



Project Summary

Dioxin Emissions from Industrial Boilers Burning Hazardous Materials

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Laboratory analyses for polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzo-furans (PCDF) were performed on waste fuels and stack gas emission samples from five industrial boiler test sites cofiring liquid hazardous waste fuels. Analytical results indicate that, apart from creosote sludge, chlorinated wastes were void of PCDD and PCDF isomers at detection limits in the range of 0.045 to 4.17 ppb. Creosote sludge cofired with wood waste in a stoker boiler was found to contain 7.4 ppm of total dioxins, primarily hepta and octa isomers. Stack gas concentrations of dioxins were highest for the creosote wood-fired stoker at about 75 ng/m³. Other PCDD results indicate concentrations ranging from below detection levels (<0.08 ng/m³) to a maximum of 1.1 ng/m³. PCDF concentrations were generally higher with total furan levels up to 5.5 ng/m³. No 2,3,7,8-tetra dibenzo-p-dioxins were detected in any waste fuel or stack gas emission samples. The 2,3,7,8-TCDF isomer was detected in stack gas at three sites with the highest concentration of 0.24 ng/m³.

This Project Summary was developed by EPA's Hazardous Waste Engineering Research Laboratory, Cincinnati, OH, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

The full report documents the results of laboratory analyses for polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzo-furans (PCDF) in liquid

waste fuels and stack gas emission samples from five industrial boiler test sites cofiring hazardous waste fuels. The objective of these analyses was to determine whether any PCDD or PCDF emissions could be attributed to waste fuels or products of combustion of waste fuels. This work was sponsored by the EPA's Office of Solid Waste (OSW-Washington) and the Hazardous Waste Engineering Research Laboratory (HWERL-Cincinnati).

Table 1 summarizes the mass flowrates of dioxin and furans for the five test sites. PCDD and PCDF isomers (tetra through octa) were not detected in any of the waste fuels with the exception of the creosote sludge at Site A, which was found to contain 7.4 ppm of PCDD primarily hepta and octa isomers. The total dioxins emissions from the Site A boiler were measured at about 75 ng/m³ corresponding to 240 ng/s, primarily tetra and penta isomers. The DRE for total PCDD at Site A was 99.94 percent. DRE data for individual homologs indicate that higher homologs (hepta- and octa-CDD) detected in the creosote may have been reduced to lower homologs (tetra- and penta-CDD) and emitted with the flue gas. In fact, the DRE for TCDD was negative, indicating the formation of TCDD during combustion of the creosote/wood mixture.

Emissions for the other test sites were generally below 22 ng/s (0.8 ng/m³) for total PCDD and below 150 ng/s (5.5 ng/m³) for total PCDF; that is, one to two orders of magnitude less than flue gas concentrations measured at Site A. PCDD and PCDF DRE's for Sites D, E, H, and L were not computed because waste fuel concentrations were less than detection

Table 1. DRE's Of Total Dioxins And Furans

Site identification	Boiler description	Waste fuel	Total PCDD			Total PCDF		
			Input rate (ng/s)	Emission rate ng/s	DRE (percent)	Input rate (µg)	Emission rate (µg/s)	DRE (percent)
A	Wood-fired stoker	Creosote sludge	370,000	240	99.94	NA ^a	NA ^a	NA
D	Watertube boiler burning no. 6 oil	Methanol and tetrachloroethylene	ND (2,400)	22	NA	ND (2,500)	150	NA
		Toluene and bis (2-chloroethyl) ether	ND (3,600)	12	NA	ND (1,800)	4.4	NA
E	Package single-burner watertube burning no. 6 oil	Methylmethacrylate byproduct waste spiked with carbon tetrachloride, chlorobenzene, and trichloroethylene	ND (5,100)	ND (4.2)	NA	ND (3,300)	7.4	NA
H	Pulverized coal- fired boiler	Methyl acetate spiked with carbon tetrachloride, chlorobenzene, and 1,1,1-trichloroethane	ND (20)	ND (2.7)	NA	ND (17)	27	NA
L	Package single- burner watertube burning natural gas	Methylmethacrylate spiked with carbon tetrachloride and chlorobenzene	ND (560)	7.4	NA	ND (570)	17	NA

^a PCDF analysis not performed on Site A flue gas samples.

Note

NA — not applicable. DRE cannot be computed because concentrations in both waste fuels and or flue gas streams were below the detection limit.

ND — not detected. Numbers in parenthesis indicate flowrates calculated based on detection limits.

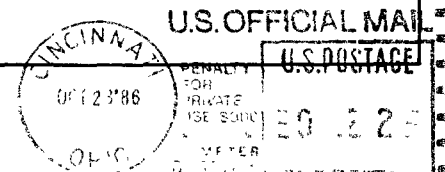
limits. The possible formation of dioxins and furans during the combustion of hazardous waste fuels at these sites cannot be stated with certainty because input rates were not necessarily below the measured flue gas emission rates.

No 2,3,7,8-TCDD emissions were detected in flue gas samples from these five test boilers at concentrations above the detection limit range of 0.0022 to 0.019 ng/m³. Flue gas emissions of 2,3,7,8-TCDF were detected at Sites D, E, and L with concentrations in the range of 0.014 to 0.24 ng/m³.

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