

DIOXINS AND DIBENZOFURANS IN THE BLOOD OF WORKERS AND RESIDENTS OF INDUSTRIAL TOWNS IN THE IRKUTSK REGION OF RUSSIAN SIBERIA

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Introduction

Russian dioxin research relating to human tissue, food and environmental levels began in 1986 as a collaboration between researchers from a number of countries including the Soviet Union, the United States, Canada and Germany. The work documented the presence of dioxins in humans, food and wildlife in Russia^{1,2}. Levels of dioxins in humans were generally found to be lower in Russians than in Americans or Europeans. An exception to this was chemical workers from Ufa, Bashkortostan Republic and some of their children^{1,3,4}. This study extends our previous work by focusing on potentially exposed and general population residents of the Irkutsk region of Russian Siberia. We report finding of elevated dioxin levels in persons residing in certain geographical regions. We also found little to no dioxin elevation in the blood of certain firefighters, some of whom are disabled, following fire fighting at chemical facilities.

Materials and Methods

Blood was collected in anticoagulant, centrifuged to remove cells, and frozen. It was delivered frozen to the German, Russian, and Canadian laboratories involved in this phase of the work. High resolution gas chromatography/mass spectrometry was employed for analyses. The German and Canadian analytical laboratories are World Health Organization certified for analysis of dioxins in human tissue⁵. The Russian laboratory cooperated with these laboratories in interlaboratory validation projects. A companion paper at this conference will present additional data from this collaboration.

Results and Discussion

The results in dioxin toxic equivalents (TEQs) are shown on Table 1 and Figure 1 with comparisons to German and American TEQ blood levels. Analyses were usually performed from individual blood samples. Sayansk samples are from both workers at a chemical factory and general residents. Two workers have elevated dioxin TEQ. One worker (#31) from a Khimprom chemical factory had a TEQ of 92 ppt, of which 2,3,4,7,8-PnCDF contributed 38 ppt, HxCDFs

Table 1. TEQ* levels of blood collected in 1998 from Irkutsk Region, Russia, compared to previous levels in Baikalsk, Germany, and North America
 pg/g (ppt) lipid basis (non-detects = 1/2 limit of detection)

	Irkutsk Region 1998			Comparison Samples			
	Angarsk Resident N =	Sayansk Residents 1	Shelekhovo Firemen 5	Baikalsk ² 1989** 8	Germany ⁷ 1989 102	Germany ⁷ 1996 139	North America ⁸ 1996** 100
PCDDs							
2378-TCDD	1.1	3.6	1.8	3.7	3.6	2.3	4.3
12378-PeCDD	3.9	8.2	3.1	4.7	13.8	5.9	8.7
123478-HxCDD +123678-HxCDD	1.1	1.4	0.7	1.1	6.6	2.9	7.3
123789-HxCDD	0.4	0.3	0.2	0.2	1.1	0.4	0.8
1234678-HpCDD	0.2	0.2	0.1	0.1	0.9	0.3	1.0
OCDD	0.0	0.0	0.0	0.0	0.1	0.0	0.1
PCDFs							
2378-TCDF	0.4	0.3	0.2	0.3	0.2	0.1	0.1
12378-PeCDF	0.0	0.0	0.0	0.0	0.1	0.0	0.0
23478-PeCDF	5.1	16.4	5.0	7.5	18.5	5.5	5.5
123478-HxCDF +123678-HxCDF	2.3	6.4	1.5	2.0	2.8	1.1	2.2
123789-HxCDF	0.0	0.0	0.1	0.1	0.2	0.0	0.2
234678-HxCDF	0.3	0.3	0.2	0.2	0.4	0.2	0.3
1234678-HpCDF	0.1	0.1	0.1	0.0	0.2	0.1	0.1
1234789-HpCDF	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OCDF	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coplanar PCBs							
77 33'44'-TCB	0.0	0.0	0.0				0.0
126 33'44'5'-PCB	8.4	20.9	6.6				4.8
169 33'44'55'-HCB	0.4	0.7	0.5				0.4
Total PCDDs	6.7	13.7	5.9	9.8	26.0	11.8	22.2
Total PCDFs	8.1	23.6	7.0	10.2	22.5	7.0	8.4
Total PCDD/Fs	14.8	37.3	12.9	20.0	48.5	18.8	30.6
Coplanar PCBs	8.8	21.6	7.1	NA	NA	NA	5.2
Total TEQ	23.6	59.0	20.0	NA	NA	NA	35.8

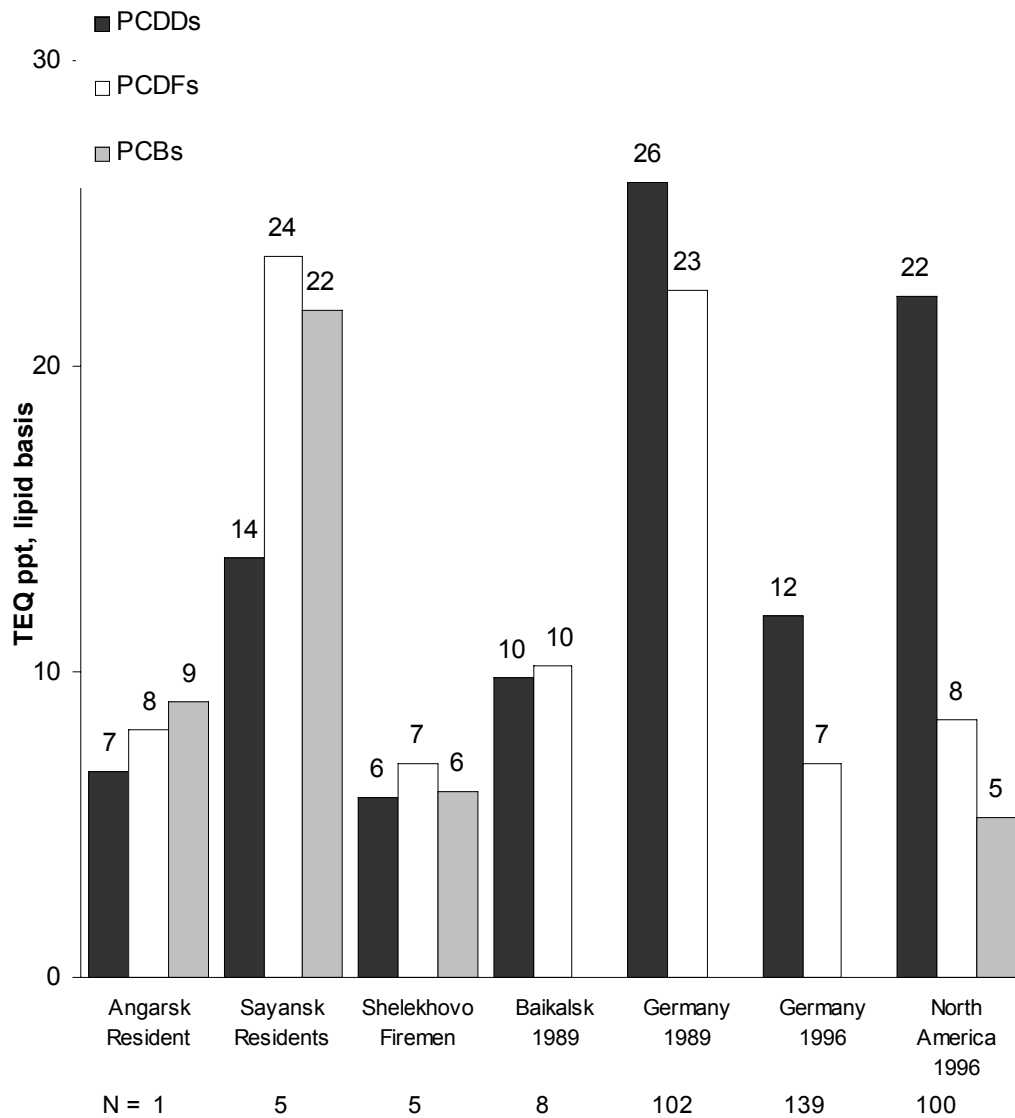
Blood samples from Angarsk and Sayansk, and one from Shelekhovo were analyzed by Health Canada Laboratory, Ottawa, Canada. All other analyses were by ERGO Laboratory, Hamburg, Germany.

*WHO 1998 TEFs⁵

**Single pooled sample

Figure 1. TEQ levels in individually analyzed blood from Irkutsk region, 1998, compared with previous blood TEQ levels from Baikalsk, Germany, and North America

pg/g (ppt) lipid basis (non-detects = 1/2 limit of detection)



20 ppt, and PCB 126 22 ppt. Another Khimprom worker (#44) had TEQ = 102 ppt, of which 2,3,4,7,8-PnCDF contributed 17 ppt, HxCDFs 5.6 ppt, and PCB 126 60 ppt. One other Khimprom worker had TEQ 47 ppt. Otherwise, none of the individuals in these Siberian towns had an elevated blood TEQ level.

2,3,4,7,8-PnCDF is frequently found at higher levels in European blood than in American blood. This congener was found elevated in the two Sayansk workers, the German 1989 blood, but not other Russian or American blood, nor in the blood of the 1996 German samples. The reason for these differences is not clear.

Since there were no elevations of dioxins in the firefighters, it is probable that their disabilities are from a cause other than dioxin exposure. Alternatively, it is also possible that sufficient time passed after an acute exposure to dioxins and dibenzofurans for the levels to have returned to background levels.

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