

**LEVELS OF PCDDs AND PCDFs IN COW'S MILK AND WORKER'S BLOOD  
COLLECTED IN CONNECTION WITH A HAZARDOUS WASTE INCINERATOR  
IN SWEDEN**

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**INTRODUCTION**

It is well established that incineration of various kinds of waste could generate a series of dioxins (PCDDs) and dibenzofurans (PCDFs). The emission levels are depending on the feedstock, the burning and cleaning technology used. During the early part of the 1980s emission levels exceeding 100 ng toxic equivalents (TEQ)/m<sup>3</sup> could be found in old and poorly designed and poorly operating incinerators. However, nowadays emission guidelines below 0.1 ng TEQ/m<sup>3</sup> have been introduced in several countries in Europe and America. A modern incinerator emits 100-1000 times less than an old incinerator.

It is also well established that most humans all over the world are exposed to PCDDs and PCDFs, primarily via the food. For the background population the levels are not very much different in Europe, America and Japan. The major contaminated food items are fatty fish and milk and other dairy products.

It has been reported that milk from cows grazing in the vicinity of incinerators is contaminated to a much higher degree than normal consumer's milk (1,2,3). A guideline of 6 pg TEQ/g milk fat in the Netherlands resulted in the closing down of a few incinerators in this country. This finding has been used as an argument against all waste incineration, in spite of the fact that no emission data have been reported for these incinerators.

The hazardous waste incinerator of SAKAB, Norrtoorp, Kumla in Sweden has been in operation since 1983. The emission guideline in the operation permit was given as 3 ng TEQ/m<sup>3</sup> and the control program has shown that with a few exceptions, this guideline has been met.

The working permit at the SAKAB incinerator also included monitoring of PCDDs and PCDFs in cow's milk as well as worker's blood. In this presentation we report on this data.

**EXPERIMENTAL**

In 1983 and 1988 milk from the farms in the closest vicinity of the SAKAB incinerator was collected and shipped frozen to Umeå. Blood serum from ten workers was collected in 1983 and 1988. The workers have been employed in the incinerator during the whole period.

All the ten milk samples as well as the 1988 serum samples were analyzed by methods earlier described and validated (4,5). The analytical instrument was a VG 70-250S.

### RESULTS

The data are collected in Table 1 and Table 2. Most 2,3,7,8-substituted PCDDs and PCDFs could be found in the samples. For the milk samples the highest levels were found for the octaCDD, but for the blood serum the dominating congener was 2,3,4,7,8-pentaCDF. These patterns are the typical for cow's milk and human fat in Sweden.

### CONCLUSIONS

No increase of the levels of PCDDs and PCDFs could be seen in the samples of cow's milk in the vicinity of the SAKAB incinerator operating with an emission level of 3 ng TEQ/m<sup>3</sup>. This is a clear indication that incinerators with a modern design fulfilling the 0.1 ng TEQ/m<sup>3</sup> guideline could operate with minimal environmental contamination. The blood levels of PCDDs and PCDFs for the workers employed in the incinerator were found to be within the expected range using control cohorts from a Swedish investigation where the influence of fish consumption was studied (6).

### REFERENCES

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Table 2. Levels of PCDDs and PCDFs in the blood of SAKAB -workers and the mean of a control group (7) in pg/g fat.

	1	2	3	4	5	6	7	8	9	10	11	Mean average fish consumption (7)
2378-TCDF	1.1	<1	2.1	6.4	1.4	1.1	<1	2.9	1.8	1.3	1.6	1.8
23478-PeCDF	8.7	15.0	7.4	20.4	15.8	9.7	3.5	10.3	21.0	9.2	25.7	20
123478-HxCDF	3.7	5.3	3.7	9.1	4.1	<2	<2	4.7	6.6	3.2	3.8	7.1
123678-HxCDF	2.7	3.7	3.0	9.2	4.8	5.3	2.6	3.6	5.2	2.6	4.3	5.4
234678-HxCDF	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	2.2
1234678-HpCDF	36.5	7.3	10.5	10.4	7.6	25.1	8.6	12.2	8.4	13.4	6.5	14
OCDF	8.1	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	1.0
2378-TCDD	1.5	2.4	1.5	5.4	3.3	3.3	2.5	2.6	3.5	1.7	4.6	2.5
12378-PeCDD	4.6	7.8	3.6	13.8	6.5	3.6	2.7	5.6	6.4	3.9	6.7	7.6
123478-HxCDD	<2	<2	<2	<2	<2	<2	<2	<2	3.0	<2	<2	3.0
123678-HxCDD	21.9	37.0	16.2	53.2	39.9	10.3	6.5	33.5	37.5	25.5	20.6	43
123789-HxCDD	3.2	3.1	4.4	11.1	7.3	<2	<2	6.9	4.8	2.9	5.9	6.0
1234678-HpCDD	32.3	70.8	68.9	59.7	51.4	23.4	28.5	86.6	36.6	50.2	31.2	80
OCDD	1064	782	509	779	874	381	260	969	527	609	656	458

Table 1. Levels of PCDDs and PCDFs (pg/g fat) in cow's milk from farms in the vicinity of the SAKAB incinerator.

	Farm 1		Farm 2		Farm 3		Farm 4		Farm 5		
	Year	1983	1988	1983	1988	1983	1988	1983	1988	1983	1988
2,3,7,8-TetraCDD		0.04	<0.07	<0.1	<0.2	<0.07	<0.08	<0.1	<0.2	<0.03	<0.2
1,2,3,7,8-PentaCDD		0.1	0.09	0.1	0.1	0.08	0.2	0.1	0.08	0.2	0.1
1,2,3,4,7,8-HexaCDD		-	-	<0.06	-	-	-	<0.04	0.08	<0.04	-
1,2,3,6,7,8-HexaCDD		0.1	0.2	0.3	0.7	0.2	0.4	0.2	0.2	0.4	0.7
1,2,3,7,8,9-HexaCDD		<0.05	<0.03	<0.03	<0.1	<0.03	<0.02	<0.03	<0.08	<0.09	<0.1
1,2,3,4,6,7,8-HeptaCDD		0.06	0.6	0.3	1.6	0.09	1.1	0.2	0.8	0.3	1.7
OCDD		<0.6	<1.5	<0.6	<3.1	<0.3	<2.1	<0.3	<1.9	<0.7	<2.7
2,3,7,8-TetraCDF		0.3	<0.1	<0.08	<0.2	<0.06	<0.2	<0.04	<0.1	<0.04	<0.09
1,2,3,7,8-PentaCDF		0.01	<0.02	<0.05	<0.03	<0.03	<0.09	<0.02	<0.06	<0.01	<0.1
2,3,4,7,8-PentaCDF		0.2	0.3	0.1	0.2	0.1	0.4	0.1	0.3	0.2	0.3
1,2,3,4,7,8-HexaCDF		0.1	0.1	0.2	0.1	0.1	0.2	0.09	0.1	0.1	0.2
1,2,3,6,7,8-HexaCDF		0.04	0.08	0.03	0.08	0.05	0.09	0.05	0.07	0.04	0.1
2,3,4,6,7,8-HexaCDF		<0.06	<0.08	<0.03	<0.1	<0.04	<0.09	<0.03	<0.1	<0.03	<0.1
1,2,3,7,8,9-HexaCDF		<0.07	<0.08	<0.04	<0.1	<0.04	<0.09	<0.04	<0.1	<0.03	<0.1
1,2,3,4,6,7,8-HeptaCDF		0.2	0.1	0.1	0.3	0.05	0.2	0.1	0.2	0.1	0.3
1,2,3,4,7,8,9-HeptaCDF		<0.1	<0.06	<0.03	<0.2	<0.03	<0.08	<0.04	<0.1	<0.04	<0.2
OCDF		<0.1	<0.5	<0.3	<0.4	<0.3	<0.3	<0.2	<0.6	<0.3	<0.5