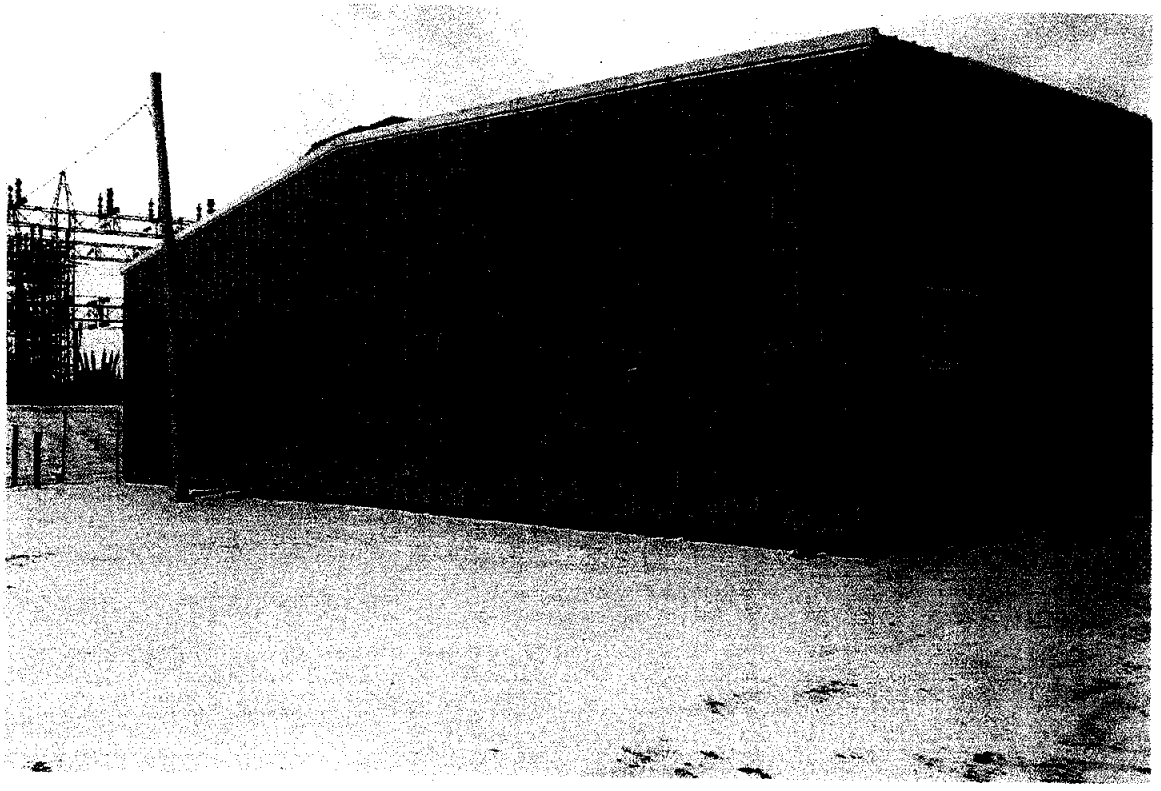
Remaining Service Life: 20 years

Factors Affecting Remaining Service Life:

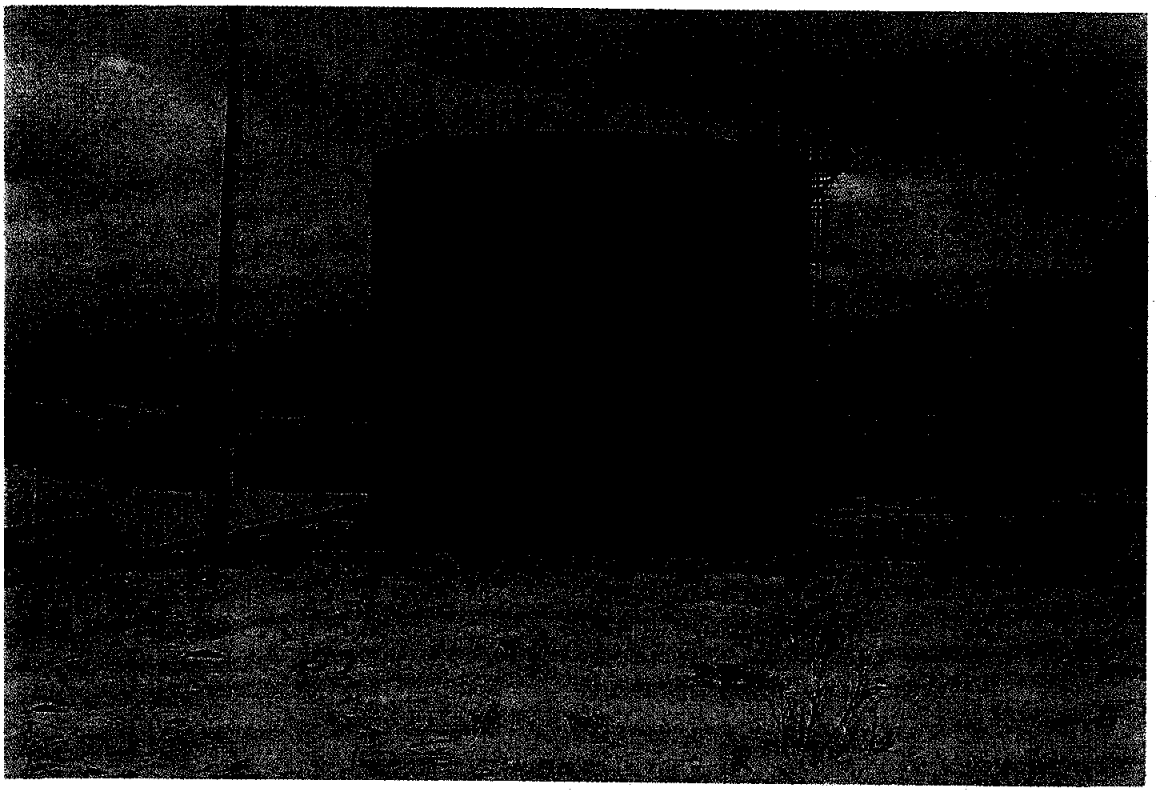
1. Plant usage.
2. Operation at reduced load and eventual requirement to replace turbine casing with modern design.
3. High level of maintenance required on components susceptable to corrosion damage.
4. Implementation of preventative maintenance program.



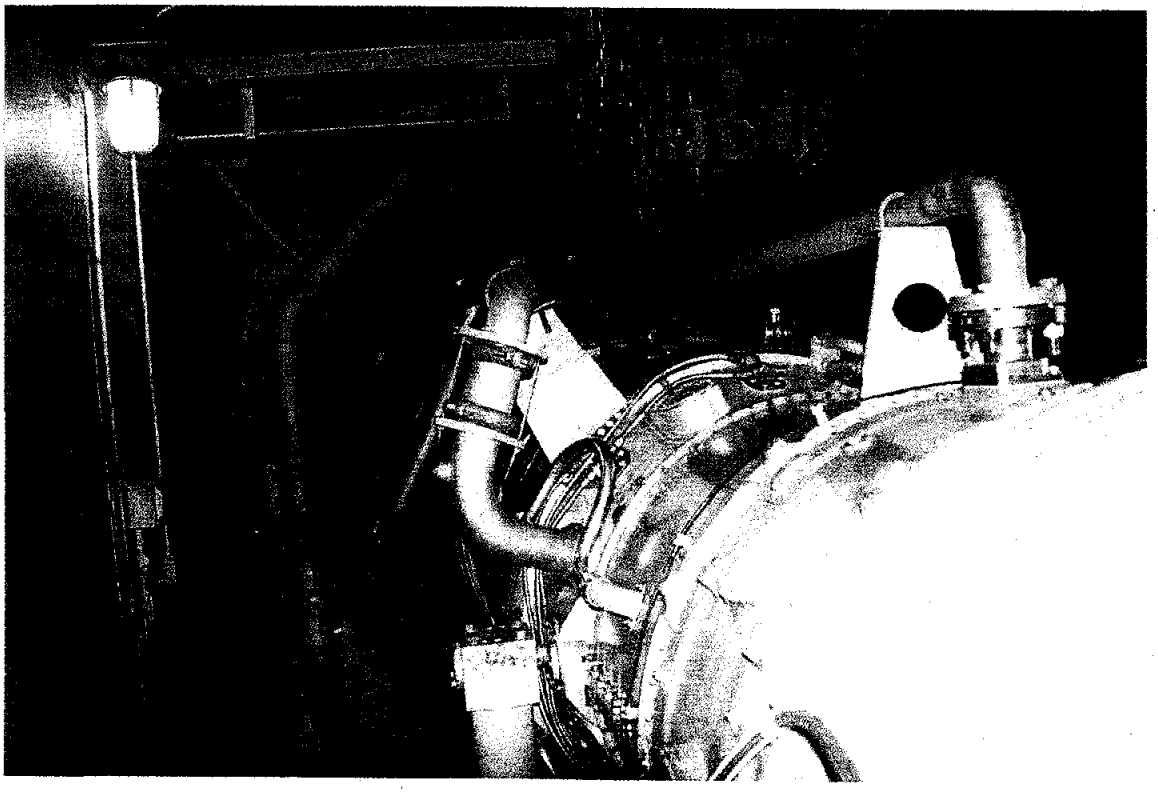
GREENHILL GAS TURBINE - EXTERIOR



GREENHILL GAS TURBINE - SERVICE BUILDING EXTERIOR



GREENHILL GAS TURBINE - FUEL TANK



GREENHILL GAS TURBINE - ENGINE HALL

SALT POND GAS TURBINE

Plant: **Salt Pond Gas Turbine** **Inspected by: M. Hunter**
Location: **Salt Pond, Burin** **Date: 1996-02-01**

Description: Plant consists of a Rolls Royce AVON Gas Generator, AEI Power Turbine, Brush Electrical Generator, lube oil heat exchanger, generator switchgear, transformer fuel storage, fuel handling equipment, and service building. The package was assembled by Associated Electrical Industries. The unit is rated at 14.7 MW.

Specifications: See Technical Data Sheet in Appendix A2.

Date Installed: 1969

Operational Duty: Peak load requirements and emergency generation in the event of transmission line or system outage.

Operating Hours:

Total Since New (TSN)

Operation: 2556 hrs
Starts: 1693

Total Since Gas Generator Overhaul (TSO)

Operation: 393 hrs
Starts: 498

Total Since Power Turbine Overhaul

Operation: 74 hrs
Starts: 112

Recent Operating Pattern:

Year	Generation (Kwh)
1991	217,400
1992	134,700
1993	7,600*
1994	396,400
1995	128,800

* Power turbine overhaul and unit rebuild.

Operation for Reliability Check: 1 "black" start per month
1 normal (AC) start per month, synchronized and operated at full load for 1 hour.

General Condition: Plant is in excellent condition. Underwent extensive repairs and overhaul in 1993. Plant was enclosed in a new building which incorporated the battery system. Gas Generator was overhauled and uprated in 1987. Exterior of exhaust stack exhibits surface corrosion. Fuel tank system in good condition.

Recent Maintenance:

1995

- New battery bank installed.
- Exhaust fan installed in gas generator/power turbine room.
- Neoprene cork gaskets installed on lube oil heat exchanger tube banks.

1994

- Fuel tank dyke liner installed.
- Protection and control relay maintenance and calibration.

1993

- Exhaust volute replaced.
- Exhaust stack refurbished.
- Inlet filter house refurbished.
- Lube oil heat exchanger refurbished.
- New powerhouse building installed to replace enclosures. Batteries relocated to powerhouse.
- Carbon dioxide fire extinguisher system installed.
- Power turbine and gearbox inspection and overhaul.
- Control sensors inspected, replaced (if necessary) and calibrated.
- Generator cooling air filters replaced.
- Filterhouse extraction fans and motors inspected, bearings replaced.
- Complete power turbine lube oil change.
- Heat tracing and insulation installed on upper end of fuel supply line.

Required Maintenance:

- Railing on fuel tanks replacement.
- Exhaust stack painting.
- Battery charger replacement.

Required Inspections:

- Gas Generator requires hot section inspection on a bi-annual basis.
- Carbon dioxide fire control system requires annual inspection.

Spare Parts:

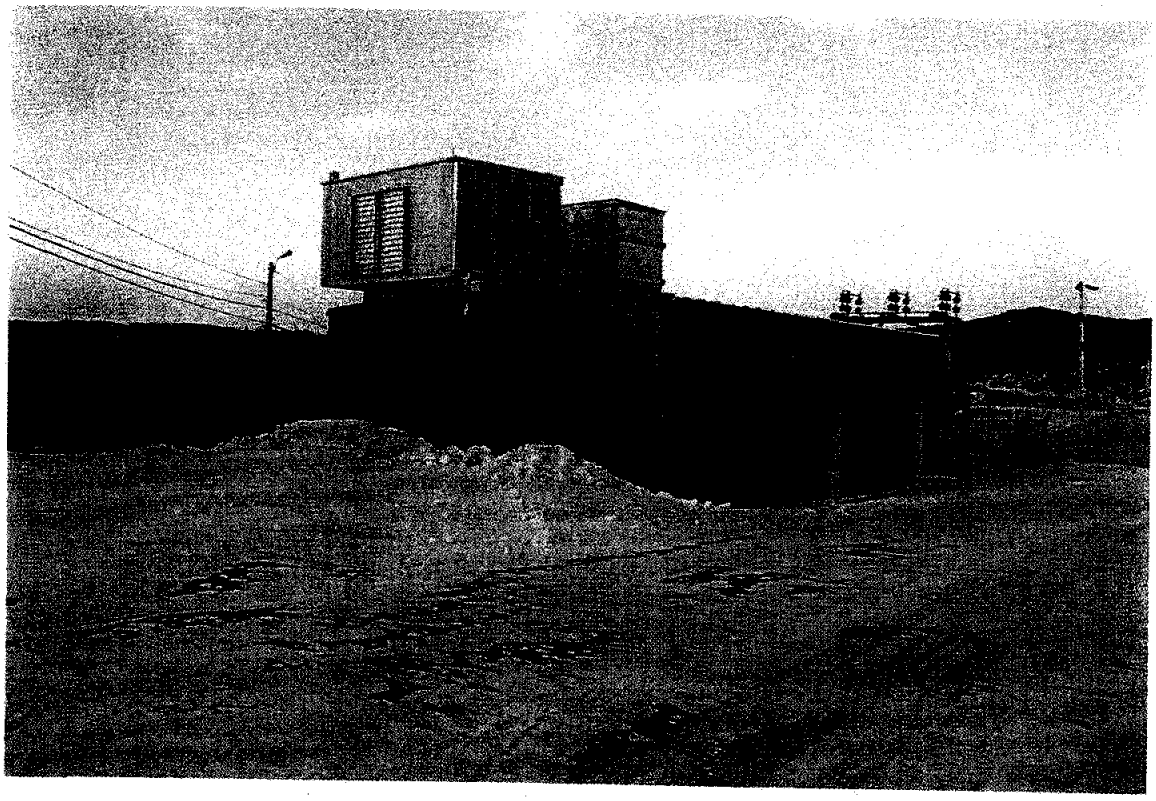
- Some spares kept on site. These are mostly gas generator components.
- Gas Generator still serviced and maintained by Rolls Royce. Spares readily available.
- Power turbine serviced by GEC Alsthom. Spares are available.
- Other components are easily obtained and replaced.
- Spare governor components were obtained from Newfoundland Hydro when they replaced their system.

Environmental Restraints: None

Remaining Service Life: 20 years

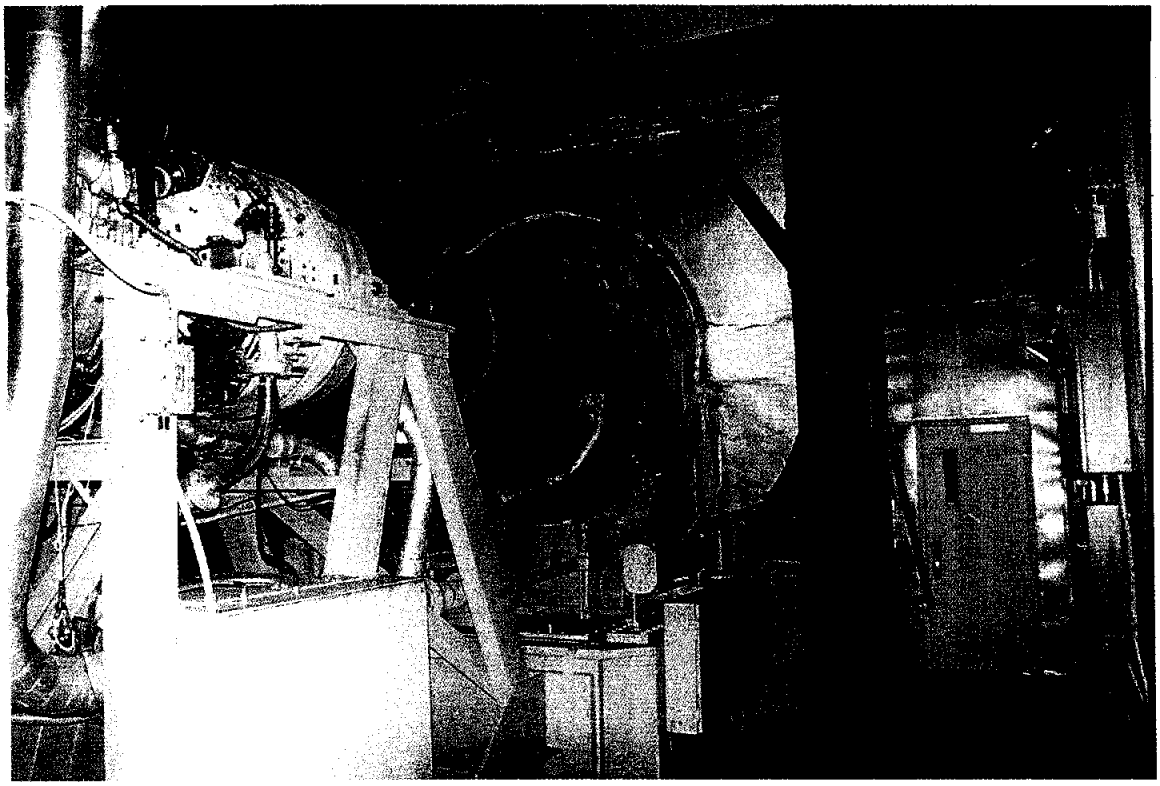
Factors Affecting Service Life:

1. Plant usage.
2. High level of maintenance required on components susceptible to corrosion damage.
3. Implementation of preventative maintenance program.



SALT POND GAS TURBINE - EXTERIOR

SALT POND GAS TURBINE - FUEL TANKS



SALT POND GAS TURBINE - ENGINE HALL

MOBILE GAS TURBINE

Plant: **Mobile Gas Turbine**
Location: **Grand Bay Substation**
Port Aux Basques

Inspected by: **M. Hunter**
Date: **1996-02-13**

Description: The plant is comprised of three trailers; one trailer houses the Orenda OT-390 Gas Generator, Orenda Power Turbine and Electric Machinery Manufacturing Co. Electrical Generator; one trailer houses the unit controls, switchgear, transformer and auxiliary power unit; one trailer is a 32,000 L Bedard fuel tanker. The package was assembled by Orenda and is rated at 7300 KW.

Specification: See Technical Data Sheet in Appendix A3.

Year Installed: 1974

Operational Duty: Peak load requirements and emergency generation in the event of transmission line or system outages.

Operating Hours:

Total Since New (TSN)

Base Load: 1537.8 hrs
Peak Load: 4.1 hrs
Elapsed: 1510.8 hrs
Starts: 1594

Total Since Gas Generator Overhaul (TSO)

Base Load: 565.8
Starts: 562

Recent Operating Pattern:

Year	Generation (Kwh)
1991	319,200
1992	279,250
1993	160,650
1994	194,300
1995	149,100

Operation for Reliability Check: 1 normal "AC" start per month, synchronized and operated at full load for 1 hour.
Auxiliary power unit operated monthly.

General Condition: Plant is in good condition. The trailer chassis require constant maintenance to prevent extensive corrosion damage. The doors on the power turbine and control trailer doors require repair. These trailers require painting. Miscellaneous protection and control improvements have been identified as required.

Recent Maintenance:

1996

- Complete Power Turbine lube oil change.

1995

- Air lift axle installed on power turbine trailer.
- Auxiliary power unit replaced.
- Motorized potentiometer replaced.
- Gas Generator fuel distributor replaced.
- Carbon dioxide fire control system inspected.
- Fuel tanker internals cleaned.
- Protection and control relay maintenance and calibration.
- Jacks and crossover pipe replaced on control trailer.
- New brakes installed on rear axle of power turbine trailer.
- One jack replaced on fuel tanker.
- Tires, brakes and lights inspected.

1994

- Power turbine trailer roof replaced.
- Exhaust stack extensions installed.
- Air intake hood replaced.
- Vibration monitor installed.

1993

- Fuel tanker undercarriage scraped and painted.

1990

- High pressure fuel pump replaced.

Required Maintenance:

- Alternate power turbine trailer levelling system required.
- Vibration monitoring system gives erratic readings.
- Governor calibration (Budgeted - 1996)
- Gas generator hot section inspection (Budgeted - 1996)
- Fuel tanker chassis, exhaust stack and power turbine and control trailer exterior painting (Budgeted - 1996)
- Power turbine trailer door repair (Budgeted - 1996)

- Control trailer door seals require replacement.
- Annual brake, tire and light inspection.
- Transformer cooling fan shrouds (Budgeted - 1996)
- Power turbine trailer roof walking surface (Budgeted - 1996)
- Fuel day tank internal cleaning.
- Ground switch replacement improvements (Budgeted - 1996)
- Protection and control improvements (Budgeted - 1996)
- Grounding problem on 125 VDC battery system.
- Fuel metering valve alarm.
- APU cover required.
- Air intake plenum floor requires scraping and painting.

Required Inspections:

- Gas generator requires hot section inspection on a bi-annual basis.
- Carbon dioxide fire control system requires annual inspection.

Spare Parts:

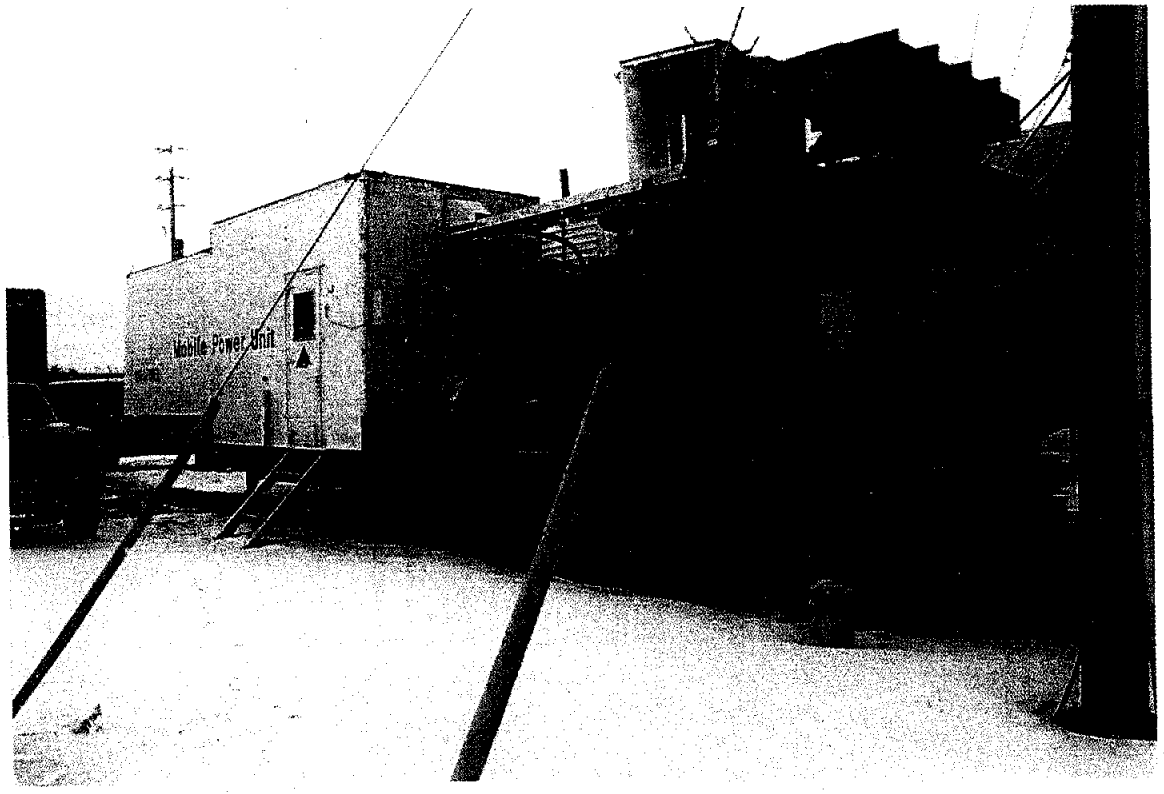
- Most spares available from Orenda. Other Parts are easily obtained or replaced.

Environmental Restraints: None

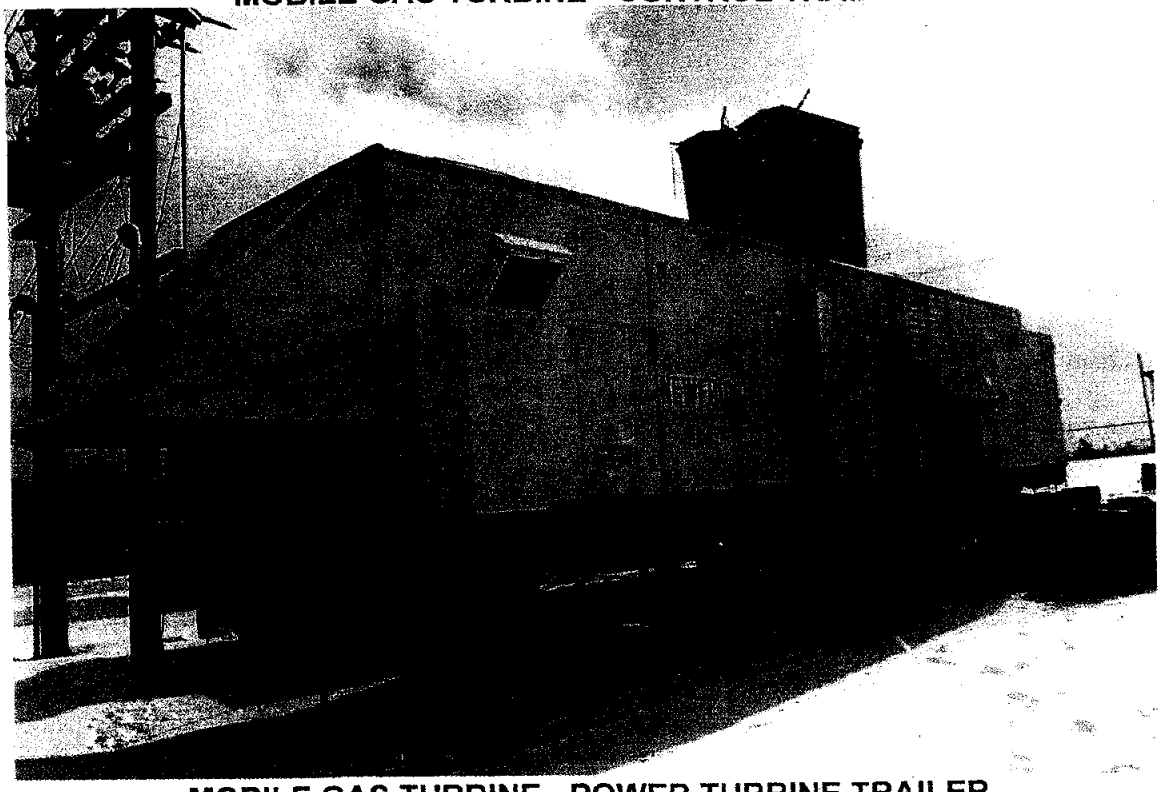
Remaining Service Life: 20 years

Factors Affecting Remaining Service Life:

1. Plant usage.
2. High level of maintenance required on components susceptable to corrosion damage.
3. Implementation of preventative maintenance program.

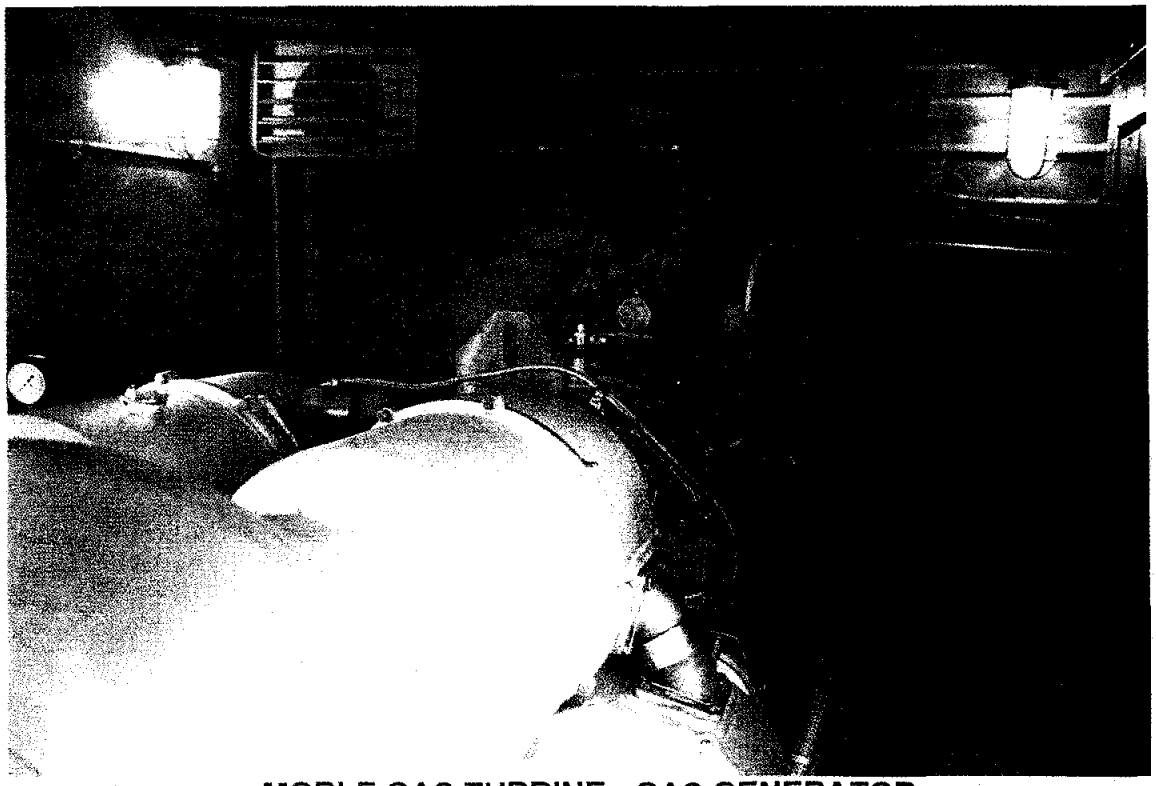


MOBILE GAS TURBINE - CONTROL TRAILER



MOBILE GAS TURBINE - POWER TURBINE TRAILER

MOBILE GAS TURBINE - FUEL TANKER



MOBLE GAS TURBINE - GAS GENERATOR

LOW SPEED DIESEL, SALT POND

Plant: **Salt Pond Diesel** **Inspected by: M. Hunter**
Location: **Salt Pond, Burin** **Date: 1996-02-01**

Description: Plant is comprised of three 500 KW Worthington diesel generator sets complete with auxiliaries and fuel storage, switchgear and transformers. The equipment is housed in a building which serves as a distribution transformer maintenance shop.

Specifications: See Technical Data Sheet in Appendix B3.

Date Installed: 1963. Units were operated at Fort Pepperal from 1941 to 1963.

Operational Duty: Emergency generation in the event of transmission line or system outage.

Operating Hours (1963 to Date):

Unit #1:	16935.2
Unit #2:	17112.0
Unit #3:	15462.0

Recent Operating Pattern:

Year	Generation (Kwh)
1991	2460
1992	7170
1993	5620
1994	1440
1995	3940

Operation for Reliability Check: Started monthly , synchronized and ran on load quarterly.

General Condition: Units are in fair condition. Controls are obsolete. Exhaust pipes are in good condition but mufflers are rusty. Air intakes are rusty and deteriorating. Unit #1 has a continuing problem of water ingress into the base oil and Unit #3 has one piston missing. Switchgear is in good condition. Fuel tanks are in good condition. Building is generally in good condition.

Recent Maintenance:

1995

- Complete oil change on Unit #1

1994

- Complete oil change on all units.
- Repaired crankshaft and bearing on Unit #1.
- Repaired centrifuge.
- Isolating valve installed on cooling water line to Unit #3.
- Main valve on water to plant installed.

1993

- Fuel tank dyke checked and repaired.

Required Maintenance:

- Water ingress into Unit #1 crankcase.
- Unit #3 operating stresses due to missing piston is a concern.
- Battery bank requires replacement.
- General protection and control relaying improvements required.
- Cooling water system requires reinstatement to original concept.
- All units require major inspection/overhaul.

Required Inspections:

- Air receiver and system require annual inspection and certification by Department of Labour.

Spare Parts:

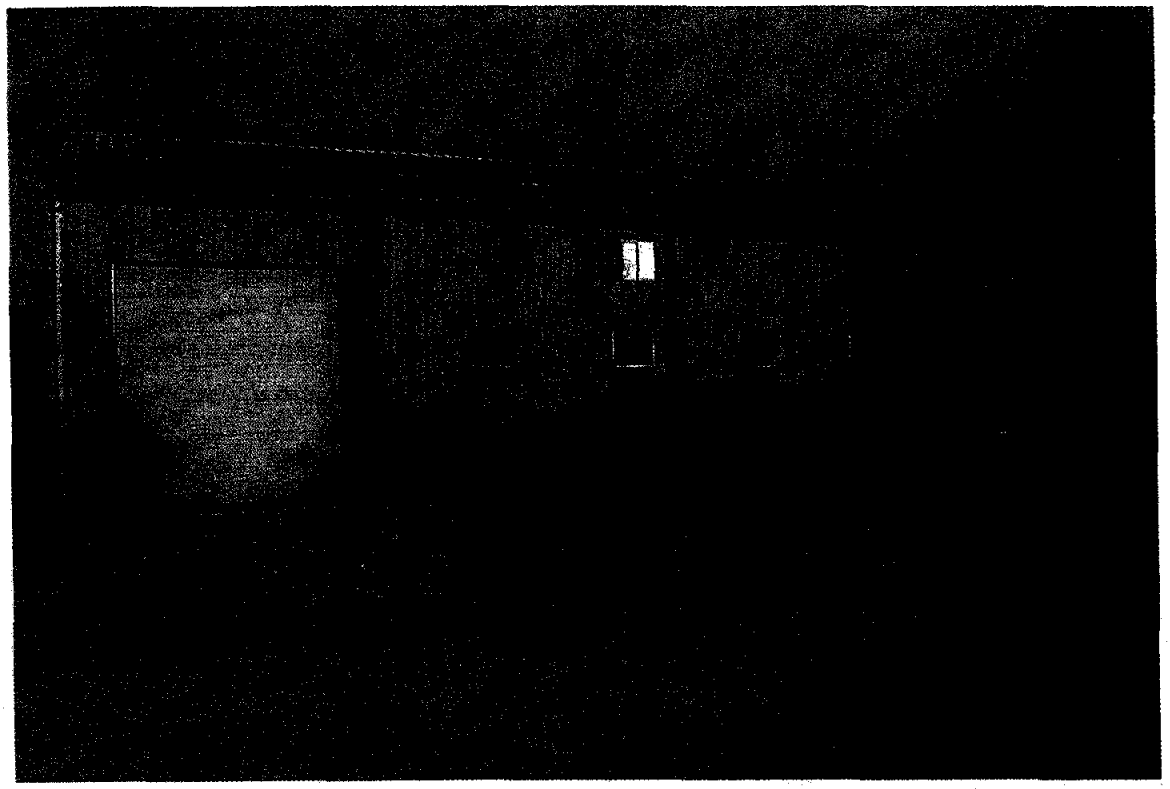
- Engines are obsolete. Some minor spares kept on site.
- Other components may be repaired or are easily replaced.

Environmental Restraints: None

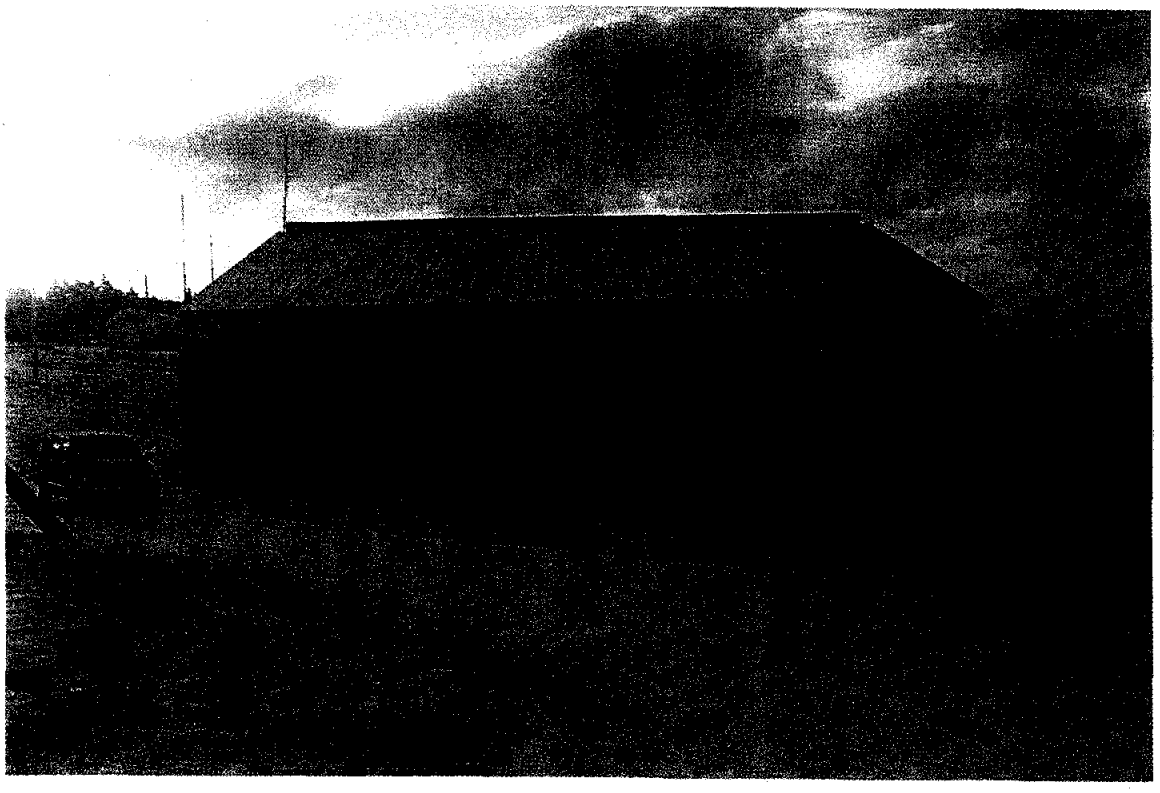
Remaining Service Life: 2 years

Factors Affecting Remaining Life:

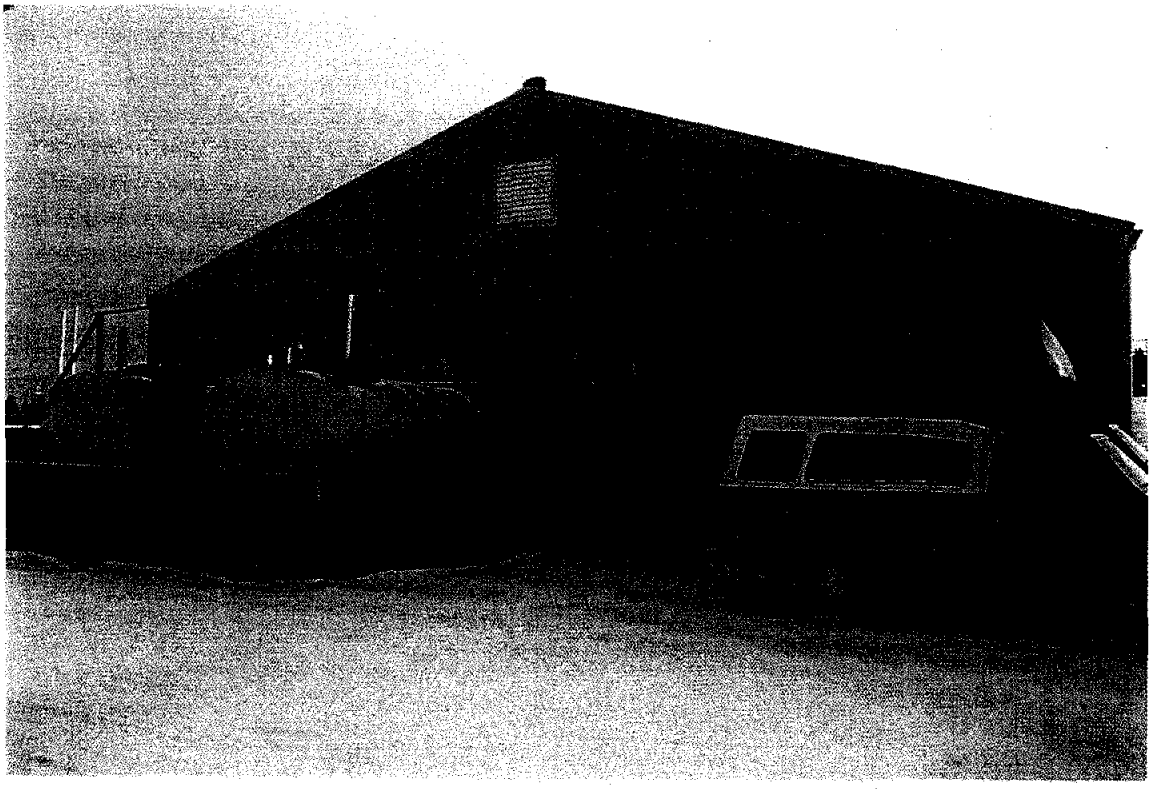
1. Low usage of plant.
2. Major overhauls required on engines if reliable performance is to be expected.
3. Lack of spare parts.



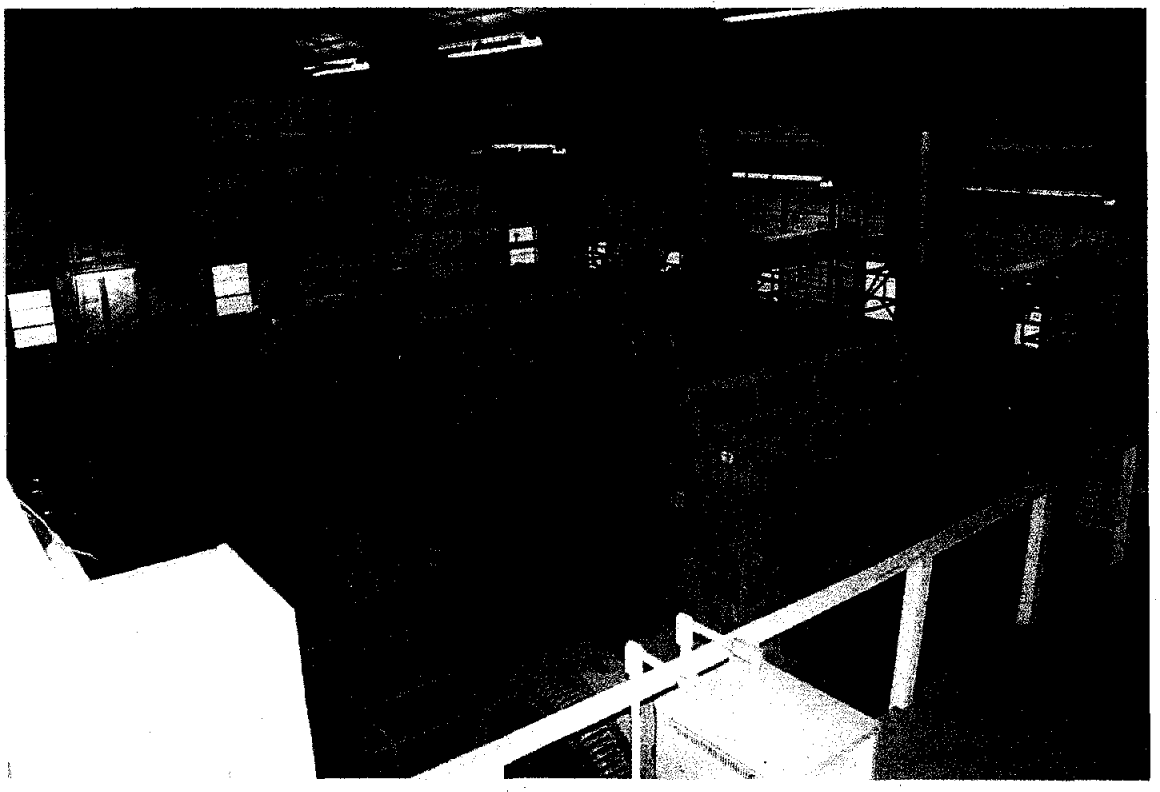
SALT POND DIESEL - EXTERIOR



SALT POND DIESEL - EXTERIOR



SALT POND DIESEL - FUEL TANKS



SALT POND DIESEL - ENGINE HALL

HIGH SPEED DIESELS, MOBILE UNITS

Plant: **Mobile Diesel Units #1 & 2**
Location: **Grand Bay Substation**
Port Aux Basques

Inspected by: M. Hunter
Date: 1996-02-13

Description: The units consist of diesel generator sets each mounted in a self contained high bed road trailer. Each trailer includes all auxiliaries such as fuel tank, switchgear and transformers. Unit #1 is rated at 700 KW and Unit #2, 670 KW.

Specifications: See Technical Data Sheet in Appendix C1.

Date Installed: Unit #1: 4610 hrs
Unit #2: 2204 hrs

Recent Operating Pattern:

Year	Generation (Kwh)	
	Unit #1	Unit #2
1993	22,610	17,900
1994	26,120	19,660
1995	15,280	12,700

Operation For Reliability Check:
- Cranked weekly.
- Started monthly, synchronized and run on load for 1 hour.

General Condition: Both generating units are in good condition. Mufflers are rusty, minor oil leaks on both engines. Radiators and fans are dirty. Trailer chassis on Unit #2 is very deteriorated and is no longer road worthy.

Recent Maintenance:

1995
- Exhaust manifold guards installed.
- Intake louvre doors installed on Unit #2.
- HV transformer bushings and lightening arrestors replaced on Unit #2.
- Unit #2 transformer and deck painted.
- Annual tire, brake and light inspection.

1994
- Unit #2 fuel tank refurbished.

1993

- Complete engine oil changes on both engines (Unit #1 - 4489 hrs, Unit #2 - 2088 hrs)
- Unit #1 batteries replaced.

1992

- Unit #2 batteries replaced.
- Unit #1 governor overhauled.
- Unit #1 chassis underwent minor repairs and painting.
- Unit #2 chassis underwent temporary structural repairs.

Required Maintenance:

Unit #1

- Engine oil leak repair.
- Reverse power relay repair.
- Annual tire, brake and light inspection (Budgeted - 1996)
- New battery charger required.
- Chassis minor painting (Budgeted - 1996)
- Generator, radiation and fan cleaning.

Unit #2

- Automatic voltage regulator repair.
- Underfrequency relay not operational.
- Belt driven alternator repair.
- Chassis repair.
- Engine minor oil leak.
- Generator, radiator and fan cleaning.
- Unit to fence grounding.

Required Inspections:

- Annual fire extinguisher inspection.

Spare Parts:

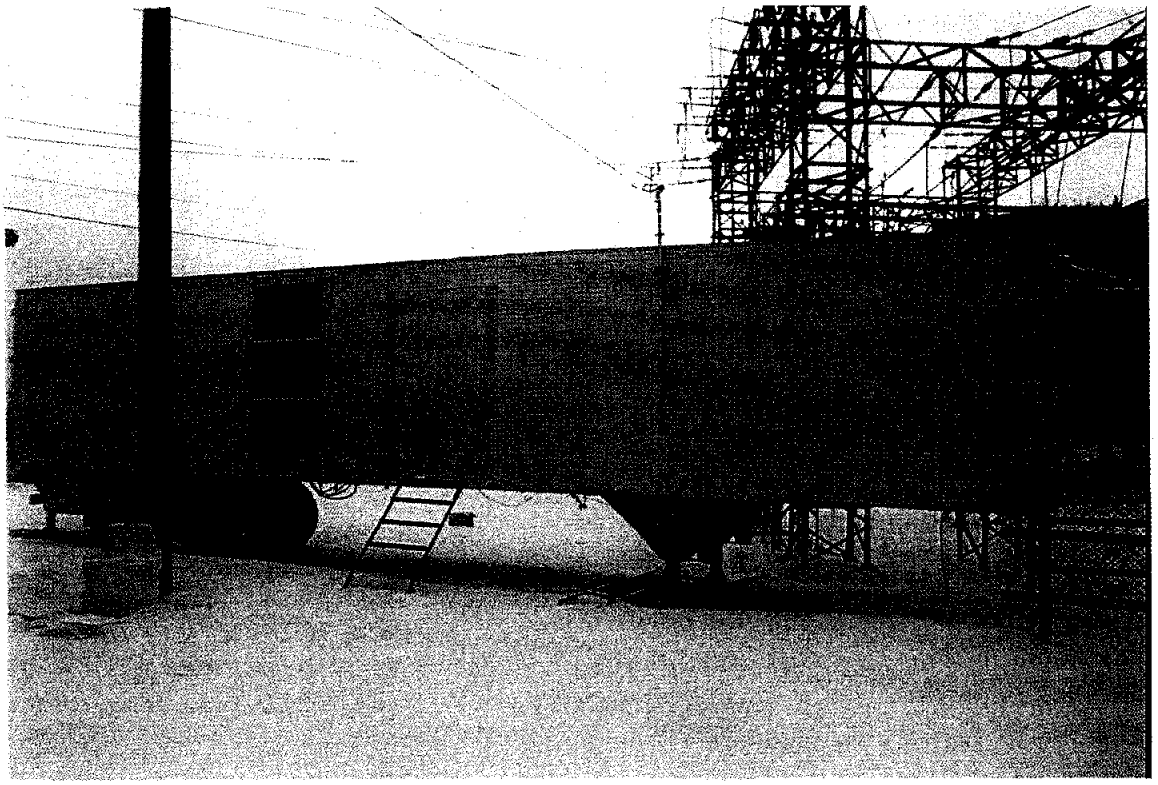
- Engines are older vintage Caterpillar and some trouble have been experienced obtaining spare parts.
- Other components are easily repaired or replaced.

Environmental Restraints: None

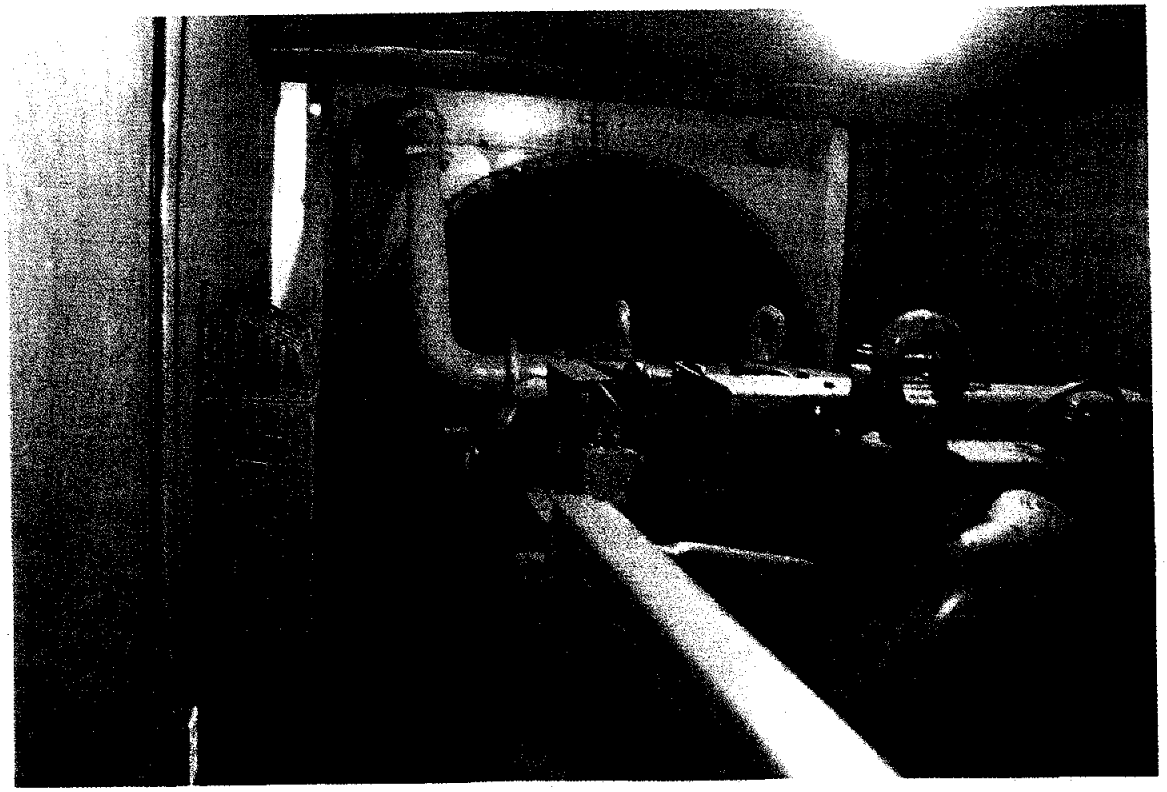
Remaining Service Life: 5 years

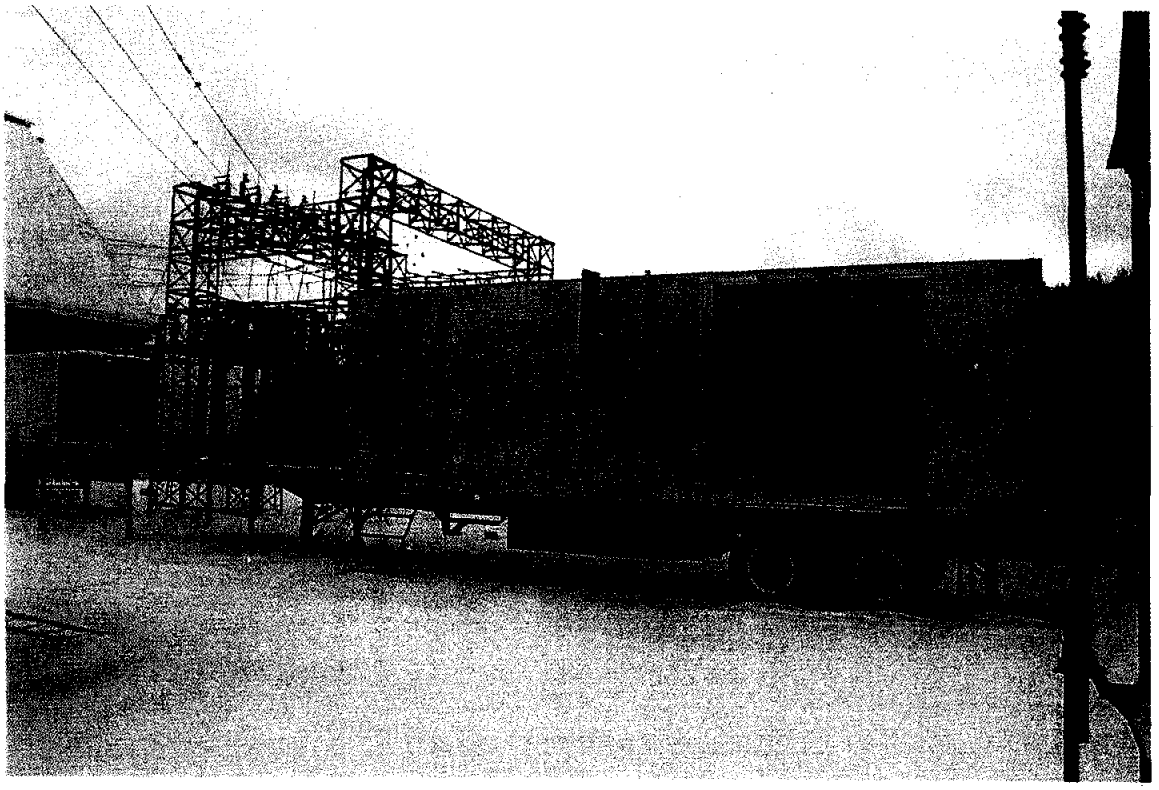
Factors Affecting Service Life:

1. Low usage of plant.
2. High level of maintenance required on components susceptable to corrosion damage. Chassis on Unit #2 major concern.
3. Spare parts availability.
4. Implementation of preventative maintenance program.

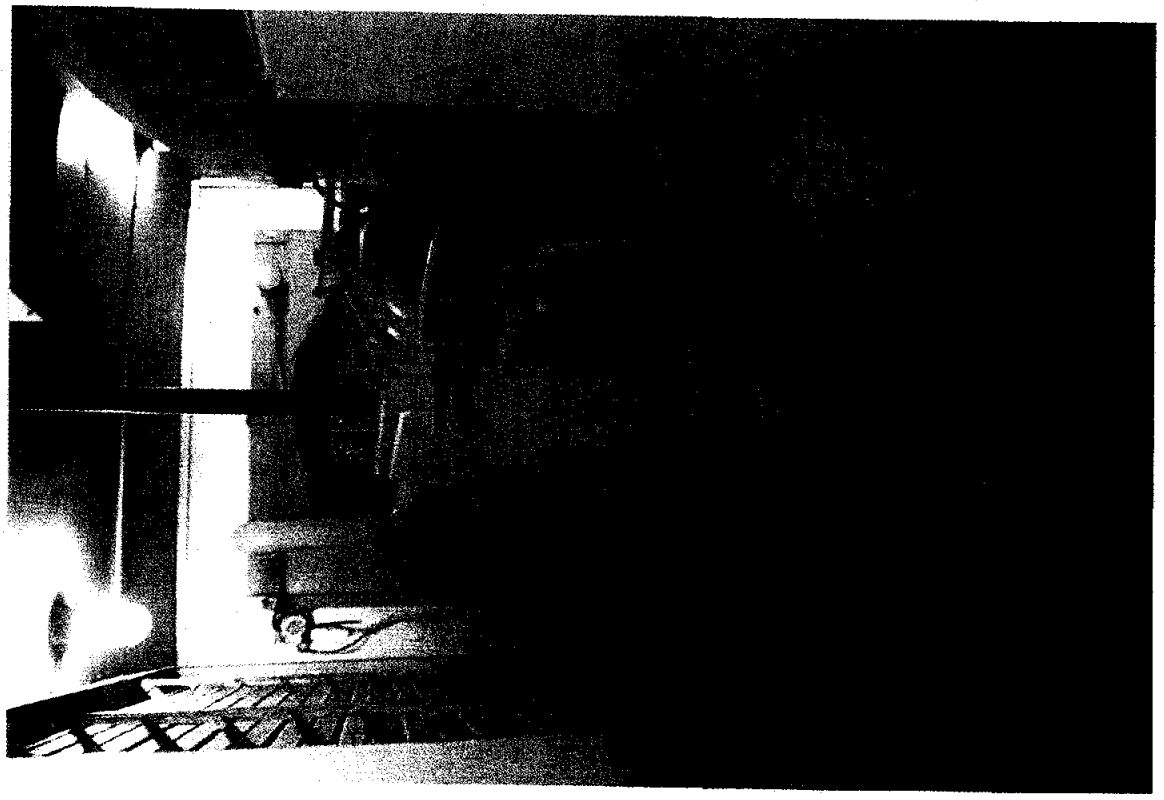


MOBILE DIESEL #1 - EXTERIOR





MOBILE DIESEL #2 - EXTERIOR



HIGH SPEED DIESELS, PORT AUX BASQUES

Plant: **Port Aux Basques Diesel** **Inspected by: M. Hunter**
Location: **Port Aux Basques** **Date: 1996-02-14**

Description: Plant comprised of six Caterpillar diesel generator sets ranging in size from 262 kVA to 438 kVA located in the main building and one 3250 kVA packaged Electromotive Diesel (GM) diesel generator set located adjacent to the building. Plant also includes auxiliaries such as controls, switchgear, fuel storage and transformers. Total installed capacity of the plant is 4159 KW.

Specifications: See Technical Data Sheet in Appendix C2.

Date Installed:

Unit #1: 1949	Unit #5: 1965
Unit #2: 1953	Unit #8: 1965
Unit #3: 1954	Unit #10: 1969
Unit #4: 1958	

Operating Duty: Emergency generation in the event of transmission line or system outage.

Operating Hours: Unit #10: 1627 hrs

The Caterpillar units ran continuously until 1968. The units do not have operating hour meters.

Recent Operating Pattern:

Year	Generation (Kwh)
1991	177,640
1992	252,350
1993	139,669
1994	149,493
1995	65,716

Operation for Reliability Check: Cranked Weekly.
Started monthly, synchronized and run on load for 1 hour.

General Condition: Overall units are in fair to good operating condition. Unit #2 generator is faulted and has yet to be repaired. Some mufflers require rebuild. Generators require cleaning. The switchgear was manufactured in 1937 and is obsolete. The only unit protection is overcurrent on the main breaker. Fuel tank system is in excellent condition.

Recent Maintenance:

Unit #1

1995

- Muffler repaired and painted.
- Engine cleaned and painted.

Unit #2

1995

- Engine cleaned and painted.
- Muffler painted.

Unit #3

1995

- Muffler repaired and painted.
- Engine cleaned and painted.

1993

- Section of exhaust manifold replaced.
- Cooling fan fin repaired (third time).

Unit #4

1995

- Muffler painted.
- Engine cleaned and painted.

1993

- Engine oil changed.

1991

- Rebuilt cylinder head installed.

Unit #5

1995

- Muffler painted.
- Engine cleaned and painted.

1994

- Engine oil changed.
- V section stripped and gasket renewed

1991

- Cylinder head repaired.

Unit #8

1995

- Muffler painted.
- Engine cleaned and painted.

1992

- Rectifier board replaced.

Unit #10

1996

- Immersion heater replaced.

1995

- Muffler repaired and painted.
- New exhaust stack liner installed.

1993

- Generator air filters replaced.
- Engine cooling tower air intake louvres and actuator motor replaced.
- Engine oil changed (@ 1533 hrs).
- Cooling system antifreeze changed.
- Governor oil changed.

Other

1995

- Main powerhouse control room extended to include Unit #10 controls. Old enclosure retired.
- Main powerhouse shingles replaced/repaired.
- Old main fuel tanks and day tanks removed and replaced by two 22,700 L self dyked tanks.

Required Maintenance:

- Unit #2 generator rewind.
- Main powerhouse generators require stator/rotor cleaning.
- Installation of anti condensation strip heaters on main powerhouse generators.
- Minor water leaks around exhaust pipes.
- Main powerhouse roof leaks.
- Main powerhouse requires painting (Budgeted - 1996).
- Mufflers on Units #2, 4, 5 & 8 require repair.
- Window repair/replacement in main powerhouse (Budgeted - 1996).
- Main powerhouse switchgear metering and protection require replacement.
- New fuel tanks require grating on steps (Budgeted - 1996).
- Fuel tank grounding and site grading required (Budgeted - 1996).
- Fuel flow metering required for main plant and Unit #10.

Unit #10 Maintenance:

- Exterior repair and painting (Budgeted - 1996).
- Internal lighting (Budgeted - 1996)
- Governor overhaul.
- Cooling air louvre motor controls.
- Black start feature inoperative.

Required Inspections:

- Air receiver and system requires annual inspection and certification by Department of Labour.

Spare Parts:

- Unit #10 engine is still supported by GM through Midwest Power Products, Winnipeg. Caterpillar engines are obsolete and parts are becoming difficult to obtain. Some spares are kept on site.
- Other components are easily repaired or replaced.

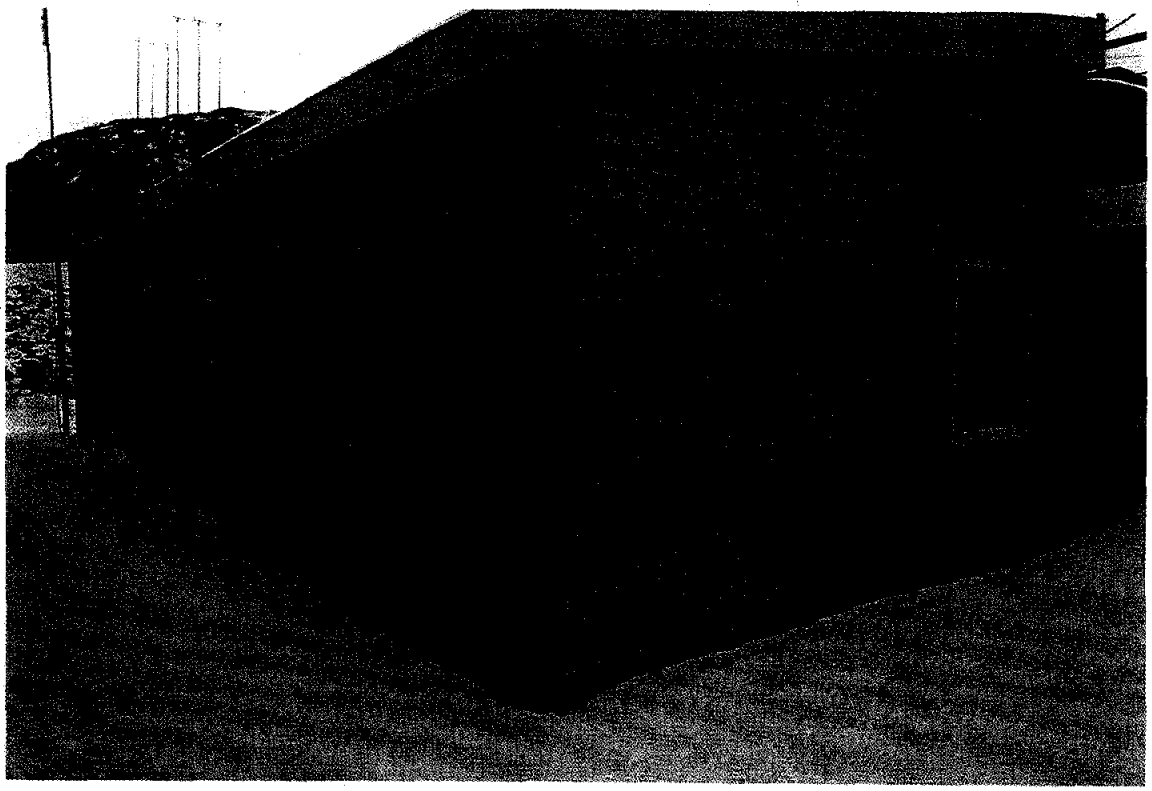
Environmental Restraints: None

Remaining Service Life:

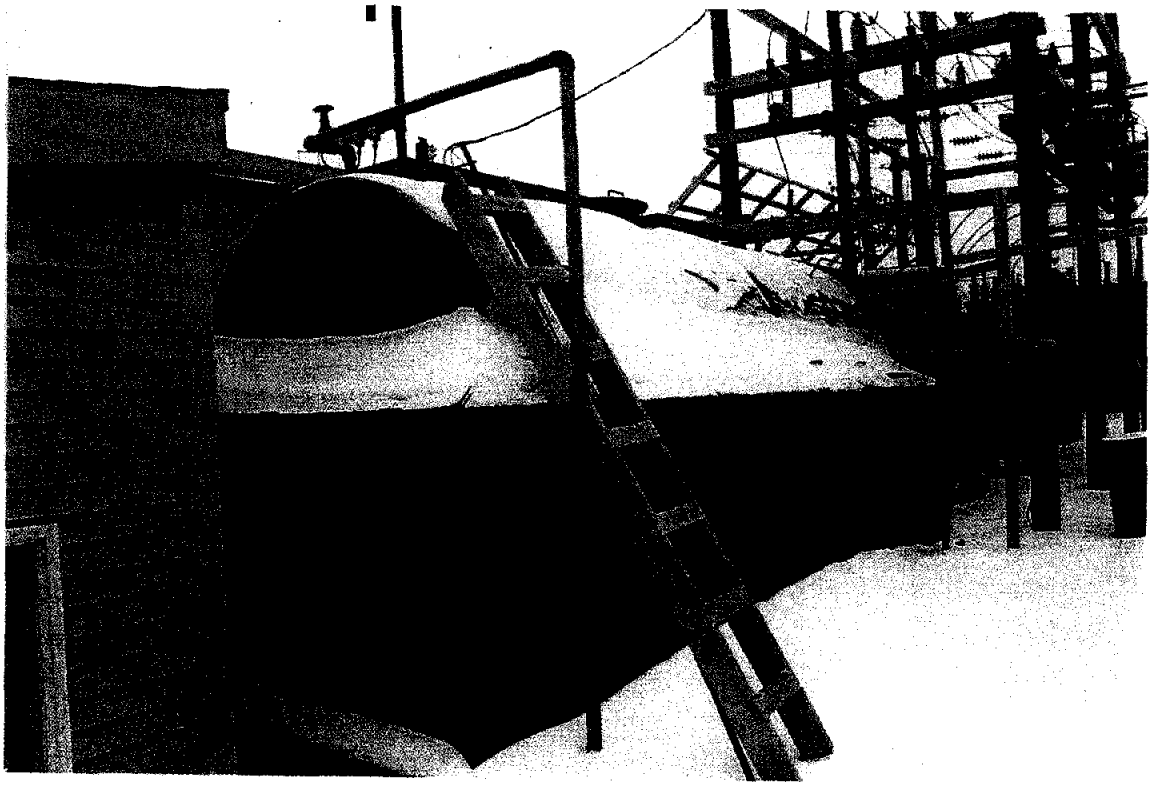
Unit #1, 3, 4, 5, 8: 5 years
Unit #2: 0 years
Unit #10: 10 years

Factors Affecting Remaining Service Life:

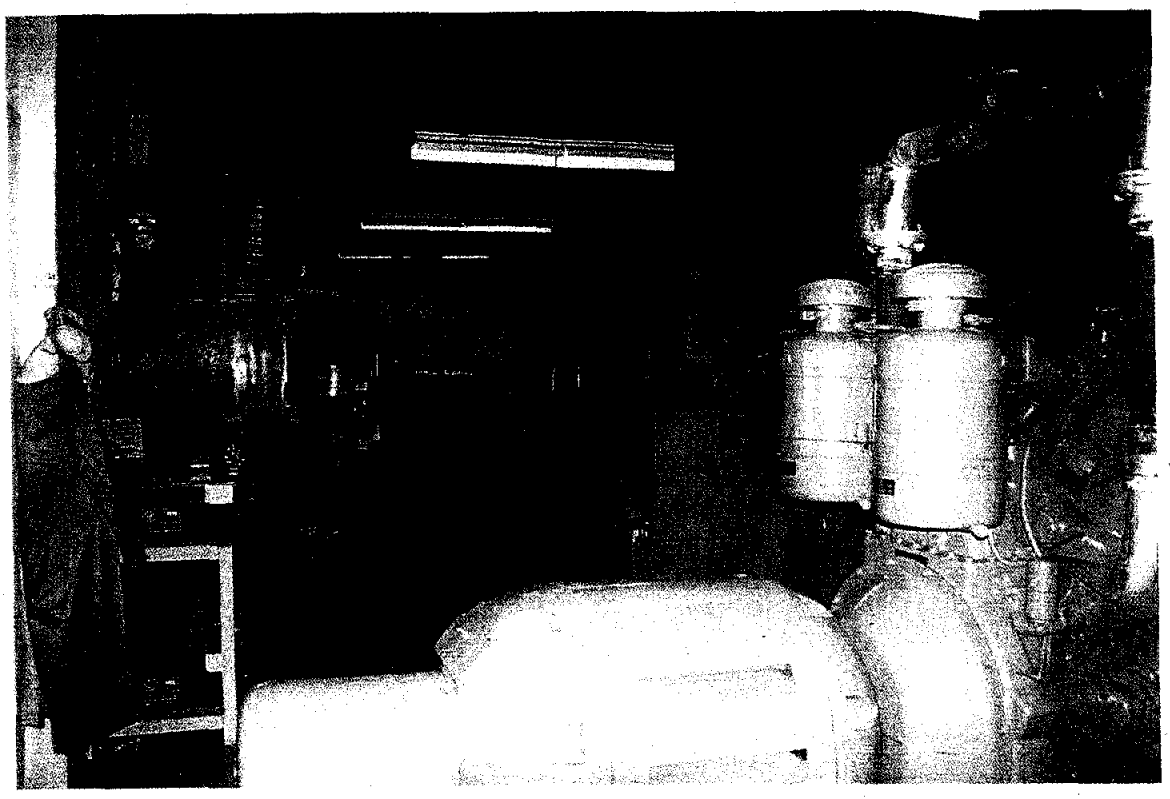
1. Plant usage.
2. Generator stator/rotor cleaning.
3. Availability of spare parts.
4. Implementation of preventative maintenance program.



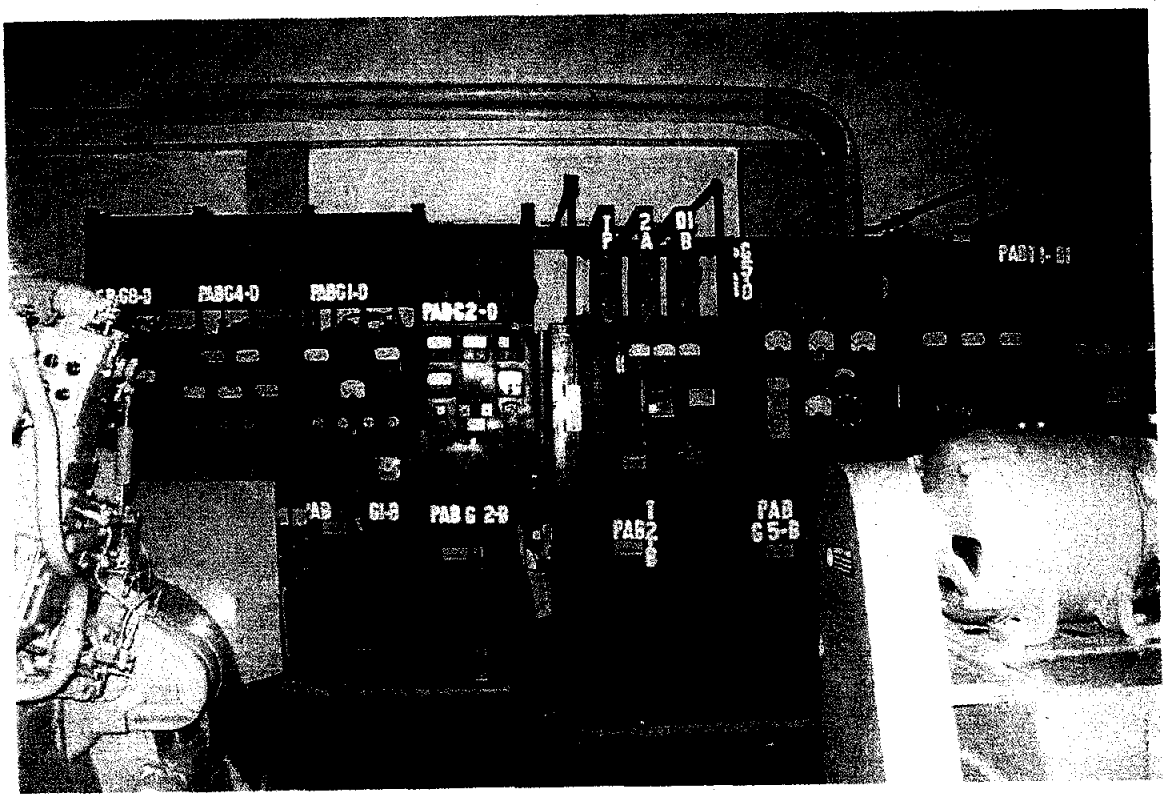
PORT AUX BASQUES DIESEL - CONTROL ROOM EXTERIOR



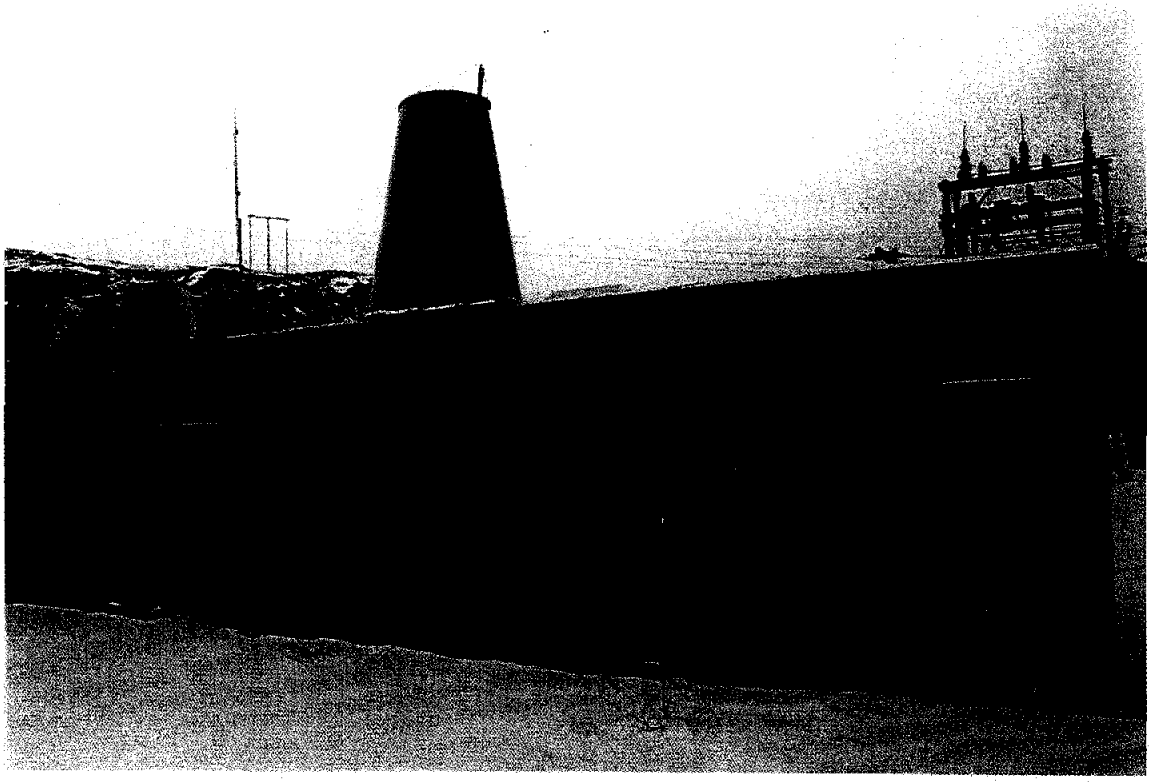
PORT AUX BASQUES DIESEL - FUEL TANK



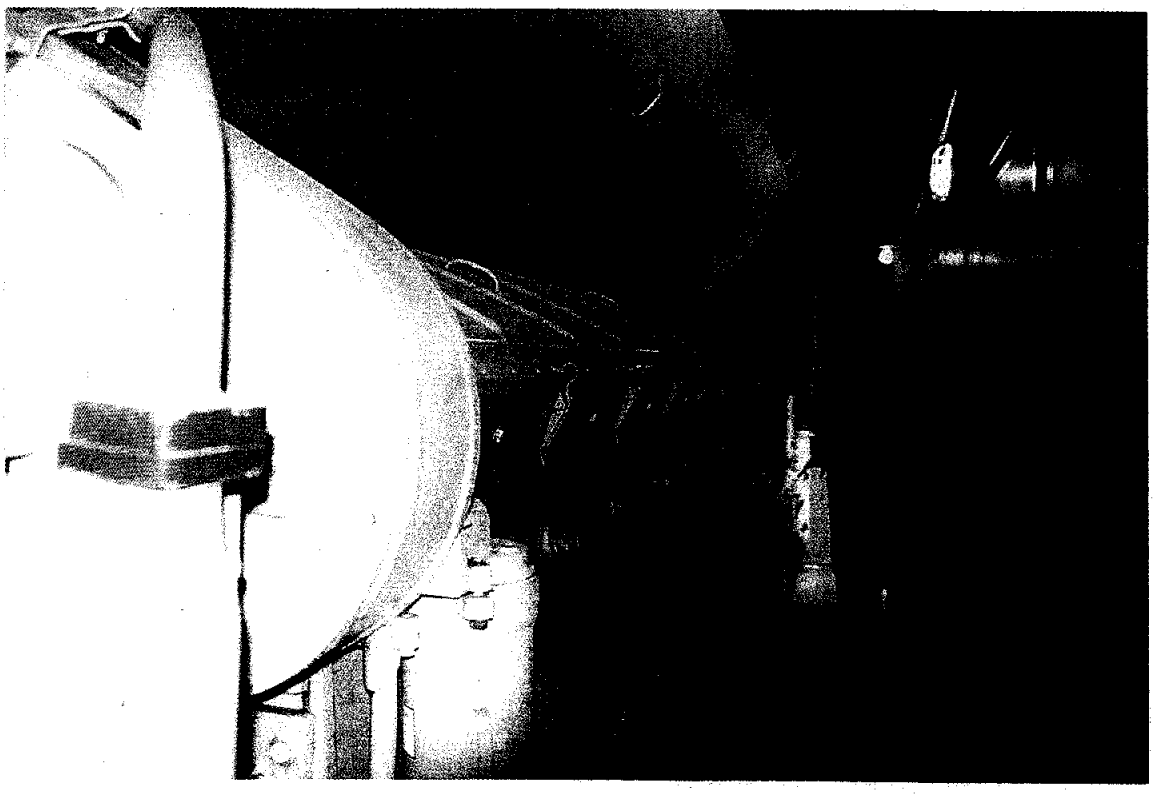
PORT AUX BASQUES DIESEL - MAIN POWERHOUSE ENGINE HALL



PORT AUX BASQUES DIESEL - MAIN POWERHOUSE SWITCHGEAR



PORT AUX BASQUES DIESEL - UNIT #10 - EXTERIOR



PORT AUX BASQUES DIESEL - UNIT #10 - ENGINE ROOM

5. PHYSICAL AND SERVICE LIFE

The service life of a plant is typically determined by the running time until normal replacement is necessary for the major item of plant. Physical life of a plant is determined by the overall plant life taking into account interim replacement of major components. To determine physical life of a plant rigorous inspections are required usually involving the original equipment manufacturers. Much of the plant's present condition depends on how the plant was operated over its lifetime. Most fossil fuel plants were originally designed as base load units and were intended to run steadily with as few starts, stops and cycling as possible. As the duty cycle changes, the increased stops, starts and load swings may cause major components to become more susceptible to failure through fatigue or creep.

Based on normal operation, steam turbine plants normally have 20 to 30 years lives while high speed diesels are not designed for continuous running and have 15 years lives. Aircraft derivative gas turbines have an exposed life of 25 years. Gas turbines are particularly sensitive to quality of fuel and air and frequency of starts and so those factors have considerable effect on physical life. Low speed diesels are generally expected to last 25 years.

Factors taken into account in determining the remaining service life of each generating unit were as follows:

- total hours run
- expected operating cycle
- availability of spare parts
- operating and maintenance history.

The expected remaining service life for each generating unit is summarized in Table 2.

TABLE 2

REMAINING SERVICE LIFE

UNIT	SIZE OF UNIT kW	REMAINING SERVICE LIFE (YEARS)
Steam Plant,		0
Unit 2	20,000	0
1	10,000	
Gas Turbines,		20
Greenhill	25,000	20
Salt Pond	14,700	20
Mobile	7,300	
Low Speed Diesels,		
St. John's	2,500	5
Aguathuna	1,200	5
Salt Pond 1	500	2
2	500	2
3	500	2
Gander 1	1,000	2
2	1,000	2
3	1,000	2
High Speed Diesels,		
Mobile 1	700	5
2	670	5
Port aux Basques 1	350	5
2	250	0
3	350	5
4	209	5
5	250	5
8	250	5
10	2,500	10
Port Union	500	5

APPENDIX A

APPENDIX A

GAS TURBINE PLANTS

A1 GREENHILL

A2 SALT POND

A3 MOBILE

APPENDIX A1

Greenhill Gas Turbine - Data Sheet

Supplier		Curtiss Wright	
Gas Generator		Rolls Royce	
Engine		Olympus "C"	
		Industrial Type Mark No. 2022	
Engine Serial No.		202203	
Power Turbine		Curtiss Wright - Model No. CT-2	
HP Rating/RPM		40500/3600	
Serial No.		12042	
Generator		Brush Electric	
kVa	31800	Frame	B Dax 70.76
rpm	3600	M/C No.	753641
volts	13800	Rating	MCR
Amps	1329	Spec.	ANSI C5013
Ph./Hz	3/60	Amb. temp.	15 degrees C
Ph. Conn	Star	Altitude	Up to 1000 ft.
Exc. volts	202	Rotor Insulation	Class B
Exc. amps	345	Stator Insulation	Class B
Date	1975	P.F.	8
Coolant	Air		
Brushless Exciter			
Rect. DC kW	77	Frame	BXJ 215
RPM	3600	M/c. No.	B753642
Rect. DC V	212	Spec.	ANSI C5013
Rect. DC A	363	Amb. Temp	15 degrees C
Ex. V	27.5	Altitude	Up to 1000 ft.
Ex. A	5.5	Rating	Cont.
Phase	3	Arm. Insualtion	B Class
Date	1975	Field Insualtion	B Class

APPENDIX A2

Salt Pond Gas Turbine - Data Sheet

Supplier	Associated Electrical Industries
Gas Generator	Rolls Royce
Engine	Avon Mark 1533-52L/10
Engine Serial No.	37127
Power Turbine	AEI B Size Power Turbine Free Power Tubine
Generator	A.E.I. - Type AG 80/100
No.	R 230435
Year	1966
kVa	17700
Kw	14150
rpm	1200
Volts	13800
Amps	740
Phase	3
Cycles (Hz)	60
Power Factor	.8

APPENDIX A3

Mobile Gas Turbine Unit

Supplier	Orenda	
Type	OT-F-390	
Gas Generator	OT-390, Model 2C Serial No. 5907	
Power Turbine	OT-3, Model 6	
Serial No.	5055	
Rating	I.S.O.	Site
Power	7380 kW	7000 kW
Altitude	Sea Level	Sea Level
Ambient Air Temp.	15 degrees C	15 degrees C
rpm	7500	7500
Generator	Electric Machinery Manufacturing Co.	
Serial No.	173184601	
Frame	Turbo 52 x 35	
kVA	8100	
rpm	3600	
Volts	4160	
Phase	3	
Cycles (Hz)	60	
PF	0.9	
Insulation Class	B	
Exciter	Electric Machinery Manufacturing Co.	
Frame	8TE1805	
Serial No.	173184606	

APPENDIX B

LOW SPEED DIESEL PLANTS

B1 AGUATHUNA

B2 ST. JOHN'S

B3 SALT POND

B4 GANDER

APPENDIX B1

Aguathuna Diesel Plant - Data Sheet

Engine Manufacturer	Harland & Wolff
Engine No.	2476
Engine HP	2000
Model	TR 400/600
Alternator Manufacturer	Harland & Wolff
No.	18180
kW	1200
rpm	327
Volts	2400
Amps	361
Phase	3
Cycles (Hz)	60
Power Factor	.8
Rating	Continuous
Excitation Volts	102
Excitation Amps	147
Exciter Manufacturer	Harland & Wolff
No.	18140
kW	15.6
rpm	327
Volts	104
Amps	150
Rating	Continuous

APPENDIX B2

St. John's Diesel Plant - Data Sheet

Engine Manufacturer	Nordberg
Engine No.	201200804
Bore x Stroke	21-1/2" x 31
rpm	225
Governor	Woodward Type 1C 500
BHP	3580
Generator Manufacturer	General Electric Type A.T.1
kVa	3125
kW	2500
Volts	6600
Amps	274 Armature
	228 Field
Excitation	125 V
Phase	3
Cycles (Hz)	60
Temp. Rise	60 degrees C
P.F.	.8
Exciter Model	33G743
Type	CD 1126
Speed	1150 rom
Volts	125
Amps	240

APPENDIX B3

Salt Pond Diesel Plant - Data Sheet

Engine	Unit G1	Unit G2	Unit G3
Manufacturer	Worthington	Worthington	Worthington
Engine No.	VO1633	VO1635	VO1680
Type	EE 6 Std	EE 6 Std	EE 6 Std
rpm	327	327	327
Generator			
Manufacturer	Electric Machinery	Electric Machinery	Electric Machinery
Serial No.	82363	83539	82362
kVa	625	625	625
PF	.8	.8	.8
Volts	4160	4160	4160
Amps	87	87	87
rpm	327	327	327
Phase	3	3	3
Cycles (Hz)	60	60	60
Temp. Rise			
Armature	40 degrees C	40 degrees C	40 degrees C
Field	50 degrees C	50 degrees C	50 degrees C
Time Rating		25% overload 2 hours	
Exciter			
Serial No.	1899422	1899402	19001100
kW	15	15	15
Volts	125	125	125
Amps	120	120	120
rpm	327	327	327

APPENDIX B4

Gander Diesel Plant - Data Sheet

Unit No.	No. 1	No. 2	No. 3
Engine			
Manufacturer	Polar Atlas	Nohab-Polar	Nohab-Polar
Type	K57M	K57M	K57M
BHP	1470	1470	1470
rpm	300	300	300
No.	86190	1611	1466
Generator			
Manufacturer	CGE	CGE	CGE
Frame	6426M	6426M	6426M
Model	664021	78393	74258
No.	404125	604571	604318
kVa	1250	1250	1250
kW	1000	1000	1000
Volts	2300	2300	2300
Excitation			
Volts	125	125	125
Amps	100	100	100

APPENDIX C

HIGH SPEED DIESEL PLANTS

C1 MOBILE DIESELS

C2 PORT AUX BASQUES

C3 PORT UNION

APPENDIX C1

MOBILE DIESELS

	Unit #1	Unit #2
Engine		
Manufacturer	Caterpillar	Caterpillar
Model	D-349	D-349
Serial No.	61P476	61P809
Rating (HP)	980	980
Alternator		
Manufacturer	Tamper-Camron	Brown-Boveri
Model	SG-1473	715
Serial No.	363-088-101	C-360-690-601
Rating (kW)	700	670
RPM	1800	1800
Volts	347/600	347/600
P.F.	0.85	0.85

APPENDIX C2

Port Aux Basques

	1	4	2	8	3	5	10
Engine	Caterpillar	Caterpillar	Caterpillar	Caterpillar	Caterpillar	Caterpillar	GM
Type	D397	D386	D353	D353	D397	D386	20-645-E4
Serial No.	41B1388	15B1	46B	46B1663	48B1181	15V54	64E1 1081
H.P.	505	344			505	364	3600
Size	12 cyl 5-3/ 4x8	12 cyl.	6 cyl.	6 cyl.	12 cyl 5-3/ 4x8"	12 cyl 5-3/ 4x8"	20 cyl.
	5.75 x 8"	5.75 x 8"	6.25 x 8"	6.25 x 8"	5.75 x 8"	5.75 x 8"	9-1/16x10"
rpm	1200	1200	1200	1200	1200	1200	900
Generator		Gen. Elect.					
Serial No.	850RN60 0	6842237	2505N17	2050N16	350RN2	6917550	69-E1-1199 (1081)
Frame		966	683	683			
kVa	438	262	315	312	438	282	3125
kW	350	209	250	250	350	250	2500
P.F.	.8	.8	.8	.8	.8	.8	.8
Volts	2400	2400	2400	2400	2400	2400	4160
Amps	105	71	75	75	108	75.4	
Phase	3	3	3	3	3	3	3
Cycle	60	60	60	60	60	60	60
Exciter							
Amps	40	40	53	53	40	40	
Volts	125	125	77	77	125	125	