

Executive Summary and Technical Report

Exhaust Gas Analysis – Mercedes ML63 AMG

By

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EXECUTIVE SUMMARY

FCC is a fuel conditioner produced by ADDFUEL PTY LTD which is a blend of surfactants (detergents), oxygenates and corrosion inhibitors (refer MSDS in Attachment 3) developed to improve fuel efficiency and saving the maintenance costs through cleaner and better combustion process. It's a non-hydrocarbon fuel conditioner that may clean fuel and improves performance whilst lowering pollutants emission to the environment.

During recent exhaust gas analysis carried out on the Mercedes ML63 AMG model, the result shows reduction in both carbon monoxide (CO) and oxide of nitrogen (NOx) emissions. Particularly in NOx as high as 75% reduction has been observed during vehicle ramp up condition.

Carbon monoxide is a toxic, colourless and odourless gas. It affects healthy and unhealthy people. Increased levels of carbon monoxide reduce the amount of oxygen carried by haemoglobin around the body in red blood cells. The result is that vital organs, such as the brain, nervous tissues and the heart, do not receive enough oxygen to work properly. No more than 2.5% of haemoglobin can be bound to carbon monoxide before some health effects become noticeable. At very high concentrations of carbon monoxide, up to 40% of the haemoglobin can be bound to carbon monoxide in this way. This level will almost certainly kill humans.

On the other hand, NOx is produced from the reaction of nitrogen and oxygen gases during combustion especially at higher temperatures. NOx mainly impacts on respiratory conditions causing inflammation of the airways at high levels. Long term exposure can decrease lung function, increase risk of respiratory conditions and increases the response to allergens. NOx also contribute to the formation of fine particles (PM) and ground level ozone, both of which are associated with adverse health effects.

CO and NOx are the by-products caused by incomplete combustion where air intake is limited. The relative amount of CO and NOx produced depends on the efficiency of combustion. FCC has the effect of improving the combustion process which notably reduces CO and NOx emissions.

As the Australia Government has taken steps to manage and reduce the amount of CO and NOx emissions to the environment including implementation of tighter vehicle emission standard, hence using FCC fuel additive could be considered beneficial to achieve cleaner burning of the vehicle's engine.

TECHNICAL REPORT FOR MERCEDES ML63 AMG

EXHAUST GAS ANALYSIS

On 18 November 2016, exhaust gas analysis was carried on Mercedes ML63 AMG model to investigate the benefit of using FCC particularly to the improvement of reducing vehicle emissions. The car was powered by petrol and the FCC was added on 3000:1 ratio. Tests were run on minimum and maximum rated power i.e.: 600 rpm and 3,000 rpm respectively. The maximum idling speed was fixed at 3,000 rpm as the average cruising speed despite of the model design maximum torque could goes higher.

The undiluted exhaust gas limit is set at 1,500 ppm CO and 1,000 NOx. The exhaust gas was diluted in a control volume before the emissions concentration was recorded. The test results of the vehicle emissions before and after the FCC fuel additive was added were recorded in Attachment 1 and 2 respectively.

Carbon Monoxide (CO) Emission

The emission of carbon monoxide (CO) before and after the FCC was added had been investigated and recorded. The CO emission trends are presented graphically in Figure 1, extracted from results obtained from the lab test reports in Attachment 1 and 2.

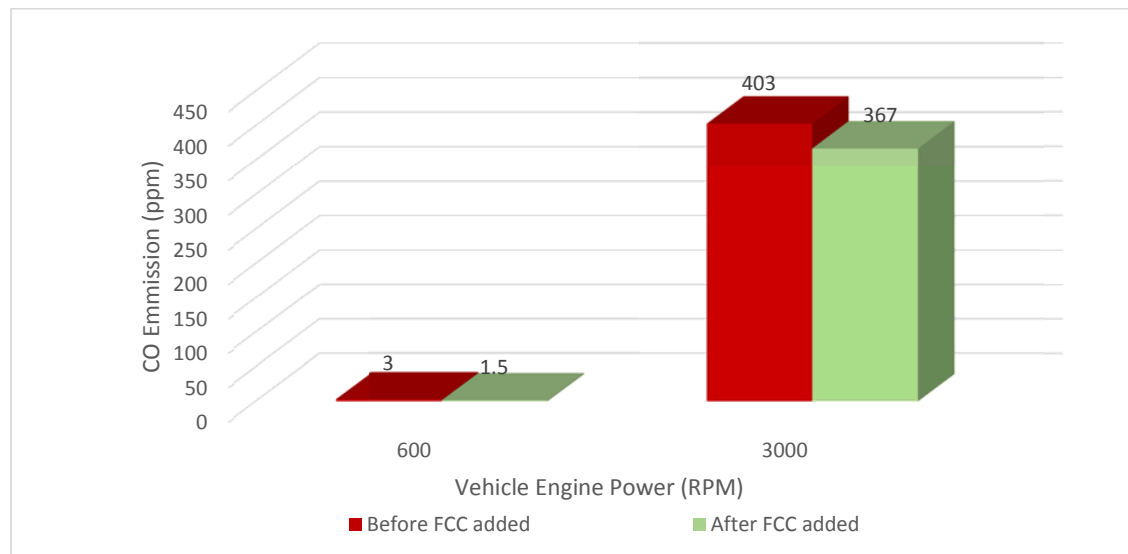


Figure 1: Mercedes ML63 AMG Model - CO Emission Before and After FCC was added

Figure 1 shows the CO emission in the exhaust gas before and after the FCC additive, measure in part per million, during both minimum and maximum engine speeds

At the beginning, when the engine was running at minimum idling speed of 600 rpm, the CO emission was reduced to nearly 50% after the FCC was added. Whereas, approximately 9% CO reduction was observed when the vehicle was ramp up to the maximum idling speed of 3,000 ppm. Both results have demonstrated the effectiveness of using FCC additive in minimising the CO emission from the exhaust gas.

The oxygenated chemical compound i.e.: alkoxy propanols (refer MSDS in Attachment 3) within the FCC contains oxygen as a part of their chemical structure. The exhaust emissions such as CO and HC level were progressively reduced as oxygen content is increased.

It is recommended that higher ratio of FCC additive to be considered during engine ramp up in attempting to achieve further reduction in CO emission.

Oxide of Nitrogen (NOx) Emission

It is noticed from the lab test results (Attachment 1 and 2) that no NOx emission was detected during minimum idling speed of 600 rpm. In general, the petrol engine ignites the fuel-air mixture with a spark, therefore compression ratio and temperature are relatively lower than that of diesel engine. NOx is formed when nitrogen and oxygen are combined under high temperature and pressure. As the premixed fuel-air mixture allows more complete combustion within the petrol engine, therefore excessive oxygen content is not expected at the exhaust particularly during low engine speed. Thus the formation of NOx may not present in the current Mercedes car model even without the FCC additive.

For this reason, the discussion of NOx emission will only focus on the results observed during the engine maximum rated speed of 3,000 rpm.

The graphical summary of the NOx emission is presented in Figure 2 below.

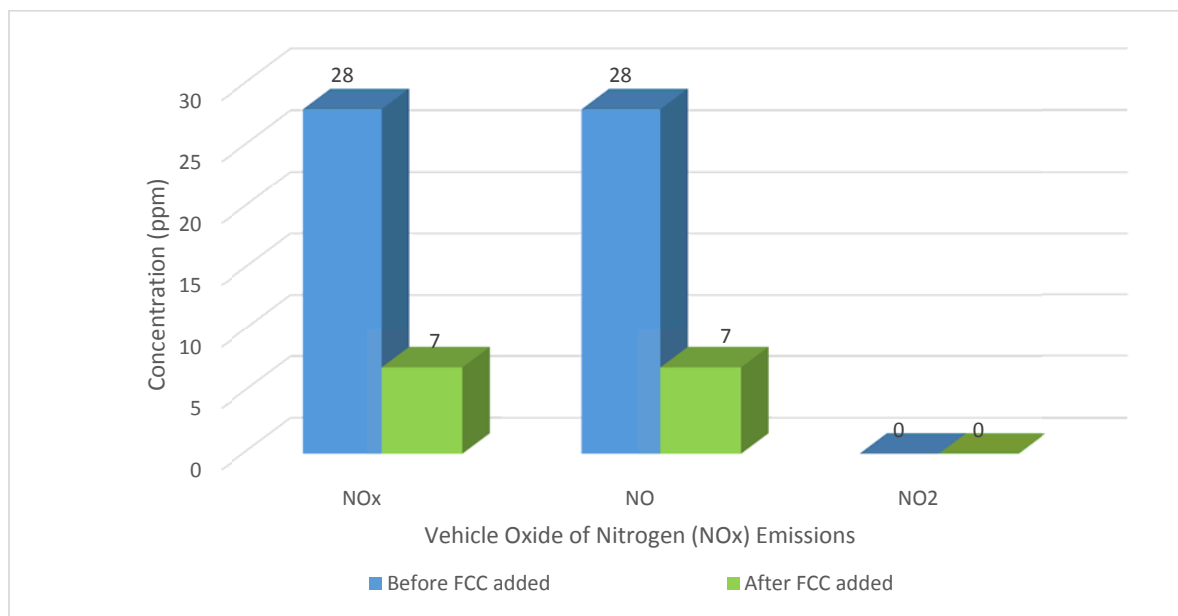


Figure 2: Mercedes ML63 AMG Model - NOx Emission Before and After FCC was added during Maximum Rate Power of 3,000 rpm

Figure 2 compares NOx emission before and after FCC additive was added during maximum rate power of 3,000 rpm, in part per million. The result has shown that the NOx emissions have been significantly lessened with the FCC additive i.e.: about 75% reduction has been recorded. NOx is produced during the combustion process when nitrogen and oxygen are present at elevated temperatures. At high temperatures, they undergo an endothermic reaction producing various oxides of nitrogen. Such temperatures can arise inside an internal combustion engine within the vehicle. The two elements combine to form nitric oxide (NO) and nitrogen dioxide (NO₂). It is also noticed that the Mercedes ML63 AMG model engine does not produce NO₂ regardless of FCC addition. NOx is harmful to environment as it combines with other pollutants in the atmosphere and creates O₃, a substance known as ground level ozone.

Overall, both results in Figure 1 and Figure 2 have demonstrated that using FCC additive in petrol engine will reduce the emission of carbon monoxide (CO) and oxide of nitrogen (NOx). Particularly in NOx emission, considerable amount of reduction has been seen. Both CO and NOx are harmful substances to the environment and are associated with adverse health effects. Therefore the use of FCC additive could be worthwhile in the effort of minimising pollution to the environment.

ATTACHMENT 1 – EXHAUST GAS ANALYSIS BEFORE
FUEL ADDITIVE

CERTIFICATE OF EXHAUST GAS ANALYSIS

SERIAL No. WDC1660742A400786

MINING COMPANY: N/A (emissions test before fuel additive)

TEST DATE: 16/11/2016

UNIT OWNER: SIAM Group

EXPIRY DATE: 16/11/2017

SITE CONTRACTOR OPERATING UNIT: N/A (emissions test before fuel additive)

NAME OF MINE/DECLINE: N/A (emissions test before fuel additive)

CONTACT PERSON: Stuart Martin (ADDFUEL)

PHONE: 0488 678 046

FAX: TBA

UNIT MAKE: Mercedes

REGO No.: 1EXI 908

MODEL No: ML63 AMG

ASSET No.: N/A

ENGINE MAKE: Mercedes

ENGINE No.: WDC1660742A400786

ENGINE CAPACITY: 5.5 litres

ENGINE kW: 386kW

TOTAL HOURS/KM RUN: 20,932kms

ORIGINAL ENGINE: Yes (AMG tuned)

EXHAUST TREATMENT TYPE: Bi-Turbo (AMG)

BANK: V8 (PETROL)

ANALYSIS RESULTS

UNDILUTED EXHAUST GAS – Maximum level of exhaust gases permitted ; 1000ppm NOx 1500 ppm CO

ALTITUDE m	Rpm	TEMP °C	O2%	CO2%	Effg%	Effn%	CO ppm	NOx ppm	NO ppm	NO ² ppm
Min Rated Power (idle)	600	34					3	0	0	0
Max Rated Power No Load (High idle)	3000	90					403	28	28	0
Max Rated Power Load Condition										

OPACITY TEST DATA

Opacity Meter calibrated before use (yes/no)?

- N/A

Average peak opacity registered at snap idle

- N/A % Maximum Opacity 50%

Average base opacity at idle

- N/A %

Speed of engine during snap idle test, if available?

- N/A rpm

Was opacity reading & procedure used representative?

- N/A

Location of test, Surface or Underground?

- Surface

EVALUATOR's NAME: S. Niederberger

SIGNATURE:



COMMENTS: PETROL / NOT FOR UNDERGROUND MINE USE

DATE: 16/11/2016

Notes: Effn% = overall efficiency of combustion system Effg% = efficiency of gases existing the exhaust related by ratios of CO2 to CO and O2 in the exhaust gases.

KALGOORLIE

Phone: (08) 9021 8399 Fax: (08) 9021 6901

10 Broadwood Street, West Kalgoorlie

Western Australia 6430

PO Box 1123, Kalgoorlie WA 6433

Exhaust Gas Test Cert - ML63 AMG 1EXI 908 Petrol 16.11.16.docx

PERTH

Phone: (08) 6279 0900 Fax: (08) 6279 0950

10 Elmsfield Road, Midvale

Western Australia 6056

ATTACHMENT 2 – EXHAUST GAS ANALYSIS AFTER
FUEL ADDITIVE

CERTIFICATE OF EXHAUST GAS ANALYSIS

SERIAL No. WDC1660742A400786

MINING COMPANY: N/A (emissions test after fuel additive)

TEST DATE: 18/11/2016

UNIT OWNER: SIAM Group

EXPIRY DATE: 18/11/2017

SITE CONTRACTOR OPERATING UNIT: N/A (emissions test after fuel additive)

NAME OF MINE/DECLINE: N/A (emissions test after fuel additive)

CONTACT PERSON: Stuart Martin (ADDFUEL)

PHONE: 0488 678 046

FAX: TBA

UNIT MAKE: Mercedes

REGO No.: 1EXI 908

MODEL No: ML63 AMG

ASSET No.: N/A

ENGINE MAKE: Mercedes

ENGINE No.: WDC1660742A400786

ENGINE CAPACITY: 5.5 litres

ENGINE kW: 386kW

TOTAL HOURS/KM RUN: 21,318kms

ORIGINAL ENGINE: Yes (AMG tuned)

EXHAUST TREATMENT TYPE: Bi-Turbo (AMG)

BANK: V8 (PETROL)

ANALYSIS RESULTS

UNDILUTED EXHAUST GAS – Maximum level of exhaust gases permitted ; 1000ppm NOx 1500 ppm CO

ALTITUDE m	Rpm	TEMP °C	O2%	CO2%	Effg%	Effn%	CO ppm	NOx ppm	NO ppm	NO ² ppm
Min Rated Power (idle)	600	36					1.5	0	0	0
Max Rated Power No Load (High idle)	3000	115					367	7	7	0
Max Rated Power Load Condition										

OPACITY TEST DATA

Opacity Meter calibrated before use (yes/no)?

- N/A

Average peak opacity registered at snap idle

- N/A % Maximum Opacity 50%

Average base opacity at idle

- N/A %

Speed of engine during snap idle test, if available?

- N/A rpm

Was opacity reading & procedure used representative?

- N/A

Location of test, Surface or Underground?

- Surface

EVALUATOR's NAME: S. Niederberger

SIGNATURE:



COMMENTS: PETROL / NOT FOR UNDERGROUND MINE USE

DATE: 18/11/2016

Notes: Effn% = overall efficiency of combustion system Effg% = efficiency of gases existing the exhaust related by ratios of CO2 to CO and O2 in the exhaust gases.

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Western Australia 6056

ATTACHMENT 3 – FCC MSDS



Material Safety Data Sheet

1. IDENTIFICATION of MATERIAL and SUPPLIER

Product Name: FUEL CONDITIONER CONCENTRATE
Other Names: FCC, Fuels Gold & Fuel Set EU
Recommended Use: Fuel additive for petrol and Diesel fuels
Supplier: GND Holdings Pty Ltd trading as Choice Chem
ABN: 16 122 257 176
Address: 27 Boulder Road,
Malaga Western Australia 6090
Telephone: (618) 9248 9590
Facsimile: (618) 9249 4810
Emergency Telephone: +61 400 015 083

2. HAZARDS IDENTIFICATION

Hazard Classification: This material is not considered **hazardous** according to the criteria of ASCC. However prolonged skin or eye contact can cause irritations.
Hazard Category: N/A
Risk Phrases: N/A
Safety Phrases: N/A

3. COMPOSITION/INFORMATION on INGREDIENTS

<u>Chemical Name</u>	<u>CAS No</u>	<u>Proportion (%w/w)</u>
Non Ionic surfactants (not considered hazardous)	N/A	30-60%
Alkoxy propanols		30-60%
Dye	Proprietary	<10%
Fragrance	Proprietary	<10%

4. FIRST AID MEASURES

FIRST AID

Swallowed: If swallowed, do NOT induce vomiting. Give a glass of water. Seek medical advice. For advice, contact a Poisons Information Centre (Phone Australia 131126) or a doctor.

Eye: If in eyes, hold eyelids apart and flush the eye continuously with running water. Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes.

Skin: If skin or hair contact occurs, remove contaminated clothing and flush skin and hair thoroughly with running water. Continue flushing until advised to stop by the Poisons Information Centre or a doctor.

Inhaled: Remove the victim from the source of exposure to fresh air. Avoid becoming a casualty. Seek medical advice if effects persist.

ADVICE TO DOCTOR Treat symptomatically.

5. FIRE FIGHTING MEASURES

Suitable Extinguishing Media:	Water spray, foam, carbon dioxide or dry chemical powder.
Fire / Explosion Hazard:	The product is a combustible liquid. Thermal decomposition may generate oxides of carbon.
Precautions for fire fighters and special protection equipment:	Fire Fighters should wear self-contained breathing apparatus to minimise the risk of exposure to the fumes.
Hazchem Code:	None

6. ACCIDENTAL RELEASE MEASURES

Spills:	Spills are slippery. Ensure adequate ventilation. Avoid accidents, clean up immediately. Wear protective equipment to prevent skin and eye contamination. Contain the spill and prevent contamination into drains and waterways. Absorb with sand or other similar material. Collect and seal in properly labelled drums for disposal in an area approved by local authority by-laws. Wash excess with plenty of water.
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7. HANDLING and STORAGE

Handling Advice:	Keep containers closed at all times - check regularly for leaks or spills. Transport and store upright. Avoid eye contact and repeated or prolonged skin contact. Do not eat, drink or smoke in handling areas. Always remove contaminated clothing and wash hands before eating, drinking, smoking or using the toilet. Wash contaminated clothing and other protective equipment before storage or re-use.
Storage Advice:	Classified as a Combustible Liquid for the purposes of storage and handling. Refer to the appropriate Regulations for storage and transport requirements. Store in the original container, in a cool, dry, well-ventilated area out of sunlight and away from heat, strong oxidising agents and open flame. Do not combine part drums of the same product, as this may cause of contamination. Do not mix with other chemicals.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure Standards:	No value assigned for this specific material by ASCC.
Ventilation:	Natural or local exhaust ventilation should be adequate under normal use conditions. Keep containers closed when not in use.
Personal Protection:	Protective equipment is recommended, including gloves, safety glasses and safety shoes. Observe good standards of hygiene and cleanliness. Trousers, long sleeved shirt and closed in safety footwear should be worn as a general precaution. If there is a risk of inhalation of vapour or spray mists, wear an organic vapour respirator meeting the requirements of AS1715 and AS1716.

9. PHYSICAL and CHEMICAL PROPERTIES

Appearance:	Clear green mobile liquid.
Odour:	Mild Eucalyptus odour
pH (Neat)	Not applicable.
S.G.:	1.0
Boiling Point (°C):	No data.
Solubility:	The product is fully soluble in water and solvents.
Flash Point (°C):	>67°C (Closed Cup).

10. STABILITY and REACTIVITY

Stability:	No data.
Conditions To Avoid:	Do not combine part drums of the same product, as this may be a source of contamination.

Product Name: Fuel Conditioner Concentrate FCC



Material Safety Data Sheet

Incompatible Materials: Incompatible with strong oxidising agents.
Hazardous Decomposition Products: Thermal decomposition may generate oxides of carbon.
Hazardous Reactions: None known.

11. TOXICOLOGICAL INFORMATION

No adverse health effects expected if the product is handled in accordance with this Material Safety Data Sheet and the product label. Symptoms and effects that may arise if the product is mishandled and over exposure occurs are:

ACUTE EFFECTS

Swallowed: May cause nausea, vomiting, headache, drowsiness and central nervous system depression
Eye: May cause irritation.
Skin: May cause irritation to skin with long and repeated contact.
Inhalation: Breathing in mist or aerosols may cause respiratory irritation.

12. ECOLOGICAL INFORMATION

Ecotoxicity Data: Avoid contaminating waterways.

13. DISPOSAL CONSIDERATIONS

Disposal: Avoid unauthorised discharge to sewer. The product is suitable for disposal by landfill through an approved agent.

14. TRANSPORT INFORMATION

AIR, SEA, ROAD AND RAIL TRANSPORT: Not Classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for transport by Air, Road and Rail.

UN Number: None
UN Proper Shipping Name: None
Class & Subsidiary Risk: None
Hazchem Code: None
Packaging Group: None

15. REGULATORY INFORMATION

Poisons Schedule (AUST): None
Other: None.

16. OTHER INFORMATION

None.

This MSDS summarises to our best knowledge, at the date of issue, the chemical health and safety hazards of the material and general guidance on how to handle the material in the workplace. Since Choice Chem cannot anticipate or control the conditions under which the product may be used, each user must, prior to usage, assess and control the risks arising from its use of the material.

If clarification or further information is needed, the user should contact Choice Chem.

Choice Chem's responsibility for the material as sold is subject to our standard terms and conditions, a copy of which is available on request.

DATE OF ISSUE: Tuesday 14 June. **This MSDS replaces all other issues. PREPARED BY:** Peter Spry

Product Name: Fuel Conditioner Concentrate FCC