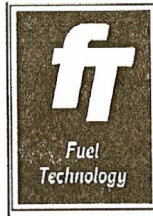


## © Copyright Statement

All rights reserved. All material in this document is, unless otherwise stated, the property of **FPC International, Inc.** Copyright and other intellectual property laws protect these materials. Reproduction or retransmission of the materials, in whole or in part, in any manner, without the prior written consent of the copyright holder, is a violation of copyright law.

041



REPORT ON  
FUEL EFFICIENCY TRIAL

**DOMINION MINING  
BANNOCKBURN SITE**

27th May, 1994

Report prepared by:

**N Millin  
Fuel Technology Pty Ltd  
70 Adelaide Street  
FREMANTLE WA 6160**

**Tel: (09) 335 6899  
Fax: (09) 430 5403**

ACN 063 561 151

## CONTENTS

|                   |      |   |
|-------------------|------|---|
| Executive Summary | Page | 1 |
| Introduction      | Page | 2 |
| Test Procedure    | Page | 2 |
| Results           | Page | 3 |
| Conclusion        | Page | 5 |

### Appendices:

- A Bosch Smoke Meter Patches
- B Microvip Mk 1.2 Energy Analyser Sample Printout
- C Specific Fuel Consumption Data Sheets
- D Carbon Balance Printouts

\* \* \* \*

## **EXECUTIVE SUMMARY**

An evaluation of Fuel Technology Pty Ltd's Combustion Catalyst, FTC-1, was commenced during 1991 at Dominion Mining's Labouchere gold mine operation. This evaluation, using international engineering standard procedures to determine fuel efficiency changes, indicated reduced fuel consumption in the mobile mining equipment and power generation facility following FTC-1 treatment of fuel.

Similar but more detailed studies were then completed at the Bannockburn and Paddy's Flat operations providing further confirmation of the fuel efficiency and maintenance benefits achievable by the introduction to fuel supply of the FTC Combustion Catalyst.

Following plant upgrades and discussions with Bannockburn Mill Superintendent, Mr Bob Markovich, it was agreed to re-evaluate the efficiencies of FTC usage in Bannockburn's power generation facility.

A study of the power station fuel consumption was conducted by two analytical methods namely, Carbon Balance and Specific Fuel Consumption. Untreated tests were conducted on 30th March, 1994 followed by six (6) weeks FTC-1 treatment of fuel. Treated tests were then conducted, providing evidence of reduced fuel consumption in the 3.3% to 3.8% region.

The purpose of this report is to review the test procedures applied to this study and report the results achieved.

## INTRODUCTION

The power generation facility at Dominion Mining's Bannockburn operation comprises of four Cummins KTA50 1.2 MW generators.

Genset No. 1 was unavailable for untreated Carbon Balance tests and Genset No. 2 received new injectors between tests so was not included in treated tests.

Specific Fuel Consumption (SFC) tests were completed on Gensets 1, 3 and 4.

## TEST PROCEDURES

### *SPECIFIC FUEL CONSUMPTION TESTS*

1. Specific Fuel Consumption (SFC) is an engineering test whereby the absolute amount of fuel consumed by the equipment at specified power settings is determined by volume or weight measurement. Volumes are corrected for temperature and density variations. Trials are *before and after* treatment.

### *CARBON BALANCE TESTS*

2. Carbon Balance Measurement (CB) whereby the mass of carbon in the exhaust is calculated as a measure of fuel being burned. The elements measured in this test include the exhaust gas composition, its temperature and the gas flow rate calculated from the pressure and exhaust stack cross sectional area. While this is an Engineering Standard Test (AS2077-1982), because field testing involves equipment with variable exhaust stack configurations, the precision of the absolute carbon mass measurement is not ideal. However, because these tests are based on back to back (*before and after*) trials on the same piece of equipment, the variables introduced by turbulent gas flow tend to cancel out.

### *EXHAUST SMOKE EMISSION TESTS*

3. Smoke testing is carried out using a Bosch diesel smoke tester. This equipment takes a measured sample of the exhaust gas at a given power loading and analyses the density of the soot on a filter paper. Tests are run on untreated fuel and after fuel has been treated for a period. In most cases smoke levels rise in the first few hundred hours after introducing FTC into the fuel and finally reduce to levels which are 20 to 50% below those measured on untreated fuel.

## RESULTS

The results of the test methods are detailed in this section.

### 1. SPECIFIC FUEL CONSUMPTION (SFC)

Baseline SFC tests were conducted on Units 1, 3 and 4 on 30th March, 1994 and treated tests on the same units on 12th May, 1994. The tests were conducted as close as practicable at the same loadings. Fuel flow was measured by means of an Oval flow meter. Energy measurements were measured by the Microvip Mk 1.2 Energy Analyser connected into each unit's section of the control room switchboard. The Microvip measures and prints out on demand the following parameters:

|        |       |        |
|--------|-------|--------|
| kWatt  | kVArh | LmA    |
| Ampere | kWh   | MVAr   |
| Volt   | Hours | PF Med |
|        | Hz    |        |

These values are shown in the sample printouts in Appendix B. The SFC Test Data Retrieval Sheets are also included, Appendix C.

A summary of Specific Fuel Consumption measurements is shown in Table I.

**TABLE I**  
**SFC TEST RESULTS - L/kWh**

| Unit No.       | Load kW             | Baseline<br>30/3/94 | Treated<br>12/5/94 | % Change    |
|----------------|---------------------|---------------------|--------------------|-------------|
| 1              | 700/780             | 0.2581              | 0.2463             | -4.6        |
| 3              | 720/780             | 0.2627              | 0.2575             | -2.0        |
| 4              | 730/770             | 0.2594              | 0.2508             | -3.3        |
| <b>AVERAGE</b> | <b>1, 3 &amp; 4</b> | <b>0.2600</b>       | <b>0.2515</b>      | <b>-3.3</b> |

Fuel temperatures and density were measured with density corrected to 15°C which is standard industry practice for comparison.

The corrections for density are (kg/kWh) shown in Table II.

**TABLE II**  
**CORRECTED SFC TEST RESULTS - kg/kWh**

| Unit No.       | Load KW | Baseline<br>30/3/94 | Treated<br>12/5/94 | % Change    |
|----------------|---------|---------------------|--------------------|-------------|
| 1              | 700/780 | 0.2093              | 0.2012             | -3.9        |
| 3              | 720/780 | 0.2136              | 0.2082             | -2.6        |
| 4              | 730/770 | 0.2109              | 0.2036             | -3.5        |
| <b>AVERAGE</b> |         | <b>0.2113</b>       | <b>0.2043</b>      | <b>-3.3</b> |

2. *CARBON BALANCE (CB)*

Carbon Balance tests were conducted in conjunction with SFC tests.

The results and computer analysis sheets are included in Appendix D.

**TABLE III  
CB TEST RESULTS - CARBON FLOW g/s**

|                | <b>Load KW</b> | <b>Baseline<br/>30/3/94</b> | <b>Treated<br/>12/5/94</b> | <b>% Change</b> |
|----------------|----------------|-----------------------------|----------------------------|-----------------|
| 3              | 700/720        | 33.003                      | 31.736                     | -3.8            |
| 4              | 750/770        | 42.641                      | 41.203                     | -3.4            |
| <b>AVERAGE</b> |                | <b>37.822</b>               | <b>36.4695</b>             | <b>-3.6</b>     |

3. *SMOKE TEST*

Bosch smoke measurement using a Bosch smoke meter were also taken. The Bosch measurement scale ranges from 0.0 (clean) to 9.9 (dirty).

**TABLE IV  
BOSCH SMOKE COMPARISON**

| <b>Unit No.</b> | <b>Load KW</b> | <b>Baseline<br/>30/3/94</b> | <b>Treated<br/>12/5/94</b> | <b>% Change</b> |
|-----------------|----------------|-----------------------------|----------------------------|-----------------|
| 3               | 700/720        | 1.9                         | 1.8                        | - 5.3%          |
| 4               | 750/770        | 1.6                         | 1.6                        | N/C             |

A significant reduction in smoke emissions are not generally measured following a short FTC-1 treatment period. We would expect to measure a more significant reduction in smoke following three (3) months treatment of fuel.

## CONCLUSION

This series of fuel efficiency tests conducted in Dominion Mining's Bannockburn power generation facility provides evidence of reductions in fuel consumption in the region of 3.3% to 3.6% as a result of FTC-1 fuel treatment.

The two engineering methods applied namely "*Carbon Balance*" and "*Specific Fuel Consumption*" have also achieved a good level of correlation.

These measured efficiency gains fall within the normal range measured in similar equipment and, along with longer term maintenance benefits, will represent significant savings to Dominion Minings Bannockburn operations.



*Appendix "A"*

**Bosch Smoke Meter Patches**

# BOSCH SMOKE TESTS

Unit No.

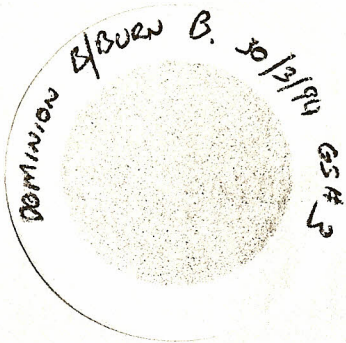
Baseline

Bosch No

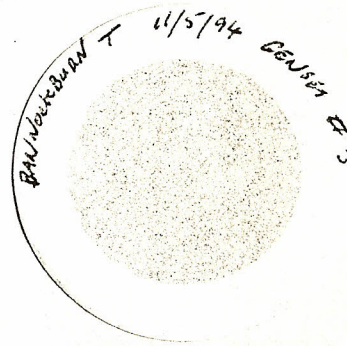
Treated

Bosch No

3

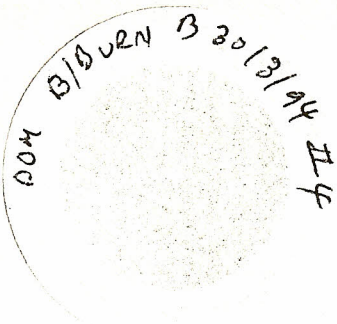


1.9

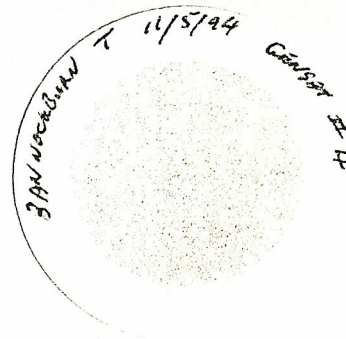


1.8

4



1.6



1.6

*Appendix "B"*

**Microvip Mk 1.2 Energy Analyser Sample Printout**

# BASELINE 30/3/94

## Unit No. 1

micro VIP  
 KWatt 90.4  
 Cos $\theta$  PF +0.86  
 Ampere 146  
 Volt 417  
 KVArh 00079.085  
 KWh 00323.458  
 Hours 0004.36  
 LmA 000  
 MVAR  $\Delta$ i > 918  
 P.F.Med. >0.97  
 Hz 50.3

micro VIP  
 KWatt 92.7  
 Cos $\theta$  PF +0.86  
 Ampere 149  
 Volt 417  
 KVArh 00088.082  
 KWh 00338.919  
 Hours 0004.46  
 LmA 000  
 MVAR  $\Delta$ i > 934  
 P.F.Med. >0.97  
 Hz 50.9

micro VIP  
 KWatt 97.9  
 Cos $\theta$  PF +0.84  
 Ampere 160  
 Volt 417  
 KVArh 00097.648  
 KWh 00354.737  
 Hours 0004.56  
 LmA 000  
 MVAR  $\Delta$ i > 979  
 P.F.Med. >0.96  
 Hz 100

micro VIP  
 KWatt 96.4  
 Cos $\theta$  PF +0.85  
 Ampere 155  
 Volt 417  
 KVArh 00107.613  
 KWh 00370.811  
 Hours 0005.06  
 LmA 000  
 MVAR  $\Delta$ i > 966  
 P.F.Med. >0.96  
 Hz 50.2

micro VIP  
 KWatt 97.8  
 Cos $\theta$  PF +0.85  
 Ampere 160  
 Volt 417  
 KVArh 00117.509  
 KWh 00386.655  
 Hours 0005.16  
 LmA 000  
 MVAR  $\Delta$ i > 963  
 P.F.Med. >0.96  
 Hz 50.2

## Unit No. 1

micro VIP  
 KWatt 96.7  
 Cos $\theta$  PF +0.85  
 Ampere 154  
 Volt 417  
 KVArh 00127.570  
 KWh 00402.882  
 Hours 0005.26  
 LmA 000  
 MVAR  $\Delta$ i > 974  
 P.F.Med. >0.95  
 Hz 50.2

micro VIP  
 KWatt 99.0  
 Cos $\theta$  PF +0.85  
 Ampere 162  
 Volt 417  
 KVArh 00137.536  
 KWh 00419.208  
 Hours 0005.36  
 LmA 000  
 MVAR  $\Delta$ i > 984  
 P.F.Med. >0.95  
 Hz 50.2

micro VIP  
 KWatt 98.5  
 Cos $\theta$  PF +0.85  
 Ampere 159  
 Volt 417  
 KVArh 00147.605  
 KWh 00435.685  
 Hours 0005.46  
 LmA 000  
 MVAR  $\Delta$ i > 981  
 P.F.Med. >0.95  
 Hz 50.2

## Unit No. 3

micro VIP  
 KWatt 97.7  
 Cos $\theta$  PF +0.82  
 Ampere 165  
 Volt 417  
 KVArh 00021.459  
 KWh 00039.700  
 Hours 0001.05  
 LmA 000  
 MVAR  $\Delta$ i > 976  
 P.F.Med. >0.88  
 Hz 50.2

micro VIP  
 KWatt 97.7  
 Cos $\theta$  PF +0.83  
 Ampere 166  
 Volt 416  
 KVArh 00030.167  
 KWh 00056.123  
 Hours 0001.15  
 LmA 000  
 MVAR  $\Delta$ i > 983  
 P.F.Med. >0.88  
 Hz 50.2

micro VIP  
 KWatt 102  
 Cos $\theta$  PF +0.83  
 Ampere 169  
 Volt 416  
 KVArh 00041.218  
 KWh 00072.820  
 Hours 0001.25  
 LmA 000  
 MVAR  $\Delta$ i > 101  
 P.F.Med. >0.87  
 Hz 50.2

micro VIP  
 KWatt 97.9  
 Cos $\theta$  PF +0.83  
 Ampere 162  
 Volt 417  
 KVArh 00049.607  
 KWh 00089.222  
 Hours 0001.34  
 LmA 000  
 MVAR  $\Delta$ i > 961  
 P.F.Med. >0.87  
 Hz 50.2

micro VIP  
 KWatt 97.1  
 Cos $\theta$  PF +0.84  
 Ampere 162  
 Volt 417  
 KVArh 00055.707  
 KWh 00105.368  
 Hours 0001.44  
 LmA 000  
 MVAR  $\Delta$ i > 978  
 P.F.Med. >0.88  
 KHz 4.47

## Unit No. 3

micro VIP  
 KWatt 98.5  
 Cos $\theta$  PF +0.84  
 Ampere 163  
 Volt 417  
 KVArh 00050.209  
 KWh 00121.809  
 Hours 0001.55  
 LmA 000  
 MVAR  $\Delta$ i > 979  
 P.F.Med. >0.90  
 Hz 50.2

micro VIP  
 KWatt 98.8  
 Cos $\theta$  PF -0.84  
 Ampere 163  
 Volt 417  
 KVArh 00059.175  
 KWh 00137.916  
 Hours 0002.04  
 LmA 000  
 MVAR  $\Delta$ i > 996  
 P.F.Med. >0.92  
 Hz 50.9

micro VIP  
 KWatt 101  
 Cos $\theta$  PF -0.84  
 Ampere 164  
 Volt 417  
 KVArh 00059.358  
 KWh 00154.291  
 Hours 0002.14  
 LmA 000  
 MVAR  $\Delta$ i > 996  
 P.F.Med. >0.93  
 KHz 9.70

micro VIP  
 KWatt 99.8  
 Cos $\theta$  PF -0.84  
 Ampere 164  
 Volt 417  
 KVArh 00060.353  
 KWh 00170.838  
 Hours 0002.24  
 LmA 000  
 MVAR  $\Delta$ i > 991  
 P.F.Med. >0.94  
 Hz 50.9

# BASELINE 30/3/94

## Unit No. 4

micro VIP  
KWatt 96.1  
Cos $\theta$  PF +0.79  
Ampere 169  
Volt 415  
KVArh 00156.593  
KWh 00448.382  
Hours 0006.02  
LmA 000  
MVar  $\Delta$ i > 955  
P.F. Med. >0.95  
KHz 15.0

micro VIP  
KWatt 92.5  
Cos $\theta$  PF +0.78  
Ampere 166  
Volt 415  
KVArh 00169.106  
KWh 00464.576  
Hours 0006.12  
LmA 000  
MVar  $\Delta$ i > 926  
P.F. Med. >0.94  
KHz 4.49

micro VIP  
KWatt 95.5  
Cos $\theta$  PF +0.78  
Ampere 170  
Volt 415  
KVArh 00181.663  
KWh 00480.287  
Hours 0006.22  
LmA 000  
MVar  $\Delta$ i > 960  
P.F. Med. >0.94  
Hz 100

micro VIP  
KWatt 93.3  
Cos $\theta$  PF +0.78  
Ampere 166  
Volt 415  
KVArh 00194.175  
KWh 00495.854  
Hours 0006.32  
LmA 000  
MVar  $\Delta$ i > 937  
P.F. Med. >0.93  
Hz 50.3

micro VIP  
KWatt 97.1  
Cos $\theta$  PF +0.79  
Ampere 166  
Volt 415  
KVArh 00206.509  
KWh 00511.173  
Hours 0006.42  
LmA 000  
MVar  $\Delta$ i > 970  
P.F. Med. >0.93  
Hz 50.2

## Unit No. 4

micro VIP  
KWatt 96.5  
Cos $\theta$  PF +0.79  
Ampere 170  
Volt 415  
KVArh 00218.998  
KWh 00527.189  
Hours 0006.52  
LmA 000  
MVar  $\Delta$ i > 963  
P.F. Med. >0.92  
Hz 50.2

micro VIP  
KWatt 97.4  
Cos $\theta$  PF +0.79  
Ampere 170  
Volt 415  
KVArh 00231.432  
KWh 00543.279  
Hours 0007.02  
LmA 000  
MVar  $\Delta$ i > 966  
P.F. Med. >0.92  
KHz 3.49

# TREATED 12/5/94

## Unit No. 1

micro VIP  
 KWatt 89.5  
 Cosθ PF +0.71  
 Ampere 174  
 Volt 421  
 KVArh 02707.159  
 KWh 03232.703  
 Hours 0043.38  
 LmA 000  
 MVAR Δi > 906  
 P.F.Med. >0.77  
 Hz 50.2

micro VIP  
 KWatt 89.4  
 Cosθ PF +0.72  
 Ampere 172  
 Volt 421  
 KVArh 02721.967  
 KWh 03247.890  
 Hours 0043.48  
 LmA 000  
 MVAR Δi > 897  
 P.F.Med. >0.77  
 Hz 50.1

micro VIP  
 KWatt 89.3  
 Cosθ PF +0.72  
 Ampere 171  
 Volt 421  
 KVArh 02736.452  
 KWh 03263.058  
 Hours 0043.58  
 LmA 000  
 MVAR Δi > 897  
 P.F.Med. >0.77  
 Hz 50.2

micro VIP  
 KWatt 88.8  
 Cosθ PF +0.71  
 Ampere 171  
 Volt 421  
 KVArh 02750.918  
 KWh 03278.040  
 Hours 0044.08  
 LmA 000  
 MVAR Δi > 885  
 P.F.Med. >0.77  
 Hz 50.2

micro VIP  
 KWatt 87.8  
 Cosθ PF +0.71  
 Ampere 170  
 Volt 421  
 KVArh 02765.534  
 KWh 03293.031  
 Hours 0044.18  
 LmA 000  
 MVAR Δi > 884  
 P.F.Med. >0.77  
 Hz 50.2

## Unit No 1

micro VIP  
 KWatt 89.0  
 Cosθ PF +0.72  
 Ampere 171  
 Volt 421  
 KVArh 02730.099  
 KWh 03300.052  
 Hours 0044.28  
 LmA 000  
 MVAR Δi > 892  
 P.F.Med. >0.77  
 Hz 50.1

micro VIP  
 KWatt 89.5  
 Cosθ PF +0.72  
 Ampere 169  
 Volt 421  
 KVArh 02734.498  
 KWh 03302.804  
 Hours 0044.38  
 LmA 000  
 MVAR Δi > 901  
 P.F.Med. >0.77  
 Hz 50.0

micro VIP  
 KWatt 91.1  
 Cosθ PF +0.73  
 Ampere 170  
 Volt 421  
 KVArh 02908.505  
 KWh 03337.712  
 Hours 0044.48  
 LmA 000  
 MVAR Δi > 910  
 P.F.Med. >0.77  
 Hz 50.1

## Unit No. 3

micro VIP  
 KWatt 98.0  
 Cosθ PF +0.82  
 Ampere 166  
 Volt 421  
 KVArh 00233.424  
 KWh 00346.520  
 Hours 0003.50  
 LmA 000  
 MVAR Δi > 952  
 P.F.Med. >0.81  
 Hz 50.1

micro VIP  
 KWatt 95.2  
 Cosθ PF +0.80  
 Ampere 161  
 Volt 421  
 KVArh 00265.095  
 KWh 00362.289  
 Hours 0004.00  
 LmA 000  
 MVAR Δi > 934  
 P.F.Med. >0.81  
 Hz 50.1

micro VIP  
 KWatt 95.1  
 Cosθ PF +0.80  
 Ampere 163  
 Volt 420  
 KVArh 00276.707  
 KWh 00378.125  
 Hours 0004.10  
 LmA 000  
 MVAR Δi > 952  
 P.F.Med. >0.81  
 Hz 50.1

micro VIP  
 KWatt 98.9  
 Cosθ PF +0.82  
 Ampere 169  
 Volt 421  
 KVArh 00289.917  
 KWh 00394.130  
 Hours 0004.20  
 LmA 000  
 MVAR Δi > 984  
 P.F.Med. >0.81  
 Hz 50.1

micro VIP  
 KWatt 91.2  
 Cosθ PF +0.81  
 Ampere 155  
 Volt 422  
 KVArh 00299.443  
 KWh 00409.766  
 Hours 0004.30  
 LmA 000  
 MVAR Δi > 911  
 P.F.Med. >0.81  
 Hz 50.1

## Unit No. 4

micro VIP  
 KWatt 101  
 Cosθ PF +0.86  
 Ampere 159  
 Volt 420  
 KVArh 00361.109  
 KWh 00490.249  
 Hours 0005.56  
 LmA 000  
 MVAR Δi > 103  
 P.F.Med. >0.81  
 Hz 50.1

micro VIP  
 KWatt 95.0  
 Cosθ PF +0.85  
 Ampere 150  
 Volt 420  
 KVArh 00330.315  
 KWh 00530.135  
 Hours 0006.16  
 LmA 000  
 MVAR Δi > 952  
 P.F.Med. >0.81  
 Hz 50.1

micro VIP  
 KWatt 95.7  
 Cosθ PF +0.85  
 Ampere 154  
 Volt 419  
 KVArh 00389.971  
 KWh 00545.043  
 Hours 0006.26  
 LmA 000  
 MVAR Δi > 947  
 P.F.Med. >0.81  
 Hz 50.1

micro VIP  
 KWatt 97.5  
 Cosθ PF +0.86  
 Ampere 157  
 Volt 419  
 KVArh 00399.631  
 KWh 00561.953  
 Hours 0006.36  
 LmA 000  
 MVAR Δi > 964  
 P.F.Med. >0.82  
 Hz 50.1

micro VIP  
 KWatt 92.9  
 Cosθ PF +0.85  
 Ampere 149  
 Volt 419  
 KVArh 00409.170  
 KWh 00577.933  
 Hours 0006.46  
 LmA 000  
 MVAR Δi > 937  
 P.F.Med. >0.82  
 Hz 50.1

*Appendix "C"*

**Specific Fuel Consumption Data Sheets**







FUEL TECHNOLOGY PTY LTD

DIESEL GENERATOR SPECIFIC FUEL CONSUMPTION LOG

CUSTOMER Dominion Mining

ENGINE NO. 1

Date:

Base \_\_\_\_\_  
Treated 11/5/94

Location BANNOCKBURN

ENGINE:

Make Cummins  
Model KTA 50-G3  
Serial No. \_\_\_\_\_  
Engine Hrs Start 29454  
Finish \_\_\_\_\_

ALTERNATOR:

Make \_\_\_\_\_  
Rating 1200

Density @15°°

Base \_\_\_\_\_  
Treated \_\_\_\_\_

0.817 @ 44.1

Temperatures °C

| TIME<br>Start<br>Finish | Δ<br>T | Nom.<br>Load<br>kW<br>+ 7.9 | kWh<br>Start<br>Finish<br>+ 7.9 | Δ<br>kWh | kW.<br>Av. | Kv<br>Volts | Amps | FUEL<br>METER<br>Start<br>Finish | Fuel<br>Ltrs. | L/kWh  | E.Gas | Air In<br>Dry<br>Wet | J.W.<br>Out<br>In | LO<br>FUEL<br>IN |
|-------------------------|--------|-----------------------------|---------------------------------|----------|------------|-------------|------|----------------------------------|---------------|--------|-------|----------------------|-------------------|------------------|
| 16 25                   |        | 89.5<br>707.05              | 3232.703                        |          |            | 3.3         | 174  | 14729.2                          |               |        |       | 23.8                 |                   | 44.1             |
| 16 35                   | 10     | 89.4<br>706.26              | 3247.89                         | 119.977  | 719.8      | 3.3         | 172  | 14757.52                         | 28.32         | 0.2360 |       |                      |                   |                  |
| 16 45                   | 10     | 89.3<br>705.47              | 3263.058                        | 119.827  | 718.9      | 3.3         | 171  | 14786.16                         | 28.64         | 0.2390 |       |                      |                   |                  |
| 16 55                   | 10     | 88.8<br>701.52              | 3278.040                        | 118.357  | 710.1      | 3.3         | 171  | 14815.92                         | 29.76         | 0.2514 |       |                      |                   |                  |
| 17 05                   | 10     | 87.8<br>693.62              | 3293.031                        | 118.428  | 710.6      | 3.3         | 170  | 14845.64                         | 29.72         | 0.2509 |       |                      |                   |                  |
| 17 15                   | 10     | 89.0<br>703.1               | 3308.052                        | 118.665  | 711.9      | 3.3         | 171  | 14875.24                         | 29.6          | 0.2494 |       | 21.8                 |                   |                  |
| 17 25                   | 10     | 89.5<br>707.05              | 3322.804                        | 116.540  | 699.2      | 3.3         | 169  | 14904.34                         | 29.1          | 0.2496 |       |                      |                   |                  |
| 17 35                   | 10     | 91.1<br>719.69              | 3337.712                        | 117.773  | 706.6      | 3.3         | 170  | 14933.60                         | 29.26         | 0.2484 |       |                      |                   |                  |
|                         |        |                             | 829.571                         |          |            |             |      | 204.4                            |               | 0.2463 | -4.6% |                      |                   |                  |
|                         |        |                             |                                 |          |            |             |      |                                  | 100/1000      | 0.2012 | -3.9% |                      |                   |                  |



FUEL TECHNOLOGY PTY LTD

DIESEL GENERATOR SPECIFIC FUEL CONSUMPTION LOG

CUSTOMER DOMINION MINING

ENGINE NO. 3

Date:

Base 30/3/94.  
Treated \_\_\_\_\_

Location BANNOCKBURN

0.826 @ 28°C

ENGINE:

Make CUMMINS  
Model KTA 50-G3  
Serial No. \_\_\_\_\_  
Engine Hrs Start 25607.  
Finish \_\_\_\_\_

ALTERNATOR:

Make \_\_\_\_\_  
Rating 1200

Density @15°°

Base 0.8350  
Treated \_\_\_\_\_

.813 @ 48.

Temperatures °C FUEL

| TIME<br>Start<br>Finish | Δ<br>T<br>Min. | Nom.<br>Load<br>kW<br>x 7.9 | kWh<br>Start<br>Finish<br>x 7.9 | Δ<br>kWh | kW.<br>Av. | Kv<br>Volts | Amps | FUEL<br>METER<br>Start<br>Finish | Fuel<br>Ltrs. | L/kWh   | E.Gas                   | Air In<br>Dry<br>Wet | J.W.<br>Out<br>In | FUEL<br>IN |
|-------------------------|----------------|-----------------------------|---------------------------------|----------|------------|-------------|------|----------------------------------|---------------|---------|-------------------------|----------------------|-------------------|------------|
| 12:10                   |                | 772                         | 39.7                            |          | 772        | 3.3         | 165  | 12827.61                         |               |         |                         | 29.5                 |                   | 48.1       |
| 12:20                   | 10             | 772                         | 56.123                          | 129.74   | 778.5      | 3.3         | 166  | 12861.92                         | 34.31         | 0.2644  |                         |                      |                   |            |
| 12:30                   | 10             | <sup>102</sup><br>805.8     | 72.82                           | 131.90   | 791        | 3.3         | 169  | 12896.09                         | 34.17         | 0.2591  | 0.2618                  |                      |                   |            |
| 12:40                   | 10             | <sup>97.9</sup><br>773.41   | 89.222                          | 129.57   | 777.5      | 3.3         | 162  | 12930.50                         | 35.41         | 0.2733  |                         |                      |                   |            |
| 12:50                   | 10             | <sup>91.1</sup><br>767.09   | 105.368                         | 127.55   | 765.3      | 3.3         | 162  | 12964.14                         | 33.64         | 0.2637  | <sup>AH</sup><br>0.2685 |                      |                   |            |
| 13:00                   | 10             | <sup>98.5</sup><br>778.15   | 121.809                         | 129.88   | 779.3      | 3.3         | 163  | 12997.71                         | 33.57         | 0.2585  |                         |                      |                   |            |
| 13:10                   | 10             | <sup>98.8</sup><br>780.52   | 137.916                         | 127.24   | 763.5      | 3.3         | 163  | 13031.65                         | 33.94         | 0.2667  | 0.2626                  |                      |                   |            |
| 13:20                   | 10             | <sup>101</sup><br>797.9     | 154.291                         | 129.36   | 776.2      | 3.3         | 164  | 13065.59                         | 33.94         | 0.2621  |                         |                      |                   |            |
| 13:30                   | 10             | <sup>99.8</sup><br>788.42   | 170.838                         | 130.72   | 781.3      | 3.3         | 164  | 13099.75                         | 34.16         | 0.2613  |                         | 34.0                 |                   | 48.6       |
|                         | Ave            |                             | 1038.09                         |          |            |             |      |                                  |               | 272.14  | 0.2627                  |                      |                   |            |
|                         |                |                             |                                 |          |            |             |      |                                  |               | 4.1/kWh | 0.2136                  |                      |                   |            |



FUEL TECHNOLOGY PTY LTD

DIESEL GENERATOR SPECIFIC FUEL CONSUMPTION LOG

CUSTOMER Domestic mining ENGINE NO. 3

Date: \_\_\_\_\_ Base \_\_\_\_\_  
Treated 12/5/94

Location BANNOCKBURN

ENGINE:

Make Cummins  
Model KTA 50 G3  
Serial No. \_\_\_\_\_  
Engine Hrs Start 26489  
Finish \_\_\_\_\_

ALTERNATOR:

Make \_\_\_\_\_  
Rating 1200

Density @ 15° Base \_\_\_\_\_  
Treated 0.8372

0.823 @ 35.5° C

Density at 55.50C 0.8085

Temperatures °C

| TIME Start Finish | Δ T | Nom. Load kW<br><small>x 7.9</small> | kWh Start Finish<br><small>.7.9</small> | Δ kWh   | kW. Av. | Kv Volts | Amps | FUEL METER Start Finish | Fuel Ltrs. | L/kWh         | E.Gas | Air In Dry Wet | J.W. Out In | kg Fuel IN |
|-------------------|-----|--------------------------------------|---|---------|---------|----------|------|-------------------------|------------|---------------|-------|----------------|-------------|------------|
| 11:20             |     | 98<br>774.2                          | 346.520                                 |         |         | 3.3      | 166  | 15913.90                |            |               |       | 24.9           |             | 55.5       |
| 11:30             | 10  | 95.2<br>757.0                        | 362.289                                 | 122.575 | 747.4   | 3.3      | 161  | 15945.98                | 32.08      | 0.2575        |       |                |             |            |
| 11:40             | 10  | 95.1<br>751.2                        | 378.125                                 | 125.104 | 750.6   | 3.3      | 163  | 15978.0                 | 32.02      | 0.2559        |       |                |             |            |
| 11:50             | 10  | 98.9<br>781.3                        | 394.132                                 | 126.455 | 758.73  | 3.3      | 169  | 16010.8                 | 32.8       | 0.2593        |       |                |             |            |
| 12:00             | 10  | 91.2<br>720.4                        | 409.766                                 | 123.508 | 741.04  | 3.3      | 155  | 16042.6                 | 31.8       | 0.2574        |       |                |             |            |
|                   |     |                                      | 499.643                                 |         |         |          |      | 128.7                   |            | 0.2575        | -2%   |                |             |            |
|                   |     |                                      |   |         |         |          |      |                         |            | kg/ltr 0.2082 | -2.6% |                |             |            |



FUEL TECHNOLOGY PTY LTD

DIESEL GENERATOR SPECIFIC FUEL CONSUMPTION LOG

CUSTOMER DOMINION MINING

ENGINE NO. 4

Date:

Base 30/3/94

Treated \_\_\_\_\_

Location BANNOCKBURN

ENGINE:

Make CUMMINS  
 Model KTA50 G3  
 Serial No. \_\_\_\_\_  
 Engine Hrs Start 21460  
 Finish \_\_\_\_\_

ALTERNATOR:

Make \_\_\_\_\_  
 Rating 1200

Density @15°

Base 0.8350  
 Treated \_\_\_\_\_

*Using PH meter.*

*0.813*

Temperatures °C

| TIME<br>Start<br>Finish | Δ<br>T | Nom.<br>Load<br>kW<br><i>X7.9</i> | kWh<br>Start<br>Finish<br><i>X7.9</i> | Δ<br>kWh | kW.<br>Av. | Kv<br>Volts | Amps | FUEL<br>METER<br>Start<br>Finish | Fuel<br>Ltrs. | L/kWh  | E.Gas | Air In<br>Dry<br>Wet | J.W.<br>Out<br>In | FUEL<br>IN |
|-------------------------|--------|-----------------------------------|---------------------------------------|----------|------------|-------------|------|----------------------------------|---------------|--------|-------|----------------------|-------------------|------------|
| 1705                    |        | 96.1<br>759.19                    | 448.382                               |          |            | 3300        | 169  | 847873.4                         |               |        |       | 27.3                 |                   | 48.1       |
| 1715                    | 10     | 92.5<br>730.75                    | 461.576                               | 127.933  | 767.6      | 3300        | 166  | 847906.9                         | 33.5          | 0.2618 |       |                      |                   |            |
| 1725                    | 10     | 95.5<br>754.45                    | 480.287                               | 124.117  | 744.7      | 3300        | 170  | 847939.4                         | 32.5          | 0.2618 |       |                      |                   |            |
| 1735                    | 10     | 99.8<br>737.07                    | 405.854                               | 122.979  | 737.9      | 3300        | 166  | 847971.4                         | 32.0          | 0.2602 |       |                      |                   |            |
| 1745                    | 10     | 91.1<br>767.09                    | 511.173                               | 121.020  | 726.1      | 3300        | 166  | 848003.0                         | 31.6          | 0.2611 |       |                      |                   |            |
| 1755                    | 10     | 96.5<br>762.35                    | 527.189                               | 126.526  | 759.2      | 3300        | 170  | 848035.1                         | 32.1          | 0.2537 |       |                      |                   |            |
| 1805                    | 10     | 97.4<br>769.46                    | 543.279                               | 127.111  | 762.7      | 3300        | 170  | 848067.9                         | 32.8          | 0.2580 |       |                      |                   |            |
|                         |        | AVG                               |                                       | 749.686  |            |             |      | 104.5                            |               | 0.2594 |       | 24.5                 |                   | 49.1       |
|                         |        |                                   |                                       |          |            |             |      |                                  |               |        |       |                      |                   |            |
|                         |        |                                   |                                       |          |            |             |      |                                  |               |        |       |                      |                   |            |
|                         |        |                                   |                                       |          |            |             |      |                                  |               |        |       |                      |                   |            |
|                         |        |                                   |                                       |          |            |             |      |                                  |               |        |       |                      |                   |            |
|                         |        |                                   |                                       |          |            |             |      |                                  |               |        |       |                      |                   |            |
|                         |        |                                   |                                       |          |            |             |      |                                  |               |        |       |                      |                   |            |

*kg/lhr - 0.2109*



FUEL TECHNOLOGY PTY LTD

DIESEL GENERATOR SPECIFIC FUEL CONSUMPTION LOG

CUSTOMER Dominion Mining ENGINE NO. 4

Date: \_\_\_\_\_ Base \_\_\_\_\_  
Treated 12/5/94

Location BANNOCKBURN

ENGINE:

Make Cummins  
Model KTA 50 G3  
Serial No. \_\_\_\_\_  
Engine Hrs Start \_\_\_\_\_  
Finish \_\_\_\_\_

ALTERNATOR:

Make \_\_\_\_\_  
Rating 1200

Density @15° \_\_\_\_\_ Base \_\_\_\_\_  
Treated \_\_\_\_\_

812 242

Temperatures °C

| TIME<br>Start<br>Finish | Δ<br>T | Nom.<br>Load<br>kW<br>x 7.9 | kWh<br>Start<br>Finish<br>x 7.9 | Δ<br>kWh | kW.<br>Av. | Kv<br>Volts | Amps | FUEL<br>METER<br>Start<br>Finish | Fuel<br>Ltrs. | L/kWh  | E.Gas | Air In<br>Dry<br>Wet | J.W.<br>Out<br>In | EO<br>Fuel<br>In |
|-------------------------|--------|-----------------------------|---------------------------------|----------|------------|-------------|------|----------------------------------|---------------|--------|-------|----------------------|-------------------|------------------|
| 1330                    |        | 101<br>797.9                | 498.229                         |          |            | 3.3         | 155  | 16073.1                          |               |        |       | 26.9                 |                   | 524              |
| 1350                    | 20     | 95<br>750.5                 | 530.136                         | 251.907  | 755.7      | 3.3         | 150  | 16136.34                         | 63.24         | 0.2510 |       |                      |                   |                  |
| 1400                    | 10     | 95.7<br>756.03              | 545.843                         | 124.085  |            | 3.3         | 154  | 16167.36                         | 31.02         | 0.2499 |       |                      |                   |                  |
| 1410                    | 10     | 97.5<br>770.25              | 561.953                         | 127.269  |            | 3.3         | 157  | 16199.41                         | 32.05         | 0.2518 |       |                      |                   |                  |
| 1420                    | 10     | 92.9<br>733.91              | 577.933                         | 126.242  |            | 3.3         | 149  | 16231.02                         | 31.61         | 0.2503 |       |                      |                   |                  |
|                         |        |                             | 629.503                         |          |            |             |      | 157.92                           |               | 0.2508 | -3.3% |                      |                   |                  |
|                         |        |                             |                                 |          |            |             |      |                                  | Kept 1 hour   | 0.2036 | -3.5% |                      |                   |                  |

*Appendix "D"*

**Carbon Balance Printouts**

**FUEL TECHNOLOGY PTY LTD****CARBON BALANCE RESULTS**

COMPANY : Dominion Mining

LOCATION : Bannockburn

EQUIPMENT : GENSET

UNIT NR. : 3

ENG. TYPE : CUMMINS

MODEL : KTA 50 G3

RATING :

FUEL : Shell Formula

**BASELINE TEST**

DATE : 30/4/94

ENG. HOURS : 25604

ENG. RPM: 1200

AMB. TEMP (C) : 21.0

STACK(mm): 320

BAROMETRIC(m) 971

LOAD: 710 - 720

|                 | TEST 1 | TEST 2 | TEST 3 | TEST 4 | TEST 5 | AVERAGE | % ST.DEV |
|-----------------|--------|--------|--------|--------|--------|---------|----------|
| PRES DIFF (Pa): | 186    | 186    | 186    | 186    | 186    | 186     | 0.00     |
| EXHST TEMP (C)  | 468.4  | 468.4  | 468.4  | 468.8  | 468.9  | 469     | 0.05     |
| HC (ppm) :      | 0      | 0      | 0      | 0      | 0      | 0.0     | #DIV/0!  |
| CO (%) :        | 0.08   | 0.08   | 0.08   | 0.08   | 0.08   | 0.080   | 0.00     |
| CO2 (%) :       | 9.25   | 9.25   | 9.25   | 9.25   | 9.25   | 9.25    | 0.00     |
| O2 (%) :        | 5.34   | 5.35   | 5.35   | 5.35   | 5.35   | 5.35    | 0.08     |

|                 |        |        |        |        |        |        |      |
|-----------------|--------|--------|--------|--------|--------|--------|------|
| CARB FLOW(g/s): | 33.008 | 33.007 | 33.007 | 32.998 | 32.996 | 33.003 | 0.02 |
|-----------------|--------|--------|--------|--------|--------|--------|------|

REYNOLDS NR. : 4.42E+04

**TREATED TEST**

DATE : 11/5/94

ENG. HOURS : 26467

ENG. RPM: 1200

AMB. TEMP (C) : 26.4

STACK(mm): 320

BAROMETRIC(m) 970

LOAD: 700 - 720

|                 | TEST 1 | TEST 2 | TEST 3 | TEST 4 | TEST 5 | AVERAGE | % ST.DEV |
|-----------------|--------|--------|--------|--------|--------|---------|----------|
| PRES DIFF (Pa): | 183    | 183    | 184    | 183    | 183    | 183     | 0.24     |
| EXHST TEMP (C)  | 460    | 460    | 460    | 460    | 460    | 460     | 0.00     |
| HC (ppm) :      | 0      | 0      | 0      | 0      | 0      | 0.0     | #DIV/0!  |
| CO (%) :        | 0.08   | 0.08   | 0.08   | 0.08   | 0.08   | 0.080   | 0.00     |
| CO2 (%) :       | 8.98   | 8.89   | 8.88   | 8.94   | 8.92   | 8.92    | 0.45     |
| O2 (%) :        | 7.24   | 7.24   | 7.24   | 7.23   | 7.22   | 7.23    | 0.12     |

|                 |        |        |        |        |        |        |      |
|-----------------|--------|--------|--------|--------|--------|--------|------|
| CARB FLOW(g/s): | 31.922 | 31.607 | 31.658 | 31.782 | 31.713 | 31.736 | 0.39 |
|-----------------|--------|--------|--------|--------|--------|--------|------|

REYNOLDS NR. : 4.41E+04

TOTAL HOURS ON TREATED FUEL : 863

PERCENTAGE CHANGE IN FUEL CONSUMPTION ((TREATED-BASE)/BASE\*100) : -3.8 %

REMARKS:

**FUEL TECHNOLOGY PTY LTD****CARBON BALANCE RESULTS**

COMPANY : Dominion Mining

LOCATION : Bannockburn

EQUIPMENT : GENSET

UNIT NR. : 4

ENG. TYPE : CUMMINS

MODEL : KTA 50 G3

RATING :

FUEL : Shell Formula

**BASELINE TEST**

DATE : 30/4/94

ENG. HOURS : 21452

ENG. RPM: 1200

AMB. TEMP (C) : 21.6

STACK(mm): 320

BAROMETRIC(m) : 971

LOAD: 750

|                 | TEST 1 | TEST 2 | TEST 3 | TEST 4 | TEST 5 | AVERAGE | % ST.DEV |
|-----------------|--------|--------|--------|--------|--------|---------|----------|
| PRES DIFF (Pa): | 330    | 330    | 330    | 330    | 330    | 330     | 0.00     |
| EXHST TEMP (C)  | 446.3  | 446.4  | 446.5  | 446.7  | 446.7  | 447     | 0.04     |
| HC (ppm) :      | 0      | 0      | 0      | 0      | 0      | 0.0     | #DIV/0!  |
| CO (%) :        | 0.065  | 0.065  | 0.065  | 0.065  | 0.065  | 0.065   | 0.00     |
| CO2 (%) :       | 8.84   | 8.84   | 8.84   | 8.84   | 8.84   | 8.84    | 0.00     |
| O2 (%) :        | 4.25   | 4.25   | 4.25   | 4.25   | 4.25   | 4.25    | 0.00     |

|                 |        |        |        |        |        |        |      |
|-----------------|--------|--------|--------|--------|--------|--------|------|
| CARB FLOW(g/s): | 42.647 | 42.644 | 42.641 | 42.635 | 42.635 | 42.641 | 0.01 |
|-----------------|--------|--------|--------|--------|--------|--------|------|

REYNOLDS NR. : 5.98E+04

**TREATED TEST**

DATE : 11/5/94

ENG. HOURS : 22418

ENG. RPM: 1200

AMB. TEMP (C) : 26

STACK(mm):

BAROMETRIC(m) : 971

LOAD: 770

|                 | TEST 1 | TEST 2 | TEST 3 | TEST 4 | TEST 5 | AVERAGE | % ST.DEV |
|-----------------|--------|--------|--------|--------|--------|---------|----------|
| PRES DIFF (Pa): | 322    | 322    | 321    | 321    | 322    | 322     | 0.17     |
| EXHST TEMP (C)  | 442.6  | 442.6  | 442.9  | 443    | 443.1  | 443     | 0.05     |
| HC (ppm) :      | 0      | 0      | 0      | 0      | 0      | 0.0     | #DIV/0!  |
| CO (%) :        | 0.06   | 0.06   | 0.06   | 0.06   | 0.06   | 0.060   | 0.00     |
| CO2 (%) :       | 8.64   | 8.66   | 8.66   | 8.65   | 8.65   | 8.65    | 0.10     |
| O2 (%) :        | 7.68   | 7.69   | 7.69   | 7.69   | 7.68   | 7.69    | 0.07     |

|                 |        |        |        |        |        |        |      |
|-----------------|--------|--------|--------|--------|--------|--------|------|
| CARB FLOW(g/s): | 41.170 | 41.264 | 41.191 | 41.142 | 41.203 | 41.194 | 0.11 |
|-----------------|--------|--------|--------|--------|--------|--------|------|

REYNOLDS NR. : 5.91E+04

TOTAL HOURS ON TREATED FUEL : 966

PERCENTAGE CHANGE IN FUEL CONSUMPTION ((TREATED-BASE)/BASE\*100) : -3.4 %

REMARKS: