



## Noise

### Impacts and protection

Noise research Interview with Dr Irene van Kamp

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# Loud, louder, noise

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If like me you live in Hessen, and close to Frankfurt Airport at that, you are bound to be familiar with the subject of noise. But it is not only near airports that people are being subjected to ever-increasing noise pollution. Many of us are finding that traffic noise, the sound of construction work or the noise of loud machinery such as lawnmowers gets on our nerves. Sometimes the noise is temporary – the house is built, the noise stops – but nevertheless, we are often exposed for long periods to decibel levels that can affect our wellbeing and even our health.

Here at the Oeko-Institut we have been working on the subject of noise for some time. Our detailed work began with our involvement with the various stages of the expansion of Frankfurt Airport. For more than 15 years we have been assisting the opposing parties with mediation and providing them with independent scientific expertise. We have also built up extensive knowledge and experience of aircraft noise and noise protection and of the effects of noise on health and quality of life. This first issue of *eco@work* in 2017 describes our work in this area – and in particular our recent activities.

At this point I should like to draw your attention to our forthcoming 40th anniversary. The Oeko-Institut, which was founded on 5 November 1977, is 40 years old this year! While we plan to use the event as an opportunity to look back, it is even more important that we look to the future and consider the challenges and tasks that face us and environmental policy in general. And we shall do a bit of celebrating as well! This will happen on various occasions, both online and offline, and a special issue of *eco@work* will be published to mark the anniversary. Let us look forward to this together, and I hope you enjoy reading the current issue.

Yours,

Michael Sailer

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*eco@work* – March 2017 – ISSN 1863-2025

Published by: Öko-Institut e.V.

Edited by: Dr Bettina Brohmann, Mandy Schossig (mas), Christiane Weihe (cw)

Responsible editor: Michael Sailer

Translated by: Christopher Hay

Design/Layout: Tobias Binnig, www.gestalter.de – Technical implementation: Markus Werz

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#### Account Details for Donations:

GLS Bank, Bank Code No.: 430 609 67, Account No.: 792 200 990 0,

IBAN: DE50 4306 0967 7922 0099 00, BIC: GENODEM1GLS

Donations are tax-deductible for German income tax purposes.

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## “The long-term impacts of noise need researching”

A study over the course of a lifetime? The psychologist Dr Irene van Kamp is an advocate of long-term analyses. She has been researching the effect of noise for many years, currently at the Dutch National Institute for Public Health and the Environment (RIVM) in Bilthoven. In addition to her specific research, the noise expert is active in various national, European and international organisations and projects. She was a member of the Scientific Advisory Board for Quality Assurance of the NORAH Study and is supporting the World Health Organization’s development of updated Environmental Noise Guidelines.

### Dr van Kamp, where is research most urgently needed regarding the effect of noise?

The long-term impact of noise over a lifetime begins during the prenatal stage. We know that children living close to an airport have a higher risk for cognitive effects or disturbance of their sleep. How will their health develop as time goes on – with regard to diseases like cardiovascular disease, diabetes, or chronic sleep disorders? Or people with a vulnerability for cardiovascular diseases: noise affects them, that much is clear; but to find out exactly how, we would need to observe them over an extended period of time. Nowadays the technology we have at our disposal could simplify such studies considerably. Unfortunately it is very difficult to obtain the funding for it.

### Why do you think that is?

I think it has something to do with the fact that noise is not always recognised as health issue. And despite the existing EU directives, policies regarding transport noise and, for example, wind turbine noise vary strongly between countries but also regions.

### Why is the issue of noise so challenging for research?

Unlike environmental pollution by substances, here there is no direct health effect except for hearing damage from really extreme noise levels. It is a somewhat nebulous issue, which also has a lot to do with personal perception. And unfortunately this can easily be devalued.

### On behalf of the WHO you have analysed many studies on noise by other experts.

That’s right. The WHO is working on the revision of its guidelines on noise, or more precisely, its Environmental Noise Guidelines for Europe, until 2017. The work consists of updating a document from 1999 with new insights from noise research. Two groups are involved: the first, which I belong to, has analysed studies on the different facets of noise, from its impacts on cognitive abilities and health and well-being to the aspect of noise abatement. The second group reviews our findings and uses them as a basis for drafting the updated Guidelines.

### What is the topic that you have been working on?

Along with Professor Lex Brown from Australia, I have been looking into the question of how effective noise abatement measures are. We have analysed around forty studies, which were selected according to very clear quality criteria. By comparison, that was a pretty low number: the colleagues who were looking into the effects on the cardiovascular system had hundreds of studies to deal with.

### Can you share any early insights with us?

The studies investigate different types of measures: For example, noise can be tackled directly at the source – by replacing ageing rail tracks, for instance – or in people’s homes, which means fitting better insulation. When it comes

to noise abatement, a combination of measures is the most interesting and probably most effective approach.

### You were also involved in the NORAH Study in an advisory capacity.

Yes, in that instance I brought to bear my expertise about the effect of noise on children. The Scientific Advisory Board for Quality Assurance, of which I was a member, gave expert advice to the project team and reviewed the various reports before publication. By the way, I was especially impressed by one aspect of the project: it is the first time I have ever experienced such intense and positive discussions on the issue of noise in such a varied group of experts.

### Thank you for talking to eco@work.

The interviewer was Christiane Weihe.



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# The roar of the turbines



## Combating aviation noise

Not many things are as loud as a jet plane. During take-off the noise is about 140 decibels (dB). For comparison, the twittering of a bird is about 50 dB, and very loud traffic noise reaches 80 dB. As a means of transport, there is no substitute yet for aeroplanes: for the present, the economy cannot do without them and we depend on them for our holidays too. But people living near airports have a right to be protected from noise pollution. Who is responsible for this noise protection? What needs to be done to reduce aircraft noise? How well are people actually being protected and through what legal avenues can they fight aviation noise? Experts at the Oeko-Institut have been considering these issues.



How people in Germany are protected against noise – whether traffic noise or leisure noise – is not well-regulated in law. “There are a lot of problems associated with noise. For example, we are all responsible for it; everyone makes noise – everyone is a polluter. Noise spreads out; multiple sources of noise accumulate. Moreover, adverse impacts cannot always be countered in the way that you can fit a filter to a chimney or a catalytic converter to a car,” explains Silvia Schütte, Senior Researcher at the Oeko-Institut. “And not everyone is affected to the same extent. In particular, the coinciding of multiple sources of noise tends to affect people living in conurbations. Finding solutions in these places is difficult.” In addition, noise pollution has increased and is continuing to grow – as a result of increasing traffic and the proliferation of urban agglomerations. “The legal framework has not kept up with these developments; other environmental issues usually take priority,” says Schütte, who is a lawyer. “However, I expect that sooner or later noise protection will carve out a course for itself in law. The solutions, though, will need to be as varied as the causes.”

### EVALUATING AVIATION NOISE PROTECTION

Efforts to come up with problem-oriented solutions could be given a boost by the report on developing the legal regulation of protection against aviation noise that the Oeko-Institut is in the process of preparing for the German Environment Agency. Working with two consultancies, GeräuscheRechner and team ewen, Oeko-Institut researchers are paving the way for the 2017 aviation noise protection report. This will be submitted to the Bundestag, which will then have to decide whether the law on protection against aviation noise (FluLärmG) needs to be revised. This law, which was updated in 2007 (the preceding version dated back to 1971), sets out a policy of passive noise protection through construction measures as a means of protecting people in the vicinity of major airports. It also strives to

strike a balance between the needs of residents and the interests of the aviation industry. “The law requires the government to carry out this evaluation; we are now analysing the legal framework, identifying the status of implementation and examining whether the law is working as it should,” says Schütte. “We are particularly interested in two issues. Firstly, are there problems in enforcing the law and if so, what is the reason for them? Secondly, is the legislation sufficient to ensure protection against aviation noise and are the thresholds laid down in the law adequate from a health protection point of view?” The researchers are also examining the findings of recent research into the effects of noise and considering developments in aviation technology.



### A jet plane reaches about **140 decibels** on takeoff

The Oeko-Institut first conducted a comprehensive online survey of a number of interest groups familiar with application of the law on aviation noise. They included the relevant ministries of the federal states as well as other stakeholders such as airline operator associations, airlines, environmental organisations and groups representing affected members of the public. “We had a good response to this survey,” says Schütte, “and the analysis identified various key issues. For example, many of those questioned said that regulation of aviation noise protection is inadequate, because there is no provision for active noise abatement.” Many respondents called for noise thresholds to be reduced. Active noise abatement is an

other avenue that could be explored, for example via modifications to the aircraft themselves. The researchers will finalise their project by collating their findings and considering whether the legal framework needs to be adapted in order to provide better protection against noise.

### THE AIRPORT & REGIONAL FORUM

Experts at the Oeko-Institut have long been involved with the issue of noise from Frankfurt Airport. Frankfurt is Germany’s largest airport, with up to 1,500 planes taking off and landing every day. “We support the work of the Airport & Regional Forum (Forum Flughafen & Region, FFR), which brings together representatives of municipalities and government agencies, the aviation industry, scientists and practical experts, with the aim of identifying and evaluating noise protection measures,” says Silvia Schütte. Scientists from various departments of the Oeko-Institut are involved in an advisory and coordinating capacity; in particular, they examine and assess noise protection proposals. “We support the expert committee on active noise protection, which means that we have, for example, assisted with the first package of measures. The majority of the recommendations were implemented and monitoring showed that they have succeeded in reducing noise.”

Options for active noise protection include the use of noise abatement technology or different flying techniques such as a steeper approach path. A steeper descent means that planes fly at a greater height for longer before landing, thus increasing the distance between the source of noise (the plane) and people on the ground. “There are things that can be done for people affected by aircraft noise – and Frankfurt’s example shows that, although they involve a lot of work, they can be extremely successful. In addition, better use should be made of synergies, for example by adapting measures that have



been tested at one location so that they can be used elsewhere." However, active noise protection is often very complex and simple solutions are rare. Approach routes are moved to avoid densely populated areas: this means that fewer people are disturbed by aircraft noise – but it also shifts the pollution so that the effect on some people living nearby may be worse than it was before.

## POLICY-MAKERS AND THE PUBLIC

For Silvia Schütte, a valuable aspect of the Airport & Regional Forum is its integrative function in bringing together a range of stakeholders with different interests. "However, we still need to work out the best way of involving the public. For example – leaving aside local participation formats such as the FFR – they could be much more closely involved in the search for solutions to the problems that exist." But decisions should be taken by policy-makers, not the public. "Policy-makers must shoulder significantly more responsibility than they have done in the past. As a scientist and also as a citizen I am frustrated by how policy-makers fail to utilise their scope for action, so that things that they could have handled are decided by the courts. One such issue is the weighting of noise pollution and the importance it is accorded when giving planning approval for airports and flight routes." In her view, the federal states have a responsibility here, as well as the central government: "The state parliaments could provide guidance; for example, they could designate low-noise zones

or decide for a general distribution of noise. The wider public could be involved in such decisions. The federal government could specify places where for one reason or another nocturnal air traffic is permitted – night flying would then be banned elsewhere." And without night-time aircraft, the only sounds that residents hear at night might then be the rustling of leaves or the buzzing of a mosquito. If they're lucky, that is – because both produce only about ten decibels.

*Christiane Weihe*



Up to **1.500 planes**  
take off and land at Frankfurt  
Airport every day

The Oeko-Institut's work on improving active noise protection at Frankfurt Airport is far from finished. There is always more to be done: there are plans for additional measures to bring about further improvements. The Oeko-Institut continues to work on these issues with the various interest groups represented in the Airport & Regional Forum.



*Silvia Schütte is a lawyer who specialises in national and European environmental law. Since joining the Oeko-Institut in 2010 she has worked on issues of participation and environmental law. As part of this role she has been involved in evaluating the statutory framework and organising civil-society dialogue.*

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# Mind the noise!



## The effects of traffic noise

On the race circuit in Abu Dhabi Nico Rosberg is doing lap after lap as he chases the World Championship title. The noise that he makes is for many the sound of freedom and the weekend. In the night after the Formula One race a lorry drives past the house. The noise that it makes forces us to close the windows. How we perceive noise depends partly on our subjective feelings about the source; it is influenced by our sensibilities and by the situation in which we find ourselves. But even if we sometimes enjoy noise, it can still have a significant effect on our health and wellbeing. A research consortium has conducted a comprehensive study of the effects of noise on health, quality of life and cognitive performance. The Oeko-Institut assisted with this study.

The effects of noise on humans are often hard to measure. This is illustrated by an example from the work of the Airport & Regional Forum (Forum Flughafen & Region, FFR), which the Oeko-Institut supports in an advisory and coordinating capacity. Focus groups were used to explore how people living near Frankfurt Airport react to “noise breaks” – i.e. periods during which no aircraft pass over their homes. Although the vast majority of those questioned stated that they had not noticed whether the noise situation had actually changed, an almost

equally large majority nevertheless want the noise breaks to be continued. This demonstrates the importance of considering not only the physical influence of noise but also its psychological and emotional impacts.

### THE NORAH STUDY

The specific impacts of traffic noise on health and quality of life have been explored in the study of Noise-Relat-

ed Annoyance, Cognition and Health (NORAH), the most extensive European analysis of this issue to date. The study, which was commissioned by the Umwelt- und Nachbarschaftshaus (UNH) information centre, was conducted by a research consortium comprised of experts in acoustics, medicine, psychology and the social sciences. The Oeko-Institut was involved in preparation and support and acted as an interface between the consortium, the external quality assurance process and the UNH.



## NORAH considers the medical history of around a million people

NORAH has set new scientific standards – by questioning around 30,000 individuals, considering the medical history of about a million people, and measuring noise pollution at some 900,000 addresses. It covered the Rhine-Main area and the regions around the Stuttgart, Cologne/Bonn and Berlin-Brandenburg airports.

The effects of noise from air, rail and road traffic on health, quality of life, and children's cognitive development were analysed in three modules. In Module 1, large-scale surveys provided information on noise pollution and quality of life. Module 2, which was concerned with health, looked at blood pressure, cardiovascular disease, and the risks of breast cancer and depression – in part by measuring the blood pressure of people living near Frankfurt Airport over two three-week periods. For the third module, which explored the impacts of persistent aviation noise on the quality of life and cognitive development of schoolchildren, the researchers administered cognitive ability tests and questioned children, parents and teachers.

The extensive work conducted by NORAH shows that at comparable sound levels, air traffic causes greater annoyance than road and rail traffic. The noise experienced by residents of some areas close to Frankfurt Airport is considerable: in 2012 more than 340,000 people were exposed to aviation noise levels of 50 decibels or more. The study found a close link between traffic noise and the risk of illness. Noise influences health in various ways. For all three types of traffic noise the link is mainly with chronic diseases; there are correlations with the incidence of heart failure, heart attacks, strokes and depression, although the size of the correlation varies for each type of noise and

each disease. For example, road and rail traffic noise has a more noticeable effect on strokes, heart attacks and heart failure than does aviation noise. For aviation noise the largest correlation is with depression: if the continuous sound level increases by ten decibels, the risk of becoming depressed rises by 8.9 percent. The continuous sound level is the average level of noise over a defined period, as determined by the frequency, duration and volume of individual sound events. Another finding is that children's progress in learning to read can be delayed if the school is persistently exposed to aviation noise. NORAH found that reading development is set back by about a month if the noise level increases by ten decibels. Teachers from severely affected schools also stated that the aviation noise had a seriously detrimental effect on lessons. As a result of the study, structural sound insulation in schools near Frankfurt Airport has already been improved.

### NEW THINKING

NORAH also looked at the "change effect", which refers to the observation by noise researchers that people may react more strongly to a change in noise than would be expected from the noise level itself. People living near an airport where flight activity is expanding may find a given level of continuous sound significantly more troubling than they did before the expansion commenced. This may be partly due to the change effect. The study also raises the question of whether the continuous sound level is the correct measure of noise-related annoyance. A more relevant criterion might be the maximum sound level – the maximum volume of an individual noise. According to NORAH, this could also influence the health risks and it

should therefore be taken into account in future studies of the effects of noise.

Moreover, noise-protection policy and research into the effects of noise have for a long time ignored psycho-social factors. But, as mentioned at the outset, these factors exert a strong influence on the perception of noise and hence also on the physiological consequences. It is likely that we shall need to re-think these interactions. For example, the question of whether noise has a negative impact on health cannot be answered solely through reference to blood pressure readings. We need to talk to people and take other influences into account. If someone feels unwell or is having a difficult time, this can affect their physical and mental health. Health will also be affected if people get worked up about noise or feel defencelessly exposed to it. The fact that this is now accepted by many decision-makers is an important step forwards – and will affect future measures for protecting people against the impacts of traffic noise.

*Dr Bettina Brohmann*



*As a Research Coordinator for Transdisciplinary Studies, Dr Bettina Brohmann assists with projects in various areas of the Oeko-Institut's work. She specialises in issues that include the social aspects of energy and climate policy, consumer research and motivation research, and participation in decision-making processes.*

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