Procedures for Rolling Stock Procurement with Environmental Requirements phase II

PROSPER II

Deliverable II:

Documentation of Legal Aspects

Dissemination Level:
Restricted

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Contents:

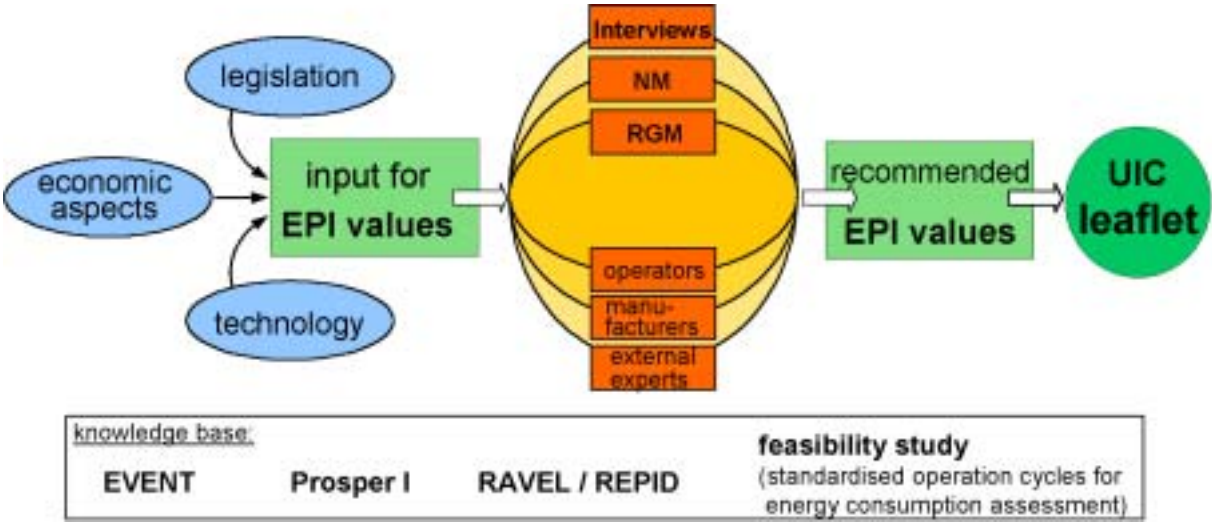
1 Objectives and Approach of PROSPER II

The PROSPER project is commissioned by the International Union of Railways, UIC to elaborate a UIC leaflet “UIC environmental guideline for the procurement of new rolling stock”.

Enhancing the environmental performance of new rolling stock is one of the ways in which the railways can be made more competitive by comparison with the other modes of transport. In this context UIC has set up the PROSPER project. The outcome of the first phase of the project is an “Environmental Guideline for the Procurement of new Rolling Stock” (see also http://www.railway-procurement.org/). The objectives of the second phase of PROSPER are:

- Co-ordinating agreed minimum values for the environmental performance of new rolling stock amongst railways and manufacturers
- Documenting environment related legal aspects for the procurement of new rolling stock (state of the art) and
- Disseminating the results made in PROSPER and PROSPER II and REPID as a UIC Leaflet.

In this respect it is not the intention of PROSPER to invent the wheel once more, but instead to combine and integrate existing knowledge into one very functional product: a UIC Leaflet serving as a guideline for implementing environmental requirements into the procurement process.



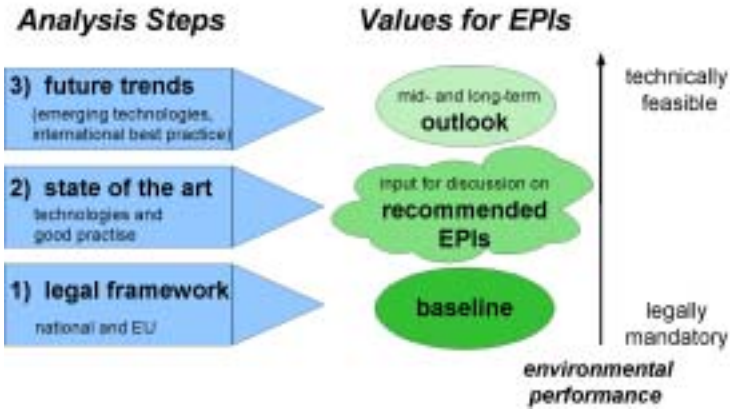
graph 1-1: *PROSPER project design – Environmental Specifications will be developed and quantified (wherever possible) in an iterative process. In several feedback loops a broad variety of stakeholders will be integrated into the project: by means of Interviews and discussion forums such as Reference Group Meetings (RGM) and Network Meetings (NM) the expertise of operators, manufacturers, and other experts will be incorporated.*

It is beyond the limits and the intention of PROSPER to do basic research in order to define new environmental indicators or limit values. Therefore PROSPER actively seeks the existing expertise and feedback from a broad range of actors and

stakeholders, especially from members of the various international working groups of UIC and UNIFE dedicated to the different aspects of the four key areas:

- Noise
- Diesel Exhaust and Other Emissions
- Energy Efficiency
- Materials, Recycling, Waste

Based upon this expert knowledge Prosper will facilitate a stakeholder process as sketched in graph 1-2. Within this process the final values of the Environmental Specifications will have to be negotiated among all stakeholders. The values will range somewhere between what is legally mandatory on the one side and what is technically feasible on the other side, taking equally into account both ecological and economic considerations.



graph 1-2: *Analysis scheme of PROSPER II – The legal framework defines the baseline of Environmental Specifications. In the upcoming working steps the technological state of the art and future trends will be analysed to serve as an input for the discussion of values for the Environmental Specifications.*

2 Summary

This document gives an overview on legal aspects of the four environmental key areas of the Prosper II project thus defining the baseline for Environmental Specifications in a UIC leaflet. (see PROSPER Analysis Scheme in graph 1-2). The intention of this document is not only to *describe* the present legal situation concerning new rolling stock for railways in Europe, but furthermore to be a qualified tool that helps to *assess* the present and possible future legal situation with regards to the overall objective of the PROSPER project which is to quantify Environmental Specifications. Therefore this document contains also summaries of sources which are not strictly legally binding (e.g. UIC recommendations on target values) and hints to intentions of stakeholders who may be influential for future developments.

The following summary gives an overview over international, EU and national legislation concerning the four environmental key areas each of which is described and discussed in detail in the chapters 3 – 6. Covered are the aspects status and trend of legislation, limit & target values, measurement procedures & comparability and actors & drivers. In addition, for each key area the priority one environmental performance indicators (which where identified in the first phase of the PROSPER) are given as an introductionary reference. In chapter 7 the legal framework for the integration of environmental aspects into the procurement process is assessed with respect to EU public procurement regulations.

This document is an update of the paper distributed in June 2004 and covers the status up to November 2004. In several fields the ongoing legislation process progresses quite rapidly so that some issues will be outdated in the near future. This holds especially true in the field of noise for the EU TSI for conventional trains. Upcoming changes of legislation will directly be fed into the design of the PROSPER leaflet.

2.1 Noise

Environmental Specifications

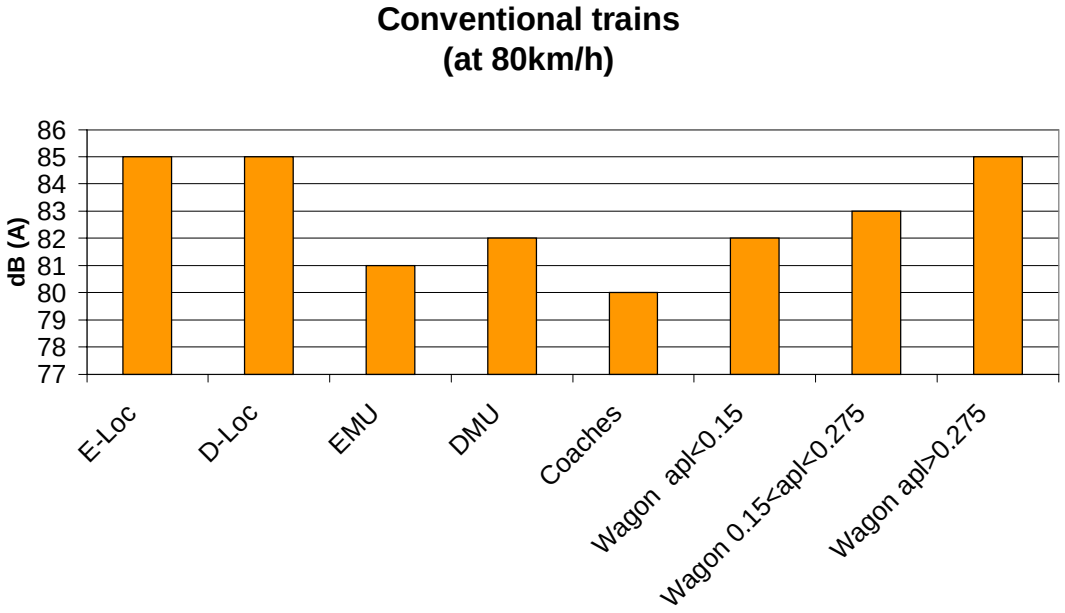
Legally mandatory

1) Passing-by noise
2) Stationary noise
3) Starting noise

Legislation

Legislation	Other Regulations	Trend
• **Harmonisation on EU-level** TSI Noise for HST (EU directive 2002/735/EC) and conventional railways (EU directive 2001/16/EC)	• EU green and white books	• No trend limit values • Noise-level-related route pricing (e.g. Switzerland, The Netherlands) • TSI revision process

Limit Values



Graph 2-1: *Comparison of noise limit values for conventional trains at 80 km/h measured at 7.5m distance ($L_{pAeq,Tp}$) – upcoming EU-TSI (preliminary values). Note that TSI limit values for renewed or upgraded freight wagons are 2 db(A) higher. apl: axles per unit length over buffers in m^{-1}.*

Measurement Procedures and Comparability

There are various **measurement procedures** for noise levels in use throughout Europe, which makes comparability of limit values as well as technical state of the art difficult. The general tendency (e.g. EU-TSI) is to measure $L_{pAeq,Tp}$ at a distance of 7.5m for conventional trains and 25m for high speed trains (>200km/h).

The condition of test tracks has a decisive influence on the noise emissions of passing trains. Grinding of rails can reduce the noise level as much as 7 dB(A). For high accuracy of results it would be favourable to use test tracks with a very smooth surface. But this is expensive and could lead to the request for very low noise limits which cannot be reached under practical conditions.

Actors and Drivers

Actor	**Operators and Infrastructure Managers**	**Manufacturers**	**Policy Makers**	**Public** *→Main driver*
Motivation & Interests	Key environmental issue Public acceptance / image	Additional costs and efforts	Health issue / high external costs	Highly sensitive
Actions & Goals	Comply with reception and emission legislation	Comply with emission legislation	EU harmonisation	Pressure on Politics and Operators

2.2 Diesel Exhaust Emissions

Environmental Specifications

Legally mandatory

1) Diesel Exhaust Emissions

Voluntary

Environmental performance defined by operation and design:

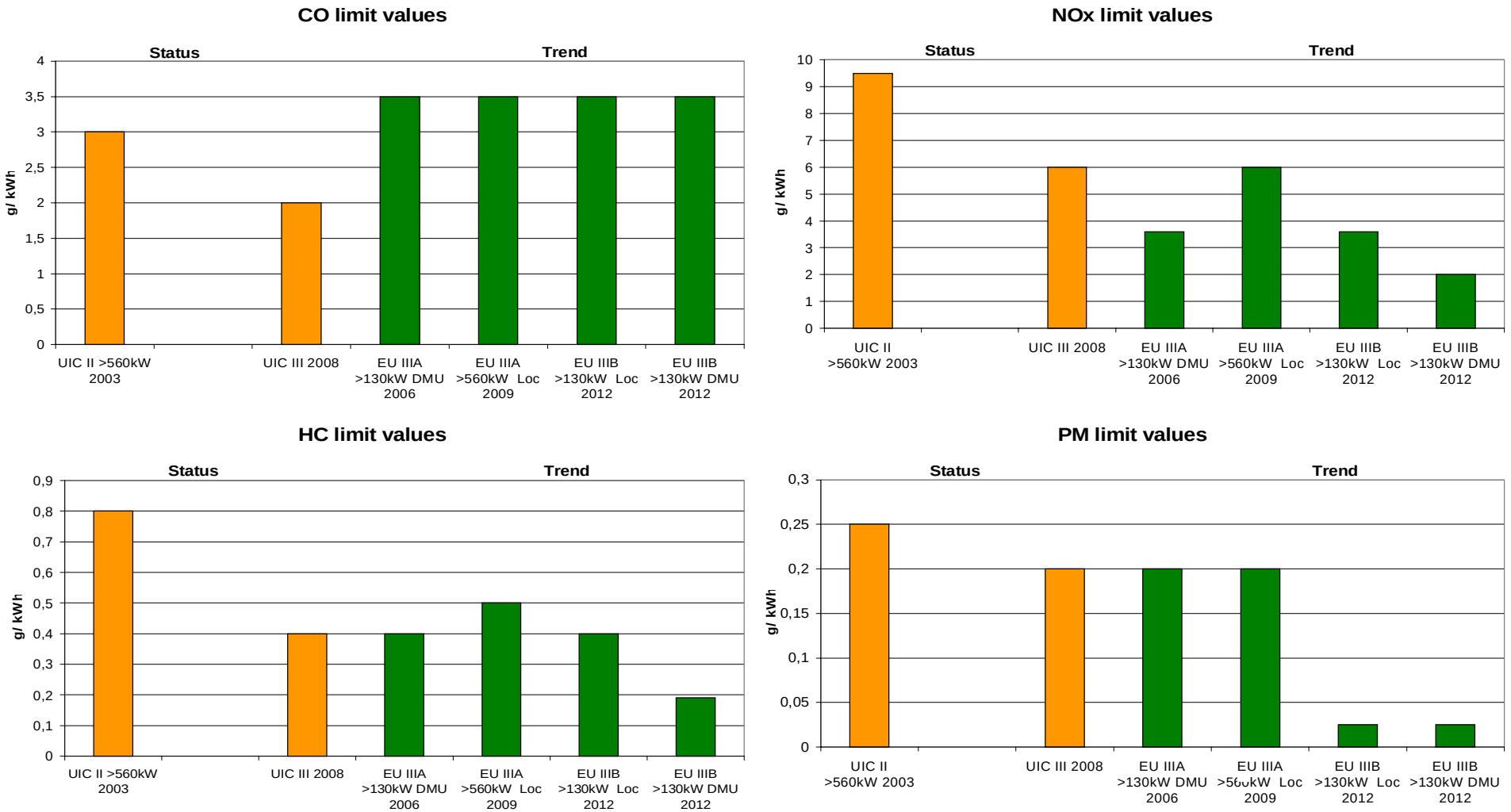
2) Diesel Exhaust Emissions – Specific Load Conditions

3) Diesel Exhaust Emissions at Longer Standstills

Legislation

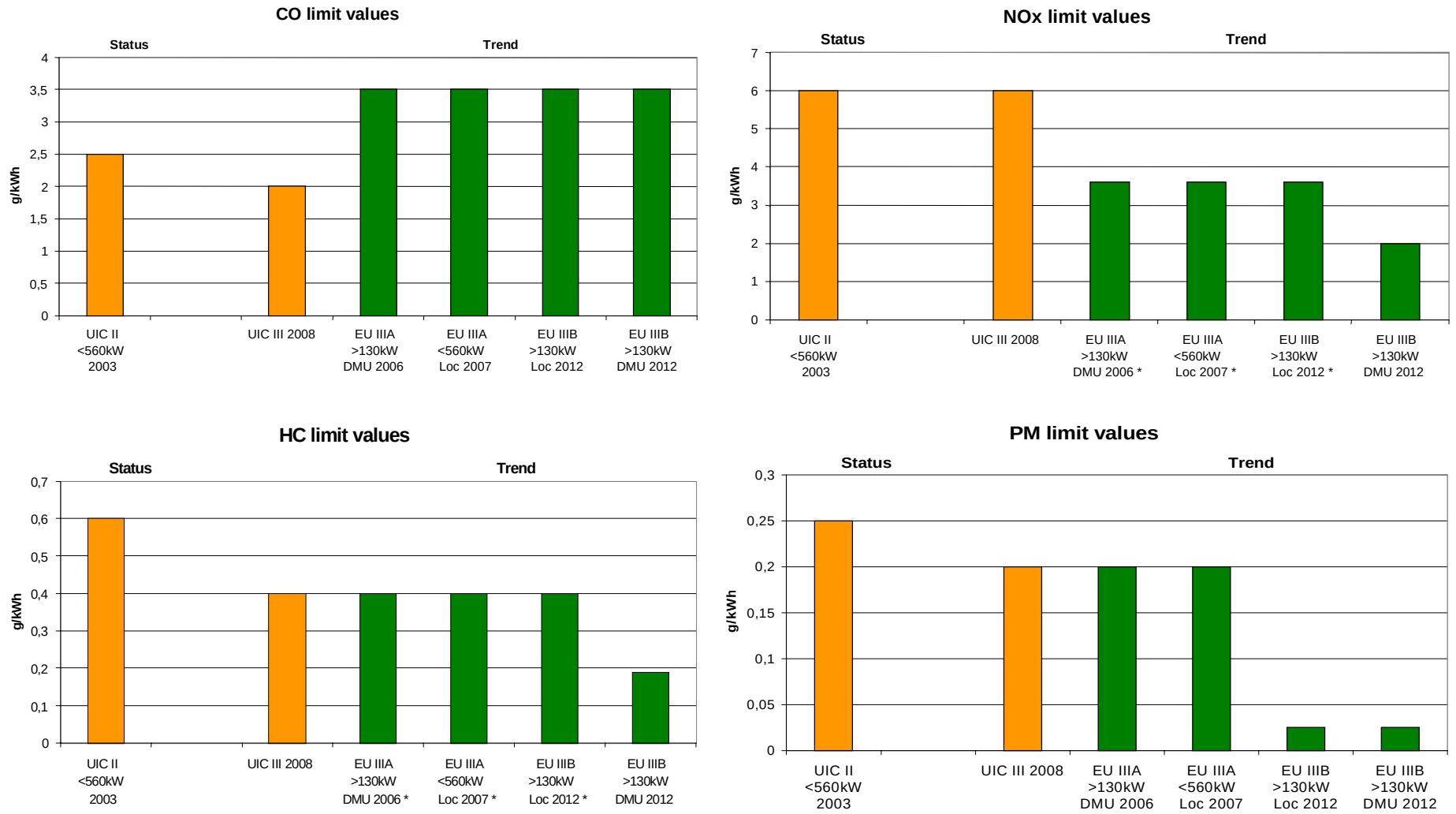
Legislation	Other Regulations	Trend
• **Harmonisation on EU-level** EU directive 97/68/EC on non-road mobile machinery is extended to railway applications by its amendment 2004/26/EC	• UIC leaflets 623/ 624 "Exhaust emission tests for diesel traction engines" • EU directive on ambient air quality	• Decreasing limit values • Stage IIIA (2005-2009) of EU directive • Stage IIIB (from 2011 on) subject to revision in 2007

Limit Values Diesel Exhaust Emissions for P > 560kW



Graph 2-2: Comparison of exhaust limit values for P > 560kW – status and trend. EU refers to the directive 97/68/EC. EU III (for DMU >130kW in 2006 and DMU >130kW in 2012) gives a combined limit value for NO_x and HC (4 g/kWh) which has been split for better comparability in the graphs.

Limit Values Diesel Exhaust Emissions for P < 560kW



Graph 2-3 *Comparison of exhaust limit values for P < 560kW – status and trend. EU refers to the directive 97/68/EC. *Note: EU III (for DMU >130kW in 2006; Loc <560kW in 2007 and DMU >130kW in 2012) gives a combined limit value for NO_x and HC (4 g/kWh) which has been split for better comparability in the graphs.*

Measurement Procedures and Comparability for Diesel exhaust Emissions

Common test cycle in Europe are the ISO 8178 F and C1 cycles. Although they represent relatively well some major working profiles, there are large deviations possible in practise.

Actors and Drivers Diesel Exhaust Emissions

Actor	**Operators & Infrastructure Managers**	**Manufacturers**	**Policy Makers**	**Public** *→Main driver*
Motivation & Interests	Key environmental issue Relevant for competition	Additional costs and efforts	Health & environmental issue External costs	Sensitive (when directly exposed, e.g.: hot spots)
Actions & Goals	Comply with legislation	Comply with legislation	EU harmonisation	Pressure on politics and operators

2.3 Energy Efficiency

Environmental Specifications

Legally mandatory

-

Voluntary

Environmental performance defined by operation and design:

1) Traction Energy Consumption
2) On-board Energy Consumption
3) Energy Recovery / Regeneration
4) Energy Management for Parked Vehicles
5) Energy-metering Devices

Environmental performance mainly preconditioned by design:

6) Specific Mass

Legislation

Legislation	Other Regulations	Trend
• No harmonisation on EU-level	• International agreements on climate protection (e.g. Kyoto Protocol) • Indirect measures and incentives: Taxes, Emission Trading	• EU proposal for a directive on energy end-use efficiency and energy services (COM (2003) 739) • EuP directive on the eco-design of energy-using products • 2008-2012: 8-9% EU average reduction for CO_2 emissions

Limit values

There are no limit values for energy efficiency in existence.

Measurement Procedures and Comparability

Presently there are no standardised measurement procedures for energy efficiency. Traction energy consumption for specific operation patterns according to standardised methodology (standardised definition of simulation and verification measurements) could be an option to measure and compare energy efficiency of rolling stock.

The energy consumption for the requested operation pattern could be calculated. That energy-related LCC costs of the train in operation can be taken into account. This operation pattern can either be one (or a set of several) specific route(s) or a standardised pattern (e.g. speeds, distance between stops, track gradients, etc.) which approximate the future service pattern of the vehicle. The calculated values have to be afterwards verifiable by measurements.[1]

[1] A feasibility-study "Harmonisation of test cycles for energy consumption of rolling stock" has been approved by the CTR (Technical and Research Commission of the UIC). Based on this study a joint project of railways and railway industry is foreseen to define an appropriate approach and develop comparable energy consumption standards.

Actors and Drivers

Actor	**Operators & Infrastructure Managers** →*Main driver*	**Manufacturers**	**Policy Makers**	**Public**
Motivation & Interests	Key environmental and economic issue Crucial for competition	Additional development costs and efforts Progress only due to technical evolution	Strong support for strategies which improve resource efficiency and contribute to climate protection	Ecological choice of transport mode
Actions & Goals	Reduce Life Cycle Costs	No major efforts without additional incentives/benefits	Support programs Taxes Emission trading	Low direct impact

2.4 Materials, Recycling, Waste

Environmental Specifications

Legally mandatory

1) Legally Restricted Materials

Voluntary

Environmental performance mainly preconditioned by design:

2) Unwanted and Controlled Materials
3) Hazardous Waste
4) Recycling Rate
5) Renewable Materials

Legislation

Legislation	Other Regulations	Trend
Harmonisation on EU-level EU directives on: • Classification of dangerous substances (EU directive 67/548/EEC and its amendments (as well as corresponding commission regulation (EC) No 1488/94 on risk assessment of existing and commission directive 93/67/EEC on risk assessment of notified substances) • Marketing and use of certain dangerous substances (EU directive 76/769/EEC and its amendments) • Dangerous preparations (EU directive 1999/45/EC and its amendments) • European waste catalogue (EWC – EU Commission Decision 2000/532/EC) • EU battery legislation, directive 91/157/EEC	• Restricted materials and recycling/recovery rates for electric/electronic equipment (EU directive 2002/96/EC – WEEE) • EU directive 2002/95/EC – RoHS)[2] • Restricted materials and recycling/recovery rates for end-of life vehicles (EU directive 2000/53/EC – ELV) • Montreal Protocol on substances that deplete the ozone layer • OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic • Stockholm Convention on persistent organic pollutants (POPs)[3]	• REACH process[4] • More substances will be included • Reduction of target values for harmful substances

[2] WEEE: **W**aste **E**lectrical and **E**lectronic **E**quipment; RoHS: **R**estriction **o**f the use of certain **H**azardous **S**ubstances in electrical and electronic equipment, WEEE and RoHS are not directly applicable to the rail sector

[3] Persistent organic pollutants (POPs) are chemical substances that persist in the environment, bioaccumulate through the food web, and pose a risk of causing adverse effects to human health and the environment. This group of priority pollutants consists of pesticides (such as DDT), industrial chemicals (such as polychlorinated biphenyls, PCBs) and unintentional by-products of industrial processes (such as dioxins and furans).

[4] REACH: **R**egistration, **E**valuation, and **A**uthorisation of **Ch**emicals

Actors and Drivers

Actor	Operators & Infrastructure Managers	Manufacturers	Policy Makers →*Main driver*	Public
Motivation & Interests	Procurement of environmentally sound products	Cut resource consumption and corresponding costs Avoid hazardous waste	High priority for public health, environmental protection and resource efficiency	Sensitivity to "pollutant of the week"
Actions & Goals	High standards for consistent environ-mental strategy	Initiatives to improve resource efficiency and waste management	International harmonisation	Low direct impact

2.5 Other

Environmental Specifications

Legally mandatory:

1) Electromagnetic Fields

Voluntary:

Environmental performance mainly preconditioned by design:

2) Emissions from Brake Friction Material

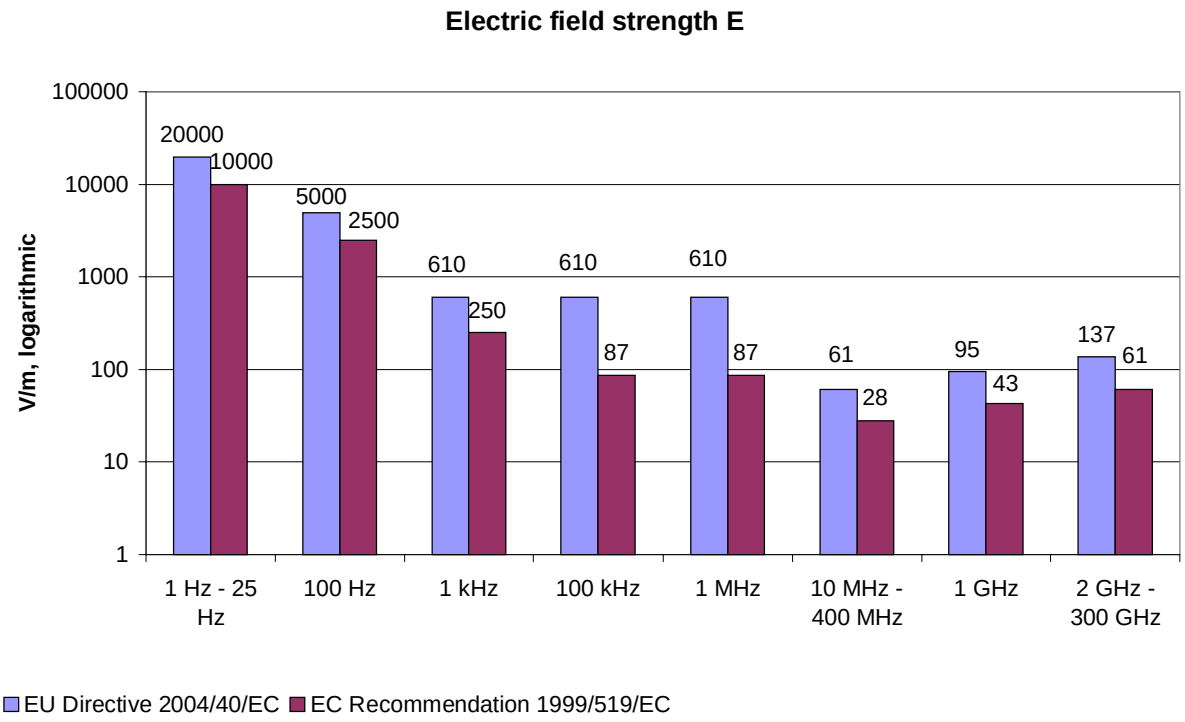
3) Spillage / Leakages

Legislation

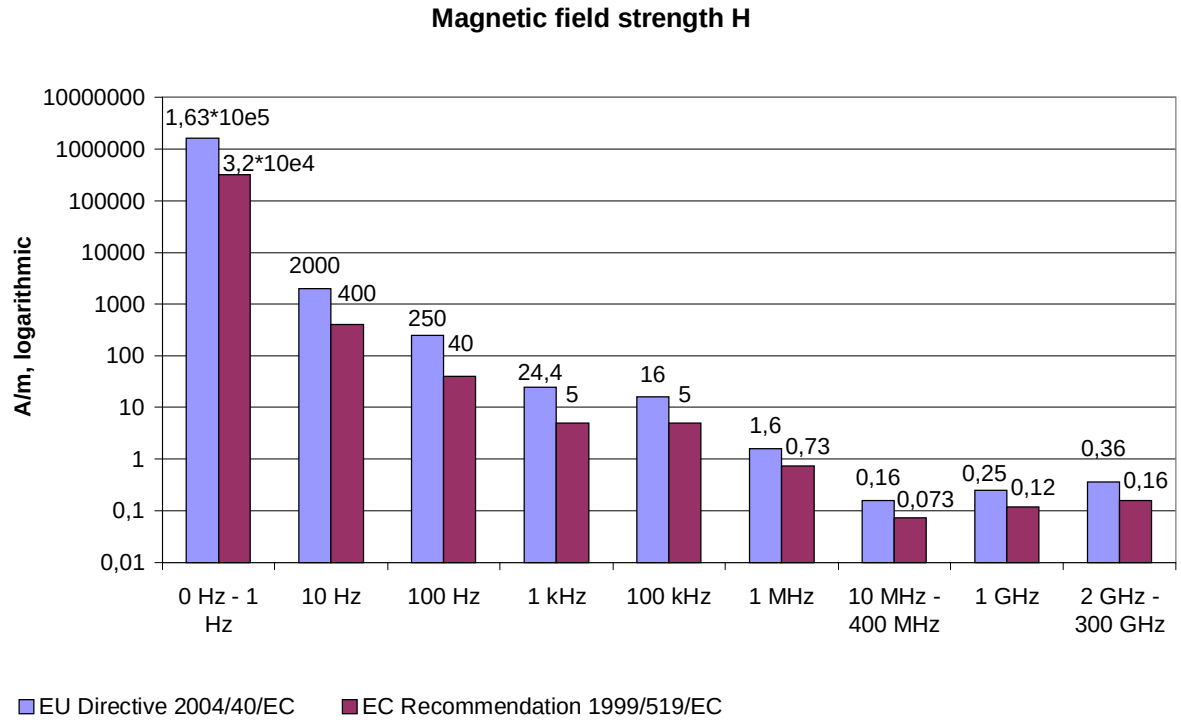
Legislation	Other Regulations	Trend
EMF • EU directive 2004/40/EC on exposure of workers to EMF • Stringent national legislation (Switzerland, Italy, Finland stricter than ICNIRP[5])	• European Council recommendation 1999/519/EC on the limitation of exposure of the general public to electromagnetic fields (stricter than EU directive 2004/40/EC) • Generally accepted recommendations (ICNIRP values) • National recommendations	• Harmonisation efforts on EU level • Low precautionary limits • No trend limit values

5 International Commission on Non-Ionizing Radiation Protection

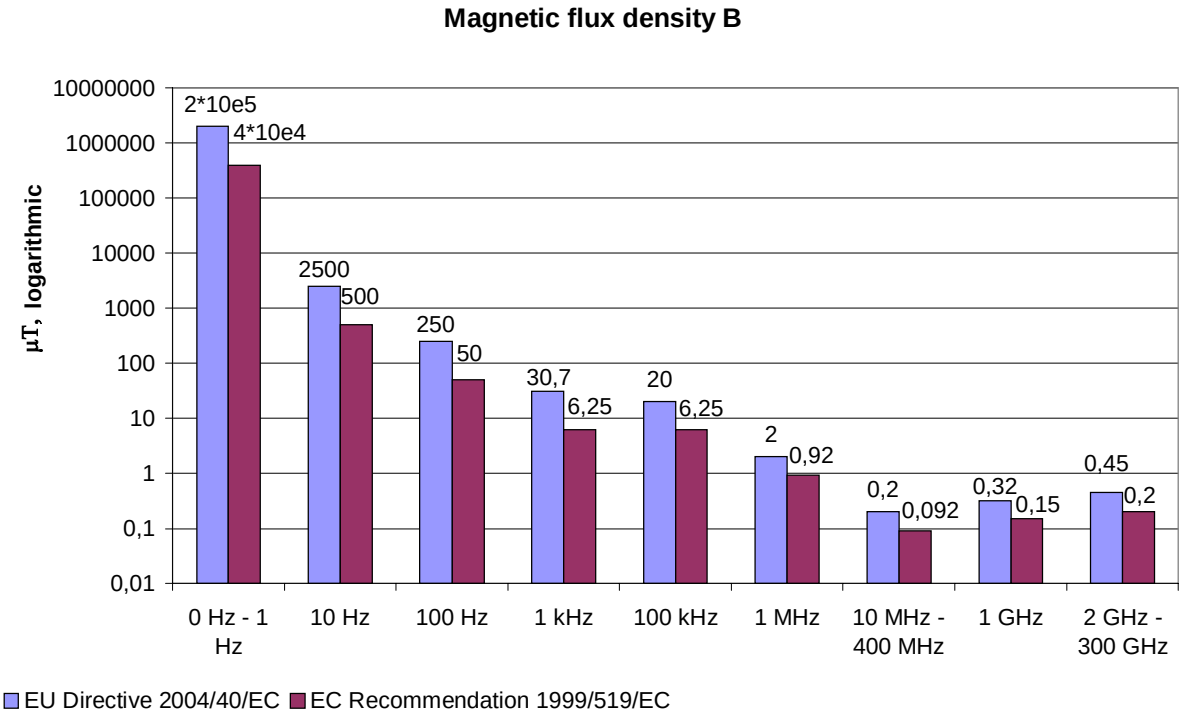
Limit values for Electromagnetic Fields



Graph 2-4 *Comparison of electric field strength – EU Directive 2004/40/EC and EC Recommendation 1999/519/. Note that a logarithmic scale was chosen for better visibility.*



Graph 2-5: *Comparison of magnetic field strength values – EU Directive 2004/40/EC and EC Recommendation 1999/519/EC. Note that a logarithmic scale was chosen for better visibility.*



Graph 2-6: *Comparison of magnetic flux density values – EU Directive 2004/40/EC and EC Recommendation 1999/519/EC. Note that a logarithmic scale was chosen for better visibility.*

Actors and Drivers Electromagnetic Fields

Actor	**Operators & Infrastructure Managers**	**Manufacturers**	**Policy Makers**	**Public** *→Main driver*
Motivation & Interests	Consistent policy Public image	Additional costs and efforts	High uncertainties Possibly relevant for public health	Sensitive topic Highly contro-versial
Actions & Goals	Precautionary measures	Comply with legislation	Precautionary principle	Pressure on politics

Precautionary principle

The issue of when and how to use the precautionary principle, both within the European Union and internationally, is giving rise to much debate, and to mixed, and sometimes contradictory views. Thus, decision-makers are constantly faced with the dilemma of balancing the freedom and rights of individuals, industry and organisations with the need to reduce the risk of adverse effects to the environment, human, animal or plant health. Therefore, finding the correct balance so that the proportionate, non-discriminatory, transparent and coherent actions can be taken, requires a structured decision-making process with detailed scientific and other objective information.

The precautionary principle is relevant in those circumstances where risk managers have identified that there are reasonable grounds for concern that an unacceptable level of risk to health or environment exists but the supporting information and data may not be sufficiently complete to enable a comprehensive risk assessment to be made. When faced with these specific circumstances, decision makers or risk mangers, may take measures or other actions to protect health based on the precautionary principle while seeking more complete scientific and other data. Such measures have to comply with the normal principles of non-discrimination and proportionality and should be considered as provisional until such time that more comprehensive information concerning the risk can be gathered and analysed.

3 Noise

3.1 Overview

The Green Paper “Future Noise Policy” of November 1996 by the European Commission states that the “public's main criticism of rail transport is the excessive noise level”. This proves that both noise is indeed perceived as the major negative environmental impact of railways by the public and that there is a growing awareness in politics for this issue which leads to stricter noise regulations. In the past noise has predominantly been governed by setting limit values for noise reception along railway lines, especially hot spots. The trend of the last decade is that legislation also sets emission levels for rolling stock. This trend will gain importance in the context of further harmonisation on EU level (interoperability) and the decoupling of responsibilities for railway infrastructure and operation of rolling stock.

In several regulations the noise inside train vehicles is also governed. Additionally to external noise there are some regulations for the noise exposure of the passengers and the staff (e.g. driver) inside train vehicles. The Environmental Manual of the Nordic Railways and also the TSI Noise give limit values to this subject. However, the focus in this update report lies on external noise.

3.2 Legislation and Limit Values

Nearly all EU member states and 5 non-member states have legislation concerning the maximum permitted railway noise reception levels for new and upgraded lines (see Table 3-1). A smaller group has official noise limits for existing lines (CH, S, N, NL, I, DK) or has guidelines for the maximum noise level (CZ, SF, H, PL).

In addition to those *reception levels*, only few countries have regulations on *emission levels* and all of them are relatively new, having come into force within the last decade. So far Austria, Finland and Italy have regulations on noise emission limits (see table 1). In Germany and Switzerland limit values were proposed or are under discussion. In addition in The Netherlands and Switzerland the concept of “emission ceiling” shall be introduced (fixing of the allowed emissions of a line with respect to the reception limits: thus the operators are allowed to increase the traffic volume if they lower the vehicle emissions).

On an European level noise emission levels will shortly be governed by the Technical Specification for Interoperability (TSI) which will most likely be ratified and enter into force in the near future. Most likely the noise emission values will be as specified below. However until the final ratification they have to be seen as preliminary. In anticipation of the final TSI the European commission published a decision on April, 29 2004 “…specifying the basic parameters of the ‘Noise’, ‘Freight Wagons’ and ‘Telematic applications for freight’ Technical Specifications for Interoperability referred to in Directive 2001/16/EC”.

Although the TSI will serve as an upper limit and as a general benchmark, stricter emission can be set for vehicles restricted to local use. Likewise local authorities can demand stricter emission levels if they are purchasing railway services.

Country	legislation concerning			
	noise reception levels for railway lines		noise emission levels for rolling stock	
	in force since	applicable for	in force since	applicable for
Austria	1993	new, upgraded	1993	new
Belgium		new, upgraded*		
Czech Republic	2001	new upgraded +		
Denmark	1985, 1997	new upgraded +		
Finland	1992	new upgraded +	2000	high speed only
France	1999	neu, upgraded		
Germany	1999	new upgraded +	concept	
Greece				
Hungary	1984	new upgraded +		
Ireland				
Italy	1998	existing and new	2002	new
Luxemburg				
The Netherlands	1987, 1993	existing and new	concept	
Norway	for road traffic only			
Poland	1998	existing and new		
Portugal	2000	existing and new		
Spain				
Sweden	1996, guideline on	existing and new		
Switzerland	1987	existing and new	under negotiation	new and existing
United Kingdom	1990	existing and new		
EU				
TSI conventional			2002	new
TSI high speed			upcoming 2004	new

upgraded+ = substantially upgraded lines

* Belgium: no specific noise legislation, but building permit for new lines set limit values

Table 3-1; Legislation concerning noise perception levels and noise emission levels

As Prosper focuses on the environmental performance of railways characterised by well defined Environmental Specifications which have to be measurable and reproducible, in the following only the legislation for noise emission levels has to be discussed. This is also in line with the development towards harmonisation on EU level which necessarily leads to common emission limits (in contrast to reception limits)

3.2.1 Actual Legislation Concerning Noise Emissions

Austria

Austria set up a regulation governing railways noise emissions for conventional trains in 1993 (“Schienenfahrzeug-Lärmzulässigkeitsverordnung”). The emission limits for freight wagons were reduced by 5 dB(A) in 1997. The limit values are 1 dB(A) stricter than the EU-TSI for electric locomotives and 1 dB(A) softer than the TSI for diesel locomotives and EMUs, and 2 dB(A) softer for DMUs. Austria distinguishes 4 types of passenger coaches (long distance, regional traffic, comfort class) and 3 types of freight wagons. The set of limit values differ by 3 and 4 dB(A) respectively. Given in the charts below is only the strictest set for wagons (flats, container wagons and sliding side vans). Values refer to 7.5m distance from track (for limit values see graphs below).

Italy

Italy published emission limits in 1998/1999. They came into force 2002 and the limits will be reduced by 2 dB(A) in 2012. Values refer to 25m distance from track.

Finland

In Finland noise emission limits are regulated by Finnish Rail Administration since 2000. They are defined for the high speed range (≥ 200 km/h for electric locomotives and MUs as well as coaches; =120 km/h for freight wagons) and are stricter than those given in the Nordic Manual. Values refer to 25m distance from track.

EU: TSI for High Speed Trains

Flanking the council directive 96/48/EC of 23 July 1996 on the interoperability of the trans-European high-speed rail system a Technical Specification for Interoperability (TSI) was ratified. Noise emission limits are set in the TSI 2002/735/EC – “Rolling Stock”. Limit values are given in Figure 3-5 and Table 3-2.

The interior noise level of passenger vehicles is not considered to be an interoperability constituent. However, within the driver's cab the equivalent continuous sound pressure level of 84 dB(A) shall not be exceeded over 30 minutes.

3.2.2 Upcoming Legislation Concerning Noise Emissions

Switzerland

The Swiss Federal Office of Transport developed a draft (24.02.2003) for a new regulation on noise limit values for locomotives, multiple units, passenger coaches and freight wagons. Since there is the will to harmonise with the EU-TSI the ratification of the regulation is pending. The values are marked as “CH prop” in the figures below.

EU: TSI for Conventional Rail

Flanking the directive 2001/16/EC on the interoperability of the trans-European conventional rail system a Technical Specification for Interoperability (TSI) is being developed. TSI for conventional train service has been approved by the “Article 21 committee” in November 2004, will be notified by the EC in the second semester of 2005 and will then become effective six months later.

The intention of the TSI is to set common standards for Interoperability. Consequently it is binding for new rolling stock which can be used across the boarders of the Member States. Rolling stock for purely local use, operating on physically confined networks (e.g. urban and sub-urban train systems) is not governed by the TSI.

The TSI is generally applicable to new vehicles. However it also contains some regulations on the renewal and upgrading of existing rolling stock.

Within a transition period of 2 years the emission limits for locomotives, MUs and coaches can be 2 dB(A) higher than in the TSI for existing design types and rolling stock being ordered before the date of entry into force of the TSI. There are several other specific temporary or permanent exceptions e.g. for engines greater 500 kW, internal noise in the drivers cab, rolling stock limited to the UK or Ireland Finland, Sweden, Norway, Estonia Latvia, Lithuania or Greece.

The TSI gives limit values for stationary noise, starting noise and pass-by noise for locomotives, multiple units and coaches as well as limit values for stationary noise and pass-by noise for freight wagons. It also gives limit values for noise in the driver's cab. The limit values for freight wagons are currently still under discussion. The reason is that there are hesitations to fix limit values which would factually require composite / disk brakes and which would not be achievable be clad iron brakes. So far the experiences with composite brakes are not only satisfactory. The environmental and health impacts of emissions from composite brake pads are not yet known. Furthermore there individual cases where problems with regards to functionality and security of freight wagons with composite brakes occure.

3.2.3 Recommendations

Nordic Manual

The Nordic Environmental Manual gives minimal and optional limit values for noise (for limit values see graphs below).

German Environmental Agency

The German Environmental Agency (UBA) has developed limit proposals for a possible German legislation. With the development of the TSI this initiative was abandoned. However the proposed values can serve as a benchmark. Those values are 5 to 7 dB(A) lower than the corresponding TSI values, however it has to be marked that UBA limit values refer to measures on an excellent test track. Therefore comparability is difficult. The difference to the TSI test track can be approximated with 2 dB(A). Thus, effectively the UBA values would be approximately 3 to 5 dB(A) stricter than the TSI values. The limit values also include a time perspective. After 10 years the limits are to be reduced by 8 dB(A).

3.2.4 Limit Values / Target Values

All values for conventional trains are normalised to a 7.5 m measuring distance. In the Nordic Manual as well as the Italian, Swiss, and Finnish regulations, the measuring distance is 25 m. The 25 m values were transferred into 7.5 m values by adding 7dB(A) (see 1.3).

For high speed trains (HST) only 25 m values are given.

Electric locomotives

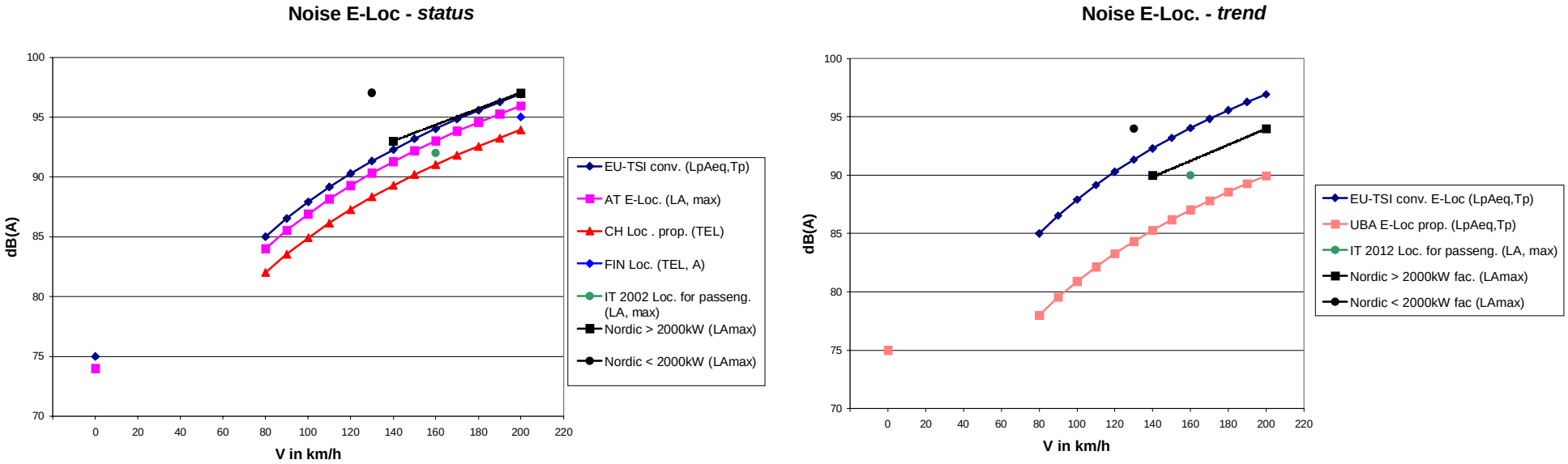


figure 3-1: *Noise limit values for electric locomotives – status and trends*
Conventional trains; measured at 7.5m distance (values for: FIN, IT and Nordic are given for 25m only – values were normalised to 7.5 m by adding 7dB(A))
Note that values refer to different measurement methods ($L_{p, A\ ep, TP}$;$L_{A, mas}$ and TEL) which cannot directly be compared.

Diesel locomotives

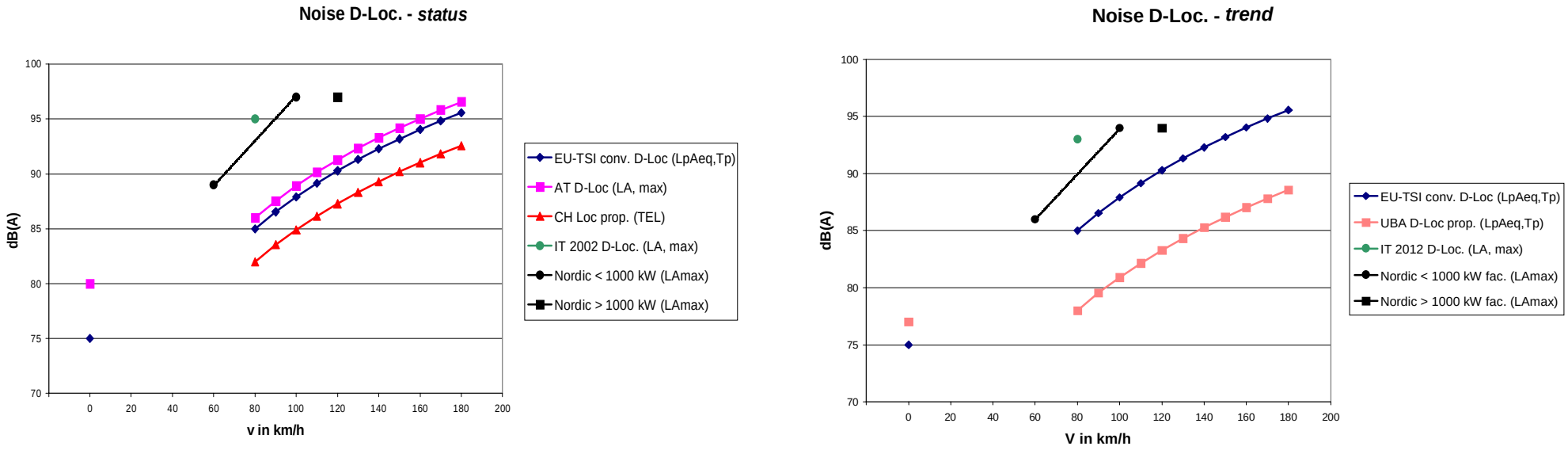


Figure 3-2: Noise limit values for diesel locomotives – status and trends
Conventional trains; measured at 7.5m distance (values for: FIN, IT and Nordic are given for 25m only – values were normalised to 7.5 m by adding 7dB(A))
Note that values refer to different measurement methods ($L_{p, A\ ep, TP}$;$L_{A, mas}$ and TEL) which cannot directly be compared.

Electric Multiple Units

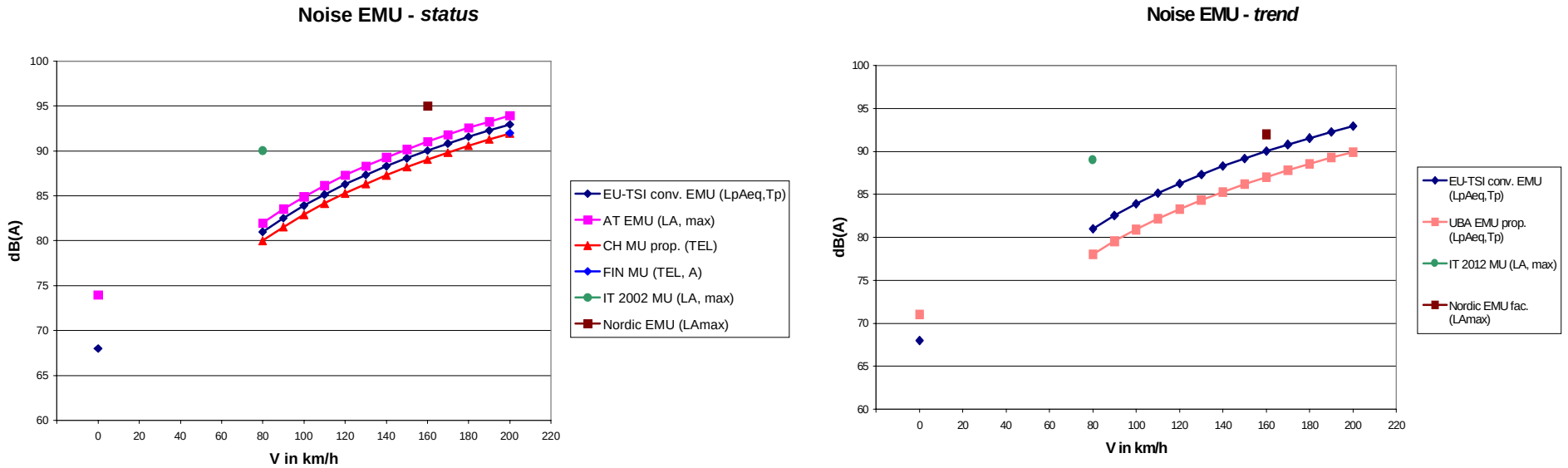
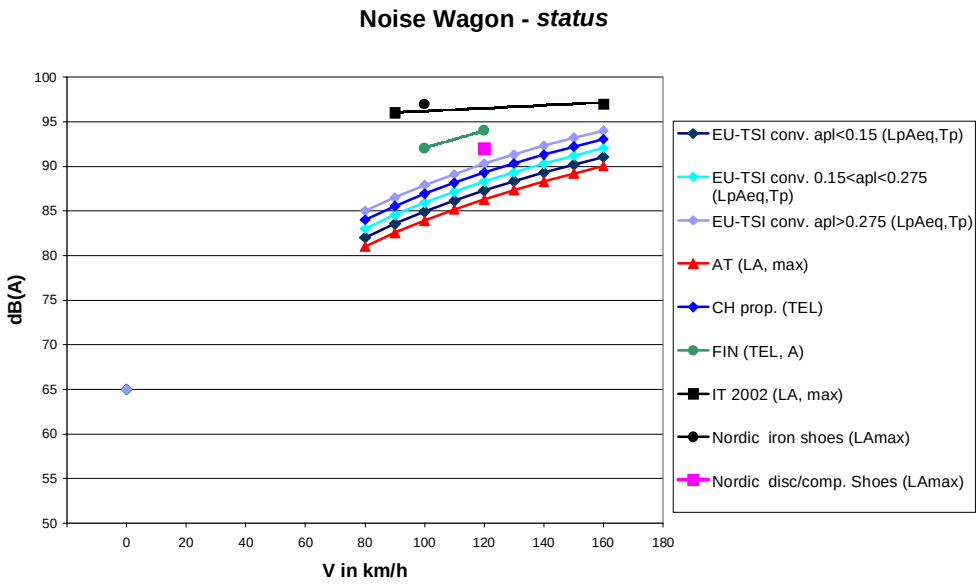


Figure 3-3: *Noise limit values for electric multiple units – status and trends*
Conventional trains; measured at 7.5m distance (values for: FIN, IT and Nordic are given for 25m only – values were normalised to 7.5 m by adding 7dB(A))
Note that values refer to different measurement methods ($L_{p, A\ ep, TP}$;$L_{A, mas}$ and TEL) which cannot directly be compared.
As indicated Austria, Switzerland and Finland do not discriminate between EMU and DMU but give one set of values for multiple units (MU) instead

Freight Wagons



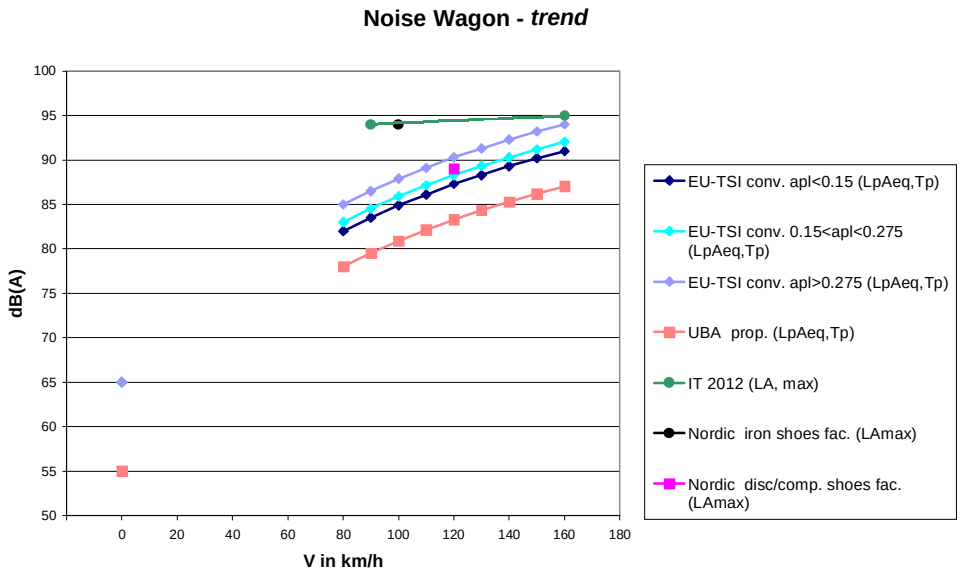


Figure 3-4: *Noise limit values for freight wagons – status and trends*
Conventional trains; measured at 7.5m distance (values for: FIN, IT and Nordic are given for 25m only – values were normalised to 7.5 m by adding 7dB(A))
Note that values refer to different measurement methods ($L_{p, A\ ep, TP}$;$L_{A, mas}$ and TEL) which cannot directly be compared.
Austrian limit values discriminate between three types of wagon give is only the strictest set (Cat.1: flats, container wagons, sliding side vans). Category 2 (other vans, hoppers) is 2 dB(A) softer; category 3 (open wagons, tank wagons) is 4dB(A) softer and equal to the TSI for passing noise.
Note that TSI limit values for freight wagons are divided into three groups depending on apl (axles per unit length over buffers in m^{-1}).
Note that TSI limit values for renewed or upgraded freight wagons are 2 db(A) higher.

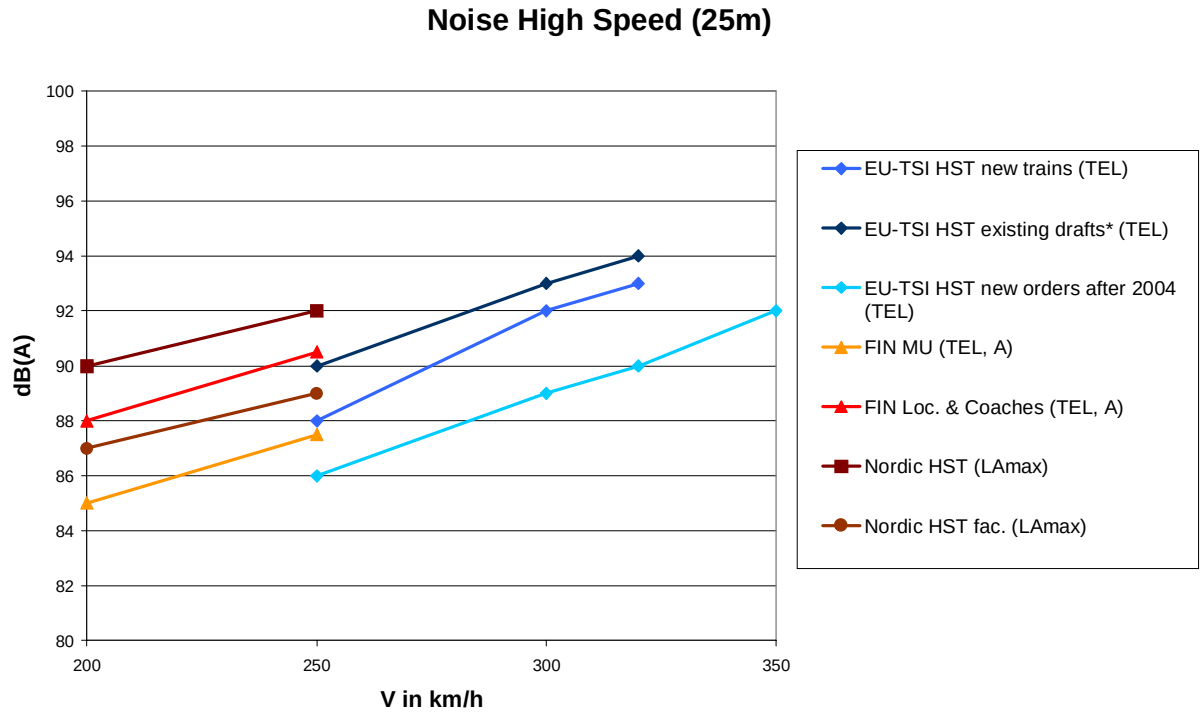


Figure 3-5: Noise limit values (TEL, 25m) for high speed train (HST) – status and trends (new trains based on existing drafts)*

Regulation	**200 km/ h**	**250**	**300**	**320**	**350**
EU-TSI HST new trains		88	92	93	
EU-TSI HST new trains based on existing drafts		90	93	94	
EU-TSI HST new orders after 2004		86	89	90	92
FIN Multiple Units	85	+ 1dB(A) per 20 km/h			
FIN Locomotives & Coaches	88	+ 1dB(A) per 20 km/h			
Nordic HST	90	92			
Nordic HST facultative	87	89			
IT 2002 Locomotives		90			
IT 2012 Locomotives		88			
IT 2002 Coaches		88			
IT 2012 Coaches		86			

Table 3-2: Noise limit values (TEL, 25m) for high speed train (HST) – status and trends Italian regulations for HST give only one value at v=250 km/h.

3.3 Measurement Procedures, Standards and Comparability

There are various different acoustic indicators in use. It is quite difficult to compare the noise limit values (proposed or legal) due to the varying measurement procedures and different definitions of acoustic indicators used ($L_{pAeq,Tp}$; L_{Amax} and TEL). The general tendency (e.g. EU-TSI) is to measure $L_{pAeq,Tp}$ at a distance of 7.5m for conventional trains (=<190 km/h) and TEL (transition exposure level)[6] at a distance of 25m for high speed trains (>190 km/h).

Furthermore for test realisation repeatability is very difficult to obtain. Measured values depend on :

- Condition of the test tracks
- External conditions (weather,…)
- Passing conditions of train (e.g.: percentage of traction power applied)

Distance from source: 7.5m and 25m

Usually the emitted noise is measured as acoustic pressure at a distance of 7.5 m ($L_{pA\ 7.5}$) or 25 m ($L_{pA\ 25}$). Theoretically $L_{pA\ 7.5}$ should be 20 lg (25/7.5) dB(A) = 10 dB(A) lower than $L_{A\ 25}$. Experimental data show a difference of 6 dB(A) for freight trains and 7 dB(A) for passenger trains, which is usually explained by absorption effects. For conventional trains a 7.5m distance is therefore favoured to achieve more accurate and comparable results. The Swiss Federal Office of Transport published limit values for both 25m and 7.5m distance[7]. The difference in noise level is 7 dB(A).

To make the different values comparable, in this paper we will generally use 7.5m values. When they are not available we added 7 dB(A) to the 25m noise levels.

Condition of Test Tracks

The condition of the tracks has a decisive influence on the noise emissions of passing trains. Grinding of rails can reduce the noise level as much as 7 to 10 dB(A). It is difficult to compare noise limit values with different specifications of the rails condition. In order to have a high accuracy when determining the noise emissions of rolling stock, it would be favourable to use test tracks with a very smooth surface. However, this has to two disadvantages:

- Very smooth test tracks with highly specified characteristics are expensive to maintain. Therefore testing would have to be done at special testing site. This would increase costs for manufacturers and railways when rolling stock has to be shipped to those testing sites.
- Using very smooth test tracks would result in very low “theoretical” noise levels. This may either result in strong opposition from producers and railways since those values may sound unrealistic if the measuring procedure is not communicated. On the other hand specifying low “theoretical” values which

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6 In the ongoing revision process of the high-speed TSI, a change to LpAeq,Tp in 25m distance is being proposed.

7 Swiss Federal Office of Transport. *Entwurf AB-EBV zu Art. 2; Ergänzung betreffend Emissionsgrenzwerte für neue Schienenfahrzeuge. Bearbeitet durch Walter Hürlimann*. Bern, 2003

will not be achieved in practical use may lead to opposition from the public (politicians, NGO, residents near railways, etc.). One point of critique could be: "Why are not all rails in the condition of this test track?" The maintenance needed could become quite costly. However the additional costs for acoustic grinding may be small compared to other anti-noise measures. (Here a need for more research exists).

The difference between the UIC test track and a very smooth rail is approx. 2 dB(A).

3.4 Actors and Interests

Unbundling of responsibilities

The general trend of setting emission (instead of reception values) falls in line with the trend of liberalisation and harmonisation on EU level. With the unbundling of railway network operators and rolling stock operators reception levels would lead to undefined responsibilities.

Holistic approach

One has to keep in mind that the overall noise emission is not only dependent on rolling stock but also on the condition of the track. Rough rails can compensate or even overcompensate reductions achieved by low noise rolling stock. Therefore a systemic approach is needed.

Noise barriers vs. low-noise rolling stock

Investment for track-side railway noise barriers makes up about 8% of the total investment for newly build railway lines. In addition, there is a growing public opposition against huge noise barrier walls for aesthetic reasons. For building new lines for high speed trains it could therefore be a cost effective as well as easier acceptable option to invest into low-noise rolling stock rather than being obliged to comply with strict reception levels by installing expensive noise barriers. With the German ICE this rational was one reason behind the noise reduction efforts.

However, current regulation and public funding is not supporting this rational. There are large sums of public funding available for track-side railway noise barriers, which can – so far – not be transferred into noise reduction actions on rolling stock. The reason is that doing so could in fact be interpreted as a subsidy of an individual railway company and could therefore distort competition.

4 Diesel Exhaust Emissions

4.1 Overview

Exhaust emissions from diesel engines is one important environmental aspect of rolling stock that is of high public interest. Especially particle matter exhaust is easily visible and a nuisance for residents near hotspots (darkening of houses, windows etc.). In addition there is a growing concern for health reasons.

Although there is no binding regulation at the present there is a growing pressure to set up increasingly strict limit values on European level. In a mid- and long term perspective exhaust emissions of diesel engines in railways will have to be compared to those of road vehicles. In view of the relatively strict existing EURO emission levels for road transportation and their further reduction it needs great common efforts within the whole railway sector to keep the advantages in environmental performance. These efforts should be based on a long term strategy for emission reduction with comparably strict limit values.

4.2 Legislation and Limit Values

Europe

The UIC and its members have for many years had a homologation procedure for railway diesel traction units and the mandatory UIC technical leaflet 624 represents the current status.

The **UIC limit values** are measured using the ISO Cycle F (60 % idling, 15 % intermediate, 25 % full power). Some railways also use exceptionally the EURO cycle as well as EURO limit values for assuring engine emission standards (e.g. for train sets with diesel mechanical transmission like in DSB).

In April 2004 the revised **EU directive 97/68/EC, amended through the directive 2004/26/EC**[8] on "measures against the emission of gaseous and particulate pollutants from internal combustion engines to be installed in **non-road mobile machinery**" was ratified. It sets emission limits for diesel engines used for railway purposes. In contrary to the UIC limit values, this values will be legally binding. The directive has to be adopted by the Member States and has to be transferred into national law. The limit values given in the directive will be binding from 2005/2006 on for engines in railcars and smaller engines in locomotives and from 2008/2009 on for stronger engines in locomotives and most probably there will be an additional tightening for all power classes from 2011/2012 on. The 2011/2012 limit values will undergo a technical review in 2007, which will determine the technical feasibility of limit values, and recommend relaxing or tightening of the limits, as may be appropriate. The review will also identify any changes that are needed to achieve worldwide alignment of regulations.

Special attention has to be paid to the fact the directive not only refers to new vehicles but also to remotorisation. Thus in the procurement of new rolling stock it has to be considered that for a future remotorisation stricter limit values could be

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8 from April, 21 2004, published in the European Journal April, 30 2004 (L 146)

applicable. Consequently it is important to make design provisions which allow for the necessary upgrades (e.g. sufficient space in locomotives for particle filters).

Apart from the above mentioned railway-specific directive the **EU directive 1999/30/EC on ambient air quality** will most probably have an effect on diesel exhaust emissions and their regulation. The directive does not aim at specific emission sources like traffic, industry or households but on the overall quality of ambient air. The directive gives limit values and alert thresholds for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particle matter (PM_{10}) and lead. The limit values will become effective on January, 1st 2005 with transition periods for nitrogen dioxide and oxides of nitrogen. The directive will most likely be revised in a way that a second stage after 2010 is to be introduced. In this second stage stricter limit values for particle matter (PM_{10}) are envisioned and limit values for $PM_{2.5}$ should be introduced.

Limit values for lead will undergo a review process which will determine the possibility for supplementing or replacing the lead limit values by a separate deposition limit value for major lead emission sources (e.g. industrial sites). This could also affect railroad shunting yards and rail lines with high traffic volume and their surrounding areas.

Local authorities will be responsible for observing and taking measures to comply with the limit values. It can be anticipated that in certain hot spots with high local pollution public pressure will become very strong forcing the communities to act quickly. Banning of trucks without particle filters from the inner city limits is already subject to discussion for some European cities. Although industrial polluters and private transport may be more in the focus of attention, there is a substantial chance, that individual cities will dramatically raise the standards for diesel emissions from rail vehicles. In this respect it may strategically advisable for the procurement of new rolling stock to aim at stricter emission values than what is currently mandatory according to EU directive 2004/26/EC.

National peculiarities

United States

In the United States the Environmental Protection Agency (EPA) has set emission standards for diesel locomotives that roughly correspond with the UIC recommended standards. An accurate comparison between UIC limits and EPA limits is problematic since both test cycles are completely different. The US test cycles distinguish between shunting conditions (“switch”) and mainline operational conditions.

Apart from the railway-specific diesel exhaust emission standards there are National Ambient Air Quality Standards for Particulate Matter (PM NAAQS) which are analogue to the European legislation on ambient air quality. Unlike the European directive a standard for fine particles ($PM_{2.5}$) is in force since 1997.

Recommendations

Several railway companies adopt emission standards in their regulations on procurement of new rolling stock. Sometimes it is discriminated between minimal values and stricter optional values.

- **UIC Recommendations**
  The UIC leaflet 624 (published in 2002, following its predecessor 623) gives

mandatory emission standards for UIC members, but there is no active checking mechanism on the compliance of the companies with these UIC rules.

- **Austria**
  ÖBB sets limit values according to ERRI 1997 and optional values according to EURO 3 (in “Technische Ausschreibungsbedingungen für Diesel-Lokomotiven” ÖBB).
- **Nordic Manual**
  The Nordic manual gives no explicit limit values (only for train sets with mechanical traction), but gives the existing EURO norm as an orientation.
- **German Environmental Agency (UBA)**
  The German Federal Environmental Agency (UBA) has developed recommended emission limits as proposition for a German law.

4.3 Limit Values

The limit values are displayed in one graph per pollutant.

Shown are the limit values of the Austrian legislation, the proposed EU-TSI, the US legislation, the UIC recommendations, and the UBA recommendations. As a reference the EURO Norms III to V for trucks are also given.

Note that the comparability of the limit values is limited since they refer to different test cycles. The UIC, UBA and ÖBB/Austria limit values as well as the best practice example refer to the ISO 8178 F test cycle. The EURO limit values refer to the A cycle for cars. The US-EPA limit values discriminate between “line-haul” and “shunting” conditions. The corresponding test cycle for the EU limit values will have to be defined in the revision process of directive 2004/26/EC. (see also chapter 3.3 Measurement Procedures, Standards and Comparability)

Limit values for P >560 kW

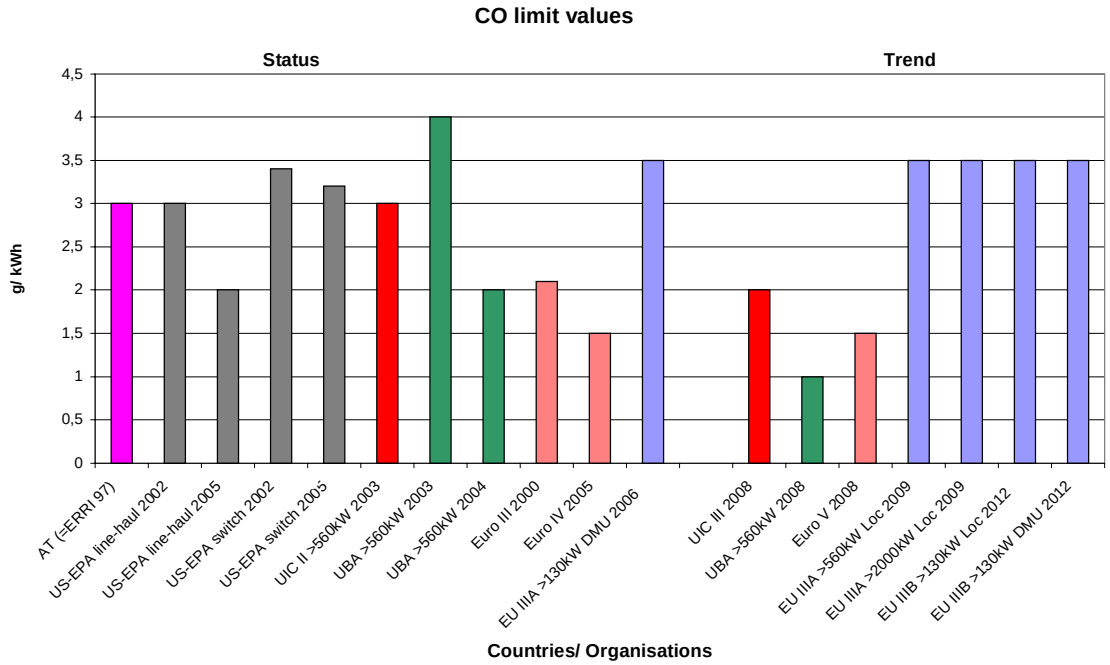

Figure 4-1: CO emission limit values (P>560 kW) - EU refers to the directive 2004/26/EC It does not reduce the CO limit, but extends the limit of 3.5 g/kWh to higher engine powers over time. The EU III limit value is more than double of the EURO IV. Note that limit values refer to different load cycles (see above)

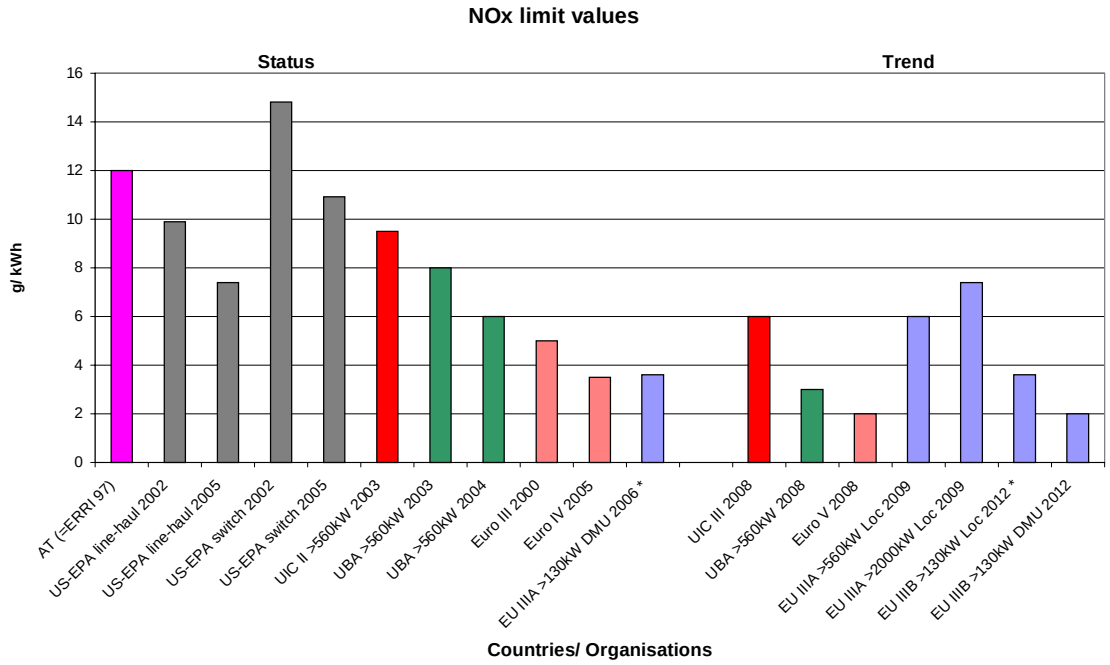

Figure 4-2: NOx emission limit values. (P>560 kW) - The EU IIIB NOx limit value for DMUs in 2012 equals the EURO V (2008).
Note that limit values refer to different load cycles (see above)
** Note also that EU III (for DMU >130kW in 2006 and DMU >130kW in 2012) gives a combined limit value for NOx and HC (4 g/kWh) which has been split for better comparability in the graphs.*

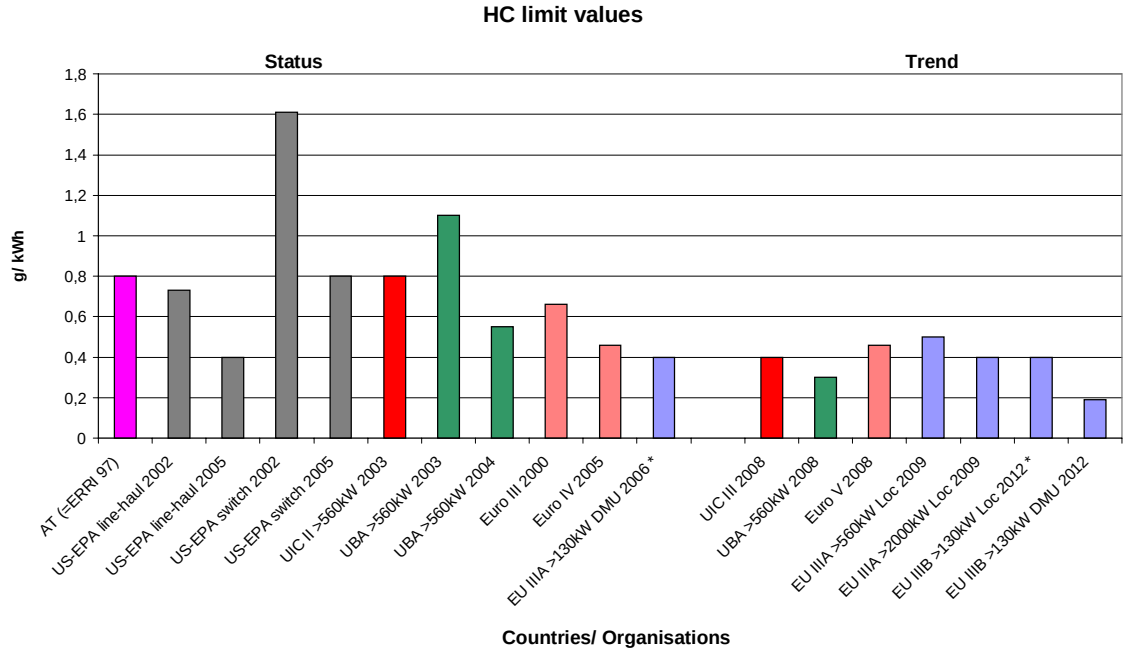

Figure 4-3: Hydro-carbon (HC) emission limit values. (P>560 kW)
The EU IIIB HC limit values for DMU drops in 2012 below the EURO V (2008)
Note that limit values refer to different load cycles (see above)
** Note also that EU III (for DMU >130kW in 2006 and DMU >130kW in 2012) gives a combined limit value for NOx and HC (4 g/kWh) which has been split for better comparability in the graphs.*

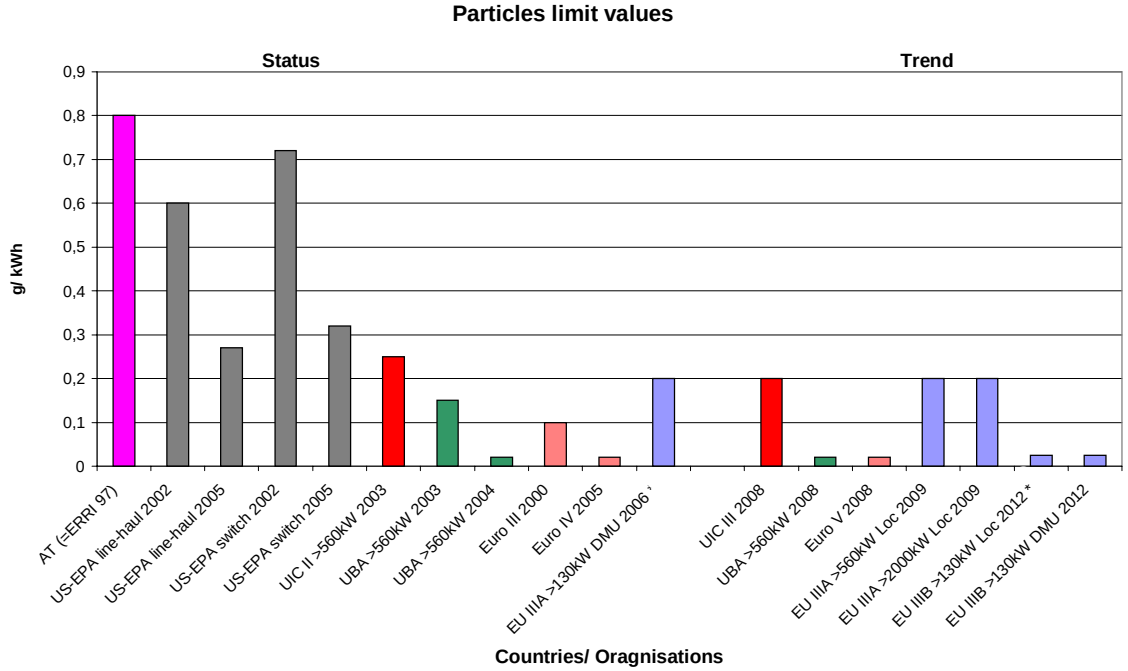

Figure 4-4: Particles emission limit values (P>560 kW)
The EU IIIB limit value (0.025 g/kWh) for particle emissions in 2012 is slightly above the 2008 EURO V value (0.02 g/kWh).
Note that limit values refer to different load cycles (see above)

Limit values for P <560 kW

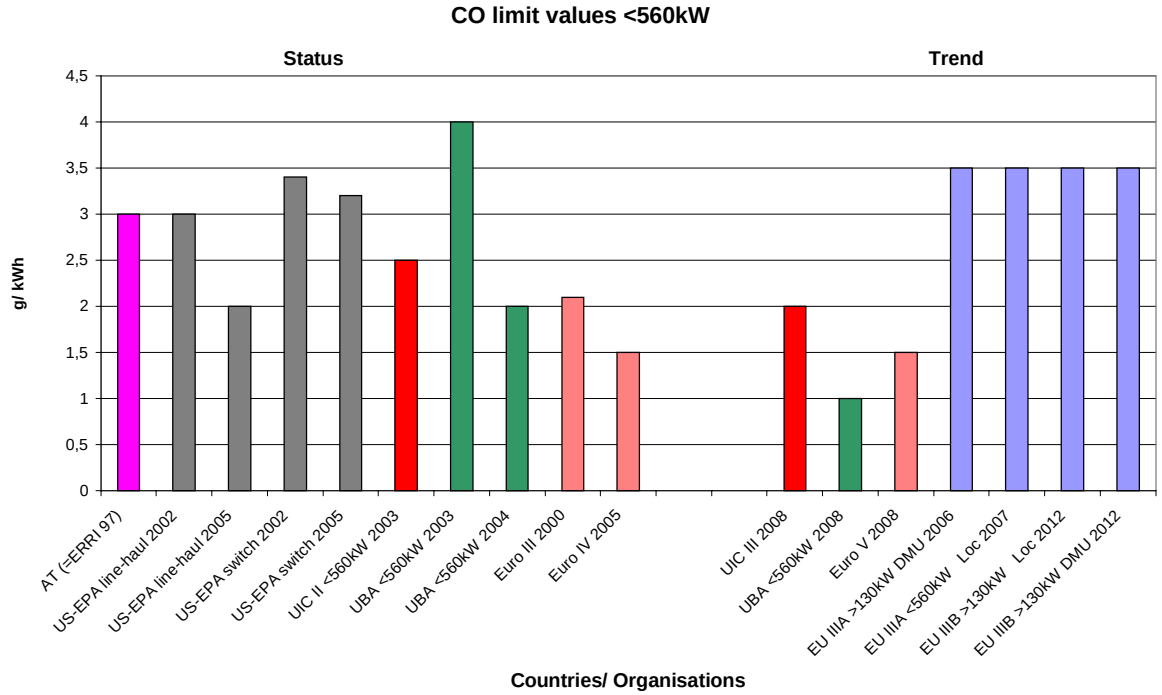

Figure 4-5: CO emission limit values (P<560 kW)
Note that limit values refer to different load cycles (see above)

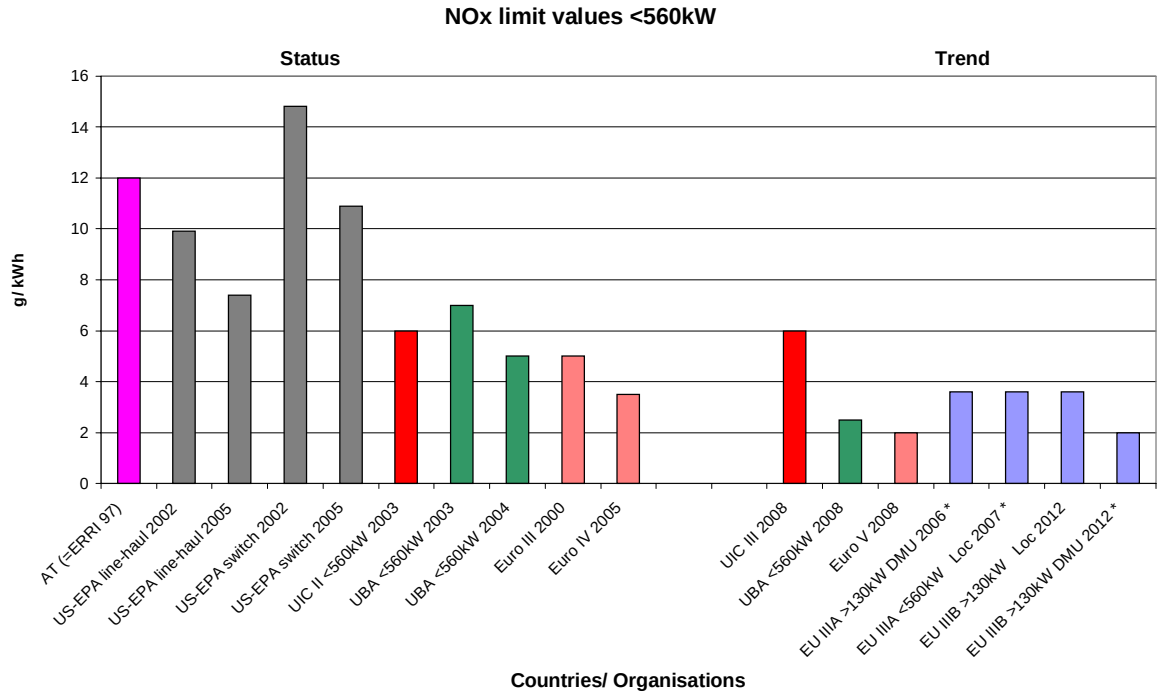

Figure 4-6: NOx emission limit values. (P<560 kW)
Note that limit values refer to different load cycles (see above)
** Note also that EU III (for DMU >130kW in 2006; Loc <560kW in 2007 and DMU >130kW in 2012) gives a combined limit value for NOx and HC (4 g/kWh) which has been split for better comparability in the graphs.*

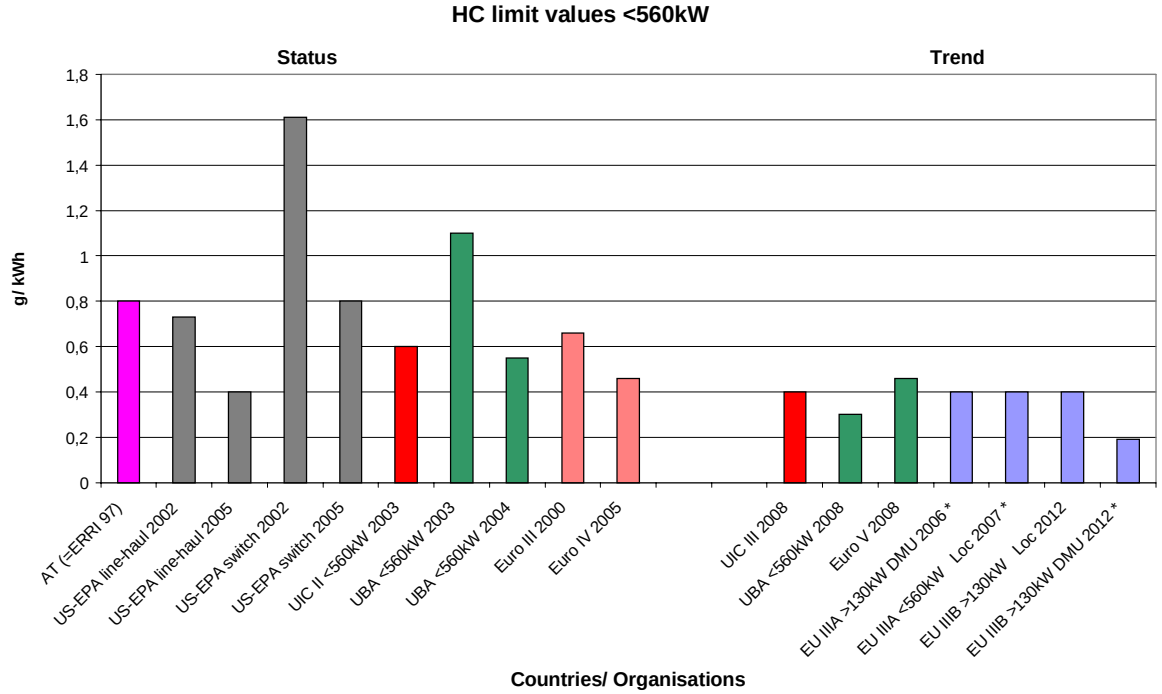

Figure 4-7: Hydro-carbon (HC) emission limit values. (P<560 kW)
Note that limit values refer to different load cycles (see above)
** Note also that EU III (for DMU >130kW in 2006; Loc <560kW in 2007 and DMU >130kW in 2012) gives a combined limit value for NOx and HC (4 g/kWh) which has been split for better comparability in the graphs.*

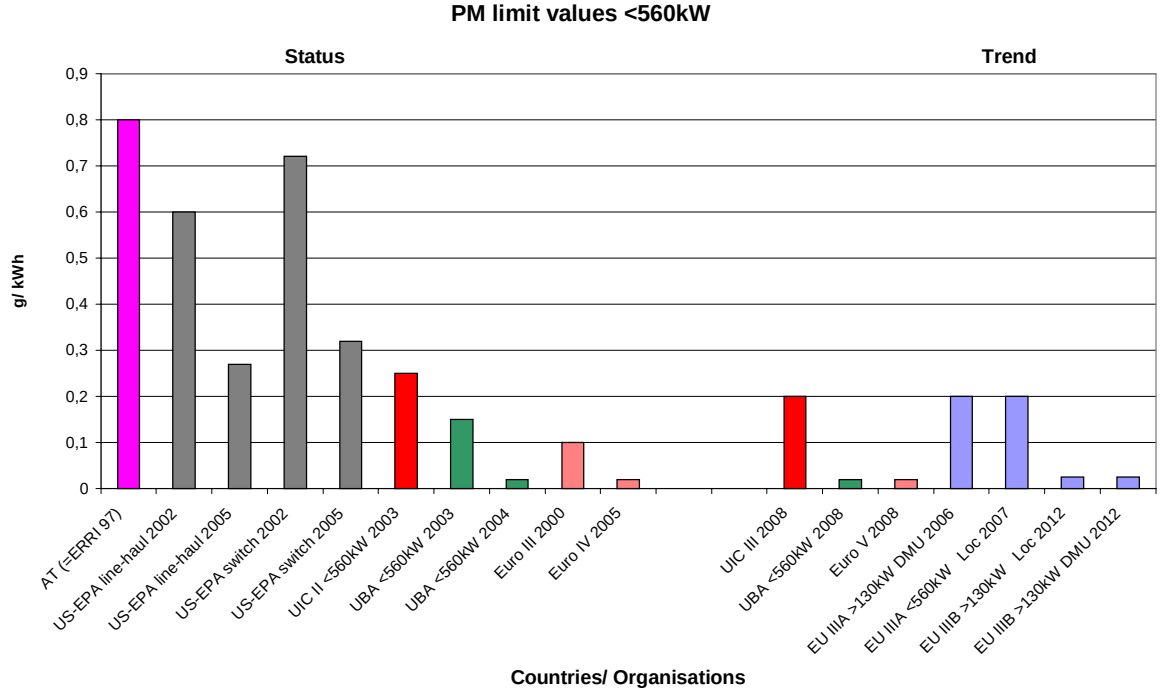

Figure 4-8: Particle emission limit values (P<560 kW)
Note that limit values refer to different load cycles (see above)

Table 4-1: Exhaust limit values

Country / Organisation	CO	NO_x	$HC+NO_x$	HC	PT
AT (=ERRI 1997)	3	12		0,8	0,8
AT recomm. (= EURO 3)	2,1	5		0,66	0,1
EU 2004/26 >130kW DMU 2006	3,5		4		0,2
EU 2004/26 <560kW Loc 2007	3,5		4		0,2
EU 2004/26 >560kW Loc 2009	3,5	6		0,5	0,2
EU 2004/26 >2000kW Loc 2009	3,5	7,4		0,4	0,2
EU 2004/26 >130kW Loc 2012	3,5		4		0,025
EU 2004/26 >130kW DMU 2012	3,5	2		0,19	0,025
Euro III 2000	2,1	5		0,66	0,1
Euro IV 2005	1,5	3,5		0,46	0,02
Euro V 2008	1,5	2		0,46	0,02
US-EPA line-haul 2002	3	9,9		0,73	0,6
US-EPA line-haul2005	2	7,4		0,4	0,27
US-EPA switch 2002	3,4	14,8		1,61	0,72
US-EPA switch 2005	3,2	10,9		0,8	0,32
UIC II <560kW 2003	2,5	6		0,6	0,25
UIC II >560kW 2003	3	9,5		0,8	0,25
UIC III 2008	2	6		0,4	0,2
UBA prop. <560kW 2003	4	7		1,1	0,15
UBA prop. >560kW 2003	4	8		1,1	0,15
UBA prop. <560kW 2004	2	5		0,55	0,02
UBA prop. >560kW 2004	2	6		0,55	0,02
UBA prop. <560kW 2008	1	2,5		0,3	0,02
UBA prop. >560kW 2008	1	3		0,3	0,02

4.4 Measurement Procedures, Standards and Comparability

Test cycles

The UIC exhaust emission limit values refer to the ISO 8178 F test cycle. There are large deviations possible between theoretical and actual work profiles (See also chapter 3 on energy efficiency). Those differences have an even greater impact on the exhaust emission than on the energy consumption.

In the process of the revision of the EU directive 2004/26/EC the limit values are to be measured using the ISO 8178 F test cycle for locomotives and the ISO 8178 C1 cycle for MUs.

5 Energy Efficiency

5.1 Overview

Energy efficiency is a key challenge for today's railway companies for reasons of cost effectiveness and environmental competition. There is general agreement about the existence of considerable energy saving potential in railways in the short, mid and long term. Due to the cost benefits often associated with the improvement of the environmental performance in the field of energy efficiency the exploitation of this potential is highly plausible. It should however be stressed that it needs a LCC oriented approach to show the economic advantages of most energy saving measures, e.g. today's focus on initial investment has to be overcome.

5.2 Legislation and Recommendations

There is no actual or forthcoming legislation – neither on a national nor on an European level – which directly addresses the energy efficiency of rolling stock.

Nevertheless there are a few directives which will come into force in the near future which address the issue of energy efficiency of (consumer) products. These directives give a clear outlook of the EU's intentions for the future development of energy efficiency and should be seen as the very first parts of a widespread legislation on energy efficiency which could cover successively all industrial sectors.

The EU proposal for a directive on energy end-use efficiency and energy services[9] enhances the cost-effective and efficient end-use of energy in the EU. Upon adoption, it provides the necessary targets, mechanisms, incentives and institutional, financial and legal frameworks to remove existing market barriers and imperfections for the efficient end use of energy. The proposal sets out clear mandatory targets for annual energy savings at Member States' level and for the share of energy efficient public procurement for the period 2006-2012. For the same period, strong incentives are given by the Directive for Member States to ensure that suppliers of energy offer a certain level of energy services.

The EuP directive (Eco-design requirements for Energy-Using Products), such as electrical and electronic devices or heating equipment, will provide coherent EU-wide rules for eco-design. The Directive does not introduce directly binding requirements for specific products, but does define conditions and criteria for setting requirements (through subsequent implementing measures) regarding environmentally relevant product characteristics (such as energy consumption) and allows them to be improved quickly and efficiently. By encouraging manufacturers to design products with the environmental impacts in mind throughout their entire life cycle, the EU implements an Integrated Product Policy (IPP) and accelerates the move towards improving the environmental performance of energy-using products.

On international level there is an overall framework which does effect the energy consumption of any industry or other user: The international agreements on climate protection. The Kyoto protocol states that the European countries have to reduce their CO_2 emissions (and according to today's structure of energy production their

9 COM (2003) 739 final of 10.12.2003

energy consumption respectively) from 1990 to 2008-2012 (average) by 8-9%. This figure represents an average reduction over all sectors and no specific goals for individual sectors are given so far.

The greatest part of the increases in overall energy consumption can be addressed to road transportation. Taking into account the great energy saving potentials of railways, there is a realistic chance even of a growing railway sector contributing to the reduction goal in mid- and long-term perspective. This would strengthen the position of railways as an environmentally sound mode of transportation.

5.3 Measurement Procedures, Standards and Comparability

Test cycles

So far there is only one well established test cycle to measure energy consumption (and exhaust) in Europe: the ISO 8178 F cycle. It consists of 60% idle, 15% partial load and 25% full power. Although this mirrors relatively well some major working profiles, there are large deviations possible in practise, especially between shunting and main line conditions.

The amended EU directive 2004/26/EC refers to the ISO 8178 F cycle for locomotives and the C1 cycle for MUs. While the F cycle comprises only three working points to be measured the C1 cycle has eight working points.

Speed	Full power (rated speed)					Partial load (intermediate speed)					idle
Torque, %	100	75	50	25	10	100	75	50	25	10	0
Cycle C1	15%	15%	15%	-	10%	10%	10%	10%	-	-	15%
Cycle F	25%	-	-	-	-	-	-	15%	-	-	60%

Table 5-1: Definition of test cycles ISO 8178 F and C1 – share of working points in %

There are a number of other test cycles or load profiles which are being used by national railway companies or by industrial producers. However, comparability is limited if possible at all. Currently a feasibility-study “Harmonisation of Energy Consumption Standards for Railways”[10] is carried out. One aim of the study is to assess whether or not test cycles can be an appropriate tool to gain comparable standards for the energy consumption of rolling stock.

[10] Machbarkeitsstudie: "Harmonisierung von Energieverbrauchstandards für Schienenfahrzeugen” Deutsche Bahn AG, contact Mr. Markus Halder

6 Material / Recycling / Waste

6.1 Overview

The environmental key area material/recycling/waste constitutes a very heterogeneous and complex field:

- Many different and often complex materials are being used.
- The corresponding legislation is highly specialised and differentiated.
- The very long live-cycles of rolling stock make recycling approaches difficult (What will the recycling management structure / technologies be like in 40 years?).
- The comparably low overall waste quantities of rolling stock (low number of trains e.g. in comparison to cars) make specialised recycling systems difficult to establish and to operate.
- There is great amount of freedom necessary for manufacturers to allow for optimised design and production processes.

There are basically two different approaches to optimise the environmental performance within this field

→ direct approach: to influence the design process of rolling stock directly and at each single step by means of a sophisticated tool on the basis of environmental indicators and explicit material lists etc. (e.g. the software tool and methodology of REPID)

→ functional approach: to influence the design and production process of rolling stock indirectly by defining strategic aims and setting priorities (e.g. high resource efficiency, use of renewables, design for environment, high recycling quota).

The concrete choice of materials for a new train or parts of it and the corresponding design concept lie mainly within the responsibility of the manufacturer. Therefore the influence of the operator is rather limited in this field.

From an operators point of view the functional approach is much more efficient. It forces the manufacturers to take up the responsibility for his product including end-of-life responsibility and ensures maximum freedom to find solutions with optimum cost/benefit ratios.

Following a functional approach the operator should communicate certain guiding principles for the choice of materials to the manufacturer which guarantee high standards of environmental performance:

- the precautionary principle
- the use of best available technology
- the principle of open communication of detailed information and documentation
- the principle of economising and recycling.

The manufacturer should be encouraged to use the REPID software tool and

methodology at an early stage of the design process to integrate the use of renewable materials, a careful resource management, the avoiding of hazardous waste and recycling efforts. In this respect two different time scales have to be taken into account: 8-10 years for major retrofit measures (mainly for interior components) and about 40 years for the live cycle of the vehicle itself.

To promote high environmental standards, the operator should communicate best practice examples and corresponding technologies and encourage the use of components and products with eco labels.

This guarantees a consistent approach to the improvement of the environmental performance of new rolling stock.

6.2 Legislation

There is a wide range of international and especially EU and national legislation concerning specific substances which are either harmful for health or environment and therefore restricted or even forbidden.

Examples of forbidden substances relevant for railway applications are PCBs (polychlorinated biphenyls) in transformers and CFCs (chlorofluorocarbons) in air-conditioning systems.

On EU level the prohibition and restriction of a wide range of dangerous substances is regulated by the **Council Directive 76/769/EEC** (and it's amendments) on marketing and use of certain dangerous substances and the **directive 67/548/EEC** (and it's amendments) on classification, packaging and labelling of dangerous substances as well as by the corresponding commission regulation (EC) No 1488/94 on risk assessment of existing and **commission directive 93/67/EEC** on risk assessment of notified substances. The harmonisation process is already far reaching and there are only minor deviation due to national law.

Due to the REACH process in the EU (**R**egistration, **E**valuation, and **A**uthorisation of **Ch**emicals) more chemical substances and preparations are expected to be classified as (more) dangerous/harmful, requiring to undergo a special registration process and to be marked with stricter/lower concentration levels.

EU recycling and waste strategy

Although there is no EU legislation which directly addresses recycling and waste issues specifically for railway's rolling stock, there are general trends which are relevant or could be in the longer run.

Within the 6th Environmental Action Programme of the EU a "thematic strategy on the prevention and recycling of waste" is to be developed. A stakeholders consultation process has been launched and on 27.05.2003 a communication paper has been published by the commission[11]. The strategy seeks to combine voluntary and mandatory actions for waste prevention. A general tendency is to make producers responsible for recycling.

Existing EU legislation which governs materials, recycling and waste primarily follows these lines:

- Restriction of certain materials (chemical policies)

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11 COM(2003)301, http://europa.eu.int/comm/environment/waste/strategy.htm

- Integrated strategies – these are generally oriented towards mass products (electronic consumer good, cars)
- The EU directive 76/769/EEC (and it's amendments) on marketing and use of certain dangerous substances and the directive 67/548/EEC (and it's amendments) on classification, packaging and labelling of dangerous substances prohibit and restrict a wide range of dangerous substances.
- Commission Directive 93/67/EEC of July 20th 1993 lays down the principles for assessment of risks to man and the environment of substances notified in accordance with Council Directive 67/548/EEC and regulates "new" substances placed on the market after September 18th 1981.
- Commission Regulation 1488/94/EC of June 28th 1994 lays down the principles for the assessment of risks to man and the environment of existing substances in accordance with Council Regulation 793/93/EEC and regulates "existing" substances placed on the market before September 18th 1981.
- The European Waste Catalogue (EWC – EU Commission Decision 2000/532/EC) is a classification system for waste materials. It categorises wastes based on a combination of what they are and the process or activity which produced them. The EWC includes also a Hazardous Waste List (HWL)

The EU directive 2002/95/EC (RoHS – restriction of the use of certain hazardous substances in electrical and electronic equipment) governs mainly electronic and electrical consumer goods and restricts several different substances to be used in such devices (with exceptions for some applications). The substances are lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE).

Additionally to the RoHS the directive 2002/96/EC (WEEE – waste electrical and electronic equipment) regulates and gives target values for the recycling and reuse of electric and electronic equipment.

Although both directives – RoHS and WEEE – do not regulate railway applications, and even equipment and devices which are not rail specific (e.g. lamps, computers, entertainment electronics etc.) are exempted when they are used in rail vehicles or installations there will be implications in particular of the RoHS directive. The main reason is that no supplier can afford to run two production lines, e.g. for circuit boards, one with lead-free solder and one without.

The **EU directive 2000/53/EC** governs end-of life (road) vehicle (ELV) issues. It lays down measures for the prevention of waste from vehicles and the reuse, recycling and other forms of recovery of end-of life vehicles and their components to reduce the disposal of waste, as well as to improve the overall environmental performance. The directive regulates that new vehicles do not contain lead, mercury, cadmium and hexavalent chromium (with several exceptions, like batteries, etc.). It also governs the rate of reuse and recycling and reuse and recovery of end-of life vehicles with at least 80% and 85% respectively (beginning from 2006 on). There is a tightening of the rates in 2015 with a 85% reuse and recycling rate and a 95% reuse and recovery rate.

In an effort to harmonise the management of information in the waste sector, **Council Directive 91/156/EEC**, among other things, required the Commission to draw up a list of wastes. This list, commonly referred to as the European Waste Catalogue (EWC), was published as **Commission Decision 94/3/EEC** (amended by decision 2000/532/EC). It is a harmonised, non-exhaustive list of wastes which will

be periodically reviewed and, if necessary, revised. It is intended that the EWC will provide a common terminology throughout the Community with the purpose of improving the collection and management of statistics on waste and, by so doing, improve the efficiency of waste management activities. The EWC will constitute the basic reference for the Community Programme on waste statistics. In 1994, a Hazardous Waste List (HWL) was drawn up and published as **Council Decision 94/904/EC**. The wastes listed in the HWL are those wastes that appear in the EWC which have been deemed to be hazardous.

6.3 Material Lists

On international, EU and national level exist many different lists for forbidden and restricted materials. As only a small portion of the dangerous substances covered is being used in railway applications, these lists are often rather difficult to handle and therefore of limited value for operator's and manufacturer's practical decisions.

Focussing on materials and substances relevant for railways, within the framework of **REPID** an easy to handle list for forbidden materials and a "grey list" for restricted materials has been developed.

7 Other

7.1 Electromagnetic Fields

7.1.1 Overview

There is a very heterogeneous and often non-consistent literature dealing with health influences of high frequency electromagnetic fields. Only very few publications directly address railway specific problems.

Problems associated with electromagnetic fields concern mostly electromagnetic compatibility (interaction between train appliances and signal technology or screen phenomena). More recently, potential health problems caused by “electrosmog” are discussed.

Even in the absence of consistent and reliable information about the effects of electrosmog caused by railways the railway companies should follow the precautionary principle and ensure low emissions levels where protective measures can be put into practise at reasonable costs.

Long-term and short-term effects

There are basically two approaches to define limit levels for electromagnetic fields - they can either be based on short-term or long-term health effects:

- Short-term effects
  EM reference levels are defined based on the directly measurable physical impact of electromagnetic fields onto the human body (dosimetric values). Examples are local heating of tissues or increase of corporeal temperature which are measure in laboratory experiments.
- Long-term effects
  Long-term effects have to be identified by statistical means, e.g. higher cancer rates of people who are exposed to higher levels of electromagnetic fields over a longer period of time.

It has to be marked that so far there is no scientific prove of long-term health risks due to EM radiation which does not exceed recommended maximum short-term exposure levels. For this reason the ICNIRP guidelines refer to reference levels based on short term exposure.

However, the levels of EM fields which are under suspicion to cause long-term effects are much lower than those which cause short-term effects. For this reason recommendations / legislations which intend to reduce the risk of long-term effects have limit values which are lower than the ICNIRP values by several magnitudes (see below).

7.1.2 Legislation and limit values

Existing EU legislation governs the exposure of working staff to electromagnetic fields. The limit values given in the **EU directive 2004/40/EC** correspond to the ICNIRP recommendations on occupational exposure.

EN 45502-2-1 and –2-2 is a noncommittal guideline for pacemaker manufacturers

which covers the EM spectrum from 16 Hz to 3 GHz. It should serve as a guiding principle for upper limits of EM-fields in all places where passengers can be present.

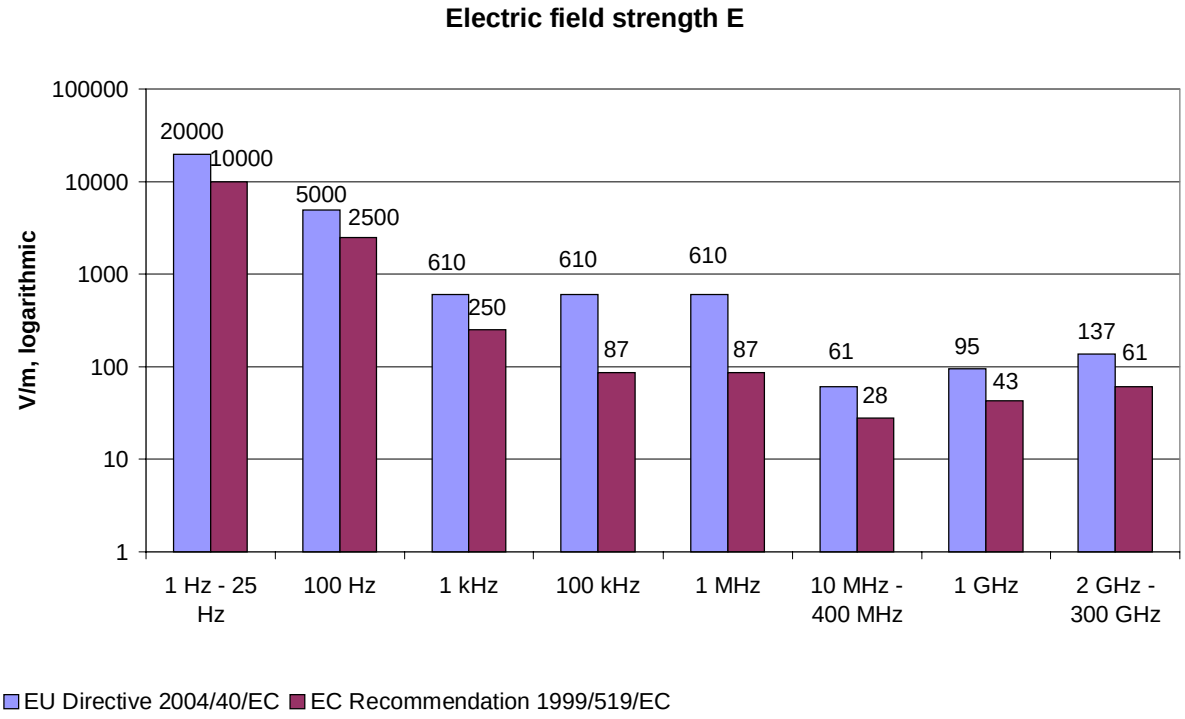
National peculiarities

Several European countries have national laws which follow the ICNIRP guidelines (e.g.: Germany, Poland, Portugal, Spain and Finland partly). In Belgium the limits are more restrictive than those suggested by ICNIRP. Italy and Switzerland are introducing legislated limit values for low frequency electromagnetic fields and for high frequency telecommunication antennas. The Swiss regulation follows the ICNIRP for the reception values, but it also introduces limits on specific emissions (emission values). The Italian law imposes precaution limits which can be up to 25 times lower for individual frequencies. The fulfilment of those strict values can be potentially problematic for railway companies.

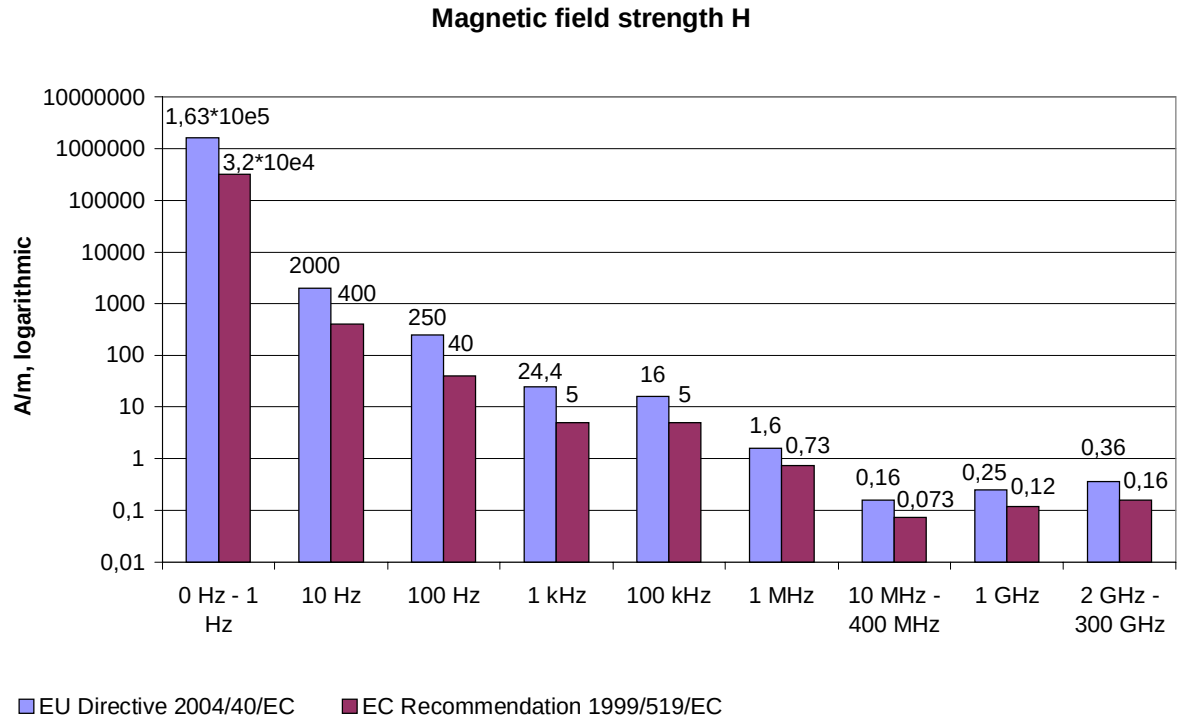
Recommendations

In addition, the EU Council **Recommendation 1999/519/EC** provides limit values for the exposure of the general public to electromagnetic fields. They correspond to the ICNIRP recommendations for the general public and are the basis for many national legislations and recommendations. These values are stricter than the working staff limit values to account for highly sensitive people (e.g.: children, pregnant women). With respect to the precautionary principle, the limit values should be met at all places where people are even briefly present.

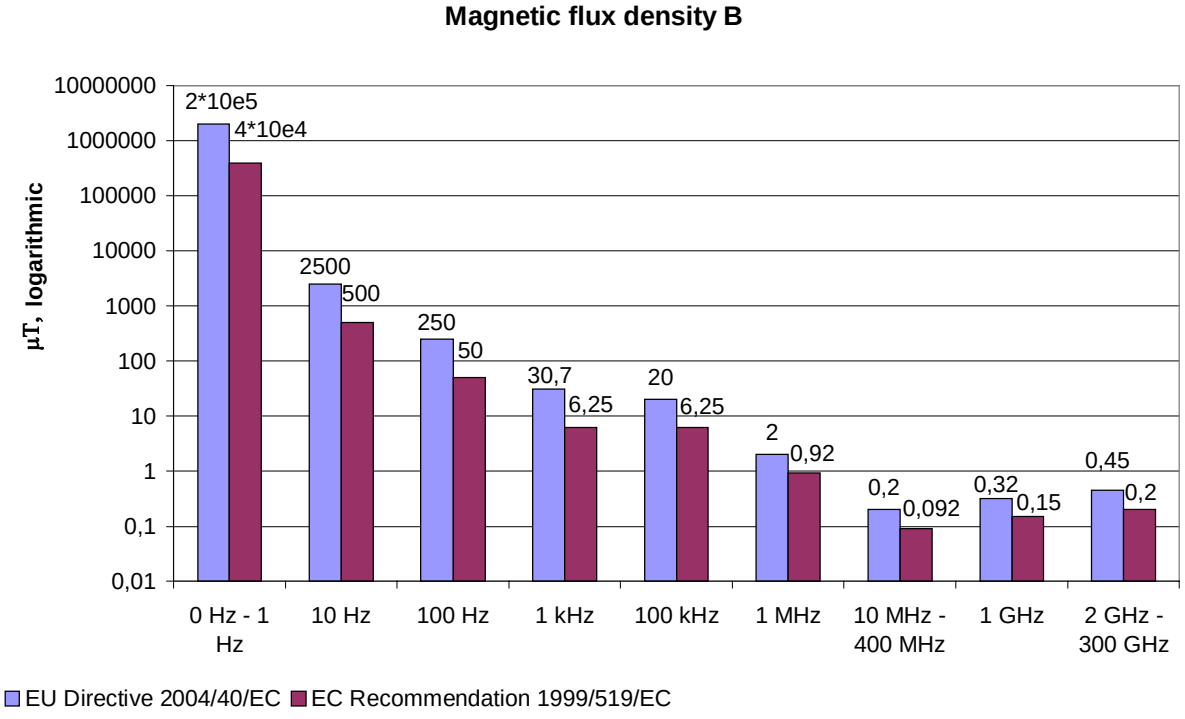
Limit values



Graph 7-1 *Comparison of electric field strength – EU Directive 2004/40/EC (on exposure of workers to EMF) and EC Recommendation 1999/519/EC (on the limitation of exposure of the general public to electromagnetic fields). Note that a logarithmic scale was chosen for better visibility.*



Graph 7-2: *Comparison of magnetic field strength values – EU Directive 2004/40/EC and EC Recommendation 1999/519/EC. Note that a logarithmic scale was chosen for better visibility.*



Graph 7-3: *Comparison of magnetic flux density values – EU Directive 2004/40/EC and EC Recommendation 1999/519/EC. Note that a logarithmic scale was chosen for better visibility.*

7.2 Emissions from Brake Friction Material

Emissions from brake friction material can contain hazardous substances. For health and environmental reasons such emissions should be minimised. While for clad iron disk brakes mainly metals are emitted and contribute to metal intake and dust generation, the situation with compound brake pads is more complex and a wider variety of potentially hazardous materials may be emitted. Compound brakes are of high interest and relevance because of lower noise emissions compared to cast-iron brakes. Thus an increasing number of trains – both passenger and freight - with compound brakes or disk brakes are put into operation. This creates emissions from brakes (wear debris and substances into which the brake friction materials are transformed under higher temperatures) which could be an issue of growing importance in the future.

However, little is known yet about the concentrations of these hazardous substances emitted into the environment or into rail vehicles (drivers and passenger cabins). Since toxicity is a combination of substance property and exposed concentration further investigation and the establishment of harmonised testing procedures are due necessary. In a Europe-wide survey (carried out by ERRI) several European rail operators expressed further need of information and investigation of this subject.

A distinction has to be made between:

- the **original substances in the break pads**, which are emitted by wearing down the pads (literally grinding them into dust). This is the case when the pads stay relatively cool as is the case for interval breaking or breaking with low power. The main problem is that the suppliers of break pads are very reluctant to give out any information on the content of the pads.
- **substances into which the brake pads are transformed under higher temperatures** (e.g. 400 – 600° C or higher) which is the case for longer breaking activities with high pressure. In this case substances like Volatile Organic Compounds (VOC e.g. Toluene, Ethylbenzene, Xylene, Benzaldehyde, Diphenylmethane), Polycyclic Aromatic Hydrocarbons (PAHs) or Benzo(a)pyrene are being emitted.

One of the major difficulties in the assessment of brake pad emissions is that no standard testing conditions exist. Furthermore no limit values for emissions exist to date which would allow judgments on whether or not certain emissions can be considered harmless. Three cases have to be distinguished:

7.2.1 Legislation and limit values

Currently there is no legal regulation regarding this specific field. Nevertheless diverse national regulations on Occupational Exposure Limits values (TLV) (also known as “maximum allowable exposure during x hours or y minutes concentrations (MAC)”) at work places are in force. These regulations have to be considered during maintenance work performed on rolling stock, carried out by staff members.

As compound brakes have lower noise emissions compared to cast-iron brakes, an increasing number of trains with compound brakes will be put into operation in the future. At the same time fine particles and fine particle emissions are becoming a top

issue in the public consciousness. The so called CAFE process[12] (Clean Air for Europe) is one process that will most probably lead to legislation in the EU regulating this issue.

Furthermore, an European norm (EN) is being developed by the European Committee for Standardization CEN (Technical Committee TC256, Work items WI171 and 173). The norm prohibits explicitly the use of certain substances (asbestos, lead, cadmium, hexavalent chrome, ceramic fibre) and any other material that may produce dust or fumes that could be hazardous to the health of maintenance personnel, operating staff or passengers.

National peculiarities

All EU countries have their own legislation on Occupational Exposure Limits[13]. The limit values from both regulations have to be considered for maintenance work on rolling stock.

The German MAK-values ("maximale Arbeitsplatzkonzentration") as well as Swedish AFS or British COHSS values include several hundred substances and specify the maximum concentration of gases, vapours and suspended matters / particulates in the air at the working place for a time period (in Germany: 8 h/day, maximum 42 h/week). Carcinogenic substances are regulated in Germany by the so-called TRK-values (Technische Richtkonzentration – technical levelling concentration). The limit values from these category of regulations have to be considered for maintenance work performed on rolling stock.

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12 Clean Air for Europe (CAFE) is a programme of technical analysis and policy development which will lead to the adoption of a thematic strategy on air pollution under the Sixth Environmental Action Programme by mid 2005. The major elements of the CAFE programme are outlined in the Communication on CAFE (COM(2001)245)). The programme was launched in March 2001. Its aim is to develop a long-term, strategic and integrated policy advice to protect against significant negative effects of air pollution on human health and the environment. The integrated policy advice from the CAFE programme is planned to be ready by the beginning of 2005. The European Commission will present its Thematic Strategy on Air Pollution during the first half year of 2005, outlining the environmental objectives for air quality and measures to be taken to achieve the meet these objectives.

13 See : http://europe.osha.eu.int/good_practice/risks/ds/oel/members.stm#1

8 Legal framework for the integration of environmental aspects with respect to EU public procurement – synopsis

Essentials

EU legislation for procurement in the transport sector explicitly permits and encourages the integration of environmental issues in the award procedure. The so-called “Utilities Directive” covers all state as well as non-state enterprises operating in the field of transportation which act based on special or exclusive rights (e.g. awarding authorities, operators, leasing companies, etc.).

Scope of the Utilities Directive

The scope of the procurement process, guided by Council Directive 93/38/EEC (“Utilities Directive”) and the corresponding Commission Regulation (EC) No 1874/2004 of 28 October 2004, include also non-state enterprises operating in the field of transport procurement, which act based on special or exclusive rights in as far as supply or service contracts exceeding a (net) order value of € 473.000,- respectively construction orders exceeding € 5.923.000,- are awarded. Thus the procurement of new rolling stock for railways must in most cases comply with the “Utilities Directive”.

Modifications by the "new" consolidated regulations for awarding contracts

By latest January 31st 2006 the EU Member States have to implement the new “Utilities Directive” 2004/17/EC. From an environmental point of view the most important change as compared to the previous one is the explicit statement that the integration of environmental issues in the award procedure is now permissible and desired. Furthermore it clarifies that the production process may be taken into consideration for the awarding procedure.

Essentials of the Awarding Procedure

The contracting authority is basically free to determine the requested scope of performance. It has a procurement autonomy which only is subject to the prohibition of direct and indirect discrimination.

Basically, a comprehensible description of the performance is required, which is guided by the European standards and specifications. The selection of the adequate tenderer (according to the qualification criteria) has to be separated from the evaluation of the offers (according to the awarding criteria). The awarder determines the decisive criteria for the evaluation of the offer. The central principles of the awarding regulations regarding disclosure, transparency, objectivity and equal treatment have to be respected.

Besides the criteria of qualification and the criteria of awarding additional criteria may be taken into consideration in the frame of the awarding decision. These additional criteria must not be contrary to the exclusion and qualification criteria standardized in the “Utilities Directive”, must not discriminate participants and have to respect further prohibitions and orders of the EU treaty; they have to be announced parallel to the other contract conditions, have to be verifiable in an objective manner and must not leave the awarder unrestricted freedom of choice.

9 Legal framework for the integration of environmental aspects with respect to EU public procurement – detailed

9.1.1 Essentials

Scope

Decisive for the award of public contracts by non-state enterprises operating in the supply sector is the Council Directive 93/38/EEC[14] ("Utilities Directive"). The field of public transport procurement comprises "the operating of networks for the supply of the public in the field of transport by rail, automatic systems, trams, trolley buses, buses or cable" (Art. 2, para 2 lit. c) 93/38/EEC). The regulations of the "Utilities Directive" are applied in as far as sector awarders are operating in these sectors. The "Utilities Directive" is only applicable for orders above certain threshold values. In case of awarding supply or service contracts a (net) order value amounting to € 400.000,00 has to be exceeded, for the award of construction contracts to € 5.000.000,- .

The "Utilities Directive" is applicable when a public enterprise or an enterprise exercising activities **on the basis of special or exclusive rights** granted by the competent authorities of a member state awards a supply, construction or service contract, e.g. purchases or leases a train or gives an order to construct a building for the rendering of transport procurement.

Modifications by the "new" consolidated regulations for awarding contracts

On 30.04.2004 the updated coordination directive 2004/17/EC of the European Parliament and the Council of March, 31st 2004 ("Utilities Directive") was published in the Official Journal of the EC which will become obligatory for all member states as of 01.02.2006[15]. It is amended by the Commission Regulation (EC) No 1874/2004 of 28 October 2004 which sets increased threshold values for supply and service contracts (473.000,- €) and construction orders (5.923.000,- €).

The essential part of the principles regarding the award procedure has been maintained in this directive. However, the possibility to implement environmental aspects was facilitated. It is now expressly defined that also environmental production processes may be determined as technical specifications of the contract scope (see Art. 34 para 8 of directive 2004/17/EC). Further amendments are not decisive for the integration of environmental issues and are therefore not described.

Essentials of the Awarding Procedure

The contracting authority is basically free to determine the requested scope of performance. It has a procurement autonomy which only is subject to the prohibition of direct and indirect discrimination[16]. However, it is bound to the stipulations of the

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[14] Official Journal OJ 1993 L 199, page 84, last modified by Directive 2001/78/EC, OJ L 285 page 1 dated 29.10.2001

[15] See Art. 71 para 1 of directive 2004/17/EC of the European Parliament and the Council dated 31.03.2004 for the coordination of the contract awards by awarders in the water, energy, transport and postal services sectors

[16] See opinion of Mr. Advocate-General Mischo regarding: Case C-513/99 (Concordia bus Finland), European Court reports (ECr) 2002, I-7215, note 146 ff.

coordination directives with regard to the definition of the performance scope. Basically, European or international standards have to be chosen.

The award procedure is subdivided into the **examination of the participants regarding their qualifications** for the performance of the contract and into the evaluation of the offers submitted. Sector awarders may perform pre-qualification procedures, see Art. 30 “Utilities Directive” which have to allow the access of all interested participants.

The evaluation of the offers has to be executed following criteria announced in advance in accordance with Art. 34 “Utilities Directive”. Accordingly, either the criterion of the lowest price or of the most economically advantageous offer under consideration of the various award criteria has to be chosen. The selection of a third criterion is not permissible in accordance with the judgement of the European Court (ECJ)[17]. Moreover, the awarders are allowed to take into consideration additional criteria which must not be contrary to the exclusion and qualification criteria standardized by the “Utilities Directive”, do not discriminate participants and respect the further orders and prohibitions of the EU treaty, and which have to be announced parallel to the other contract conditions, have to be verifiable in an objective manner and musts not leave the awarder an unrestricted freedom of choice[18].

During the complete award procedures, (sector) awarders are bound to the awarding principles derived from the EC treaty – the principles of equal treatment, mutual recognition, proportionality and transparency.

9.1.2 Degree of freedom regarding the implementation of the legal framework

Necessity of tight coordination procedures
In order to make use of the existing potentials, a tight coordination of the individual parties involved is required. First of all, the definition of the requested criteria and performance standards is necessary which have to be implemented in the performance description by integrating the environmental protection representatives and the legal consultants.

Definite Layout Options
Basically, there are – as laid out under item “Essentials of the Awarding Procedure” – various options in order to integrate environmental aspects into the public contract award procedure.

On one hand, environmental aspects may be implemented into the scope of performance.

On the other hand there is the possibility to take into consideration **environmental aspects** without integration into the scope of performance as purposes "outside the award" **in addition to the standardized qualification and awarding criteria for the awarding procedure**. Then it is essential that those are not contrary to the criteria standardized in the “Utilities Directive”.

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17 ECJ dated 20.09.1988, Case: 31/87 (Beentjes), ECr 1988, page 4635

18 ECJ dated 20.09.1988, Case: 31/87 (Beentjes), ECr 1988, page 4635

The selected criteria

- have to be executable by each participant based on his own entrepreneurial decision – i.e. they must not resemble expulsion facts and must not be contrary to the criteria for the evaluation of the performance and the qualification standardized in the directive 93/38/EEC,
- must not discriminate potential participants and have to respect the prohibitions and orders of the EC treaty,
- have to be indicated in the contract documents or the announcement of the award together with the other contract conditions,
- must not leave the awarder an unrestricted freedom of choice.

A consideration of environmental criteria which were not integrated into the scope of performance has been expressly declared as permissible to a limited extent by the ECJ also **in the frame of the evaluation of the offer**[19].

The consideration of environmental criteria not integrated into the scope of performance in the frame of the evaluation of the offers is permissible if

- there is a concrete relation of the respective criterion to the scope of performance put out to tender (see item 1.),
- the criteria have been made public with the other contract conditions in accordance with the general principles of the awarding procedure (see item 2.) and
- the selected criteria are verifiable in an objective manner, the fulfilment of which therefore can be checked by the awarder (see 3.),
- no unrestricted freedom of choice is generated (see 4.).

1. An essential precondition is **the connection of the selected criterion to the subject matter of a contract,** i.e. to the concrete scope of performance. The ECJ has confirmed this e.g. in the frame of proceedings regarding the award of transport services where bonus points for the presentation of an environmental concept and for falling short of certain emission values are taken into consideration in the awarding procedure[20]:

   "…With respect to the main proceedings, it must be stated, first, that criteria relating to the level of nitrogen oxide emissions and the noise level of the buses, such as those at issue in those proceedings, must be regarded as linked to the subject-matter of a contract for the provision of urban bus transport services….".

   On the other side, the fulfilment of this criterion was rejected in case such an environmental criterion should not be linked to the subject matter of the contract, but instead was covering a performance outside the scope of performance. In this case the favouring of electricity from renewable energy sources was concerned. The public awarder had intended to favour the performance of a bidder for the supply of electricity beyond the enquired supply quantity. The EJC considered this is as not permissible[21]:

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[19] ECJ dated 17.09.2002, Case: C-513/99 (Concordia bus Finland), ECr 2002, I-7215; ECJ dated 04.12.2003, Case: C-448/01 (Wienstrom)

[20] ECJ dated 17.09.2002, Case: C-513/99 (Concordia bus Finland), ECr 2002, I–7213, No. 65

[21] ECJ dated 04.12.2003, Case: C-448/01 (Wienstrom), Nor. 68

"…An award criterion that relates solely to the amount of electricity produced from renewable energy sources in excess of the expected annual consumption, as laid down in the invitation to tender, cannot be regarded as linked to the subject-matter of the contract. …".

2. Moreover it is important that all criteria are made known to the participants in accordance with the regulations regarding the awarding of contracts[22]:

   "…Finally, in order to meet the directive' s aim of ensuring development of effective competition in the award of public works contracts, the criteria and conditions which govern each contract must be given sufficient publicity by the authorities awarding contracts . (…) At the same time additional information concerning contracts must, as is customary in the Member States, be given in the contract documents for each contract or else in an equivalent document (…)."

3. The awarder is not allowed to select any criteria the fulfilment of which cannot be verified by him[23]:

   "…Objective and transparent evaluation of the various tenders depends on the contracting authority, relying on the information and proof provided by the tenderers, being able to verify effectively whether the tenders submitted by those tenderers meet the award criteria. 51 It is thus apparent that where a contracting authority lays down an award criterion indicating that it neither intends, nor is able, to verify the accuracy of the information supplied by the tenderers, it infringes the principle of equal treatment, because such a criterion does not ensure the transparency and objectivity of the tender procedure."

4. The public awarder must not be left unrestricted freedom of choice[24]:

   „… Next, criteria whereby additional points are awarded to tenders which meet certain specific and objectively quantifiable environmental requirements are not such as to confer an unrestricted freedom of choice on the contracting authority…."

The practice of the award procedure can guarantee the objectivity and transparency of the awarding decision by working out a scheme which takes into consideration the individual criteria which shall be essential for the evaluation of the offers.

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22 ECJ dated 20.09.1988, Case: 31/87 (Beentjes), ECr 1988, 4635, No. 21 ff.

23 ECJ dated 04.12.2003, Case: C-448/01 (Wienstrom), No. 50

24 ECJ dated 20.09.1988, Case: 31/87 (Beentjes), ECr 1988, page 4635, Nr. 18; ECJ dated 17.09.2002, Case: C-513/99 (Concordia bus Finland), ECr 2003, I-7213, No. 66

Example:

	Tenderer 1	Tenderer 2	Tenderer 3	Tenderer 4
Noise (30 %)				
Energy Efficiency (30%)				
Exhaust and other Emissions (25 %)				
Materials/Recycling/Waste (15%)				

Examples
These essentials will now be explained with examples by referring to the 4 key areas listed in this guideline:

Noise

Possible integration of noise emission values into the scope of performance

On one hand, upper noise limits may be integrated as minimum requirements into the scope of performance, e.g. by referring to technical standards and specifications to be stipulated in accordance with the technicians. Thus the scope of performance is defined by these minimum requirements. Consequently, by integrating noise emissions as obligatory minimum requirements, an offer which does not respect these minimum requirements has to be excluded compulsively. The practical consequence of such cases will be as a rule that the tenderers include the fulfilment of such minimum requirements in their price calculation resulting regularly in more expensive offers.

Integration as secondary purpose

Consequently it is highly attractive to introduce environmental interests as secondary purpose. Thus the respective requirements are not integrated into the definition of the scope of performance, but taken into consideration as matters unrelated to the procurement in the frame of the evaluation of offers.

In so far it would be possible to stipulate certain values independently from the qualification criteria and the evaluation of the offers as additional condition for the awarding of a contract.

It would be less decisive to choose a further option for the consideration of secondary purposes in such a way that the sector awarder only states legal requirements and takes into consideration an "overfulfilment" of these requirements by the granting of bonus points or alternatively by a fictitious reduction of the price offered. This means more or less that an offer fulfilling higher qualities as the stipulated minimum requirements would be favoured by a certain factor.

It is at the discretion of the public awarder which of these options is given preference.

Energy efficiency

Also in the field of "energy efficiency" it should be weighed up carefully to which extent environmental requirements are integrated into the scope of performance or taken into consideration as secondary purpose. Energy efficiency also is of great economic importance. Therefore in this regard an optimised tender seems to make sense also from the entrepreneurial point of view.

On one hand the sector awarder has the option – as shown under “Noise” - to define minimum requirements for the energy consumption and to integrate this in the scope of performance. Thus the scope of performance is determined by environmental policies, but in fact leads to a corresponding price adjustment as the tenderers will include increased requirements in the calculation of their offers.

Moreover, according to the principles stated under “Definite Layout Options” the energy efficiency can be integrated **into the evaluation of the offers** without being integrated into the scope of performance. The choice of criteria which shall determine the energy consumption has to be guided by objective and transparent standards. This has to be agreed upon in detail with the technical employees in the company. Here the REPID-Systems could possibly be made use of.

The integration of secondary purposes is also possible as an additional criterion besides the qualification and awarding criteria. Thus the fulfilment of certain requirements could be integrated into the awarding procedure as additional awarding criterion requested independently from the qualification as tenderer and the profitability of the offers. However, this is only permissible if the corresponding requirement is announced in accordance with the principles listed under “Definite Layout Options”.

Exhaust and other emissions

The current European legislation regarding exhaust emissions (incl. the already defined long-term target values) could make a compulsory stipulation of even tighter values difficult. If the intended performance shall be better than the legal baseline the integration as secondary purpose is favourable as laid out under “Noise”.

Materials/Recycling/Waste

The selected criteria have to be verifiable. This means that criteria the fulfilment of which cannot be verified must not be taken into consideration. The consideration of such criteria in this area seems to be difficult. Here an orientation towards the total environmental behaviour of the participating company is recommended.

General requirements to the participants

The environmental behaviour of a company can also be integrated into the awarding procedure in accordance with the abovementioned principles. As an alternative, it is possible to define corresponding minimum requirements of the participants for the participation in the competition as a criterion leading to a preference of those participants who implement environmental protection in their company, e.g. by obtaining an environmental management certification.

However, the consideration of suppliers having an environmental management system has to be limited to those suppliers supplying materials for the scope of performance. It would not be permissible to give preference to those suppliers who – independent from the subject matter of the order - lay proof that all suppliers have

introduced an environmental management system independent from the scope of performance as thus the necessary relation to the order would be missing. In addition, such a criterion would hardly be verifiable by the awarder.

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Links

http://www.aeif.org/
European Association on Railway Interoperability
Download of legislation texts

http://europa.eu.int/comm/transport/rail/index_en.html
Directorate-General for Energy and Transport / Rail transport
Download of legislation and background papers

Diesel Exhaust and Other Emissions

Diesel

Background papers

1) den Boer, Eelco, Joost Vermeulen, Max Smith, Jos Dings. *Clean on Track – Reducing Emissions from Diesel Locomotives*. Study by CE, Delft, 2003
2) UIC. *Feasibility Study: "UIC Action Plan for Reduction of Diesel Exhaust emissions from Tractive Units".*
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12) CODEC 1354. *ADDENDUM TO "I" ITEM NOTE Approval of a compromise package with a view to a 1st reading agreement on COM(2002)* 765; Brussels, 10 October 2003

13) UIC. *Leaflet 624 Exhaust emission tests for diesel traction engines*. 2002

Links

http://www.dieselnet.com
Good overview of status and process of EU legislation to regulate emissions from nonroad (off-road) mobile equipment / directive 97/68/EC and amendments.

EMF

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1) Müller, Roger, Raimondo Orsini, Luigi Contestabile. *UIC Scoping Study on Electromagnetic Fields and Environment („Electrosmog“) Report*. Paris, 2002

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http://www.datadiwan.de/netzwerk/index.htm?/esmog/es_001d_.htm

Energy Efficiency

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2) REPID. Specification of material properties in the REPID Database. 2003

3) COM(2003) 301 final. COMMUNICATION FROM THE COMMISSION - *Towards a thematic strategy on the prevention and recycling of waste.* Brussels, 27.5.2003

4) Selin, Henrik and Stacy D. VanDeveer. *Hazardous Substances and the Helsinki and Barcelona Conventions: Origins, Results and Future Challenges. 2002*
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6) Directive 2002/95/EC *On the restriction of the use of certain hazardous substances in electrical and electronic equipment.* Brussels, 27 January 2003.
7) Directive 2002/96/EC *On waste electrical and electronic equipment (WEEE).* Brussels, 27 January 2003.
8) German Legislation on hazardous materials - *Gefahstoffverordnung* – GefStoffV, 2003

Links

http://europa.eu.int/comm/environment/waste/index.htm
Background papers and general outlook of EU waste strategy

11 Annex: Target Values

11.1 Noise

11.1.1 TSI Noise Conventional Rail System

As the TSI Noise for conventional rail systems is still subject of negotiations the limit values have to be seen as preliminary.

All measurements have to be carried out in accordance to prEN ISO 3095:2001 at a distance of 7.5 m from the track centreline and 1.2 m above top of rail with deviations in measurement procedures defined in the annex of the TSI Noise for conventional rail.

The TSI Noise for conventional rail is binding. In case of deviations between this leaflet and TSI Noise for conventional rail only the indications in the TSI Noise are valid.

Limit values for Pass-by Noise

The pass-by noise of a train shall be measured at 80 km/h and at maximum speed, but less than 190 km/h. The value to be compared with the limits is the greater of the measured value at 80 km/h and the measured value taken at maximum speed but normalised to 80 km/h by the equation:

$L_{pAeq,Tp}(80\ km/h) = L_{pAeq,Tp}(v)-30*\log (v/80\ km/h)$.

Table 11-1: Limit values for pass-by noise

Vehicles	**$L_{pAeq,Tp}$**
New wagons with apl up to 0.15 m^{-1}	82 dB(A)
New wagons with apl between 0.15 m^{-1} and 0.275 m^{-1}	83 dB(A)
New wagons with apl higher than 0.275 m^{-1}	85 dB(A)
Electric locomotives	85 dB(A)
Diesel locomotives	85 dB(A)
EMU's	81 dB(A)
DMU's	82 dB(A)
Passenger coaches	80 dB(A)

apl: axles per unit length

Limit values for Stationary Noise

Table 11-2: Limit values for stationary noise

Vehicles	**$L_{pAeq,T}$**
All freight wagons	65 dB(A)
Electric locomotives	75 dB(A)
Diesel locomotives	75 dB(A)
EMU's	68 dB(A)
DMU's	73 dB(A)
Passenger coaches	65 dB(A)

Limit values for Starting Noise

Table 11-3: Limit values for starting noise

Vehicles	**$L_{pAeq,T}$**
Electric locomotives	82 dB(A)
Diesel locomotives	86 dB(A)
EMU's	82 dB(A)
DMU's P < 500 kW / engine	83 dB(A)
DMU's P > 500 kW / engine	85 dB(A)

11.1.2 TSI Noise High Speed Trains

Flanking the council directive 96/48/EC of 23 July 1996 on the interoperability of the trans-European high-speed rail system a Technical Specification for Interoperability (TSI) was ratified. Noise emission limits are set in the TSI 2002/735/EC – "Rolling Stock".

Limit values for Pass-by Noise

All measurements have to be carried out in accordance to prEN ISO 3095:2001 at a distance of 25 m from the track centreline and 3.5 m above top of rail.

Table 11-4: Limit values for pass-by noise

Speed			
250 km/h	87 dB(A)	90 dB(A)	85 dB(A)
300 km/h	91 dB(A)	93 dB(A)	88 dB(A)
320 km/h	92 dB(A)	94 dB(A)	89 dB(A)
	a)	b)	c)

Remarks:

a. A margin of 1 dB(A) on the limit values is tolerated.

b. For a transitional period of 24 months starting from the date of entry into force of TSI for HST, the limit values cited above are allowed for:

   i. purchasing additional vehicles in contracts already signed at the date of entry into force of TSI for HST

   ii. and for rolling stock being contracted during the transitional period based one existing design platforms.

c. These limit values are recommendations and will serve as a basis for revising the limit values in the context of the TSI revision process.

Limit values for Stationary Noise

All measurements have to be carried out in accordance to prEN ISO 3095:2001 at a distance of 7.5 m from the track centreline and between 1.2 m and 3.5 m above top of rail, measured over a time period of 30 seconds.

Noise levels in stations or on stabling tracks shall not exceed 65 dB(A) measured continuously or 70 dB(A) intermittently.

11.2 Diesel Exhaust Emissions

Exhaust limit values for railway diesel engines are governed by the EU directive 97/68/EC (and it's amendments) as cited in the table below. All measurements have to be accomplished in accordance with ISO 8178-4.

Table 11-5: Limit values for exhaust emissions from railway diesel engines

Stage	Category Net Power (P) (kW)		Propulsion by	Limit values in force		**CO** g/kWh	**HC** g/kWh	**NO_x** g/kWh	**PT** g/kWh	**Test cycle** (ISO 8178-4)
				Type approval from	In traffic from					
IIIA	RC A	P > 130 kW	Railcars	*01.07.2005*	01.01.2006	**3,5**	**4,0**		**0,2**	C1
	RL A	130 kW < P < 560 kW	Locomotives	*01.01.2006*	01.01.2007	**3,5**	**4,0**		**0,2**	F
	RH A	P > 560 kW	Locomotives	*01.01.2008*	01.01.2009	**3,5**	**0,5**	**6,0**	**0,2**	F
	RH A	P > 2000 kW and SV> 5l/cyl	Locomotives	*01.01.2008*	01.01.2009	**3,5**	**0,4**	**7,4**	**0,2**	F
IIIB	RC B	P > 130 kW	Railcars	*01.01.2011*	01.01.2012	**3,5**	**0,19**	**2,0**	**0,025**	C1
	R B	P > 130 kW	Railcars	*01.01.2011*	01.01.2012	**3,5**	**4,0**		**0,025**	C1

11.3 Electromagnetic Fields

Exposure limit values according to EU Directive 2004/40/EC on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields).

Depending on frequency, the following physical quantities are used to specify the exposure limit values of electromagnetic fields:

- exposure limit values are provided for current density for time-varying fields up to 1 Hz, to prevent effects on the cardiovascular and central nervous system,
- between 1 Hz and 10 MHz exposure limit values are provided on current density to prevent effects on central nervous system functions,
- between 100 kHz and 10 GHz exposure limit values on SAR are provided to prevent whole-body heat stress and excessive localised heating of tissues. In the range 100 kHz to 10 MHz, exposure limit values on both current density and SAR are provided,
- between 10 GHz and 300 GHz an exposure limit value on power density is provided to prevent excessive tissue heating at or near the body surface.

The action values referred to in Table 11-6 are obtained from the exposure limit values according to the rationale used by the International Commission on Non-ionising Radiation Protection (ICNIRP) in its guidelines on limiting exposure to non-ionising radiation (ICNIRP 7/99).

Table 11-6: Action values for electromagnetic fields. All conditions to be satisfied

Frequency range	Electric field strength, E (V/m)	Magnetic field strength, H (A/m)	Magnetic flux density, B (mT)	Equivalent plane wave power density, S_{eq} (W/m^2)	Contact current, I_C (mA)	Limb induced current, I_L (mA)
0 – 1Hz	–	$1{,}63 \times 10^5$	2×10^5	–	1,0	–
1 – 8 Hz	20000	$1{,}63 \times 10^5/f^2$	$2 \times 10^5/f^2$	–	1,0	–
8 – 25 Hz	20000	$2 \times 10^4/f$	$2{,}5 \times 10^4/f$	–	1,0	–
0,025 – 0,82kHz	500/f	20/f	25/f	–	1,0	–
0,82 – 2,5 kHz	610	24,4	30,7	–	1,0	–
2,5 – 65 kHz	610	24,4	30,7	–	0,4 f	–
65 – 100 kHz	610	1600/f	2000/f	–	0,4 f	–
0,1 – 1 MHz	610	1,6/f	2/f	–	40	–
1 – 10 MHz	610/f	1,6/f	2/f	–	40	–
10 – 110 MHz	61	0,16	0,2	10	40	100
110 – 400 MHz	61	0,16	0,2	10	–	–
400 – 2000 MHz	$3\ f^{1/2}$	$0{,}008\ f^{1/2}$	$0{,}01\ f^{1/2}$	f/40	–	–
2 – 300 GHz	137	0,36	0,45	50	–	–

Notes:

- f is the frequency in the units indicated in the frequency range column.
- For frequencies between 100 kHz and 10 GHz, Seq, E, H, Band ILare to be averaged over any six-minute period.
- For frequencies exceeding 10 GHz, Seq, E, Hand Bare to be averaged over any 68/f1.05-minute period (f in GHz).
- For frequencies up to 100 kHz, peak action values for the field strengths can be obtained by multiplying the rms value by (2)½. For pulses of duration tp, the equivalent frequency to apply for the action values should be calculated as f = 1/(2tp).
  For frequencies between 100 kHz and 10 MHz, peak action values for the field

strengths are calculated by multiplying the relevant rms values by 10 , where a = (0,665 log (f/10) + 0,176), f in Hz.
For frequencies between 10 MHz and 300 GHz, peak action values are calculated by multiplying the corresponding rms values by 32 for the field strengths and by 1 000 for the equivalent plane wave power density.

- With regard to pulsed or transient electromagnetic fields, or generally with regard to simultaneous exposure to multiple frequency fields, appropriate methods of assessment, measurement and/or calculation capable of analysing the characteristics of the waveforms and nature of biological interactions have to be applied, taking account of harmonised European standards developed by Cenelec.
- For peak values of pulsed modulated electromagnetic fields, it is also suggested that, for carrier frequencies exceeding 10 MHz, Seq as averaged over the pulse width should not exceed 1 000 times the Seq action values or that the field strength should not exceed 32 times the field strength action values for the carrier frequency.