EVALUATION OF AIRCRAFT NOISE – PROTECTION OF RESIDENTS

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Introduction The paper is focussed on aircraft noise. Based on an extensive and detailed review evaluation criteria are suggested for the prediction of the effects and for the protection of residents living in the vicinity of civil airports. The protection concept provides graded assessment values:

– *Critical Loads* indicate noise loads that shall be tolerated only exceptionally during a limited time.
– *Protection Guides* are central assessment values for taking actions to reduce noise immission.
– *Threshold values* inform about measurable physiological and psychological reactions due to noise exposures where long-term adverse health effects are not expected.

Table 1: Evaluation criteria for different protection goals

Aircraft noise – Evaluation criteria Griefahn, Jansen, Scheuch, Spreng, 2002			
noise level	threshold-value	protection guide	critical load
hearing damage			
L_{max}	90 dB(A)	95 dB(A)	115 dB(A)
$L_{eq,\ 24\ h}$	70 dB(A)	75 dB(A)	80 dB(A)
communication			
$L_{eq,\ 16\ h,\ indoor}$	35 dB(A)	40 dB(A)	45 dB(A)
$L_{eq,\ 16\ h,\ outdoor}$	56 dB(A)	59 dB(A)	62 dB(A)
sleep, two periods 2/3 of flights between 22.00 and 1.00			
$L_{max,\ 22\text{-}1\ h,\ indoor}$	23 x 40 dB(A)	8 x 56 dB(A)	6 x 60 dB(A)*
$L_{max,\ 1\text{-}6\ h,\ indoor}$		5 x 53 dB(A)	
$L_{eq,\ 22\text{-}1\ h,\ indoor}$	30 dB(A)	35 dB(A)	40 dB(A)
$L_{eq,\ 1\text{-}6\ h,\ indoor}$		32 dB(A)	
sleep, one period			
$L_{max,\ 22\text{-}6\ h,\ indoor}$	23 x 40 dB(A)	13 x 53 dB(A)	6 x 60 dB(A)*
$L_{eq,\ 22\text{-}6\ h,\ indoor}$	30 dB(A)	35 dB(A)	40 dB(A)
high annoyance			
$L_{eq,\ 16\ h,\ outdoor}$	55 dB(A)	62 dB(A)	65 dB(A)
recreation			
$L_{eq,\ 16\ h,\ outdoor}$	50 dB(A)	57 dB(A)	64 dB(A)
diseases			
$L_{max,\ 16\ h,\ outdoor}$	-	25 x 90 dB(A)	19 x 99 dB(A)*
$L_{eq,\ 16\ h,\ outdoor}$	-	65 dB(A)	70 dB(A)

*This number-and-noise value must not be excreeded

Evaluation criteria in terms of noise levels are provided for various protection goals (Tab. 1). Apart from hearing damage, evaluation criteria are provided for the avoidance of primary extraaural effects on communication and on sleep, for the avoidance of annoyance as a secondary effect and for the avoidance of suspected cardiovascular diseases. They enable authorities to outline the areas around airports, where appropriate measures are mandatory to protect the residents against the deleterious effects of noise.

The protection goals given in Table 1 refer to the average person. There are, however, persons and situations where special noise abatement is appropriate. The noise levels presented in Table 2 are suggested for the indoor environment and refer predominantly to undisturbed communication and to undisturbed rest and sleep.

Table 2: Protection Goal: Persons/areas with special needs

Kindergartens:		L_{eq} = 36 dBA	
Schools:		L_{eq} = 40 dBA	
Hospitals:	Day:	L_{eq} = 36 dBA	L_{max} = 45 dBA
	Night:	L_{eq} = 30 dBA	L_{max} = 40 dBA
Old peole's homes:	Day:	L_{eq} = 36 dBA	L_{max} = 51 dBA
	Night:	L_{eq} = 32 dBA	L_{max} = 45 dBA

Under the aspect of noise abatement, the effects of aircraft noise on the residents in the vicinity of airports, is estimated by the calculation of outdoor levels. Where the evaluation values were defined for the indoor environment a 15 dBA additional is regarded as appropriate due to tilted windows. The standard values to be calculated are listed in Table 3.

The Protection Guide defined for 'High Annoyance', namely L_{eq3} = 62 dBA includes, the critical loads for the suspected health effects and for outdoor communication.

Table 3: Standard values for the calculation of isocontours

	Protection Guides			**Critical Loads**		
Daytime:	L_{eq}	=	62 dBA	L_{eq}	=	65 dBA
	L_{max}	=	25 x 90 dBA	L_{max}	=	19 x 99 dBA
Nighttime:	$L_{max, 22\text{-}1h}$	=	8 x 71 dBA	$L_{max, 22\text{-}6h}$	=	6 x 75 dBA
	$L_{max, 1\text{-}6h}$	=	5 x 68 dBA			
.	$L_{max, 22\text{-}6h}$	=	13 x 68 dBA			
	$L_{eq, 22\text{-}1h}$	=	50 dBA			
	$L_{eq, 1\text{-}6h}$	=	47 dBA			
	$L_{eq, 22\text{-}6h}$	=	50 dBA	$L_{eq, 22\text{-}6h}$	=	55 dBA

A major disadvantage and thereby one reason for future revisions is that there are currently no models for the assessment of the effects that are caused by the simultaneous influence of noise from different sources. This is particularly relevant for airports where an increase of air traffic is always associated with an increase of road and rail traffic.