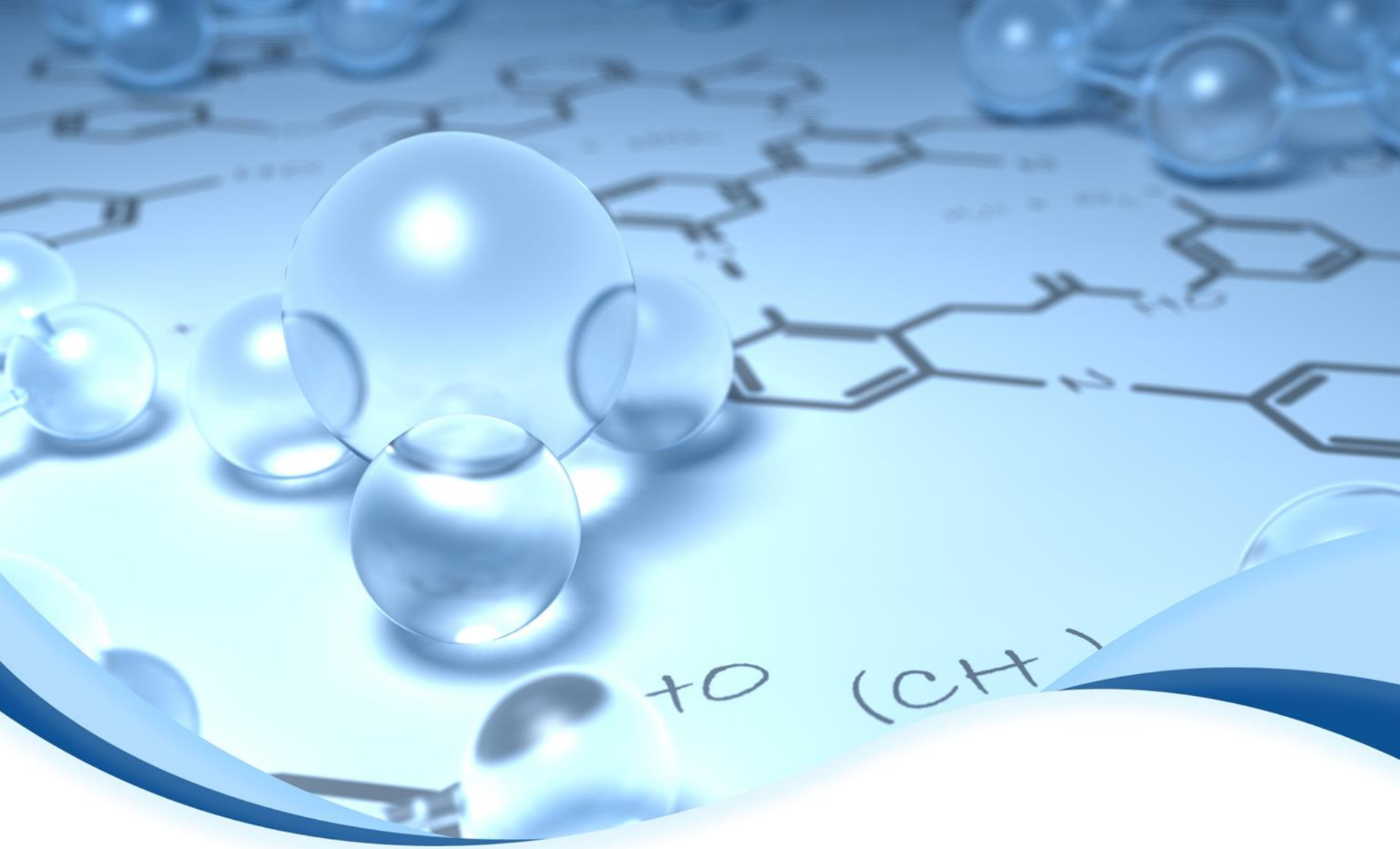


Customer Case History

ARRIVA BUS LTD – SPEKE – FUEL AND OIL

By WWW.KLEENOIL.CO.UK

CUSTOMER DETAIL

ARRIVA BUS – SPEKE - MERSEYSIDE

Arriva UK Bus is part of the Arriva group, which is owned by Deutsche Bahn. Arriva is a leading pan-European public transport operator with around 47,500 employees and operations across 12 European countries

REASON FOR KLEENOIL

ARRIVA SPEKE OPERATE SOME VOLVO B7 with inherent sooting problems.

- Opted for KLEENOIL trial on Volvo B7 with both oil and fuel

TO REDUCE OIL & STANDARD FILTER CHANGE.

ARRIVA have opted to change oil and filters at 60,000km and Kleenoil Cartridges in the 10,000km interims with a twice yearly fuel filter change.

INSTALLATION DETAIL

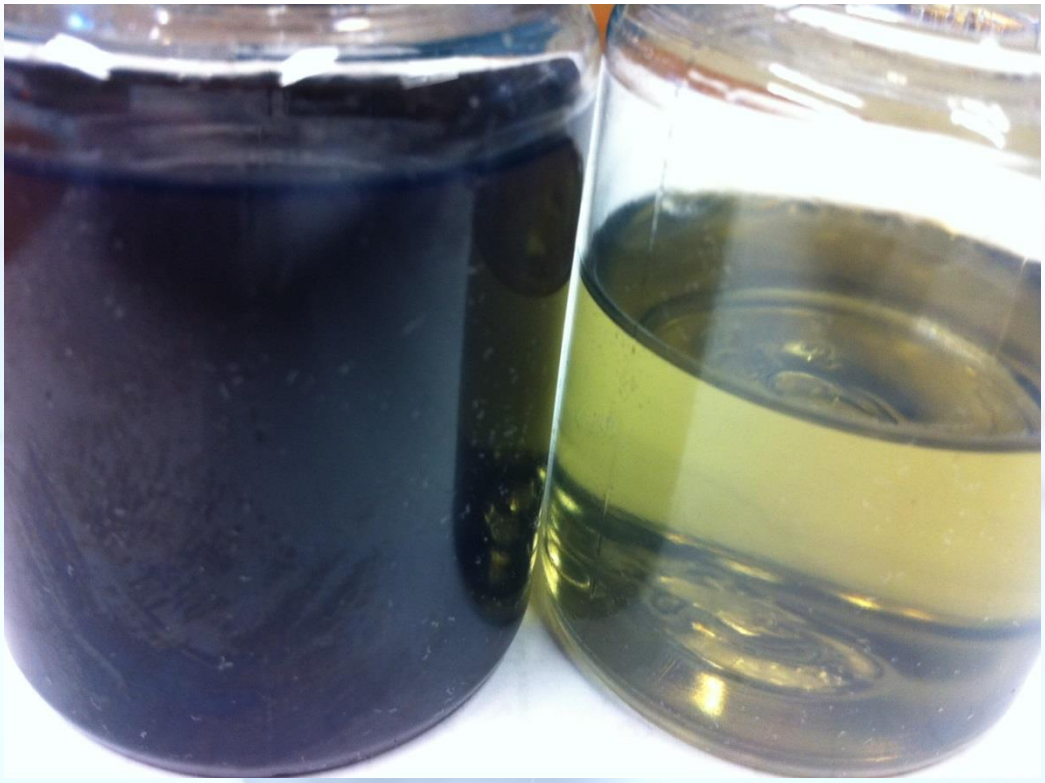
VOLVO B7 BUS

INSTALL DATE 02/05/13

- Install 1 x SDFU9788KU85 oil
- Install 1 x HDFU9778KU50 fuel

ANALYSIS

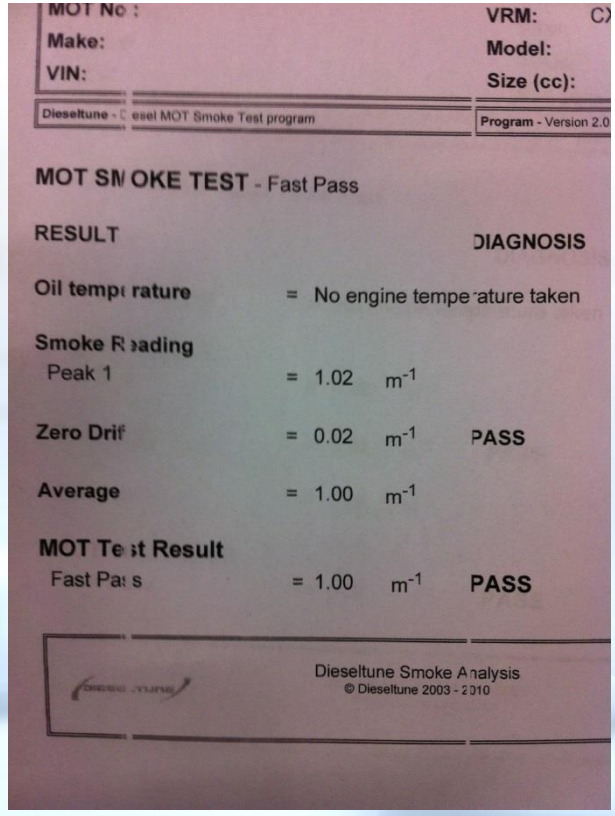
A visual analysis on fuel at time of fitment proved instant cleansing

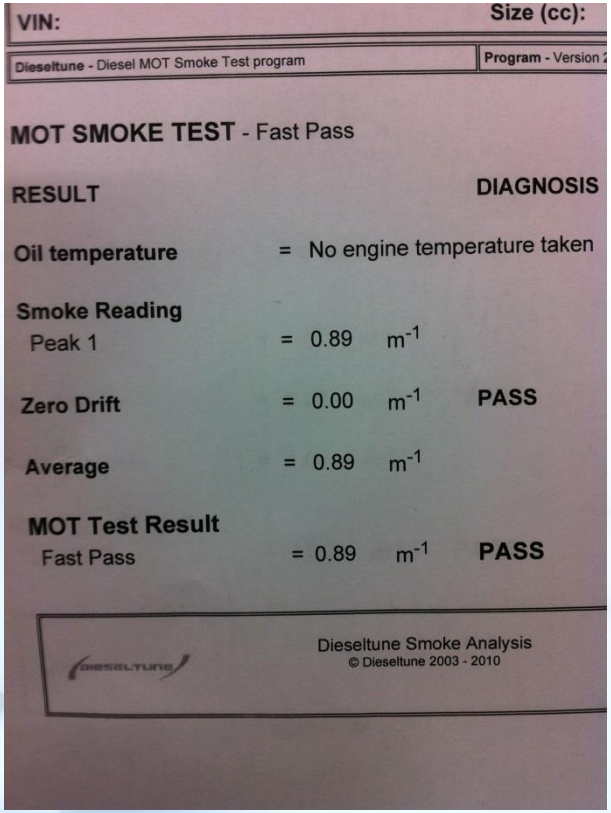


Fuel on left indicated high level of particulate
Fuel on right shows level of cleanliness on single pass through Kleenoil Filter

Emissions - sameday

Exhaust emissions – diesel smoke test – before/after





Initial test was taken cold, at start of day before installation.

Retest showed a 10% emissions decrease after a single run.

We would concur that further running would continuously flush out particulate and next tests will show higher reductions.

Independent Test Proofs of lowered Exhaust Emissions & fuel consumption

Tests were taken by The South African University of Johannesburg Chemical Engineering Technology Dept on 'post' fuel filtration down to the 3micron abs. The full report is available—but to conclude :

CONCLUSIONS

The results show a significant reduction of emissions on all the vehicles after fitment of a micron filter. **Based on the test it is evident that the 35.3%, 26.1% and 34.3% average reduction in carbon monoxide, nitrogen oxides and un-burnt hydrocarbon respectively was as a result of micron filter use.** Previous test results conducted by the South African Bureau of Standards (SABS) on the same filter have also shown a reduction in nitrogen oxides and particulate matter (PM). When large numbers of particles are passing through pumps and injector tips, cavitation occurs causing erosive wear and increasing nozzle size. This leads to larger fuel drop sizes and dirt particles becoming trapped in the mating surfaces of the sealing areas of the injector tips, keeping them apart. Leaking and dribbling subsequently occur. Wear between barrel and piston occurs sometimes, resulting in seizure or reduced injection pressure and poor atomisation. The effects of these various problems are the main cause of inefficient combustion and subsequent emissions. Post-filtration of diesel using a Micron filter ensures uniform fuel flow through the injectors resulting in efficient combustion, optimum pressure and ignition temperatures and emissions.

RECOMMENDATIONS

The reduction in un-burnt hydrocarbon observed from these tests suggests an improved fuel utilisation in the engine, this need to be investigated under controlled conditions to validate if the filter has fuel economy benefits.

The Micron filter is designed for micro-filtration, the filter media may be slightly modified to perform simultaneous molecular filtration since the filter has a larger active filtration area. The claims around fuel consumptions reduction would need to be further tested and verified in a controlled environment. The reduction in total un-burnt hydrocarbons in the emissions would theoretically suggest improved fuel Economy

FUEL CONSUMPTION LOWERING BY INSTALLING KLEENOIL JUST ON THE OIL SYSTEM … *NOT ON FUEL* …

A bus engine fuel consumption study by G. Andrews, et al. of the University of Leeds provides evidence of the benefit associated with cleaner oil on fuel economy in an actual road trial. It was noted that the **Cummins engine's fuel efficiency increased 2 percent to 3 percent when a six-micron by-pass filter was used along with a full flow filter**. The study spanned 50,000 miles of service. The fuel consumption was calculated based on detailed fuelling records from the fleet.

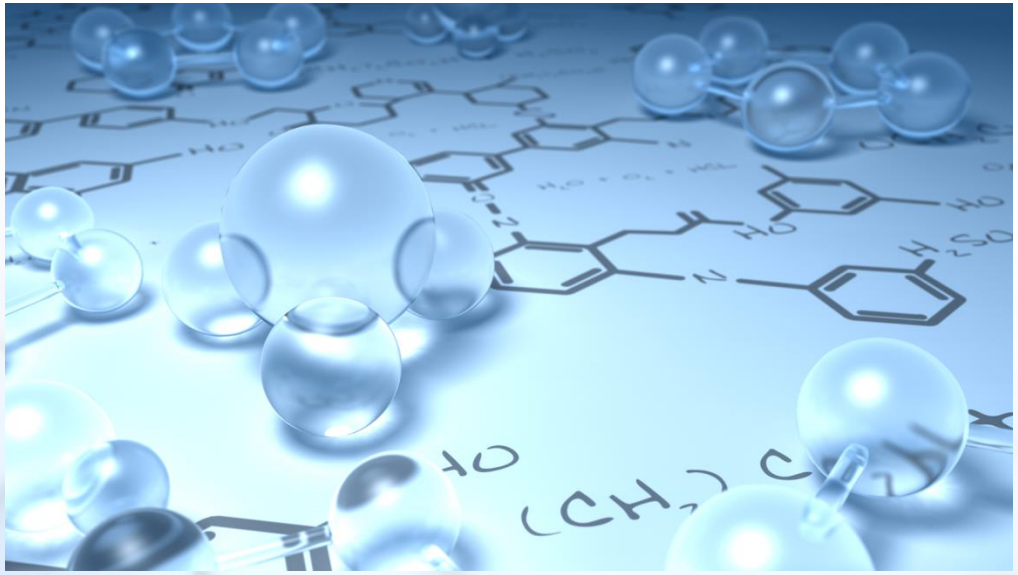
In a similar study reported by the same authors using by-pass filtration, **a 5 percent to 8 percent reduction in fuel consumption was achieved** on a 1.8 litre Ford passenger car IDI diesel engine.

A study reported by J. Fodor and F. Ling of the Research Institute of Automotive Industry-Budapest and published in Lubrication Engineering magazine found a sharp improvement in fuel economy in a six-cylinder diesel engine fitted with improved filtration. **By reducing oil contamination by 98 percent, not only was a nearly 5 percent reduction in fuel consumption achieved** but wear and friction were reduced by 93 percent and 2.9 percent respectively.

Summary

FURTHER STUDIES ….

By simply changing the KLEENOIL cartridges once a month, ARRIVA eliminate 5 x the cost of a ltr sump capacity of oil, standard filters and considerable labour / downtime.



Both Arriva and Kleenoil are continuing this trial for more results and will update shortly.

BENEFITS OF KLEENOIL TO ARRIVA

ARRIVAS OBJECTIVE IN IMPLEMENTING KLEENOIL …

Was to primarily save on engine wear in the Volvo B7.

VOLVO led ARRIVA to KLEENOIL as the B7's have proven to have an increased sooting problem and the Kleenoil filter is adept in removing this contaminant as it is being created.

SIGNIFICANTLY REDUCE SOOT CONTAMINATION
A RECURRING PROBLEM IN THE VOLVO B7

SIGNIFICANTLY REDUCE COSTS,LABOUR AND DOWNTIME
eliminate 2 out of 3 expensive & laborious maintenance processes

INCREASE OIL & FUEL HYGIENE
maintain 'as new' to ensure less wear inside the machine

REDUCE MACHINE WEAR TO INCREASE MACHINE LIFE
clean machines have less breakdowns and a longer lifetime

Further benefits to ARRIVA

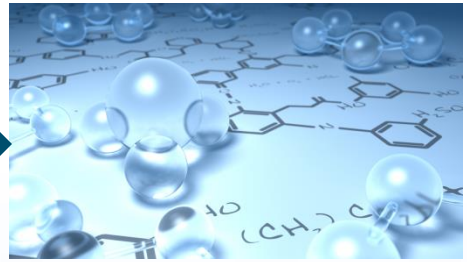
Time and money are always key … but the hidden benefits are :

ARRIVA are a 'green' company

Installing KLEENOIL is fundamental in meeting Green legislation and benefiting the carbon footprint not only by reducing emissions and oil consumption, but moreover oil disposal.

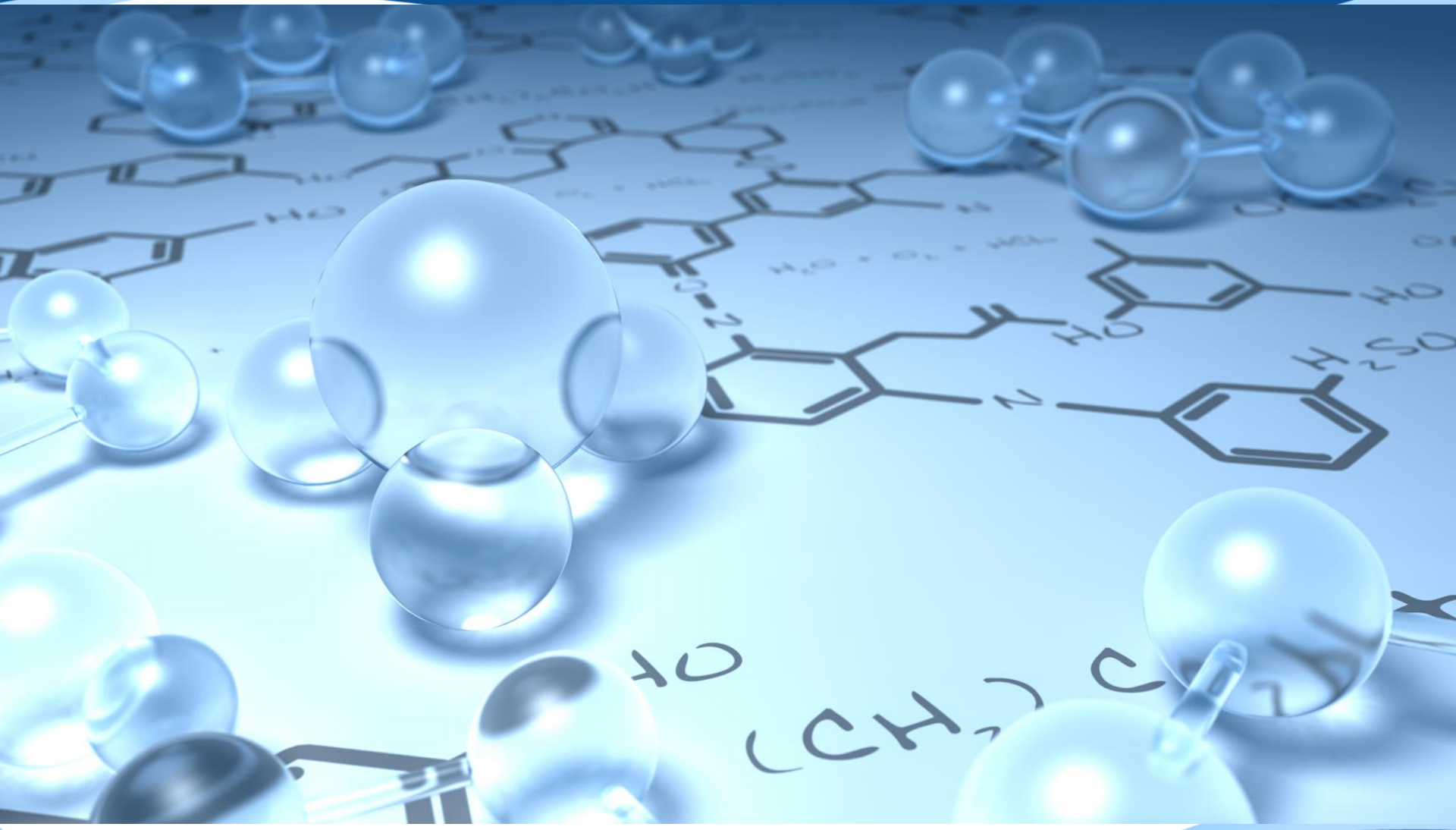
ARRIVA use monthly oil condition monitoring

By operating simple oil analysis : ARRIVA are implementing proactive maintenance rather than reactive.



ARRIVA can reduce downtime.

…operating a tighter maintenance schedule is imperative in public transport operations.



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