

**EXPLANATORY MEMORANDUM TO
THE AGRICULTURAL OR FORESTRY TRACTORS (EMISSION OF
GASEOUS AND PARTICULATE POLLUTANTS) (AMENDMENT)
REGULATIONS 2006**

2006 No. 2393

1. This explanatory memorandum has been prepared by the Department for Transport and is laid before Parliament by Command of Her Majesty.

2. **Description**

These Regulations amend SI 2002/1891 of the Agricultural or Forestry Tractors (Emission of Gaseous and Particulate Pollutants) Regulations 2002 (“the principal Regulations”), to implement Directive 2005/13/EC, which sets revised emissions limits for tractor engines. They also make minor updating and presentational changes, to ensure clarity and consistency with related legislation.

3. **Matters of special interest to the Joint Committee on Statutory Instruments**

None.

4. **Legislative Background**

4.1 Directive 2000/25/EC, sets emissions standards for tractor engines, binding on all EU Member States. It makes compliance with these standards mandatory in order for a type of tractor to receive “type-approval”. Such an approval then allows any tractor conforming to the approved type to be placed on the market.

4.2 Directive 2000/25/EC also prohibits the entry in service of any tractor or tractor engine that does not comply with its requirements, whether or not the tractor or engine is subject to type-approval.

4.3 The type-approval requirements of Directive 2000/25/EC were transposed into UK law by the Tractor Etc (EC Type-Approval) Regulations 2005 (SI 2005/390). The principal Regulations transpose the requirements that apply regardless of whether the tractor or engine is subject to type approval requirements.

4.4 The latest amendments to Directive 2000/25/EC are set out in Directive 2005/13/EC. Tractor emission standards closely follow those on non-road mobile machinery (NRMM), established by Directive 1997/68/EC, last amended by 2004/26/EC. Directive 2005/13/EC on tractors closely follows the example set by Directive 1997/68/EC, and cross-refers to its emission limits.

4.5 The present Regulations are made under s2(2) of the European Communities Act 1972, which allows Community obligations and related matters to be implemented by statutory instrument.

5. Extent

This instrument extends to all of the United Kingdom.

6. European Convention on Human Rights

As the instrument is subject to the negative resolution procedure, and does not amend primary legislation, no statement is required.

7. Policy background

7.1 EC Directive 2000/25 prohibits the initial entry of service of tractor engines which do not meet specified emissions requirements. It sets out emissions standards, to be phased in two stages (I and II) from 30 June 2001 to December 2003. Directive 2005/13/EC introduces three further stages (IIIA, IIIB and IV) between 31 December 2005 and 30 September 2014. Engines that were made prior to the dates when new emission standards become effective may be sold up to two years after that date.

7.2 Directive 2005/13/EC also introduces a flexibility scheme, under which a limited number of engines that comply only with the emission limit value stage immediately preceding the currently applicable stage may be placed on the market. Finally, it provides that replacement engines only need to comply with the limit values that applied to the engine they replace when it was first entered into service.

7.3 The UK has the obligation, under EC law, to implement this Directive.

7.4 These Regulations amend only the domestic provisions that relate to then entry into service of all tractors. The type approval provisions of Directive 2005/13/EC will be implemented through an amendment to SI 2005/390.

7.5 The addition of the new emission stages has added some complexity to tractor emissions legislation. To improve clarity, we have therefore changed the structure of the table setting out the engine categories and effective dates.

7.6 Finally, we wish to clarify how the requirements relate separately to tractor engines and tractors. Directive 2000/25 makes this distinction, and introduction of the flexibility scheme makes it more important. The roles of the tractor manufacturer are set out separately from those of the engine manufacturer. Some obligations are defined with reference to engines and others to tractors. This has led to a redrafting of various provisions.

7.7 Consultation took place over 12 weeks, from 6 February to 28 April 2006. We consulted a wide range of stakeholders, including equipment

manufacturers, trade and agricultural associations. Of the 386 organisations contacted, 9 responded, and only two offered substantive comments. Neither opposed the policy or the way it was to be implemented. The first comment asked whether we would require in-service (MoT type) emissions testing. This is outside the scope of Directive 2005/13/EC which deals only with standards for new vehicle and not with ensuring good maintenance of engines of in-service tractors. Such measures are therefore outside the scope of these Regulations. The second comment asked whether similar regulations would cover railway engines. DfT confirmed that emissions from new railway engines had to comply with similar emission limits under the Non-Road Mobile Machinery (Emission of Gaseous and Particulate Pollutants) (Amendment) Regulations 2006 (SI 2006/29).

8. Impact

8.1 A full regulatory impact assessment of the effect that this instrument will have on the costs of business is attached to this memorandum.

8.2 There are no impacts on the public sector.

9. Contact

Tony Baker at the Department for Transport (tel: 020 7944 2063 or e-mail: TonyT.Baker@dft.gsi.gov.uk) can answer any queries regarding the instrument.

**REGULATORY IMPACT ASSESSMENT
NEW EMISSION STANDARDS FOR AGRICULTURAL AND FORESTRY
TRACTORS (EU DIRECTIVE 2005/13/EC)**

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1. TITLE OF PROPOSAL

The Agricultural or Forestry Tractors (Emission of Gaseous and Particulate Pollutants) (Amendment) Regulations 2006, implementing Directive 2005/13/EC of the European Parliament and of the Council concerning the emission of gaseous and particulate pollutants by engines intended to power agricultural or forestry tractors. Directive 2005/13/EC will also amend Annex I to Directive 2003/37/EC of the European Parliament, concerning type approval of agricultural or forestry tractors.

2. PURPOSE AND INTENDED EFFECT

2.1. The Objective

This proposal aims to reduce emissions of Oxides of Nitrogen (NO_x) and Particulate Matter (PM) from the engines of new diesel agricultural and forestry tractors and provide a single market for tractor engines. It will introduce further emission limits in three stages, which will apply to the whole of the UK.

2.2. Background

2.2.1 Air quality objectives

Clean air is essential for quality of life. European, international and national legislation set legally binding health and ecosystem based objectives that the UK and other countries have agreed to achieve.

Latest projections, which include already agreed measures, predict difficulties in achieving EU legally binding air quality objectives for concentrations of nitrogen dioxide (NO₂) and particles (PM₁₀) in various areas in the UK. The objective for ozone (O₃), of which NO_x is one of the two main precursors, is also unlikely to be met in a large part of England. 122 Local Authorities (LAs) in Great Britain have declared Air Quality Management Areas (AQMAs) for NO₂ and/or PM₁₀ and are implementing air quality action plans to pursue these objectives. Although tractor emissions are small when compared against emissions from transport they are not insignificant. As tighter emission standards take effect for road vehicles the relative significance of tractor emissions will increase unless further measures are taken to reduce them.

In addition to concentration based objectives, the UK is signed up to a legally binding ceiling on total annual emissions of NO_x (1167 kilotonnes to be achieved from 2010 onwards) under the EC National Emission Ceilings Directive. There is a significant risk that the UK will not meet its target. In addition the National Emission Ceilings Directive is likely to be reviewed in the near future. There is likely to be increasing pressure from Europe to agree further reductions in NO_x emissions to reduce the human health effects of NO₂, ozone and particles, and to reduce the environmental effects of nitrogen deposition.

2.2.2 EU & US Emissions Standards

EU Directive 2000/25/EC sets mandatory emissions standards which must be met by new agricultural tractor engines. This Directive was transposed into UK law by SI 2002/1891, "Agricultural or Forestry Tractors (Emission of Gaseous & Particulate Pollutants) Regulations 2002. It aligned diesel emission standards for tractors with non-road mobile machinery (bulldozers, excavators, forklift trucks, loading shovels, portable generator sets and portable air compressors) set by EU Directive 97/68/EC. Emission standards were tightened in two stages (I and II) between 31st December 2000 and 31st December 2002. They regulate the maximum allowable emissions of NO_x, PM, hydrocarbons (HC) and carbon monoxide (CO). Stage I is already in force for all engine categories and Stage II has now entered into force for almost all engines. Stage I & II are predicted to bring about major reductions (>50%) in emissions from this sector of machinery. Both Stages are aligned with US regulations, allowing manufacturers to sell the same products in both markets.

The regulations banned the initial entry into service of engines that did not meet emission standards on specific dates. However, Member States were allowed to postpone such dates by up to two years. The proposed draft regulations will impose new emission standards aligned with recently tightened limits for non-road mobile machinery (NRMM) in Directive 2004/26/EC which brings in tighter emission standards in three stages (IIIA, IIIB and IV) to be phased in between 31st December 2005 and September 2014. These standards are also aligned with recently introduced US Tier III & IV standards.

Harmonised standards allow off-road engine manufacturers to produce common products for use in NRMM and tractors in both EU and US markets. This is particularly important for this industry where product volumes are lower than in the on-road sector. It ensures that manufacturers have access to both markets and reduces the unit cost impact of complying with emissions standards.

We have explored ways of simplifying current legislation when transposing the new requirements. Our draft legislation therefore provides a consolidated table of emissions standards imposed by both the latest and earlier directives. These tables identify the limits that specific engines must meet, based on power output, their date of production and entry into service. This should significantly improve ease of reference, as details of current emission standards for earlier, current, future tractor models may be found in one document. However, the latest and earlier directives specify binding EU requirements, which must be implemented in UK law. There are no national tractor emissions requirements which could be relaxed or repealed. Consequently, no other simplification measures are possible.

2.3 Risk assessment

The proposed Stage IIIA, IIIB & IV standards reduce NO_x and PM emissions: the two main pollutants emitted by diesel engines of continued air quality concern.

2.3.1 Short term health effects

Air quality has serious implication for people's health. DoH's Committee on the Medical Effects of Air Pollutants (COMEAP) estimated the number of deaths and hospital admissions for respiratory diseases affected per year (in 1996) by PM₁₀, NO₂ and Ozone. They were:

PM ₁₀	Deaths brought forward: 8,100 (GB urban). Hospital admissions (respiratory) additional or brought forward: 10,500.
NO ₂ ¹	Hospital admissions (respiratory) additional or brought forward: 8,700.
Ozone ²	Death brought forward: between 700 and 12,500 depending on threshold for health effects.

Hospital admission (respiratory) additional or brought forward: between 500 and 9,900 depending on threshold for health effects.

COMEAP has also recently concluded that PM₁₀ may be associated with cardiovascular hospital admissions.

2.3.2 Long term/chronic health effects

Whilst emissions have decreased substantially since 1996, COMEAP have also said that long-term exposure to air pollutants is likely to damage health and reduce life expectancy. Such effects are not included in the above figures, however, when quantified they represent the majority of the health impacts attributed to air pollution and substantially increase the magnitude of the health effects of air pollution.

There is evidence from the United States that long term exposure to particulate air pollution is associated with a decrease in life expectancy. In addition, whereas acute effects are mainly experienced by the elderly and those in poor health, studies have shown that chronic effects can also be experienced by people in 'typical health' rather than particularly poor health, thus affecting a larger proportion of the population. In 2001 the COMEAP published a report on the long-term effects of particles on mortality

¹ The reliability of the estimate for NO₂ is much less certain and ought to be considered with care.

² Estimates for O₃ are presented as NO₂ is a precursor for O₃. It should be noted that a large component of O₃ has a transboundary nature. EU wide measures to reduce emissions of precursors, such as Euro standards, would eventually benefit the UK as well. Latest health studies indicate that no threshold might exist for O₃. If this is confirmed the top figure of the range given above will apply.

(Department of Health, 2001). COMEAP concluded that it was likely that long-term exposure to particles reduced life expectancy. Hence, since 2001 the Interdepartmental Group on Costs and Benefits and Air Quality (IGCB) has followed the COMEAP recommendation and quantifies the long-term mortality effects from reductions in PM₁₀ emissions in any benefits assessment³.

However, these health effects are due to emissions from all sources of which tractors are only a small part. Health evidence is not sufficiently definitive to judge exact health impacts from tractor emissions. Although tractors do not produce emissions in urban areas, they do contribute to background pollutant concentrations, increasing the risk of exceedances of air quality targets in urban areas. In addition, there are no threshold concentration levels below which PM₁₀ has no effect on health. Therefore reductions below air quality target values also deliver health benefits. Furthermore NO₂ is an ozone precursor and projected exceedances of ozone targets are widespread and are not limited to urban areas.

2.4 Main Provisions of the Proposal

Directive 2005/13/EC contains 3 stages of future emissions limits (Stage IIIA, IIIB & IV) applying to tractors already within the scope of Directive 2000/25/EC.

2.4.1 Stage IIIA

Stage IIIA will come into force in 2006-8, tightening NO_x limits by 30-40% relative to Stage II, but makes no reduction in particulate (PM) limits other than for the smallest engine category (18-37kW). Stage IIIA is aligned with US Tier III emissions limits, so would allow industry to offer a single product in US and EU markets. For small engines (37-75kW) the predicted technology required to meet these limits includes engine modifications, adoption of electronic engine control, improved fuel pumps and limited, uncooled Exhaust Gas Recirculation (EGR). For larger engines which already use electronic engine control, the technology predicted to be adopted includes engine modifications, common rail injection, air-air charge cooling and limited, uncooled EGR.

The standards proposed for the smallest engine category (18-37kW) are those set in US Tier II legislation. This broadly represents reductions of 20% in NO_x and 25% in PM relative to EU Stage II. Significant further reductions for the smallest engines are considered impractical, because adding after treatment devices would be disproportionately expensive and low power, frequently 2 cylinder engines cannot practically be turbocharged.

2.4.2 Stage IIIB

³ An Economic Analysis to inform the review of the Air Quality Strategy Objectives for Particles, A second report of the IGCB group, DEFRA, September 2001.

Stage IIIB will come into force in 2010-12 and tightens PM limits by around 90% relative to Stage II & III, but generally leaves other limits unchanged. It is expected that in addition to the technology described above, this would force the adoption of diesel particulate filters (DPFs) on tractors. To ensure reliable operation of DPFs fuel of 10 mg/kg sulphur (virtually 'sulphur free') would probably need to be adopted (tractors currently use gas oil which is regulated to 2000 mg/kg sulphur, falling to 1000 mg/kg from 2008).

DPFs have been developed successfully for the on-road sector and there has been some international experience of traps on non-road equipment. But further work will be required to develop DPFs suitable for all machinery types, including tractors.

2.4.3 Stage IV

Stage IV tightens NOx limits by 75% on >75kW engines and comes into force in 2013, this is expected to force the adoption of Selective Catalytic Reduction (SCR) de-NOx after treatment systems in addition to DPFs. These systems rely on adding urea to reduce the NOx over a catalyst. This presents a risk that users will not keep urea tanks filled up (tanks might need refilling once a month), meaning that NOx emissions could rise to the levels of a Stage IIIB engine.

2.4.4 Flexibility

Tractors include some specialised applications produced in extremely low volumes. Regular redesign of products which sell in very small numbers is prohibitively expensive. Flexibility provisions which allow engine manufacturers to sell a small number of old specification engines are included. This provides a supply of engines for low volume products allowing tractor manufacturers to delay redesign of such products.

2.4.5 Durability

The Directive also introduces emissions durability requirements for tractor engines, requiring manufacturers to demonstrate at the type approval stage that the emissions performance will be maintained across several thousand hours of operation. The exact procedures for demonstrating this are left at the discretion of the manufacturer and approval authority.

2.4.6 Transient Test Cycle

For Stage IIIB a new transient test cycle for particulate emissions testing is introduced (to reduce testing burden the same cycle may optionally be used for gaseous emission testing also). This cycle is intended to better represent the tractor operating conditions under which peak particulate emissions occur.

3. Consultation

3.1 Within Government

The Department for Transport have consulted widely within government during negotiation on the Directive, including DEFRA, DTI, Cabinet Office, FCO and the Devolved Administrations.

3.2 Public Consultation

The UK consulted a wide range of stakeholders, such as engine and equipment manufacturers, trade and agricultural associations, including the National Farmers' Union. No significant user comments were received during public consultation. Prior to consultation, manufacturers conveyed the view that achieving global harmonisation the most important issue for them. Manufacturers have stressed that the tractor industry has much lower design resource than the on-road sector and also much lower sales volumes to recover development costs. They therefore considered it essential to be able to develop a single product for EU & US markets and supported aligning EU with US-EPA standards.

4. OPTIONS

4.1 Identifying the Options

This is a "single-market" Directive setting mandatory requirements which the UK is obliged under EU law to implement. The intention of the Directive is to create uniform emission standards for tractor engines across the EC and therefore the options for implementation are very limited.

4.1.1 Option 1: Do nothing - do not enact the Directive in UK law.

4.1.2 Option 2: Implement the Directive by regulation.

5. COSTS & BENEFITS

5.1 Business sectors affected

The Directive primarily affects manufacturers of engines for tractors who will have to redesign engines to comply with the new standards. In addition tractor manufacturers will have to redesign their products to accommodate new engines, the physical dimensions and heat rejection requirements of which will have changed.

UK tractor manufacturers mostly rely on separate engine manufacturers to supply engines. The engine manufacturers obtain engine type approval, which the tractor manufacturer includes for whole vehicle certification. Therefore the directive affects both of these parties. One major UK manufacturer (Case New Holland) produces both engines and tractors. UK engine manufacturers affected are Cummins, JCB, Perkins and Case New

Holland. UK based tractor manufacturers affected are Case New Holland, McCormick, International, Trantor and JCB. Importers of tractors must also comply. The proposal will also affect manufacturers of fuel injection systems, turbochargers and exhaust after treatment equipment since these are key components in engine emissions control. The Directive will significantly affect purchasers of tractors and hence certain sectors in the agricultural industry. This is explained in more detail in section 5.3.2.

5.2 Benefits

5.2.1 Option 1

- Economic.

Doing nothing, (not implementing the Directive) would bring no economic benefit.

- Environmental.

This option would result in no environmental benefit and the current level of health impacts and associated costs would still be incurred.

- Social.

This option would result in no social benefit.

5.2.2 Option 2

- Economic

The Directive provides common EU standards and also maintains broad alignment with US emissions limits. Alignment of standards is the highest priority for manufacturers, they consider this to be essential for economic viability and future technological progress. It allows manufacturers to provide common products meeting a truly global market, across the UK, EU and USA for NRMM and tractor applications. Manufacturers benefit from lower costs and simplicity in organising development and production. This means larger sales volumes against which to recoup investment costs and economies of scale in component production cost. This is more crucial for tractors than for car and truck manufacture, where production and sales volumes tend to be much higher. UK companies specialising in catalytic after-treatment systems would have increased market opportunities beyond road vehicles. If tractor manufacturers had to produce separate products to meet non-aligned standards for the UK, Europe and the USA, then the costs to them would be far higher. Tractor manufacturers cannot give a figure on such costs, but they emphasised that developing separate products for different markets was not commercially viable. The cost, and complexity of redesigning machinery, and providing different components, tooling and extra technical support to meet different standards would deter most, if not all tractor manufacturers from setting up separate production lines. They would target countries with the best return, ignoring the others, leading to a confused and fragmented market.

- Environmental

The main purpose is to reduce NOx and PM emissions, to reduce health effects. Whilst agricultural equipment operates mostly outside areas of poor air quality, NOx and PM emissions are not purely a local problem and non-urban NRMM still contributes to background levels of pollution in areas of poor air quality.

Predicted annual emissions savings delivered by each Stage are given in Table 1 (these are cumulative rather than incremental savings for each Stage). Savings for each Stage are quoted relative to a 100% Stage II compliant fleet and are quoted for the year where each Stage reaches its maximum penetration into the fleet e.g. for Stage IIIA this will be when Stage IIIB enters into force, for Stage IV it will be the year by which the entire fleet is assumed to be Stage IV compliant. To give an indication of the significance of these savings they are also quoted as a percentage of UK total emissions against a 2002 baseline.

	Year	NOx (ktonnes)	PM (ktonnes)
Stage IIIA	2011	5.40 (0.3%)	0.1 (0.1%)
Stage IIIB	2014	9.56 (0.6%)	0.47 (0.3%)
Stage IV	2026	21.9 (1.4%)	1.29 (0.8%)

Chart 1: Annual emissions savings relative to a Stage II compliant fleet

A full analysis of monetary benefits from emissions reduction requires a detailed benefits assessment of air quality at a spatial level. This would identify the health and environmental benefits from improved air quality. It is not possible to perform this type of assessment due to lack of regional tractor activity data.

As an alternative, it is possible to make use of monetary estimates of damage costs per tonne for different pollutants and compare the costs with the damage costs saved by the new tractor emissions standards. Whilst this is less satisfactory than a detailed benefits assessment it is useful as a guide to the relative costs and benefits of the new standards.

Illustrative damage costs per tonne for PM₁₀ and NO_x have recently been estimated for transport. Since the vast majority of emissions from tractors occur outside of urban areas, the damage cost for PM₁₀ applicable to rural areas has been used. This is lower than the average damage cost and reflects the fact that lower population densities in rural areas mean that emissions of PM₁₀ there have lower health effects. These damage costs are presented in Chart 2. These are DEFRA's interim damage costs per tonne. Revised estimates will be published in the Air Quality Strategy Review later this year.

Damage costs per tonne from transport in 2010 ⁴		
Pollutant	£ per tonne (2005 prices)	
	Central Low	Central High
PM ₁₀ (rural value)	£4,246	£26,955
NO _x	£200	£1,267

Chart 2: Damage costs per tonne of pollutant [Source: AEA Technology (July 2004), provisional estimates, discounted values]

These damage costs are a subset of all the potential damages caused by PM₁₀ and NO_x emissions and are therefore likely to be underestimates of the real damage costs per tonne associated with these pollutants. Other caveats associated with these damage costs are detailed in Annex A. In addition, while this analysis focuses solely on costs and benefits to the UK from UK action, due to the trans-boundary nature of air pollution there would be additional air quality benefits to the UK from EU action.

- Social

This option would result in no social benefit.

5.3 Costs

5.3.1 Option 1

- Economic

By not implementing this Directive, the UK would incur various costs. It is a mandatory Directive which we are obliged to implement. Failure to do so would lead to infraction proceedings and ultimately fines being imposed by the European Court of Justice that would continue until the Directive becomes effective. Tractors are a small source of UK emissions in NO_x and PM. But added to overall emissions from all sources, it could contribute to breaching binding air quality standards. This could mean more ECJ fines.

Non-aligned standards would greatly impede fair competition by imposing barriers to the movement of goods in the single European and wider global market. This would considerably reduce the financial incentive for manufacturers to develop new tractors with improved emissions technology. It would greatly increase the complexity of tractor making, with separate products for different countries, meaning lower production and sales volumes for recouping costs

⁴ There are a number of important caveats to the damage cost figures that are summarised in Annex A. These need to be taken into account in the interpretation of the benefits. DEFRA's interim damage costs are inflated to 2005 prices and uprated by 2% a year to reflect increasing value of the damage over time.

Without controls on emission standards for new engines, old engines or those built for markets outside the EU or United States could be "dumped" on the UK market. This would place manufacturers building machinery with compliant engines at a competitive disadvantage. Should they respond by marketing machinery built to lower standards, they would incur additional costs of manufacturing machinery to two sets of standards (US/EU and UK/developing nations). Consequently the benefits of international harmonisation of emission standards results in lowering development and approval costs for engines, allowing manufacturers to spread development costs, would not be realised.

- Environmental

While there would be no direct cost of not implementing the Directive the UK would not benefit from the emissions reductions that would result from this measure.

- Social

There are no social costs involved in the UK not implementing this Directive.

5.3.2 Option 2

- Economic

During 2004, the latest year for which DVLA figures are available, there were 197,000 tractors registered in the UK. As this fleet is gradually replaced with new tractors meeting the new standards, there will be significant costs to agriculture. However, the impact will vary considerably between farming sectors where reliance on tractors differs widely. For the average farm, the extra costs of compliance with both NRMM and tractors directives will represent 0.2% of total costs. The cereals sector will be most affected with a cost increase of 0.3%. These estimates apply up to 2015 and incorporate Stages IIIA and IIIB, but exclude Stage IV. Pigs, poultry and horticulture sectors are much less reliant on NRMM and tractors and negligible cost increases are expected.

The agriculture industry may also face increased fuel costs (included in the above estimates) once Stage IIIB enters into force. Whilst Directive 2005/13/EC does not specify improved fuel quality, technology for Stage IIIB is predicted to require sulphur free fuel to operate reliably. The Commission have indicated that they will introduce a directive to mandate such fuel quality for non-road mobile machinery and tractors at a later date subject to the requirement for the fuel being confirmed. However, this will not apply until 2009 or later.

Under regulations being prepared, the oil industry is required to introduce sulphur free fuel for road use from 2006 with all road fuel having to comply from 2009. However, it seems unlikely that petroleum companies would switch any gas oil (used for industrial and space heating, NRMM and tractor

fuel, also known as 'red' diesel) to sulphur free, before the EU makes it compulsory or there is a significant demand from users, due to the increased costs of production. Since heating is estimated to represent two thirds of demand, and the molecules within gas oil are harder to desulphurise than those in road diesel, the oil industry is likely to continue to meet heating demand by supplying high sulphur gas oil. The sulphur content of gas oil is due to be reduced from a maximum of 2000ppm to 1000ppm in 2008, though that is not related to the tractor proposals. Given the increased difficulty in desulphurising gas oil and the fact that the UK is a net importer of diesel, demand for sulphur free tractor fuel is most likely to be met by importing sulphur free diesel. It is extremely unlikely that all gas oil supply (including heating oil) would be switched to sulphur free since this would be much more costly than supplying 1000ppm sulphur gas oil for heating and sulphur free diesel for tractors.

The additional cost of using sulphur free gas oil is difficult to predict and will be determined by a variety of variable factors. The difference in current trading prices of road fuel and gas oil imply a cost increase of around 1.4p/l, but where ultra-low sulphur gas oil is supplied at present, it costs around 3p/l more than standard gas oil. If demand for sulphur free is low (e.g. only from users of new machinery), this might mean higher distribution costs in supplying an extra grade of fuel in relatively low volumes, making increases closer to the 3p/l level. However, if demand is high (e.g. the Commission mandates sulphur free tractor fuel or when penetration of Stage IIIB or IV tractors into the fleet is high), the cost increase is likely to be closer to the 1.4p/l level. The range of total annual additional fuel costs are presented in chart 3, using 1.4 - 3p/l unit cost increases. These increase until 2022 as tractors meeting the new standards form a larger part of the fleet over time.

	Total additional fuel cost per annum (£million 2005 prices)⁵
2010	£0m
2015	£9m - £12m
2020	£18m - £24m

Chart 3: Total additional fuel cost per annum by agrarian sector (DfT)

Additional storage costs will be incurred provided cheaper high sulphur gas oil continues to be available for heating. Gas oil for non-road use qualifies for the rebated excise duty level, regardless of sulphur content, provided it is supplied with the prescribed fiscal markers. Businesses in the supply chain might bear additional costs for installing new storage tanks to separate sulphur free tractor fuel and high sulphur heating gas oil or (in the case of duty suspended installations) for installing facilities to inject the prescribed fiscal marker into road quality diesel as it is transferred to road tankers. Farmers may also face a decision on whether to acquire separate storage tanks for sulphur free fuel for tractors and NRMM, whilst retaining existing tanks to use higher sulphur gas oil for heating. No data is available on the use of gas oil for

⁵ These additional fuel costs include a 2% fuel economy penalty which may result from the additional technology

heating purposes within agriculture, but NFU advise that they believe its use to be minimal outside of the horticulture sector. Tractor use in the horticulture sector is low and is predominantly of smaller tractors to which Stage IIB, and therefore the requirement for sulphur free fuel, does not apply. If a farmer switched entirely to sulphur free fuel, new tanks would not be needed. His existing tanks could store that fuel, after being emptied and cleaned. If a farmer uses both fuels (and we do not believe this to be common) and did not wish to use expensive sulphur free fuel for heating, then an extra tank to store sulphur free gas oil would be needed. The costs of new tanks to store non-road mobile machinery fuel in the agricultural and other sectors have already been accounted for in the NRMM Regulatory Impact Assessment. A new tank's cost varies from £1058 (5000 litres) to £1665 (10,000 litres). Separate tanks should not be needed to store fuel just to power tractors.

The marking of fuel to indicate that the lower rate of duty has been paid takes place under duty suspension at refineries and import terminals; in addition, where HMRC are satisfied that there is a legitimate business need, and that appropriate controls are in place, distribution terminals may be approved as remote marking premises, allowing duty paid road fuel to be marked and the rebate to be reclaimed as an offset against duty due. Duty suspended installations and remote marking premises might therefore need additional storage tanks to stock two grades of rebated gas oil. However there may be circumstances in which HMRC would be prepared to permit the markers to be added when fuel is loaded into tankers. This could reduce the need for additional tankage for sulphur free gas oil, but there would still be a cost in upgrading loading facilities. Upgrading loading facilities at major distribution terminals would cost the petrochemical industry around £10m.

Marking of gas oil after the duty point by anyone other than the person who paid the duty is not permitted. Permitting downstream distributors to mark fuel would make enforcement of the duty regime far more difficult, with many more firms for HMRC to monitor, and the risk of fraud would rise sharply. If distributors with own storage intended to stock both sulphur free gas oil and high sulphur gas oil, they would therefore have to purchase additional storage tanks, which range widely in cost from £10,000 to £200,000, depending on their size. It should be noted that the effect of these costs in the distribution chain are included in the range of unit cost increases used for sulphur free gas oil.

5.3.2.1 Tractor unit costs increases

UK manufacturers of diesel engines and machinery for tractors might face increased costs in producing emissions compliant machines. These costs may be passed on to end-users. However, at this stage it is difficult to quantify what these costs might be. As mentioned in section 5.2.2, such costs could be offset by economies of scale from long production runs, as manufacturers develop new models to meet a single standard for three markets, rather than separate ones. Agriculture will be the main user group affected.

There is much uncertainty in estimating the costs of future emissions limits, especially where these would require technology which is yet to be mass produced, such as particulate traps and de-NOx after treatment systems. Available figures on likely costs of these after treatment systems vary greatly, but costs of particulate and de-NOx after treatment systems are expected to be of a similar magnitude. A very rough estimate of £920 per system has been used for 75-130kW engines, as most new tractors fall in this power band. There might be some cost reduction for smaller engines and increases for larger engines. This estimate assumes reasonable optimism in cost reductions from mass production. The following figures are only as a rough estimate and are very sensitive to input assumptions. The average cost of a new tractor is currently £35,000. Increased costs per tractor are estimated to be £440 at Stage IIIA, £1400 at Stage IIIB and £2360 at Stage IV. Annualised costs over the useful lifetime of a tractor are roughly £55 (0.2%) for Stage IIIA, £174 (0.5%) for Stage IIIB and £295 (0.84%) for Stage IV. The estimated total annual cost increases to UK tractor purchasers are given in Chart 4.

2006	2007	2008	2009	2010	2011	2012	2013
£0.6m	£1.2m	£1.9m	£2.5m	£3.1m	£6.2m	£9.3m	£12m

2014	2015	2016	2017	2018	2019	2020	2021
£17m	£21m	£26m	£30m	£33m	£37m	£41m	£45m

2022	2023	2024	2025	2026
£46m	£48m	£49m	£49m	£49m

Chart 4: Total annual cost increase relative to Stage II [DfT estimate]

- Environmental

The adoption of particulate trap technology, likely to be required to meet the Stage IIIB limits may result in poorer fuel economy of engines and therefore higher CO₂ emissions, but this is only likely to be in the order of 2%. This corresponds to a total annual increase in carbon emissions of 0.01-0.02 Mtonnes, although as with estimates of total tractor fuel consumption there is a great deal of uncertainty over this estimate. This equates to a social cost of around £1m a year in 2015 rising to £2m a year in 2020.

- Social

There is no additional social cost associated with this Directive.

5.4 Cost Effectiveness

The following cost effectiveness figures are calculated using annualised additional technology costs, redesign costs and additional fuel costs. These costs are divided by the lifetime emissions savings from a compliant fleet of machinery.

	NOx (£/tonne)	PM (£/tonne)
Stage IIIA – 2011	£700	£29,100
Stage IIIB – 2014 excluding fuel related costs	£700	£8400
Stage IIIB - 2014 including fuel related costs	£700	£28,300
Stage IV – 2026 excluding fuel related costs	£1000	£11,100
Stage IV - 2026 including fuel related costs	£1000	£28,300

Chart 5: Estimated cost effectiveness for tractors at each Stage [DfT estimate]

As indicated earlier, we have monetary estimates of damage costs per tonne for NO_x and PM₁₀ (as set out in section 4) and we can compare these with the estimates of costs of abating a tonne of pollutant. This is not intended to replace a detailed benefits assessment but is useful as a guide to the relative costs and benefits of the emissions standards set out in section 5. On this basis, the estimates for cost per tonne for NO_x are within the range of the damage costs per tonne, and the estimates of cost per tonne for PM are very close to the range. As the damage cost per tonne only cover certain health effects, and there are other important environmental effects, the proposal's costs are probably justified by the benefits. Actual damage costs for NO_x especially are likely to be higher than those in 5.2.2 if all the adverse effects could be quantified making the justification for tighter standards stronger. Furthermore, the UK is subject to legally binding total NO_x emission ceiling (currently under review).

Broadly speaking, the tractors' directive compares favourably with other schemes for reducing emissions, as the chart 6 below shows.

MEASURE	NO _x	PM
TRACTORS' DIRECTIVE (INCLUDING FUEL RELATED COSTS)		
Stage IIIA	£700	£29,100
Stage IIIB	£700	£28,300
Stage IV	£1000	£28,300
TRANSPORT MEASURES - AIR QUALITY		
Tighter road vehicle emissions standards (Euro V/VI) scenario B - 20-50% reduction in NO _x from all diesel vehicles, diesel particulate traps on all diesel cars.	£5900 or less	£29,747 or less
Tighter road vehicle emissions standards (Euro V/VI) scenario G - 69% reduction in NO _x from all diesel cars, LGVs, 50% reduction in NO _x from HDVs, diesel particulate filters on all diesel vehicles.	£7281 for LGVs (but could be higher)	£29,747

MEASURE	NO _x	PM
ELECTRICITY SUPPLY INDUSTRY MEASURES - AIR QUALITY		
Domestic combustion: 100% switch from coal to natural gas.	£2870	£6340 - £26,344
Selective catalytic reduction (SCR) for NO _x reductions on iron & steel plant, public power stations, petroleum refining	£2447 - £9056 (depending on the sector)	

Domestic combustion: 100% switch from coal to solid smokeless fuels		£10,384
Industry - low cost filters for small processes		£12,000 - £25,000

Chart 6: costs per tonne in reducing NOx and PM [DfT and DEFRA estimates]

6. Small firms' impact test

As Directive 2005/13/EC reflects mandatory European Commission levels on emission standards, there is no scope for an opt-out. Enterprises most likely to be affected by the regulations are manufacturers of tractors and their engines, but they are large firms. There are uncertainties in assessing the impact on small farmers. Tractor manufacturers have yet to decide whether to pass on the cost of product development to their customers. But these costs might be off-set by economies of scale in making products that meet similar standards for three different markets. Small farmers should not be disproportionately affected, as they are likely to buy fewer tractors, use them longer and consume less fuel. It seems likely that very small farms would hire machines rather than purchase them, so would be unlikely to incur any direct costs of significance from these regulations.

7. Competition assessment

This Directive affects the UK diesel tractor engine market. Stage IIIB and IV will create a market for off-road diesel after treatment systems. It should not have a major impact on competition despite these markets being dominated by a small number of large manufacturers. The cost impact is expected to be similar across all firms and the proposal is unlikely to affect market structure. The proposal will not create higher costs for new manufacturers than for existing manufacturers. However set up costs in diesel engine manufacturing are high which tends to discourage new entrants to the market. The tractor engine market is not characterised by rapid technological change. Generally, changes tend to be in response to legislation. Although the Directive will not restrict the range of products offered by engine manufacturers it could adversely affect the range of machinery produced by equipment manufacturers if redesign cost for niche products are too high. However, flexibility arrangements in the Directive are designed to address this issue so restriction in product range should not be a problem.

8. Enforcement and sanctions

The Agricultural or Forestry Tractors (Emission of Gaseous & Particulate Pollutants) Regulations 2002 are already enforced in the UK by the Vehicle Certification Agency. Enforcement is by means of the type approval regime. Before new models of tractors can enter service, they must be type approved, to demonstrate compliance with regulatory requirements. This will include checking that they are approved to the relevant pollutant emission limits. There are no requirements for enforcement visits to farms. This proposal does not change the sanctions for non-compliance.

9. Summary and Recommendation

Option	Total cost per annum Economic, environmental, social	Total benefit per annum Economic, environmental, social
1. Do nothing - do not enact the Directive in UK law.	Infraction costs, daily fine level unknown	None
2. Transpose Directive by UK Regulation	Annualised annual average costs from 2006 to 2026 are £10.8m. But actual costs will start at £0.6m in 2006, rising annually, reaching a total of £48.8m in 2026. Thereafter, costs will remain constant.	21.9ktonnes reduction in annual NO _x emissions 1.29ktonnes annual reduction in PM emissions. [see chart 1]

It is recommended that the Directive is transposed into UK regulation. This will benefit engine and equipment manufacturers by ensuring continued alignment of Non-Road emissions legislation with US requirements. In addition it will deliver useful emissions benefits assisting UK in meeting air quality targets and reducing the adverse effects of air pollution on public health. The costs of implementing the directive compare favourably with the monetised health benefits implied by the estimated emissions savings.

10. Ministerial Declaration

I have read the Regulatory Impact Assessment and I am satisfied that the benefits justify the costs

Signature: G Merron

Date: 5 September 2006

Parliamentary Under Secretary of State
Department for Transport

11. Contact Details

Comments or enquiries regarding this RIA should be directed to;

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NOTES ON USE OF ENVIRONMENTAL DAMAGE COSTS

The values presented in Section 5.22 of the RIA show the environmental costs per tonne of emissions. A central low and central high value is provided. The range refers to a restricted central range, based only on different analysis (of impacts and valuation) for two key health endpoints (acute and chronic mortality). All values are consistent with the analysis within DEFRA report, entitled 'An Evaluation of the Air Quality Strategy' – January 2005.

Important Caveats

The following notes should be attached to any use of the values:

1. Numbers only include costs that occur in the UK - all trans-boundary pollution and impacts are excluded.
2. Values for NO_x and SO₂ include secondary particulate (PM₁₀) formation (nitrates and sulphates).
3. Values for VOC include ozone formation and effects.
4. Values for NO_x do NOT include ozone formation and effects.
5. The analysis assumes no threshold of effects.
6. Future life years lost have been discounted using agreed 1.5% discount rate
7. Central low assumes £3100 for death brought forward and £31500 per life year lost, with future life years discounted (1.5%).
8. Central high assumes £110000 for death brought forward and £65000 per life year lost, with future life years discounted (1.5%)
9. All chronic mortality impacts use original PM_{2.5} functions for PM₁₀ pollution data.
10. External costs of air pollution vary according to a variety of environmental factors, including overall levels of pollution, geographic location of emission sources, height of emission source, local and regional population density, meteorology and so on. These numbers take these issues into account to a certain degree only.
11. The numbers exclude several categories of impact. They are therefore a sub-total of overall costs. The key areas excluded are:

- Effects of NO_x on ozone formation (note: ozone effects from NO_x could be positive as well as negative, due to issues with local NO + ozone reactions, and regional precursor levels).
- Effects on ecosystems (acidification, eutrophication, etc).
- Effects on cultural or historic buildings from air pollution.
- Chronic mortality health effects from PM₁₀ on children.
- Chronic morbidity health effects from PM₁₀.
- Morbidity and mortality health effects from chronic (long-term) exposure to ozone.
- Change in visibility (visual range).
- Effects of ozone on materials, particularly rubber.
- Non-ozone effects on agriculture.

IMPLEMENTATION AND DELIVERY PLAN

How will success be measured?

1. Our objective is to meet the European Commission's latest emission standards for tractors as set out by Directive 2005/13/EC. The desired outcome is to significantly emissions of oxides of nitrogen and particulates from new diesel tractor engines, while contribution to single market standards. Success will be reflected by the extent to which:
 - Engine manufacturers are able to meet tightened emission standards in three stages from 2006 to 2013:
 - The Vehicle Certification Agency is capable of enforcing the new standards at the type approval stage, prior to new models of tractors being placed on the market.

Key milestones with dates for implementation

2. Implementation will be carried out through transposition of Directives 2005/13/EC into the Agricultural or Forestry Tractors (Emission of Gaseous and Particulate Pollutants) (Amendment) Regulations 2006. A draft Statutory Instrument has been prepared and should come into force by October 2006. Engines entering service will need to meet specific emissions standards (Stage IIIA, IIIB or IV), by certain dates, depending on when it was produced and its power output. These dates are shown in the following table:

POWER IN KW	PRODUCTION DATE	DATE OF INITIAL ENTRY INTO SERVICE	ENGINE GROUP & EMISSIONS STAGE
130 ≤P ≤560	On or before 30/12/05	31/12/07 to 30/12/12	H (Stage IIIA)
	31/12/05 to 30/12/10	31/12/05 to 30/12/12	H (Stage IIIA)
	On or before 30/12/10	31/12/12 to 30/12/15	L (Stage IIIB)
	31/12/10 to 30/12/13	31/12/10 to 30/12/15	L (Stage IIIB)
	On or before 30/12/13	31/12/15 onwards	Q (Stage IV)
	31/12/13 onwards	31/12/13 onwards	Q (Stage IV)
75 ≤P <130	On or before 30/12/06	31/12/08 to 30/12/13	I (Stage IIIA)
	31/12/06 to 30/12/11	31/12/06 to 30/12/13	I (Stage IIIA)
	On or before 30/12/11	31/12/13 to 29/09/16	M (Stage IIIB)
	31/12/11 to 29/09/14	31/12/11 to 29/09/16	M (Stage IIIB)
	On or before 29/09/14	30/09/16 onwards	R (Stage IV)
	30/09/14 onwards	30/09/14 onwards	R (Stage IV)
56≤P <75	On or before 30/12/07	31/12/09 to 30/12/13	J (Stage IIIA)
	31/12/07 to 30/12/11	31/12/07 to 30/12/13	J (Stage IIIA)
	On or before 30/12/11	31/12/13 to 29/09/16	N (Stage IIIB)
	31/12/11 to 29/09/14	31/12/11 to 29/09/16	N (Stage IIIB)
	On or before 29/09/14	30/09/16 onwards	R (Stage IV)
	30/09/14 onwards	30/09/14 onwards	R (Stage IV)

POWER IN KW	PRODUCTION DATE	DATE OF INITIAL ENTRY INTO SERVICE	ENGINE GROUP & EMISSIONS STAGE
37 ≤P <56	On or before 30/12/07	31/12/09 to 30/12/14	J (Stage IIIA)
	31/12/07 to 30/12/12	31/12/07 to 30/12/14	J (Stage IIIA)
	On or before 30/12/12	31/12/14 onwards	P (Stage IIIB)
	31/12/12 onwards	31/12/12 onwards	P (Stage IIIB)
19 ≤P <37	On or before 30/12/06	31/12/08 onwards	K (Stage IIIA)
	31/12/06 onwards	30/12/06 onwards	K (Stage IIIA)

Risk assessment and management

3. There are no risks foreseen in transposing Directive 2005/13/EC, as industry is aware of their content and is already up-to-speed in making the necessary engineering changes to products in order to comply.

Who will implement and deliver the initiative?

4. The Vehicle Certification Agency will implement the Directives as part of the mechanism for type-approving new heavy-duty vehicles.

ANNEX 3

POST IMPLEMENTATION REVIEW

1. Verification that the requirements of Directives 2005/13/EC are being met by tractors entering into service on the UK farms roads will be carried out by the Vehicle Certification Agency and other EU certification agencies by checks on a manufacturer's Conformity of Production (COP).

TRANSPOSITION NOTE

COMMISSION DIRECTIVE 2005/13/EC of 21 February 2005 amending Directive 2000/25/EC of the European Parliament and of the Council concerning the emission of gaseous and particulate pollutants by engines intended to power agricultural or forestry tractors, and amending Annex I to Directive 2003/37/EC of the European Parliament and of the Council concerning the type approval of agricultural or forestry tractors			
Article	Objectives	Implementation	Responsibility
Articles 1(1) and 1(2)	Create a derogation for replacement engines, which will only need to comply with the limit values that the engine to be replaced has to meet when originally placed on the market.	These provisions are implemented by regulation 5 of the Agricultural or Forestry Tractors (Emission of Gaseous and Particulate Pollutants) (Amendment) Regulations 2006.	The Secretary of State
Article 1 (3) and Annex II	Create a "flexibility scheme" under which manufacturers may sell a limited number of engines which only meet the stage of emission limits prior to the latest one. This is to support the continued production of niche market tractors which it would be uneconomic to redesign to accommodate a new engine every time a new emissions stage enters into force. Number of engines allowed to be sold will either be 20% of their annual tractor sales by power output or a fixed number.	This provision is implemented by regulations 4 and 8 of the Agricultural or Forestry Tractors (Emission of Gaseous and Particulate Pollutants) (Amendment) Regulations 2006.	The Secretary of State
Article 1(4)(b)	Imposes further emissions requirements on tractor engines and tractors.	This provision is implemented by regulations 5 and 6 of the Agricultural or Forestry Tractors (Emission of Gaseous and Particulate Pollutants) (Amendment) Regulations 2006.	The Secretary of State
Articles 1(4)(c) and 1(4)(d)	Allow member States to postpone the dates of application of the emissions requirements for two years for certain categories of engines.	This provision is implemented by regulation 6 of the Agricultural or Forestry Tractors (Emission of Gaseous and Particulate Pollutants) (Amendment) Regulations 2006.	The Secretary of State
Article 1(4)(d)	Requires member States to allow special marking and labelling for types or engine families meeting the emission requirements before the required date	This provision requires no particular implementation, since nothing in UK law prevents such special marking or labelling from being used for that purpose.	The Secretary of State

The Table above only relates to the implementation of the provisions of the Directive that apply regardless of whether the tractor or engine is subject to type approval or not. The other provisions will be implemented at a later date.