

**Measurements of Household Dust
Concentrations of PCDDs, PCDFs, and PCBs
from a Community in Michigan, USA**

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The University of Michigan Dioxin Exposure Study

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UMDES Study Objectives

- Determine the factors that explain variation in serum congener levels of PCDDs, PCDFs, and PCBs, and quantify how much variation each factor explains
- **Household dust concentration was included in the list of potentially explanatory factors to investigate.**
- Five regions were studied: Midland/Saginaw Floodplain, Midland/Saginaw Near Floodplain, Midland/Saginaw Out of Floodplain, Midland Plume, and Jackson/Calhoun

(Midland/Saginaw = M/S; Floodplain = FP)



Method for Household Dust Collection

- Vacuum sampling (HVS3): cyclone and filter system capable of capturing 99.95% of particles above $0.3 \mu\text{m}$ aerodynamic mean diameter
- Samples were collected from living areas including living rooms, family rooms, dining rooms, and kitchens
- Samples were collected from both hard and soft surfaces but preferentially collected from soft surfaces





Method for Household Dust Analysis

- Attempted to collect at least 10 grams of dust
- One composite sample collected from each home
- Samples were sent by overnight delivery to Alta Analytical Laboratory and analyzed for the WHO designated 29 PCDD, PCDF, and PCB congeners using HRGC/HRMS
- TEF Values: WHO 1998
- Results were weighted by survey sampling probabilities



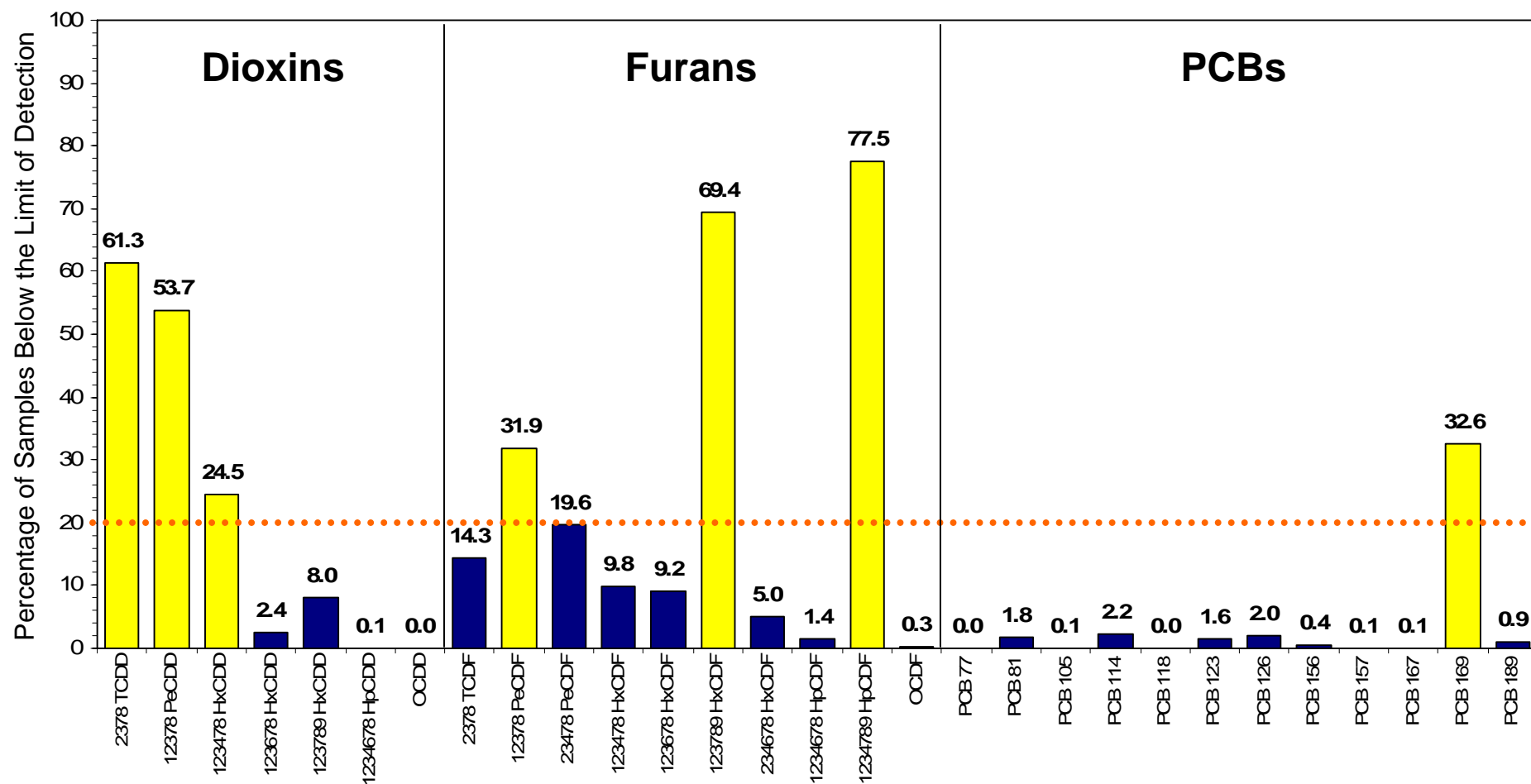
Number of Household Dust Samples

Number of Participants

	Floodplain	Near Floodplain	Midland Plume	Other Midland/Saginaw	Jackson/Calhoun	Total Across All Areas
Interviews	314	276	66	309	359	1324
Blood Samples	243	205	43	204	251	946
Household Dust Samples	205	161	32	168	198	764
Soil Samples	203	164	32	173	194	766
Interviews, blood, dust and soil	195	156	30	167	183	731



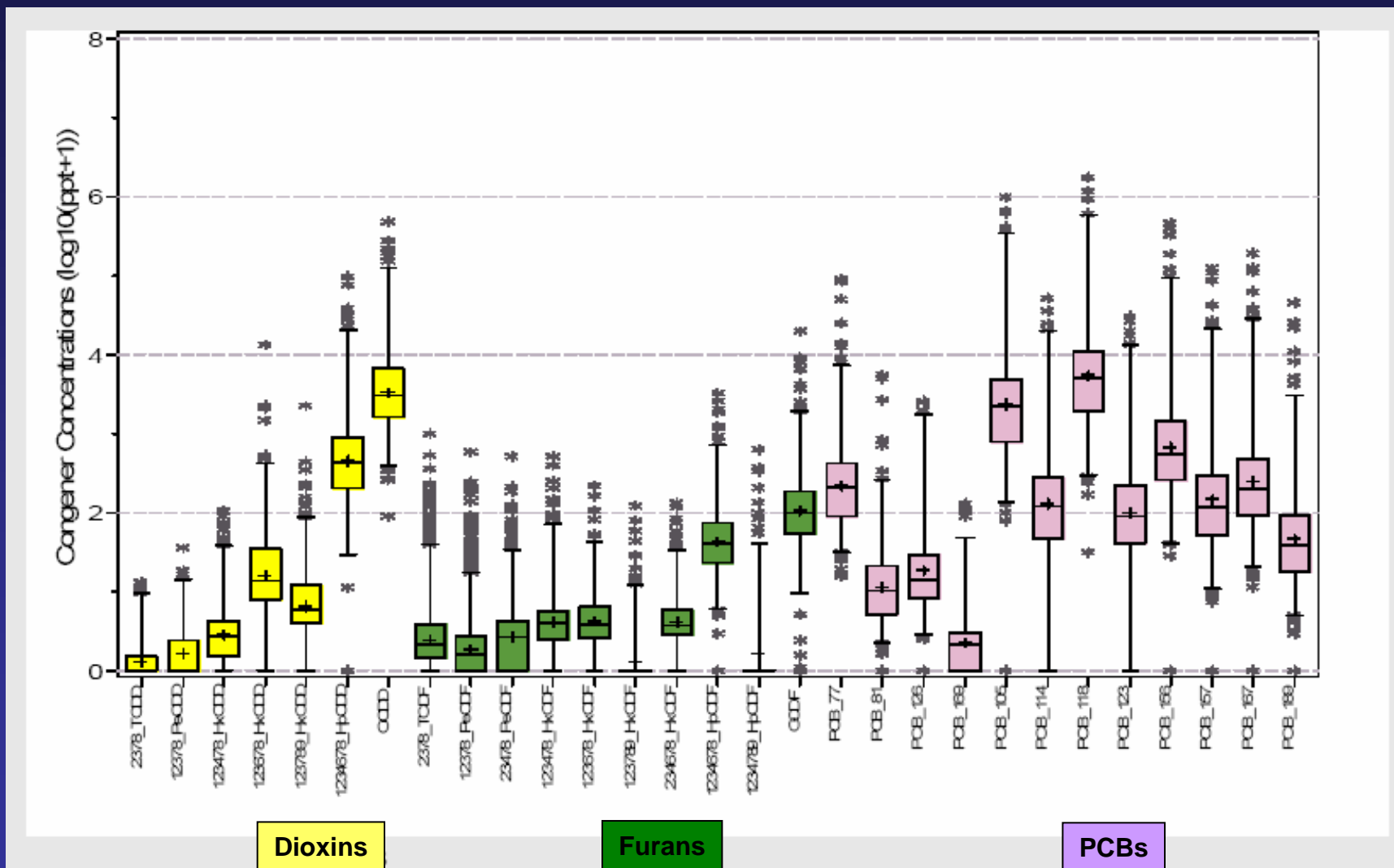
Household Dust Samples Below the Limit of Detection (LOD)



More than 20% of 2378 TCDD, 12378 PeCDD, 123478 HxCDD, 12378 PeCDF, 123789 HxCDF, 1234789 HpCDF, and PCB 169 samples were below the limit of detection.



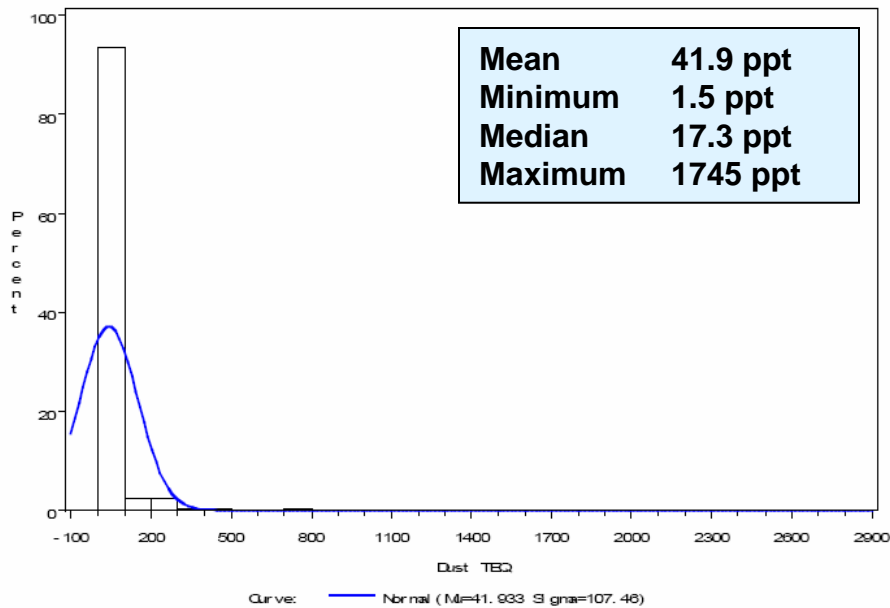
Distribution of Dioxin, Furan, and PCB Congener Concentrations in Household Dust



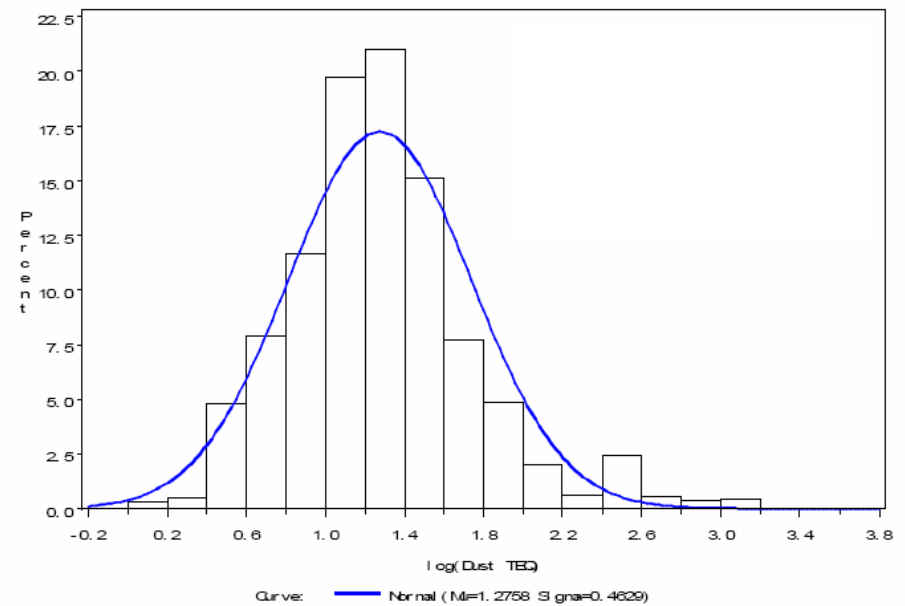


Distribution of Household Dust TEQ Concentration

Overall Distribution of TEQ (N= 764)

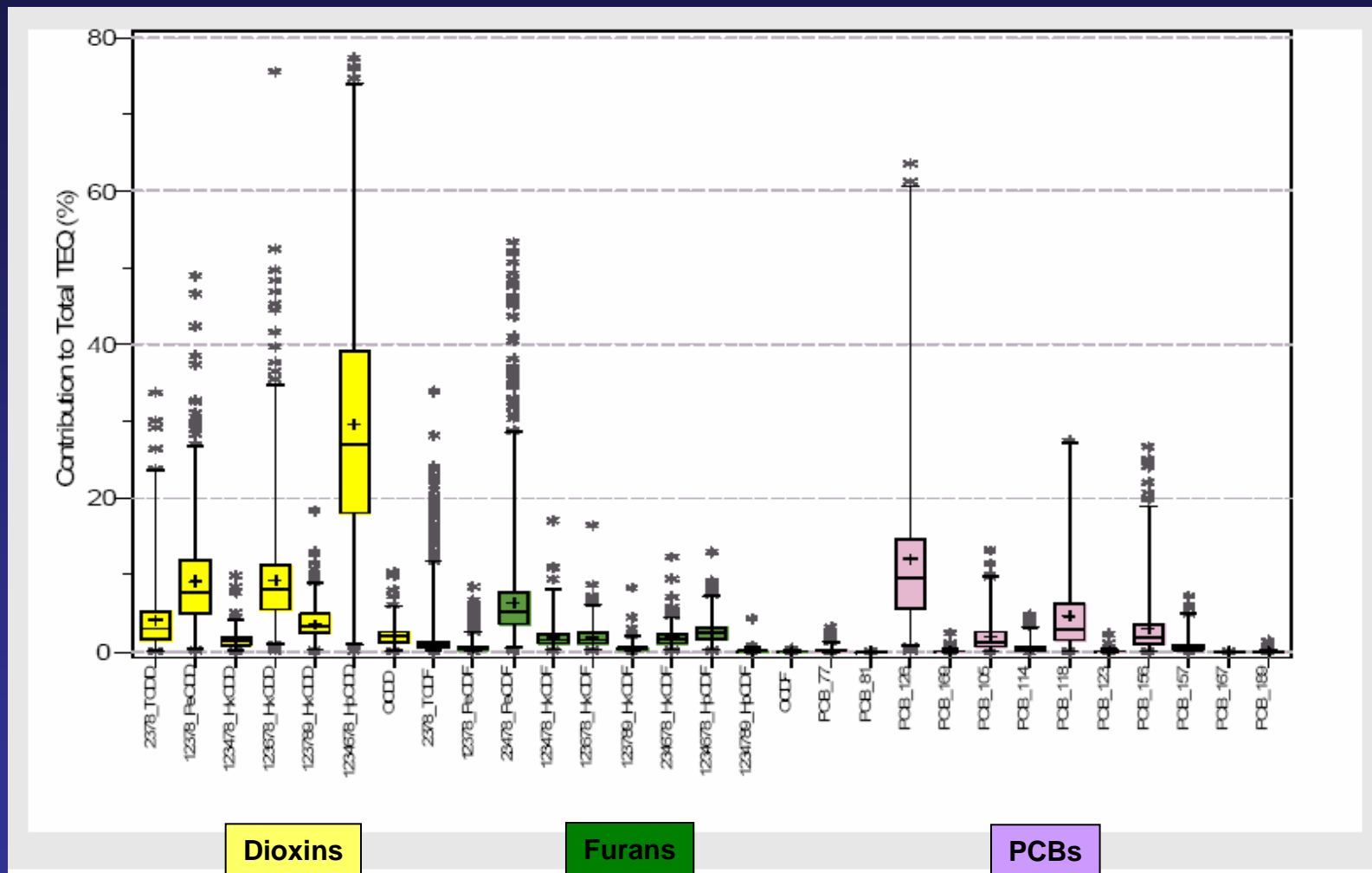


Overall Distribution of log₁₀(TEQ)(N= 764)



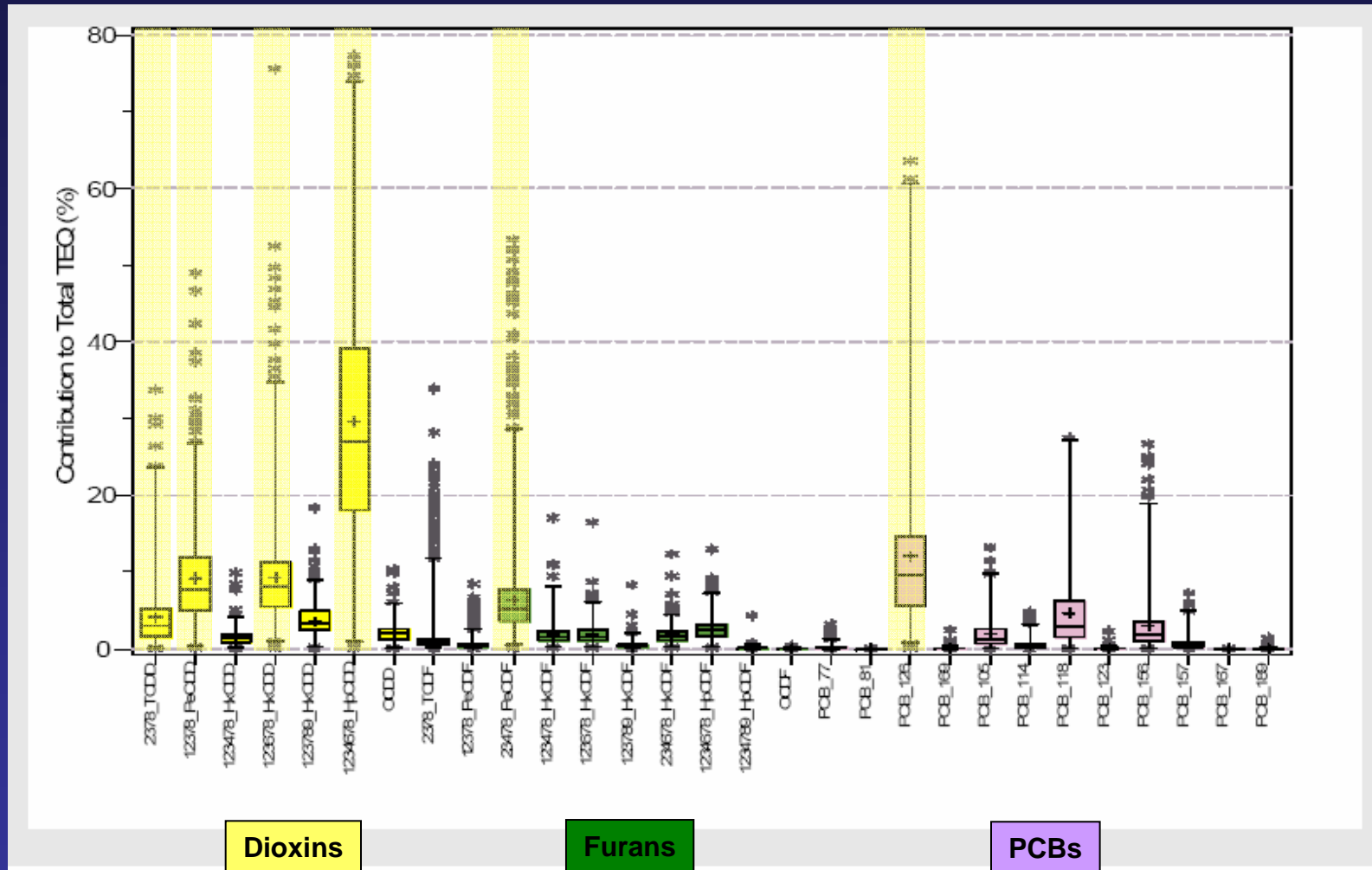


Contribution of Each Congener to the Total TEQ in Household Dust





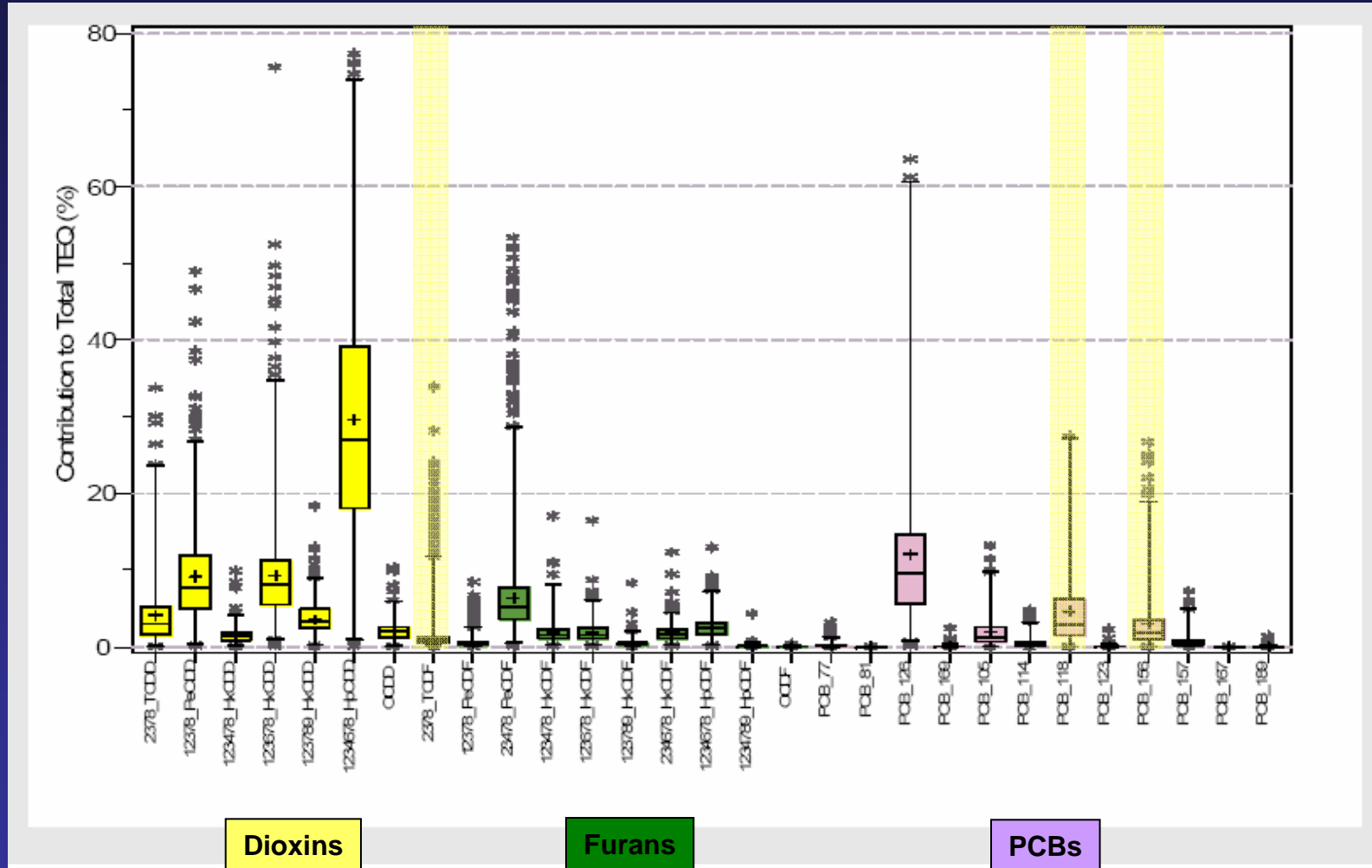
Contribution of Each Congener to the Total TEQ in Household Dust



1234678 HpCDD, PCB 126, 123678 HxCDD, 12378 PeCDD, 23478 PeCDF, and 2378 TCDD are the largest contributors to the household dust TEQ values.



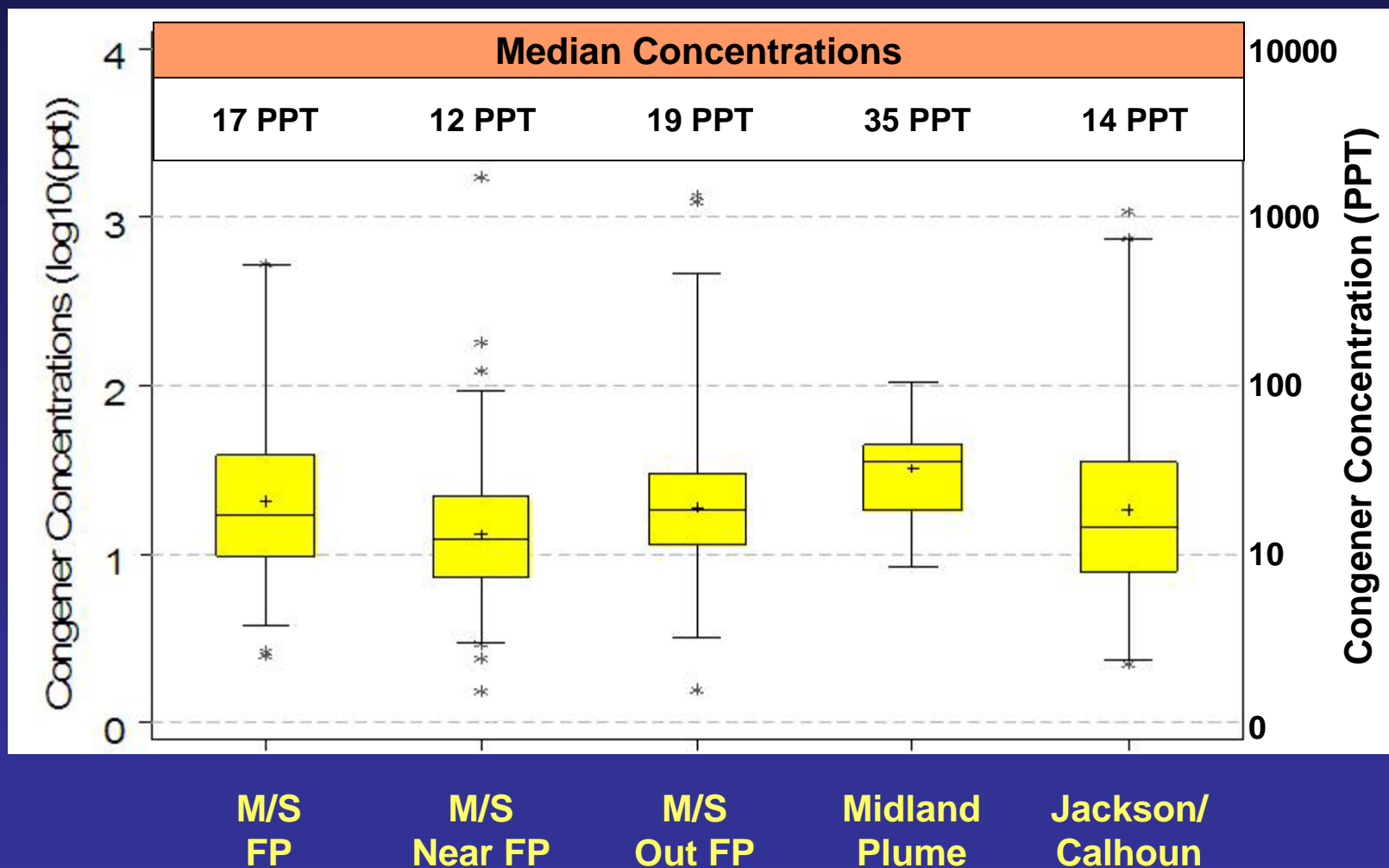
Contribution of Each Congener to the Total TEQ in Household Dust



2378 TCDF, PCB 118, and PCB 156 are also of interest because of the upper end of their distributions.

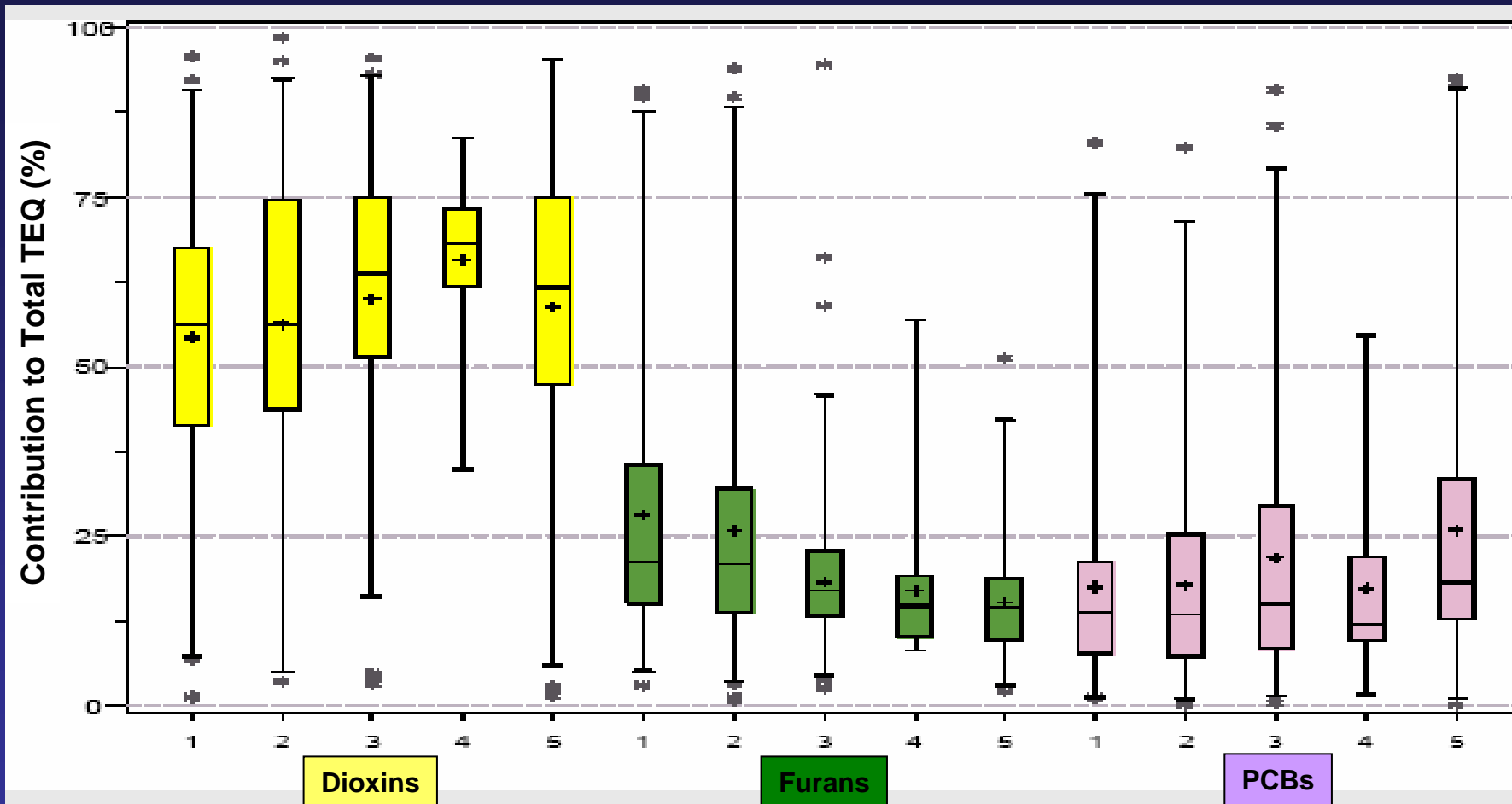


Household Dust TEQ Concentration by Region





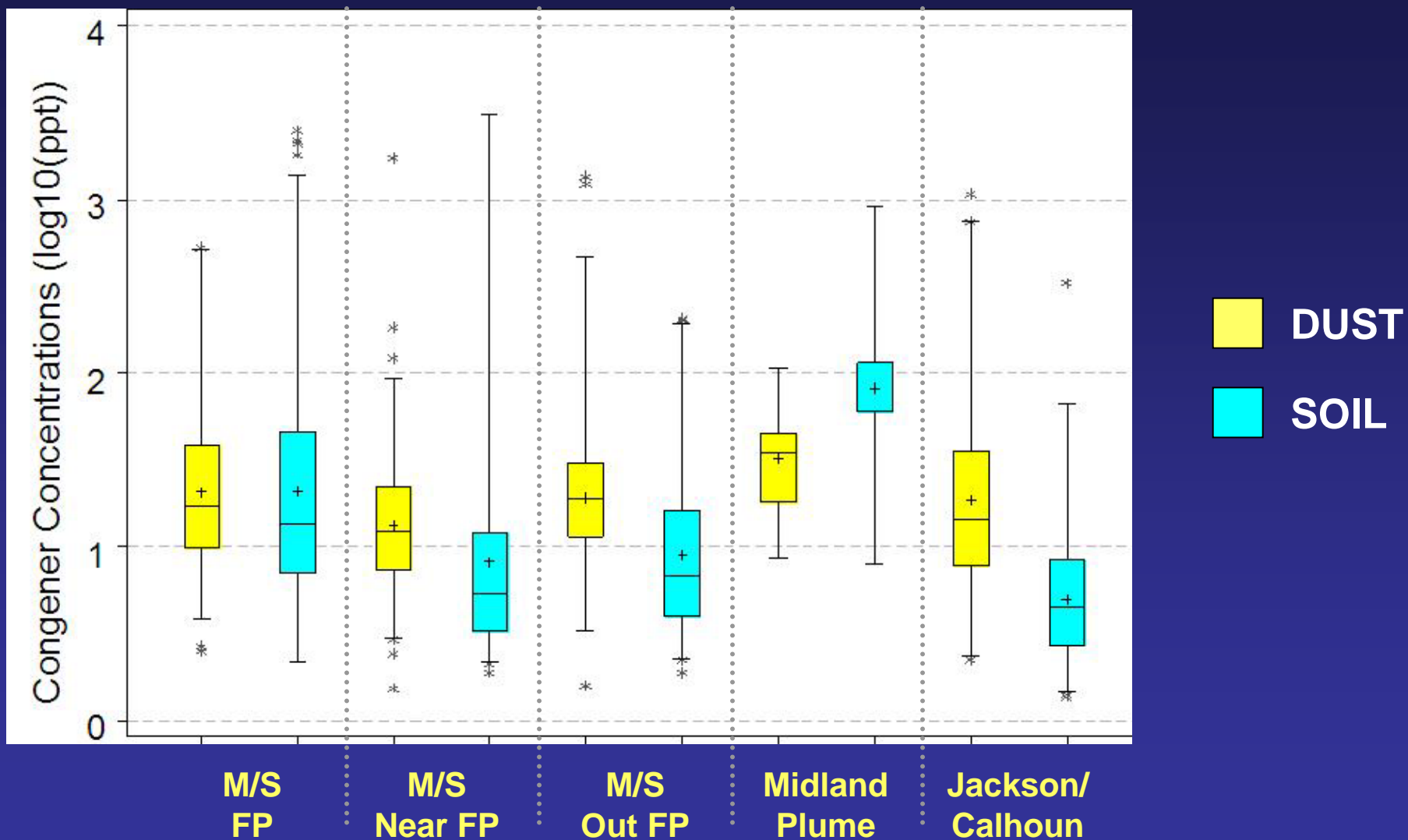
Contribution of PCDDs, PCDFs, and PCBs to the Total TEQ in Household Dust by Region



Region 1: Midland/Saginaw FP 2: Midland/Saginaw Near FP 3: Midland/Saginaw Out FP
4: Midland/Saginaw Plume 5: Jackson/Calhoun



Household Dust TEQ Values versus House Perimeter Soil TEQ Values by Region





Previous Household Dust Studies

Reference (Location)	Congeners Analyzed	N	TEQ Version	Mean (pg/g)	Range (pg/g)
<i>Comparing the 17 Dioxin and Furan Congeners</i>					
Berry 1993	17 Ds & Fs	2	I-TEF/89	8.3 12	NA
Wittsiepe 1997 (Germany)	17 Ds & Fs	10	I-TEF/89	101	7.83-332
O'Conner 2005 (MS, USA)	17 Ds & Fs	14	I-TEF/89 WHO/98	25.2 20.3	2.3-63.6 1.3-53.7
UMDES (MI, USA)	17 Ds & Fs	764	I-TEF/89 WHO/98	34.2 27.2	1.0-1761 1.2-1743
<i>Comparing the 29 Dioxin, Furan and PCB Congeners</i>					
Saito 2003 (Japan)	29 Ds, Fs, & Ps	5 5	WHO/98	15.6 16.0	8.6-26.0 5.9-30.5
UMDES (MI, USA)	29 Ds, Fs, & Ps	764	WHO/98	41.9	1.5-1745



Conclusions about Household Dust Data

- The major contributors to the overall population's household dust TEQ are: 1234678 HpCDD, PCB 126, 123678 HxCDD, 12378 PeCDD, 23478 PeCDF, 2378 TCDD
- Household dust contamination was evident in all five regions
- Congener contributions differed between regions
 - The Midland Plume has an increased contribution to the TEQ from dioxins compared to all other regions
 - The M/S FP has increased contribution to the TEQ from furans
- Household dust is consistently higher than house perimeter soil in all regions except for the Midland Plume
- UMDES household dust levels are generally higher than what has been shown in previous dust studies



Additional UMDES Household Dust Data

In Poster Session A, Poster Area 2:

Poster 102

Principal Components Analysis of Household Dust Concentrations of PCDDs, PCDFs, and PCBs from a Community in Michigan, USA

Poster 103

Methods for Sampling and Analyzing Household Dust for the University of Michigan Dioxin Exposure Study

Poster 104

Predictors of Household Dust Concentrations of PCDDs, PCDFs, and PCBs in a Community in Michigan, USA