Letter Health Consultation

Evaluation of Fish Tissue Data

WURTSMITH AIR FORCE BASE

OSCODA, IOSCO COUNTY, MICHIGAN

Prepared by
Michigan Department of Community Health

AUGUST 31, 2012

Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Community Health Investigations
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

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LETTER HEALTH CONSULTATION

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Under Cooperative Agreement with
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry (ATSDR)

STATE OF MICHIGAN
DEPARTMENT OF COMMUNITY HEALTH
LANSING

RICK SNYDER
GOVERNOR

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August 29, 2012

Joseph Bohr, Coordinator
Fish Contaminant Monitoring Program
Michigan Department of Environmental Quality
P.O. Box 30458
Lansing, MI 48909

Dear Mr. Bohr:

On May 2, 2012, the Michigan Department of Environmental Quality (MDEQ) provided fish tissue data to the Michigan Department of Community Health's (MDCH) Division of Environmental Health, requesting a public health opinion. The fish, taken from ponds in Clark's Marsh, near Oscoda in Iosco County, had been analyzed for perfluorinated chemicals (PFCs), the main chemical of interest being perfluorooctane sulfonate (PFOS). MDCH concluded that the levels of PFOS in the fish exceeded the preliminary no-consumption screening level. The source of the PFCs is not sufficiently characterized nor is it controlled. The lack of characterization and control of the source presents uncertainty whether the existing samples, which represent a snapshot in time, are representative of future concentrations. Based on these two facts, MDCH issued a public health "do not eat" fish advisory notice (attached).

This letter discusses in further detail the derivation of the preliminary Fish Consumption Screening Value (FCSV) for PFOS and the analytical results of the Clark's Marsh fish samples. Recommendations for additional actions are also provided.

The MDEQ is overseeing environmental monitoring at the former Wurtsmith Air Force Base (WAFB) in Oscoda (see attached map). The WAFB was proposed as a National Priorities List (Superfund) site in 1994 (http://www.epa.gov/R5Super/npl/michigan/MI5570024278.html). In recent years, the fire-training area on the south side of the base has been investigated for PFCs (R. Delaney, MDEQ, personal communication, 2011). PFOS was a constituent of aqueous film-forming foam (AFFF), used for fire-fighting when flammable liquids, like aviation fuel, are involved (http://www.fffc.org/images/AFFFfactsheet.pdf). PFCs have contaminated the groundwater, which flows toward Clark's Marsh, a wetland area with fishable ponds. The marsh is located between WAFB and the Au Sable River, a nationally popular fishery (R. Delaney, MDEQ, personal communication, 2011).

Fish samples were taken from four ponds in Clark's Marsh in 2011 and analysis completed in 2012. Table 1 shows the results of the sampling. Although other PFCs were present (data not shown), PFOS was the predominant PFC detected in the fish samples.

Table 1. Perfluorooctane sulfonate (PFOS) concentrations in fish sampled from ponds in Clark's Marsh (south of Wurtsmith Air Force Base [WAFB]) in Oscoda, Iosco County, Michigan in 2011. (Concentrations are in nanograms per gram [ng/g, or parts per billion (ppb)]).

Pond	No. fish	Species	PFOS Range	PFOS Average[1]
1 (closest to WAFB)	5	Pumpkinseed	4,750 - 8,930	7,040
2	5	Pumpkinseed	3,290 - 9,580	5,642
3	4	Pumpkinseed	3,170 - 3,820	3,390
4 (farthest from WAFB)	5	Pumpkinseed (4), Bluegill (1)	334 - 1,290	618

The State of Michigan currently does not have finalized FCSVs for PFCs, nor does a formal U.S. Environmental Protection Agency (EPA) chronic Reference Dose (RfD) for PFOS exist. However, the EPA (2009) has derived a subchronic RfD of 0.08 micrograms per kilogram-day (µg/kg-day) for PFOS, and the Minnesota Department of Health (MDH; 2007) has established the same value as its chronic RfD for PFOS. The EPA subchronic/MDH chronic RfD is derived from a study by Seacat et al. (2002) in which male and female Cynomolgus monkeys were orally dosed with different levels of PFOS for 183 days. Increased levels of thyroid-stimulating hormone in males, reduced total triiodothyronine in males and females, and reduced levels of high-density lipoproteins in females were observed at the lowest administered dose. The half-life of PFOS in humans is estimated to be 5.4 years (Lau et al., 2007).

The EPA selected the No Observed Adverse Effect Level (NOAEL) of 0.03 milligrams per kilogram per day (mg/kg-day) and applied uncertainty factors of 10 for intraspecies variation, 3 for toxicodynamic variations in dose-response between monkeys and humans, and 13 for toxicokinetic consideration of differences in clearance from the body, for a composite interspecies uncertainty factor of 39. The total uncertainty factor applied, therefore, was 390 (EPA 2009).

$$EPAsubchronicRfD = \frac{0.03}{(10 \times 3 \times 13)} = 0.000077 mg/kg-day = 0.08 \mu g/kg-day$$

When it first developed a chronic RfD for PFOS, MDH selected the Lowest Observed Adverse Effect Level (LOAEL) of 0.15 mg/kg-day and divided it by 20, for slower elimination, to derive a human dose equivalent of 0.0075 mg/kg-day. MDH applied an uncertainty factor of 10 for intraspecies variation, a factor of 3 for toxicodynamic variations between species (the toxicokinetic considerations were addressed when deriving the human dose equivalent), and a factor of 3 for extrapolating from a LOAEL to a NOAEL. The total uncertainty factor applied, therefore, was 100, resulting in an RfD of 0.075 µg/kg-day (MDH 2007).

MDH re-evaluated its assessment of PFOS using blood serum data from the monkey study. In the re-evaluation, MDH derived a benchmark dose of 35 micrograms per milliliter (µg/ml) and converted that to a human dose of 0.0025 mg/kg-day. They applied the same intraspecies uncertainty factor (10) and the interspecies toxicodynamic factor of 3, for a total uncertainty factor of 30 (MDH 2007).

$$MDHchronicRfD = \frac{0.0025}{(10 \times 3)} = 0.000083 mg/kg-day = 0.08 \mu g/kg-day$$

[1] Average given is the arithmetic mean. Sample size was not sufficient to conduct statistical analysis.

Following EPA guidance (2000), MDCH used the EPA subchronic/MDH chronic RfD in a screening value algorithm to derive a preliminary FCSV for PFOS:

$$FCSV_{PFOS} = \frac{RfD \times BW}{CR}$$

where BW (body weight) = 80 kg (EPA 2011), and
CR (consumption rate) in grams/day (g/day).

MDCH calculates the consumption rate (CR) by assuming a frequency of fish meals ranging as low as 6 meals per year. MDCH considers one meal of fish to be one half pound, which is equal to 227 grams (Great Lakes Consortium 2007). At 6 meals per year, the average CR is about 3.7 grams of fish per day and the preliminary $FCSV_{PFOS}$ is calculated to be 1.7 µg/g, which is equivalent to 1,700 ppb. Fish containing levels of PFOS greater than this concentration should not be eaten.

Although the concentrations of PFOS in fish tested from Pond 4 (average PFOS concentration of 618 ppb) were less than the preliminary FCSV, the lack of source control and characterization given the presence of the chemical is sufficient reason to extend the no-consumption advisory to this pond. Also, because PFC concentrations may biomagnify in the food chain, resulting in higher trophic level species of fish with higher concentrations, the advisory is applied to all fish species.

Currently, there are no PFC data for fish in the Au Sable River. Groundwater may discharge to the river, and the Clark's Marsh ponds are connected to the river by surface water, although fish are not expected to travel between the water bodies (R. Delaney, MDEQ, personal communication, 2012). Until data from Au Sable River fish are available, the lack of PFC source control and characterization at this site is the basis on which MDCH has extended the no-consumption advisory to fish in the lower stretch of the river. There is a dam about four miles upriver from the marsh, so potentially contaminated fish would not be expected to swim upstream of that point.

Based on the fish samples collected from Clark's Marsh exceeding the preliminary FCSV for PFOS, the lack of source control and characterization, and given that the key toxicological study for PFOS showed effects presumed to be relevant to humans, MDCH concludes that consumption of fish from Clark's Marsh and the lower Au Sable River may harm people's health. Therefore, people should not eat fish from Clark's Marsh or, as a precaution, the lower Au Sable River (from Foote Dam to the mouth).

MDCH makes the following recommendations for follow-up public health actions:

- *Conduct additional fish testing in this area to better understand the extent of the problem.* MDEQ has fish samples from the Au Sable River and Van Etten Lake, which is east of WAFB, and has begun the analysis. MDCH will evaluate the results and adjust the fish consumption advisory as appropriate.
- *Determine a State of Michigan FCSV for PFOS and, if possible, other PFCs.* MDCH has begun this process and is conferring with toxicologists from other agencies.
- *Conduct outreach and education to affected communities.* MDCH is working with the U.S. Department of Defense (DOD), who is the responsible party for the WAFB.
- *Conduct a broader evaluation of public health impacts from environmental contamination at the WAFB.* MDCH will partner with its federal partner, the Agency for Toxic Substances and Disease Registry, in assessing the site. Findings will be documented in a Public Health Assessment report.

Sincerely,

Christina Rose Bush

Christina Bush, Toxicologist
Toxicology and Response Section
Division of Environmental Health

CC: Bob Delaney, MDEQ Remedial Division
District Health Department #2
Agency for Toxic Substances and Disease Registry
David Strainge, U.S. Department of Defense
Oscoda Township
Au Sable Township
U.S. Forest Service

Attachments

References:

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May 2, 2012 MDCH news release: MDCH Issues “Do Not Eat” fish Advisory for Clarks Marsh in Iosco County”. http://www.michigan.gov/mdch/0,4612,7-132-8347-277156--,00.html

MDCH - MDCH Issues "Do Not Eat" Fish Advisory for Clarks Marsh in Iosco County - Windows Internet Explorer

Department of Community Health

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MDCH Issues "Do Not Eat" Fish Advisory for Clarks Marsh in Iosco County

Contact: Angela Minicuci (517) 241-2112

FOR IMMEDIATE RELEASE: May 2, 2012

LANSING - The Michigan Department of Community Health (MDCH) has issued a 'do not eat' advisory for all fish taken from Clarks Marsh, south of the former Wurtsmith Air Force Base, in Iosco County. Pumpkinseed and bluegill fish samples were collected from the marsh in 2011. Laboratory analysis of the samples indicates that levels of perfluorinated chemicals (PFCs) in the fish are too high for people to safely eat.

Currently there are no PFC data for fish from the Au Sable River near the marsh, however MDCH advises that people do not eat fish taken from the river south and east of Clarks Marsh.

The MDCH bases this fish consumption advice on reference values used by the U.S. Environmental Protection Agency (EPA) and the Minnesota Department of Health.

While only smaller fish from Clark's Marsh have been analyzed, scientific information suggests that as larger, predatory fish eat the smaller fish, the PFCs will build up in the edible flesh, therefore the fish advisory covers all species. For the Au Sable River upstream from Clarks Marsh, people should follow the fish consumption advice in the Michigan "Eat Safe Fish" Advisory, at www.michigan.gov/eatsafefish or call (800) 648-6942.

PFCs are chemicals that are used in fire-fighting foams, non-stick ("Teflon") manufacturing, electroplating, and textiles. They are of concern because they are persistent in the environment and the food chain and can result in health hazards to humans. The only known site of PFC contamination in Michigan is the former Wurtsmith Air Force Base in Oscoda. MDCH is working with the Michigan Department of Environmental Quality and the EPA to determine the nature and extent of this issue.

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Map of Wurtsmith Air Force Base, the area of Clark's Marsh, the Au Sable River (to south), Van Etten Lake (inland lake to northeast), and the town of Oscoda (east, along Lake Huron shoreline), Iosco County, Michigan.