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**FPC-2 COMBUSTION CATALYST
BOSCH SMOKE TESTS FOR
PACIFIC NATIONAL
KOORAGANG NSW**

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EXECUTIVE SUMMARY

The FPC Combustion Catalysts manufactured and marketed by Fuel Technology Pty Ltd have proven in laboratory and field testing to reduce fuel consumption in the **2%** to **8%** range under comparable load conditions and substantially reduce carbon emissions.

Several renowned International testing facilities around the world have verified these benefits including Southwest Research Institute (SwRI) San Antonio, Texas, where tests were conducted to Association of American Railroads recommended Test Procedure RP-503.

A recent study and subsequent paper written for BHP Billiton Iron Ore by University of Western Australia Chemical Engineering, Professor Zhang, states that Fuel Technology's Combustion Catalyst will provide fuel efficiency savings of a minimum 2.5% at a 97% confidence level and the chemistry has a "sound scientific basis" (*Report available upon request*).

An FPC-2 fuel efficiency study conducted early 2009 on Pacific National locomotives operating between Port Augusta power station and Leigh Creek coal mine resulted in an average **4.1%** fuel saving along with substantial reductions in exhaust particulates.

Further fuel efficiency tests were then scheduled to be conducted on locomotive 9034 at Kooragang Island Newcastle at which time Fuel Technology conducted Bosch Smoke Tests where an average **45%** reduction in particulate exhaust emissions were recorded following FPC treatment of fuel. Pacific National personnel also commented on the significant visible reduction in exhaust smoke of test Loco following the introduction of FPC.

INTRODUCTION

Untreated Bosch Smoke tests were conducted on 90 class loco 9034 on 20 August 2009 after which fuel was manually treated with FPC Combustion Catalyst at time of each refuelling. Treated tests were then conducted on 12 October 2009.

The results of this present study are documented in this report.

TEST METHOD

The Bosch Smoke tester pump nozzle is inserted into exhaust stack and when activated, draws one third of a litre of exhaust particulates through a white blotter paper. This blotter paper is then evaluated by infrared light with a Bosch evaluation number assigned between 0.0 (white) and 9.9 (black).

The Bosch Smoke Tests are conducted to maintain general conformity (where practical) with the Australian Design Rule ADR30/00 diesel engine exhaust smoke emissions and the Bosch smoke meter operating instructions.

INSTRUMENTATION

Bosch Smoke meter sampling pump ETD 020.00
Bosch infrared evaluator ETD 020.50

TEST RESULTS

Bosch Smoke Tests

Bosch smoke measurements were conducted at the four test throttle Notch settings 2, 4, 6 & 8. The results of these tests are summarised in Table No 1. The smoke patches are contained in the *Appendix*.

TABLE 1

**LOCOMOTIVE 9034
(Bosch assigned evaluation number)**

Notch	Untreated	Treated	Change
2	0.7	0.4	-43%
4	0.6	0.2	-66%
6	0.8	0.5	-37%
8	1.0	0.6	-40%
AVERAGE	0.775	0.425	- 45%

BENEFITS OF REDUCED EXHAUST PARTICULATES

A reduction in exhaust particulates equates to a more complete combustion of the fuel which in turn results in fuel efficiency savings, lower soot levels in lubricating oil and reduced wear rates and carbon build up in combustion areas. Following treated tests loco 9034 injectors were removed and as photo indicates, were in extremely clean condition.

**Injectors from Loco 9034 following seven weeks FPC treatment of fuel.
(Injectors wiped with soft workshop rag only)**



Experience in North America has also, due to reduced hot carbon emissions, demonstrated a substantial reduction in track wayside fires following the introduction of FPC Combustion Catalyst to the fuel supply.

NET ANNUAL SAVINGS

Engineering test procedures conducted by some of the world's leading test facilities and to AAR RP503 have proven FPC to provide a minimum fuel efficiency saving of 1.7% when tested on as new engines run at their most efficient mode. (Cost of FPC is 0.7% of efficiency gains).

Example of savings to Pacific National Rail are as follows:

100,000,000 litres fuel per annum @ cost of \$0.70 per litre.

1.7% fuel efficiency	\$718,000 net saving per annum.
3% fuel efficiency	\$1,634,000 net saving per annum.
4% fuel efficiency	\$2,339,000 net saving per annum.

GREENHOUSE GAS EMISSIONS

Applying formula outlined in Worksheet 1 of the "Electricity Supply Business Greenhouse Change Workbook" the following reduction in Greenhouse Emissions will apply:

1.7% fuel efficiency	4,574 tonnes per annum.
3% fuel efficiency	8,071 tonnes per annum.
4% fuel efficiency	10,762 tonnes per annum.

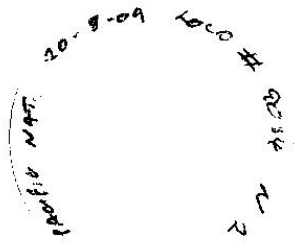
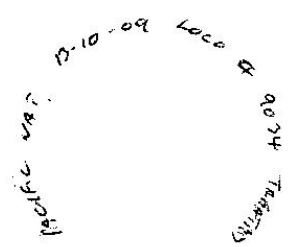

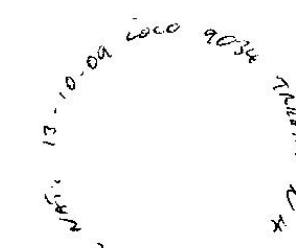
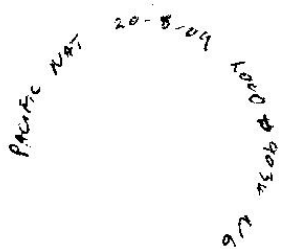
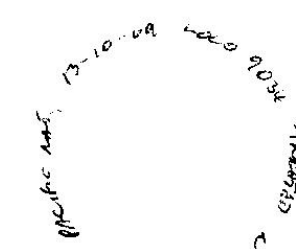
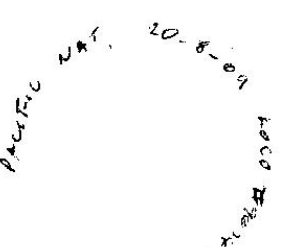
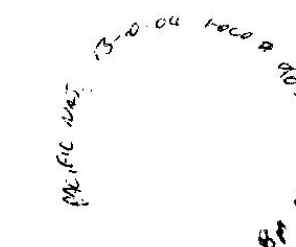
CONCLUSION

These Bosch Smoke emission tests conducted on Pacific National locomotive 9034 provide clear evidence of reduced exhaust particulates in the region of **45%** providing further evidence of a more complete burn of the fuel following the introduction of FPC Combustion Catalyst to fuel supply.

Appendix “A”

Bosch Smoke Patches

BOSCH SMOKE METER FILTER TEST RESULTS **PACIFIC NATIONAL - LOCOMOTIVE 9034**

Notch No.	Untreated	Bosch No.	Treated	Bosch No.
2		0.7		0.4
4		0.6		0.2
6		0.8		0.5
8		1.0		0.6