

**Improved
“Operational Emissions
Compliance”
by the application of
“Emission Event Recording”.**

Background

- WHDC Group was tasked to consider the control of off-cycle emissions.
- The cost of measuring the emission from vehicles in the field is prohibitive.
- If excessive off-cycle emission is a result of a cycle beating strategy it is unlikely to be identified by repetition of the certification test.

Concept Background

- NTE approach implies that manufacturer can predict with reasonable precision the emission resulting from multiple combinations of sensor input.
- Recording of the operational sensor inputs and their real time ECU output would develop a vehicle specific operation map.
- Aggregated maps could be compared with a signature map recorded during certification.
- Engines showing significant deviations could be tested against the real operational map.

Feasibility Study

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- Report prepared July 2001
- Contractor - Lotus Engineering
- Quality Review by heavy-duty fuel/control system supplier

Feasibility Study

Considered:

- Control Parameters
- Data management
- Application on vehicle
- Data storage / Data recovery / Data security

Control Parameters

- Primary Inputs
 - Demand, Crank angle, Engine speed, etc.
- Sensor derived Inputs
 - Manifold pressure, Barometric Pressure, Charge air / Water / Ambient air / Fuel temperature, etc.
- Outputs
 - Injection timing, Fuel quality, Boost pressure,
 - EGR, Fuel pressure

Data Management

- Instantaneous buffered data
 - Snap shots limited by memory capacity switched on & off as directed
- Long-term averaged duty cycle
 - 16x16 speed/load matrix for each parameter
 - aggregate values would determine period spent at each condition

Recommendation

- Long term duty cycle to provide operational map
 - Short term buffer overflow to storage matrix when full
- Supplement with configurable short term buffer.
e.g. record events when vehicle operating outside “normal” conditions
- Compare “real world” signature with “certification” signature

Application on vehicle

Options:

- Direct wiring to ECU inputs and outputs
- Standardised diagnostic link
- Embedded monitor
- CAN Bus interrogation (Recommended)

Data Capture

CAN Bus interrogation

- Achievable with permanent or temporary monitoring
- Should be a discrete module
- Temporary installation by Authority delivers economy
- Requires dumb access

Data storage/retrieval

- Recommendation for European solution
 - integrate the recorder with the electronic tachograph
 - record to be maintained in recorder head and downloaded by the introduction of secure access smart card held by the regulatory authority

Tampering

- The monitor would identify certain types of tampering

e.g. modified input signals showing irrationality or “superchips” which are likely to have significantly different engine control parameters compared to the base signature.

- Signal tampering downstream of the ECU is unlikely to be identified other than by physical inspection.

Emission Event Recorder

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- Requires no new technology

Application of existing knowledge can deliver:

- data capture
- data storage
- data security
- retrieval

Emission Event Recorder

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- Unlike OBD/OBM, EER requires no threshold limits.
- EER reports engine operating history and makes no judgement about emission performance.
- Significant deviations from the Regulated cycle signature indicate a requirement for emission verification using a stylised cycle.

Summary

EER:

- Reduces reliance on standard test cycles
 - provides for adoption of harmonised cycles.
- Reduces enforcement costs by:
 - identifying target engine types.
- Improves enforcement effectiveness by:
 - providing real in-service test data.