



# Serum dioxin concentrations from the University of Michigan Dioxin Exposure Study

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## INTRODUCTION & OBJECTIVES

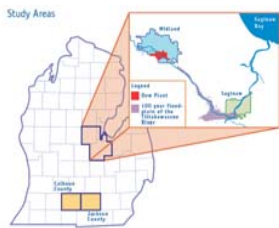
The University of Michigan Dioxin Exposure Study (UMDES) was conducted in response to concern that body burdens of dioxin-like compounds are elevated in Midland and Saginaw counties, Michigan, because of environmental contamination from the Dow Chemical Facility. The Dow Facility is located on the bank of the Tittabawassee River in the city of Midland, MI. Historical emissions from the facility are believed to have contaminated the downstream river sediments, while aerial depositions are thought to have fallen on the city of Midland.

The Tittabawassee River and its floodplain are recreational resources for hunting, sport fishing, picnicking, and water sports in the surrounding communities. Additionally, many residents own property along the river that is contaminated with dioxin-like compounds ('dioxins'). Because potential for human exposure exists it is important to determine whether people who live along the river and use its resources have elevated serum dioxins as compared to the general population.

The objective of this poster is to give a brief overview of the population characteristics and provide the serum concentrations identified during the UMDES.

## METHODS

Adults age 18 years and over who had lived in their current residence for five or more years were eligible to participate. Eligible subjects were randomly selected from the populations of five counties in Michigan. Three counties (Midland, Saginaw, and part of Bay Counties, MI) were chosen because of their proximity to the Dow Chemical Facility and two counties (Jackson and Calhoun Counties, MI) were chosen as a referent population.



Individuals in the five counties were further categorized as living in one of five, geographically-defined regions based on the location of their residence:

- Residents of Midland and Saginaw counties living in the floodplain of the Tittabawassee river. ('Floodplain')
- Residents of Midland, Saginaw, and Bay counties living in areas adjacent to the floodplain of the Tittabawassee River. ('Near floodplain')
- Residents of Midland, Saginaw and Bay counties who do not reside in or near the floodplain of the Tittabawassee River. ('Other Midland/Saginaw')
- Residents of Midland who live downwind from the Dow Chemical Facility. ('Midland plume')
- Residents of Jackson and Calhoun counties in Michigan, a referent population. ('Jackson/Calhoun')

The sampling used a two-stage area probability selection of housing units in each geographic region and a third stage of selection of an eligible person within each sample housing unit. The sample, collected in 2004-2005, included 1324 residents who completed the questionnaire, among whom 946 were medically eligible and completed the blood draw. Data presented in this poster is limited to these 946 individuals.

Demographic and health variables presented here are survey weighted to estimate proportions in the relevant populations. BMI is calculated from self-reported height and weight; cigarette pack-years is calculated by multiplying duration of smoking in years by the average number of packs per day consumed. All other variables are as reported by the respondent.

The serum concentration measurement or Toxic Equivalency (TEQ) is the weighted, summed concentrations of 29 congeners designated by the World Health Organization as having dioxin-like activity. Serum concentration measurements that fell below the limit of detection ('LOD') were estimated using the LOD/√2. Serum results presented are lipid adjusted and survey weighted.

## RESULTS & DISCUSSION

The UMDES questionnaire has ten sections and over 200 questions covering basic health and demographics, residential history, diet, occupation and recreational activities.

Table 1: Demographics & Serum Dioxin Toxic Equivalency (TEQ) Concentrations

	Midland & Saginaw Counties				
	Floodplain N = 243	Near floodplain N = 205	Midland plume N = 43	Other Mid/Sag N = 204	Jackson/ Calhoun N = 251
	<b>Mean (SE)</b>				
Age at interview, yrs	53.8 (1.1)*	50.9 (1.3)	50.9 (2.1)	52.6 (1.9)	49.9 (1.3)
BMI, kg/m <sup>2</sup>	27.8 (0.4)	27.6 (0.4)	29.6 (1.2)	29.1 (0.6)	28.7 (0.5)
Cigarette pack-years	12.6 (1.4)	8.2 (1.3)*	11.0 (3.4)	12.3 (1.6)	12.5 (1.4)
Years at current residence	18.9 (0.8)*	15.4 (0.8)	19.2 (2.7)	20.4 (1.5)*	15.9 (1.0)
	<b>Frequency</b>				
Female, %	53.6	47.2*	77.4	51.1*	61.9
White, %	100.0*	93.9*	98.7	89.6*	95.2
HS graduate, %	91.5	94.5	91.6	87.1	86.2
Ever employed at Midland, MI Dow Chemical Facility	10.0*	7.8	10.0	11.1*	0.5
	<b>Median (Range)</b>				
Serum TEQ <sub>29</sub> – 2005, pg/g lipid	23.3 (4.7 – 211)	21.9 (4.2 – 154)	18.7 (3.8 – 74.9)	20.7 (4.1 – 107)	18.5 (4.7 – 109)

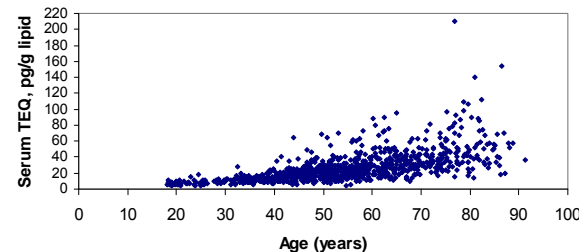
\*Difference from Jackson/Calhoun population is significant at the p ≤ 0.05 level.

Table 1 presents the results of only select demographics from this questionnaire. There are small, but statistically significant differences in the age, sex and racial distributions of Midland and Saginaw Counties from Jackson and Calhoun Counties. Additionally, residents of the Floodplain and Other Midland/Saginaw regions have lived in their current homes for slightly longer (on average), and residents of the Near floodplain region have consumed fewer cigarettes over their lifetime. Most importantly, less than one percent of the Jackson and Calhoun County population has ever worked at the Dow Chemical Facility in Midland, MI as compared to 10% of the population in Midland and Saginaw Counties.

Table 1 also shows that residents of the Floodplain, Near floodplain and Other Midland/Saginaw have slightly higher median serum TEQ levels than residents of Jackson and Calhoun Counties. The primary aim of the University of Michigan Dioxin Exposure Study was to determine if and why serum concentrations were elevated.

Figure 1 shows the 946 serum concentrations plotted by participants' age. As can be seen in the figure, serum dioxin concentrations generally increase with age.

Figure 1: Serum TEQ Concentrations by Age



In addition to adjusting for this increase in serum dioxin concentrations with age, linear regression modeling will assess the impact on population serum levels of occupation, living on soils contaminated with dioxins, recreational activities and consumption of fish and game from the contaminated region.

For more information on dioxins, the University of Michigan Dioxin Exposure Study and the linear regression findings, see **Session T3-G: Dioxins are Forever: Dioxin Exposure and Public Health** and **Session T4-G: Michigan Dioxin Study – University of Michigan Perspective**.

For the UMDES protocol and more in depth information on serum, house dust and soil dioxin concentrations, see the UMDES website at: [www.umdioxin.org](http://www.umdioxin.org).

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