# Performance of Personnel Transport Vehicles in high methane concentrations

**ACARP Project C15029**

Presenter:
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# Presentation summary

- Background
- Project Objectives
- Engine testing
- Vehicle trials
- Could an engine become an ignition source due to increased temperature?
- Conclusions

# Background

Simtars, with Mines Rescue and ACARP, has been investigating the operation of underground coal mine personnel transport vehicles in non standard mine atmospheres.

# Background

This current phase of the project sought to provide as much information as possible to allow the mining industry to decide on the safe use or otherwise of such vehicles in emergency situations.

# Objective of Project

To determine:

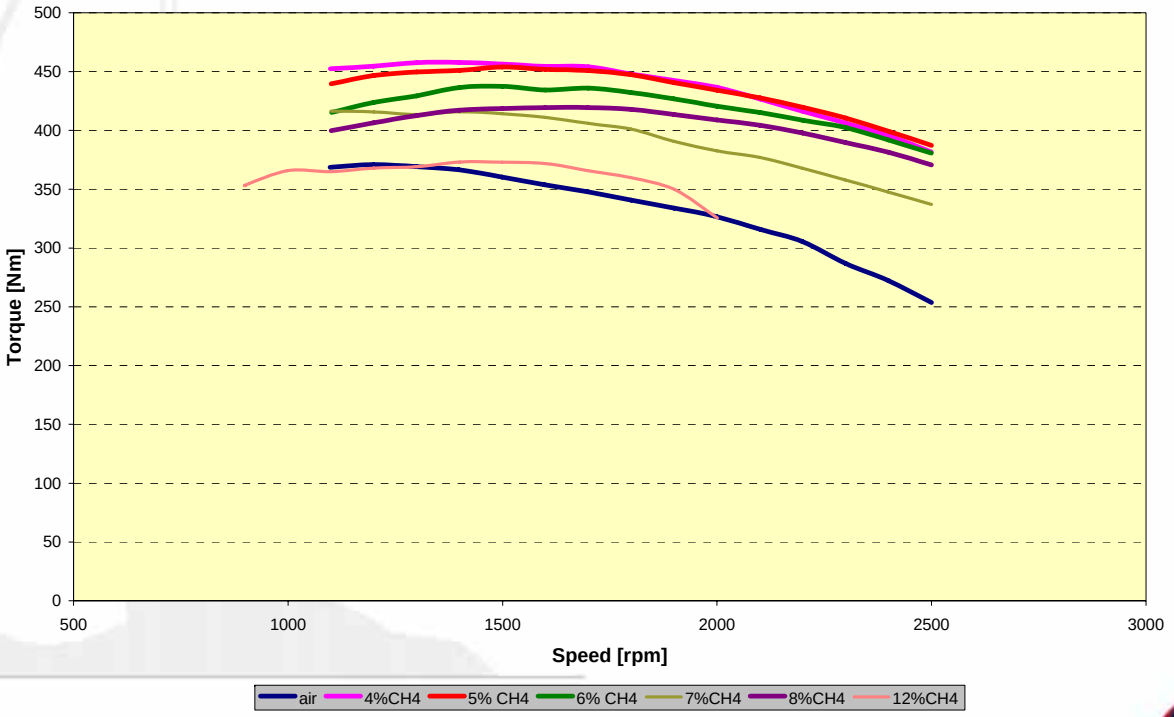
- Torque and power characteristics when operating in high methane concentrations
- Investigate controllability with worn and reconditioned engines
- Impacts on engine temperatures

# Engine testing

- 6 cylinder Perkins flameproof diesel in “as traded” condition
- 6 cylinder Perkins flameproof diesel above but with reconditioned head
- 4 cylinder Tier 2 Perkins flameproof diesel in new condition

# Engine testing

- Methane concentrations up to 12%
- Peak performance at 4 – 8% methane
- Increases in torque of up to 25%



# Engine testing

- The worn engine tended to idle high (2500rpm) at 6 – 8% methane
- New or reconditioned engines did not show this high idle tendency

# Vehicle trials

- Decided to trial a complete vehicle on a test bed (chassis dynamometer) to better demonstrate controllability
- Previous engine testing gave us confidence
- An “as traded” vehicle chosen as worst case

# Vehicle trials


- Power developed
- Performance on level ground
- Performance climbing a typical grade
- Ability to run on with no diesel fuel

# Vehicle trials

## Power developed at the wheels

# Vehicle trials

## Performance on level ground (7% methane)

- Engine idled at 2500rpm
- In first gear attained 3 - 4 km/hr
- In second gear attained 5 km/hr
- In third gear attained 10 km/hr
- This represents the slowest the vehicle would operate without applying the brakes

# Vehicle trials

## Performance climbing a 1 in 10 grade

- Max speed in air was 17km/hr
- Max speed in 7% methane was 26km/hr

## Performance climbing a 1 in 5 grade

- Max speed in air was 10km/hr
- Max speed in 7% methane was 16km/hr

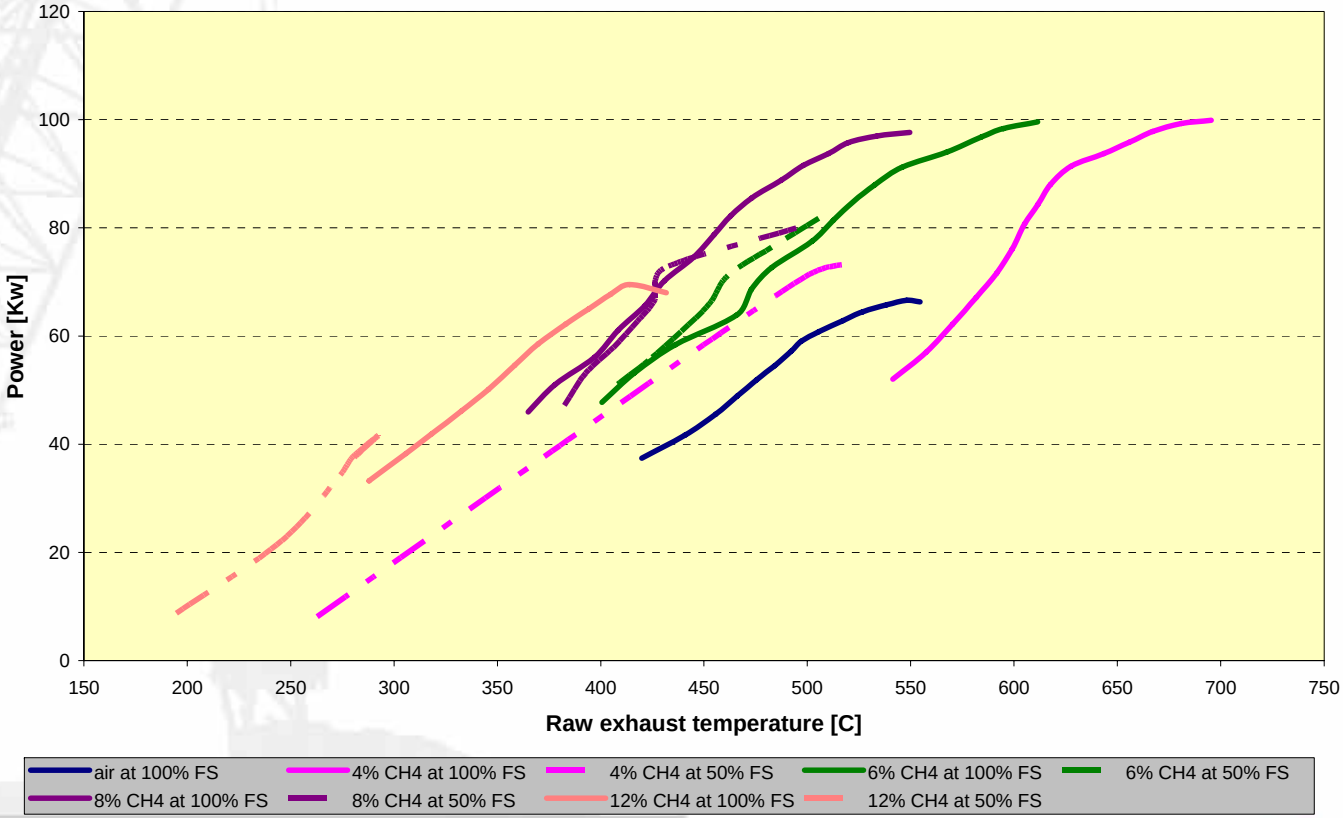
# Vehicle trials

## Ability to run on (at 7% methane)

- The engine was idling at 2500rpm in neutral when diesel fuel was cut off. It continued to run on at 2500rpm
- On selecting first gear and engaging drive, the engine stalled

# Could an engine become an ignition source due to increased temperature?

## Raw exhaust temperatures



# Could an engine become an ignition source due to increased temperature?

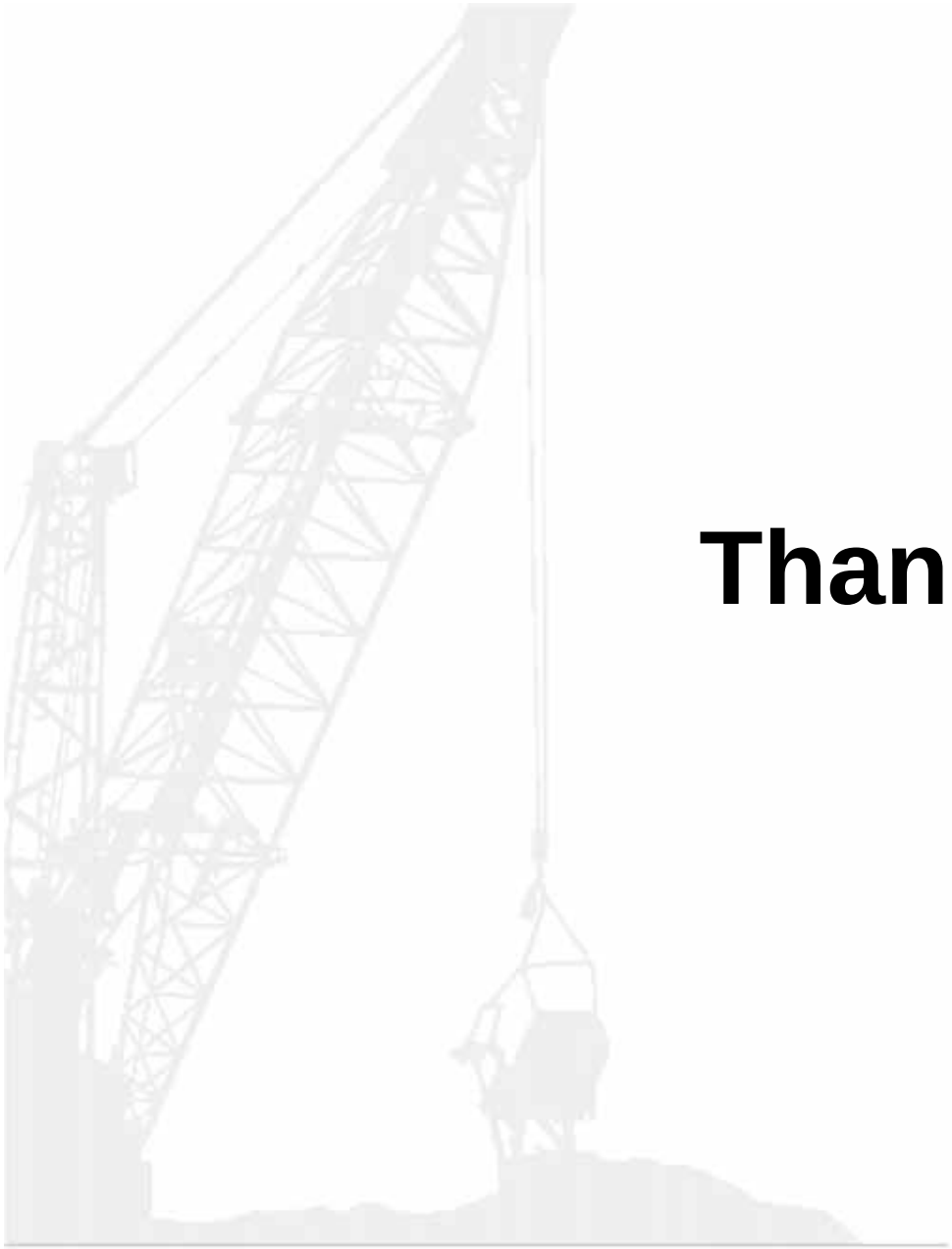
- Engine coolant temperatures did not increase significantly (Max recorded was 95.2°C)
- Exhaust temperatures after scrubber did not increase significantly (Max recorded was 106°C)
- Maximum surface temperature recorded was 128.3°C

# Conclusions

- A transport vehicle suddenly encountering a high methane concentration would have more power available to it
- The operator could easily allow for this increased power by reducing pedal effort
- After methane injection, the effect of 48kW of power on a vehicle weighing at least 6 tonnes should not cause the operator to lose control
- Regardless of the methane concentration, the engine temperatures should not exceed those for the engine driven similarly in normal air

# Conclusions

- If methane gas is suddenly encountered the vehicle could still be driven as slow as 3 – 4 km/hr without having to apply the brakes
- The results show that if the vehicle is capable of starting and operating it could be used to effect self assisted rescue
- In keeping with the conference theme this is considered a step change to a safer future



# Thank you