



RECENT ACTIVITIES AND POLICY RECOMMENDATIONS FROM THE EPA NETWORK INTEREST GROUP ON NOISE ABATEMENT

René Weinandy^{1*}

Bert Peeters²

¹ German Environment Agency, Wörlitzer Platz 1, 06844 Dessau-Roßlau, Germany

² M+P, Wolfskamerweg 47, 5262ES Vught, The Netherlands

ABSTRACT

The informal network of European Environmental Protection Agencies (EPA network) has been working to exchange information and opinions on a wide range of environmental noise topics, through their Interest Group on Noise Abatement (IGNA) since 2010. Where the first five years focused on road, rail and air traffic noise being the largest sources of health burden, the IGNA in the 2017-2022 period has covered wider and higher-level subjects. Their published work includes decision and cost/benefit methods for noise abatement, as well as noise limit and target values around Europe in relation to the 2018 WHO Guidelines. Another report focuses on protecting and improving the acoustic quality of environments through quiet areas and soundscaping. Findings are summarized in the 2022 Final Report, and in this paper.

IGNA concludes that the environmental noise situation in Europe has grown worse rather than improving. Increased ambitions as set out in the Commission's Zero Pollution Action Plan are highly needed but will require significantly more effort. Policy measures are proposed, aiming particularly at noise road vehicles and low-noise tyres and pavements, with additional recommendations for rail and aircraft noise. IGNA will continue to try and raise noise on the European agenda in the upcoming years.

Keywords: *environmental noise, transport noise, policy, noise abatement measures*

*Corresponding author: rene.weinandy@uba.de

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1. INTRODUCTION

The EPA Network is an *informal* gathering of Europe's Environmental Protection Agencies (EPAs). The Network is initiated and supported by the EPAs themselves, independent from the EU and the European Environment Agency (EEA). The EEA does provide secretarial support, as well as organization of the plenary meetings and hosting the website (<https://epanet.eea.europa.eu/>). The EEA's information exchange network (EIONET) has been a regular source of input and information for IGNA. Due to the independent nature of the EPA Network, the IGNA has been able to perform its own research, formulate its own opinions, and directly address the EU institutions with policy recommendations from its position in representing protection of the environment and associated public health.

The EPA Network currently has ten Interest Groups (IGs) cooperating on different subjects, including climate change, circular economy and citizen science. The IGs interact with stakeholders on national and EU level, by organizing ad-hoc meetings and events, and by sharing their views in reports and letters, all of which are published on the website. The EPA Network usually has two plenary meetings per year. In the 2010 meeting in Krakow, the Interest Group on Noise Abatement (IGNA) was founded. The IGNA gathers, exchanges and spreads state-of-the-art information about environmental noise in Europe, aiming to help its member organizations and others with the practical day-to-day implementation of environmental noise policies. Also, it aims to inform and pressure EU and national authorities to get on top of the game with regards to preventing and reducing the noise-related health burden all over Europe.

The general focus of the IGNA is on:

- harmonization and standardization of methods to monitor and evaluate noise exposure and abatement measures;

- noise abatement measures at the source, and protection of quiet areas;
- critical levels: limit and target values that trigger remedial measures;
- economic instruments: cost-benefit aspects and financial measures to compensate external costs and set incentives for source measures.

2. PREVIOUS WORK

2.1 General overview

The IGNA has been working in two consecutive five-year mandate periods, 2011-2016 and 2017-2022. In yearly workshops, the 15 participating organizations exchanged current noise activities in their countries, but also focused on specific topics. For each topic, a report has been prepared as input for the workshop and then finalized for publication and further dissemination for the rest of Europe. Figure 1 shows the different topics that have been covered since 2011.

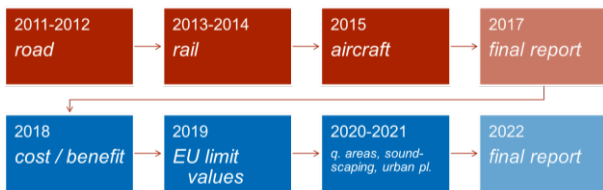


Figure 1. Overview of noise topics covered in the 2011-2016 and 2017-2022 periods

2.2 Previous Final Report (2011-2016)

- In the first period 2011-2016, the IGNA focused on noise from road, rail and air transport, as these were and still are the most important sources of environmental noise **Error! Reference source not found..** Results were summarized in the 2017 Final Report **Error! Reference source not found.,** in short:
- Urbanization is a driver for environmental noise problems, as settlements concentrate around major transport axes. Aviation has generally grown.
- Noise emission from road, rail and aircraft vehicles, as well as tyres and rails, has increased in total, although more quiet freight wagons and airplanes have partially been able to compensate for growth.
- The number of Europeans exposed to L_{den} levels over 55 dB has increased, at least until 2016. Two-thirds of these people live in urban areas. Road traffic is by far (89%) the largest source of noise exposure > 55 dB L_{den} .

- The impact is that 1.5 million healthy life years are lost. This results in 45 billion Euro (2004) of external costs resulting from loss of real estate and land value, productivity loss and health loss.
- In terms of responses, source reduction measures such as low-noise tyres/pavements, wheels/rails and engines are more effective and cost-efficient than measures to reduce the amount of traffic. A modal shift from aircraft to rail would help, as people are more sensitive to aircraft noise. People's attitudes towards the noise may also be improved by means of education and increased participation.

The report recommends to put more pressure on improving type approval regulations for road/rail vehicles and aircraft, not only by strengthening limits but also by improving the associated test methods, e.g. more representative testing of real behavior for high-performance cars.

3. KEY DEVELOPMENTS SINCE 2017

During the 2017-2022 period, there have been major developments in EU general noise policy and transport noise in particular.

3.1 General noise policy

The EU Green Deal (2020) set the ambitious target for Europe to be climate-neutral in 2050. As part of the Green Deal, the European Commission also launched the Zero Pollution Action Plan (ZPAP, 2021) [3] that aims to reduce air, water and soil pollution to levels no longer considered harmful by 2050. For noise, the ZPAP sets an important interim target, that:

by 2030 the EU should reduce by 30% the share of people chronically disturbed by transport noise.

Here, the 30% reduction is defined with respect to 2017 and monitored by the strategic noise maps produced under the Environmental Noise Directive (END). The ZPAP targets *transport* noise specifically, not e.g. industry or leisure noise. It focuses on the *disturbance* rather than the exposure, which implies that measures to reduce the annoyance by means of education and communication also contribute, as well as tackling excessively noisy vehicles that contribute relatively little to the L_{den} but significantly worsen people's attitudes towards road traffic noise.

2018 has seen the light of the latest WHO Environmental Noise Guidelines for the European Region [4]. The WHO recommends among other things to lower L_{den} and L_{night} levels below certain maximum levels, which are given

specifically for road, rail, aircraft, wind turbine and leisure noise. These levels are based on new exposure-response functions (ERFs) per source, which have been derived by the WHO researchers from a state-of-the-art evidence base. These ERFs have also been taken over by the Commission in Annex III of the END, by means of EU Directive 2020/367, and are now to be used by Member States in all noise action plans. The Commission has also amended the noise assessment method in END Annex II (“CNOSSOS-EU”) used for the strategic noise maps by implementing the improvements proposed by researchers in 2019 [5].

The EEA, based on analysis of these five-yearly noise maps, produces regular reports describing the current state of the situation, with the latest Environmental Noise in Europe report in 2020 [1]. This process has been improved by the new and INSPIRE-proof END data repository. Contrary to what Europe has seen for air quality, the noise problem is not decreasing since 2007 and is not expected to meet existing targets for 2020 soon.

Finally, the noise research community has remained active. Of particular interest is the Phenomena study [6], commissioned by the European Commission, which concluded that a reduction of the total transport-related health burden by 20% by 2030 would be possible, and at a good benefit-cost ratio, but requires a combination of noise reduction measures across all transport modes, including source measures as well as noise barriers, façade insulation and urban planning measures.

3.2 Road traffic noise

EU and UN regulations for type approval of cars and trucks have been updated, among other things with the introduction of Additional Sound Emission Provisions (ASEP) to cover a wider range of driving conditions during noise testing, preventing ‘cycle beating’ similar to what happened in ‘Dieselgate’ for air emissions. Other UN Working Groups currently focus on reducing measurement uncertainty, and the ISO10844 standard specifying noise test tracks has been updated in 2021. Commission research has shown that lowering type approval limits for cars, trucks and motorcycles by 1 to 3 dB is feasible and cost-effective, but that more effect could be obtained by better prevention and enforcement of vehicle tampering / tuning, as well as (mostly illegal) replacement exhausts and aggressive driving. The EU Regulation 2018/858 introduced market surveillance of vehicles and components, including tyres, forcing Member States since September 2020 to regularly call in and test a certain number of in use vehicles for their continued compliance with type approval

limits and tyre label values. Sanctions may be put on manufacturers in case of non-compliance.

The network organization of European national road authorities (CEDR) has had a research call in 2018 leading to three research projects on road noise¹:

- the *STEER* project on improving the accuracy and effectiveness of the tyre noise label;
- the *SOPRANOISE* project on improved in-situ visual checks and measurements on acoustic performance of noise barriers;
- the *FAMOS* project on the influence of psycho-acoustic effects (“non-acoustic factors”) on noise annoyance, with recommendations for effective non-acoustic remediation measures.

3.3 Rail traffic noise

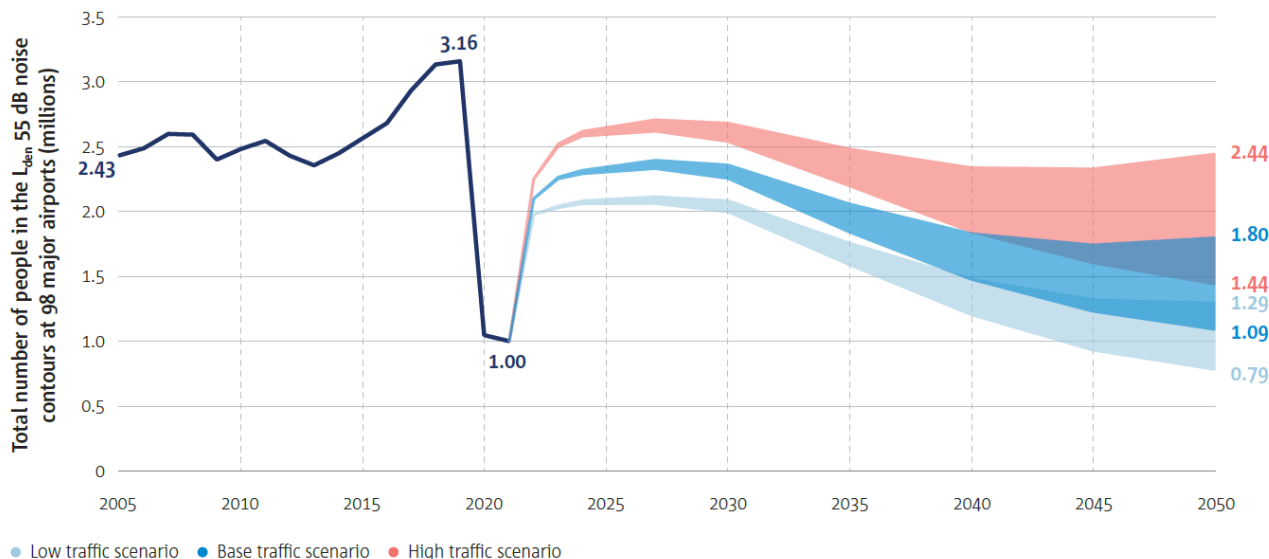
In 2019, through EU regulation 2019/774, the Quieter Routes approach has been introduced into the Technical Specification for Interoperability (TSI) for European rail vehicles. As of December 2024, freight wagons with cast iron brake blocks, which cause high wheel/rail roughness resulting in high rolling noise levels, are no longer allowed on all rail routes with more than twelve freight trains during the night period. Significant “spillover” of the quiet wagons on other rail routes is expected. Retrofitting of quieter composite brake blocks is financially stimulated by a third round of the EU’s Connecting Europe Facility (CEF). Germany and Switzerland have introduced a full ban of such wagons on their network.

The proliferation of quieter freight wagons is a successful measure in bringing rail noise levels down. However, as the International Union of Railways (UIC) concludes in their 2021 State of the Art report, further noise reduction measures need to be found to counteract the traffic growth that is expected, as a modal shift towards sustainable rail transport is a key development in achieving the Green Deal ambitions.

3.4 Aircraft noise

The aircraft sector has seen a sharp decrease during the coronavirus pandemic, but is expected to grow back according to an EU Aviation Safety Agency (EASA) environmental report [8]. The number of people above 55 dB L_{den} is however not expected to grow, and decrease towards 2050 (see Figure 2) mainly as a result of new quieter aircraft and phasing out of older, noisier ones.

¹ <https://www.cedr.eu/peb-research-programme-2018-noise-and-nuisance>



Assumptions:

- Infrastructure of each airport is unchanged (no new runway)
- Population distribution around airports is unchanged
- Local take-off & landing noise abatement procedures are not considered

For each traffic scenario, the upper bound of the range reflects fleet renewal with a 'frozen' technology scenario, and the lower bound reflects the 'advanced' technology scenario.

Figure 2. Prognosed development of number of people exposed to > 55 dB L_{den} aircraft noise, from [8]

As of January 2018, newly built airplanes must comply with more stringent noise emission limits as defined by the International Civil Aviation Organization (ICAO) in 'Chapter 14' of their *Chicago Convention*.

Other developments for aircraft noise are, in short:

- introduced obligation of the Doc29 calculation method for strategic noise mapping of all EU major airports;
- an interesting scientific debate, summarized in [9], challenging the WHO systematic reviews underpinning the maximum noise levels recommended in their 2018 Guidelines [4];
- increased research, such as in the ANIMA project², on the role of non-acoustic factors and subjective perception, and the possibilities this gives for airport noise management strategies.

4. IGNA ACTIVITIES 2017-2022

In the second mandate period of IGNA 2017-2022, the group has widened its scope and devoted attention to less source-specific topics, more focused on the problem of environmental noise as a whole.

² <https://anima-project.eu>

4.1 Cost-benefit and decision methods

Many different noise abatement measures exist to reduce the exposure to noise from various sources. Such measures need to be paid for, usually by local or national authorities with limited funds. The question arises whether the costs for installing and maintaining the measures weigh up to the benefits to society. The IGNA has investigated different cost-benefit methods that are used throughout Europe to make decisions on noise abatement measures, through literature study and a survey around the EEA's EIONET network. The results are published in an IGNA report [10] and summarized e.g. in [11]. Table 1 below describes five main categories of methods that have been found. These methods mainly differ in the way that the benefits are quantified, which may be in terms of decibels or health factors, but also in monetary units using appropriate external cost factors.

The cost-benefit report concludes that:

- fair and transparent decisions require objective decisions methods that are applied consistently;
- some EU countries have well-established decision-making methods that may serve as good examples for other countries seeking such methods;
- external cost factors used for monetization of benefits vary widely, up to a factor of 10, between EU countries with comparable welfare levels.

Table 1. Overview of decision methods for noise abatement measures, with decision criteria

method	decision criteria	remarks
cost-minimization	cheapest measure that fulfils the target	the output is fixed, to the required noise reduction; costs are then the only variable parameter
cost-effectiveness (CEA)	optimal ratio between noise reduction and costs	for noise, the output parameter is usually the noise reduction (in dB*persons)
cost-utility (CUA)	optimal ratio between public health (utility) parameter and costs	the health impact contains various endpoints; the impact is expressed in DALY/QALY units
cost-benefit (CBA)	optimal ratio between multiple, monetized criteria, summed to a single value, and costs	every benefit is translated to monetary units, e.g. using WTP
multi-design criteria analysis (MDCA)	highest score as a weighted sum over multiple criteria, each on a different arbitrary scale	costs and benefits are scored, then combined on a numeric scale using weighting factors

It is recommended to noise policy and decision makers to be clear and specific about the method used, the assumptions and the outcome, with realistic uncertainty bandwidths. It should also be clear what is included on the costs side. The IGNA report may serve as guidance to decision makers.

4.2 EU noise limits vs. WHO recommendations

The 2018 WHO Environmental Noise Guidelines [4] provides recommended intervention levels for environmental noise, in dB L_{den} and L_{night} for road and rail traffic, aircraft and wind turbines. Although the WHO Guidelines are not mandatory EU regulations, many countries will consider reviewing and possibly updating their national noise limit values. The IGNA wanted to know how the WHO recommended levels compared to noise limit and target values used in European countries, before any such updates. Data was gathered from 29 survey responses representing 27 European countries.

Noise regulations are usually complex, e.g. limit values may not apply everywhere or take on different dB levels for the same source in different situations. A comparison of dB limit values between countries as shown in Figure 3 requires severe simplification and assumptions. However, a clear conclusion from the IGNA report on EU limit values [12] is that many European countries have some form of noise limit values in their national regulations, often separated per noise source. The actual dB values reported vary widely (> 20 dB L_{den}) between countries, as the figures show, with the vast majority of noise limits being higher than the WHO recommended levels.

Perhaps more important than the exact dB level are the consequences attached to exceeding the limits. These may vary from a full stop of the noise-producing activities, e.g.

for industry or aviation, or to financial sanctions. For road and rail traffic, there is often an obligation to take active noise source measures, such as low noise pavements or rail dampers, or noise barriers. Façade insulation may also be mandatory in case of exceedance, or in case active noise measures are considered not cost-effective.

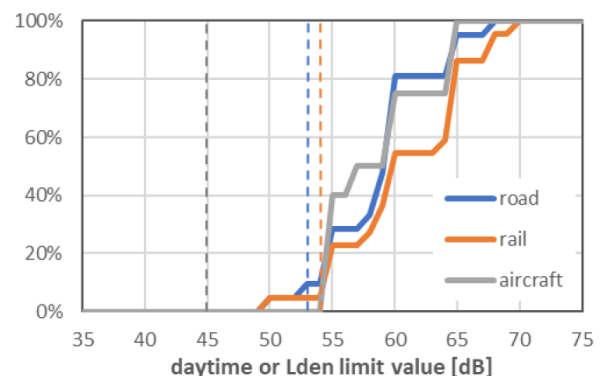


Figure 3. Cumulative distributions of limit values, based on L_{den} or other daytime indicator, as a % of countries that have limits for that source. Vertical dashed lines indicate WHO recommended levels.

The report recommends to countries that are considering implementing or updating their noise limits:

- to be clear about the limit objective: a target value triggering some action, or a maximum value that is not be exceeded?
- to also regard how the limit is implemented: what are enforcement methods and triggers for assessment of the limits, as well as the legal consequences of exceedance;
- to publicly document the rationale behind the noise limit values. Preferably, limits are based on (local) exposure-response functions, along with transparent cost-benefit and other considerations.

4.3 Quiet areas, soundscaping and urban planning

All IGNA reports until 2019 focused on abatement of noise: the reduction or prevention of public exposure to unwanted, annoying and unhealthy sounds. In 2020-2021 the group shifted the perspective to improving the acoustic quality of the environment: how to preserve and enhance positive sounds and high-quality acoustic environments. The report [13] published in 2022 focused on three related subjects.

Quiet areas (QAs) are mentioned specifically in the END as areas where the acoustic quality is good and should be preserved. QAs are shown on the strategic noise maps and mentioned in the action plans. No formal definition is given. Examples are found of absolute L_{den} noise levels, e.g. < 55 dB, or relative levels, e.g. 10 dB lower than the immediate surroundings. Figure 4 shows potential quiet areas identified in rural and urban areas in Luxemburg. Some countries define QAs only in qualitative terms.

The report concludes that QAs have a positive effect on people's wellbeing, as they provide a much desired contrast to the noisy environment. They should be green, clean and accessible, preferably close to or inside urban areas. More efforts should be taken to preserve them, which would be easier if more research were done to substantiate their socio-economic value.

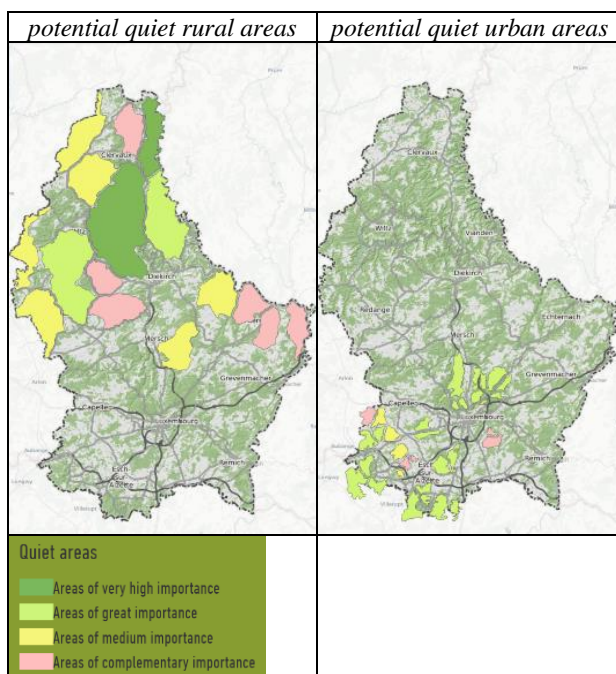


Figure 4. Potential rural and urban quiet areas in Luxemburg, see <http://g-o.lu/3/Meje>

Soundscapes are defined in ISO12319-1 as acoustic environments *as perceived or experienced and/or understood by a person or people, in context*. Not all sound is perceived as noise; many sounds are considered pleasant, exciting or otherwise positive. This adds a whole new dimension to the traditional approach of noise abatement, focusing on preservation, enhancement or even introduction of wanted sounds to improve unpleasant environments. This also requires new descriptors to describe and quantify acoustic environments, e.g. in terms of Pleasantness or Eventfulness. The soundscaping concept is finding its way from the academic world to real-world solutions that provide urban planners with new tools to design and improve the acoustic quality of the environment as a whole.

Urban sound planning is a term introduced to highlight the responsibility of urban planners to take into account sound and noise in their daily work to design the local urban environment, given its social and economic function.

Here, urban sound planning should be about acoustic quality, not just about decibel levels. For example, nearby quiet areas, or smaller green elements in the surroundings will reduce noise annoyance. Also, quiet sides to noise-exposed dwellings can significantly improve people's living environments.

The three topics are closely related and overlapping: quiet areas are not supposed to be totally silent, they are characterized by a calming soundscape where sounds of nature (birds, water, walking on gravel) prevail. Humans sounds or particular soundmarks, such as church bells, may be very valuable, if present in the right place and time.

The IGNA report provides an anthology of legislative examples, research works and case studies with illustrative applications of these concepts. Some general conclusions and recommendations are the following:

- Acoustic quality is more than the absence of sound. Unwanted noise is only brought down because there are other sounds that we do want to hear. Yet, some sounds such as traffic and industry are mostly disliked and harmful, and should be constrained.
- Quiet areas are positive for people's physical and mental health. They are under pressure due to housing demands and economic development. Efforts to protect them and make them accessible should increase.
- The development of the soundscape approach into guidelines and ISO standards, including efforts to objectively describe and quantify acoustic environments, is interesting and welcome, as the complexity of acoustic urban environments requires more than decibel levels.

5. CONCLUSIONS

The EPA Network Interest Group on Noise Abatement (IGNA) has been active since 2011 to exchange and publish information and provide policy recommendations on all environmental noise topics. Starting with road, rail and air transport as the most relevant sources in 2011-2016, the group has widened its scope to more overarching topics in 2017-2022, focusing on decision making methods, noise limit and target values, quiet areas, soundscaping and urban planning. These are valuable and important tools for local and national policy makers, to help them manage and regulate noise in general.

In the meantime, the situation has not improved. The number of Europeans exposed to harmful levels of noise has not decreased and is likely to increase, due to urban growth and increased mobility [1]. The Commission has set an ambitious target in their Zero Pollution Action Plan to reduce the share of people disturbed by noise by 30%, which is hopeful and welcomed by IGNA. Yet, as the EEA has communicated in a recent briefing³, supported by a scenario study [14], *reaching this target is unlikely without further regulatory or legislative changes.*

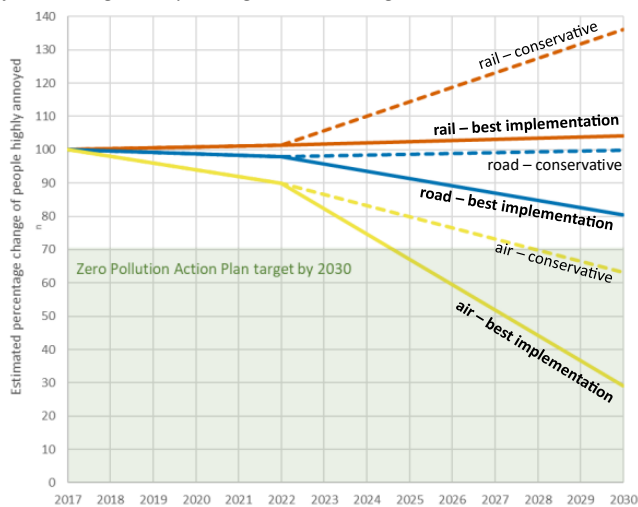


Figure 5. Outlooks for 2022 and 2030 for the change in highly annoyed people >55 dB L_{den} , for conservative (—) and best implementation (---) scenarios [14]

Figure 5 shows the scenario study results for noise annoyance, while other indicators (e.g. number of people

³ <https://www.eea.europa.eu/publications/outlook-to-2030/outlook-to-2030-can-the>

exposed, sleep disturbance) show similar trends. Significant reduction of road traffic noise, which is the largest source of noise exposure, is particularly difficult to reach. Railway noise is expected to increase due to an expected increase of traffic activity, as railways are the sustainable transport mode in every other aspect but noise. In urban areas some decrease of rail noise is expected in the best implementation scenario. Aircraft noise is projected to decrease as a result of quieter aircraft and low noise take-off and landing procedures.

Additionally, many European countries and cities see a rising demand for more housing, which puts more pressure on making land available for residents. This means more houses in high noise-exposed areas and less space available for green and quiet areas.

6. RECOMMENDATIONS AND OUTLOOK

With these conclusions and this status quo in mind, the IGNA has several recommendations aimed at policy makers, the transport and vehicle industry and the noise community.

For road noise:

- experts and policy makers must stay on top of the EU and UNECE noise regulations for vehicles and tyres, to put pressure on improving measurement methods and emission limits;
- EU and local authorities should increase enforcement of measures against noisy vehicles, such as motorcycles, high performance cars and noisy exhausts. Eliminating these high emitters will reduce both the exposure and the response, as these vehicles are much more disturbing than others;
- low noise tyres and pavements should be further promoted, as increased demand will stimulate innovation for tyre manufacturers and road contractors. Tyre and possibly road labelling should be enhanced for this purpose.

For rail noise:

- the implementation of the new TSI Noise and the Quieter Routes approach should be further monitored and supported;
- further measures at the source, such as disc brakes, low noise rail pads or sleepers, must be examined to counteract the increased exposure as a result of the growing demand for sustainably traffic;

- reduction efforts should include also (high speed) passenger transport and noise emitted by parked trains in urban areas.

For aircraft noise:

- further implementation of the Balanced Approach by EU airports should be supported, taking into account recommendations from the Commission's recent evaluation;
- remaining scientific discussions towards the WHO recommendations should be settled;
- unmanned aerial vehicles (UAV, or 'drones') are arising as a potential future noise problem. This urgently calls for additional or updated EU and local noise regulations for these vehicles.

And with respect to noise abatement in general:

- urban planners must consider noise in an early stage. Successful reduction of emissions should not lead to housing constructed closer to infrastructure, as this will retain the problem;
- authorities should realize the importance of quiet areas and other areas with positive soundscapes especially in noisy urban areas, as they provide inhabitants with places to recover and restore;
- vibrations and low frequency noise are relevant related subjects especially for railways, wind turbines and industry, and should not be neglected.

It will be the focus of the IGNA to make these recommendations more specific and to bring these closer to the attention of decision makers in the coming years. In the 38th EPA Network plenary meeting in Bucharest, October 2022, the Final Report was endorsed by the EPA Network a new mandate was given to IGNA for the period 2023-2027. The Heads of other EPAs were requested to consider participation in this Interest Group.

7. ACKNOWLEDGMENTS

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