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# Teknisk Notat

## Ny Viden

**2012-2**

**MILJØSTYRELSENS**
**REFERENCELABORATORIUM**
**FOR STØJMÅLINGER**

| | |
|---|---|
| **Titel** | Ny Viden 2012-2 |
| **Journal nr.** | RL-1/13 |
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| **Rekvirentens ref.** | Jørgen Jakobsen |

DELTA, 1. februar 2013

Jens E. Laursen

# Indholdsfortegnelse

# 1. Baggrund og formål

Miljøstyrelsen har ønsket, at en del af Referencelaboratoriets aktiviteter i 2012 skulle være at formidle ny viden til Miljøstyrelsen. Referencelaboratoriet har gennemgået tidsskrifter og samlet en oversigt over årets kongresser for at identificere ny viden af betydning for måling og administration af ekstern støj. Notatet udsendes to gange om året. Søgningen i tidsskrifter er afsluttet i december 2012.

Indholdsfortegnelser for de valgte tidsskrifter findes på de respektive hjemmesider på Internettet. Links til disse hjemmesider er angivet i Bilag 1.

# 2. Afgrænsning

Valg af emner og vægtning af stoffet er rettet mod Miljøstyrelsen.

# 3. Tidsskrifter

## 3.1 Journal of the Acoustical Society of America (JASA)

Årgang 2012: Vol. 132, No. 2 - 6 (august - december)

Et link til dette tidsskrift findes i Bilag 1. Der er fundet følgende artikler:

*Annoyance and self-reported sleep disturbance due to night-time railway noise examined in the field*

Vol. 32, No.5, pp. 3109-3117, Sibylle Pennig, Julia Quehl, Uwe Mueller, Vinzent Rolny, Hartmut Maass, Mathias Basner, and Eva-Maria Elmenhorst

Formålet med denne undersøgelse var at finde dosis-respons-forholdet mellem jernbanestøj om natten og geneoplevelsen og desuden viden om subjektive søvnforstyrrelser. Undersøgelsen var et feltstudie, hvor der deltog 33 personer, der alle boede nær en jernbane i Køln/Bonn området, hvor der kører en stor andel godstog - de fleste eldrevne. Støjen blev målt som $L_{Aeq}$ tæt ved den sovendes øre. Der blev målt over 9 sammenhængende dage heriblandt to weekender, og antallet af gods- og passagertog i søvnperioden blev optalt. Efter hver nat skulle deltagerne udfylde et spørgeskema om søvnkvalitet og –forstyrrelser, evalueret på en 5-punkt skala.

Støjgenerne skyldtes hovedsageligt godstog, som havde større varighed, makismalniveau og lavfrekvent støj end passagertog.

Den rapporterede støjgene steg signifikant med antallet af tog (overvejende godstog), men kun lidt med det indendørs støjniveau, $L_{Aeq}$. Andelen af moderat til stærkt generede personer varierede mellem 2 % (ved 10 tog pr. nat) og 45 % (ved 183 tog pr. nat). Også hyppigheden af deltagernes opvågninger om morgenen (søvnforstyrrelser) blev signifikant påvirket af antallet af tog. Derimod var andre aspekter, såsom den subjektive vurdering af søvnkvaliteten (og – kvantiteten), sovedybde og restituering efter søvnen, ikke påvirket signifikant af det målte støjniveau. Forfatterne fremhæver, at resultaterne viser, at for soveforstyrrelser er antallet af forstyrrelser / begivenheder (togpassager) en bedre støjindikator end middelstøjniveauet ($L_{Aeq}$), begrundet i de basale egenskaber ved menneskets hørelse, som påvirkes af hurtige forandringer (begivenheder) i omgivelserne snarere end langtidspåvirkninger ($L_{Aeq}$).

Resultaterne understøtter ikke teorier om "støjtilvænning", idet de beboere, som havde boet der i længst tid, var mere generede end dem, som havde boet der i kort tid. Resultaterne peger snarere på, at individuel tilvænning til jernbanestøj har at gøre med folks evne til generelt at håndtere indtryk.

*Exposure modifiers of the relationships of transportation noise with high blood pressure and noise annoyance*

Vol. 132, No. 6, pp. 3788-3808, Wolfgang Babisch et. al

Artiklen er ikke fundet umiddelbar relevant.

## 3.2 Applied Acoustics

Årgang 2012: Vol. 73, No. 12 (december)

Årgang 2013: Vol. 74, No. 1 - 5 (januar - maj)

Et link til dette tidsskrift findes i Bilag 1.

Volume 74, No.2, pp. 223-300, var et temanummer om lydlandskaber (*Applied soundscapes*). Artiklerne har følgende overskrifter:

*Handbook for acoustic ecology*

*Perception of soundscapes: An interdisciplinary approach*

*The development and application of the emotional dimensions of a soundscape*

*Soundscape categorization on the basis of objective acoustical parameters*

*An exploratory evaluation of perceptual, psychoacoustic and acoustical properties of urban soundscapes*

*The production of a Perceived Restorativeness Soundscape Scale*

*Time frequency source separation and direction of arrival estimation in a 3D soundscape environment*

*Investigation of sampling frequency requirements for acoustic source localsation using wireless sensor networks*

*Physiological responses to and subjective estimates of soundscape elements*

*Analysis of the perception and representation of sonic public spaces through on site survey, acoustic indicators and in-depth interview*

*A framework for improving urban soundscapes*

## 3.3 Journal of Low-Frequency Noise, Vibration, and Active Control

Årgang 2012: Vol. 31, No. 2 – 3 (juni - september).

Et link til dette tidsskrift findes i Bilag 1. Der er fundet følgende artikel:

*Helping sufferers to cope with noise using distance learning cognitive behaviour therapy*

Vol. 31, No.3, pp. 193-204, Authors Geoff Leventhall, Donald Robertson, Steve Benton, and Lyn Leventhall.

I denne artikel fra England gennemgås først problematikken omkring folks reaktioner overfor støj, i særdeleshed i de tilfælde, hvor personer oplever støjgener ved støjniveauer tæt på eller under støjgrænsen. Forfatterne understreger, at støjbekæmpelse bør prioriteres højest, men at man i de tilfælde, hvor støjkilden ikke har kunnet lokaliseres, bør finde nogle midlertidige personligt individuelle løsninger, der kan afhjælpe stress og angst.

I artiklen beskrives et opfølgningsprojekt baseret på erfaringer fra deres tidligere undersøgelse publiceret i samme tidsskrift, Vol. 27, No. 1, pp. 35-52, *Coping Strategies for Low Frequency Noise*. Undersøgelsen omhandlede et forsøg med 9 personer, der havde klaget over støj. I forsøget blev der afholdt gruppeterapimøder med en psykoterapeut og gennemført spørgeskemaundersøgelser før og efter forsøget. Forsøget blev ledet af psykoterapeuten Donald Robertson, som ekspert i kognitiv adfærdsterapi (*CBT – Cognitive Behaviour Therapy*). Forsøget viste en klar tendens til forbedring af deltagerne livkvalitet, men antallet af personer var for lille til at

kunne konkludere med statistisk signifikans. Begge projekter var finansieret af Defra (UK Department for Environment, Food and Rural Affairs). Artiklen er resumeret i Ny Viden 2008-1.

Opfølgningsprojektet bestod af udvikling og gennemførelse af et online-kursus af 6-8 ugers varighed. Der blev udsendt materiale med 3 CD'er, og kurset indeholdt følgende lektioner: Introduktion og forberedelse, opbygning af motivation og overvågning af fremskridt, følsomhedsnedsættelse overfor lyde, sund indstilling til lyde og lære at sove bedre. På et online-diskussionsforum kunne deltagerne komme i kontakt med hinanden og lærerne.

I alt 29 personer gennemførte kurset og udfyldte spørgeskemaer, hvor de på en 5-trins skala skulle evaluere i hvor høj de var enige i 25 udsagn, som omhandlede negative reaktioner på lavfrekvent støj. De største problemer viste sig at være søvn/træthed samt ængstelse/anspændthed. En sammenligning af spørgeskemaerne før og efter kurset viste, at vurderingerne af de 25 udsagn gennemsnitligt faldt med 1 – 1,5 point på responsskalaen (i retning af mindre gene).

Artiklen gengiver til sidst 17 af deltagernes peronlige evaluering af kurset.

Forfatterne konkluderer, at e-learning-kurset reducerede stressniveauet for mange af deltagerne og gav dem større livskvalitet og bedre søvn.

## 3.4 Noise Control Engineering Journal

Årgang 2012: Volume 60, No. 3 - 5 (juni - september)

Et link til dette tidsskrift findes i Bilag 1. Der er ikke fundet relevante artikler.

## 3.5 Acta Acustica

Årgang 2012: Vol. 98, No. 5 – 6 (september/oktober - november/december)

Et link til dette tidsskrift findes i Bilag 1. Følgende artikel er udvalgt:

*The Influence of Background Sounds on Loudness and Annoyance of Wind Turbine Noise*

Vol. 98, No.5, pp. 741-748, Karl Bolin, Anders Kedhammar, Mats E.Nilsson

Kun abstract er læst. Forfatterne har foretaget en lyttetest med henblik på at undersøge maskeringseffekten fra naturlige lyde i sammenhæng med vindmøllestøj. Det oplevede loudness niveau og støjens genevirkning blev fundet – med og uden baggrundslyde fra naturlige omgivelser. Resultaterne indikerer, at den oplevede loudness og støjgene mindskes, når niveauet af

baggrundslydene overstiger vindmøllens støjniveau. Loudness-undersøgelsen viste, at opfattelsen af baggrundslyde influerer mere på opfattelsen af vindmøllestøjen, end hvad der kan forventes af niveaumæssig maskering på energibasis. Omfanget af genevirkningen hang derfor mindre sammen med baggrundslydniveauet end med loudness-niveauet. Forfatterne konkluderer, at maskering med positive naturlige baggrundsslyde kan benyttes som et supplement i tilfælde, hvor konventionelle metoder til støjdæmpning ikke er tilstrækkelige.

# 4. Kongresser

ICA - International Commission for Acoustics - har en liste over møder og kongresser på deres hjemmeside: www.icacommission.org/calendar.html.

EAA - The European Acoustics Association - har en tilsvarende liste over deres møder og konferencer her: http://www.european-acoustics.org/event-calendar/eaa-conferences.

## 4.1 Euronoise

Afholdtes sidst i forbindelse med "Ninth European Conference on Noise Control" den 10.-13. juni 2012 i Prag, Tjekkiet. Euronoise afholdes næste gang i 2015.

Link:

www.euronoise2012.cz

## 4.2 Inter-Noise

Afholdtes sidst den 19.-21. august 2012 i New York. Inter-Noise afholdes næste gang den 15.-18. september 2013 i Innsbruck, Østrig.

Links:

www.internoise2012.com

www.internoise2013.com

## 4.3 International Conference on Noise as a Health Problem

Afholdtes forrige gang den 21.-25. juli 2008 i Mashantucket, Pequot Tribal Nation (CT, USA), som en del af "The 9th Congress of the International Commission on the Biological Effects of Noise (ICBEN)". Papers fra denne konference kan hentes på www.icben.org.

Afholdtes sidst den 24.-28. juli 2011 i London, England. Et kompendium herfra kan købes her: http://www.proceedings.com/12476.html.

Det vides endnu ikke, hvor konferencen afholdes næste gang.

## 4.4 Forum Acusticum

Afholdes hvert 3. år, sidst den 26. juni-1. juli 2011 i Aalborg, Danmark. Afholdes næste gang den 7.-12. september 2014 i Krakow, Polen.

Links:

www.fa2011.org

www.fa2014.pl

## 4.5 Baltic-Nordic Acoustics Meeting

Afholdes hvert 2. år, forrige gang den 10.-12. maj 2010 i Bergen, Norge. Afholdtes sidst den 18.-20. juni 2012 på Syddansk Universitet i Odense, Danmark. Afholdes næste gang den 2.-4. juni 2014 i Tallinn, Estland.

Link:

www.bnam2012.com

## 4.6 Low Frequency Noise and Vibration and its Control

Afholdtes forrige gang den 9.-11. juni 2010 i Aalborg, Danmark. Afholdtes sidst den 22.-24. maj 2012 i Stratford upon Avon, England (14th International Conference on Low Frequency Noise and Vibration and its Control). Afholdes næste gang i 2014.

Links:

www.lowfrequency2010.org

www.confweb.org/lfn2012

## 4.7 Wind Turbine Noise 2011

Afholdes hvert 2. år, sidst den 11.-14. april 2011 i Rom (4th International Conference on Wind Turbine Noise). Afholdes næste gang 27.-30. august 2013 i Denver, USA.

Links:

www.windturbinenoise2011.org

www.inceusa.org

# Bilag 1

## Links til tidsskrifters hjemmesider

### Journal of the Acoustical Society of America (JASA)

http://asadl.org/jasa/resource/1/jasman

### Applied Acoustics

http://www.sciencedirect.com/science/journal/0003682X

### Journal of Low-Frequency Noise, Vibration and Active Control

http://multi-science.metapress.com/content/121510/

### Noise Control Engineering Journal

http://ince.publisher.ingentaconnect.com/content/ince/ncej

### Acta Acustica

http://www.ingentaconnect.com/content/dav/aaua;jsessionid=2hrx8pvp3nh7.victoria

# Bilag 2

## Udvalgte abstracts fra Inter-Noise konferencen 2012 i New York

*Perception-based protection from low-frequency sounds may not be enough* (Paper No. 602)

Alec N. Salt, Jeffery T. Lichtenhan, Department of Otolaryngology, Washington University School of Medicine

Hearing and perception in the mammalian ear are mediated by the inner hair cells (IHC). IHCs are fluid-coupled to mechanical vibrations and have been characterized as velocity sensitive, making them quite insensitive to low-frequency sounds. But the ear also contains more numerous outer hair cells (OHC), which are not fluid coupled and are characterized as displacement sensitive. The OHCs are more sensitive than IHCs to low frequencies and respond to very low-frequency sounds at levels below those that are perceived. OHC are connected to the brain by type II afferent fibers to networks that may further attenuate perception of low frequencies. These same pathways are also involved in alerting and phantom sounds (tinnitus). Because of these anatomic configurations, low-frequency sounds that are not perceived may cause influence in ways that have not yet been adequately studied. We present data showing that the ear's response to low-frequency sounds is influenced by the presence of higher-frequency sounds such as those in the speech frequency range, with substantially larger responses generated when higher-frequency components are absent. We conclude that the physiological effects of low-frequency sounds are more complex than is widely appreciated. Based on this knowledge, we have to be concerned that sounds that are not perceived are clearly transduced by the ear and may still affect people in ways that have yet to be fully understood.

*Numerical simulation of infrasound perception, with reference to prior reported laboratory effects* (Paper No. 1451)

M.A.Swinbanks, MAS Research Ltd, 8 Pentlands Court, Cambridge

In earlier presentations, the author has argued that conventional assessments of the perception of infrasound based on mean (rms derived) sound energy levels underestimate the importance of the associated crest factor of very low frequency sound pressure variations. By simulating the dynamic response of the ear at levels close to the hearing threshold, it is apparent that infrasound may be perceptible at lower levels than those based on long time constant rms assessment. In particular, it will be shown that the existence of a finite threshold of audibility, together with the added presence of low level higher frequency noise in the first critical band (i.e. below 100Hz), can imply the perception of infrasound at significantly lower levels than has hitherto been acknowledged. The results of simulations will be compared to independently reported effects which have been observed in laboratory testing by other researchers.

*Noise events in road traffic and sleep disturbance studies* (Paper No. 260)

A.L. Brown and Deanna Tomerini, Urban Research Programme, Griffith School of Environment, Griffith University, Brisbane, Australia
Dibyendu Banerjee, Department of Environment, B.B.College, Asansol, West Bengal, India & Visiting Research Fellow, Urban Research Programme, Griffith University, Australia

A conclusion from the sleep literature is that integrated measures of road traffic noise levels by themselves (eg Lnight) do not account for all of the observable effects of traffic noise on human sleep, and that level and numbers of noise events in road traffic streams are related to sleep disturbance. Each of the END and the Night Noise Guidelines for Europe refer to both integrated energy descriptors and noise event descriptors as measures relevant to assessment of human sleep disturbance. At Griffith University we are beginning to investigate more closely the occurrence and nature of noise events arising from road traffic streams (our focus is specifically on road traffic noise events, not air or rail traffic noise events), including the relationship between noise event metrics and more conventional noise metrics. As part of this we have scanned, and report in this paper, how noise events have been measured and utilised in the literature of experimental and field sleep disturbance studies from road traffic noise. Our work is still in progress, but we note that, while the notion of an "event" in a noise stream is conceptually unambiguous, the application of the concept to streams of road traffic noise, vis-à-vis air and rail traffic noise, needs further consideration.

*Examining an empirical relationship between Lnight and the probability of awakening* (Paper No. 137)

Nicholas P. Millera, Harris Miller Miller & Hanson Inc., Burlington, Massachusetts, USA

The World Health Organization, WHO, has proposed "Night Noise Guidelines for Europe" which it recommends in terms of Lnight (11 p.m. to 7 a.m.). The target recommended is Lnight,outside of 40 dB with an interim target of 55 dB. Sleep disturbance, however, is acknowledged to be a reaction to single events. Hence, any single value of Lnight can be a result of many combinations of single event levels and hence could result in different degrees of sleep disturbance. This paper uses measured values of indoor night time Sound Exposure Levels produced by aircraft overflights, applies the methods of ANSI Standard S12.9-2008, Part 6, "Methods for Estimation of Awakenings Associated with Outdoor Noise Events Heard in Homes," and compares the resulting probabilities of awakening with the associated computed Lnight values. The author finds some correlation of Lnight with the probability of awakening and ponders the selection of a quantitative sleep disturbance guideline.

*Road traffic noise and risk for stroke and myocardial infarction* (Paper No. 384)

Mette Sørensen, Zorana J Andersen, Rikke B Nordsborg, Anne Tjønneland,, Ole Raaschou-Nielsen, Danish Cancer Society Research Centre, Danish Cancer Society
Kenneth G Lillelund, Rambøll Danmark A/S
Jørgen Jakobsen, Danish Environmental Protection Agency
Kim Overvad Department of Epidemiology, School of Public Health, Aarhus University

Epidemiological studies have found long-term exposure to road traffic noise to increase the risk for cardiovascular disorders. Also, ambient air pollution which correlates with road traffic noise has been associated with cardiovascular disorders, but only few inconsistent studies include both exposures. In a population-based cohort of 57.053 people aged 50 to 64 years at enrolment in 1993-1997, we identified 1881 cases of first-ever stroke and 1600 cases of first-ever myocardial infarction between enrolment and 2006. Exposure to road traffic noise and air pollution from 1988 to 2006 was estimated for all cohort members from residential address history. Associations between exposure to road traffic noise and event (stroke and myocardial infarction) were analysed in a Cox regression model with adjustment for air pollution (NOx) and other potential confounders. We found an incidence rate ratio (IRR) for stroke of 1.14 (95% confidence interval (CI): 1.03–1.25) and for myocardial infarction of 1.12 (95% CI: 1.02-1.22) per 10 dB higher level of road traffic noise (Lden). For stroke, there was a statistically significant interaction with age with a strong association among cases over 64.5 years (IRR: 1.27; 95% CI: 1.13–1.43) and no association for those under 64.5 years.

*Exposure modifiers of the relationships between road traffic noise and aircraft noise with high blood pressure (HYENA study)* (Paper No. 526)

Wolfgang Babisch, Federal Environment Agency (UBA),
Danny Houthuijs, Wim Swart,The National Institute For Public Health And The Environment
Konstantina Dimakopoulou, Panayota Sourtzi, National and Kapodistrian University of Athens
Jenny Selander, Gösta Bluhm, Karolinska Institute
Ennio Cadum, Piedmont Regional Environmental Protection Agency
Sarah Floud, Anna L Hansell, Imperial College London

Within the framework of the multi-centred HYENA study, the relationship between road traffic noise, aircraft noise and hypertension was investigated. The data collection comprised a variety of potentially exposure modifying factors, including type of housing, location of rooms, window opening habits, use of noise reducing remedies, shielding due to obstacles and lengths of exposure. The quantitative role of these factors on the relationship between noise and hypertension is explored (interaction terms, stratified analyses). Type of housing, length of residence, location of rooms and the use of noise reducing remedies modified the relationship between noise and hypertension. However, the effects were not always in the direction of a stronger association in the presumably higher exposed subgroups.