

INFLUENCE OF PCDD/PCDF LEVELS IN GRASS AND SOIL ON THE CONTAMINATION OF COW'S MILK

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Introduction

It is generally accepted that human diet represents the main route of exposure to PCDDs and PCDFs. Usually more than 90% of the total daily intake derive from food. Because of the lipophilic nature of these two classes of environmental contaminants foodstuffs of animal origin are of special importance. It is estimated, at least in the Federal Republic of Germany, that dairy products, meat and meat products as well as fish and fish products contribute each approximately 30% of the daily intake of 2-3 pg toxic equivalents (I-TEq)/kg body weight via food ^{1,2}. This level can be increased significantly by special consumption habits or by migration of PCDDs and PCDFs from packaging material into food. As a result, the actual daily intake via food already exceeds the tolerable daily intake set by the health authorities in several countries.

Contamination of cow's milk is of special importance because of its high consumption compared to other food-stuffs. Previous investigations have shown that the contamination level is highly dependent on the origin of the specimens. Results from cow's milk samples collected on farms illustrated the existence of certain "hot spots", especially near PCDD/PCDF emitting sources, like cable waste incinerators or metal refining industries where elevated PCDD/PCDF levels were measured ³⁻⁶. On the other hand, an extensive survey which comprised investigation of 168 dairy products collected

directly in 43 dairies indicated that the average contamination level of consumer's milk and milk products in an highly industrialized area like North Rhine-Westphalia is not as high as often suspected from the analysis of individual samples originating from contaminated areas ⁷.

This led to the question which parameters mainly influence the levels of PCDDs/PCDFs in cow's milk. With respect to governmental regulations, for example establishing threshold values for PCDD/PCDF in soil of pastures it is of special interest whether PCDD/PCDF levels in soil or possibly in grass or fodder have the predominant influence on the contamination of dairy products.

Approach and Results

In order to answer these questions three surveys were conducted at different areas.

Survey 1: Investigation of emission-, deposition-, soil-, grass- and cow's milk samples at different sampling sites each in the vicinity of a potential emission source.

Survey 2: Investigation of soil-, grass- and milk samples in the vicinity of an old copper mine which released huge amounts of PCDDs/PCDFs into the environment during copper production from 1939 - 1945.

Survey 3: Investigation of soil-, grass- and milk samples in a rural area where illegal copper reclamation in open systems took place.

The results of these investigations showed that the contamination levels in soil do not have the influence on the PCDD/PCDF levels in cow's milk as often suspected. Even soil levels up to 30 ng I-TEq/kg dry matter did not result in elevated PCDD/PCDF levels in cow's milk. On the other hand, with increasing levels in grass a tendency to slightly higher levels in milk could be observed.

These results seem to indicate that the pathway air -> grass -> cow is more important than the pathway soil -> grass -> cow. Moreover, it became apparent that the bioconcentration factor (BCF) between PCDDs/PCDFs in grass and milk dif-

fers significantly dependent on the congeners. While 2,3,7,8-T₄CDD showed the highest BCF, OCDD was less accumulated by a factor of almost 30 (Figure 1). The relative ratio of these factors for each congener in question was very similar at all sampling sites. However, the absolute height differed to a certain degree. It is striking that the bioconcentration factors for all congeners were highest at those sampling sites which showed the lowest PCDD/PCDF levels in grass.

Although it has to be stated that these investigations were not performed under controlled but field conditions the results of these surveys demonstrate that it is questionable to establish maximum contamination limits for soil or grass based on toxic equivalents in order to reduce the PCDD/PCDF levels in cow's milk since the bioaccumulation of these contaminants is highly dependent on the congeners. Therefore, a meaningful estimation of the risk deriving from PCDD/PCDF transfer from soil or grass into cow's milk should be performed in a congener-specific manner.

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PCDD / F - ratio milkfat / grass, mean from three measurements during October / November 1991 in the vicinity of a cable waste incinerator, having operated from 1979 until 1991 in a rural area of Northrhine-Westphalia

