



# Exhaust emissions from non-road mobile machinery



## Starting position

The Deutsche Umwelthilfe e.V. (DUH) once again identified, as part of emission measurements, that many non-road machines do not comply with the emission limit values valid all over Europe. The environmental and consumer protection organisation has been having the exhaust emissions of motor saws and brush cutters controlled by TÜV NORD since 2013.

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**The limit values serve to protect the environment and human health, in particular against the impacts of ground-level ozone.**

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DUH's main concern is to limit the actual emissions from combustion engines of non-road machinery to a legally permissible value and to motivate the market players, in particular manufacturers, importers and traders, to supply the market with environmentally and consumer friendly products.



*Hardly any consumers know about the invisible health risks resulting from excessive pollutant emissions. The DUH advocates for better market surveillance - to give devices which exceed the limit values no chance on the market.*

## Background

Emissions from combustion engines contribute considerably to pollution in the air from carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), hydrocarbons (HC) and ground-level ozone (O<sub>3</sub>). These pollutants not only contaminate the air we breathe, but they are to some extent also extremely dangerous to human health.

For this reason, pollution limit values valid throughout Europe have been established for non-road mobile machines and devices with a combustion engine, which also include garden machinery such as motor saws, string trimmers and brush cutters.<sup>1</sup> These limit values act to protect both the environment and human health, because the users of these machines are directly exposed to the emissions.

DUH has been advocating a consistent implementation of environment-related consumer protection regulations for years. The organisation sees itself as advocate for consumers as market players who trust that the products marketed in Germany comply with the legal prerequisites, and who are misled by the non-compliance of pollutant limit values. DUH is the only German environmental and consumer protection organisation that is engaged in the enforcement of regulations under emission law regarding non-road machinery. As an registered consumer protection agency, DUH also takes legal action in the interest of consumers against violations of environmentally relevant consumer protection regulations.

Such legal disputes aim at removing non-compliant products from the market and are a strong signal towards manufacturers to only bring such products to the market which reliably comply with the set limit values.

Non-road mobile machinery emits, among other things, the following substances which are detrimental to health:

- **Carbon monoxide (CO)** is a hazardous respiratory poison. It is colourless, non-irritating, odourless and tasteless and it is easily absorbed through the lung. Consumers who use a motor saw which exceeds the limit values for carbon monoxide, can show symptoms of slight poisoning. The risk of accidents considerably increases due to the typical impacts such as headache, dizziness and symptoms similar to that of a flu. Higher doses may have a significantly toxic impact on the central neural system and the heart.
- **Hydrocarbons (HC)** contribute, together with nitrogen oxides and the sunlight, to the formation of ground-level ozone and are therefore regulated in the exhaust gas legislation. In addition, aromatic (benzene) and in particular polycyclic aromatic hydrocarbons (PAH) are often classified as especially hazardous to health. They may trigger leukaemia, bone marrow damage and other diseases without any known threshold level.
- **Nitrogen oxides (NO<sub>x</sub>)**: Nitrogen oxides lead to irritations and damage of the respiratory system and thus have a negative impact on human health. Nitrogen oxides originate as a

by-product in combustion processes. In this process, nitrogen oxides are mainly emitted as nitrogen monoxide (NO). In the atmosphere they oxidise into nitrogen dioxide (NO<sub>2</sub>) which attacks human mucous membranes and thus leads to diseases of the respiratory system, such as chronic bronchitis and asthma. A higher NO<sub>2</sub> concentration also increases the risk of dying from cardiovascular diseases.

- **Ground-level ozone (O<sub>3</sub>):** Ozone is a greenhouse gas. It originates from nitrogen oxides and volatile hydrocarbons under the influence of solar radiation. Since it is not directly emitted, ozone is also described as a secondary pollutant. From an ozone content of more than 110µg/m<sup>3</sup> onwards, a clear impairment can be noted, and from approx. 200µg/m<sup>3</sup> of ozone onwards, symptoms such as lacrimal irritation, mucous membrane irritation, bronchial irritation, headache and a deterioration of the lung function can occur, and plants can be damaged. Furthermore, it is assumed that there is a correlation between ozone concentrations and cardiovascular diseases (e.g. heart attack).



*Clamping fixture for string trimmers/brush cutters.*

## DUH measurement of pollutant emissions from mobile machinery

In the year 2013, DUH commissioned the TÜV NORD testing institute for the first time with testing pollutant emissions from non-road machinery on a random basis. The measurements carried out showed considerable exceedances of emission limit values for eight of the twelve tested motor saws and brush cutters.<sup>2</sup>

At the end of 2014, TÜV NORD was commissioned again with carrying out a second test. The results were published at the beginning of 2015: Six of 11 devices scored badly in the test and some of them exceeded the European limit values by up to 400 percent.

In 2016, DUH also tested machines from the Swedish and French market for the first time. A total of 33 devices were measured,



*Machines which exceed the emission limit values by up to 300 percent can still be found on the German market.*

among them 24 different device types of motor saws and brush cutters. Of the device types available on the German market, two devices each were tested. If the first device exceeded the limit values, the second device was also tested on the engine test stand.

In total, 18 of the 24 device types significantly exceeded the limit values for HC+NO<sub>x</sub> (total of hydrocarbon and nitrogen oxide emissions) valid throughout Europe. Only seven of the 33 objects tested complied with the current limit value level II of Directive 97/68/EC in its version 2012/46/EU.
















Seven of the tested device types had a problem with the type approval number. The number was not detectable in some cases, not readable or could only be found in the instruction manual. The respective distributor is obliged to clearly label the respective consumer product before the product is supplied to the market. According to Directive 97/68/EC and/or the 28th Federal Emission Control Ordinance (28th BImSchV) and the Machine Directive 2006/42/EC, which is transposed into German law by means of the Product Safety Act (ProdSG) and the Machine Ordinance (9th ProdSV), a clearly visible type approval number must be fixed on the device. In addition, each single device must be clearly identifiable by an attached serial number.

In six of the devices bought on the German market, the carburettor could also be unrestrictedly adjusted by the user. This is not permissible, because the limit values protecting the environment and the consumer might be further exceeded to a considerable extent, if the carburettor can be unrestrictedly adjusted by the user. On the other hand, a carburettor which can be unrestrictedly adjusted by the user gives rise to considerable safety concerns. In line with the ProdSG, products may only be supplied to the market, if they do not endanger the safety and health of humans when they are used in line with the intended and foreseeable purpose. In addition, if the carburettor can be adjusted freely, this may impair the engine and thus causing higher costs for the consumer.

The 2016 results can be seen in detail on the following pages 4 and 5:

## Results of the emission measurements in spark ignition engines for non-road mobile machinery 2016

Specific hydrocarbon (HC) and nitrogen oxide (NO<sub>x</sub>) emissions from motor saws and string trimmers/brush cutters

| Country   | Manufacturer/Importer              | Type                        | Machine   | Limit value*<br>[g/kWh] | Deviation to the limit value*<br>[%] |
|---|------------------------------------|-----------------------------|---|-------------------------|--------------------------------------|
|    | HP Schou A/B                       | GARDEN 77749                |    | 50                      | 600,40                               |
|   | Clas Ohlson AB                     | CO TECH PN 3800II           |   | 50                      | 191,00                               |
|   | Biltema                            | BILTEMA GT 25               |    | 50                      | 337,80                               |
|   | Clas Ohlson AB                     | CO TECH GT25                |   | 50                      | -15,20                               |
|   | Nutool                             | Nutool PLT26A               |   | 50                      | 334,20                               |
|   | HORNBACH Baumarkt AG               | PATTFIELD PE-BT 25          |   | 50                      | 252,00                               |
|   | Clas Ohlson AB                     | CO TECH YT 9071A            |   | 50                      | 382,80                               |
|  | Canbolat Vertriebs GmbH            | AREBOS AR-HE-KS 52CC        |   | 72                      | 486,40                               |
|   |                                    |                             |   |                         | 260,80                               |
|   |                                    |                             |   |                         | 303,47                               |
|   |                                    |                             |   |                         | 130,28                               |
|   | ikra GmbH                          | Hanseatic IPCS46            |   | 50                      | 224,17**                             |
|   | ATIKA GmbH                         | ATIKA BKS 45                |   | 50                      | 46,80                                |
|   | Westfalia Werkzeugcompany          | Westfalia Art.-Nr. 80 01 50 |   | 50                      | 8,80**                               |
|   | BVBA Tech and Trade                | TIMBERPRO CS 5800           |   | 50                      | 19,40                                |
|   | Güde GmbH & Co. KG                 | Güde KS 401 BW              |   | 50                      | 139,40**                             |
|   |                                    |                             |   |                         | -43,00                               |
|   |                                    |                             |   |                         | 157,36                               |
|   |                                    |                             |   |                         | 163,06                               |
|   | Primopet GmbH                      | Rotfuchs BC52               |  | 72                      | 249,58**                             |
|   |                                    |                             |   |                         | 30,80                                |
|   |                                    |                             |   |                         | 28,00**                              |
|   | ATIKA GmbH                         | ATIKA BF 43                 |   | 50                      | 182,08                               |
|  | MATRIX GmbH                        | POWERtec GARDEN BMS1400-2   |  | 72                      | 147,92                               |
|   | ikra GmbH                          | IKRA mogatec BF 43          |   | 50                      | 123,19**                             |
|   | Grizzly Gartengeräte GmbH & Co. KG | Grizzly MTS 43 AC E2        |   | 50                      | 88,49**                              |
|   | Bargain24 GmbH                     | Nemaxx MT22                 |   | 72                      | 89,80                                |
|   | Alpina                             | ALPINA A3700                |  | 50                      | 7,80                                 |
|   | ADEO Services                      | STERWINS PCS 46-2           |   | 50                      | -50,83                               |
|   | Castorama France                   | Mac Allister MCSWP45        |   | 50                      | 30,40                                |
|   | EURO DEPOT ESPANA, S.A.U.          | Mac Allister CSP40          |   | 50                      | -4,00**                              |
|   | Castorama France                   | FPCSP38                     |  | 50                      | 19,40                                |
|   |                                    |                             |   | 50                      | 297,36                               |
|   |                                    |                             |  | 50                      | 354,72**                             |
|   |                                    |                             |   | 50                      | -21,00                               |
|   |                                    |                             |  | 50                      | 58,20                                |
|   |                                    |                             |   | 50                      | 65,00                                |
|   |                                    |                             |  | 50                      | -36,00                               |
|   |                                    |                             |   | 50                      | -31,40                               |

\* Limit value: sum of HC+NO<sub>x</sub>, according to EU Directive 97/68/EC (2012/46/EC).

\*\* Measurement second copy



























-100 0 100 200 300 400 500 600 in %

The measurements were carried out by TÜV NORD Mobilität GmbH & Co.KG (IFM - Institut für Fahrzeugtechnik und Mobilität) on behalf of DUH. Of the device types available on the German market, two devices each were tested. If the first device exceeded the limit values, the second device was tested on the engine test stand. For freely adjustable carburetors, the emission measurements were carried out with the adjustments "high" and "low". The limit values must not be exceeded in either case. All devices were measured several times.



## Results of the emission measurements in spark ignition engines for non-road mobile machinery 2016

### Specific carbon monoxide (CO) emissions from motor saws and string trimmers/brush cutters

| Country   | Manufacturer/Importer              | Type                        | Machine   | Limit value*<br>[g/kWh] | Deviation to the limit value*<br>[%] |
|---|------------------------------------|-----------------------------|---|-------------------------|--------------------------------------|
|    | HP Schou A/B                       | GARDEN 77749                |    | 805                     | -45,12                               |
|   |                                    |                             |   |                         | -69,18                               |
|   | Clas Ohlson AB                     | CO TECH PN 3800II           |    | 805                     | -44,88                               |
|   |                                    |                             |   |                         | -37,58                               |
|   | Biltema                            | BILTEMA GT 25               |    | 805                     | -0,66                                |
|   | Clas Ohlson AB                     | CO TECH GT25                |   | 805                     | -74,21                               |
|   | Nutool                             | Nutool PLT26A               |    | 805                     | 4,00                                 |
|   | HORNBACH Baumarkt AG               | PATTFIELD PE-BT 25          |   | 805                     | -77,05                               |
|  | Clas Ohlson AB                     | CO TECH YT 9071A            |    | 805                     | 40,11                                |
|   |                                    |                             |   |                         | -73,85                               |
|   | Canbolat Vertriebs GmbH            | AREBOS AR-HE-KS 52CC        |   | 603                     | 15,44                                |
|   |                                    |                             |   |                         | -66,58                               |
|   | ikra GmbH                          | Hanseatic IPCS46            |   | 805                     | -18,42                               |
|   |                                    |                             |   |                         | -34,85**                             |
|   | ATIKA GmbH                         | ATIKA BKS 45                |   | 805                     | -41,98                               |
|   |                                    |                             |   |                         | 10,02**                              |
|   | Westfalia Werkzeugcompany          | Westfalia Art.-Nr. 80 01 50 |   | 805                     | -69,79                               |
|   |                                    |                             |   |                         | -16,71                               |
|   | BVBA Tech and Trade                | TIMBERPRO CS 5800           |   | 603                     | -13,19                               |
|   |                                    |                             |   |                         | 14,09**                              |
|   | Güde GmbH & Co. KG                 | Güde KS 401 BW              |   | 805                     | -44,49                               |
|   |                                    |                             |   |                         | -40,93**                             |
|   | Primopet GmbH                      | Rotfuchs BC52               |  | 603                     | -35,71                               |
|   |                                    |                             |   |                         | -88,61                               |
|  | ATIKA GmbH                         | ATIKA BF 43                 |  | 805                     | -67,49**                             |
|   |                                    |                             |   |                         | -91,31**                             |
|   | MATRIX GmbH                        | POWERtec GARDEN BMS1400-2   |  | 805                     | -27,36                               |
|   |                                    |                             |   |                         | -71,05                               |
|   | ikra GmbH                          | IKRA mogatec BF 43          |  | 603                     | -76,02                               |
|   |                                    |                             |   |                         | -52,45                               |
|   | Grizzly Gartengeräte GmbH & Co. KG | Grizzly MTS 43 AC E2        |  | 805                     | -75,97**                             |
|   |                                    |                             |   |                         | -51,93                               |
|  | Bargain24 GmbH                     | Nemaxx MT22                 |  | 603                     | -4,89                                |
|   |                                    |                             |   |                         | -15,02**                             |
|   | Alpina                             | ALPINA A3700                |  | 805                     | -74,75                               |
|   | ADEO Services                      | STERWINS PCS 46-2           |   | 805                     | -5,66                                |
|   | Castorama France                   | Mac Allister MCSWP45        |  | 805                     | -9,24                                |
|  | EURO DEPOT ESPANA, S.A.U.          | Mac Allister CSP40          |  | 805                     | -75,58                               |
|   | Castorama France                   | FPCSP38                     |  | 805                     | -74,64                               |

\* Limit value: CO, according to EU Directive 97/68/EG (2012/46/EU).

\*\* Measurement second copy

-100 -80 -60 -40 -20 0 20 40 in %

The measurements were carried out by TÜV NORD Mobilität GmbH & Co.KG (IFM - Institut für Fahrzeugtechnik und Mobilität) on behalf of DUH. Of the device types available on the German market, two devices each were tested. If the first device exceeded the limit values, the second device was tested on the engine test stand. For freely adjustable carburetors, the emission measurements were carried out with the adjustments "high" and "low". The limit values must not be exceeded in either case. All devices were measured several times.

## Successes

As a follow-up to the tests, DUH informed the respective manufacturers, trade businesses and the responsible authorities about the current measurement results and demanded that the mobile machinery distributed by them comply with the pollutant limit values in future and that they withdraw the harmful machines from the market. One manufacturer has now had all sales stopped for one of the motor saws tested.

Since the series of measurements started, several manufactures have guaranteed DUH that they will comply with the limit values, subject to penalty. Although traders must ensure the legal conformity of the products distributed by them, the trade sector often refuses to assume responsibility for products. The Amazon mail order chain, when addressed by DUH, consented to stop selling at least one of the products distributed by it. Under pressure from DUH, the toom DIY chain already took one product from their shelves in 2014, because it exceeded the pollutant value limits. In February 2015, on the initiative of DUH, the OBI DIY chain withdrew two motor saws from circulation, which are produced by its subsidiary Euromate. In addition, the responsible authority initiated contempt proceedings against the company, following pressure from DUH. These devices had already been tested in the previous year and failed the test again in the 2014 measurements.

## Legal framework

The European Directive 97/68/EC also aims at effectively protecting humans against health risks resulting from air pollution caused by mobile machines, and thus serves both environmental and consumer protection. Mobile machines and devices which are not intended for use on the road (internationally referred to as Non-Road Mobile Machinery, shortly NRMM) must not exceed the pollutant limit values as laid down in Directive 97/68/EC. In Germany, the requirements of the EU Directive are transposed into national law by the 28th Federal Emission Control Ordinance (28th BImSchV). Since these regulations serve to protect the safety and health of consumers, they also aim



at regulating market behaviour in line with the Unfair Competition Act (UWG) in the interest of consumers as market players. At the end of the currently ongoing coordination process, Directive 97/68/EC will be replaced by the EU Regulation on requirements relating to emission limits and type approval for internal combustion engines for non-road mobile machinery, which will then apply directly.

The European legislator has introduced regulations for the protection of consumers and the environment in many areas or has tightened existing requirements. The necessary official infrastructure to impose and/or control these regulations has however not been established to a sufficient degree. The new European NRMM Regulation considers this need to some extent, since it is planned to establish uniform regulations throughout Europe. Both the duties of the authorities and the obligations of manufacturers and traders of these products will be regulated more clearly in future.

Together with international partners, DUH contributed greatly to the ongoing negotiations by putting forward improvement proposals which were partly taken up by the EU Commission. The position papers submitted can be found on the DUH homepage at [www.duh.de](http://www.duh.de).

## Official measures for market surveillance

The measurement results demonstrate again how important it is that authorities constantly monitor the market. They are responsible for imposing the emission limit values. At the same time, the tests commissioned by the DUH also show that the activities carried out by the market surveillance authorities so far are far from being satisfactory. At the present time, consumers cannot identify whether a product complies with the legal requirements or not. They generally trust that the distributed products fulfil these requirements. Consumers who use such devices which exceed the limit values are mainly affected by health risks due to toxic emissions.

Since 2013, DUH has carried out annual surveys at market surveillance authorities of the Federal States to confirm that emission limit values are complied with, and has subsequently evaluated the monitoring activities by awarding cards in line with the traffic-light system. These surveys investigate whether and to what extent emission measurements and formal controls have been carried out on non-road machinery, and which results were obtained, as well as which sanctions were imposed in cases of violations of the law.

The results of the first survey in 2013 were disappointing: Ten „Red Cards“ had to be awarded in that year. Most of the Federal States did not consider it to be their task to make sure that the emission limit values were imposed. Only one Federal State was awarded a „Green Card“. Six „Red Cards“ had still to be awarded

in 2014. The 2015 survey regarding official measures showed first improvements. At least Baden-Württemberg, Bavaria and North Rhine-Westphalia monitor the market activities and carry out emission measurements themselves. In the meantime, awareness of the problem has been rising among the authorities. Four „Yellow Cards“ and nine „Red Cards“ for the remaining Federal States however show that the competent authorities still fail to sufficiently monitor the market, which means that they do not sufficiently protect consumers' health.

## Conclusion

As part of pollutant measurements for motor saws and brush cutters, DUH repeatedly confirmed that many products are distributed which pose a danger to user health, and contaminate the air. Monitoring the pollutant emissions of mobile machinery by the responsible authorities is urgently needed to ensure effective consumer protection. The measures taken so far are not consistent enough. A lack of controls and sanctions mean that manufacturers and traders can bring products into circulation that do not comply with the legally established limit values over their entire period of distribution.

Therefore DUH demands the following:

- **Valid laws must be complied with by all market players, in particular, limit values protecting the environment and human health must be met.**

- **Consistent and coordinated market surveillance by all competent national authorities.**

This includes providing information and, in particular, carrying out a significant number of regular controls. It must be investigated whether all formalities are complied with and the emission behaviour of the devices must be examined.

- **The establishment of specific obligations subject to sanctions and addressing them at all market players.**

Market players include manufacturers, manufacturers of original devices and traders of devices. Any violations must be prosecuted consistently, in particular, by imposing administrative fines and prohibition orders.

- **The emission behaviour of non-road mobile machinery must be constantly improved.**



### End notes

- <sup>1</sup> Directive 97/68/EC „on the approximation of the laws of the Member States relating to emission standards and type approval procedures for combustion engines to be installed in non-road mobile machinery“, last amended by Directive 2011/88/EU.
- <sup>2</sup> TÜV NORD Mobilität GmbH & Co. KG (IFM – Institut für Fahrzeugtechnik und Mobilität): Exhaust gas measurements for ignition engines for non-road mobile machines and devices, 09/2013

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### Environmental Action Germany

Headquarters Radolfzell  
Fritz-Reichle-Ring 4  
78315 Radolfzell  
Phone: +49 7732 9995-0

Headquarters Berlin  
Hackescher Markt 4  
10178 Berlin  
Phone: +49 30 2400867-0

### Contact person

Ms. Agnes Sauter  
Head of consumer protection  
Phone: +49 7732 9995-11  
Mobile: +49 175 5724833  
E-mail: sauter@duh.de

Ms. Annette Stolle  
Project Manager  
Transport and Air Quality  
Phone: +49 30 2400867-78  
E-mail: grass@duh.de

[www.duh.de](http://www.duh.de) [info@duh.de](mailto:info@duh.de) [umwelthilfe](https://twitter.com/umwelthilfe) [umwelthilfe](https://facebook.com/umwelthilfe)

[We'll keep you posted: www.duh.de/newsletter-abo.html](https://www.duh.de/newsletter-abo.html)



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