

The ODELIA Study on Noise Limits for Outdoor Machinery

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ABSTRACT

In the ODELIA study for the European Commission an assessment of the outdoor equipment noise directive 2000/14/EC and its amendment 2005/88/EC has been performed. The directive requires noise marking for 57 types of equipment used outdoors, and sets noise limits for 22 of these. Since the limits have remained unchanged for many years, there is now a compelling need to revise the existing limit values, potentially add new ones and introduce new equipment types where justified. Also the test codes for the many different machines types have been reviewed. Proposals have been made taking available documents and data into account from 2007 until the present. Criteria applied in the assessment included member state requests and information, environmental impact, stakeholder information from industry, notified bodies, authorities and NGOs, technical progress including databases of declared values, economic impact, and quality of the test codes. Tighter limits were proposed for 9 equipment types and new limits were proposed for 28 types currently without limits. 13 new equipment types were proposed to be included in the directive. In this paper the findings, justifications and recommendations of the study are summarised.

Keywords: Machinery, Noise limits, Regulation

I-INCE Classification of Subjects Number(s): 13.6,13.7,84

1. INTRODUCTION

Directive 2000/14/EC (1) is part of the European Union's strategy to reduce noise at source, in particular noise emissions from equipment for use outdoors, and to provide relevant information to purchasers, users and citizens to encourage the choice of quieter equipment. The Directive requires noise marking for 57 types of equipment used outdoors, and sets noise limits for 22 of these (Article 12). First stage noise limits applicable from January 2002 were to be reduced by a second stage applicable from January 2006. But an amending Directive, 2005/88/EC (2) made the second stage limits merely indicative for certain types of equipment as they were not considered technically feasible by that time. These limits remain unchanged until the present. Guidance on the application of the directive is provided in (3).

Since the limits have remained unchanged for many years, there is now a compelling need to revise the existing limit values and introduce new equipment types where justified, inside or outside the directive. The ODELIA study (**OutDoor Equipment L**imit **A**ssessment) (4), performed by TNO, TÜV-Nord and IMAMOTER for the European Commission DG GROW, addressed this need. Other aspects such as labelling, conformity assessment or the relationship with harmonised standards were not in the scope of the study. An assessment has been made of the outdoor equipment noise directive (OND) 2000/14/EC and its amendment 2005/88/EC in relation to

- the limit values for equipment listed in Article 12, as to whether these could be modified in the light of the latest evidence such as the development of the state of the art concerning their performance characteristics;
- equipment listed in Article 13, as to whether any, or all, of this equipment should be assigned mandatory limit values;

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- new equipment types which could feasibly be included in a future Regulation, meeting the generic description of 'equipment for use outdoors' in Article 3(a) or a foreseeable adaptation of this description, for this equipment to be assigned limit values in a future Regulation and what these should be;
- identifying and proposing the test methods for the measurement of sound power levels.

In 2007 the NOMEVAL study (5) was performed by the TNO/TÜV Nord/VCA/LNE consortium for DG Enterprise to evaluate the effectiveness of the Directive and the possibility of lowering noise limits, introducing new ones and adding new equipment types. The study also included a stakeholder consultation, an impact assessment and broader evaluation of the directive. This was followed by a detailed impact analysis study in 2009 by Arcadis (6) including a further market consultation and a separate impact assessment study on conformity of SMEs (7). In 2010 the stakeholder group Working Group 7 made a new evaluation of limit proposals and equipment types based on the previous studies (8). Also subtypes of equipment and definitions found in the guidelines (4) were evaluated.

In the last few years, the notified bodies provided some guidelines on uncertainty (9) and other aspects such as test conditions for hybrid powered equipment (10). Also, some individual studies have been performed, some at national level, to assess noise emission levels of different types of equipment including lawnmowers (11), chainsaws (12), shredders (13) and others. Since 2007, many more noise data have been collected by the Commission in an EU database and also by national authorities, meaning there is more recent data available to assess noise levels. For certain product groups, further developments in technology and in the market have resulted in noise reductions. For some product groups, quieter versions have appeared including shredders, chainsaws, municipal vehicles, high pressure water jet cleaners and others.

From 2010, the Commission considered whether to merge the 2000/14/EC directive with the Machinery Directive 2006/42/EC (14). After some research it was decided not to move forward with this as the Machinery Directive does not set noise limits, even though it sets out mandatory essential requirements on machinery noise in relation to occupational safety. The CEPS study from 2013/14 (15) reports on the various policy alternatives for this issue. The preferred option was to maintain the two directives separately, which has been accepted by all industry stakeholders. Continued importance was attached to the stating of noise values on the equipment through labelling and if justified, the imposition of limits.

The OND is consistent with the 7th general Union Environmental Action Plan (EAP) (16) of 2013 in which the third key action area covers 'challenges to human health and wellbeing, such as air and water pollution, excessive noise, and toxic chemicals'. Amongst others, the EAP sets out 'commitments to improve implementation of existing legislation, and to secure further reductions in air and noise pollution'.

In this paper the main findings, justifications and recommendations of the ODELIA study are presented. It will be the basic reference for the incoming revision exercise of the EU legislation on noise emissions from outdoor equipment, but other considerations coming from the "New Legislative Framework" and the Impact Assessment Report may still lead to a Commission proposal differing from the recommendations of the study.

2. METHODOLOGY

2.1 Key questions and criteria for limit revision

Key questions to be answered in the study were whether findings and recommendations from previous studies and papers since 2007 are still valid, and whether new information and evidence is available that supports additional or different conclusions from the NOMEVAL study and the WG7 paper.

Proposals for limit revision or new limits were based on the following criteria:

- Environmental need: relevance for noise problems in one or more member state and requests or specific information from member states including policy or position papers;

- Environmental impact: medium or high, e.g. high noise levels, large numbers of affected population;
- Technical feasibility: technical progress and available new technology if evident; This includes evidence from databases and the public domain where available and reliable, using statistical analysis including pass rates;
- Economic impact: manufacturing and R&D costs if evident;
- Potential uncertainty in measured results and suitability of test method.

Decision diagrams were used to verify and document these criteria for each equipment type.

2.2 Environmental Impact Indicator

The environmental impact was assessed with the EI indicator proposed in the Nomeval study to allow comparison of results (see (4,5) for description of the method). As shown in the Nomeval study, it seems to be reasonably consistent with reported complaints mentioned by municipalities and NGOs. The EI indicator is purely a means of ranking the equipment and takes into account for the whole EU:

- the average sound power level in typical usage conditions, taken as the average guaranteed sound power level;
- numbers of machines in service for each characteristic area of usage;
- usage times and duration;
- penalties for tonal, impact or fluctuating noise and for night time usage
- numbers of affected people in each type of situation (e.g. urban, suburban, residential, rural).

The environment types and noise distributions for each environment situation are the same as in the Nomeval study. Typical values for the environmental impact indicator vary between 20-80 dB(A) and are classified from very low to very high as listed in table 1 below. The borderline criterion for changing or introducing limits is between low and medium, so equipment just above or just below 47 may give rise to discussion.

Table 1 - Rating ranges of the Environmental impact indicator as used in the Nomeval study.

Rating	Range of environmental impact indicator EI in dB
Very low	<37
Low	37-46
Medium	47-56
High	57-67
Very high	>67

The input data for each equipment type was re-evaluated based on new data on sound power, fleet numbers and other parameters, resulting in new EI values, some differing from previous estimates. Results from the ODELIA study ('EI new') and the NOMEVAL ('EI NVL') study are set out in Figure 1 for comparison. Many of the differences are due to adjusted fleet numbers, and result in a different ranking for some equipment types.

3. DATABASES

3.1 Available databases and analysis

Several databases of declared guaranteed sound power levels were made available for the assessment, containing guaranteed and measured sound power levels and the technical parameter:

- The EU NOISE database, from the European Commission;
- The Italian MARA database, made available by ISPRA;
- The UK NMRO database, made available by NMRO;
- The Dutch MIA/VAMIL database, provided by the Agency RVO.

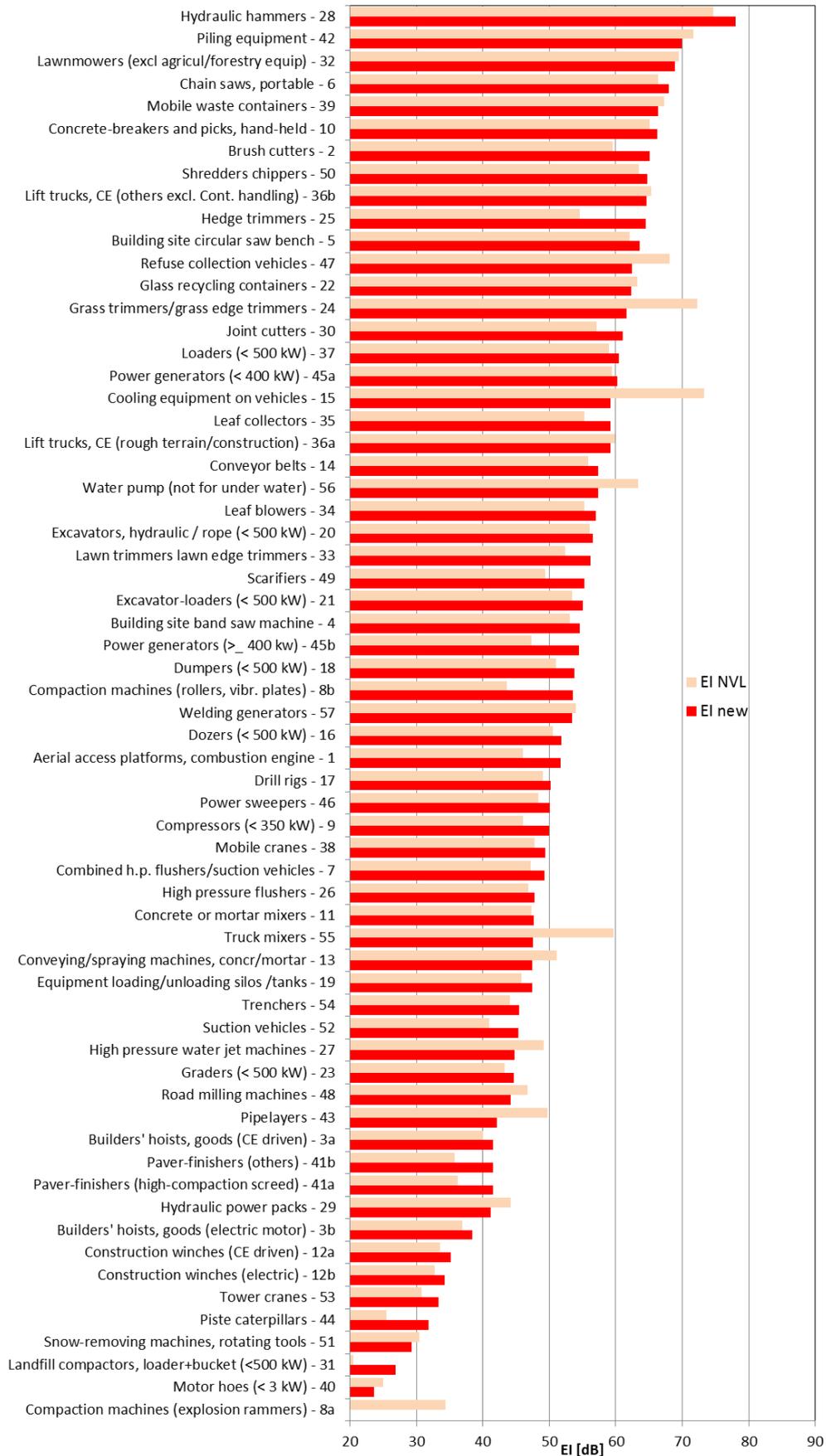


Figure 1 - Environmental impact indicator level for each equipment type as determined for ODELIA input data (EI new) and compared with the Nomeval results (EI NVL, light red).

Analysis of these databases was made for declarations in the period 2007-2015. Most, but not all, equipment types are present in the databases and some are under-represented. Erroneous and incomplete data was omitted. The EU database contained 8245 records for the period 2007-2015. The MARA database contained 5058 records for 2012-2015. The UK database contained 13209 records, with 5415 records for 2007-2015. The Dutch database contains only specific low noise equipment types included in the MIA/VAMIL list, containing 1322 records over the period 2009-2015, of specific quieter models and therefore not included in the overall database analysis.

The pass rate for different limit proposals was analysed for each equipment type and in each range of the technical parameter (e.g. mechanical or electrical power). Also a histogram of the number of declarations in each power range was made. An example of the results of this analysis is shown in Figure 2 for power generators (currently limit for equipment below 400 kW) and Figure 3 for chainsaws (currently no limit).

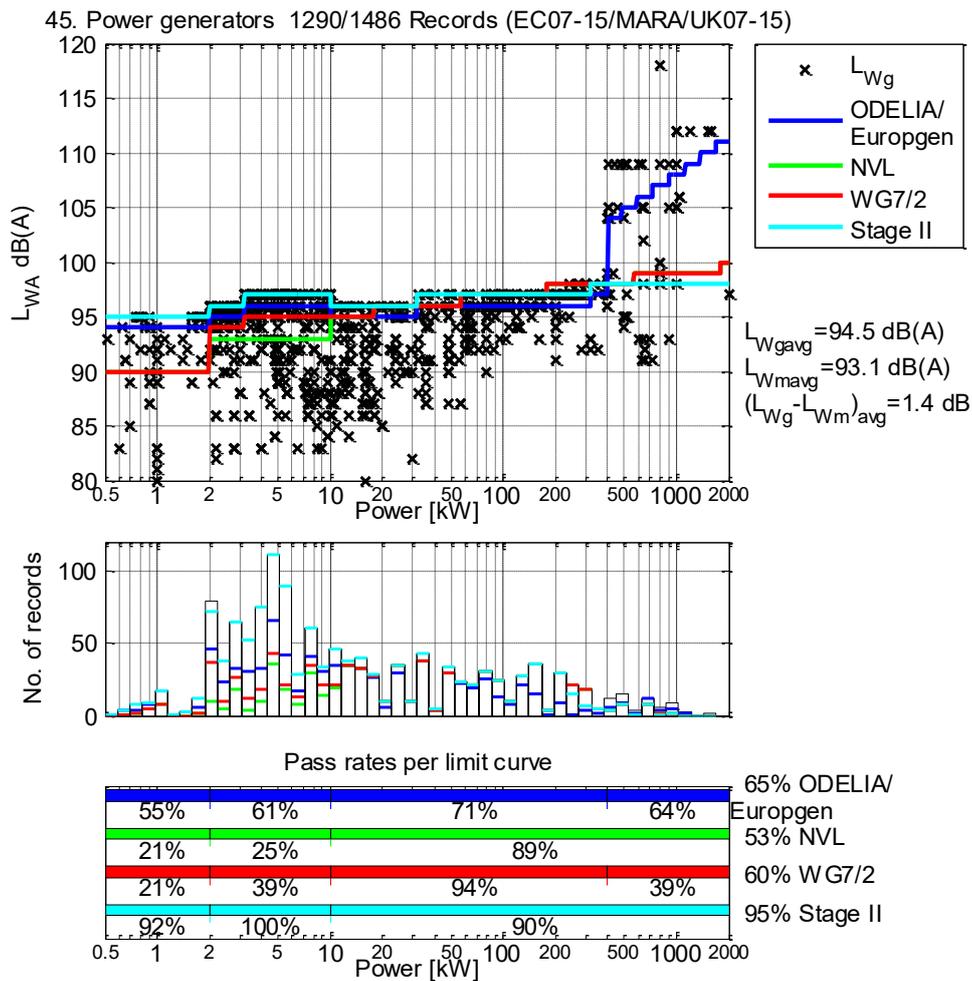


Figure 2 – Database analysis for different limit proposals for power generators. Top: declared guaranteed sound power levels and limit curves; middle: histogram of number of records analysed; bottom: pass rates for each limit curve. L_{Wgavg} is the average guaranteed sound power level; L_{Wmavg} is the average measured sound power level. The average difference between guaranteed and measured level is the uncertainty K.

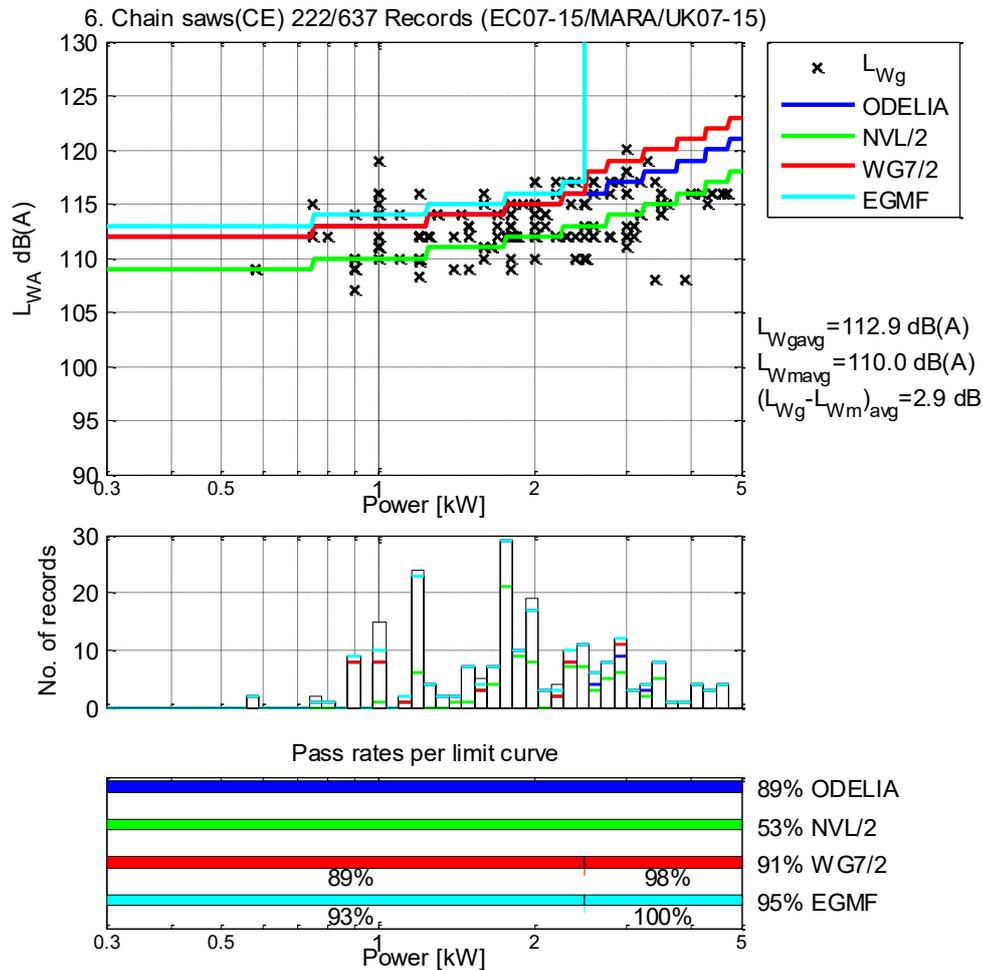


Figure 3 – Database analysis for different limit proposals for chain saws with combustion engine. Top: declared guaranteed sound power levels and limit curves; middle: histogram of number of records analysed; bottom: pass rates for each limit curve.

4. CURRENT TRENDS IN ENVIRONMENT, TECHNOLOGY AND MARKET

4.1 Environmental trends

Over the past decade, both the amount of noise disturbance and the sensitivity to it has increased. This is due to several factors:

- growth of all types of traffic;
- population increase especially in urban areas;
- numbers of vehicles and machines, in combination with further automation;
- new infrastructure projects and urban (re)development;
- growth in recreational activity such as events;
- wider availability of low cost equipment, for example as found in supermarkets and via the internet;
- stronger public awareness and reaction;
- a shift in working patterns with more people able to work from home.

Also further research has been done on health effects of noise providing better understanding and the nature and magnitude of its impact on public health. Much of this information is summarised in recent and ongoing studies published by the World Health Organisation WHO (17). At the same time, legislation has been amended both at national and EU level to address this, and both demand for

quieter products and available information on noise emission has increased, especially on internet. The nature of the noise from outdoor equipment remains specific and different to other sources such as road vehicles:

- outdoor equipment is often mobile;
- its usage is temporary or periodical;
- when in use, the noise source is more or less stationary or moving around a limited area;
- noise can occur at a wide variety of locations besides roads, such as in gardens, along pathways and parks, courtyards, close to dwellings, offices and sensitive locations such as hospitals, hotels, residential homes and schools, both in urban areas and in the countryside;
- high noise levels can occur, sufficient to cause severe annoyance or even sleep disturbance, even if not necessarily of long duration.

In the last decade more actions have been taken to protect the public against noise from construction work and other activities including noise mapping for large construction sites and noise monitoring. In some cases this is included in legislation, limiting the duration of noise exposure at certain noise levels. This means that quieter equipment benefits all parties concerned, the contractors for being able to work longer and the public for undergoing less noise exposure.

4.2 Technology trends

In recent years, several developments have affected noise emission and the potential noise reduction of outdoor equipment.

Hybrid drives are used increasingly in outdoor equipment, especially larger units. It is still not mainstream and the actual portion of hybrid equipment put on the market is unknown. The main benefits are fuel efficiency, lower exhaust emissions and noise reduction. The numbers of these can be expected to increase further depending on market conditions.

Electrically powered equipment is increasingly available mainly due to the improving performance and lower price of battery-powered units. As this develops further, numbers on the market can be expected to grow too, potentially replacing some of the combustion engine (CE) powered equipment. This is particularly relevant for consumer products and handheld equipment, where batteries can be separately carried in a backpack. CE powered equipment is still in the majority for professional and large equipment types. Most have four-stroke engines except for handheld units such as chainsaws, brush cutters and leaf blowers with the noisier two-stroke engines where weight is critical. Electronic systems are available to control the peak impact force for mechanical processes or the time rate of pressure gradients for fluid dynamic processes, with positive effects in terms of noise reduction.

The conflict between noise and cooling requirements for combustion engines remains an issue, although quieter fans and improved airflow design are available; also electronic control for efficiency and noise reduction has advanced.

For many types of equipment, quieter versions are available as demand and noise awareness has increased. The technical solutions are often available even if in some cases there may be some trade-off with performance or slightly higher cost. Some new working principles have been developed resulting in significant noise reductions, for example shredders with rotating rollers and robotic lawn mowers.

Noise control affects many other important design features, such as speed, power, efficiency, weight and others. The usual approach to apply noise control solutions at the production stage, introduces significant constraints in the choice of possible noise solutions and available technologies, at the expense of the whole machine performance. These effects could be greatly limited if noise control were to be better included at the design stage of a machine together with all the other design parameters. This would also help reduce costs. When noise is in conflict with performance, it is best to quantify this so as to achieve the best balance between the two factors.

For some equipment types with high process noise (such as for hydraulic hammers), the analysis of databases have shown great differences in the sound power levels for quite limited differences in the

engine powers. This suggests that meeting stricter limits is possible even if the contribution of process noise is high.

4.3 Market trends

The market for outdoor equipment has developed over the past decade in the following general terms:

- Better availability of product information on the internet including noise levels;
- More environmental awareness both of consumers and professional users including green procurement;
- More demand for quiet equipment;
- Growth in variety of equipment (e.g. multi-purpose);
- Growth in low cost consumer equipment (e.g. gardening tools as found in supermarkets).

5. LIMIT PROPOSALS

5.1 General justification of limits

Noise limits for both means of transport and for machinery are intended to ensure that excessive and unnecessary noise is avoided, within reasonable technical and economic means. Limits ensure that noise is taken into account in the design process, and are a highly cost effective way of avoiding more expensive and often inadequate abatement measures at local level. In fact they benefit both users and exposed inhabitants, workers, people resting, at recreation and in quiet areas. Noise limits represent the milestones of the EU noise policy to guarantee a common and uniform approach across Europe to reduce noise pollution in the environment. The existence of local permits and national regulations is insufficient reason not to apply EU noise emission limits as they are two complementary ways to reduce noise levels at the receiver but at two different levels.

For privately used equipment such as gardening tools, neighbourhood noise is a key issue, often not easy to regulate or enforce. In this case, noise emission limits will benefit a large number of people. Customer demand for quieter products is not a sufficient indicator for the environmental need, as the customer is not always aware of the environmental noise impact.

All means of transport have EU noise emission limits in addition to national regulations for traffic noise calculation and limitation. These are regularly reviewed and tightened where necessary. For example, the new EU regulation 540/2014 for noise emission limits for road vehicles (18) has been published in 2014, tightening limits for all vehicle types including lorries and heavy road vehicles. These are also relevant for some of the OND equipment types powered by the vehicle engine, even if the operating conditions differ.

The environmental need is based not only on the newly evaluated environmental impact, but also on stakeholder information from member states and on internet data where available. Information received from environmental stakeholders (associations of municipalities and noise abatement societies) mentioning Article 12 equipment includes lawnmowers and handheld CE powered garden tools, concrete breakers, excavators, generators and water pumps. Some of the equipment types in Article 12 have a low environmental impact, in which case the limits are not required to change, but should be retained to avoid noisier models coming onto the market.

Article 13 equipment specifically mentioned by environmental stakeholders includes private and professional gardening equipment, leaf blowers/collectors, brush cutters, chainsaws and other small CE powered equipment, glass recycling containers, chippers/shredders, piling equipment, hydraulic hammers, paver-finishers and water pumps. Many of the equipment types in Article 13 have medium or higher environmental impact due to high noise levels, large numbers of equipment, sensitive operation times, operating locations, duration, distance to dwellings and/or affected population numbers.

Where changes to the limits are proposed, this is mostly supported by evidence from the databases, using selected data where considered acceptable. Despite the limitations and critique of the database,

it can provide an important resource in assessing limits as long as incorrect data are excluded. In addition, ad hoc checks have been carried out to compare the data with internet resources such as company websites.

Proposed limits take into account the pass rate for data in the databases, information from the industry stakeholders and technical and economic feasibility. The ODELIA report includes datasheets on each individual equipment type.

The timescale between 2007 and the expected coming into force of a revised regulation in 2021 is considered sufficiently long to contain several design cycles, which is why in some cases the second stage limits put forward in Nomeval are proposed, unless the databases or other information indicate otherwise. Given the availability of technical solutions and know-how the proposed limits are considered to be both technically and economically feasible. The expected long period until the introduction of the future limits make them also economically feasible even for those equipment types for which little progress in the low noise design has been made to date.

5.2 Proposed limit changes for equipment already with limits

For equipment currently in Article 12, tighter limits have been proposed for 9 equipment types, while none have been proposed to move to Article 13. For some of the equipment types with a low environmental impact the limits have not been changed, as well as for some equipment with a medium impact if current limits have been considered already sufficient or the changes technically or economically not feasible. Tighter limits are proposed as below:

- 8b. Compaction machines/Vibratory plates: Stage II where possible
- 9. Compressors: $96, 95 + 2 \lg P$ (1 dB reduction for $P < 3$ kW)
- 10. Concrete-breakers and picks, $m > 3\text{kg}$: 105 ; $15\text{kg} \leq m < 30\text{kg}$: $92 + 11 \lg m$; $m > 30$: $94 + 9.6 \lg m$
- 32. Lawnmowers: $L \leq 120$ cm: $77 + 12 \lg L$; $L > 120$ cm: $73 + 15 \lg L$
- 33. Lawn trimmers / lawn edge trimmers: 95
- 36. Lift trucks: $P \leq 55\text{kW}$: 102 ; $P > 55\text{kW}$: $83 + 11 \lg P$ (Stage II+1)
- 38. Mobile cranes: $P \leq 55\text{kW}$: 100 ; $P > 55\text{kW}$: $81.5 + 11 \lg P$
- 45. Power generators:
 $P_{el} \leq 2$ kW : $94 + \lg P_{el}$; $2 < P_{el} \leq 10$ kW : $95 + \lg P_{el}$;
 $10 < P_{el} < 400$ kW: $94 + \lg P_{el}$; $P_{el} \geq 400$ kW: $75 + 11 \lg P_{el}$
- 57. Welding generators, same as for power generators < 400 kW.

5.3 Proposed new limits for equipment currently without limits

For equipment currently in Article 13, limits have been proposed for 28 equipment types. Only one obsolete equipment type has been proposed for removal from the directive (explosion rammers). Other equipment types with low environmental impact have been proposed to remain in the directive in order to avoid the re-emergence of noisy products.

For 4 equipment types, different limits for electric and CE powered machines have been proposed (chainsaws, hedge trimmers, leaf blowers and leaf collectors). These proposals were supported by evidence from the databases or by the collection of a significant amount of data from company websites. New limits are proposed as below:

- 1. Aerial access platforms with combustion engine: $P \leq 55\text{kW}$: 104 , $P > 55\text{kW}$: $87 + 9.3 \lg P$
- 2. Brush cutters and 24. Grass trimmers: $P \leq 1.5$ kW: $107 + 5.5 \lg P$, $P > 1.5$ kW: 115
- 5. Building site circular saw bench: 111
- 6a Chain saws, portable CE powered, including telescopic pruners: $111 + 2P$ (new test code)
- 6b Chain saws, portable electrically powered, including telescopic pruners $100 + 4P$ (new test code)
- 7. Combined high pressure flushers and suction vehicles, 26. High pressure flushers and 52. Suction vehicles: $P \leq 55$ kW: 108 , $P > 55$ kW: $89 + 11 \lg P$
- 8a Compaction machines/Explosion rammers: Remove/none on market
- 11. Concrete or mortar mixers: $P \leq 2$ kW: 95 , $P > 2$ kW : $92 + 11 \lg P$
- 13. Conveying and spraying machines for concrete and mortar: $93 + 11 \lg P$
- 15. Cooling equipment on vehicles CE-powered: $104 + 2 \lg P$; Other: $90 + 2 \lg P$
- 17. Drill rigs: a. Percussive 128 ; b. Non-percussive $P \leq 55$ kW: 107 , $P > 55$ kW: $92 + 10 \lg P$

- 22. Glass recycling containers: Stage I: 100 Stage II: 96
- 24. Grass trimmers/grass edge trimmers: combine with 2. brush cutters.
- 25 Hedge trimmers: CE: 108; Electric: 100.
- 26. High pressure flushers: see 7
- 28. Hydraulic hammers Stage I: 120 + 3 lg m; Stage II: 117 + 3 lg m
- 30. Joint cutters 111 (include hand held stone cut-off saws)
- 34/35. Leaf blowers and collectors: CE: $P \leq 1.5$ kW: 106; $P > 1.5$ kW: 109; Electric: 105`
- 36. Lift trucks , CE (others): $P \leq 55$ kW: 102, $P > 55$ kW: 83 + 11 lg P
- 39. Mobile waste containers: Stage I: 100 Stage II: 95
- 42. Piling equipment: a. Percussive 132; b. Vibrating or static: 115
- 45d Power generators (≥ 400 kW): 75 + 11 lg P_{el}
- 46. Power sweepers (Rename to Road sweepers): $P \leq 5$ kW: 96; $P > 5$ kW: 89+11 lg P
- 47. Refuse collection vehicles: 105 (new test code / workcycle needed)
- 49. Scarifiers, CE powered: 99 + 2 lg P (Electric: Art 13)
- 50. Shredders/chippers: $P \leq 5$ kW: 109, $P > 5$ kW: 119
- 55. Truck mixers: $P \leq 55$ kW: 109, $P > 55$ kW: 90 + 11 lg P
- 56. Water pump units (include pool pumps):
CE: $P \leq 25$: 109; $P > 25$: 94 + 11 lg P; Electric: 99

5.4 Proposed new equipment types

The list of potential new equipment to add to the Directive is almost the same as in the Nomeval study, reconsidered in the light of current information. Among the 22 types, 9 have been considered out of the scope of the directive, of insufficient impact or covered by other regulation, 3 types are proposed to be put into Article 13 and 10 types into Article 12. Some are proposed to be included in existing equipment categories.

1) Move to Article 13: 3 types

- 107. Portal cranes for harbours and terminals
- 102. Mobile sieve installations (potential limit: 112; 92+11 lg P)
- 103. Mobile waste breakers (wood, concrete) (potential limit: 112; 92+11 lg P)

2) Move to Article 12: 10 types

- 108. Vehicle mounted loader cranes (same limits as mobile cranes)
- 109. Walk-behind road sweepers, no aspirators (motorized broom, same limits as road sweeper)
- 110. Street washing machine (same limits as road sweeper)
- 111. Snowmobiles: L_{pASmax} @ 15.2m, accelerating : 78 dB(A) (LWA: 110)
- 115. Telescopic or pole pruner a. CE-powered b. Electric (same limits as chainsaws)
- 117. Straddle carrier and 118. Reach stacker (same limits as lift trucks)
- 119. Handheld stone cut-off saw: 112 + 2*P
- 120. Stone chainsaw (same limits as chainsaws)
- 121. Swimming pool pumps (same limits as water pumps)
- 122. Air suction refuse vehicles (same limits as High pressure flushers or suction vehicles)

3) Not to be included: 9 types

- 100. Airco/ ventilation equipment (other regulation)
- 101. Heat pumps (other regulation)
- 104. Tractors for construction and water pumping (other directive)
- 105. Reverse movement alarm signals (all machines) (out of scope)
- 106. Non-fixed lifting gear, own power source (too little information and low impact)
- 112. Quad (off-road) (out of scope, other directive)
- 113. Golf green edger (currently too small numbers and impact)
- 114. Bird scare canons/Gas guns (out of scope)
- 116. Tree stump grinder (currently too small numbers and impact)

6. REVISION OF TEST CODES

The test codes have been evaluated for each equipment type, indicating where improvements or changes are necessary, in particular with reference to new or updated standards, many of which have been revised over the last 8 years. Some however still remain an obstacle due to lack of a suitable code, shortcomings or lack of measured data. CEN has provided feedback from the Technical Committees which has been included in the evaluation. A general issue is the resolution of horizontal issues in the standards, such as how to deal with process noise, the work cycle, test conditions and common references.

For machines currently in Article 13 or outside the scope of the OND, the lack of a suitable test code, large uncertainty factor, presence of process noise, local regulations or large size of machines should not be obstacles to proposing noise limits if the need is established. Test codes with shortcomings should be worked on to allow timely introduction of new limits.

The detailed description of the test methods in the directive serves to determine comparable and reproducible values of the sound power level of the listed equipment. A reliable test method is necessary for the equipment listed under Article 12 for the comparison with the limit values and the evaluation of the EU database. This is why the measuring methods in the OND and the international and European standards were specified for each equipment type individually. 15 years on from the introduction of the OND, some of the standards it refers to are no longer valid or available. Some have been revised or replaced, also in view of reproducibility.

The recommendations are mainly based on existing regulations and standards. New or modified test codes can result in changes in the measured values. This is generally acceptable as long as the correlation of the measured values obtained with the old and new test codes is taken into account in introducing or changing the noise limit values. Issues covered include:

- Improvement of existing test codes for reproducibility, either in the Directive itself or in the relevant standard(s);
- Application of new or revised standards;
- Proposed modifications to the standard and/or operating conditions.
- It is proposed that the OND should refer to the following standards for the test codes, offering clear advantages for repeatability and reproducibility:
- ISO 3744: 2011 for sound power measurement;
- ISO 22868: 2011 for sound pressure and sound power measurement of portable, hand-held combustion engine powered forestry and garden machines;
- EN 500-4: 2011 for safety of mobile road construction machinery (including environmental noise);
- ISO 6395: 2008 for sound power measurement of earth moving machinery under dynamic operating conditions.
- UN ECE R120: its measurement method and conditions should be used for the definition of power of internal combustion engines.

The specific proposals for each equipment type are listed in the ODELIA report.

7. CONCLUSIONS

In the ODELIA study, proposals have been made for new noise limits and new equipment types for a future revision of the current EU directives 2000/14/EC and 2005/88/EC. Tighter limits were proposed for 9 equipment types and new limits were proposed for 28 types currently without limits. 13 new equipment types were proposed to be included in the directive. Available documents and data from 2007-2015 have been taken into account. Criteria applied in the assessment included member state requests and information, environmental impact, stakeholder information from industry, notified bodies, authorities and NGOs, technical progress including databases of declared values, economic impact, and quality of the test codes. General and specific justifications have been given for each individual limit proposal. Both general and equipment-specific improvements for the test codes have been proposed. The proposals from this study will be the basic reference for the incoming revision exercise of the EU legislation on noise emissions from outdoor equipment, but the final Commission proposal may differ depending on the impact assessment and the New Legislative Framework.

ACKNOWLEDGEMENTS

The ODELIA study was funded by the European Commission DG GROW, whose support is gratefully acknowledged. Also thanks are due to industry associations, NGOs, authorities and other stakeholders for providing input to the study such as databases, background documents and bilateral discussions.

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