HUMAN HEALTH RISK ASSESSMENT (HHRA) NOTE 2

ISSUE DATE: May 2009 INTERIM

ISSUE: Remedial Goals for Dioxins and Dioxin-like Compounds for Consideration at California Hazardous Waste Sites

SUMMARY

This note presents a suite of suggested Dioxin-TEQ soil remedial goals that have been developed for consideration at mitigation sites in California for the protection of human health. These goals may be revised in the future, as new scientific information becomes available.

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Table 1 - Dioxin-TEQ Remedial Goals for Sites in California

Landscape Scenario	**ng WHO-TEQ/kg dry matter (ppt)** (11)	**Comments**
Residential[a,b]	50	• 10^{-6} risk level • 95% UCL
Commercial/Industrial[c]	200 -1000	• 10^{-6} risk level – HI of 1 • 95% UCL
Agricultural[d]	<40	• Based on Germany Guideline (6) • Ceiling value

a) Based on the California Human Health Screening Level (CHHSL) (3). The CHHSL is adjusted, multiplied by 10, to account for the minimal contribution of soil and dust to the dioxin human body burden as shown in the University of Michigan Dioxin Exposure Study (7, 8). In this study of 946 persons, it was found that less than 0.01% of the variation in serum dioxin concentrations could be attributed to soil and household dust polychlorinated dibenzo-p-dioxins (PCDDs). Similar observations were made in a study of women in West Virginia (4). EPA SW-846 screening level bioanalytical assays (4000 series) may be considered in initial site investigation activities, if this remedial goal is used.

b) The suggested residential remedial goal should only be considered if no farming (raising food animals and/or the majority of the food supply of families) is likely to take place at the site.

c) A range is proposed from a 10^{-6} risk, based on the commercial/industrial CHHSL (3) to a concentration based on a Hazard Index of 1 (see below). This risk range should be adequately protective, given the results of the dioxin exposure studies (7, 8, 4).

d) Use of this remedial goal as a ceiling value should result in 95% UCL concentrations close to 10 ppt, the guideline for dairy farming in The Netherlands and sensitive uses in Sweden (6).

Dioxin remedial goals based on non-cancer effects: A non-cancer remedial goal of 78 ppt is calculated for the residential child based on 1 pg/kg/day (the Minimum Risk Level, MRL, based on neurological effects in monkeys) (1, 10). Therefore, the suggested residential remedial goal of 50 ppt should be protective of non-cancer adverse health effects. The non-cancer commercial/industrial remedial goal is 1,000 ppt, based on the same MRL.

Dioxin remedial goals based on the protection of ecological health: This is variable depending on the ecological receptors of concern at the site but may drive a risk-based cleanup.

Table 2 – 2005 World Health Organization Human Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds (WHO-TEQ) (11)

Compound	WHO 2005 TEF
Chlorinated dibenzo-p-dioxins	
2,3,7,8-TCDD	1
1,2,3,7,8-PeCDD	1
1,2,3,4,7,8-HxCDD	0.1
1,2,3,6,7,8,-HxCDD	0.1
1,2,3,7,8,9-HxCDD	0.1
1,2,3,4,6,7,8-HpCDD	0.01
OCDD	0.0003
Chlorinated dibenzofurans	
2,3,7,8-TCDF	0.1
1,2,3,7,8-PeCDF	0.03
2,3,4,7,8-PeCDF	0.3
1,2,3,4,7,8-HxCDF	0.1
1,2,3,6,7,8-HxCDF	0.1
1,2,3,7,8,9-HxCDF	0.1
2,3,4,6,7,8-HxCDF	0.1
1,2,3,4,6,7,8-HpCDF	0.01
1,2,3,6,7,8,9-HpCDF	0.01
OCDF	0.0003
Non-ortho substituted PCBs	
PCB 77	0.0001
PCB 81	0.0003
PCB 126	0.1
PCB 169	0.03
mono-ortho substituted PCBs	
105	0.00003
114	0.00003
118	0.00003
123	0.00003
156	0.00003
157	0.00003
167	0.00003
189	0.00003

The TEQ concentrations shown in Table 1 are calculated by converting the measured congener concentration in a soil or sediment sample by its TEQ, shown in Table 2, and adding these converted values to get a Dioxin-TEQ concentration for the sample. These TEQs were accepted by the DTSC/HERD October 2006.

Table 3 - Current Dioxin-TEQ Guidelines/Standards

Country/Entity	Landscape Scenario	ng I-TEQ per kg dry matter (ppt)	Comments	Reference
Finland	Agricultural/Residential	500	Limit value	5
Germany	Residential	<1,000	Presumed to be a limit value	6
	Industrial	<10,000	Limit value	6
	Playground	<100	Limit value	6
	Agricultural	5 – 40		6
	Agricultural	<5	Target concentration	6
The Netherlands	Agricultural	1		6
	Dairy farming	10		6
Sweden	Sensitive use	10		6
	Less sensitive use	250		6
Japan	?	1,000 (WHO-TEQ)	Environmental Standard	6
US EPA	Residential	1,000	Action level	1, 12
	Commercial/Industrial	5,000 – 20,000	Action level	1, 12
ATSDR	Child – soil ingestion	50	Limit value EMEG* Endpoint: Neurobehavioral effects	1
Michigan	Direct contact	90	10^{-5} target risk level	9
Cal/EPA	Residential CHHSL	4.6	10^{-6} target risk level	3
	Commercial/Industrial CHHSL	19	10^{-6} target risk level	3
California background	Urban	7-20	Mean ~ 9	2
	Rural	1-6	Mean ~ 3	2

*EMEG: Environmental Media Evaluation Guide

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