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Accompanying document to the

Proposal for a

DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

amending Directive 2000/25/EC as regards the application of emission stages to narrow-track tractors

Impact Assessment

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This report commits only the Commission's services involved in its preparation and does not prejudge the final form of any decision to be taken by the Commission

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1. PROCEDURAL ISSUES AND POSITIONS FROM CONSULTATION OF INTERESTED PARTIES

1.1. Introduction

This report provides an assessment of the impact of pollutant emission requirements on a specific type of agricultural tractor, generally called the narrow-track tractor (NTT)[1]. NTTs exist in three categories: T2, C2 and T4.1[2], as defined in the Framework Directive on the type-approval of tractors[3]. These tractors are specially designed to meet the specific terrain and layout characteristics of vineyards and orchards in Europe and, as a consequence, are almost solely produced and used in Europe. Their specific design - which makes them suitable for use in narrow rows in vineyards and orchards - creates particular engineering constraints, mainly dimensional, for integrating new technology while meeting customer requirements.

Pollutant emissions, such as carbon monoxide (CO)[4], hydrocarbons (HC), nitrogen oxides (NOx) and particulate matter (PM) from tractors, including NTTs, are regulated by Directive 2000/25/EC[5]. This Directive was amended by Directive 2005/13/EC[6] that introduced the currently applicable level of emission limits, called Stage IIIA. It also defined the more stringent Stage IIIB and Stage IV limits that will enter into force progressively, depending on the engine power category.[7]

Article 4.8 of the amended Directive points to the particular needs of narrow-track tractors and tasks the Commission with reviewing and potentially revising the foreseen emission limits requirements in accordance with these needs. The current impact assessment (IA) is part of the implementation by the Commission of this legal requirement.

It is considered that this IA concerns a 'narrow' legislative action, as defined in Section 3.3.1 of the European Commission Impact Assessment Guidelines of 15 January 2009[8].

1.2. Organisation of the impact assessment

The current initiative is mentioned in the Commission's Work Programme under the reference 2010/ENTR/011. Directive 2000/25/EC on tractor emissions, including its revisions, makes extensive reference to Directive 97/68/EC on emissions of non-road mobile machinery (NRMM). Due to the significant overlap between the two legislative

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1 See Annex V for examples of narrow tractors.

2 T4.1 tractors strictly speaking are not narrow-track tractors but high-clearance tractors, riding above the vines during work; they have the same constructional limitations and problems as the other 2 categories.

3 Directive 2003/37/EC

4 Additional information on abbreviations used is available in the Glossary in Annex I.

5 OJ L 173, 12.7.2000, p.1.

6 OJ L 55, 1.3.2005, p.35.

7 See Annex III, for a detailed table

8 http://ec.europa.eu/governance/impact/commission_guidelines/docs/iag_2009_en.pdf

acts, the technical review (see supporting studies in section 1.4 below) on both legislative acts was carried out jointly. The review identified a need for action in three areas:

– the need for additional flexibilities for NRMM;

– the need for additional flexibilities for tractors;

– the particular difficulties for NTTs to meet the emission requirements.

The first two areas have already been subject to an Impact Assessment and legislative proposals are currently in preparation. This report concerns the third area.

The present Impact Assessment was led by DG Enterprise and Industry and carried out between 21 January 2010 and 21 September 2010. For the purposes of this IA, an Impact Assessment Steering Group (IASG) was created involving the Secretariat-General (SG), the Legal Service, DG Environment (ENV), DG Mobility and Transport (MOVE), DG Economic and Financial Affairs (ECFIN), DG Employment, DG Trade and DG Agriculture. The IASG met twice on 22 July 2010 and 21 September 2010. The SG, MOVE, ENV and ECFIN contributed to the IA either through participation in these meetings or via written contributions. As significant analysis of the issue had already been performed in previous studies (see section 1.4 below), two IASG meetings were deemed sufficient. The suggestions of the IASG group have been incorporated in the IA.

1.3. Impact Assessment Board

A draft Impact Assessment Report was presented on 20 October 2010 to the Impact Assessment Board. Further to that meeting, the following improvements have been integrated to the report as requested in the opinion of the Board:

– the reasons for unavailability of compliant NTTs were clarified (in Chapter 2)

– further explanations on the flexibility scheme have been added (in Chapter 2)

– the technological issues have been elaborated in more detail (in Chapter 2)

– the baseline scenario and assessment of impacts have been clarified (in Chapter 5)

– more detailed treatment of health impacts and the transition to Stage IV have been added (in Chapter 5).

In addition, several other minor improvements were made, based on technical comments received from the Board.

1.4. Relevant scientific studies

The impact assessment is based on a number of scientific studies[9]. These were carried out to investigate many different topics, covering NRMM and all types of tractors, as well as the specific needs of NTTs. The three studies are:

– A Technical Review[10] by the Joint Research Centre (JRC), September 2008, which includes, inter alia, a specific evaluation on NTTs. For NTTs, the study confirmed the severe technical difficulties of meeting Stage IIIB and IV requirements. Hence, the impacts of exempting NTTs and delaying both stages by 5 years were analysed.

– An Impact Assessment study[11] by ARCADIS, January 2009, to assess the impacts of the policy options as defined in the Technical Review of JRC. For NTTs, the study analysed the impacts of three policy options: no change policy option, a 5-year delay in implementation and an exemption from the emission requirements. The 5-year delay came out clearly as the preferred option.

– An additional SME Test study[12], March 2010. For NTTs, detailed information was obtained for the professional users of NTTs in the agricultural sector and for manufacturers of a specific type of NTTs (high-clearance tractors). The study confirmed the substantial difficulties these businesses would face if the emission requirements would not be changed, including details on the length of homologation procedures.

1.5. Consultation of stakeholders

For the assessment of some of the requirements of the tractors and NRMM emissions Directives, the Commission's services carried out between May and June 2009 an in depth consultation with Member States' authorities and other stakeholders (industry, environmental organisations, workers associations)[13]. In addition to two meetings of the Working Group on Agricultural Tractors (WGAT), composed of representatives of Member States and other stakeholders advising the Commission on tractors-related issues[14], additional meetings were organised with the Committee for European Construction Equipment (CECE) and the Committee for European Agricultural machinery

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9 All studies can be found on the Europa website: http://ec.europa.eu/enterprise/sectors/mechanical/non-road-mobile-machinery/publications-studies/index_en.htm

10 The final report of the Technical Review is available on the NRMM web page at the Europa website http://ec.europa.eu/enterprise/sectors/mechanical/files/nrmm/final_report_nrmm_review_part_ii_en.pdf.

11 The final report is available on the Europa website: http://ec.europa.eu/enterprise/sectors/mechanical/files/nrmm/ia_study_on_nrmm-_final_report_-_arcadis_en.pdf. The parts of the study relevant for this IA have been included in Annex IX.

12 The final report is available on the Europa website: http://ec.europa.eu/enterprise/sectors/mechanical/files/nrmm/final_report_sme_test_nrmm_2010_03_29_en.pdf. The parts of the study relevant for this IA have been included in Annex X.

13 Summarised information on the contributions of the public consultation on this proposal may be found in Annex V

14 See Annex VII.

Manufacturers (CEMA). On 17 July 2009 a consultation was held with the Expert Group on Emissions of NRMM.

An additional meeting with industry representatives was organised on 2 September 2010 with a view to obtaining additional information on the state of preparedness of the industrial actors to meet Stage IIIB and Stage IV emission requirements.

The positions of different stakeholders can be briefly described as follows:

– manufacturers of narrow tractors have clearly stated since 2005 that there are severe technical difficulties for NTTs in meeting the emission requirements. They initially called for an exemption and later for a 5-year delay of Stages IIIB and IV.

– manufacturers of engines and after-treatment devices have only recently presented new technological concepts that could be developed into solutions for NTTs.

– also, several Member States (Italy, Austria, France, Spain, Greece, Finland Sweden, the Netherlands) have recognised the problem and asked the Commission to take the necessary action in order to avoid severe negative consequences for the sector.

Also consumer organisation BEUC, representatives of agricultural and rural contractors, the association of clean fuels (IANGV) and that of catalysts manufacturers (AECC) were invited. No reaction from environmental organisations was received.

A summary of the positions expressed by the various stakeholders in those meetings can be found in Annex V**.**

2. BACKGROUND, PROBLEM DEFINITION AND SUBSIDIARITY

2.1. Policy Context

The tractors emissions Directive 2000/25/EC[15] was adopted by the European Parliament and the Council in 2000 and amended in 2005 by Directive 2005/13/EC. Both acts defined the pollutant emission limits and their mandatory introduction dates based on the scientific knowledge available at that time.

The Directive covers all categories of agricultural and forestry tractors (hereafter: tractors), including the NTTs described above. The required emission limits are based upon those contained in Directive 97/68/EC, which covers emission limits for *non-road mobile machinery* (NRMM) because engines used for these two applications are of a similar technical nature, and it is logical that their emission requirements should be aligned to allow interchangeability between engine designs used for NRRM and tractor applications.

For all types of tractors, the Directive stipulates the maximum permitted engine exhaust emissions as a function of the power of the installed engine. Moreover, the Directive includes a series of emission limit stages of increasing stringency with corresponding

[15] OJ L 173, 12.7.2000, p.1.

compliance dates[16]. Tractor manufacturers must ensure that new engines used in their tractors comply with these limits when placing them on the market. The reductions in PM and NO_x emissions resulting from stricter emission limits are significant and come in addition to those obtained with the previous Stages. For PM, a reduction by 88 to 94 % is required for the transition from Stage IIIA to Stage IIIB; for NO_x similar reductions are required for the transition from Stage IIIB to Stage IV (as can be seen in the last table of Annex III**)**.

Stage IIIA emission requirements have been applicable to NTTs since 1 January 2008. The implementation dates currently defined concerning the placing on the market of NTTs for the relevant engine categories are as set out in the table below. New type-approvals of NTTs need to comply with the new stages one year ahead of these dates.

Engine power	**Implementation date** (Stage IIIB)	**Implementation date** (Stage IV)
56-75 kW	1 January 2012	1 October 2014
37-56 kW	1 January 2013	-

As the Stage IIIB limits are much stricter than the currently applicable Stage IIIA, current engines will need to be modified or re-designed to ensure that the limits can be respected. ***Engine manufacturers*** must develop and apply the technology needed: engines must be fitted with electronic control systems and high pressure injection systems that deliver the fuel at the right time and in the right quantity for a cleaner burning in the combustion chamber. In addition, exhaust gas recirculation (EGR) and possibly sophisticated after-treatment systems are necessary. Several of these technologies require additional cooling capacity.

The further transition from Stage IIIB to Stage IV is likely to require the fitting of a NOx after-treatment system (or making an existing system more efficient) and/or the installation of a Diesel Particulate Filter (DPF). In on-road applications, development work is ongoing on combining these after treatment systems into a single device that reduces the space requirement when fitted on the vehicle.

These redesigns affect ***tractor manufacturers*** who have to adapt the design of their tractors to accommodate the modified engines. This is a time- and resource-consuming procedure, the timing of which depends heavily on the development programmes of the engine manufacturers to design engines appropriate for NTT applications. Considerable R&D investment is required for these processes.

[16] The emission limits and implementation dates can be found in Annexes III and IV

2.2. Economic context

From autumn 2008 onwards most of the EU-based production of machinery has been unexpectedly and severely hit by the global financial and economic crisis. Steep falls in sales caused a large decrease in income and available capital to finance the necessary technology research and development (R&D) for machinery with Stage IIIB compliant engines. Firms prioritise their R&D expenditure to cover firstly those products with high existing and potential sales' volumes. These sales then provide the business with revenues that can be used for R&D in order to develop technical solutions for smaller niche markets.

For agricultural tractors as a whole the decline started in most European countries in early 2009. For the sector of NTT the crisis seems to have little effect on the sales to date, but there will be some indirect effects from other product lines ('normal' tractors) if the company produces those too.

Moreover, the global crisis affecting the European economy, particularly the reduced availability of credit, has definitely made R&D and other investments for new products harder also for NTT manufacturers. However, this was not considered to be the main reason for this action which is first of all based on technical grounds.

2.3. Market overview

Narrow tractors are a product manufactured exclusively in Europe and sold almost entirely on the European market. In other regions of the world, such as the USA or South America, available field space is much bigger (JRC, 2007) and therefore normal types of tractors with specific dedicated equipment can be used for the cultivation of vineyards and orchards.

The European Committee of associations of manufacturers of Agricultural Machinery (CEMA) estimates that around 26 000 units of NTTs are sold per year in the EU, and 2 500 outside the EU[17]. NTTs represent around 16% of the total EU market for new tractors, which is about 160.000 units annually. The average price of a narrow tractor is € 30 000 with a minimum of € 17 000 and a maximum of € 58 000, corresponding to an estimated turnover of € 843 million. However, for very specific products (types) the prices can be as high as € 100 000. These prices are 15-20% higher than for a 'normal' tractor of comparable engine power and even up to 50% higher for sophisticated versions due to the need to design as small as possible NTTs with specific technical features to be able to manoeuvre in narrow vineyard and orchard rows.

NTT use engines of the power categories below 75 kW. Around 75% of the NTTs sold are in the 37-75 kW engine categories and are the focus of this report. The NTTs which fall in the lower engine categories (below 25 kW) are not subject to Stage IIIB and IV requirements. NTT manufacturers do not produce their own engines, but purchase them directly from specialised engine manufacturers. The latter supply also engines for machinery and other types of tractors. New engine designs are usually developed in the first place for applications in different types of machinery. The engine designs are then

[17] See Annex XI for more details.

adapted, either by the engine supplier or the tractor manufacturer, for tractors. Special tractors, such as NTTs, require further technical development of the engine and surrounding systems (see Annex VI for typical industrial development steps and their timeline). Since NTTs constitute only a minor market for the engine suppliers, the development work of an engine specifically for an NTT may not represent a high priority for an engine manufacturer compared to other engine categories. Delays in developing engines appropriate for NTT applications may impact on NTT manufacturers as NTT vehicle re-engineering can only occur once the basic engine design is known.

The development and production of NTTs is to a very large extent done by specialised companies of a limited size and capital. This can be illustrated by the fact that some major tractor manufacturers have NTTs in their offer, but instead of producing them themselves, they rely on the supply from smaller manufacturers dedicated completely to producing this type of product. An SME Test study was performed and investigated, among other things, the specific situation of small businesses producing or using NTTs[18].

In terms of market structure, for tractors belonging to the categories **T2 and C2**, the 4 largest companies in the EU hold a market share of 55%; the remainder of the market is in the hands of SMEs. All producers are based in Italy or Germany, and the SMEs are all Italian. Altogether, these producers employ 1 800 people directly, and 1 200 people indirectly. The SME test study (see Section 1.4. above) was not able to provide much specific data on T2 and C2 manufacturers, as the companies contacted did not match the official definition of SME (*i.e.* having a maximum of 250 employees). In fact, the larger companies in this segment typically employ 300-400 persons and therefore can still be considered as small industrial enterprises, although strictly speaking not SMEs.

According to the same study, high-clearance tractors **(T4.1)** are typically produced in France. The total production is 500-600 units per year, with 95% coming from 2 manufacturers (one SME, one is part of a larger group); 5% comes from 3 very small specialists. 90% of the production is sold in France. Sales dropped 12% in 2007-2008 and another 12 to 15% in 2009, largely as a result of the economic recession. The study observed that for two out of the three companies interviewed the length of the homologation procedure was a major concern and that the implications of future emission requirements were not well understood. However, these two companies were very small businesses, representing a very limited part of the market. These observations cannot be generalised for the high-clearance segment, neither to the NTT sector as a whole, and should be considered of marginal importance. Further details on these manufacturers can be found in the SME Test study.

End-users of NTTs are typically SMEs, and mostly micro-firms including farmers and contract workers. NTTs are used mainly in the mountains and hills in Southern Europe in the regions where high quality wines are produced. Further details on these companies can be found in the SME Test study.

[18] See Annex X: "SME Test study and IA on possible options for reviewing the Directive 97/68/EC relating to NRMM", ARCADIS, 30-03-2010. This includes a chapter specifically on NTT.

2.4. Emissions from Narrow-track Tractors

The key air polluters from tractors are particulate matter (PM) and nitrogen oxide (NO_x) emissions[19]. Although carbon monoxide (CO) and hydrocarbons (HC) emissions from tractors are also regulated, emission requirements only change marginally for these pollutants. Therefore, the analysis will focus on PM and NOx. According to the latest report of the European Environment Agency (EEA) on the EU's emissions of air pollutants[20] the total PM10[21] emissions in the EU27 in 2008 amounted to 2.126 kt. For NOx the total emissions were 10.397 kt in 2008. The report also attributes around 4% of PM10 emissions and 5% of NOx emissions to off-road vehicles used in agriculture, forestry and fishing. For the sake of comparison, road transport is deemed responsible for 14 % of PM10 emissions and 37% of NOx emissions.

Using figures from the Arcadis study (section 3.6.1) as a basis for calculation, the annual emissions from NTTs can be estimated at 4.8 kt of PM and 51 kt of NOx. This represents 0.2% of the total annual emissions of PM in the EU and 0.5% for those of NOx. These emissions are generated by the current NTT fleet, which, taking into account that the average lifetime of an NTT is nine years, includes only a small proportion of NTTs complying with Stage IIIA. This contribution from NTTs to air pollution in the EU provides the rationale for increasing the efforts to reduce pollutant emissions in the coming years. Any proposal should therefore carefully consider the policy objective to progressively reduce overall air pollutant emissions from road transport, including tractors.

2.5. Problem definition

The problem under examination concerns the feasibility of meeting the currently enacted emission requirements for NTTs. As things currently stand, this issue is composed of two elements: regulatory failure and lack of technological feasibility.

2.5.1. Regulatory failure

When the emission limits for NTTs were introduced by the legislator there was a limited amount of information available on the technology needed to meet those values. The 2004 amendment for NRMM, Directive 2004/26/EC was based on the need for alignment with USA exhaust emission legislation. At that time, the envisaged measure was much broader and the specific impact on NTTs was probably underestimated. However, the Directive did provide for a technical review clause which, among others, requires the Commission to "*consider the available technology, including the cost/benefits, with a view to confirming*

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19 Definitions of the gaseous and particulate pollutants are the same as in Directive 97/68/EC Annex I, as amended, and include:
'2.2. gaseous pollutants shall mean carbon monoxide, hydrocarbons (assuming a ratio of C1: H1.85 and oxides of nitrogen, the last named being expressed in nitrogen dioxide (NO2 equivalent; 2.3. particulate pollutants shall mean any material collected on a specified filter medium after diluting C.I. engine exhaust gas with clean filtered air so that the temperature does not exceed 325 K (52 oC)'

20 http://www.eea.europa.eu/publications/european-union-emission-inventory-report

21 Particulate matter below 10 μm diameter

Stage IIIB and IV limit values and evaluating the possible need for additional flexibilities, exemptions or later introduction dates for certain types of equipment or engines and taking into account engines installed in non-road mobile machinery used in seasonal applications". The 2005 amendment of the tractors Directive was adopted in the comitology procedure simply aligning the requirements for all tractors with those applicable to NRMM engines. The potential existence of difficulties for NTTs was acknowledged and article 4 (8) was introduced requiring a further study of the feasibility of the foreseen emission limits for NTTs.

Over time, it was confirmed that NTTs would have serious difficulties meeting the emission requirements. This is because contrary to normal –larger- tractors, NTTs have only a limited space available for the fitment of new engine and pollutant after-treatment technologies, which are needed to meet the next stages of emission limits. These new technologies require more space, which is generally not available on NTTs, or could result in an increase in the vehicle size leading to a loss in manoeuvrability. This would make these tractors unsuitable to use in the cultivations for which they are designed.

Further research and technological development is required in order to ensure that narrow-track tractors complying with the Stage IIIB and later the Stage IV emission limits can be placed on the market.

2.5.2. Lack of technical feasibility

The emission requirements of Stage IIIB and IV would not be problematic for NTTs if satisfactory technological solutions were available in the appropriate timeframe. An important part of the current analysis has been concentrating on an assessment of recent technological developments for engines used in NTTs. The state of the art of technology has a large influence on the outcome of this impact assessment and therefore it is explored in detail in this section.

In 2008, the technical feasibility for NTTs of meeting the emission requirements of stage IIIB was assessed in detail in the report of DG JRC (see Annex VIII), which considered a 5-year necessary to allow the development of IIIB-compliant NTTs. Subsequently, some new technical developments have taken place, which are taken into account as well. These have lead to a downward adjustment of the extent of required technical development.

Development for engine technologies to meet Stage IIIB and IV is still ongoing. If the implementation dates are maintained, engine adaptation and integration in the vehicles needs to start on current state-of-the-art technology. In that case, there seems to be general agreement among the relevant experts on the following points:

– Stage IIIB will require electronically controlled engines with high-pressure fuel injection systems;

– For some engine power categories exhaust gas after treatment may not be required to comply with the Stage IIIB limits whilst for others one of the following may be needed:

    - either the fitment of cooled exhaust gas recirculation (EGR) and diesel particulate filters (DPF) or

- selective catalytic reduction (SCR) technology.

– The first technology is the most likely to be implemented for NTTs.

– Stage IV will need the simultaneous adoption of both the above mentioned technologies which may however be combined into a single after treatment system.

The installation implications can be summarised as:

– Increased cooling capacity of the engine due to the cooled EGR estimated between 15 and 25% of present requirements and equivalent increase of the cooling radiator volume;

– Installing a DPF with a ca. 20 dm^3 volume;

– Installing an SCR system with a ca. 25 dm^3 volume.

As described in detail in the JRC report, these implications are incompatible with the space constraints created by the user requirements to operate in vineyards and orchards. The severity of these constraints can be illustrated by the fact that already today several NTTs, in addition to the main fuel tank, are equipped with small secondary fuel tanks, fitted wherever space is available under the hood. Also, larger engine compartments may require farmers to replace their implements (tools mountable on the engine and tractor for performing specific agricultural operations) and/or damage the fruits by exposing them to heated surfaces.

NTTs operate as mobile power sources for a wide range of implements, which are tools mounted on the engine of the tractor necessary to perform different operations in vineyards and orchards. As mentioned before, these are often located in mountainous areas, which also pose a certain demand on engine power. Over time the power demand increased to achieve an indicative upper limit of 75 kW. The chosen engine power of a NTT is essential to meet its customer requirements. Therefore, replacement of higher power NTTs by those with an engine of a lower power category, which are not subject to the next emission stages, would not be a acceptable solution for NTT users.

In the course of 2010, new technical developments have been communicated by the engine and after-treatment supplying industry. A few engine concepts have been presented that are capable of meeting stage IIIB requirements without the use of a DPF. However, these engines were designed primarily for the use in machinery and the adaptation to tractors, particularly to NTTs, remains to be proven. Without DPF, the space implications for integrating the new engine concept in the current engine compartments are mitigated. Also, after-treatment technology has recently demonstrated a progress: specific concepts have been developed that offer better potential for integrating this technology within the space constraints of NTTs. It has to be stressed, however, that neither of these technologies is sufficiently developed at the time of the present assessment to enable NTTs meeting the Stage IIIB limits within the current legal timeframe.

For Stage IV-compliant technology, which would be compatible with NTT-needs, no technical solution is for the moment demonstrated, even as a R&D concept. Even if Stage IV technology is likely to rely on the use of both sophisticated engine measures, such as

high-pressure fuel injection and cooled EGR, as well as both DPF and SCR after-treatment technology (potentially combined) as explained above, engine and after-treatment system manufacturers will have to develop the technology further to propose a system that meets the limit values. With regard to the installation in NTTs, Stage IV compliant engines would face even bigger challenges, given the need for large after-treatment systems.

In conclusion, the current state of technological development of engine and after-treatment technologies is considered such that stage IIIB-compliant technology could be available for NTTs once the recent prototypes for other applications have been adapted to fit NTT-needs, integrated and tested in the vehicle. This process, according to standard industrial leadtimes (see Annex VI), will take between 3 and 6 years. Although the industry stated that significant R&D investments have been made in the past years, the probability that some manufacturers may be ready before 3 years is considered low. For Stage IV-compliant technology, the fitment of after-treatment systems will be needed and NTTs are likely to face difficulties integrating this equipment. If technical solutions are found, it is very likely that it will take a full development cycle of 6 to 10 years before acceptable Stage IV-compliant NTTs can be put on the market.

2.6. Affected parties

The things as they currently stand affect both the European manufacturers of NTTs and farmers who rely on the use of NTTs. While the former are left with neither sufficient time nor sufficient technological development to adapt their products to the new emission limits, the latter are left with no modern mechanisation tools needed in the European specialized agriculture.

2.7. Subsidiarity and proportionality

The legal basis of this initiative is the same as for the tractors emissions Directive 2000/25/EC, namely Article 114 of the TFEU on the approximation of laws.

The Directive already harmonises the laws of the Member States relating to emission limits and the type-approval procedure for engines to be installed in tractors. Any modifications to the Directive can only be done at EU level. Therefore EU action is justified and provides added value in maintaining the internal market for tractors.

In terms of proportionality, a close review of the impacts of legislation is important in this case. There is a rather small and geographically concentrated market for NTTs, which potentially has to cope with prohibitive compliance burden or severe technical challenges to adapt to new legal limits.

3. OBJECTIVES

3.1. Definition of objectives

The objectives are mainly twofold: competitiveness and environment related. The general, specific and operational objectives are set out in the table below.

GENERAL	SPECIFIC	OPERATIONAL
1. To safeguard the competitiveness and viability of the tractor industry.	1. To enable industry to continue investing in R&D so that technology becomes available for all NTTs to meet Stage IIIB and Stage IV.	1. To introduce a cost effective and timely measure that allows engine and tractor producers to continue selling new NTTs. 2. To allow industry to finance expenditure on R&D in the short term to develop innovative tractors by allowing them to continue to generate revenues from sales.
2. To maintain a high level of environmental protection.	1. To limit the overall emissions of the NTT tractor fleet by enabling fleet renewal.	1. To enable the replacing of older, more polluting and fuel consuming engines and tractors by cleaner ones by setting emission requirements in such a way that demand for new tractors can be met by the cleanest available models. 2. To send a clear signal to industry that further emission reductions are required and that the current path of reducing emissions is maintained.

3.2. Consistency with other horizontal objectives of the European Union

3.2.1. The European Economic Recovery Plan

The present proposal is in line with the objectives of the EU 2020 Strategy[22] and complements the European Economic Recovery Plan (EERP)[23]. Adopted in November 2008, the EERP addresses the difficulties of the wider economy brought about by the global financial crisis. The Plan outlines a series of measures to cope with the squeeze on credit, declining sales and revenues. It refers inter alia to the need for a swift stimulation of demand and consumer confidence as well as measures to lessen the human cost of the

[22] COM(2010) 2020

[23] COM (2008) 800

economic downturn and its impact on jobs. The EERP highlights the need to ensure full coherence between immediate actions and the EU's medium- and longer term objectives.

Such immediate action needs to focus on improving business conditions through maintaining the competitive industrial base and through promoting a knowledge based and low carbon economy as set out in the EU2020 Strategy.

3.2.2. Environmental Policies

The tractors emissions Directive, which provides an important contribution to a progressive reduction of air pollution, is also in line with the EU environmental policies, in particular with the Sixth European Environment Action Programme and one of its initiatives – the Clean Air For Europe (CAFE) strategy. The initiative sets out an integrated and long term strategy for reducing the adverse impact of air pollution on human health and environment. These objectives are implemented through Directive 2008/50/EC[24] on ambient air quality and cleaner air for Europe which establishes a system for the assessment of ambient air quality and provides thresholds for each pollutant. Member States have to assess and manage the ambient air quality. Besides this instrument it remains important to combat emissions of pollutants at source and to implement the most effective emission reduction measures.

Today, a large number of Member States are in non-compliance with the air quality limit values for PM_{10} which entered into force in 2005 but where extra time has been granted for some air quality management zones until June 2011. Many Member States are also expected not to comply with the air quality limit values for nitrogen dioxide when official monitoring data is reported in 2011. One of the reasons most frequently cited by Member States for their non-compliance with PM_{10} air quality limits is the substantial contribution made to observed levels from transboundary air pollution. In this respect, it is important to note that more than 10 Member States are expected not to comply with their national emission ceilings for NOx (under the Directive 2001/81/EC) that are binding from 2010 onwards based on their emissions forecasts so far submitted to the Commission[25].

It is broadly recognised that these problems, as far as they are related to vehicles, are largely caused by the emissions from the existing fleets, which are still composed of many old vehicles. Current actions therefore focus on measures stimulating fleet renewal and retrofitting.

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24 Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe (AAQD) entered into force on 11 June 2008. It merges existing legislation into a single directive with no change to existing air quality objectives for PM_{10} and NO_x contained in Directive 1999/30/EC; maintains two limit values for NO_x based on hourly and annual average concentrations; sets (new) air quality objectives for $PM_{2.5}$ including the limit value and exposure related objectives – exposure concentration obligation and exposure reduction target; creates the possibility for time extensions for compliance up until June 2011 for PM_{10} (where the limit values entered into force on 1 January 2005) or up until 31 December 2014 for NO_2 and benzene) based on conditions and the assessment by the European Commission. Single most important condition is that the notification must include an air quality plan that delivers compliance by the extended deadline for compliance.

25 http://www.eea.europa.eu/publications/nec-directive-status-report-2008

4. POLICY OPTIONS

4.1. Options identified

Six policy options have been identified as possible means of meeting the policy objectives described in the previous section. These are:

- ***Option 1- No new action = Baseline scenario.***

  The current implementation dates for NTTs, to achieve compliance with the new Stage IIIB and Stage IV limits remain unchanged, meaning that Stage IIIB would be required for new NTTs starting from 1 January 2012 and Stage IV from 1 October 2014.

- ***Option 2 – Allowing 3 extra years for implementation of Stages IIIB and IV for NTTs.***

  The implementation dates for NTTs for meeting Stage IIIB and Stage IV emission requirements would be delayed by 3 years. Stage IIIB would be required for new NTTs starting from 1 January 2015 and Stage IV from 1 October 2017.

- ***Option 3 – Allowing 5 extra years for implementation of Stages IIIB and IV for NTTs.***

  The implementation dates for NTTs for meeting Stage IIIB and Stage IV emission requirements would be delayed by 5 years. Stage IIIB would be required for new NTTs starting from 1 January 2017 and Stage IV from 1 October 2019.

- ***Option 4 – Exempting NTTs from Stages IIIB and IV for NTTs.***

  Given the specific design constraints of NTTs and their limited market share compared to the entire tractor market, an additional option could be to completely exempt NTTs from Stages IIIB and IV requirements. This would maintain the current Stage IIIA requirements for these special tractors for an unlimited period of time.

- ***Option 5 – Skipping Stage IIIB and introducing Stage IV at the dates originally foreseen***

  This option foresees skipping Stage IIIB and introducing Stage IV emission limits at the dates originally foreseen in the tractors emissions legislation i.e. as of 1 October 2014.

- ***Option 6 – Extending the flexibility provisions for NTTs***

  This option foresees a further extension of the flexibility provisions in the Tractor Emissions Directive for NTTs, so as to allow them to sell an additional number of non-compliant tractors without changing the emission requirements as such.

4.2. Options discarded at an early stage

- ***Option 5:***

Some companies may find it beneficial to focus directly on solutions capable of meeting Stage IV and would therefore avoid investing resources in developing an intermediate solution. However, as shown in Annex III, Stage IV will not apply to the power category between 37 and 56kW. This option would therefore only be applicable to the power category between 56 and 75 kW.

Furthermore, the JRC study highlighted that the technical solution to meet Stage IV would imply an improved engine and extensive after-treatment systems to reduce both PM and NOx emissions. Stage IV solutions will largely build on Stage IIIB compliant-technologies, and therefore the two stages are mutually complementary. In terms of technical feasibility, manufacturers will face the same design and installation problems as encountered with Stage IIIB. The state of the art of technology, as discussed in section 2.5.1, is in such a premature stage that the possibility for NTTs to meet Stage IV in 2014 can be excluded with near certainty. Even if this option would avoid the negative impacts on the sector and the environment between 2012 and 2014, damages of a similar nature (impossibility to sell compliant NTTs, loss of revenues, continued use of old tractors) can be expected as of 2014, probably in an even larger extent. This is because vehicle design (as demonstrated in Annex VI) will take much longer than the time available until the mandatory introduction of Stage IV foreseen by the legislation and after-treatment seems unavoidable, creating particular difficulties for integration into NTTs. Moreover, it would mean a waste of resources for the companies that have invested in technical solutions for Stage IIIB (see Annex VII). Therefore, this option has been discarded, since it will not deliver on the defined policy objectives.

- ***Option 6:***

The current Tractor Emissions Directive includes flexibility provisions which allow a number of new tractors non-complying with the new emission stage to be sold in the year following the introduction of this stage. Currently this is limited to 20% of the number of sales in the previous year. The Commission adopted a proposal on 27 October 2010[26] to increase the flexibility provisions to 50%. In both cases, these provisions would provide only limited relief to manufacturers, allowing them to continue sales for a period of a few months, which are far from sufficient to allow technical solutions to be developed in time (see section 2.5.2).

In order to bring the flexibility for NTTs more in line with the leadtime needed for developing compliant NTTs, one could imagine a further extension of the flexibility provisions, specifically for NTTs. In that case, the flexibility provisions would need to be around 300%. In practice, such an option would represent a delay of 3 years in the application of the new emissions Stages, very similar to Option 2. However, the administrative burden for manufacturers and administrations to implement the flexibility scheme would be significantly higher. For that reason, this option was discarded.

[26] COM(2010) 607 final

5. ANALYSIS OF IMPACTS

As this IA concerns a 'narrow' legislative action, it will assess the options essentially in a qualitative way with quantifications for those impacts for which sufficient data was available. The options will be analysed with respect to the economic, environmental and social aspects. The economic impacts considered include the direct impact of sales and revenues on industry, including many SMEs, the indirect impact on users of increased cost and price, or unavailability of NTTs and the impact on R&D investments, their expected returns and innovation. The environmental impacts considered include the emissions of PM and NOx and the corresponding cost estimates. The social impacts considered include employment and the safety of workers related to the use of different types of tractors. For the latter, it is important to note that all new tractors entered into service after July 2009 are legally required to be equipped, among other safety-related measures, with roll-over protection, which is particularly relevant for the safety of workers using NTTs.

The assessment is based on the data available from different sources, including the JRC and Arcadis studies and the industry itself (in particular engine, after-treatment and tractor manufacturers), who delivered information on R&D results and the state of the art of technology related to the introduction of the new stages for NTTs. Additional information on the R&D budget for the sector was obtained from EUROSTAT. Some of the factors, which are impossible to quantify due to lack of detailed information from the industry, and therefore are not taken into account in the analysis include: increased learning & training costs; reduced availability of manpower; increased stock piling; reduced availability of low volume products; standstill state of the art; increased peak load for certification bodies; increased warranty cost due to rush released tractors and the health impacts of workers using NTTs due to the direct exposure to pollutants. Nonetheless, the magnitude of these factors is not likely to affect the overall conclusions of the assessment.

5.1. Impacts of Option 1 (no new action)

Option 1 can evolve in two directions for which two different scenarios can be foreseen:

– ***Scenario 1a: adapting compliant NTTs to current customer requirements***

Emission requirements remain unchanged, NTT manufacturers are not able to offer compliant NTTs once the new limits are required (beyond limited flexibility provisions). The surviving companies will re-enter the market once a technical solution is found permitting NTTs to be used in existing vineyards and orchards.

– ***Scenario 1b: Redesigning vineyards and orchards to fit NTTs of a bigger size***

Emission requirements remain unchanged, compliant NTTs could become available although of different sizes than those currently used by the agricultural sector. As a form of self-help, the agricultural sector redesigns the existing vineyards and orchards to fit wider or longer tractors.

Scenario 1b has been investigated in the Arcadis Report (in section 3.6.4.2) and the JRC report (in section 5.3.2) and was considered not plausible, due to the associated high costs

that would need to be incurred by the agricultural sector and for other reasons stated below:

Vineyards and orchards were already restructured some 10-15 years ago following the adoption of the Council Regulation No 1493/1999 on the common organization of the wine market[27]. As a consequence, the row width increased from narrow row widths of about 1m to larger row widths of about 2m. One reason was the possibility to switch from manual cultivation to techniques assisted by special tractors. Substantial EU-resources (the SME Test report mentions 400-465 M€ annually over a period of seven years) from the Common Agricultural Policy were spent for this purpose, in addition to private and other expenses. This shows the extent of the necessary investments and, given the fact that the average life cycle of a vineyard is forty years, it would evidently be an enormous waste of resources if farmers would have to replant vineyards again.

Further, the JRC report has estimated that redesigned vineyards (either by increasing the row width or reducing the row length so that larger tractors can turn) would result in a 20% loss of cultivable grounds. This would obviously be a heavy blow to the relevant economic actors and to the competitiveness of the EU wine sector; especially to the part producing high quality wines that already faces strong space limitations and makes widespread use of NTTs.

As scenario 1b is highly unlikely, the analysis of option 1 is based on scenario 1a. This has been investigated in detail in the Arcadis study (see Annex IX) and the analysis below is largely based on the conclusions of this study.

5.1.1. Economic impact of Option 1

As explained in the section 2.5.2, the technological development of engine and after-treatment technology is not likely to deliver acceptable solutions in time for NTTs to meet the Stage IIIB and Stage IV limits by the dates currently prescribed by the Directive.

In that case, NTT manufacturers would not be able to comply with existing deadlines, would continue to struggle with technical problems and would not have tractors ready, neither for Stage IIIB nor for Stage IV, until a technical solution is found. At the same time, since the sale of NTTs not complying with Stage IIIB will not be allowed as of January 2012, industry would not be able to place products on the market beyond the limited volumes offered with the sell off and flexibility provisionsSeveral firms – in particular SMEs which are specialised in NTTs and can hardly benefit from revenues in other tractor segments, run a significant risk of going out of business. Following standard economic theory, a reduced number of firms will also lead to less competition, lower product diversity and probably higher prices, thus lower consumer welfare.

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[27] Under the Council Regulation (EC) No 1493/1999 on the common organisation of the market in wine, Member States can obtain annual payments for restructuring and conversion of a set number of hectares of vineyards. The objective of this system is the adaptation of production to market demand. It covers the following measures: varietal conversion, relocation of vineyards and improvements to vineyard management techniques. The system does not cover the normal renewal of vineyards which have come to the end of their natural life. As consequence of the restructuring of vineyards, the row width has changed from about 1 meter to 1,6 - 2,2 meter. NTT are designed to work in this situation. For more detail see the JRC report in Annex VIII.

Clients of tractor manufacturers will be faced with a disruption of a satisfactory product offer. Wider or longer NTTs compliant with Stage IIIB may be offered, but would in the best case only be bought by a small number of farmers (for example those who can accept a lower yield of their cultivable land). The large majority of users, if not all, will maintain existing tractors (for which the purchase costs have already been amortised) in operation until a technical solution is found. That would mean that they will not be able to purchase newer, safer, less fuel-consuming tractors that can work more efficiently, even though this decision brings higher operating costs. These are estimated at 1339 M€[28].

In terms of R&D investment and innovation, this option has some benefit. It could indeed reward the companies that are the quickest to offer Stage IIIB-compliant NTTs with a quasi-monopoly, according to the 'winner takes it all' principle. It remains very doubtful whether this would avoid an interruption of NTT supply. It would certainly create casualties as several smaller firms will not have the capital resources to engage in such an excessive innovation race, in the absence of revenue from sales, and are likely to risk their business. In the long term, a reduced number of firms and product diversity would have a negative impact on innovation.

The impacts for applying Stage IV without any delay as of October 2014 would be of a similar nature as for Stage IIIB (impossibility to sell compliant NTTs, loss of revenues, continued use of old tractors). However, given the lack of demonstrated technical solutions and the certainty that they will require after-treatment, the problems for the sector can be expected to be even larger than for Stage IIIB. Also in terms of innovation, impacts would be similar, leading to an excessive innovation race, with a small number of winners and many casualties. Based on information currently available, it is considered highly unlikely that any company would be capable of developing Stage IV compliant NTTs in time.

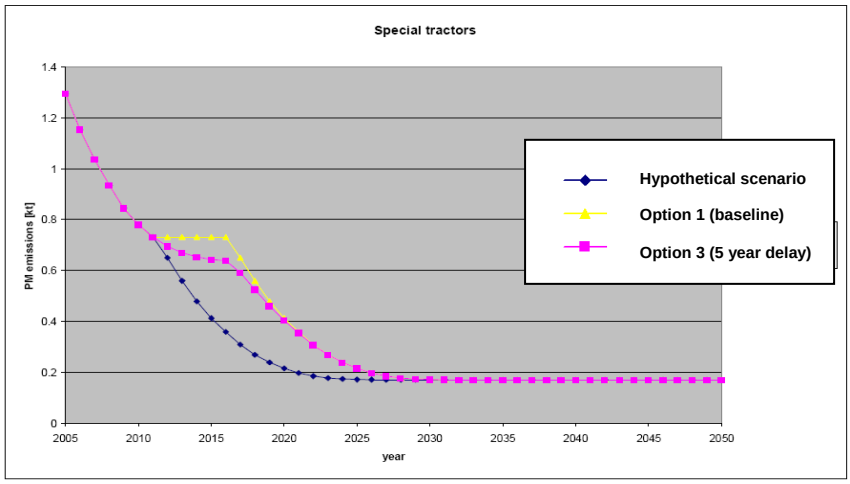
5.1.2. Environmental impact of Option 1

Due to unavailability of compliant NTTs, at least for a number of years after the emission limits will enter into force, i.e 2012, the emissions of pollutants cannot achieve the reductions that could have been expected from the Tractor Emissions Directive. The expected reductions from stricter limits form therefore a hypothetical scenario, which has nevertheless been chosen as the benchmark for quantifying and comparing the emissions under different scenarios in the JRC and Arcadis studies. It will be referred to as 'hypothetical scenario' in the graphs in this report. The environmental impacts have been determined based on external costs of calculated emissions. Emissions have been calculated taking into account tractor/engine stocks, average use and the lifetime of tractors.

The Arcadis study estimates that, under Option 1, PM emissions and NOx emission would be substantially higher than the hypothetical scenario (blue curve). This is illustrated in the two graphs below. The increase in emissions (yellow curve) is due to the continued use of the oldest tractors, whose emissions were not regulated at the time of entry into force or complied with the first sets of emission limits.

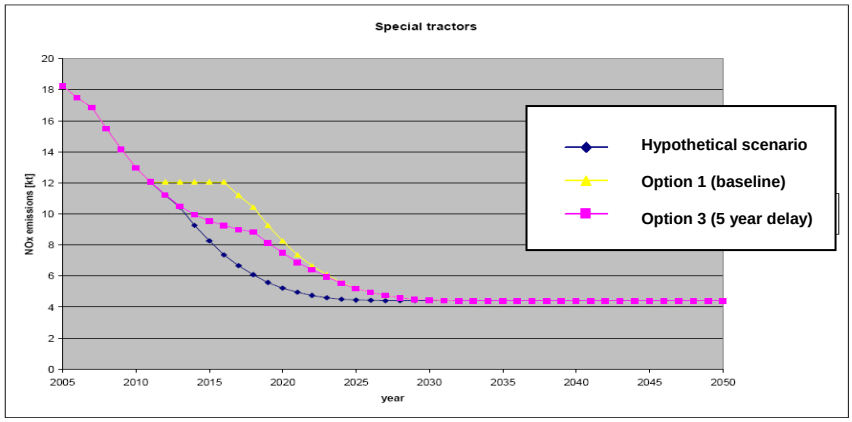
[28] See SME Test Study, section 8.2.2

Figure 1: PM emissions of NTTs (time span 2005-2050)



Source: Arcadis report

Figure 2: NOx emissions of NTTs (time span 2005-2050)



Source: Arcadis report

The estimated increase[29] in emissions compared to the hypothetical scenario amounts to 4,3 kt for PM and 62 kt for NOx for the period until 2050. The monetized emission impacts for the increased PM emissions are estimated at 60 M€ and those for NOx emissions at 134 M€ over the 2012-2030 timeframe. As this option reflects the baseline scenario, the above figures are taken as the reference and the environmental impacts indicated for the other policy options are relative to the baseline.

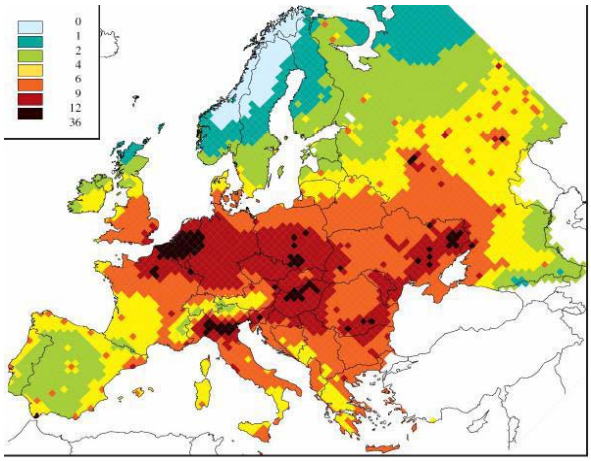
It should however be noted that the overall impact of emissions is not expected to significantly affect the Member States obligations under the Directive on Ambient Air Quality and Cleaner Air for Europe, which requires MS to meet certain ceilings for ambient air quality in defined geographical areas[30]. Moreover, the emissions of NTTs are normally not generated near those geographical areas in the EU that experience the most problems with meeting the air quality targets and associated implications for human

29 See Annex XII for more details

30 Directive 2008/50/EC L 152 11.6.2008 p1, Annex III

health. Figure 3 illustrates the geographical distribution of health impacts associated with PM emissions in Europe. One exception may be Northern Italy, where vineyards and air quality problems coincide.

Figure 3: Loss in life expectancy attributable to anthropogenic PM2.5 in 2000[31]



5.1.3. Social impact of Option 1

As mentioned in the Arcadis study, the prolonged disruption (of several years) of revenue represents a serious risk for all NTT manufacturers, many of which are SMEs or other small businesses. The estimated number of jobs[32] that could be lost would correspond to 3000 for around three years. The application of Stage IV (for NTT corresponding to the larger engine power category) would perpetuate the majority of these losses. The expected job losses would be concentrated in Germany, France and Italy. The larger companies may be able to survive thanks to their activities in other (tractor) markets and could re-enter the NTT market (for the lower engine power category, not subject to Stage IV) when satisfactory technical solutions have been found, presumably after 3 years.

As was already explained above, the non-availability of new NTTs will lead to the continued use of old tractors, which are not equipped with modern safety devices such as roll-over protection. This risk should not be underestimated as the NTTs, due to their high centre of gravity and the fact that they are employed frequently in mountainous regions, are prone to these types of accidents. It can be estimated that around 80.000 workers, active in agricultural cultivation, will be exposed to higher safety risks, at least for the 3 coming years.

Option 1 (no new EU action) represents a serious risk of disrupting the NTT industry and market, as industry would not have compliant tractors ready for Stage IIIB, nor for Stage IV. Users will not be able to replace old polluting tractors with modern equipment and are likely to continue to use old tractors with high pollution and deteriorated worker safety. Some compliant tractors (in the lower engine category) may come some years later to the market, but the prolonged loss of revenue from

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31 Impact Assessment of the Thematic Strategy on Air Pollution, SEC(2005)1133, 21.09.2005, p. 32

32 See Arcadis study, section 3.6.4.2

NTT could lead several manufacturers to close business, resulting in a significant proportion of jobs lost in the sector. Stakeholders (mainly from industry) have for many years criticised this option and warned against its negative consequences.

5.2. Impacts of Option 2 (Allowing 3 extra years)

Unlike Option 3, this Option was not investigated in detail in the Arcadis study. Therefore, the analysis of the present option had to be performed by adapting the analysis of Option 3[33]. Option 2 foresees a Stage IIIB implementation delay for NTTs shorter by 2 years compared to Option 3. The shorter delay takes into account technological solutions that have been developed over the past years.

5.2.1. Economic impact of Option 2

As already recalled above, at this moment the available engine and after-treatment technology is not mature enough to allow industry to build this into NTTs and comply with Stage IIIB requirements. The specificities of these vehicles (very narrow design, all hot components under the engine hood, short turning circles required, inherent risk of instability) asks for further development of technology: smaller components, smaller engines still suitable for this purpose. The additional 3 years can be expected to help all related industries (vehicle, engine and after- treatment manufacturers) to solve these issues.

The compliance costs for tractor manufacturers to cope with the new emission limits are nevertheless significant. These costs include for example: costs for research and development, equipment redesign, after treatment devices, investment, documentation and labelling, etc. In order to recover those investments, the price of NTTs will have to increase. This is particularly challenging for NTTs in the engine power range of 56-75 kW as they only have less than three years before Stage IIIB tractors have to be replaced by Stage IV. The increase in price is estimated at 15% (according to industry sources). Above the normal expenses projected for NTT replacement, this would amount to additional equipment expenses for the users of NTTs of 117 M€ per year, starting in 2015. It can be expected that these costs will decrease over time thanks to learning effects, economies of scale and product optimisation. Moreover, and contrary to the situation for manufacturers of other categories of tractors and all other aspects being equal, for NTT the cost increases are less of a problem compared to the availability of viable technologies, as these tractors already adopted sophisticated and expensive solutions and are priced well above the equivalent conventional tractor.

Manufacturers estimate that they would have to increase their R&D spending from 3% to more than 6% of turnover over the coming 4 years in order to meet Stage IIIB as of 2015. Total R&D investment from NTT manufacturers is therefore expected to be around 50 M€. These costs include the homologation, which is perceived as time consuming and

[33] The estimation was obtained by assuming a proportionate relationship between the calculated emissions and the length of the delay. A similar approach was used for the monetized emission impacts.

particularly burdensome for small companies (see the SME test report in Annex X). They do not include the necessary investments by engine manufacturers and system suppliers.

This option seems to foster innovation in a healthy way. It would provide sufficient leadtime to those companies that have invested early in R&D to be able to develop Stage IIIB-compliant solutions in time and get a fair return on investment, compared to competitors that have invested later.

Also for Stage IV, the delay can be expected to provide sufficient time to develop compliant NTTs, if technical solutions can be demonstrated in the near future. It would provide an immediate boost for R&D investments as prototype solutions need to be found rapidly in order to be able to put compliant NTTs on the market by the new deadline.

5.2.2. Environmental impact of Option 2

Before Stage IIIB would be applied, industry would in the meantime still be allowed to place on the market Stage IIIA compliant tractors that would in turn replace older, more polluting ones still in use. Simulations of emissions under this option were unfortunately not performed in the Arcadis and JRC studies, but can be estimated by adapting the results provided for Option 3. In the Figure 1 and Figure 2 on PM and NOx emissions (on pages 21-22), under option 2 the curve would follow the one for option 3 until 2015 when it would tend towards the line for the hypothetical scenario. Emissions compared to the baseline scenario are estimated by adapting the JRC results for Option 3 (see Annex XII). They would amount to a reduction in emissions of 2.2 kt (-5.2%) and 42kt (4.1%) for PM and NOx respectively until 2050.

The monetized emission impacts for the reduced PM emissions can again be estimated by adapting the results for Option 3 from the Arcadis study. This would result in a benefit of 31 M€ and would set those for NOx emissions at 91 M€. The total environmental benefits can thus be estimated at 122 M€ compared to the baseline scenario.

5.2.3. Social impact of Option 2

It is expected that, with the three additional years, the majority of manufacturers can adapt their NTTs to meet Stage IIIB while satisfying the essential user requirements. Therefore, the social impacts of this option on the industry are not very significant. It cannot be excluded that a small number of firms are not capable of adapting to the new more advanced technology, leading to some job losses. It is likely, however, that these losses will be compensated by additional jobs with stronger competitors. Compared to the baseline scenario, there would be a significant improvement in worker safety. As mentioned before, customers will be able, during the 3 year delay, to replace old NTTs with new (Stage IIIA-compliant) tractors. As there is no difference in safety requirements for NTTs complying with Stage IIIA and Stage IIIB, the improvement of worker safety will be safeguarded under this option.

Option 2, by allowing NTTs three extra years to comply, would be very effective in mitigating the economic impacts on the industry to challenging but feasible proportion, without serious social drawbacks. Also, the environmental impacts are

improved due to the fact that, while Stage IIIB NTTs are not available, new Stage IIIA NTTs will be able to reduce pollutant emissions, compared to the old NTTs that they will replace. Industry would, however, remain under continuous pressure to find technical solutions to meet the new emission limits introduced by the Directive, so innovation is fostered. Some industrial companies have indicated that this might be feasible, while others think it is not.

5.3. Impacts of Option 3 (Allowing 5 extra years)

5.3.1. Economic impacts of Option 3

This Option has been investigated in detail in the Arcadis study (see Annex IX) and this analysis is largely based on its conclusions. The analysis is similar to the one for Option 2. Therefore, the remarks here will focus on the differences compared to Option 2.

With an additional period of 5 years, all relevant industrial actors should have sufficient time to develop technical solutions for NTTs to meet Stage IIIB emission requirements. The additional two years compared to Option 2 may be needed if the initial technical developments for machinery engines discussed in Section 2.5.2 do not progress as quickly as expected into suitable solutions for NTTs.

The compliance costs can be expected to be somewhat lower than under option 2, as the technology has more time to improve and progress along the 'learning curve'. Price increases for customers could amount to around 13% initially, leading to additional expenses of around 100 M€ per year initially. Again, these costs are likely to be reduced over time.

In terms of innovation, there may be a drawback for this option. The industrial actors that invested to develop Stage IIIB solutions as quickly as possible may be able to offer NTTs complying with Stage IIIB even before the implementation dates. In the absence of fiscal incentives, these products would be put at a competitive disadvantage due to the higher price compared to IIIA-compliant NTTs. Forward looking business decisions and investments in innovation may therefore not be rewarded. In terms of legal certainty, it could also be considered a perverse incentive if economic actors that did not prepare for meeting Stage IIIB in the past years, will now benefit from an opportunity to catch up with competitors.

Also for Stage IV, the 5-year delay gives more leeway to industry to develop compliant NTTs, even if technical solutions are not demonstrated in the near future. It would provide only a moderate boost for R&D investments as more time is available for finding prototype solutions to be able to put compliant NTTs on the market by the new deadline. Some investments could in fact be delayed.

5.3.2. Environmental impact of Option 3

Before Stage IIIB would be applied, industry would in the meantime still be allowed to place on the market Stage IIIA compliant tractors that would in turn replace older, more polluting ones still in use. Simulations of emissions under this option were performed in the Arcadis and JRC studies, The pink curve in the figures 1 and 2 on PM and NOx

emissions (p. 21-22) shows the estimated emission under this option. Emissions reductions compared to the baseline scenario (yellow curve) are estimated (see Annex XII), based on the results of the JRC study, at 0.8 kt (-1.9%) and 29kt (-2.9%) for PM and NOx respectively until 2050.

The monetized emission impacts for the reduced PM emissions are estimated at a benefit of 12 M€ and those for NOx emissions at 62 M€. The total real environmental benefits can thus be estimated at 74 M€. These results include the effects of both Stage IIIB and Stage IV.

5.3.3. Social impact of Option 3

Compared to option 2, a difference is that companies that did not make early investments would have time to catch up with their competitors before the new limits become mandatory. Therefore, the risk that a small number of companies will not be capable of transforming to adapt to the new market situation is even lower, as is the risk for job losses.

As for option 2, there is an improvement in worker safety, brought about by the renewal of old NTT by newer models.

Option 3, allowing NTTs five extra years to comply, would be very effective in avoiding job losses in the sector. However, there will be some drawback for environment as the new Stages IIIB requirements will not be effective for 5 years. According to calculations this will nevertheless be better than option 1, where the old tractors (instead of new and Stage IIIA compliant ones) will continue to be used. Industry would remain under pressure to find technical solutions to meet the Directive. It may, however, question somewhat the credibility of legislation, if it is perceived that the industry did not try to meet the limits in time. This option corresponds to the current requests from NTT manufacturers.

5.4. Impacts of Option 4 (Exemption)

This Option has been investigated to some extent in the JRC study (see Annex VIII) and this analysis is largely based on its conclusions.

5.4.1. Economic impact of Option 4

Under this option, the industry could continue to produce NTTs at the present Stage IIIA level of requirements, as is already the case for tractors with small engines (up to 37 kW). There would be no specific threat nor pressure for businesses to seek innovative solutions. Many companies will have done superfluous preparatory work on technical solutions that will not be required anymore.

Customers would benefit as they can continue to replace old polluting tractors by relatively clean new tractors meeting Stage IIIA, but without having to pay the additional costs for Stage IIIB and IV. In terms of innovation, past investments made by economic

actors for meeting Stage IIIB would effectively be lost. There would also be no incentive to develop new emission-reducing technologies in the future for meeting Stage IV requirements, so environmental innovation in this sector would come to a halt. In addition, it could again be considered a perverse incentive to 'reward' operators that did not prepare for meeting Stage IIIB and Stage IV in the past years.

5.4.2. Environmental impact of Option 4

The JRC study estimated that emissions of PM per year would in the long term be 0.7 kt higher than under the reference level. That would amount to a total increase in PM emissions of around 22.7 kt until 2050, compared to the baseline scenario (see Annex XII for details). Similarly, NOx emissions per year would be increased by 6 kt per year. Until 2050, this would give rise to a total of 168 kt of NOx emissions by NTTs.

The monetization of the environmental impacts under this option was not carried out in the Arcadis report. They would logically be more or less proportionate to the increase in emissions and can be estimated at an increase in environmental cost of 313 M€ for PM and 361 M€ for NOx, compared to the baseline scenario. These results include the effects of exempting both Stage IIIB and Stage IV.

5.4.3. Social impact of Option 4

There would be no risk that companies are pushed out of business due to emissions requirements, as they would effectively stay as they are today. However, a small number of jobs related to R&D in the tractor manufacturer and exhaust after-treatment supplier sector may be lost. As for options 2 and 3, there is an improvement in worker safety, brought about by the renewal of old NTT by newer models.

A permanent exemption does effectively mitigate the negative impacts for industry but does not give any certainty that pollutant emissions are reduced in the long term, as it is far from certain that NTTs meeting Stage IIIB or IV would be developed. As other sources of PM and NOx are expected to reduce their emissions over time, the relative share of NTTs in those emissions will therefore increase. In the short term, however, it would be positive for environment as at least new Stage IIIA tractors would be available to replace older, more polluting ones. An exemption would also largely remove any incentive to invest in R&D and innovation in environmental technologies for NTTs. Initially, this was the solution requested by (industrial) stakeholders. More recently, they requested a 5-year delay.

6. COMPARISON OF THE OPTIONS

The detailed assessment of economical, environmental and social impacts of the previous chapter are summarised in the following table[34] for each of the policy options.

[34] The impact of the baseline scenario has for methodological reasons been set to zero. The symbols for the other options indicate the impact relative to the baseline scenario, ranging from very unfavourable (--) to very favourable (++)

	Option 1 - Baseline	Option 2 – 3 year delay	Option 3 – 5 year delay	Option 4 - exemption
Direct economic impact (on industry)	0 No NTTs sold until technical solution is found, loss of revenue, serious risk of bankruptcies	+ Most actors can stay in business, sales continue, sunk investments not lost	+ All actors can stay in business and sales continue, sunk investment not lost	+ No need to invest more, sales continue, loss of sunk investments
Indirect economic impact (on consumers)	0 Cannot renew tools, higher maintenance costs	+ Additional equipment cost of 117 M€ initially per year	+ Additional equipment cost of +/- 100M€ initially per year	++ No particular cost increases
Impact on R&D	0 Wild race among some to innovate, without revenue to finance it	**++** R&D investment continued, allowing most to participate	**+** Early R&D investment not rewarded, allowing all to participate	**--** No incentive to innovate
PM emissions[35]	0 Use of old, polluting tractors is prolonged	++ Fleet renewal continued, reduction of 2.2 kt, 31 M€ benefit	**+** Fleet renewal continued, reduction of 0.8 kt, 12 M€ benefit	**--** Long-term higher emissions of 22.7 kt, 313 M€ cost
NOx emissions	0 Use of old, polluting tractors is prolonged	**++** Fleet renewal continued, reduction of 42 kt, 91 M€ benefit	**+** Fleet renewal continued, reduction of 29 kt, 62 M€ benefit	**--** Long-term higher emissions of 168 kt, 361 M€ cost
Impact on employment	0 Serious risk for job losses, up to 3000 over 3 years	**+** Job losses limited, not structural, some additional jobs at suppliers	**+** Job losses further limited, not structural, some additional jobs at suppliers	**+** No risk of significant job losses, no additional jobs at suppliers
Impact on worker safety	0 Unsafe tractors are used longer, ca. 80.000 workers exposed	**+** Improvement of safety through fleet renewal	**+** Improvement of safety through fleet renewal	**+** Improvement of safety through fleet renewal

As a result of the above analysis, it is concluded that postponing the implementation dates for NTT with 3 years (Option 2) is the most appropriate measure to ensure that the policy objectives of ensuring a competitive industry and a better protecting the environment are met.

[35] The estimated pollutant emissions and monetized impacts are relative to the baseline scenario. The emissions correspond to the timeframe until 2050, the monetized environmental impacts to the 2012-2030 timeframe.

The 3-year delay would allow most of the manufacturers to transform the recent technological progress into NTTs complying with Stage IIIB limits and simultaneously meeting the essential customer requirements for their use in vineyards and orchards. Thereby, significant job losses of Option 1 are avoided and the environmental and worker safety impacts continue to be positive due to the continued renewal of the EU fleet. Compared to Option 3, the delay would be in line with the necessary technological development and continue to foster innovation. With a limited delay, the environmental benefits that were expected from the original legislation will therefore be realised, unlike Option 4.

7. MONITORING AND EVALUATION

7.1. Indicators of progress towards meeting the objectives

Since the implementation of the preferred option entails postponing the deadline for complying with Stage IIIB and Stage IV, it is important to monitor over time the technical advancement in the industry, in order to track progress towards the transition towards these limits. Accordingly, one of the key indicators to be taken into account for evaluating the performance of the proposed action is the level of R&D investment in the sector, with specific reference to R&D aimed at the development of engines complying with Stage IIIB and Stage IV.

At the same time, the level of sales and profitability of firms (in particular, SMEs) active in the sector will have to be monitored to ensure that the new option contributed to the competitiveness of this sector and enables the replacement of old tractors with Stage IIIa-compliant and, later Stage IIIB-compliant tractors. Alternatively, since the key mechanism by which the proposed Regulation will take effect is the tractor type-approval process, a core indicator of progress will be the number of NTTs which are successfully type-approved to the Stage IIIB and IV limit values over time.

As an additional indicator, where possible, the monitoring of NOx and PM emissions attributed to NTT will reveal whether the chosen option has positively contributed to the environmental objectives related to this policy initiative.

The monitoring of these indicators can be carried out through regular contacts with the sector's trade associations and is therefore not expected to lead to significant costs.

7.2. Ongoing dialogue with stakeholders

The main reason for this proposed directive is that the technical advancement of the NTT industry does not allow for a smooth transition towards Stage IIIB as originally envisaged: this poses both a problem of regulatory failure (*i.e.* too ambitious deadlines) and a problem of industry competitiveness. The proposed 3-year extension is thus a viable solution insofar as the industry will be able to invest in R&D to develop technical solutions that comply with the set objectives at EU level for the NTT sector.

Accordingly, constant dialogue with the industry, aimed at tracking of R&D investment by large and small firms in the sector and monitoring the competitiveness of the sector and its

ability to develop suitable technological solutions within the next few years will be of utmost importance. In view of the future implementation of the rules at hand, it will be essential to monitor the NTT market and the development of technologies, including the appearance of potential solutions for the transition to Stage IV.

One suitable way of achieving this constant dialogue is to rely on the Working Group for Agricultural Tractors (WGAT).

ANNEX I – GLOSSARY & DEFINITIONS

1 - Glossary

Adsorption: the accumulation of atoms or molecules on the surface of a material.

Engine family: a manufacturer's grouping of engines which, through their design, are expected to have similar exhaust emission characteristics and which comply with the requirements of Directive 2000/25/EC

CECE: Committee for European Construction Equipment

CEMA: Committee for European Agricultural Tractor Manufacturers

C.I.: An engine that works under the compression-ignition principle, e.g. diesel engine

CO: Carbon monoxide

DPF: Diesel Particulate Filter

EGR: Exhaust Gas Recirculation

Engine manufacturer: the person or body who is responsible to the approval authority for all aspects of the type-approval process and for ensuring conformity of production of the engines.

HC: Hydrocarbons

NO_x: Nitrogen oxides

NRMM: non-road mobile machinery (emissions directive 97/68/EC)

NTT: narrow-track tractors (categories defined in Directive 2003/37/EC as T2, C2 and T4.1, the width of which is less than 1,15 m)

Original equipment manufacturer (tractor manufacturer): a manufacturer of a type of tractor (final product).

PM: Particulate Matter

UNECE: United Nations Economic Commission for Europe (Geneva)

2 – Definitions of tractor categories

Directive 2003/37/EC classifies tractors by describing the specifications of

- T2: Narrow wheeled tractors (vineyard and orchard),
- C2: narrow tracked tractors (vineyard and orchard),

- T4.1: High clearance tractors

as follows:

Definition of vehicle categories and vehicle types

A. The vehicle categories are defined as follows:

(1) Category T: Wheeled tractors

(a) Category T2: wheeled tractors with a maximum design speed of not more than 40 km/h, with a minimum track width of less than 1 150 mm, with an unladen mass, in running order, of more than 600 kg and with a ground clearance of not more than 600 mm. However, where the height of the centre of gravity of the tractor (measured in relation to the ground) divided by the average minimum track for each axle exceeds 0,90, the maximum design speed is restricted to 30 km/h.

(b) Category T4: special purpose wheeled tractors with a maximum design speed of not more than 40 km/h (as defined in Appendix 1).

- T4.1 High-clearance tractors: tractors designed for working with high-growing crops, such as vines. They feature a raised chassis or section of chassis, enabling them to advance in parallel with the crop with left and right wheels on either side of one or more rows of the crop. They are intended for carrying or operating tools which may be fitted at the front, between the axles, at the rear or on a platform. When the tractor is in working position the ground clearance perpendicular to the crop rows exceeds 1 000 mm. Where the height of the centre of gravity of the tractor (measured in relation to the ground, using the tyres normally fitted) divided by the average minimum track of all of the axles exceeds 0,90, the maximum design speed must not exceed 30 km/h.

(2) Category C: Track-laying tractors

Track-laying tractors that are propelled and steered by endless tracks and whose categories C1 to C5 are defined by analogy with categories T1 to T5.

Annex II - Reference Documents

Final Report Technical Review - DG JRC- 28 November 2008

Administrative arrangement for a Technical Review of Directive 97/68/EC, carried out by DG JRC, on behalf of DG ENTR, September 2006 - September 2008.

http://ec.europa.eu/enterprise/newsroom/cf/document.cfm?action=display&doc_id=5015&userservice_id=1&request.id=0

Final Report of the IA study - ARCADIS - January 2009

External specific contract, under LOT5 framework contract, for an Impact Assessment study of options presented in the Technical Review of Directive 97/68/EC, carried out be ARCADIS N.V., April 2008 - January 2009.

http://ec.europa.eu/enterprise/newsroom/cf/document.cfm?action=display&doc_id=5028&userservice_id=1&request.id=0

Additional Report on narrow-track tractors - DG JRC- June 2008

Final Report of the SME Test Study and IA on possible options for reviewing of the Directive 97/68/EC relating to NRMM - ARCADIS - March 2010

Additional external specific contract, under LOT5 framework contract, for an SME Test study, carried out be ARCADIS N.V., 2009 - March 2010.

See Annexes VIII, IX and X for the sections relevant for this impact assessment report.

Annex III – Emission limit standards relevant for NTTs

Date of application of the subsequent emission limit standards

Power (kW)	Year							
	2009	2010	2011	2012	2013	2014	2015	2016
56 - 75	CO: 5,0; HC+NOx: 4,7; PM: 0,4			CO: 5,0; HC: 0,19; NOx: 3,3; PM: 0,025			CO: 5,0; HC: 0,19; NOx: 0,4; PM: 0,025	
37 - 56	CO: 5,0; HC+NOx: 4,7; PM: 0,4				CO: 5,0; HC+NOx: 4,7; PM: 0,025			
19 - 37	CO: 5,5; HC+NOx: 7,5; PM: 0,6							

Stage IIIA | Stage IIIB | Stage IV

limit values: gr/kWh

CO = carbon monoxide; HC = hydrocarbons; NO_x = nitrogen oxides; PM = particulate matter;

Percentage reductions in pollutant emission limits of subsequent emission limit standards

	NO_x: IIIA → IIIB	**NO_x: IIIB → IV**	**PM: IIIA → IIIB**	**PM: IIIB → IV**
56 – 75 kW	HC+NOx=4,7 → HC+NOx=3,49; 27 %	3,3 → 0,4 = 86 %	0,4 → 0,025 = 94 %	0,025 → 0,025 = 0 %
37 – 56 kW	HC+NOx=4,7 → no change	No Stage IV	0,4 → 0,025 = 94 %	No Stage IV

Annex IV - Implementation dates

Current Directives 2000/25/EC – 2005/13/EC [36]:

Article 4 - Timetable

1. Member States may not after 30 September 2000:

– refuse to grant EC type-approval or national type-approval in respect of an engine type or family, or

– prohibit the sale, entry into service or use of a new engine, or

– refuse to grant EC type-approval or national type-approval of tractor types, or

– prohibit the use, the sale, the initial entry into service of tractor types,

on grounds relating to air pollution if the pollutants emitted by those engines or the engines fitted to those tractors meet the requirements of this Directive.

2. Member States may no longer grant EC type-approval or national type-approval for a type or family of engines or a tractor type where the pollutants emitted by the engine do not meet the requirements of this Directive:

(a) in stage I

….

(c) in stage III A

– after 31 December 2005 for engines of categories H, I and K ,

– after 31 December 2006 for engines of category J;

(d) in stage III B

– after 31 December 2009 for engines of category L,

– after 31 December 2010 for engines of **categories** M and **N,**

– after 31 December 2011 for engines of **category P;**

(e) in stage IV

– after 31 December 2012 for engines of category Q,

– after 30 September 2013 for engines of **category R**.

3. Member States shall prohibit the initial entry into service of engines and tractors where the pollutants emitted by the engines do not meet the requirements of the Directive:

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[36] For engine categories / power classes: see end of this annex

– after 30 June 2001 for engines of categories A, B, and C,

– after 31 December 2001 for engines of categories D and E,

– after 31 December 2002 for engines of category F,

– after 31 December 2003 for engines of category G,

– after 31 December 2005 for engines of category H,

– after 31 December 2006 for engines of categories I,

– after 31 December 2006 for engines of categories K,

– after 31 December 2007 for engines of category J,

– after 31 December 2010 for engines of category L,

– after 31 December 2011 for engines of categories M

– after 31 December 2011 for engines of **categories N,**

– after 31 December 2012 for engines of **category P,**

– after 31 December 2013 for engines of category Q,

– after 30 September 2014 for engines of **category R.**

However, for tractors fitted with category E or F engines, the above dates shall be postponed for six months.

4. The requirements of paragraph 3 do not apply to engines intended to be installed in tractor types for export to third countries and the replacement of engines for tractors in service.

5. For engines of categories A to G Member States may postpone the dates laid down in paragraph 3 for two years with respect to engines with a production date prior to the said date. They may grant other exceptions under the conditions laid down in Article 10 of Directive 97/68/EC.

6. For engines of categories H to R, the dates laid down in paragraph 3 shall be postponed for two years with respect to engines with a production date prior to the said date.

7. For engine types or engine families meeting the limit values set out in the table in section 4.1.2.4, 4.1.2.5 and 4.1.2.6 of Annex I to Directive 97/68/EC before the dates laid down in paragraph 3 of this Article, Member States shall allow special labelling and marking to show that the equipment concerned meets the required limit values before the dates laid down.

8. In accordance with the procedure referred to in Article 20(2) of Directive 2003/37/EC, the Commission shall align the limit values and dates of stages IIIB and IV with the limit values and dates decided following the revision procedure provided for in Article 2(b) of Directive 2004/26/EC, with a view to the needs of agricultural or forestry tractors and, in particular, tractors of categories T2, T4.1 and C2.

Power classes for engines (as defined in Directive 97/68/EC)

NB: narrow-track tractors are in the power range of 37 to 75 kW; classes P, N and R.

Stage I: ENGINE CATEGORIES: A, B, C

— A: 130 kW ≤ P ≤ 560 kW,

— B: 75 kW ≤ P < 130 kW,

— C: 37 kW ≤ P < 75 kW,

STAGE II: ENGINE CATEGORIES: D, E, F, G

— D: 18 kW ≤ P < 37 kW,

— E: 130 kW ≤ P ≤ 560 kW,

— F: 75 kW ≤ P < 130 kW,

— G: 37 kW ≤ P < 75 kW,

Stage IIIA: ENGINE CATEGORIES H, I, J and K

— H: 130 kW ≤ P ≤ 560 kW,

— I: 75 kW ≤ P < 130 kW,

— J: 37 kW ≤ P < 75 kW,

— K: 19 kW ≤ P < 37 kW,

STAGE III B: ENGINE CATEGORIES L, M, N and P

— L: 130 kW ≤ P ≤ 560 kW,

— M: 75 kW ≤ P < 130 kW,

— N: 56 kW ≤ P < 75 kW,

— P: 37 kW ≤ P < 56 kW,

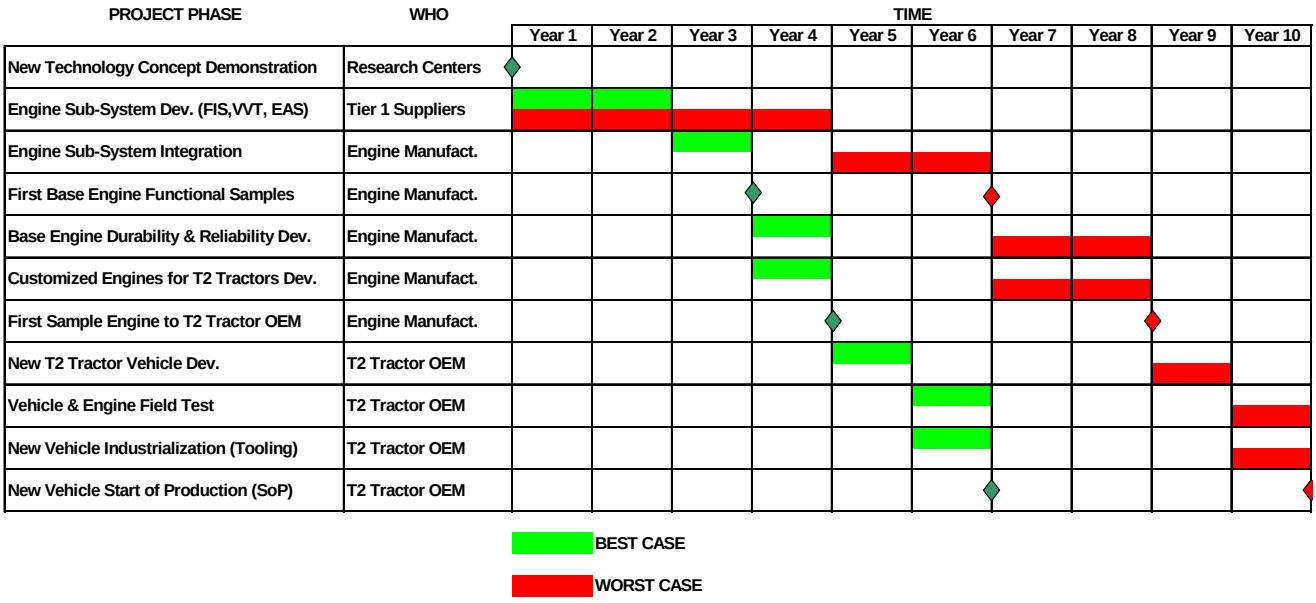
STAGE IV: ENGINE CATEGORIES Q and R

— Q: 130 kW ≤ P ≤ 560 kW,

— R: 56 kW ≤ P < 130 kW.

Annex V – Examples of Narrow Track Tractors

Annex VI - Typical NTT Engine and Vehicle Development Process



Source: CEMA

Annex VII –Stakeholders' opinions at Working Group for Agricultural Tractors meeting

(Extracts from the minutes of the Working Group for Agricultural Tractors - WGAT)

1 - Positions of stakeholders regarding a possible exemption from emission limits, based on an agenda item presented by the Commission

22-6-2009	TA authority, Austria	TA authority	Fully support the consideration to amend the current legislation
22-6-2009	Ministry, France		Welcomes the proposal to amend
22-6-2009	Ministry, Spain		Welcomes the proposal to amend
22-6-2009	Ministry, Italy		Strongly supports the proposal to amend
20-1-2009	CEMA	European tractor manufacturers	Fully support the proposal, although they prefer a complete exemption, not just 5 years exemption
22-6-2009	UNACOMA	Italian tractor manufacturers	Fully support the proposal to amend
01-07-2009	EUROMOT	The European Association of Internal Combustion Engine Manufacturers	Fully support the amendment to amend
10-07-2009	SMMT	The Society of Motor Manufacturers and Traders (UK) off Highway Engine & Equipment Group	Strongly endorses the proposal to amend
13-07-2009	AGORIA	Belgium Employers Organisation	Fully support the proposal to amend.
14-07-2009	AECC	Association for Emissions Control by Catalyst	Supports additional measures acting as incentives for Stage IIIB engines to be placed on the market but not the proposed measure. Justifications include impacts on environment, EU competiveness in the global market.

2 - Extract from minutes of WGAT

85th WGAT, 22 June 2009

4. Narrow-track tractors – exemption from emission requirements

The expert for CEMA/EUROMOT stated that in 2004, as soon as Stages IIIB and IV were decided in the frame of the amendment to Directive 97/68/EC, the specialised tractors manufacturers addressed their concerns to the Commission in view of the adaptation of the tractors directive. In time the proposal to exempt NTT received the support of Vice-President Verheugen, was successfully submitted to the technical inquiry by DG JRC, the impact assessment of Arcadis and the legal scrutiny.

He insisted that ENTR F1 presented last November a draft proposal that represents a realistic compromise between environmental expectations and technical reality and pointed to the urgency of the matter. He asked whether it should be recorded that the efforts of industry, the Commission services and independent consultants were not able to deliver a solution in 5 years?

The Italian expert expressed his surprise that after all the discussion the issue is not solved yet. Possibly his ministry would not wait for a European solution, as it is a very urgent regional problem. He also referred to requests for higher 'flexibility' percentages in the NRMM Directive.

The Austrian expert agreed, stating that in these special tractors not enough space is available for the extra emission equipment needed. The Spanish expert agreed too.

86th WGAT, 18 December 2009

5.2. Narrow-track tractors

The chairman explained that the Commission is well aware of the urgency of this issue, and that there seems to be a wide support from Member-States and industry to solve the matter. The original approach of a comitology amendment had proved to be unacceptable. A second ISC procedure for the co-decision proposal that has been prepared now had not had a promising outcome; the Unit needs to prepare an IA Report. Some discussion followed on the type of additional and detailed information needed for such report.

The Italian expert was struck by this statement. He said that many companies will have to close down with tragic numbers of lay-offs as a result. The Commission should take the economic situation into account.

A representative from CEMA gave a clear Power Point presentation to show why it's impossible now to adapt NTTs to emissions Stage IIIB and IV, on technical grounds: no space under the bonnet, unacceptable reduction of steerability or ground clearance, etc.

Another representative for CEMA, representing a specific company, explained that she would have to close down her company (400 staff) if there would be no exemption for Stages IIIB and IV. Still the users, mainly in the mountains and hills in Southern Europe, need these NTT. The emission stage IIIA already required huge investments by the manufacturers; 1 in 10 tractors of the existing EU fleet are IIIA compliant now, and the presentation highlighted that to stop the replacement of old tractors with new models will present a damage for both environment and the safety (old tractors still don't have ROPS, safety belts etc).

The Austrian expert, supporting the need for an exemption, stated that tractors in agriculture use only about 1% of the fuel, so have little impact on the environment. Stage IIIB would be technically 'impossible' in a NTT.

The Greek expert stated that this is a technical issue; if there is no technical solution then we need an administrative solution. She supports the proposal.

The French expert had the same view as the Italian and CEMA colleagues; there is a crisis now in this sector (minus 50% in 2 years).

Experts from Finland, Sweden and the Netherlands also supported the exemption.

The representative of EUROMOT stated that six months after his last intervention at a similar meeting, the situation had not advanced. He felt that this is unacceptable, but what is even more unacceptable is that the existence of the specialised tractors is questioned only on bureaucratic grounds. All the evidence of independent studies for the Commission (ref. JRC, ARCADIS) confirms the justification of the exemption of these tractors from Stages IIIB and IV due to the impossibility to meet those requirements. All the requested data are available already from those studies (mainly Arcadis) or were supplied later. What makes the situation even more surreal is that yet another impact assessment study is asked where in reality we are trying to correct a mistake in a piece of legislation not based on *Sound scientific knowledge and economic assessments, reliable and up to-date data and information and the use of indicators (Sixth environmental Action Programme)*, but is only the result of a 'cut and paste exercise' from US legislation. The co-legislators had left an open door to verification of the technical feasibility and soundness of their decisions, but now bureaucracy is closing this door. What seems worrying, from EUROMOT perspective, is that there are no signs that the system is able to correct its own mistakes in a reasonable time and that it ignores scientific evidence and puts at risk jobs in industry and agricultures and the active and productive economy of the Community.

Meeting with industry on Impact Assessment emissions NTT, 2-9-2010.

Participants: representatives from CEMA and EUROMOT and DG ENTR
Purpose: to obtain information for the IA of a proposal to solve problems for the introduction of new Stage IIIB and IV requirements for the special tractors of categories T2, C2 and T4.1 for use in vineyards and orchards, as indicated in Directive 2005/13 – article 1.4(d).

Background: when stages IIIB and IV were discussed in 2004 / 2005, industry warned for the problems for these NTT; this resulted in article 1.4(d) of 2005/13, stating in the new paragraph 8 that the Commission shall act '… with a view to the needs of agricultural or forestry tractors and, in particular, tractors of categories T2, T4.1 and C2'.

These new stages, aiming at reduction of environmental problems in Europe, were adopted without IA, fully based on alignment with USA limits and tests (Tier IV-interim and IV). In 2008 the study by JRC showed that an exemption was needed; in 2009 ARCADIS studied the IA consequences, first in the overall report on amendments to Directives 97/68 (Machinery) and 2000/25 (tractors) and afterwards in the additional SME Test study.

Two power bands as defined in 2000/25 are used for NTT: 37-56 and 56-75 kW. Most engines are in the higher class, close to 75 kW (with the new tendency to go to 80 kW, as farmers need more power for additional equipment). The 56 limit comes from US legislation

and is not specific for EU. In general the overall dimensions of the NTT are the same, regardless of whether the engine used belongs in the lower or higher power class.

IASG: on 22 July a first meeting was held, in which questions were raised (SG, ENV). This led ENTR to send a list of questions to CEMA (tractors and machinery manufacturers) and EUROMOT (engine manufacturers), which were discussed in the 2/9 meeting. The resulting info is presented below; in addition industry promised to collect and submit further data in 2 weeks time.

Industry stated that for NTT the functionality is essential, more than costs; if the user is not satisfied about functionality (esp. dimensions and fit of additional equipment) he will not buy a new tractor.

Questions and answers

Q1: are engines for NTT and other tractors the same?
Answer: yes and no. No engine is specifically designed for NTT; base engine is for use in 'all' types of tractors, but they must be adapted for use in NTT (different placing of turbo, EGR, cooling, hoses etc).

Engines for use in tractors have specific requirements (strength of sump, shape/dimensions, passage of transmission axle to front axle 'through' sump), which makes that some IIIB approved engines for machines cannot be used here. For this reason some recently presented engines (JCB engine presented in July in the AECC symposium; Cummins) are not suitable.

Q2: when can IIIB engines be available for NTT?
Answer: industry does not see IIIB becoming available until more is finished, maybe a prototype in one year. Tractor manufacturers started requesting engine manufacturers in 2006 to produce IIIB engines in time. Only recently specially adapted (shaped) filters became available for engines below 56 kW, not yet for the larger ones. EUROMOT presented in WGAT (Dec 2009) a graph showing the example of a timeline for the development of the engine and then the tractor, taking 6 -10 years (best – worst case) from the moment of demonstration of the concept of new technology.

From the moment that a first functional sample of a new base engine is available it would take 3-4 years to adapt them for use in NTT.

Costs: as this is a limited market, for competitiveness reasons industry cannot readily give figures. CEMA proposed to use a different approach which should allow to come with relevant generalised figures in the near future.

On the issue of **Stage IV**, industry stated that there are no solutions in sight; at present they do not see a date when NTT could meet those requirements ('totally in the dark'). As a consequence there are no cost figures to be indicated.

Q3: is it a useful option to skip Stage IIIB and go to Stage IV at the defined deadline?
Answer: industry stated that with the present state of knowledge it is impossible to make a Stage IV compliant NTT. Engines are not ready; SCR and DPF seem necessary but require too much space. On the other hand, for engines below 56 kW, no Stage IV is required.
On the other hand, industry invested heavily already in developing for Stage IIIB; this money would be lost if IIIB would be lost.

Q4: Is 50% flexibility a solution for NTT?
Answer: this is not the proper solution for this problem, as it basically allows only for some more weeks of leadtime, for products which are not ready by the deadline of the directive.

Annex VIII – Relevant parts of the JRC report 2008

Land Based Compression Ignited Engines

The problem arising from the application of Stage IIIB and Stage IV emission limits for *special small tractors* was discussed and analysed in large detail. In conclusion, the special narrow track tractors used in vineyards and orchards should be exempted from the emission Stage IIIB and Stage IV.

5.3 Application of Stage IIIB and Stage IV emission limits to special agricultural tractors used in vineyards and orchards

Under the Council Regulation (EC) No 1493/1999 from 14.07.1999 (OJ L179, Chapter III, Articles 11 and 13) on the common organisation of the market in wine from 1999, Member States can obtain annual payments for restructuring and conversion of a set number of hectares of vineyards. The objective of this system is the adaptation of production to market demand. It covers the following measures:

– varietal conversion,

– relocation of vineyards and

– improvements to vineyard management techniques.

The system does not cover the normal renewal of vineyards which have come to the end of their natural life.

As consequence of the restructuring of vineyards, according to a German wine producer, the row width has changed from narrow row width of about 1 meter to larger row widths of 1,6 - 2,2 meters. One reason was the possibility to switch from manual cultivation techniques to the use of special agricultural tractors and machinery. As reason for the upper row width limit the micro-climatic control was mentioned: larger row width would dry out the grounds and increase ventilation and cooling between the plants. In general it was stated that the new row width gives the best results in terms of quantity at the desired high quality level.

Similar to vineyards also the orchards are set up with row widths of about 2 meters, allowing for automation of cultivation of ground, plant/fruit treatment and harvesting by using special agricultural tractors and machinery.

5.3.1 Classification according to Directive 2003/37/EC

[See Annex I]

5.3.2 Problems reported by manufacturers and user regarding the installation of additional after-treatment equipment on special purpose tractors

The report is based on a presentation prepared by UNACOMA and material provided by manufacturers during visits to their production sites. The following list gives a summary of the reasons for which the additional (necessary) equipment required to fulfil Stages IIIB and IV can currently not be installed in the special small tractors.

General technical development and construction

– Introduction of Stage IIIB and Stage IV would need introduction of after-treatment systems for PM and NOx

– PM after-treatment is likely to be accomplished by a closed particle trap requiring sometimes also an additive tank for regeneration

– Typical volume for such a PM system is 2 - 2.5 times the engine displacement

– PM traps need high temperatures for regeneration and consequently a position near the engine out valve

– NOx after-treatment is most probably accomplished by a SCR system requiring a catalyst, a urea injection system and a urea tank. The catalyst should be placed near the engine out valves

– Typical volume for such a de-NOx system is 2 times the engine displacement

– De-NOx system requires operation temperatures above 280 C and consequently a place near the engine out valves (as does already the PM system)

– Engine temperatures during tractor operation are high. This creates already now difficulties because of the lack of space for additional cooling systems

– Under specific working conditions tractor is operated at low load with high oil consumption and high ash formation and low temperature which is difficult for running a PM filter

– When operated at high load the problems will arise from the increase in counter pressure due to construction limits; all connections between engine and exhaust after-treatment need to be bended and their cross section must be reduced.

Special purpose tractors and their specific problems

– The total number of T2 tractor sales in Europe is about 16.000 units, and the T2 engine power goes up to 75 kW. The T2 tractors are part of the about 85.000 tractors sold in year 2005 in the 19-75 kW power range (see NRMM inventory).

– Special machinery to be operated with the T2-tractors can’t be used any longer when the general shape of the tractors needs to be modified

– Average life of T2 tractor in professional environment is about 8-10 years

– Price of T2 tractors is much higher than for an equivalent “normal” tractor

– T2-tractors are sometimes used for community work, cleaning roads from snow, cutting trees or similar work. A T2-tractor would not be suitable to replace a “normal” tractor due to its higher price and its uncomfortable design with narrow driver cabin and high centre of gravity. The latter one results in frequent overturn of the tractors in steep vineyards.

– T2 tractors need to turn in a very limited area. To reduce the radius for turning, some models have shaped the tractors body to avoid that the tyres touch the tractor body. Others, the articulated tractors, have introduced additional front parts to be turned. The latter models are special flat tractors in which the driver is lying rather than sitting

– The engine is packed in the T2 tractor, and has elements that with a special shape to fit under the bonnet, which is giving the physical boundary for construction. The fuel tank is often made up of several smaller canisters put in different places.

Boundary conditions for field operation of a special purpose tractor

– T2 tractors are built for special purpose, they need to operate at high efficiency in narrow vineyards and orchards.

– They should have a maximum engine height of about 1.2 meters, a width of down to 1 meter and cabins/outside pieces that can be bended for not touching fruits during operation in field. Hot and sharp surfaces are not allowed outside the tractors, otherwise the grapes or fruits will be damaged.

– The T2-tractors are highly specialized tractors which can be operated simultaneously with different cultivation machines to reduce number of treatment steps (and consequently as by-product also the emissions per treatment).

– Limiting factors for construction and engineering freedom are the space between rows, the height of fruits above the tractors body and the space at the end of rows for turning into the “next” row.

European market and wine production

– T2 tractors are a special European product, wine producers in US have no need because the available field space there is much bigger allowing for different cultivation methods.

– European space for vineyards is limited and expensive. It needs to bring high quality products instead of mass production.

– European space for vineyards is in almost all cases difficult terrain, either in mountains or on hills, where normal tractors can’t operate.

– Vineyard row width has been changed some 10-15 years ago, funded by European commission, in order to increase competitiveness of European wine producers (see introduction).

– The change from manual to machinery treatment and fruit/grapes collection is based on the enlarged row width, increasing from about 1m to about 2m width.

– Turning with the tractor into each 2nd row is possible today without loosing too much space at both ends of the vineyard for turning the tractor. This would not be any longer possible when tractors become longer.

– Cultivation cycles are about 20-30 years: changing row width would not be immediately possible without financial losses. Cutting plants away at both field ends to allow for turning with longer tractors would reduce the field or vineyard yield substantially because European fields are already now short in length. Cutting away additional plants would result in an estimated 20% loss of cultivable grounds.

5.3.3 Environmental impact of the exemption

Further to the estimates on the environmental impact of an exemption of special narrow track tractors (categories T2, C2, T4.1) from the emission limits set in Stage IIIB and Stage IV, a more detailed emissions inventory was made. The assumptions used for the calculations and the final results are reported herein after.

(i) Basic elements and assumptions

Engine survival rate

The engine survival rate follows a normal distribution (mean = average life; $\sigma = 0.25$)

Numbers for average life of 8, 10, 12, 16 years are given in the table below and are illustrated in the graph.

Annual operating hours

The annual operation hours' curves follow a suggestion from Euromot, CECE, CEMA, but includes a linear decrease until the end of engine life, instead of a constant 50% rate.

Table 5.6: Engine survival rate per year as function of the expected average life.

engine surival rate in year x over full life				
	Average Life			
Year	8 Years	10 Years	12 years	16 years
1	1	1	1	1
2	1	1	1	1
3	1	1	1	1
4	0.99	1	1	1
5	0.96	0.98	1	1
6	0.89	0.96	0.98	1
7	0.77	0.92	0.96	0.99
8	0.60	0.84	0.93	0.98
9	0.40	0.72	0.88	0.97
10	0.23	0.58	0.79	0.95
11	0.11	0.42	0.69	0.91
12	0.045	0.28	0.57	0.87
13	0.014	0.16	0.43	0.81
14	0.004	0.08	0.31	0.73
15	0.0008	0.04	0.21	0.65
16	0.0001	0.02	0.12	0.55
17		0.01	0.07	0.45
18		0.0016	0.04	0.35
19		0.0004	0.02	0.27
20		0.0001	0.01	0.19
21			0.0026	0.13
22			0.0009	0.09
23			0.0003	0.05
24			0.0001	0.03
25				0.02
26				0.01
27				0.0046
28				0.0022
29				0.0010
30				0.0004
31				0.0002
32				0.0001
total	8.005	10.000	12.000	16.000

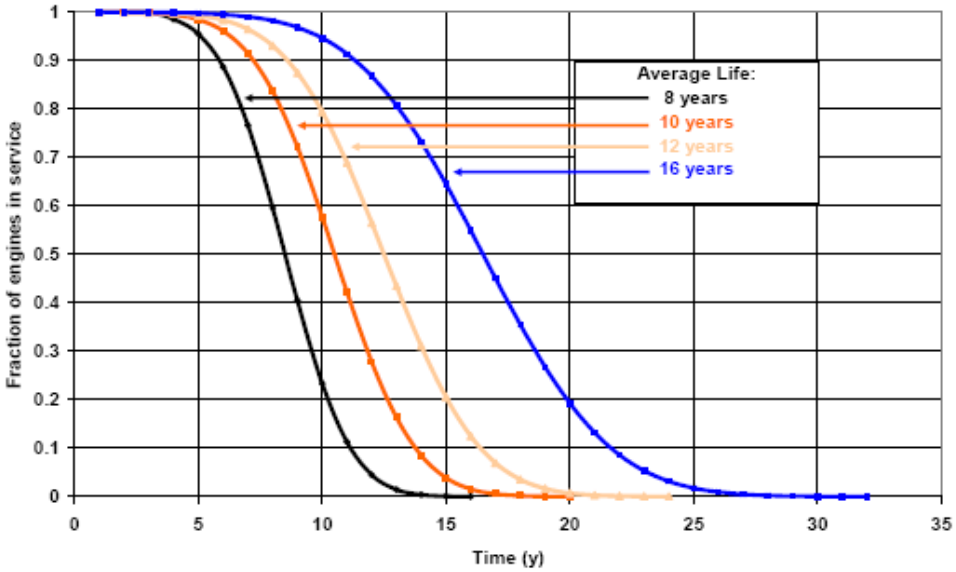


Figure 5.1: Graphical sketch of the assumed engine survival rate over the engine's life for different average life periods.

Table 5.7: Relative engine operating hours over the full life of the equipment.

engine operating hours in year x over full life				
	Average Usage			
Year	8 Years	10 Years	12 years	16 years
1	1	1	1	1
2	1	1	1	1
3	0.88	0.9375	1	1
4	0.75	0.8125	0.88	1
5	0.68	0.75	0.77	0.93
6	0.6	0.71875	0.75	0.8
7	0.5	0.625	0.74	0.75
8	0.5	0.53125	0.65	0.75
9	0.5	0.5	0.55	0.75
10	0.5	0.5	0.5	0.72
11	0.42	0.5	0.5	0.67
12	0.33	0.5	0.5	0.56
13	0.25	0.44	0.5	0.5
14	0.17	0.38	0.5	0.5
15	0.08	0.31	0.5	0.5
16	0.01	0.25	0.44	0.5
17		0.19	0.39	0.5
18		0.13	0.33	0.5
19		0.06	0.28	0.5
20		0.01	0.22	0.5
21			0.17	0.46
22			0.11	0.42
23			0.06	0.38
24			0.01	0.33
25				0.29
26				0.25
27				0.21
28				0.17
29				0.13
30				0.08
31				0.04
32				0.01
total	8.170	10.135	12.350	16.690

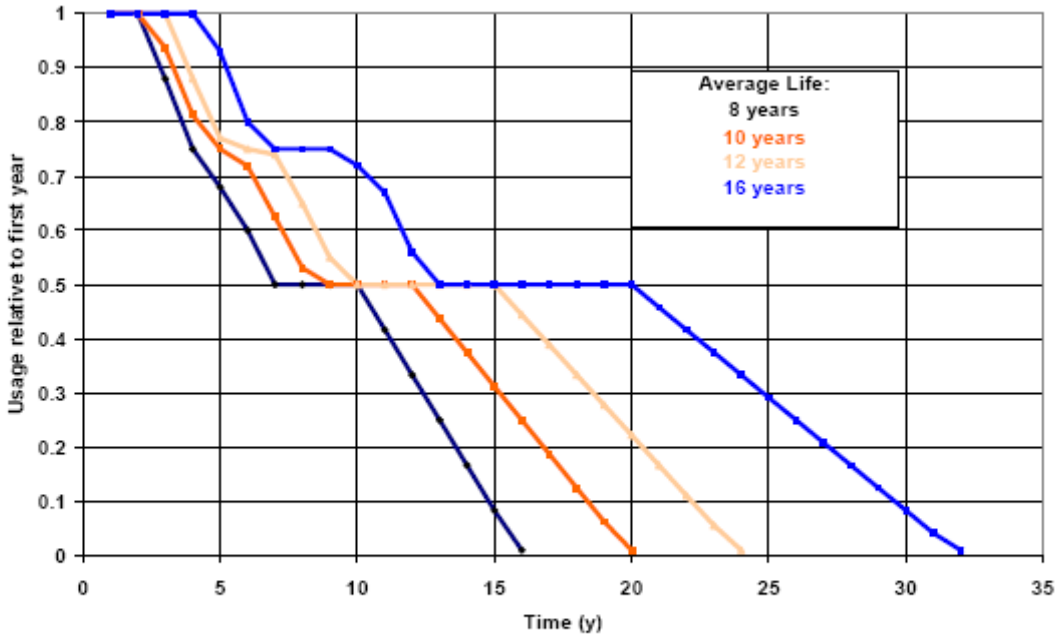


Figure 5.2: Relative usage of equipment over the full life; usage in first year is 1 (=100%).

First year operation hours

The first year operating hours within the different power categories relevant to specialised tractors are given in the table below, together with the average total operation hours over the full life of an engine. The selected conditions for the special tractors and normal tractors inventory are:

– power band 19-37 kW: 8 years average life; 400 hours operation in 1st year for normal tractors; 250 hours operation in 1st year for special tractors

– power band 37-56 kW: 12 years average life; 500 hours operation in 1st year for normal tractors; 300 hours operation in 1st year for special tractors

– power band 56-75 kW: 16 years average life; 700 hours operation in 1st year for special tractors; 350 hours operation in 1st year for special tractors

Emissions from large (normal) tractors in the power band above 75 kW were also calculated for having a complete picture of all agricultural tractors' emissions. The selected conditions for the large tractors inventory are:

– power band 75-135 kW: 16 years average life; 700 hours operation in 1st year

– power band 135-560 kW: 16 years average life; 750 hours operation in 1st year

Table 5.8: Total number of operation hours as function of the expected hours used in the first year and the expected average life; numbers in red boxes are those selected for tractors and special tractors in the calculations

Normal tractors total hours over full life				
	Average Usage			
hours Y1	8 years	10 years	12 years	16 years
400	2347	2924	3512	4738
500	2934	3655	4390	5922
700	4107	5117	6146	8291
p-band	19-37 kW		37-56 kW	56-75 kW
Special tractors total hours over full life				
	Average Usage			
hours Y1	8 years	10 years	12 years	16 years
250	1467	1827	2195	2961
300	1760	2193	2634	3553
350	2054	2558	3073	4146
p-band	19-37 kW		37-56 kW	56-75 kW

It can be questioned if the 12 and 16 years average life selected for normal tractors is also appropriate for the narrow track tractors. In the inventory it would have an impact on the fleet renewal, thus a reduced life of narrow track tractors would reduce the impact time when calculating a delay in the introduction date of an emission limit stage. But there would be no effect on the emission level of the stabilised projection.

Annual sales

Annual sales numbers for all tractors in the different power categories were taken from information given by Euromot/CECE/CEMA. The special tractors' sales numbers (named T2 sales in the table) were presented to JRC by the manufacturers during a visit to their production sites. Although these numbers were confirmed by industry in private communications, and not questioned when presented during GEME meetings, there remains a high level of uncertainty because one source quoted a total of 14.000 special tractors sold in 2004. Furthermore the total sales of special tractors with about 30.000 units per year are quite large. This has to be compared with the total sales of all tractors in the power range 19-75 kW, summing up to about 85.000 units, and with the overall tractor sales of about 150.000 units over the full power range. The share of specialised tractors in these two cases becomes 35% and 20% respectively.

However, the sales numbers used for this inventory, and shown in the table below, refer to the base year 2005. They are estimates for the sales in the EU15. For the projection a stable market was assumed (no increase/decrease in sales over the years).

Table 5.9: Total tractor and narrow tractor (T2) sales numbers in the different power classes for the reference year 2005 in EU15.

sales p.a.	p range	19-37 kW	37 - 56 kW	56 - 75 kW	all
	T2 sales	3000	13000	14000	30000
	others	300	20000	35000	55300
	total sale	3300	33000	49000	85300

Emission limits and introduction date

PM and NOx emissions from tractors were examined, being today the most relevant ones for diesel fuelled engines. Emission factors for the inventory were derived from the relevant emission limits as given in the NRMM Directives.

These values were multiplied with a "correction factor" of 0.7 for PM and 0.8 for NOx, to account for that the expected average emissions are lower than the limit values.

The real world operation and actual in-use engine power has been taken in consideration by another multiplicative "load factor" which has been set to 0.5 for all engines.

Emission limits and introduction dates shown in the table 5.10 below are those given in Directive 2000/25/EC and Directive 2005/13/EC.

Table 5.10: PM and NOx emission limits for engines used in agricultural tractors and their introduction dates for the relevant engine power classes (all new engines).

p(kW)	19-37	37-56	56-75	p(kW)	19-37	37 - 56	56 - 75
PM limits (g/kWh)					Introduction		
unregulate	1.2	1.1	1.1	unregulate			
StgI		0.85	0.85	StgI		Jul-01	Jul-01
StgII	0.8	0.4	0.4	StgII	Jan-02	Jan-04	Jan-04
StgIIIA	0.6	0.4	0.4	StgIIIA	Jan-07	Jan-08	Jan-08
StgIIIB		0.025	0.025	StgIIIB		Jan-13	Jan-12
StgIV		0.025	0.025	StgIV			Oct-14
p (kW)	**19-37**	**37-56**	**56-75**	**p (kW)**	**19-37**	**37-56**	**56-75**
Nox limits (g/kWh)					Introduction		
unregulate	10.5	12.5	12.5	unregulate			
StgI		9.2	9.2	StgI		Jul-01	Jul-01
StgII	8	7	7	StgII	Jan-02	Jan-04	Jan-04
StgIIIA	7.5	4.7	4.7	StgIIIA	Jan-07	Jan-08	Jan-08
StgIIIB		4.7	3.3	StgIIIB		Jan-13	Jan-12
StgIV		4.7	0.4	StgIV			Oct-14

Emission factors for old engines ("unregulated") were estimated from different values found in the literature. The overall impact of these engines is small in the period of interest where the exemptions for small specialised tractors might become effective.

(ii) Scenarios

Calculations were made for emissions from all tractors and separately for special tractors in the different power bands between 19 kW and 560 kW. Annual emissions, always given in kilo tonnes, are calculated until year 2050.

A first scenario estimates the annual emission pattern for all tractors under the assumption that all follow the current legislation, i.e. no exemption for special tractors.

For PM emissions additional calculations were made under the assumption that special tractors are exempted from Stage IIIB, and under the assumption that the introduction date is postponed by 5 years.

For NOx emissions additional calculations were made under the assumption that special tractors are exempted from Stage IIIB only, exempted from Stage IIIB and Stage IV, and under the assumption that the introduction date for Stage IIIB and Stage IV is postponed by 5 years.

(iii) Results

The tables and graphs below are summarising the results obtained for the different scenarios. The short discussion below is made separately for PM emissions and NOx emissions .

PM emissions:

Following the current legislation, all tractors in the full power range 19-560 kW would reach by the year 2050 a total annual emission of 1.1 kt. Taking only the power range 19-75 kW, in which the special tractors are included, the total annual emissions reach 0.3 kt in year 2050.

Exempting special tractors from Stage IIIB, the annual emissions of all tractors in the full power range 19-560 kW would reach about 1.8 kt in year 2050, from which a total of about 1 kt can be attributed to tractors in the power range 19-75 kW, in which the special tractors are included.

In other words: the exemption of small tractors would increase on the long term the PM emission by about 0.7 kt per year.

Postponing the introduction would result in year 2050 in the same total annual emission as calculated for the "current legislation". The delay would result over a period of about 34 years a total additional emission of 3.5 kt in addition to the estimated 38 kt PM emissions of all tractors in the power range 19-75 kW over the same period. This equals an overall increase by 9%.

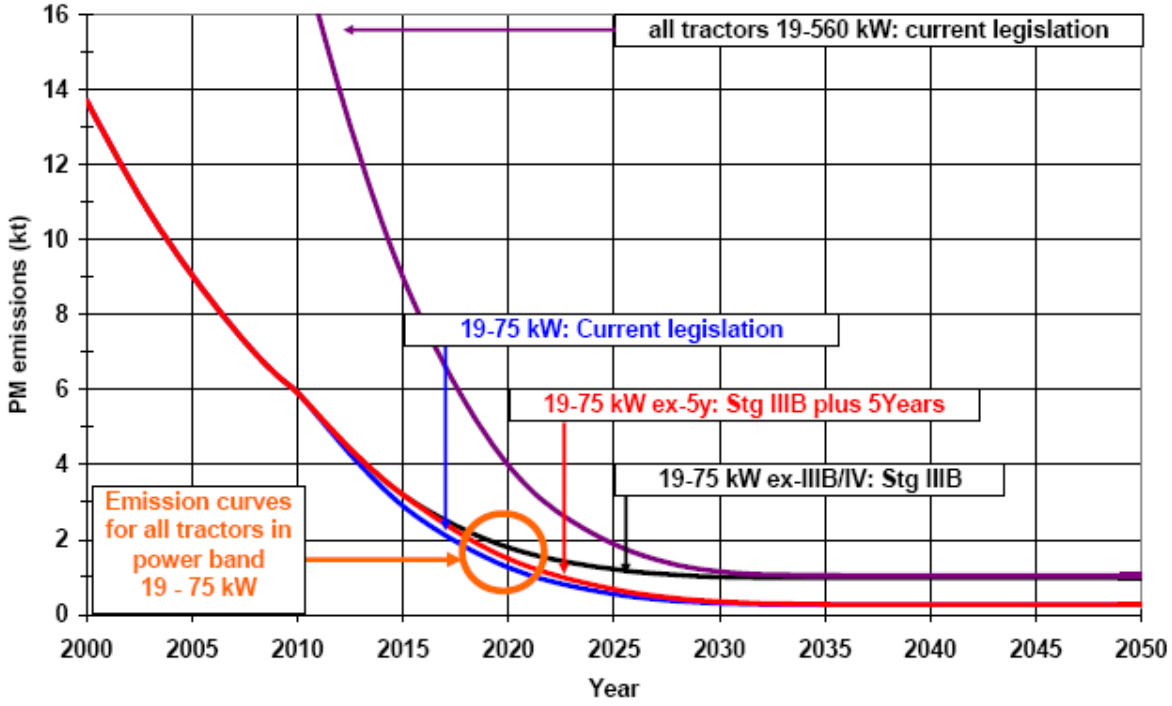


Figure 5.3: Annual PM emissions as calculated for the different scenarios until the year 2050.

Note: the graph shows the annual PM emission pattern for all tractors in the power band 19-560 kW, but the differences for different scenarios only for the tractor power band in which narrow track tractors are found (19-75 kW).

NOx emissions:

Following the current legislation, all tractors in the full power range 19-560 kW would reach by the year 2050 a total annual emission of 29 kt. Taking only the power range 19-75 kW, in which the special tractors are included, the total annual emissions reach 15 kt in year 2050.

Exempting special tractors from Stage IIIB and Stage IV, the annual emissions of all tractors in the full power range 19-560 kW would reach about 35 kt in year 2050, from which a total of about 21 kt can be attributed to tractors in the power range 19-75 kW, in which the special tractors are included.

In other words: the exemption of small tractors from Stage IIIB and Stage IV would increase on the long term the NOx emissions by about 6 kt per year.

Exempting special tractors from Stage IV only, the annual emissions of all tractors in the full power range 19-560 kW would reach about 33 kt in year 2050, from which a total of about 19 kt can be attributed to tractors in the power range 19-75 kW, in which the special tractors are included.

In other words: the exemption of small tractors from Stage IV only would increase on the long term the NOx emissions by about 4 kt per year.

Postponing the introduction of both Stages IIIB and IV would result in year 2050 in the same total annual emission as calculated for the "current legislation". The delay would result over a period of 36 years a total additional emission of 33 kt in addition to the estimated 965 kt NOx emissions of all tractors in the power range 19-75 kW over the same period. This equals an overall increase by about 3.5%.

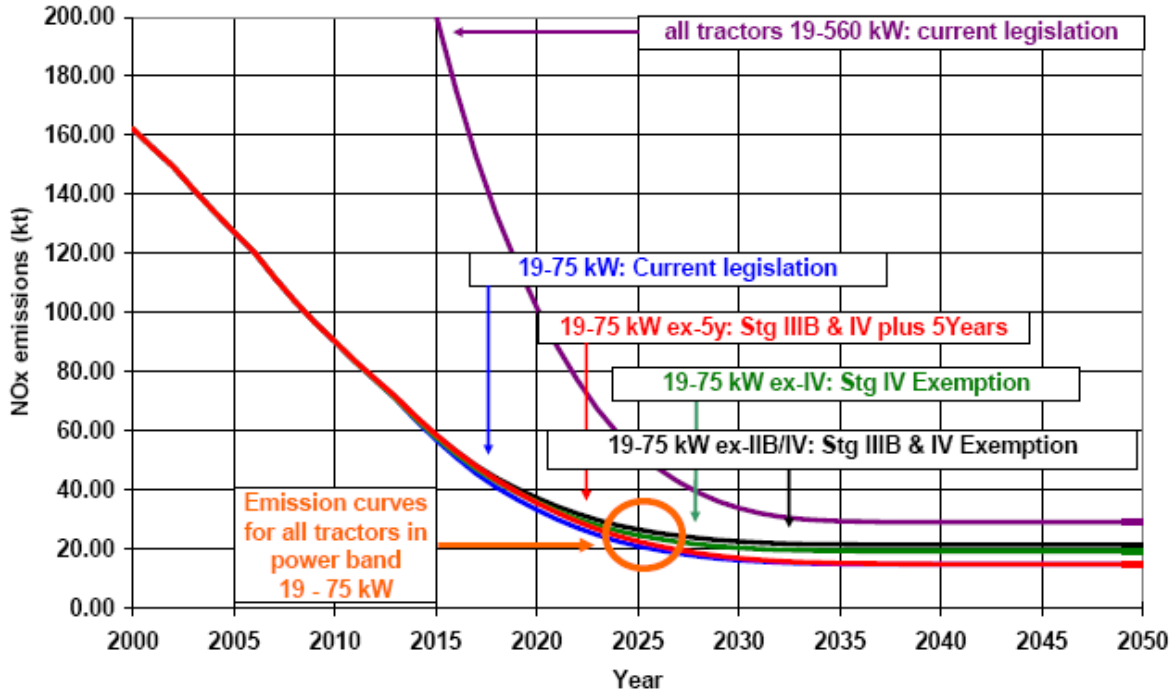


Figure 5.4: Annual NOx emissions as calculated for the different scenarios until the year 2050.

Note: the graph shows the annual NOx emission pattern for all tractors in the power band 19-560 kW, but the differences for different scenarios only for the tractor power band in which narrow track tractors are found (19-75 kW).

5.3.4 Summary

No sufficient free space is available in the current structures of T2 tractors for installation of secondary after-treatment devices. To install such emission reduction technologies, the shape of T2 tractors would need to be changed: they should be made either longer or wider. Making them higher is probably no option because of the already today's high instability of the tractors resulting from the high centre of gravity.

As consequence of the re-shaped design the user requirements will no longer be fulfilled: the tractors would touch and destroy fruits and grapes with a wider shape, or would need to be turned in time consuming and ground compacting manoeuvres. The existing special machinery could not be used any longer and would need to be replaced

To overcome these problems the vineyards and orchards need to be restructured to fit to the new shaped tractors. This would be an additional financial burden, mainly for small producers, especially caused by the reduced productivity of a field with larger row width and/or shorter row length.

On the other side the user claim that they would utilise the current tractor models longer than the normal 8-10 years to avoid the additional costs of buying a new tractor not serving their need, the new machinery to be operated with the new models and the necessary field restructuring. The new models would not find customers on the market, and some T2 tractor manufacturers stated that they would then give up this low profit market segment.

Possible actions to be taken

Option 0: No action

Option 1: Exempt special purpose tractors for a limited time from the emission Stages IIIB and Stage IV.

Annex IX – Relevant sections of the ARCADIS report 2009

IMPACT ASSESSMENT STUDY – Reviewing Directive 97/68/ECEmissions from non-road mobile machinery

Specific Contract n° SI2.ACPROCE018014400; ENTR/04/093 Lot 5

FINAL REPORT for EC DG Enterprise and Industry - 30 January 2009

3.6 LAND BASED COMPRESSION ENGINES: SPECIAL AGRICULTURAL TRACTORS USED IN VINEYARDS AND ORCHARDS

3.6.1 Background

The current structures of special agricultural tractors used in vineyards and orchards (T2, T4.1 and C2 tractors) have no sufficient free space for the installation of secondary after-treatment devices. To install such emission reduction technologies, the shape of these tractors needs to be changed: they should be made either longer or wider, which could result in higher instability of the tractors.

The eventual reshaped tractors will no longer fulfil the user requirements. They will touch and destroy fruits and grapes unless users restructure their vineyards at relatively high costs. Even if stage IIIB and stage IV compliant tractors become available, users could use the actual models longer to avoid this field restructuring and the additional costs of buying a new tractor not serving their needs. (JRC, 2007 and stakeholders input)

T2: narrow wheeled tractors

T4.1 high clearance tractors

C2: narrow tracked tractors

Emissions of special purpose tractors are roughly estimated at 8.5 % of all CI NRMM for NOx and 4.8 % of all CI NRMM for PM. (JRC, 2007 and own calculations) With a reduction of emissions of other CI engines, the relative emissions of these engines will grow in importance.

3.6.2 Options to investigate

– option 0: do nothing or keep stage IIIB and stage IV for special purpose tractors

Risks are that new tractors are not bought in the short term and that producers pull out of the market

– option 1: exempt special purpose tractors form stage IIIB and stage IV

This option will cause some extra emissions. It will make life of users easier. An exemption of 5 years seems to be reasonable from a technical point of view (Mr Krasenbrink)

Remark:

– for the smallest segment 19-37 kW there is no stage IIIB and thus no problem

– for the 37-57 kW there is a stage IIIB but not a stage IV

– for the 57-75 kW there is a stage IIIB and a stage IV foreseen

Emission standards

Table 1 Relevant emission standards for special purpose tractors

emission standards g/kwh	19-37 kw			37-56 kw			56-75 kw		
	standard		start date	standard		start date	standard		start date
	Nox	PM		Nox	PM		Nox	PM	
stage IIIA	7.5 (HC incl)	0.6	31/12/2006	4.7 (HC incl)	0.4	31/12/2007	4.7 (HC incl)	0.4	31/12/2007
stage IIIB	no stage IIIB emission standard			4.7 (HC incl)	0.025	31/12/2012	3.3	0.025	31/12/2011
reduction compared to IIIA					94%		27%	94%	
stage IV	no stage IV emission standard			no stage IV emission standard			0.4	0.025	30/09/2014
reduction compared to IIIB							88%	0%	

3.6.3 Sector description

Special agricultural tractors are a purely European product –in the US, available field space is much bigger (JRC, 2007). According to the JRC, about 28 000 tractors are sold in the EU 15[37] – this corresponds 5.8% of all sold NRMM CI engines.

CEMA estimates that 25 600 units are sold per year in the EU, and 2 500 outside the EU. The price is € 30 000 with a minimum of € 17 000 and a maximum of € 58 000, corresponding to an estimated turnover of € 843 million.

The 4 largest companies in the EU hold a market share of 55% - the remainder of the market is in hands of SMEs. All producers are based in Italy or Germany, and the SME"s are all Italian. These producers employ 1 800 people directly, and 1 200 people indirectly.

3.6.4 Main impacts of the options

3.6.4.1 Compliance costs

Building small vineyard and orchard tractors seems to be unfeasible for the industry. Those small tractors have to operate at high efficiency in narrow vineyards and orchards. Maximum weight and width, end of row turn, are strictly limited due to these elements. The width is a decisive factor in the decision to buy a specialized tractor.

Fitting after-treatment on the small tractors without modifying their specific characteristics is with current technologies unfeasible.

A diesel particulate filter could be added at the side of the tractor, under the tractor or on top of the engine. All solutions modify one or more of the specific small tractor characteristics to wit and cause therefore other potential problems:

- Impossibility to overcome real life ramp angles
- Insufficient visibility
- Impossibility to use mid mounted implements
- Impossibility to steer

[37] Personal communication from Mr Krasenbrink, updating the estimate in the JRC report, p. 89.

- Impossibility to perform operations with side mounted implements
- Impossibility to perform operations with front loaders…..

3.6.4.2 Socio economic impacts

For an evaluation of the socio-economic impacts, we will assume that option 0 is indeed technologically not feasible.

In this case, the following solutions would be open for the end users:

- Redesign existing vineyards and orchards to fit compliant tractors
- Maintain old tractors until a technical solution has been found for new tractors

The first solution has been clearly excluded by the vineyard sector. The European Confederation of Independent Winegrowers (CEVI) has not been able to quantify its financial implications, but has pointed out that a grubbed-up and replanted vineyard does not give grapes before three years. The average life cycle of a vineyard is forty years. However, as explained in section 0, the JRC has estimated that 5 additional years would be sufficient to develop of solution for special tractors!

Moreover, according to the CEVI, the planting density is determined by the specifications of the designation of origin. An enlargement of rows would then run counter to EC support for replanting with a higher density. In some slope or terrace zones, CEVI also claims that it would not be possible to widen the rows.

The JRC report has also pointed out that 20% of cultivable land will be lost when vineyards are adapted to new tractors while European space for vineyard is limited and expensive.

Therefore, we think we can safely assume that the first solution is excluded.

Therefore, the more realistic assumption is that end users will simply not buy new tractors, but maintain their old ones until a new technical solution is found. In this case, the environmental benefits of the Directive would be lost.

As the smaller producers of special tractors are niche players, discontinuation of the production of this type of tractors would put them out of business. Employment at the larger manufacturers would be reduced proportionally, at least until a solution has been developed. Due to a lack of more specific information, we can only conclude that this would correspond to a maximum of 3,000 job losses for a period of up to 5 years.

3.6.4.3 Environmental impacts

Emission results

The graphs below show the main environmental impacts of the options under investigation: Figure 3 for PM and Figure 4 for NOx.

The graph for the compliant solution (option 0) is rather hypothetical, as it is unfeasible to comply with stage IIIB and stage IV. Two sub options are possible in the case 0 option:

- Option 0A: No new machinery is available and vineyards have to close down (not shown on graph)

- Option 0B: No new machinery is available and older tractors continue to work. Machinery is repaired instead of replaced.

In the hypothetical situation that all engines are able to meet the emission limits at the date as originally planned (option 0), the decrease in emissions is larger than if special tractors are exempted from Stage IIIB emission limits for 5 years (option 1).

However, if Stage IIIB emission limits are imposed and no new machinery is able to meet the limits, causing old machines to remain in service (option 0B), emissions are higher than for option 1.

These general conclusions are similar for PM emissions and NOx emissions. However, there is one notable difference between PM and NOx: the difference between option 0 and option 1 is larger for PM than for NOx.

As a result, option 1 emissions are closer to option 0B emissions for PM than for NOx.

As it is assumed that Stage IIIB (and Stage IV in the case of 56-75kW engines) emissions can eventually be met, emissions of all options converge after the complete stock has been renewed around the year 2030. Eventual yearly emissions are estimated at 0.171 kt for PM and 4.41 kt for NOx.

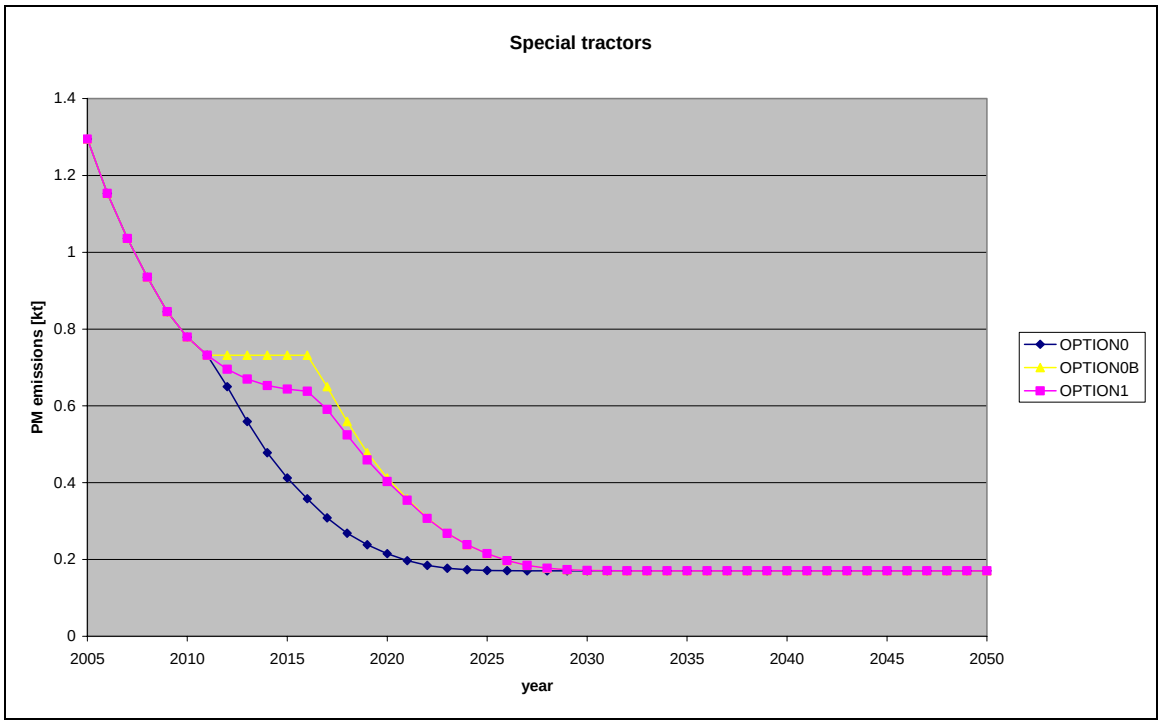


Figure 3 PM emissions of Special agriculture tractors (time series 2005-2050)

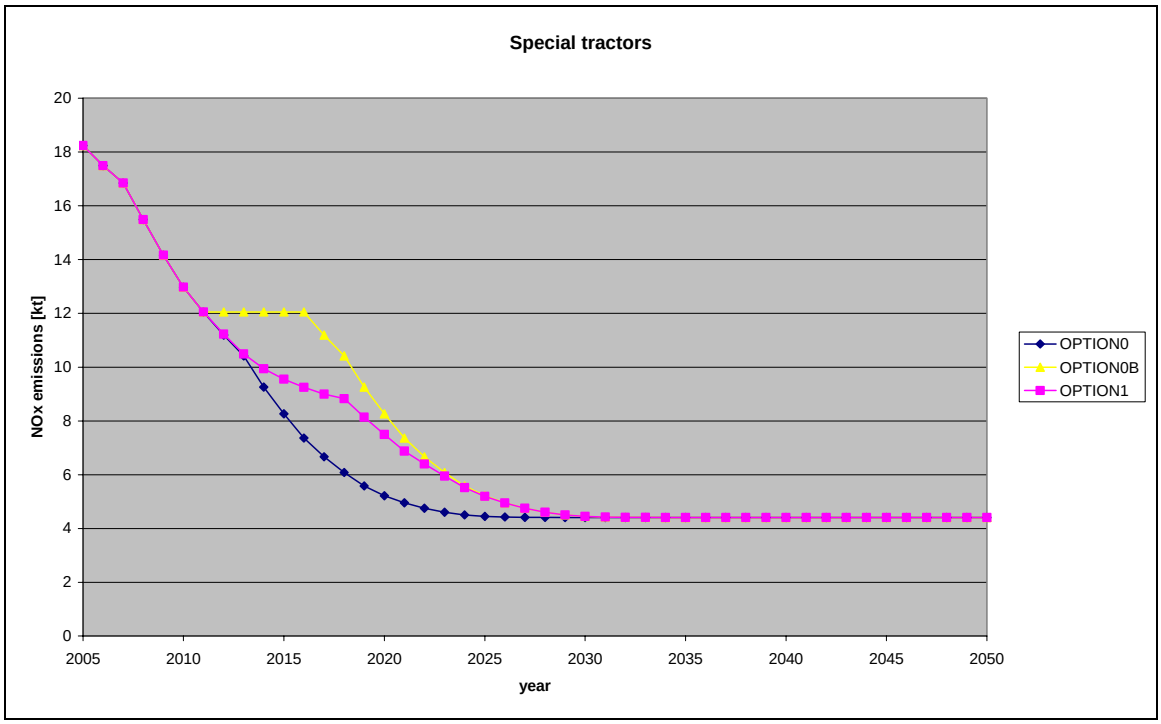


Figure 4 NOx emissions of Special agriculture tractors (time series 2005-2050)

Methodology emission calculation

In the annex a small emission model for CI engines is described.

This model is also used to assess the impact on emissions for the different options for special agricultural tractors.

From the 7x7 matrix in the emission model, the cells for the category “agricultural tractors” for engine power classes 19-37 kW, 37-57 kW and 57-75 kW are used in this calculation.

The input for the emission model is adapted for special agricultural tractors, based on info from the JRC report and based on input from CECE/CEMA.

- Annual sales

Annual sales are estimated at 26 000 per year for EU15. These sales are assumed to remain constant (stable market conditions).

Special agricultural tractors have a power range between 19 and 75 kW.

Due to lack of better data, the shares of the three power classes between 19 and 75 kW are assumed to be equal, see Table 2.

Table 2 Estimated annual sales special agricultural tractors (EU15)

	19-37 kW	37-56 kW	56-75 kW
Share	33%	33%	33%
Agricultural Tractors	8666	8666	8666

- Useful machine life

In the JRC report, useful machine life was reported to be between 8 to 10 years. Therefore, the average useful machine life is assumed to be 9 years.

- Emission factors

The only difference between the different options, is the set of emission factors that is used for each option. The options under investigation are described in section 0.

There are three engine size classes for special agricultural tractors. The option 0 emission factors for 19-37 kW are indicated in **Error! Reference source not found.**, those for 37-56 kW engines are indicated in Table 4, and Table 5 contains the emission factors for 56-75 kW engines. The pre-Stage I emission factors are based on (Van Zeebroeck, 2005). The Stage I, Stage II and Stage IIIA emission factors are calculated as the emission limit multiplied by a reduction factor, as an estimate for typical emissions. The reduction factors are based on those provided by Euromot/CECE/CEMA, see Table 6.

To calculate emissions for option 1, Stage IIIB emission factors are delayed 5 years. For 56-75 kW engines, the Stage IV emission factors are also delayed 5 years.

Table 3 Emission factors for 19-37kW CI engines (option 0)

From	To	NOx	PM	Comments
0	1980	16.20	1.60	Based on [Van Zeebroeck, 2005]
1981	1990	16.20	1.50	Based on [Van Zeebroeck, 2005]
1991	2000	9.80	1.26	Based on [Van Zeebroeck, 2005]
2001	2006	5.76	0.45	Stage II * red_factor_typical_emissions; PM adapted for alignment with JRC
2007	2050	4.55	0.34	Stage IIIA * red_factor_typical_emissions

Table 4 Emission factors for 37-56kW CI engines (option 0)

From	To	NOx	PM	Comments
0	1980	11.500	1.800	Based on [Van Zeebroeck, 2005]
1981	1990	8.600	1.200	Based on [Van Zeebroeck, 2005]
1991	1998	7.700	0.720	Based on [Van Zeebroeck, 2005]
1999	2003	7.360	0.476	Stage I * red_factor_typical_emissions
2004	2007	5.600	0.224	Stage II * red_factor_typical_emissions
2008	2012	3.171	0.224	Stage IIIA * red_factor_typical_emissions
2013	2050	3.171	0.025	mininimum of (Stage IIIB, ef_factor previous years)

Table 5 Emission factors for 56-75 kW CI engines (option 0)

From	To	NOx	PM	Comments
0	1980	11.500	1.800	Based on [Van Zeebroeck, 2005]
1981	1990	9.460	1.200	Based on [Van Zeebroeck, 2005]
1991	1998	8.470	0.800	Based on [Van Zeebroeck, 2005]
1999	2003	8.096	0.536	Stage I * red_factor_typical_emissions
2004	2007	6.160	0.252	Stage II * red_factor_typical_emissions
2008	2011	3.480	0.252	Stage IIIA * red_factor_typical_emissions
2012	2013	3.300	0.025	mininimum of (Stage IIIB, ef_factor previous years)
2014	2050	0.400	0.025	mininimum of (Stage IV, ef_factor previous years)

Table 6 Reduction factors for typical emissions for pre-Stage IIIB emission limits for 19 to 75 kW CI engines

red_factor_typical_emissions			
	NOx	PM	Comments
original	0.8	0.7	Source: CECE-CEMA-EUROMOT, 2006
19-37kW	0.72	0.56	adapted to align with JRC calculation
37-56kW	0.8	0.56	adapted to align with JRC calculation
56-75kW	0.88	0.63	adapted to align with JRC calculation

Monetized estimate of environmental impacts of options for small tractors

Based on the above calculated emissions in tons and the external costs for NOx and PM we calculate the monetized values of the differences in emissions between the reference option and option 1-exemption and option 0b-old tractors remaining. We considered the 2012-2030 period and discounted monetized emissions to 2008 at a discount rate of 4%. The table below illustrates the results.

Table 7 Monetized emission impacts for option 1 and option 0b for small tractors (million EUR)

mil EUR	option1 exemption	option 0b(old tractors)
total	-120	-193
PM	-48	-60
Nox	-72	-134

The figures in the table show negative values as these are real environmental costs. Each of the options increase the emission compared to the theoretical (unrealistic) reference option. Exempting special tractors for 5 years costs € 120 million more in emissions than having small tractors complying from the foreseen dates. Keeping the emission standard as foreseen, but not having compliant tractors ready will however cost € 193 million due to the old tractors that are kept in service.

3.6.4.4 Multi criteria analysis

There are no technical compliance costs as compliance is technically unfeasible. We analyse therefore not the efficiency of the options. We give however for the different options an overview of the different options.

Other elements

Category	Option 0	Option 1
Functioning of the internal market	No specific issues identified	No specific issues identified
Competitiveness, trade and investment flows	Could lead to decreased competitiveness of European orchards or vineyards compared to foreign competitors As T2 tractors are a specific European product (see JRC report, p 90), trade is not an issue for this equipment type	Would solve issues of competitiveness
Operating costs and costs of business	Would lead to increased operation costs for orchards and vineyards due to longer maintenance of special tractors	Would solve issues of cost increases
Administrative burden to companies/SME's	Most vineyards and orchards are SMEs producing special tractors would disappear from the market	Would solve issues
Property rights	No changes expected	No changes expected
Innovation and technological development	Could lead to more R&D for compliance at the expense of customer-oriented R&D; no information provided by industry	Could lead to more R&D for compliance at the expense of customer-oriented R&D but less so than under option 0; no information provided by industry
Consumer and households	Will lead to increased wine price, but no information available that would allow to quantify this impact	Would solve issues
Specific regions, sectors or workers	Will have negative impact in rural areas and in the sector involved in the production of special tractors	Would solve issues

Third countries and international relations	No specific issues identified	No specific issues identified
Impact on public authorities, including administrative costs	No specific issues identified	No specific issues identified
Impact on macroeconomic environment	With EU27 GDP estimated at 12,870,560 million EUR (EUROSTAT), estimated compliance costs and employment effects do not have a significant macroeconomic impact	Would solve issues
Employment and labour markets	Localised and temporary job losses of a few thousand units	Would solve issues
Standards and rights related to job quality	No specific issues identified	No specific issues identified
Social inclusion and protection of particular groups	No specific issues identified	No specific issues identified
Public health and safety	Loss of 193 million EUR compared to theoretical option 0	loss of 121 million EUR compared to theoretical option 0

Annex X – Relevant sections of the ARCADIS SME Test report 2010

"SME Test Study and IA on possible options for reviewing the Directive 97/68/EC relating to NRMM – Reviewing Directive 97/68/ECEmissions from non-road mobile machinery"

EXTENDED EXECUTIVE SUMMARY

The aim of this study was to complement the existing Impact Assessment study related to Directive 97/68/EC (as amended) with a detailed assessment of the impacts the identified policy options may have on SMEs.

We have focused our research on the following categories of stakeholders:

– the manufacturers of engines, equipment and components

– professional end users of the equipment.

Based upon the results of the IA study, there was no indication that other SMEs are affected significantly by this Directive. Therefore, in our proposal, we had proposed that the focus of the study would be on these categories. The most striking conclusion of this study is that, despite the very important efforts undertaken by the project team, less than 10 individual tractor manufacturers (abstracting from the shipbuilders) have been identified unequivocally as SMEs and have contributed actively to the study.

The number of SMEs identified amongst professional end users was much higher, but really new information was only provided by the following sectors: independent winegrowers, cableway and ski lift operators, and by the inland waterways sectors.

There are several possible explanations to the large difference with previous estimates of the number of SMEs:

– The discrepancy between the Commission's definition of SMEs and the public perception of what an SME is.

– SMEs feel that their specific interests are not always well represented by the sector federations. Therefore, we have also used alternative communication channels but this has resulted in very limited response rates as well.

– For SMEs, the burden of responding actively to the questionnaire is often too high compared to the (perceived) benefits of doing so. This is certainly the case for professional end users.

However, if a less restrictive definition of SMEs would be used in future work, this would ignore two essential problems of SMEs that are solved with mergers and acquisitions (high fixed costs and difficult access to capital). Moreover, a change of the scope of the definition could lead to confusion on the side of the industry.

Allowing longer response times could lead to a slightly higher response rate, but, in this study, the extension of the contract has not had a significant impact on the actual response rate. Drafting a questionnaire in several languages (or allowing SMEs to answer in their mother tongue), would have huge implications in terms of translation budget and in execution time. Finally, there are limits to how far we can go in simplifying the questionnaires without missing the whole point of the study.

The most important policy conclusions are:

…

– Virtually all tractor manufacturers that have been interviewed in the course of the study have expressed concerns with respect to the rapid succession of emission stages (rather than the absolute values of the imposed emission limits). This affects their business negatively through the following channels: (a) shorter production runs to cover fixed costs (b) the costs linked to teething problems of new equipment.

– The most important concern raised by producers of agricultural machinery was not the next stage in the Directive, but the homologation process, and more specifically: the length of this process, the lack of international standardisation and the fact that even minor changes require rerunning a complete homologation process.

– Regarding the impact of the Directive on tractors used in orchards, no information has been obtained from the relevant professional organisation of end users. Regarding the impact on tractors used in vineyards, the European sector federation has confirmed that all independent winegrowers are SMEs, and the vast majority are micro-enterprises. Our calculations indicate that:

    – the cost for redesigning vineyards to accommodate stage IIIB and IV compliant tractors would be several orders of magnitude larger than the environmental cost of *not* exempting the special tractors from stage IIIB and IV;

    – the increased maintenance cost following from keeping old tractors in use would be an order of magnitude larger than the environmental cost of *not* exempting the special tractors from stage IIIB and IV.

This study has considered the two following generic mitigating measures:

….

– An extension of the duration of the flexibility scheme would allow small equipment manufacturers to overcome the long time lag between the development of a new engine and the full integration of this new engine in the equipment (including homologation for use on the road);

Most tractor manufacturers that we have interviewed are aware of the flexibility scheme, but not all seem keen on using it. One manufacturer has raised the specific concern that the engine options for reviewing the Directive 97/68/EC relating to NRMM suppliers may not always be able to supply engines complying with the previous stage of the Directive.

…

3.4 Consultation with the identified target group

The questionnaires have been sent out after the inception meeting with the Commission services. However, as our experience with the IA study had shown that few stakeholders have the resources to provide comprehensive answers to this type of questionnaire, the project team has proposed to concentrate on two groups of selected stakeholders:

– First, we have contacted the European industry associations that have been consulted during the IA study: AECC, CCNR, CECE, CEMA, CER, EBU, EGMF, ESO, ISMA, ORGALIME, UITP, UNIFE, VDMA and EUROMOT.

– Second, we had proposed to single out a representative group of SMEs that is willing and able to cooperate on this study. The selection of this group would take place in consultation with the European industry associations and with UEAPME.

We aimed at 2 SMEs per main NRMM sector used in the IA study.

Our intention was to organise round table discussions with those selected stakeholders. Experience with the IA study had shown that this is the most effective means to elicit a maximum of information. We proposed to organise six half-day round table discussions, focussing on the most relevant sectors. Relevant sector are those where many SMEs are active as a manufacturer or as a professional user of the equipment.

We also proposed to approach the SMEs via in-depth telephone interviews and mail exchange, as it is difficult to organise meetings with them in Brussels. A round table discussion has been asked with UEAPME.

3.5 General development of the consultation process

Table 1 gives an overview of all the contacts that have been made with stakeholders. Although the questionnaires have been sent out immediately after the signature of the contract, and although there has been a steady follow up, the general response rate has been very low. We will discuss the specific reasons chapter per chapter, but the main reason is that, for most sectors covered by the NRMM Directive, there are very few (if any) SMEs. One of the reasons why the relative importance of the number of SMEs might have been overestimated in the past is that the criterion of autonomy in the definition is often overlooked: companies that fulfil all other criteria (headcount and turnover or balance sheet total) can still not be considered SMEs if they are part of a larger group that does not meet the criteria. Moreover, the sector of internal combustion engines has recently gone through a consolidation phase, and the full extent of the reorganisation of the sector is now only becoming clear.

Effects on SMEs are therefore generally limited to the professional end users, who are much less familiar with the NRMM Directive.

Upstream in the product chain, the manufacturers of exhaust emissions control equipment are an important actor. The sector federation AECC does not count any SMEs amongst its members, but has referred us to some individual companies that are not members of AECC. Amongst these, one SME has been identified, which has been contacted individually. However, this contact has not led to the identification of information that could be useful for

the purposes of the current study. CLEPA, the European Association of Automotive Suppliers, has informed us that this subject was of no interest to them.

Therefore, our invitation to organise round table meetings has met a very low positive response rates. We have been able to hold several telephone interviews who turned out to be very informative, but also less than we had hoped for.

As explained above, in parallel with the sector organisations, in order to reach SMEs that are not affiliated to sectoral associations, we had taken several steps in parallel:

– We have contacted UEAPME, the European Association of Craft, Small and Medium-sized Enterprises. UEAPME has sent out the questionnaires, but has pointed out that it does not work directly with SMEs, but with its members, which are national horizontal SME organisations. This means that 1) UEAPME cannot send the questionnaires directly to SMEs or invite them directly to attend meetings in Brussels 2) UEAPME does not know whether or not its members have national branch organisations specialised in the sectors concerned by the NRMM and the Noise Directives. Therefore, UEAPME cannot target these SMEs specifically. Because the NRMM and the Noise Directives are very specific, it is not possible for UEAPME to speak in the name of its members on this issue. UEAPME has also expressed concerns with respect to the representativeness of any response because of (1) the language barrier some SMEs face (2) the short deadline. This channel has not led to any specific response.

– Thanks to the kind cooperation of Mr Berck and Németh of DG ENTR, we have launched the questionnaires through the Enterprise Europe Network on 03 June.

This channel has not led to any specific response.

– Taking into account that many equipment types that are covered by the Noise Directive contain engines that are covered by the NRMM Directive, we have taken a sample of more than 80 companies out of the noise database that the Commission is managing according to Article 16(4) of Directive 2000/14/EC. This sample has led to the identification of just 2 SMEs. As already pointed out above, many “small” companies do not fall under the definition of SMEs because they fail to satisfy the criterion of autonomy.

– We have also contacted associations of local authorities (Eurocities and CEMR), who are important end users of some machine types covered by the Directive. On 22 July, the CEMR has informed us that they would not be able to provide input on this issue.

On 28 May, the Commission services have sent us a list of Italian SMEs that they had received from an Italian stakeholder. All these enterprises have been contacted immediately, and some individual responses were received. On 29-30 June, reminders (per e-mail and phone) were sent to all individual companies that had not yet responded.

On 30 June, CECE has handed over a list of industry directories that could be useful in identifying individual SMEs: www.intermat.fr ; http://www.bauma.de/ ; www.smopyc.es ; www.lectura.de ; ANMOPYC ; www.khl-group.com .

These directories contain several thousands of companies. We have taken a targeted sample of 170 companies in order to identify SMEs that are not members of the sector associations. Based upon publicly available information, we have concluded that 71 of these companies do

not fall within the EC definition of SMEs. All other companies have been contacted individually.

PNEUROP has informed us that, to the best of their knowledge, none of their members is actually an SME. However, they have provided us with a (short) list of manufacturers that they think may be SMEs but that are not members of PNEUROP. These manufacturers have been contacted individually. On 15 September, CECE has also handed over a list of companies that produce drill rigs. They have all been contacted individually. In some cases, individual respondents to the questionnaires have also indicated that some of their competitors may well fall within the EC definition of SMEs. These companies have been contacted individually. Reminders have been sent.

On 12 October 2009, the contract was formally amended, allowing an extension until the end of March 2010. We have used this extension to send reminders, both to professional organisations and to the companies that had been contacted on an individual basis. This has unfortunately not led to a significant increase in the response rate.

8 Landbased compression engines: Special agricultural tractors used in vineyards and orchards

8.1 Impact on producers

The IA study had concluded that 45% of the tractor market is in hands of SMEs.

Discontinuation of the production of this type of tractors would put them out of business.

T2 (narrow wheeled) tractors and C2 (narrow tracked) tractors are produced in Italy and Germany only. After thorough investigation, the 3 manufacturers that were indicated as SMEs turned out to have a workforce between 250 and 300 people[38]. Therefore, they do not qualify as medium enterprises according to the EC definition. We will therefore no longer pursue the issue of the T2 and C2 tractors in this section.

The T4.1 (high clearance) tractors are a typically French product. 95% of the market is held by Bobard and Tecnoma. Bobard is an SME, while Tecnoma is part of the Exel group. The remaining 5% is held by very small producers, who sell at most 10 to 20 tractors per year. The market has gone through a consolidation phase in the 1990s, which is indicative of the existence of economies to scale. According to Bobard, this market is a small one. Industry sales amount to 500-600 units per year. 90% of these are sold in France while the remainder is exported to Switzerland or to Central and Eastern European countries.

Sales (in units) at the industry level have decreased by 12% in 2007-2008 and by 12-15% in 2009. This decrease is largely due to the on-going economic recession, and not to structural factors.

On the contrary, due to an ongoing consolidation of the viticulture sector, the average surface area of individual enterprises is increasing. Clients are requesting products of ever increasing precision. Thus, while the number of tractors sold is decreasing, the unit price of tractors is increasing.

Actually, demand can be expected to increase in the future. In France, the Grenelle de l'Environnement has requested a decrease of pesticide use in agriculture with 50%[39], which should lead to increased mechanical weeding (and thus to an increase in demand for high clearance tractors).

Besides Bobard, we have identified 3 other producers of high clearance tractors. One of them declined to allow an interview due to time constraints. This leaves us with three case studies based on telephone interviews.

8.1.1 Case study 1

Bobard produces only high clearance tractors (T4.1) which are used in narrow vineyards.

According to Bobard, horses are the only technical alternative to this type of tractors. Currently, Bobard sells about 250 tractors per year, in 5 different models. With an average

[38] Personal communication by Dr Billi (24 November 2009).

[39] see: http://www.legrenelle-environnement.fr/grenelle-environnement/IMG/pdf/Fiche_6.pdf

lifetime of 3 years, this means that fixed development costs have to be amortized over a series of 150 tractors.

The large number of models is explained by the diversity of terrain conditions (relief, plantation width) on which vineyards are built.

The relative share of fixed costs is increasing through time. The development costs linked to the integration of an engine complying with a new stage of emission standards correspond to one full time project engineer during one year (to which one has to add the homologation costs, which vary from 12 000 to 15 000 EUR, depending on the tractor type). These resources are then unavailable to meet new technical requirements from the clients. Bobard can manage the development of 3 new projects per year. Each new tractor type requires 23 months as a prototype.

The typical sales price of a T4.1 tractor sold by Bobard lies in the range 70 000 to 85 000 EUR.

The typical economic lifetime (in use) a T4.1 tractor is 7 to 10 years. If a tractor is used beyond this period, annual maintenance costs can be expected to increase from (approximately) 1500-2000 EUR per year to 3000-4000 EUR per year.

Bobard has suggested to have a longer time interval between subsequent stages. Bobard does not take advantage of the flexibility scheme. Their main motivation for not doing so is that they are uncertain whether their engine suppliers will be able to supply engines that comply with the previous stages of the Directive, whilst they have already started the production of engines complying with the next stage. With a longer time interval between subsequent stages, the product cycles of engine and tractor producers would be synchronised.

Bobard estimates that the homologation of a new tractor for use on the road requires 7 to 8 weeks of internal work, and between 15 and 23 weeks before approval of the DRIRE is obtained.

8.1.2 Case study 2

VSP Construction is a family business in the category “micro enterprises”. 90% of their turnover (1 200 000 EUR) originates from the sale of T4.1 tractors. This corresponds to 10-15 tractors per year. Occasionally, they also sell tracked tractors.

6 employees (out of a total of 17) are directly involved in the production of T4.1 tractors.

The production of the frame is subcontracted to their sister company C2MH – this corresponds to 2 indirect jobs.

The vast majority of their sales take place in France; although they also occasionally sell on the Belgian market.

Their principal activity consists in the production of customized high clearance tractors. This is not limited to applications in vineyards; their clientele consists of firms who do not find suitable solutions in the mass market. Non-vineyard applications include tractors for picking up algae under the water level or for picking up boulders from fields. However, vineyard applications still constitute 90% of their turnover. Another competitive advantage is a shorter delivery time than some of their competitors. A disadvantage compared to larger manufacturers is that the share of development costs is relatively high (one sixth of the

payroll). However, their activity is not capital intensive and depreciation of physical capital is not an important cost category[40].

On average, this company sells its tractors at a unit price of 100 000 EUR, which is significantly higher than the prices quoted by Bobard. This confirms that this producer does not compete on price.

Their main concern is related to the homologation costs. All tractors using public roads (even for very short trips) have to be homologated[41]. Every time a new engine is installed, the producers need to go through the whole homologation procedure, even if the tractors are otherwise identical. The development of a new tractor requires on average 3 to 4 months. The test (pollution, brakes…) are undertaken under the surveillance of UTAC, who prepare the homologation dossier for the DRIRE. This requires approximately 10 working days. Although, in theory, the homologation file should be processed within 45 days, this can take up to 1 year in practice.

As it is allowed to sell non-homologated tractors as long as they do not use public roads, some vineyards use trucks to move the tractors on the public roads. However, this solution requires the winegrower to obtain a driving licence for trucks. Moreover, it is far from obvious to load and unload tractors. Therefore, for short distances, users prefer to take the road.

VSP's engines suppliers are already capable of supplying stage IV compliant engines, at a price that is 50% higher than engines that meet the current emission limits. As already reported in the JRC report and the IA study, these engines take much more place and limit the manoeuvrability of tractors in the vineyards.

As a supplier of customized products, VSP feel that they cannot adapt their designs pro-actively, as they cannot anticipate the specific client needs that will arise in the future. VSP has no specific comments on the NRMM Directive in itself – for them, the priority should be a simplification of the homologation procedure (which falls outside the scope of this study). They point out that, as end users sometimes adapt the tractors themselves, without being subject to the slightest control, these heavy and costly procedures are circumvented anyway.

8.1.3 Case study 3

FREMA is a small company with 12 employees (2 of which are working on development).

They have a turnover of 5 million EUR, which is uniquely composed of high clearance tractors. Their annual production corresponds to 50 tractors, which are sold at a price that varies between 50 000 and 100 000 EUR, depending on the model.

Their main competitive advantages compared to larger producers are their higher flexibility and proximity to the clients. They sometimes produce tailor made tractors, but most of their production is made in series.

Homologation of new machines is a major concern. The tests by UTAC cost 2 500 EUR. The subsequent approval of the file by the DRIRE can take between 6 months and a year. As already pointed out above, it is legally possible to sell tractors that have not been homologated if they do not circulate on the roads. However, in FREMA's experience, clients do not accept this possibility. An important problem is that the French homologation for the road is not recognized in the countries to which they export (such as Germany and Austria). This is due

[40] No concrete figure has been given.

[41] By the DRIRE, the Directions Régionales de l'Industrie, de la Recherche et de l'Environnement.

to different standards (for instance, with respect to the brakes). Every time a new engine is installed in a tractor, the whole homologation procedure has to start all over again.

FREMA has confirmed the usefulness of the flexibility mechanism.

The high clearance tractors for vineyards are sold uniquely in France. FREMA also sells high clearance tractors for cereals (seed corn, sunflowers, tobacco). These are also exported, mainly to Europe, but also to Latin America (where no regulations on emissions exist). Exports outside the EU correspond to 4-5 tractors per year (sales of 300 000 EUR). This firm is thus heavily dependent on the EU market.

8.2 Impacts on professional users

For the impact on end users in the agricultural and vineyard sector, we have contacted COPA-COCEGA. A meeting to discuss the approach for the consultation has taken place on 14 July. As no response had been received from COPA-COGECA by the end of September, ARCADIS has submitted a thoroughly simplified questionnaire to COPA- COGECA with a renewed request to forward this questionnaire to the members. No answer has been provided to date.

Concerning the impact on vineyards, we have consulted with the European Confederation of Independent Winegrowers (CEVI). CEVI represents European independent winegrowers. In the case of independent winegrowers, the whole process (vine growing, harvesting, winemaking and wine selling) is fully vertically integrated. CEVI represents 9000 members. The total number of independent winegrowers in Europe is estimated to be, in total, from 180,000 to 200,000. A large number of these winegrowers produce only for household consumption, but no reliable estimate exists of the number of winegrowers who sell their products.

The large majority of independent winegrowers are micro-enterprises, generally family owned. Only a very small minority are small enterprises. In France, the "very big estates" of independent winegrowers account for 2.5 % of all the independent winegrowers' estates, where "very big" refers to estates of 10 employees on average and a surface of 84.4 ha[42]. CEVI reckons that the proportion is roughly the same in the other countries.

None of these enterprises are medium.

As pointed out in the IA study, in the absence of stage IIIB and IV tractors, the end users have two options:

– Redesign existing vineyards to fit compliant tractors

– Maintain the old tractors until a technical solution has been found for new tractors

Let us discuss the economic implications of both in turn.

8.2.1 Redesign of existing vineyards

In the case of vineyards, it is useful to first consider the possibilities for public support that exist for restructuring existing vineyards:

Since the entry into force of Regulation (EC) N°1493/1999, recently amended by Regulation (EC) N° 479/2008, the common organisation of the market in wine has provided for the

[42] The average independent winegrower's estate in France is 12.3 ha

possibility for Member States to give support for the restructuring and conversion of vineyards.

Chapter 1 of the Regulation lays down the rules governing the attribution of Community funds to Member States and the use of those funds by Member States through national support programmes (hereinafter referred to as support programmes) to finance specific support measures to assist the wine sector.

According to Article 4, Member States shall be responsible for the support programmes.

According to Article 11 of Regulation (EC) N° 479/2008, the objective of measures relating to the restructuring and conversion of vineyards shall be to increase the competitiveness of wine producers.

Support for restructuring and conversion of vineyards may only cover one or more of the following activities:

(a) varietal conversion, including by means of grafting-on;

(b) relocation of vineyards;

(c) improvements to vineyard management techniques.

The normal renewal of vineyards which have come to the end of their natural life shall not be supported.

Support for restructuring and conversion of vineyards may only take the following forms:

(a) compensation of producers for the loss of revenue due to the implementation of the measure;

(b) contribution to the costs of restructuring and conversion.

Compensation of producers for the loss of revenue may cover up to 100 % of the relevant loss. The Community contribution to the actual costs of restructuring and conversion of vineyards shall not exceed 50 %. In regions classified as convergence regions, the Community contribution to the costs of restructuring and conversion shall not exceed 75 %.

Summarising the text above, Member States could thus decide to provide financial support for the adaptation of the row width of vineyards in order to allow the use of tractors[43].

However, it is not clear whether financial compensation would be enough to compensate winegrowers for the other drawbacks of redesigning the vineyards. Indeed, CEVI has argued that in vine growing, a higher planting density guarantees a better quality of the grapes, and that this explains why the European Community supports replanting with a higher density[44]. Redesigning the vineyards to better accommodate special tractors would run counter to this objective. However, the relation between planting density and grape quality is controversial[45].

We do not think it would be worthwhile to further deepen this issue here, as it is of relatively minor importance compared to the financial implications of adapting the row widths one more time. Indeed, in the first seven years of application of the scheme, 400 to 465 million EUR were allocated *annually* to restructuring and conversion measures[46].

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43 Personal communication from DG AGRI.

44 However, in the text of the Regulation (EC) N° 479/2008, no explicit reference to density is made.

45 Cesare Intrieri and Ilaria Filippetti. Proceedings of the ASEV 50th Annual Meeting, Seattle, WA, June 19-23, 2000, pp 296-308

46 http://ec.europa.eu/agriculture/markets/wine/prod/depens.pdf

The IA study had shown a *total* environmental cost of 120 million EUR in case the special purpose tractors would be exempted from stage IIIB and stage IV. This figure is obviously very low compared to the financial implications of a redesign of existing vineyards and orchards. Of course, not all existing vineyards would need to be redesigned. However, the figure above does suggest that the cost of adapting the row width can be significantly higher than the environmental cost of exempting the special purpose tractors from stage IIIB and IV.

Moreover, adapting the row width in itself would lead to the release of carbon, which is also an environmental cost. CEVI admits that no independent estimate of these releases exists.

8.2.2 Maintenance of old tractors

In Section 8.1 we had reported that if a high clearance tractor is used beyond its economic lifetime, annual maintenance costs can be expected to increase from 1 500- 2 000 EUR per year to 3 000 – 4 000 EUR per year.

For illustrative purposes, we assume that the cost increase is 2 500 EUR per year per tractor, and that all special tractors face the same increase in maintenance costs as the high clearance tractors. To remain consistent with the IA study, we assume that a technical solution can be found 5 years after the planned introduction date of the next emission stage, that a total of 25 600 units are sold per year in the EU and that a discount rate of 4% applies.

For the T4.1 tractors, based upon the response received during the consultation, we assume that 400 units are sold per year.

To the best of our knowledge, no data on the sales of C2 tractors are publicly available[47]. Thus, in total we assume that 26 000 special tractors are sold per year. We assume that all sales correspond to replacement sales and that, once the technical solution has been developed, old tractors are replaced at a rate of 26 000 units per year.

The table below gives then, for each year after the planned introduction of stage IIIB until all "old" tractors have been replaced by stage IIIB compliant tractors, the *increase* in the number of tractors that are kept in use beyond their economic lifetime and the implied extra maintenance costs at the EU level.

Table 5: Extra maintenance costs for special tractors used beyond economic lifetime

Year	Number of tractors kept in use	Extra cost per year
1	26 000	65.000.000
2	52 000	130.000.000
3	78 000	195.000.000
4	104 000	260.000.000
5	130 000	325.000.000
6	104 000	260.000.000
7	78 000	195.000.000

[47] This has been confirmed in a personal communication by Dr Krasenbrink of the JRC

8	52 000	130.000.000
9	26 000	65.000.000

The net present value of these costs (discounted to the planned introduction of stage IIIB) is 1 339 million EUR. This is an order of magnitude higher than the environmental benefits linked to not postponing stage IIIB with 5 years (120 million EUR).

Thus, even if actual higher maintenance cost would be significantly lower than suggested by the manufacturers, the costs of not postponing stage IIIB would still be much higher than the benefits.

8.3 Conclusion

On the producers' side, no SMEs are involved in the production of special agricultural tractors, except in the niche of high clearance tractors. This market represents less than 2% of the total market for special tractors in Europe. The following points are noteworthy:

- Although the **tractor manufacturers** we have interviewed know that the machines they produce are regulated by the NRMM Directive, some of them **did not appear to understand fully the implications of the next stage in the Directive**. Some of the smaller companies are not affiliated to professional associations, and were not aware of the on-going legislative process until the phone interview. It was therefore sometimes difficult to keep the phone interview focused on the subject at hand.

- Maybe because of this lack of information, the **most important concern raised** was not the next stage in the Directive, but the **homologation process**. The points raised by the producers of special tractors were almost identical to those discussed in Chapter 7: the length of the process, the lack of international standardisation and the fact that even minor changes require rerunning a complete homologation process. The possibility to sell non-homologated tractors and to use trucks to move them on the road was rejected as unrealistic. One manufacturer has pointed out that the **homologation procedures** are sometimes **circumvented by the end users**, who adapt tractors to their own needs without any external control.

- Most manufacturers that we have interviewed are aware of the flexibility scheme, but not all seem keen on using it. One manufacturer has raised the specific concern that the engine suppliers may not always be able to supply engines complying with the previous stage of the Directive[48].

- This **very small market is further divided in subniches** determined by the diversity of terrain conditions on which vineyards are built. This implies that producers have to amortize fixed development costs (including homologation costs) over very small series. The **rapid succession of stages in the Directive exacerbates these problems**. At least one producer has suggested introducing longer time intervals between successive stages of the Directive.

Regarding the impact on **orchards, no information** (even indicative) has been obtained from the relevant professional organisation.

Regarding the impact on vineyards, the European sector federation has confirmed that all independent winegrowers are SMEs, and the vast majority are micro-enterprises. Using

[48] In other applications, engine manufacturers keep on producing engines complying only with previous stages of the Directive, but these engines are exported to unregulated regions of the world. We have to keep in mind that this chapter treats a niche market, where this outlet does not necessarily exist.

figures on existing public support schemes, we have argued that the **cost for redesigning vineyards** to accommodate stage IIIB and IV compliant tractors **would be several orders of magnitude larger than the environmental cost of *not* exempting the special tractors from stage IIIB and IV**. Moreover, such a policy would run counter to the existing policy to stimulate a higher plating density.

The alternative option would be for vineyards to keep old tractors in use beyond their economic lifetime. Our calculations suggest that the **increased maintenance cost** following from this option would be an **order of magnitude larger than the environmental cost of *not* exempting the special tractors from stage IIIB and IV**. As another way to put these compliance costs in perspective, one could note that they are of the same order of magnitude as the compliance costs linked to the Euromot proposal for inland waterway engines.

Annex XI - Fleet and annual sales of tractors

Annual sales estimates per tractor category and power class (year 2005, EU15)

	Power (kW) Total Nr[49]	19-37	37-56	56-75
Agricultural tractors	163 000	3 260	32 600	48 900
T2	24 439	5 004	7 690	10 338
C2	1 128	10	711	407
T4.1	550			

Total number of tractors in use per tractor category and power class (year 2005, EU15)

Total engines in use	Total Nr	19-37	37-56	56-75
Agricultural tractors	2 500 420	32 600	521 600	782 400
Percentage		1,3	20,9	31,3

Source: JRC / CEMA

[49] The total number includes also tractors of engine power categories above 75 kW.

Annex XII – Estimation of environmental impacts

This Annex presents the way the environmental impacts mentioned in the current Impact Assessment report have been estimated, based on the results of the JRC and Arcadis reports. The latter two reports contain several figures on the environmental impacts of some of the options. These impacts are given relative to the hypothetical scenario, whereby compliant NTTs would be placed on the market by the dates foreseen in the current Regulation. In this IA report, other options have been investigated and the reference chosen was option 1 (the baseline scenario), where no compliant NTTs can be put on the market and the use of older NTTs is prolonged.

The following steps have been carried out:

- JRC report mentions for Option 3 additional emissions of 3,5 kt PM and 33 kt NOx
- The Arcadis report mentions for Option 3 environmental costs of 48 M€ for PM, 72 M€ for NOx
- This report also mentions for Option 1 environmental costs of 60 M€ for PM, 134 M€ for NOx
- The cost factors used can therefore be calculated, based on the above figures for Option 3
- These cost factors can be applied to calculate the additional emissions of Option 1
- The additional emissions of Option 2 were estimated by taking a proportionate share of those of Option 3
- Environmental costs of Option 2 can be estimated by multiplying the emissions by the cost factors
- The JRC report mentions, for option 4, yearly additional emissions of 0,7 kt PM and 6 kt for NOx
- The total additional emissions are estimated by multiplying by 38 (for 2012-2050)
- Environmental costs of Option 4 can be estimated by multiplying the emissions by the cost factors

The results are presented in the following table:

	hypothetical scenario	**option 1 (baseline)**	**option 2 (3 yr delay)**	**option 3 (5 yr delay)**	**option 4 (exemption)**
Change in PM emissions (kt)	*0*	4,3	2,1	3,5	27
Change in NOx emissions (kt)	*0*	62	20	33	230
Change in PM costs (M€)	*0*	60	29	48	373

Change in NOx costs (M€)	*0*	134	43	72	495

The environmental impacts for options 2, 3 and 4 mentioned in this report, represent the variations relative to the ones of option 1 (baseline scenario).