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Effects of air pollution on farm animals – Guideline VDI 2310

For pollutants to enter farm animals' fodder, one way out of others is by air. The contaminants are deposited on plant parts above ground and accumulate in the soil. From there they get into or onto forage plants. Experts of the Commission on Air Pollution Prevention of VDI and DIN (Kommission Reinhaltung der Luft im VDI und DIN – KRdL) have dealt with this topic since the mid 1990s. In several Technical Rules, they provide substance-specific maximum immission values as maximum concentrations in fodder in order to protect farm animals and to ensure the quality of foodstuffs. So far, Guideline VDI 2310 "Maximum immission values to protect farm animals and foods derived from them" consists of Parts 26 to 46.

Keywords
Air pollution, farm animal, foods, maximum immission values, maximum immission dose

Abstract
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Objective of Guideline 2310 Parts 26 to 46 is to protect farm animals such as ruminants (**figure 1**) and foods derived from them against detrimental effects of airborne pollutants. Since a contamination by direct inhalative intake is of subordinate relevance only, the recommendations on the amount of pollutant-intake from ambient air refer to the animals' diet. These maximum immission doses (MID) are given as maximum level of the respective substance in fodder in milligram per kilogram of total fodder ration with 88 % dry mass and as maximum tolerable dose in milligram per kilogram body mass and day.

According to current scientific evidence, the levels given in Parts 26 to 46 have no adverse effects on health and performance of farm animals, even after long-term intake. Nor do they lead to dangerous contamination of foods derived from these animals, even taking into account accumulations in critical tissues. Therefore, if the MID values are observed, there are no concerns that the consumption of these foods will be harmful to human health. Thus the MID values also consider aspects of food-toxicology.

Maximum immission dose – evaluation methods

The MID values are derived from dose-time-response relationships. Detectable biological effects on the animal, such as biochemical changes and reduced performance, and/or detrimental impact on the animals' health serve as response indicators. In addition, data concerning the transfer of the respective substance from fodder to foods derived from the animals are taken into account. In the case of polychlorinated biphenyls (PCBs) and dioxins, this is the main response indicator.

Experts' knowledge pooled in Guideline

Editor of Guideline VDI 2310 is the Commission on Air Pollution Prevention of VDI and DIN – Standards Committee KRdL.

Fig. 1

Maximum immission values for pollutants conduce to protect farm animals and foods derived from them. Source: Wichern

The Commission's main business is to compile Technical Rules. In doing so, the KRdL tasks involve all technical and scientific aspects of air pollution prevention. That includes the sector "Effects of air pollution on human health, animals, plants, soil and materials", which is dealt with in Subdivision III "Environmental Quality" of KRdL. Honorary specialists from the scientific, industrial and administrative fields develop the KRdL Guidelines, for instance Guideline VDI 2310 Parts 26 to 46. The working group "Effects of air pollution on farm animals and the foods derived from them" has mainly compiled Technical Rules concerning diverse metals, but also such dealing with other pollutants like PCBs, dioxins and fluorides. In doing so, the experts particularly take into account contaminants which are not regulated by animal feed legislation. **Table 1** lists those parts of Guideline VDI 2310 published so far. The working group revises the parts in regular intervals checking whether they are still up-to-date, and adapts them if necessary. At the same time, parts dealing with further substances including iron are prepared.

Table 1

Overview of the parts of Guideline VDI 2310 "Maximum immission values to protect farm animals and foods derived from them" published so far

VDI 2310	**Maximale Immissions-Werte für... *Maximum immission values for...***	**Ausgabedatum/ *Date of release***
Blatt/*Part* 26	Fluoride/*Fluoride*	2001-11
Blatt/*Part* 27	Blei/*Lead*	1998-09
Blatt/*Part* 28	Cadmium/*Cadmium*	2008-10
Blatt/*Part* 29	Thallium/*Thallium*	2000-11
Blatt/*Part* 30	Nickel/*Nickel*	2005-01
Blatt/*Part* 31	Zink/*Zinc*	2005-01
Blatt/*Part* 32	PCB/*PCBs*	1995-11
Blatt/*Part* 33	Quecksilber in organischer Bindungsform/*Organic bonded mercury*	1996-02
Blatt/*Part* 34	Vanadium/*Vanadium*	1996-02
Blatt/*Part* 35	Arsen/*Arsenic*	2009-12
Blatt/*Part* 37	Molybdän/*Molybdenum*	1998-04
Blatt/*Part* 38	Kupfer/*Copper*	2008-12
Blatt/*Part* 39 E[1)]	Chrom/*Chromium*	2010-01
Blatt/*Part* 41 E[1)]	Selen/*Selenium*	2010-02
Blatt/*Part* 44	Aluminium/*Aluminium*	2006-11
Blatt/*Part* 45	Lithium/*Lithium*	2006-11
Blatt/*Part* 46	Dioxine/*Dioxin*	2005-10

[1)] Entwurf/*Draft*

Current publications

Published in December 2009, Part 35 "Arsenic" is one of the most current releases of Guideline VDI 2310. The MID values are set on the basis of increased arsenic retention, particularly in the liver and kidneys, but also in the muscular system [1]. Two further parts concerning chromium and selenium were published as drafts at the beginning of 2010. All VDI Guidelines are submitted to public scrutiny first. After having been adapted where applicable, they are released in the final version, the so-called "white paper", both in German and English language.

The parts mentioned above as well as all other parts of Guideline VDI 2310 are available at Beuth Verlag in Berlin, online order at www.beuth.de. Guidelines can also be ordered at www.vdi.de/richtlinien, where in addition, the respective table of contents plus press releases may be downloaded. Further information on KRdL and Subdivision III "Environmental Quality" can be found on www.krdl.de.

Literature

[1] VDI 2310 Blatt 35: Maximale Immissions-Werte; Maximale Immissions-Werte für Arsen zum Schutz der landwirtschaftlichen Nutztiere und der von ihnen stammenden Lebensmittel (Maximum immission values; Maximum arsenic intake values for the protection of livestock and foods derived from them). Beuth Verlag GmbH, Berlin, 2009.

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