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Assessing Hospital Employee PCDD/PCDF/Coplanar PCB Exposure from a Medical Waste Incinerator.

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1. Introduction

In 1995, the Oregon Health Division (OHD) was asked to assist in an evaluation of employee exposure to emissions from a medical waste incinerator (MWI) at a Portland hospital. During the 12 years of the incinerator's operation, the proximity and orientation of the incinerator relative to the hospital resulted in significant impacts on the hospital building. Previous dispersion modeling by the Oregon Department of Environmental Quality had predicted emissions impacts exceeding target levels at the air intake for the hospital's intensive care unit (ICU). Smoke had been reported inside the building on numerous occasions. ICU employees and others indicated that they had experienced numerous respiratory, reproductive, and other health effects, which they attributed to MWI emissions. The employees expressed particular concern about their possible exposure to high levels of PCDDs/PCDFs.

The incinerator was dismantled in January, 1995. Limited testing of incinerator ash collected during dismantling showed 2,3,7,8-TCDD levels up to 1600 pg/g (93,000 pg/g TEQ).

At the hospital's request, OHD agreed to work with labor and management to address the employees' concerns regarding possible PCDD/PCDF exposure.

2. Methods

OHD requested that a ventilation engineer at the National Institute for Occupational Safety and Health (NIOSH) evaluate the hospital's ventilation system to determine which areas of the

hospital would likely have had the greatest impact from incinerator emissions. Several of the identified locations matched areas where employees had reported health problems.

Currently employed staff who had worked the longest in the high impact areas were selected for serum PCDD, PCDF, and coplanar PCB (cPCB) analysis. Nine (two male, seven female) full-time employees with an average of 16 years' work history in the targeted areas agreed to be tested (Table 1).

Table 1. Hospital employees selected for serum PCDD/PCDF/ Coplanar PCB testing.

Employee	Hospital Department	Years in High Exposure Area
001	Maintenance; Power Plant	16
002	Critical Care	23
003	Laboratory	20
004	Operating Room	21
005	Critical Care	15
006	Emergency Room	8
007	Respiratory Therapy	16
008	Critical Care	*
009	**	**
010	Operating Room	10

*No data
**Withdrew from Study

Selected employees were asked to complete a short questionnaire designed to identify previous PCDD/PCDF/cPCB exposure.

Blood samples (150 ml) were collected according to protocol[1] from selected employees and sent to CDC for PCDD/PCDF/cPCB analysis. Serum samples (25g) were spiked with totally carbon-13 labeled internal standards and allowed to equilibrate for 30 min prior to extraction. The spiked samples were then cleaned up by a solid phase multicolumn extraction method and analyzed by high resolution gas chromatography/high resolution mass spectrometry using isotope-dilution quantification[1]. Each set of three unknown samples was accompanied by a quality control (QC) sample and all analytes were within 95% control limits for each QC pool sample.

3. Results

PCDD/PCDF/cPCB concentrations and TEQs for the employees' serum samples are summarized in Table 2.

Table 2. PCDDs/PCDFs/Coplanar PCBs in serum of hospital employees (pg/g lipid). [S.D. = Standard Deviation; ND(<DL) = Not Detected (< Detection Limit); NRI = Not Reported, Interference; n = 9]

	Mean	S.D.	Range	Reference Range	TEQ
2,3,7,8-TCDD	2.2	2.2	ND(<1.9)-7.3	ND-38	2.2
1,2,3,7,8-PCDD	5.4	1.8	3.2-9.1	ND-180	2.7
1,2,3,4,7,8-HCDD	NRI	-	-	3.1-58	-
1,2,3,6,7,8-HCDD	NRI	-	-	17-494	-
1,2,3,7,8,9-HCDD	6.5	2.4	3.4-10.7	3.5-51	0.7
1,2,3,4,6,7,8-HpCDD	71.1	29.8	42.2-130	ND-1260	0.7
OCDD	501	294	218-958	64-2550	0.5
2,3,7,8-TCDF	1.3	1.0	ND(<1.0)-2.4	ND-32	0.1
1,2,3,7,8-PCDF	ND(<1.5)	-	-	ND	-
2,3,4,7,8-PCDF	7.6	2.5	5.2-11.9	ND-77	3.8
1,2,3,4,7,8-HCDF	6.8	1.9	4.0-10.1	1.7-28	0.7
1,2,3,6,7,8-HCDF	4.7	1.1	2.9-6.6	1.8-18	0.5
1,2,3,7,8,9-HCDF	ND(<1.5)	-	-	ND	-
2,3,4,6,7,8-HCDF	ND(<1.5)	-	-	ND	-
1,2,3,4,6,7,8-HpCDF	8.6	1.8	5.4-11.7	ND-55	0.1
1,2,3,4,7,8,9-HpCDF	ND(<1.5)	-	-	ND	-
OCDF	ND(<1.5)	-	-	ND	-
3,3',4,4',5-PCB	14.7	12.4	7-47.1	14.6-371	1.5
3,3',4,4',5,5'-PCB	16.2	3.1	11.7-21.1	29.5-174	0.2
Total TEQ					13.7

Serum PCDD/PCDF/cPCB concentrations were all within range of background levels.

4. Conclusions

Medical waste incinerator emissions are an important source of environmental PCDDs/PCDFs[2,3] and may pose a significant health risk to local populations[4,5]. In the present study, hospital

employees who were considered most likely to have had the greatest exposure to the hospital's MWI emissions were identified and serum from these employees was analyzed for PCDDS/PCDFs/cPCBs. Results show that the employees' serum PCDD/PCDF/cPCB levels are within the range of background serum levels found in the U.S.[1] and do not reflect excessive PCDD/PCDF/cPCB exposure. Based on these findings, it is likely that other employees at the hospital who had similar or less exposure to incinerator emissions would also not have elevated PCDD/PCDF/cPCB levels.

Though it is possible that some of the hospital employees' past health problems (e.g. headaches, respiratory effects) may have resulted from exposure to MWI emissions, concerns regarding excessive PCDD/PCDF exposure appear to be unfounded.

5. References

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