EXPOSURE TO POLYCHLORINATED DIOXINS (PCDD) AND DIBENZOFURANS (PCDF) FROM GRAPHITE ELECTRODES IN A CHLORALKALI PLANT.

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Electrolysis of brine in mercury cells is a common procedure to produce chlorine. Previously, graphite electrodes were used as anodes in this process. In electrode sludge from this kind of chlorine production, high levels of PCDFs have been found[1]. Thus, working in this industry, and handling of the sludge, may have caused occupational exposure to organic chlorinated compounds. Also, in some places, the sludge from graphite electrodes have been deposited at dump sites close to the plant and so contaminated the earth. These deposited masses may still cause exposure to workers and leakage to the general environment.

The aim of this study was to see if blood levels of certain PCDDs/PCDFs in workers from a chloralkali plant indicated past or present exposure to these compounds.

METHOD

From a Swedish chloralkali plant, where graphite electrodes were used during the period 1924-1979, six men were selected. Two of these (**A** and **B**) had a direct exposure to sludge from the electrodes. Subject **A** during the period 1946-1979, and subject **B** most of the period 1970-1979. Two other persons (**C** and **D**) have a recent exposure to earth and dust from the plant area, which might have been contaminated with sludge. Subjects **E** and **F** are employees without any known exposure to grahite sludge or contaminated earth.

All men were healthy. They were interviewed about their work and relevant life-style factors (**TABLE**). From each subject about 450 ml venous blood was drawn into standard hospital blood bags. Plasma was separated and handled as described earlier [2]. Plasma levels of PCDDs/PCDFs were analyzed at the Institute of Environmental Chemistry, University of Umeå. For the PCDDs and PCDFs analyzed, TCDD equivalents (TEQ) were calculated according to the model proposed by a Nordic expert group[3].

RESULTS AND DISCUSSION

Subject **A**, who had the longest exposure to graphite sludge, had higher levels of dibenzofurans (23478 PeCDF, 123478 HxCDF, and 123678 HxCDF) than the other subjects (**TABLE**). The other exposed subject (**B**), who had a considerably less exposure, also had slightly higher levels of the hexa-furans.

The level of 123478 HxCDF in one of the subjects (**C**), with possible exposure to contaminated earth, was a little higher than the levels in the referent subjects. However, the results did not indicate any substantial exposure to PCDDs/PCDFs from work with contaminated earth.

The total burden of PCDDs/PCDFs, expressed as Nordic TEQ, for subject A is above the level previously found in Swedish men without any occupational exposure to PCDDs/PCDFs, and with **average** Swedish fish consumption habits (**TABLE**). The other subjects have levels within the range found in this group.

CONCLUSIONS

Analysis of blood levels of PCDFs/PCDDs in workers from the chloralkali industry indicate that handling of sludge from graphite elctrodes have caused exposure to polychlorinated dibenzofurans.

REFERENCES

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2. Svensson BG, Nilsson A, Hansson M, Rappe C, Åkesson B, Skerfving S. Exposure to dioxins and dibenzofurans through the consumption of fish. *N Eng J Med* 1991; 324: 8-12.

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TABLE. Relevant life-style factors and blood levels of some polychlorinated dioxins (PCDDs) and dibenzofurans (PCDFs) in six men, with and without occupational exposure to sludge from graphite electrodes. The results from an earlier study of Swedish men without occupational exposure[2] are indicated for comparison. (T= tetra; Pe= penta; Hx= hexa; Hp=hepta; O= octa)

	EXPOSED TO				**REFERENTS**		**Men from Sweden**	
	Sludge from electrodes		Contamin. earth, dust				**without occup.exp.**	
	A	B	C	D	E	F	**to PCDD/PCDF**	
							(n=9)	(n=11)
Age, years	67	39	57	51	61	49	26-50	30-52
Smokers	0	0	0	0	0	0	4/9	4/11
Fishmeals/week	<1	<1	2	1	1.5	2	**1-2**	**4-7**
PCDDs/PCDFs in blood fat (pg/g fat)								
2378 TCDD	2.8	1.7	7.5	2.6	3.1	1.2	1.2-4.2	2.4-13
12378 PeCDD	8.2	2.3	9.2	7.2	5.5	4.5	3.3-14	4.2-24
123478 HxCDD	3.7	<1	3.4	4.6	3.9	1.6	1.6-4.4	1.8-9.6
123678 HxCDD	37	14	41	36	23	17	24-70	21-94
123789 HxCDD	4.9	2.9	7.6	6.0	4.7	3.0	3.9-9.1	4.7-9.3
1234678 HpCDD	47	42	44	46	49	32	40-145	47-139
OCDD	293	210	223	432	305	248	249-1100	241-830
2378 TCDF	1.3	1.5	2.3	3.0	1.5	1.1	1.2-2.1	1.5-7.8
23478 PeCDF	109	11	30	20	14	12	9-51	15-109
123478 HxCDF	40	29	13	9.1	5.4	4.2	3.3-10	4.6-17
123678 HxCDF	21	11	8.2	6.4	3.3	3.0	2.6-8.5	3.6-27
234678 HxCDF	2.3	<0.5	2.0	1.1	1.1	1.2	1.0-3.9	1.4-12
1234678 HpCDF	11	13	11	19	9.1	6.8	6.0-38	8.2-51
Nordic TEQ	**73**	**15**	**36**	**24**	**18**	**13**	**12-48**	**18-88**