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Some photography within this brochure shows optional features that are not standard on the vehicle.

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SpecCheck

AdBlue: The facts

A handbook for AdBlue users

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Introduction

By the end of this year, there will be around 40,000 trucks on Britain's roads equipped with Selective Catalytic Reduction and using AdBlue. Why? Quite simply, because it's the system adopted by most truck manufacturers to meet the latest European legislation on diesel engine emissions. It is successful. Over the short period of the legislative programme, there has been a dramatic reduction in noxious nitrogen oxides and particulate matter, and SCR/AdBlue technology has made a major contribution to that achievement.

AdBlue is new to road transport and, as such, there are features of its role that may be unfamiliar or misunderstood. This handbook is intended to help clarify some of the key aspects of AdBlue by answering questions like those listed here. We hope they shed light on a subject which affects us all.

AdBlue: The facts

Why do new trucks need AdBlue?	2
Is AdBlue an additive to diesel?	3
Is there a separate tank?	3
How do you top up?	3
What is AdBlue?	4
So what's urea then?	4
Is AdBlue hazardous?	4
Do I need protective clothing?	5
What if I spill AdBlue?	5
How do I find where AdBlue stockists are located?	6
Will operators bunker AdBlue in the same way as fuel?	6
How will AdBlue be available?	7
Do DAF dealers stock AdBlue?	8
Is AdBlue difficult to find when you're out on the road?	8
Where is AdBlue available?	8,9
What stops me from putting diesel into the AdBlue tank?	10
Do the tanks need to be banded?	10
Does AdBlue freeze like water?	10
What about prices? Is AdBlue expensive?	11
How much AdBlue does a Euro 4 truck use?	12
How does AdBlue affect my operating costs?	12,13
But AdBlue is still an on-cost isn't it?	14
Is this borne out in road tests?	14
What was the AdBlue consumption?	15
Does running out of AdBlue damage the engine?	16
If you run out of AdBlue, are you running illegally?	16
If you run out of AdBlue does the engine shut down?	16
Isn't this just another example of Brussels bureaucracy?	17
So why does SCR need AdBlue?	18
What are the benefits of SCR?	18
Are we progressing towards a cleaner environment?	20

Why do new trucks need AdBlue?

It's all about protecting the environment. All commercial vehicle manufacturers have had to meet the European Union Euro 4 diesel engine emissions legislation which became effective on 1st October 2006.

It's the latest stage in a legal process which started with Euro 1 in 1993. Emissions from diesel engines have been reduced progressively since that date but the latest and most stringent stage has required the application of completely new technology.

The industry has responded with two different innovations: Selective Catalytic Reduction (SCR) and Exhaust Gas Recirculation (EGR), both of which require a form of exhaust gas after treatment. DAF has adopted the former technology, an integral element of which is AdBlue.



Did you know

There were no specific European exhaust emissions standards until Euro 1 was implemented in 1993. In the short time between then and the Euro 5 vehicles available today, nitrogen oxides or NO_x has been reduced by 75% and particulate matter by 94% - a remarkable result. SCR and AdBlue have played a significant role in this achievement.

Is AdBlue an additive to diesel?

No. *AdBlue is a completely separate system. It never comes into contact with diesel.*

Is there a separate tank?

Yes. *There is a separate tank located on the chassis identified by a blue filler cap.*

How do you top up?

It couldn't be simpler. It's quick and easy, using a straightforward nozzle. And it's infrequent because the vehicle uses so little AdBlue (see pages 12 and 13).



What is AdBlue?

AdBlue is designed specifically for this application – to be safe, easy to store and use and to reduce emissions. AdBlue is a colourless liquid made up of 67.5% demineralised water and 32.5% urea. In the SCR process its role is as a reduction agent that reacts with, and neutralises, nitrogen oxides (NOx).

So what's urea then?

Urea is an organic compound of carbon, nitrogen, oxygen and hydrogen.

Its principal use is as a nitrogen-rich fertiliser, enabling the world's farmers to improve crop yields. It is also

- a component of animal feed
- an alternative to rock salt in the de-icing of roadways and runways. It does not promote metal corrosion as salt does
- an ingredient in the cloud-seeding agent to produce rain
- an ingredient to promote rehydration of the skin.

Is AdBlue hazardous?

No. There have been some misplaced concerns about AdBlue.

However, as we've seen, two-thirds of AdBlue is water and the remaining third is an organic compound. As such, it is less corrosive than salt water to metal or concrete, and it is neither toxic nor dangerous. AdBlue is not ammonia – it's a clean, harmless, environmentally friendly solution. In fact, of all of all the fluids used in a truck: diesel, engine oil, battery acid, clutch fluid and even windscreen washer fluid, AdBlue is the least hazardous.



Did you know

Urea is an ingredient in some cosmetics and bath oils.

Do I have to wear protective clothing when filling up?

No. Protective clothing is not necessary.

You can simply rinse away any AdBlue spillage with water.

What if I spill AdBlue?

Don't worry. You can rinse it off with water.

With small spillages you may see white crystals forming after a while but they are non-corrosive and can be wiped away.



How do I find where AdBlue stockists are located?

There's a website.

GreenChem has developed a website that shows all its dealers in the UK and in Europe, which is constantly updated. It's www.adblue4you.com and there's also a European free phone number: 00800 2007 7002. GreenChem currently has a network of 250 outlets, including all DAF dealers, plus Volvo and Mercedes dealers.

The company's purpose-built AdBlue production plant in Mold, Cheshire, is in operation and another will be built in the north-east.

AdBlue[®]4you
www.adblue4you.com

GreenChem

Presumably operators will bunker AdBlue in the same way as fuel?

Yes. 90% will.

There has already been considerable investment by operators in bulk AdBlue storage facilities. Most operators, about 90%, will bunker AdBlue on their premises because they only need to top up occasionally. It means that those fleets will rarely need access to AdBlue when they're away from base so the need for bulk quantities of AdBlue on the road is unlikely to be significant.



How will AdBlue be available?

All DAF Dealers will stock the following AdBlue products under the TRP brand name (also available through GreenChem):

Top-up containers 5 and 18 litre capacities



Drums 200 litres

GreenStar 1 1,000 litres Portable IBCs (Intermediate Bulk Containers)



Contact your local DAF dealer

If you are considering a larger installation, GreenChem can supply the following products:

Greenstar Smart 2,900 litres; built-in telemetry, heating; fully bundled

GreenStar 2 5,000 litres self contained units with built-in telemetry. Basic and Professional models

GreenStar 3 4,000 – 15,000 litres. Slimline unit with fully bundled inner tank with built-in telemetry. For storage on operators' premises.



Tailor made Installations (including underground) can be recommended by GreenChem.

To contact GreenChem tel: 01296 468 531

email: info@greenchem-adblue.com

www.greenchem-adblue.com

Do DAF dealers stock AdBlue?

Yes. Every DAF dealer has supplies of AdBlue in the form of 5 and 18 litre top-up containers, 200 litre drums and 1000 litre IBCs.

Is it difficult to find AdBlue when you're out on the road?

No, not really.

We need to put this into context. There is, right now (February 2007), a network of some 400 AdBlue outlets servicing a total of around 4,000 SCR / AdBlue trucks. The number of such trucks will grow rapidly during this year, reaching 40,000 units by the year end, by which time 22 million litres of AdBlue will have been sold in 12 months. We expect the network to grow to meet this level of demand. It should also be remembered that 90% of operators will bunker AdBlue so on-the-road outlets will never be the primary source.



Did you know

Four out of every five trucks purchased in 2007 will be SCR/AdBlue.

Where is AdBlue available?

The number of stockists of AdBlue increases by the day.

To give an indication of the coverage, the following truck and AdBlue networks (wholly or partially) carry stocks:

- DAF
- Mercedes-Benz
- Iveco
- Volvo
- Scania
- Renault Trucks
- GreenChem
- Yara Air1
- Dureal



Mercedes-Benz



There are numerous specialist suppliers that are building networks across Europe. GreenChem is DAF's choice for first AdBlue-fill on the production lines at Eindhoven and Leyland. All DAF dealers hold supplies of GreenChem AdBlue. In the UK, there are two other major players, Yara Air1 and Dureal.

What stops me from putting diesel into the AdBlue tank on my vehicle and vice versa?

We've done everything we can to stop this happening.

To avoid putting diesel into the AdBlue tank, the neck of the AdBlue tank has been designed so that a diesel nozzle cannot fit into it.

To avoid putting AdBlue into the fuel tank in bulk storage installations, there is an automatic safety nozzle. Inside the neck of the AdBlue tank on all SCR / AdBlue vehicles there is a circular magnet. When the AdBlue nozzle is placed inside the neck of the tank, it opens a valve in the nozzle which allows AdBlue to flow. If the nozzle is placed in the neck of a fuel tank, the valve will not open and the AdBlue will not flow.



If AdBlue is harmless, do the tanks need to be bunded?

No. As with any storage of liquids, bunded tanks make good business practice, but there are no legal requirements to do so.

Does AdBlue freeze like water?

No. AdBlue starts to freeze at -10°C and is completely frozen at -20°C . When it thaws, it is not affected.

What about prices? Is AdBlue expensive?

No, it's not. There have been surveys of the market by the trade press that have reported a wide diversity of prices.

Commercial Motor, however, found that DAF had a network which had good bulk supplies and consistent pricing between 35-45p per litre, an average of 39p per litre.

DAF has consistently said that the bulk price of AdBlue will average around 40 pence per litre and, as the market settles, it will move towards 35 pence. Currently, it's very much in the order that Commercial Motor reported: 35-45 pence per litre and falling. Clearly, top up container prices will be more than this but they are likely to be only a short-term requirement.



Did you know

On the truck, the AdBlue tank is usually adjacent to the exhaust which helps to keep the temperature above freezing. On some vehicles where the AdBlue is separated from the exhaust, the AdBlue tank is heated using engine coolant.

How much AdBlue does a Euro 4 truck use? Surprisingly little.

A small tank will give a long range. The actual amount can vary, considerably dependant on the nature of the work – vehicles working harder will produce more NO_x during combustion and will require proportionately more AdBlue.

How does Adblue affect my operating costs?

It's likely that your operating costs will go down. You may well find the figures in the table below surprising.

The table identifies some typical values based on in-service Euro 4 trucks and road tests conducted by the commercial vehicle press. The quantity of AdBlue consumed as a percentage of diesel consumed, reflects driver and operator experience, and press reports to date.

Typical weekly AdBlue consumption, costs and mileages; weekly fuel costs

Euro 4	Typical weekly mileage (miles)	Typical mpg (miles)	Weekly fuel consumption (litres)	Weekly fuel cost (£)	AdBlue % of fuel (%)	Weekly AdBlue consumption (litres)	Weekly AdBlue cost (£)	Standard AdBlue tank size (litres)	Miles per AdBlue tank (miles)
7.5 tonnes	500	18	126	101	3	4	1.6	26	3250
18 tonnes	1000	13	350	280	3	10	4.1	26	2725
3 axle rigid 26 tonnes	1000	10	455	364	4	18	7.0	45	2500
3 axle tractor 44 tonnes	2000	8	1135	908	4	45	17.6	45	2000
2 axle tractor 40 tonnes	2000	8.5	1070	856	4	43	16.8	75	3500

Assumptions:

Miles per gallon based on published road tests

Weekly fuel costs based on diesel price of £0.80 (excluding VAT) per litre

Weekly AdBlue costs based on price of £0.39 (excluding VAT) per litre



Based on the assumptions shown beneath the table, an average 7.5 tonner covering about 500 miles per week will consume in the order of 4 litres of AdBlue for an indicated cost of £1.60. Taking another example, a three axle tractor at 44 tonnes running 2,000 miles

a week will consume approximately 45 litres of AdBlue costing around £17.60. Comparing this with a fuel bill of about £908 shows that the relative cost of AdBlue is not that significant.

For Euro 5 vehicles, the AdBlue consumption will be about 50% greater, which will have a proportional effect on AdBlue costs and the range on each tank of AdBlue.



Did you know

A typical 18 tonner running from Land's End to John O'Groats will use just 8.6 litres of AdBlue at a total cost of £3.35.

But AdBlue is still an on-cost isn't it?

No. It's more than compensated for by the savings in fuel.

By using SCR technology with AdBlue, DAF have been able to improve the fuel economy which more than compensates for the cost of AdBlue. A fuel saving of 1.5% – 2.0% compensates for the cost of AdBlue and DAF's SCR engines can give up to 4% fuel savings over their Euro 3 predecessors.

Is this borne out in road tests?

Yes. By Commercial Motor.

A top-of-the-range Euro 4 XF105.510 operating at 44 tonnes was tested after an earlier group test of competitor Euro 4 models. The graph opposite shows the results and also compares them with Euro 3 models. As shown, the XF105, at 7.93 mpg achieved 4% better fuel consumption than the 'average', despite being the fastest and most powerful of the trucks tested. The driving conditions on the test were far from ideal and the Commercial Motor curtain side trailer is not the most aerodynamic so in Commercial Motor's words, 7.93 mpg 'is an impressive overall figure'.

In a later test by Motor Transport, the same truck achieved an astonishing 8.23 mpg.

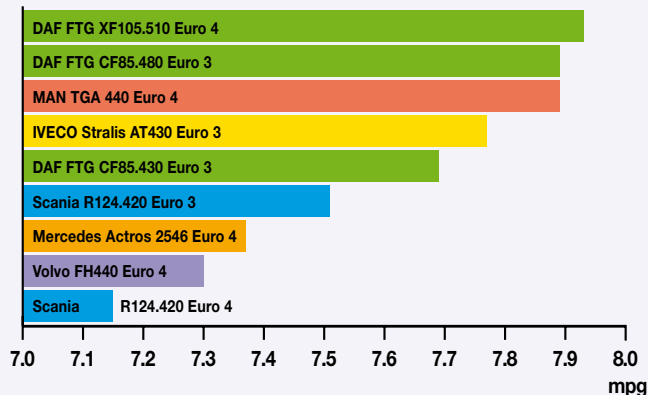


What was the AdBlue consumption?

The XF105 is the leader of the pack!

The Commercial Motor test route is around 460 miles and the AdBlue consumption was 9 litres. Using the average bulk price of 39 pence per litre, the cost is £3.51, in line with those shown in the table on pages 12-13.

Fuel Economy - Commercial Motor Road Tests



Did you know



A full 75 litre tank of AdBlue will last the average two axle tractor from London to Istanbul and back!

I've heard that if you run out of AdBlue you damage the engine. Is this right?

No. *There are no immediate harmful consequences to the vehicle.*

Lack of AdBlue will not damage the engine in the short term. In any event, just topping up with five litres of AdBlue would give the vehicle a range of 250/300 miles.

If you run out of AdBlue, are you running illegally?

Yes. *In the same way as if you run out of windscreen washer fluid.*

Exceeding maximum emissions, however, runs the same risk whether the system is SCR or EGR.

Is it true that if you run out of AdBlue, the engine shuts down?

No. *This is another misplaced concern.*

In fact, for vehicles registered from October 2007, legislation will take effect in which engine emissions are measured and if excess NO_x is detected for any reason (for, example if the vehicle is running out of AdBlue, or if there is a valve failure on an EGR engine), the engine's torque will be restricted to 60% of its peak level to encourage rectification. However, it will only happen after the driver information warning system has alerted the driver and the vehicle has come to a complete standstill. Even at 60% of peak torque, the vehicle will still normally reach its regulated road speed limit, albeit with less acceleration.



Did you know

All trucks entering Greater London will need to be at Euro 4 emission levels or cleaner for particulate matter, by 2012. A daily charge of £200 is currently proposed for non-compliant vehicles.

All right, but let's get back to the reason for limiting exhaust emissions. Isn't this just another example of Brussels bureaucracy?

No. *Far from it.*

The EU is at the forefront of the international efforts to reduce greenhouse gases and so limit global warming. The EU legislation addresses the noxious emissions from diesel engines of nitrogen oxides (NO_x) – a greenhouse gas and a source of acid rain – and 'particulate matter', an atmospheric pollutant. We should add here that 99.7% of diesel exhaust gases are 'clean': it's only the remaining 0.3% that are 'noxious.'



So why does SCR need AdBlue?

Selective Catalytic Reduction involves optimising the fuel injection timing so fuel burns more efficiently and particulate emissions are radically reduced. But at the resultant higher combustion temperatures, the levels of NO_x are increased so a catalytic converter is employed to reduce NO_x.

Before the exhaust gases actually reach the catalytic converter, AdBlue is injected in minute measured quantities into the exhaust system. In the heat of the exhaust stream, the AdBlue hydrolyses and ammonia molecules are released. The ammonia molecules and NO_x react in the catalyst, producing harmless nitrogen and water in the form of steam.

What are the benefits of SCR?

The two principal benefits of SCR are relatively longer service intervals plus better fuel economy.

SCR / AdBlue has significant advantages over the alternative strategy to meet Euro 4 emissions, EGR, in terms of cost of operation and the ability to meet Euro 5 emission levels today. With EGR, up to 30% of the engine's exhaust gas is recirculated into the combustion process. It reduces oxygen levels, cools the burn and therefore reduces NO_x. But it's hot, dirty air rather than cool, clean air and particulates still need to be removed by some form of particulate trap. The process can result in shorter service intervals which mean higher operating costs, plus a deterioration in fuel economy.



Did you know

Several manufacturers have given their reasons for choosing AdBlue / SCR in preference to EGR. Here's a quote from Cummins, one of the world's largest independent manufacturer of diesel engines:

'Based on our experience and our knowledge of the European market, Cummins knows that the advantages provided by using SCR technology far outweigh those of using EGR systems. Improved fuel economy, longer service intervals and higher vehicle uptime are why Cummins has chosen SCR to meet the Euro 4 and Euro 5 emissions standards.'

Volvo sells both SCR and EGR vehicles worldwide and clearly believes that SCR is the preferred solution for European operators. The company's approach is detailed in a brochure entitled 'Volvo knows all about EGR. That's why we recommend SCR'.

Are we making progress towards a cleaner environment?

The emphasis in the EU legislative schedule Euro 1 - 5, has been on the progressive reduction in noxious nitrous oxides and particulate matter. Legislators and manufacturers can be justifiably satisfied in the results that have been achieved. In the short period of time between the implementation of the first emissions standards, Euro 1, in 1993 and the Euro 5 vehicles available today, noxious nitrogen oxides have been reduced by 75% and particulates by 94%. SCR and AdBlue have played a significant role in this achievement.

Focus is now turning to the reduction of carbon dioxide emissions. It is an uncomfortable fact that every litre of diesel burnt translates into about 2.7 kg of carbon dioxide. Today's trucks have progressed rapidly. Comparing a 32 tonner in 1980 with a 44 tonne DAF XF105 now, the XF105 emits 40% less CO₂ per tonne of payload than its predecessor.

Further progress lies in reducing the actual number of litres of fuel consumed. The fuel efficiency of the vehicle has again made significant strides. To put this in context, an XF105 uses one tablespoon of fuel to move one tonne of payload a distance of one mile. Significant fuel savings are limited in the short term using current commercial technologies.

Fuel efficiencies can, however be achieved operationally. A correctly-specified vehicle with tyres at the correct pressure, running 100% full and driven correctly can make the largest contribution to the environment.

Returning to SCR / AdBlue trucks, they are the best-selling vehicles by far. Around 80% of the vehicles currently being put into operation are adopting the benefits of SCR / AdBlue. 22 million litres of AdBlue will be sold this year and the AdBlue infrastructure will develop rapidly as a result. This is good news for availability and the price of AdBlue as it becomes more widespread.

