Natural-gas buses left standing again in US emissions research

For the second time in less than six months, the environmental credentials of natural-gas engines have taken a knock in US dynamometer trials. Researchers in the US again conclude that current low-emission diesel engines have the potential to be cleaner than natural-gas engines. This time the work was carried out by the Southwest Research Institute (SwRI) of San Antonio, Texas, a big independent research organisation. Its conclusions not only echo those published a few months earlier by the California Air Resources Board (*Transport Engineer* June 2002) but go further by calling into question established opinion on the toxicity of diesel emissions.

The SwRI research was sponsored by International Truck and Engine Corporation, the Navistar division whose product range includes engines and schoolbuses designed to take advantage of California's low-emissions schoolbus replacement scheme. This provides generous state grants for schoolbuses with much lower exhaust emissions than demanded by federal regulations.

A 21-mile, 85-minute city/suburban heavy-vehicle test cycle was used to simulate a schoolbus route on SwRI's chassis dynamometer. The natural-gas bus in the trial was a 2000-model-year Blue Bird All-American with an 8.1-litre John Deere engine. Like most gas-engined buses in service in the US, it has no oxidation catalyst in the exhaust. The vehicle up against the Blue Bird was an American Transportation Corporation schoolbus fitted with an International DT530 diesel engine: an 8.7-litre, six-cylinder in-line unit developing 275hp and available with what Navistar calls "green diesel technology", including an oxidation catalyst and particulate filter in the exhaust. Recalibration of the engine is said to have cut its oxides of nitrogen (NOx) emissions by about 25 per cent. The test was repeated on the same bus fitted with the standard, non-green-diesel-technology version of the engine. Diesel used in the trial had a sulphur content of less than 15 parts per million.

Compared with the natural-gas engine, the low-emissions diesel engine emitted less particulate matter (PM), less oxides of nitrogen (NOx), less hydrocarbons (HC) and less carbon monoxide (CO). The natural gas engine beat it only on emissions of carbon dioxide (CO_2) and nitrogen dioxide (NO_2).

Even the standard diesel engine emitted less NOx and hydrocarbons than the natural-gas engine. More surprising still is that in the exhausts of both diesel engines SwRI found only 20 of the 41 expected toxic air contaminants. "The SwRI used special sampling provisions specifically to detect low levels of these contaminants," says Charles Lapin, a toxicologist and co-author of the Society of Automotive Engineers (SAE) paper on the SwRI research. "The fact that the contaminants were missing casts doubt on previous statements about diesel toxicity."

International and other diesel engine makers are seizing on the SwRI research results. Until now they have relied largely on economic arguments to swing customers towards diesel engines and away from natural gas. Gas engines usually are found to emit less NOx than even the cleanest diesel, but the US$25,000-35,000 premium for each gas engine means that a fixed grant buys many more buses with low-emission diesels, thus ultimately delivering a deeper cut in total emissions, including NOx.

"The SwRI findings provide a serious challenge to assertions that natural-gas buses are inherently cleaner than diesels," says William Bunn, International's chief medical officer. "Diesel is clearly part of the clean-air future in transportation, and we are glad to have this research available to decision-makers and customers who rely on diesel power for performance as well as environmental compliance." ■

A fuel-cell bus that has gone into revenue-earning service in California "points the way to buses of the future", according to the British company behind its design. Alan Ponsford, managing director of Capoco Design of Salisbury, Wiltshire, describes the driveline of the 30ft bus, an Eldorado National EZ-Rider, as "world-leading technology." The vehicle's 75-kilowattt fuel-cell. mounted at the rear, produces the electricity both to power the vehicle and charge a 600-volt battery pack which provides the energy for all bus systems. The battery pack is also linked to a regenerative braking system.

Oil companies urged to get slicker at sulphur removal

The sulphur content of engine oil needs to be cut if the latest exhaust after-treatment systems are to work efficiently, according to a top diesel engine research engineer.

"Modern truck and bus engines burn far less lube oil than their 1980s predecessors," says Walter Knecht, general manager of Iveco's engine research centre at Arbon, Switzerland. "But consumption remains significant enough for the sulphur in the oil to reduce the efficiency of diesel after-treatment catalysts. The sulphur in today's average diesel lube oil has a catalyst-poisoning effect equivalent to an extra 15ppm (parts per million) sulphur in the fuel."

The efficiency of the SCR (selective catalytic reduction) equipment being adopted by several manufacturers to meet Euro-4 emissions legislation will be impaired if the amount of sulphur is not reduced, according to Mr Knecht. The main de-NOx catalyst of an SCR installation is unaffected by sulphur, but the accompanying upstream oxidation and downstream "ammonia-slip" catalysts are more sensitive. This is why Mercedes-Benz is planning to forgo some de-NOx efficiency by opting for a single-catalyst SCR set-up. The aim is to prevent catalyst damage to SCR-equipped long-haul vehicles obliged to refuel with high-sulphur fuel in eastern Europe and further afield.

Oil companies are already working on low- and zero-sulphur lubricants for diesel engines. Castrol is planning to offer an upgraded version of its latest fully-synthetic Elixion OW-30 oil, with no sulphur, phosphorus or ash. This lubricant is intended to be compatible with any Euro-4 or Euro- 5 exhaust after-treatment. The absence of ash will also reduce the risk of particulate filters becoming clogged.

Low-sulphur engine oil is already available for Euro-3 lean-burn natural-gas engines. Their methane-reducing catalysts (needed to meet a 1.6g/kWh tailpipe CH_4 limit) can be rendered ineffective by a coating from combustion sulphates. For its 11-litre diesel-to-gas converted engines, Scania demands lubricants with no more than 0.4 per cent sulphur or one per cent ash, by weight. Mobil's Pegasus 1 and Castrol's RX Supergas meet this specification. ■