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May 31, 2023

The Honorable Tom Kilian
City Council Alderman, District 3, Wausau
133 E. Thomas St.
Wausau, WI 54401

Subject: Response to Request for Updated Wausau Dioxin Assessment, Sample P11 / Differing Sets of TEF Values

Dear Mr. Kilian,

Thank you for contacting the Wisconsin Department of Health Services (DHS) concerning the recent dioxin soil samples at Riverside Park. Per your request, DHS analyzed the results for cancer health risks. In this letter, we will address the requests you asked:

1. What is the difference in dioxin toxic equivalency quotient (TEQ) for sampling site P-11 when using the International Toxic Equivalent (ITE) derived values instead of the World Health Organization (WHO) values?
2. What is the cleanup level (CUL) for 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)?
3. What is acceptable cancer risk?
4. An update health assessment from results from site P-11 and a residential site.

Our health assessment from sample site P-11 suggests that the dioxin is at high enough of a level to cause unacceptable cancer risk. We therefore recommend that the area between sampling location P-10 and P-12 be covered in landscaping fabric and filled over with a clean material such as woodchips to prevent a complete exposure pathway. We also would recommend signage indicating the potential exposure to harmful chemicals.

ITE TEQs vs WHO TEQs

Toxic equivalency factor (TEF) is a risk assessment approach that allows us to compare the toxicity of different combinations of dioxins and dioxin-like compounds. The values are calculated by considering the relative toxicity of individual compounds in the dioxin family to the most toxic dioxin compound: 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), which results in a single toxic equivalency (TEQ).

The Wisconsin Department of Natural Resources (DNR) only recognizes TEFs derived by the WHO. Our health risk calculations, described in letters sent on June 6th and 9th, 2020, were based on TEF values pulled directly from Pace Analytical Reports that were derived from the International Toxic Equivalent (ITE)^{2,3}. However, in these cases, the ITE-derived TEQ, used in the reports, estimated higher levels of TCDD equivalents than the WHO derived TEQ that the DNR endorses. In other words, the previous assessments were made based on higher levels of TEQs than they should have been. Therefore, conclusions from our previous health assessment still stands in that the dioxin levels do not pose a health risk to visitors and residents. See tables 1 and 2 below for a comparison of the WHO and ITE derived TEQs for the Riverside Park samples and residential location samples.

Table 1. Soil test results from Riverside Park, Wausau, WI collected on April 23, 2020⁴.

Sampling Location	Soil Depth	ITE TEQ-adjusted Total 2,3,7,8-TCDD (ng/kg)	WHO TEQ-adjusted Total 2,3,7,8-TCDD (ng/kg)
P1	2-3"	35	28
P1	7-9"	66	54
P2	2-3"	3.0	2.5
P2	10-12"	0.37	0.31
P3	2-3"	1.6	1.4
P3	12-14"	2.5	2.1
P4	2-3"	5.2	4.1
P4	9-11"	2.0	1.6
P5	2-3"	5.4	4.7
P5	11-13"	0.75	0.54

Table 2. Soil test results regarding BRRTS # 02-37-584785 at Riverside Rail Corridor 132 River Street, Wausau, WI collected on April 23, 2020⁵.

Sampling Location	Soil Depth	TEQ-adjusted Total 2,3,7,8-TCDD (ng/kg)	WHO TEQ-adjusted Total 2,3,7,8-TCDD (ng/kg)
R1	3-5"	41	33
R2	4-6"	24	19
R3	3-6"	0.80	0.60
R4	3-5"	3.6	3.0
R5	6-9"	5.1	3.5
R6	6-8"	5.9	5.4
R7	11-13"	0.10	0.14
R8	2-4"	0.11	0.077
R9	4-5"	0.089	0.064
R10	5-6"	0.73	0.51

CUL for Dioxin

Wisconsin Code NR 720 establishes soil cleanup standards and how they are determined. Values calculated are residual contamination levels (RCLs). RCLs are protective of the direct-contact pathway of exposure. The RCL for TCDD is 4.82 ng/kg.

Acceptable Cancer Risk

A previous letter to Alderman Patrick Peckman, sent February 7th, 2019, outlines our process for calculating cancer risk¹. In brief, there is assumed to be no "safe dose" of a chemical that can cause cancer. A theoretical cancer risk is used to evaluate the risk of exposures to carcinogens. Cancer risk is estimated by calculating a dose of a chemical received and multiplying that dose by the cancer-causing potential of that chemical, also known the cancer slope factor or cancer potency factor.

According to Wisconsin Administrative Code NR 720, "an individual compound's soil RCL for direct contact may not exceed a target cancer risk of 1×10^{-6} (1 in 1,000,000) and the cumulative effect of all compounds in the soil may not exceed a target cancer risk of 1×10^{-5} (1 in 100,000)."

Non-Cancer Risk

A previous letter to Alderman Patrick Peckman, sent February 7th, 2019, outlines our process for calculating non-cancer risk following a hazard quotient approach¹. A hazard quotient greater than 1 suggests that the substance may represent a risk to human health. The results of the non-cancer risk assessments are summarized in table 3. The hazard quotients were below 1 and thus our assessment is that exposure to dioxins in surface soil at Riverside Park of park users during occasional recreational activities and Thomas Street residents in their yards is not expected to harm their health.

Table 3. Non-cancer hazard calculations resulting from exposure to dioxins in surface soils from Riverside Park and Thomas Street Area, Wausau, WI.

Location	Concentration (ng/kg)	Scenarios	Estimated Dose (mg/kg/day)			RfD (mg/kg/day)	Hazard Quotient
			Ingestion	Skin	Total		
Riverside Park	108	Child	4.2x10 ⁻¹⁰	3.6x10 ⁻¹¹	4.6x10 ⁻¹⁰	7.0x10 ⁻¹⁰	0.65
		Adult	4.3x10 ⁻¹¹	5.3x10 ⁻¹²	4.9 x10 ⁻¹¹		0.07
Thomas Street	47	Child	3.0x10 ⁻¹⁰	2.6x10 ⁻¹¹	3.3x10 ⁻¹⁰		0.47
		Adult	3.2x10 ⁻¹¹	3.9x10 ⁻¹²	3.6x10 ⁻¹¹		0.05

Cancer Risk

The results of our findings are summarized in table 4.

Table 4. Cancer hazard calculations resulting from exposure to dioxins in soils from Riverside Park and Thomas Street Area

Location	Concentration (ng/kg)	Scenarios	Duration	Excess Cancer Risk (per 1,000,000)		
				Ingestion	Skin Contact	Total
Riverside Park	108	Child	5 years	4.4	0.38	4.8
		Lifetime	30 years	6.8	0.68	7.5
		Lifetime	70 years	10.6	1.1	11.7
Thomas Street	47	Child	5 years	3.2	0.28	3.5
		Lifetime	30 years	5.2	0.49	5.6
		Lifetime	70 years	8.2	0.82	9.1

Our calculations follow the same assumptions as outlined in the previously mentioned letter. For the park setting, our calculations suggest an excess cancer risk of 7.5x10⁻⁶ for a 30-year exposure and 1.2x10⁻⁵ for 70 years. This means that if one million people are exposed to this level of dioxin, there might be 7 to 12 additional cases of cancer. Residential exposure results in a cancer risk of 5.6x10⁻⁶ for a 30-year exposure assessment and 9.1x10⁻⁶ for a 70-year exposure assessment. Stated another way, if one million people are exposed to the same level of dioxin over the same amount of time (30 or 70 years), we estimate that 5 to 9 additional cases of cancer might occur.

Conclusions and Recommendations

Based on our analysis, DHS concludes that the concentration of dioxin and dioxin-like compounds at the residential location does not pose a cancer health risk. The level of dioxin and dioxin-like compounds at site P-11 in the park does exceed our cumulative target cancer risk of 1×10^{-5} and should be addressed. Site P-11 is in an accessible area we conclude that individuals can have a completed exposure (Figures 1 and 2). Our recommendation is that actions are taken to eliminate these exposures. We understand that the City has a remedial plan to address soil contamination in the park, which involves excavation of soils to reduce exposures. Interim actions should also be taken to limit exposures in advance of remedial work commencing. This could be achieved by maintaining adequate cover for the contaminated area (e.g., covering with landscaping fabric and clean material such as wood chips) and using signage to notify people about the potential exposures that could result from disruption of the covering material.

Consistent with our role in supporting local efforts to address sites of environmental contamination, DHS will continue to assist DNR, the city of Wausau, and the Marathon County Health Department with technical support related health concerns.

Please feel free to contact me with additional questions.

Sincerely,



Jeremiah Yee, PhD
Toxicologist
Bureau of Environmental and Occupational Health

Cc:

Matt Thompson, Department of Natural Resources

Dale Grosskurth, Marathon County Health Department

References

1. Letter to the City of Wausau, February 7, 2019, subject line: Response to Comments on the Wisconsin Department of Health Service's Letter on Dioxin Contamination
2. Letter to the City of Wausau, February 7, 2020, subject line: Review of soil sampling results regarding BRRTS # 02-37-584785 at Riverside Rail Corridor, Wausau, WI.
3. Letter to the City of Wausau, February 7, 2020, subject line: Review of soil sampling results from Riverside Park, Wausau, WI.
4. Full data including the TEQ-adjusted values are presented in the Pace Analytical report dated May 15, 2020. Subject line: RE Pace Project 9073 City of Wausau Park, Pace Project No: 40206820
5. Full data including the TEQ-adjusted values are presented in the Pace Analytical report dated May 11, 2020. Subject line: RE Pace Project 9073 City of Wausau RR Corridor, Pace Project No: 40206821

Figure 1. Location of sampling site



Figure 2. Approximate location of P-11, photo taken 4/13/23

