



THE JM LOW-NO₂ CRT® SYSTEM
12 OCTOBER 2006

 Johnson Matthey
Catalysts


**Progress in the Development of a low-NO₂ CRT®
System Suitable for Underground Mining**

Presentation to the MDEC Conference 2006

**Alex Beavan, Claus Görsmann, Richard O'Sullivan,
Joe Stevenson & Peter Werth**

ENVIRONMENTAL CATALYSTS AND TECHNOLOGIES


THE ADVANTAGES OF THE CRT® SYSTEM




The CRT® system reduces PM emissions by >90% and


- requires no extra energy from electrical heaters or fuel burners,
- requires no alterations to or integration with the engine,
- requires no fuel additives,
- regenerates itself continuously giving a low, constant exhaust back pressure.

Regenerates at lower exhaust gas temperatures than any other passive system.

c. 120,000 systems supplied for retrofit applications around the world.



THE CRT® SYSTEM OPERATING REQUIREMENTS



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUN 17 2005

Mr. Marty Lamm
Manager,
Commercial Development and Marketing
Johnson Matthey
381 Lane Road
Malvern, PA 19355


Dear Mr. Lamm:

The U.S. Environmental Protection Agency (EPA) has reviewed Johnson Matthey, Inc.'s request for adjusting the average exhaust temperature operating condition criteria on the CRT® and CCRT® particulate filters. Based on an evaluation of the data provided, EPA is granting this adjustment and will amend its Verified Producers website to reflect this reduction in exhaust temperature requirements.

For the CRT filter an adjustment to the average exhaust temperature operating condition from 275 °C for 40% of the operating duty cycle down to 240 °C for 40% of the operating duty cycle.


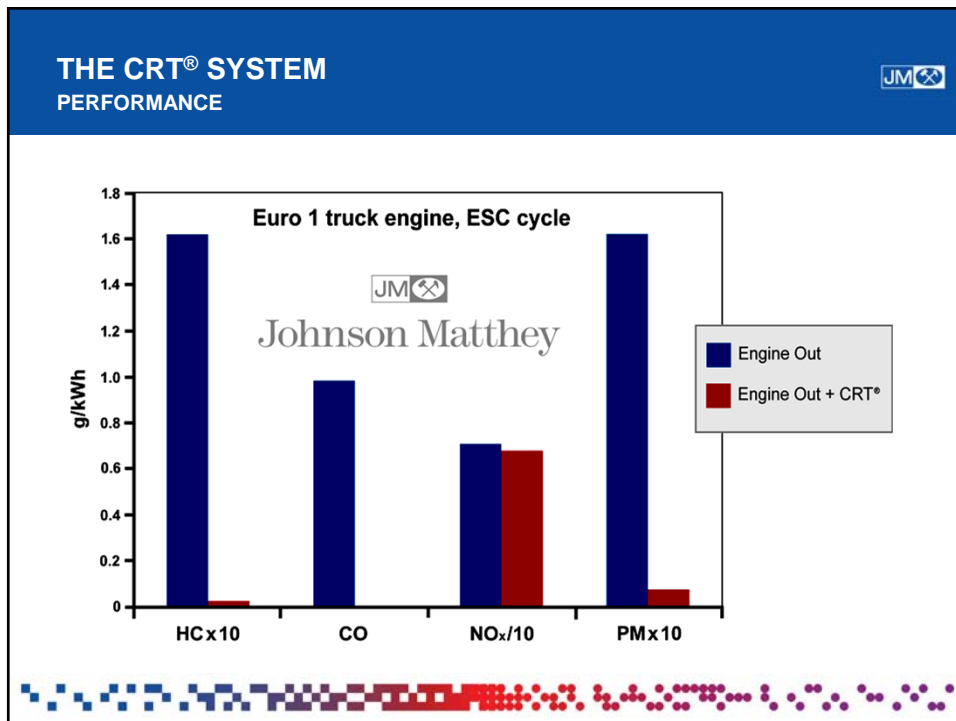
For the CCRT filter an adjustment to the average exhaust temperature operating condition from 235 °C for 40% of the operating duty cycle down to 200 °C for 40% of the operating duty cycle.

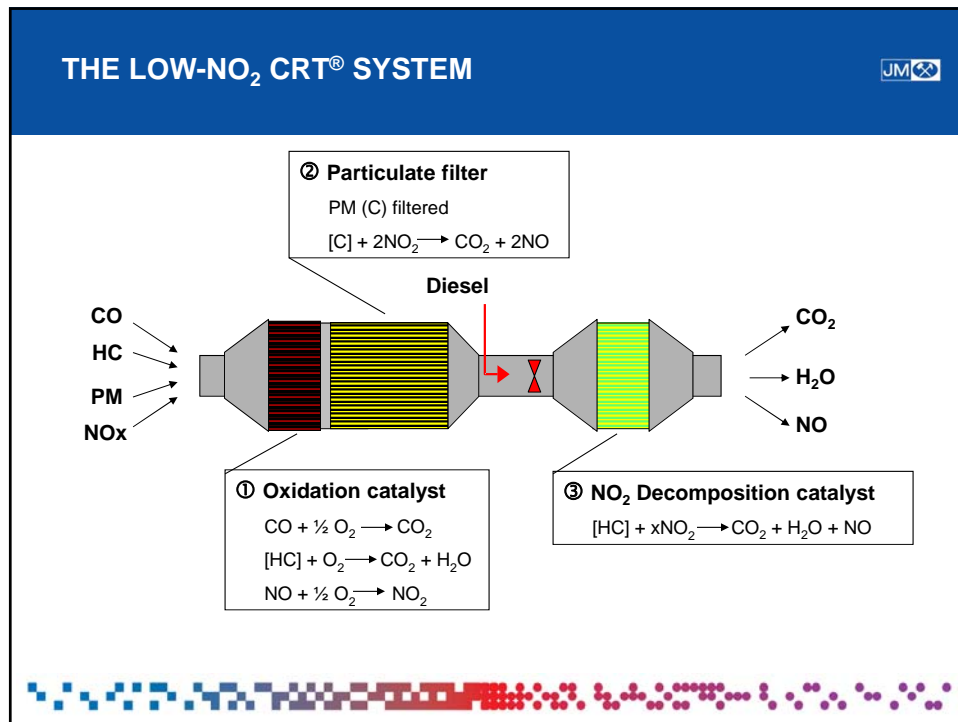
The amended website wording for the operating criteria is enclosed. If you have any questions or comments, please contact Arman Tamam, of my staff, at (202)343-9126.

Sincerely,

Marylin Zuo-Mao, Director
Certification & Compliance Division
Office of Transportation and Air Quality
or: CARB

EPA certifications:

- for CRT® system, T >240°C for 40% operating time
- for CCRT® system, T >200°C for 40% operating time
- This certification based on <30ppm S fuel and sufficient (preferably >20) NOx:PM ratio



DEVELOPING THE SYSTEM

System supplied to UMN for NIOSH test programme in April 2005

- Calibration based on ISO8178 C1 emissions data using engine speed and exhaust temperature

Continued development and testing of decomposition catalyst

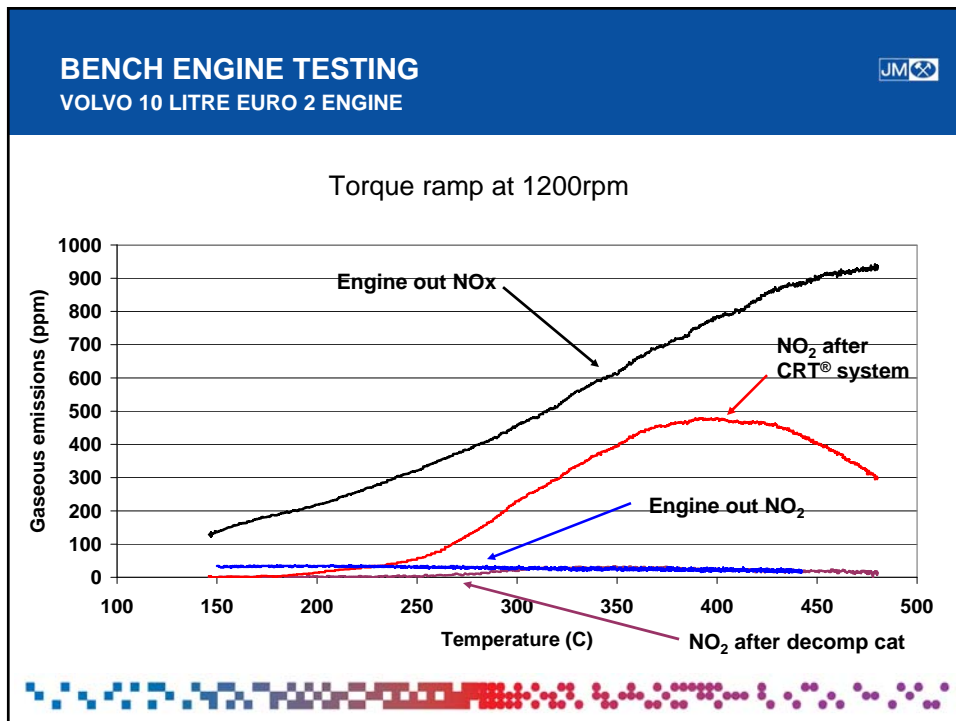
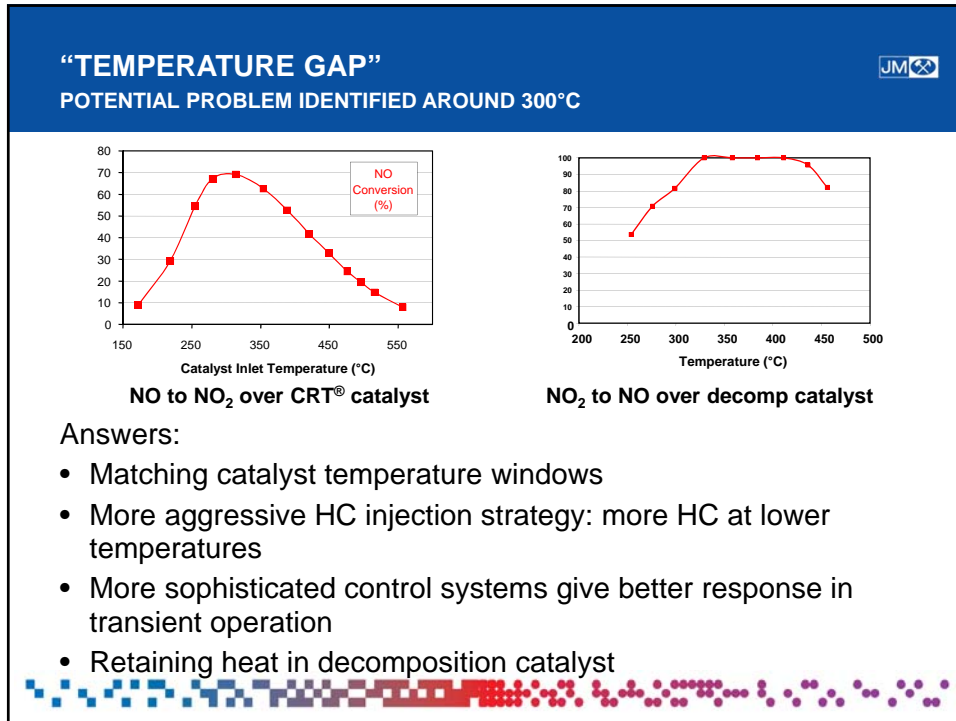
- Effect of formulation and volume on NO₂ decomposition, hydrocarbon slip, etc..

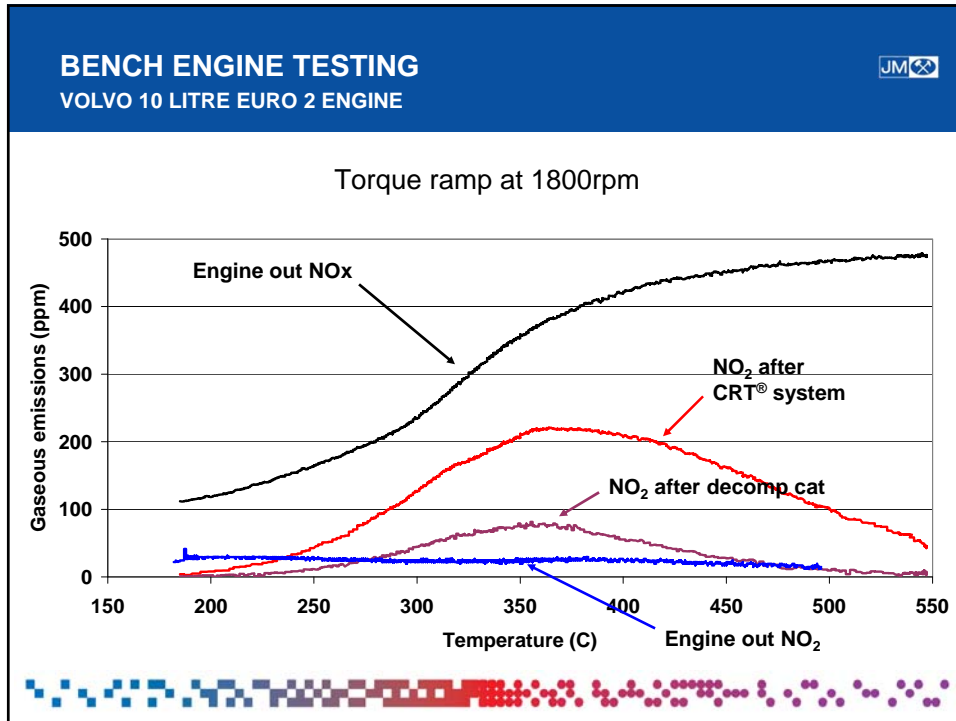
Continued development and testing of control systems on bench engines and on machines above ground

- Improved HC distribution in system
- More sophisticated system calibration – optimisation of HC injection strategy
- Introduction of real time feedback control

Mine testing

A decorative border of colored dots is at the bottom.





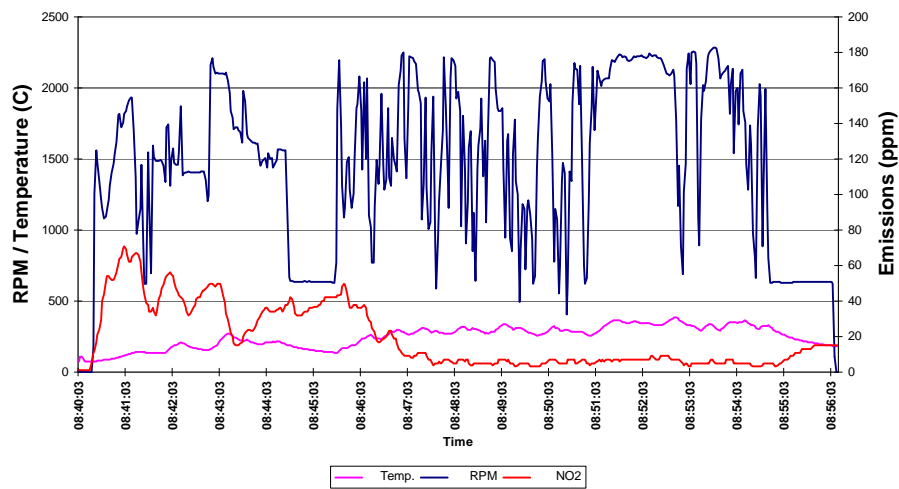
SYSTEM TRIALS UNDERGROUND INSTALLED SYSTEM

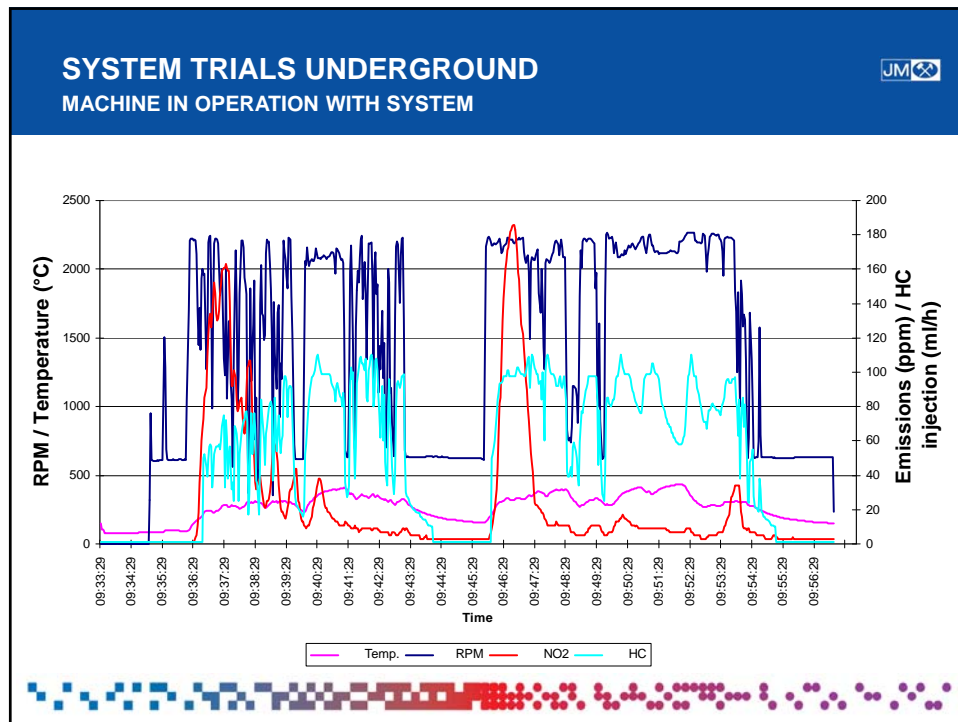


Two systems installed, one for each bank of cylinders



SYSTEM TRIALS UNDERGROUND MACHINE IN OPERATION WITHOUT SYSTEM





THE NEXT STEPS

- Demonstrate durable performance in a mine environment:
 - PM conversion
 - Regeneration performance
 - Low NO₂ emissions
- Further development of control and monitoring systems and calibration