



The University of Michigan School of Public Health  
*David H. Garabrant, MD, MPH*

1420 Washington Heights  
Ann Arbor, Michigan 48109-2029

e-mail: dhg@umich.edu

Phone: 734-936-0753  
FAX: 734-763-8095

---

Cheryl Howe, PhD  
Hazardous Waste Management Unit  
Hazardous Waste and Radiological Protection Section  
Waste and Hazardous Materials Division  
Michigan Department of Environmental Quality  
P.O. Box 30241,  
Lansing, MI 48909-7741

February 23, 2007

Dear Cheryl,

I have attached the analyses from the UMDES that were requested at the HHRA meeting on Feb 14. We were asked to provide information on fish consumption that summed the population frequencies of fish consumption for all types of fish. (The materials available on our website to date give information on fish consumption broken down by specific types or groups of fish, but not summed across all types of fish.) Please distribute this to the group that attends the HHRA meetings. I have also attached the Excel version of the tables as a separate document, in case anyone wants them in that format.

There are 6 tables, each giving the frequency of eating fish (ever/never in last 5 years) from a different geographic area/source. As an example, the first table shows the number and percent of people who said they had eaten any of the following types of fish (Catfish, Bullhead, Carp, Suckers, Walleye, Perch, Pike, Pickerel, Muskellunge, Bass, Pan Fish, Steelhead, Trout, Salmon, and any other freshwater fish) taken from the Tittabawassee River in the last 5 years. Results are given for the entire study population (overall), as well as for each of the sub-populations we studied. We studied people who lived in the following areas:

FP = Tittabawassee River floodplain

NearFP = adjacent to Tittabawassee River floodplain

OutFP = all areas of Midland/Saginaw not in any floodplain and not in the Dow plume

Plume = plume downwind of Dow plant in Midland

Jackson = Jackson and Calhoun counties

The second half of the table gives the descriptive statistics (N, mean, SE, 5<sup>th</sup> percentile, 25<sup>th</sup> percentile, median [50<sup>th</sup> percentile], 75<sup>th</sup> percentile, and 95<sup>th</sup> percentile) for the number of fish meals eaten by the study participants for all 5 groups combined (Overall), as well as for each of the sub-populations we studied.

The remaining 5 tables show the same results for fish taken from the

- Saginaw River or Saginaw Bay
- Kalamazoo River
- Fish that were caught elsewhere (meaning sport caught fish not from the Tittabawassee River, Saginaw River, Saginaw Bay, or Kalamazoo River)
- Store bought or bought in a restaurant
- All of the above sources/areas combined

These results are useful because they allow us to estimate the proportion of the population that consumed fish from each of the geographic areas/sources and how many fish meals the people ate. It is important to recognize that these are population estimates, meaning that these estimates apply to entire population that lives in each of the areas we studied. This is true because our study participants were a stratified random sample of the overall population in each area.

During the meeting, the question was raised whether our study included many people who lived in the City of Saginaw. The answer is yes. Because the OutFP participants were a random sample of the population of Midland and Saginaw Counties (excluding the FP, Near FP, and Plume populations), and because the City of Saginaw comprises the large majority of that population, a high proportion of the OutFP participants were drawn from the City of Saginaw.

I hope these tables are helpful to you. Please feel free to call me if I can provide any further information or explanation.

Sincerely,

David H. Garabrant, MD, MPH

**Area: Tittabawassee River**

All fish species: Catfish, Bulhead, Carp, Suckers, Walleye, Perch, Pike, Pickerel, Muskellunge, Bass, Pan Fish, Steelhead, Trout, Salmon, and any other freshwater fish.

Region	N	% Yes	% No	S.E.
Overall	1324	3.2	96.8	0.9
1-FP	314	9.9	90.1	2.0
2-NearFP	276	3.9	96.1	1.3
3-OutFP	309	6.0	94.0	1.6
4-Plume	66	3.3	96.7	2.1
5-Jackson	359	0.5	99.5	0.4

Note: Tables shows the percentage of all participants who had ever/never eaten fish that were caught from the Tittabawassee River during the last 5 years.

Region	N	Mean	S.E.	5%ile	25%ile	Median	75%ile	95%ile
Overall	67	96.3	44.0	2.0	10.0	25.0	75.0	840.0
1-FP	32	47.0	17.8	1.0	5.0	10.4	30.0	180.0
2-NearFP	11	20.6	10.6	2.0	7.0	20.0	25.0	60.6
3-OutFP	19	100.9	51.6	2.0	10.0	25.0	75.0	840.0
4-Plume								
5-Jackson								

Note: Tables shows the total number of meals eaten during the last 5 years among participants who had ever eaten fish that were caught from the Tittabawassee River.

Saved in:

N:\Secure\UMDES\Data\_Statistics\Risk Assessment\For web\HHRA\_1\_02232007.doc

Created by BH, February 23, 2007

**Area:Saginaw River or Saginaw Bay**

All fish species: Catfish, Bulhead, Carp, Suckers, Walleye, Perch, Pike, Pickerel, Muskellunge, Bass, Pan Fish, Steelhead, Trout, Salmon, and any other freshwater fish.

<b>Region</b>	<b>N</b>	<b>% Yes</b>	<b>% No</b>	<b>S.E.</b>
Overall	1324	10.6	89.4	1.1
1-FP	314	21.2	78.8	2.6
2-NearFP	276	29.5	70.5	3.3
3-OutFP	309	18.9	81.1	2.7
4-Plume	66	16.4	83.6	7.6
5-Jackson	359	2.3	97.7	1.1

Note: Tables shows the percentage of all participants who had ever/never eaten fish that were caught from the Saginaw River or Saginaw Bay during the last 5 years.

<b>Region</b>	<b>N</b>	<b>Mean</b>	<b>S.E.</b>	<b>5%ile</b>	<b>25%ile</b>	<b>Median</b>	<b>75%ile</b>	<b>95%ile</b>
Overall	228	50.2	9.6	2.0	10.0	25.0	60.0	240.0
1-FP	71	39.4	8.6	3.0	10.0	15.0	32.4	150.0
2-NearFP	78	50.7	9.8	2.0	5.6	19.0	60.0	260.0
3-OutFP	62	53.7	11.7	3.0	10.0	25.0	60.0	240.0
4-Plume	10	81.3	37.0	5.0	10.0	75.0	75.0	520.0
5-Jackson	7	12.7	5.3	1.0	3.0	10.0	10.0	60.0

Note: Tables shows the total number of meals eaten during the last 5 years among participants who had ever eaten fish that were caught from the Saginaw River or Saginaw Bay.

Saved in:

N:\Secure\UMDES\Data\_Statistics\Risk Assessment\For web\HHRA\_1\_02232007.doc  
Created by BH, February 23, 2007

**Area: The Kalamazoo River between Morrow Pond Dam and Lake Michigan**

All fish species: Catfish, Bulhead, Carp, Suckers, Walleye, Perch, Pike, Pickerel, Muskellunge, Bass, Pan Fish, Steelhead, Trout, Salmon, and any other freshwater fish.

Region	N	% Yes	% No	S.E.
Overall	1324	0.9	99.1	0.3
1-FP	314	0.0	100.0	0.0
2-NearFP	276	0.6	99.4	0.6
3-OutFP	309	0.4	99.6	0.4
4-Plume	66	0.0	100.0	0.0
5-Jackson	359	1.5	98.5	0.6

Note: Tables shows the percentage of all participants who had ever/never eaten fish that were caught from the Kalamazoo River between Morrow Pond Dam and Lake Michigan during the last 5 years.

Region	N	Mean	S.E.	5%ile	25%ile	Median	75%ile	95%ile
Overall	8	69.4	45.9	3.0	7.0	14.0	75.0	240.0
1-FP								
2-NearFP								
3-OutFP								
4-Plume								
5-Jackson	6	84.2	55.1			20.0		

Note: Tables shows the total number of meals eaten during the last 5 years among participants who had ever eaten fish that were caught from the Kalamazoo River between Morrow Pond Dam and Lake Michigan.

Saved in:

N:\Secure\UMDES\Data\_Statistics\Risk Assessment\For web\HHRA\_1\_02232007.doc

Created by BH, February 23, 2007

**Fish that were caught from somewhere else**

All fish species: Catfish, Bulhead, Carp, Suckers, Walleye, Perch, Pike, Pickerel, Muskellunge, Bass, Pan Fish, Steelhead, Trout, Salmon, and any other freshwater fish.

<b>Region</b>	<b>N</b>	<b>% Yes</b>	<b>% No</b>	<b>S.E.</b>
Overall	1324	68.2	31.8	1.4
1-FP	314	61.9	38.1	3.3
2-NearFP	276	59.6	40.4	3.5
3-OutFP	309	66.4	33.6	3.1
4-Plume	66	59.1	40.9	9.1
5-Jackson	359	70.6	29.4	2.9

Note: Tables shows the percentage of all participants who had ever/never eaten fish that were caught from somewhere else during the last 5 years.

<b>Region</b>	<b>N</b>	<b>Mean</b>	<b>S.E.</b>	<b>5%ile</b>	<b>25%ile</b>	<b>Median</b>	<b>75%ile</b>	<b>95%ile</b>
Overall	833	135.0	21.5	2.0	11.8	35.0	125.2	552.0
1-FP	195	75.6	7.8	1.0	8.2	34.0	94.4	303.8
2-NearFP	156	113.1	18.9	2.0	10.0	45.0	121.2	520.0
3-OutFP	200	110.0	18.0	2.0	10.0	26.2	95.0	603.0
4-Plume	43	113.2	31.6	5.0	10.0	57.4	91.0	551.6
5-Jackson	239	158.6	38.4	2.0	15.0	49.0	147.0	528.0

Note: Tables shows the total number of meals eaten during the last 5 years among participants who had ever eaten fish that were caught from somewhere else.

Saved in:

N:\Secure\UMDES\Data\_Statistics\Risk Assessment\For web\HHRA\_1\_02232007.doc

Created by BH, February 23, 2007

**Fish that were store-bought or bought in a restaurant**

All fish species: Catfish, Bulhead, Carp, Suckers, Walleye, Perch, Pike, Pickerel, Muskellunge, Bass, Pan Fish, Steelhead, Trout, Salmon, and any other freshwater fish.

<b>Region</b>	<b>N</b>	<b>% Yes</b>	<b>% No</b>	<b>S.E.</b>
Overall	1324	77.8	22.2	1.3
1-FP	314	83.4	16.6	2.7
2-NearFP	276	88.0	12.0	2.1
3-OutFP	309	83.1	16.9	2.7
4-Plume	66	75.4	24.6	9.3
5-Jackson	359	73.0	27.0	2.6

Note: Tables shows the percentage of all participants who had ever/never eaten fish that were store-bought or bought in a restaurant during the last 5 years.

<b>Region</b>	<b>N</b>	<b>Mean</b>	<b>S.E.</b>	<b>5%ile</b>	<b>25%ile</b>	<b>Median</b>	<b>75%ile</b>	<b>95%ile</b>
Overall	1080	168.2	12.6	4.0	20.0	64.0	191.0	655.0
1-FP	271	122.3	8.6	5.0	26.2	62.0	183.2	360.0
2-NearFP	239	154.5	14.3	9.6	35.0	75.0	204.0	524.2
3-OutFP	256	176.8	19.9	5.0	25.0	75.0	240.0	640.0
4-Plume	55	131.3	24.7	5.0	15.0	62.0	240.0	500.0
5-Jackson	259	163.1	17.7	3.0	15.0	60.0	180.0	795.0

Note: Tables shows the total number of meals eaten during the last 5 years among participants who had ever eaten fish that were store-bought or bought in a restaurant.

Saved in:

N:\Secure\UMDES\Data\_Statistics\Risk Assessment\For web\HHRA\_1\_02232007.doc

Created by BH, February 23, 2007

**Fish that were from any areas.**

All fish species: Catfish, Bulhead, Carp, Suckers, Walleye, Perch, Pike, Pickerel, Muskellunge, Bass, Pan Fish, Steelhead, Trout, Salmon, and any other freshwater fish.

<b>Region</b>	<b>N</b>	<b>% Yes</b>	<b>% No</b>	<b>S.E.</b>
Overall	1324	87.1	12.9	1.2
1-FP	314	89.3	10.7	2.3
2-NearFP	276	92.3	7.7	1.7
3-OutFP	309	89.9	10.1	1.6
4-Plume	66	78.8	21.2	9.4
5-Jackson	359	84.9	15.1	2.2

Note: Tables shows the percentage of all participants who had ever/never eaten fish.

<b>Region</b>	<b>N</b>	<b>Mean</b>	<b>S.E.</b>	<b>5%ile</b>	<b>25%ile</b>	<b>Median</b>	<b>75%ile</b>	<b>95%ile</b>
Overall	1175	266.6	22.8	10.0	44.4	122.6	299.6	1040.0
1-FP	287	181.1	12.2	6.0	42.0	116.0	276.0	546.0
2-NearFP	252	237.7	19.5	10.0	60.0	143.6	291.4	745.4
3-OutFP	278	263.0	27.1	10.0	49.4	120.0	305.0	1020.0
4-Plume	59	236.8	47.8	11.0	60.2	175.0	276.8	742.0
5-Jackson	299	274.0	38.8	9.0	37.0	125.0	300.0	1040.0

Note: Tables shows the total number of meals eaten during the last 5 years among participants who had ever eaten fish.

Saved in:

N:\Secure\UMDES\Data\_Statistics\Risk Assessment\For web\HHRA\_1\_02232007.doc

Created by BH, February 23, 2007

**February 26, 2007**

After we sent out the previous tables to the group that attends the HHRA meetings, we were asked to provide two more tables to show:

- (1) The percentages of participants that consumed fish (including all types of fish) from both the Tittabawassee River and Saginaw River/Bay during the last 5 years;
- (2) The descriptive statistics for the number of meals eaten during the last 5 years among participants that consumed fish (including all types of fish) from both the Tittabawassee River and Saginaw River/Bay.

**Area: Both the Tittabawassee River and the Saginaw River/Bay**

All fish species: Catfish, Bullhead, Carp, Suckers, Walleye, Perch, Pike, Pickerel, Muskellunge, Bass, Pan Fish, Steelhead, Trout, Salmon, and any other freshwater fish.

Region	N	% Yes	% No	S.E.
Overall	1324	2.8	97.2	0.8
1-FP	314	6.3	93.7	1.5
2-NearFP	276	3.4	96.6	1.3
3-OutFP	309	5.2	94.8	1.4
4-Plume	66	1.6	98.4	1.3
5-Jackson	359	0.5	99.5	0.4

Note: This table shows the percentages of participants that consumed fish from both the Tittabawassee River and Saginaw River/Bay during the last 5 years.

Region	N	Mean	S.E.	5%ile	25%ile	Median	75%ile	95%ile
Overall	54	187.3	67.4	4.0	50.0	100.0	135.0	1020.0
1-FP	24	125.9	37.0	6.0	20.0	40.0	240.0	480.0
2-NearFP	9	36.7	24.7	17.0	23.8	30.0	34.4	109.2
3-OutFP	17	192.4	77.6	4.0	50.0	100.0	140.0	1020.0
4-Plume								
5-Jackson								

Note: Tables shows the total number of meals eaten during the last 5 years among participants that consumed fish from both the Tittabawassee River and Saginaw River/Bay.

Saved in:

N:\Secure\UMDES\Data\_Statistics\Risk Assessment\For web\HHRA\_1\_02232007.doc

Created by BH, February 26, 2007