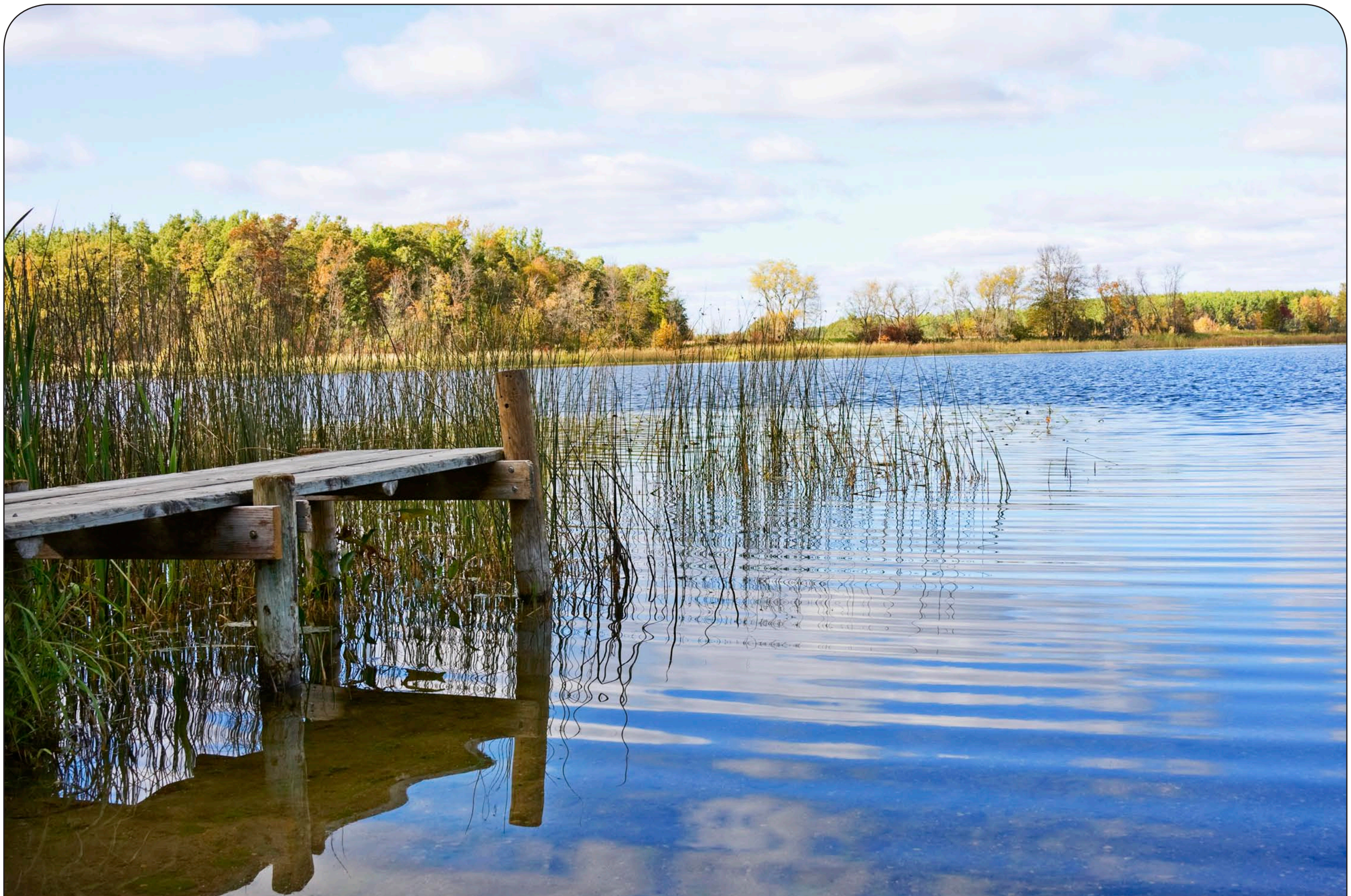

PFCs in Minnesota's Ambient Environment:

2008 Progress Report

Minnesota Pollution Control Agency

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PFC Acronym Glossary

Groups

PFCs – perfluorochemicals or perfluorinated compounds
PASs – perfluoroalkyl surfactants
PFCAs – perfluorocarboxylic acid
PFSAs – polyfluorinated alkyl substances
FTOH – fluorotelomer alcohols
PFAAs – perfluoroalkyl acids

Individual

PFBA – perfluorobutanoic acid
PFBS – perfluorobutane sulfonate
PFPeA – perfluoropentanoic acid
PFHxA – perfluorohexanoic acid
PFHxS – perfluorohexane sulfonate
PFHpA – perfluoroheptanoic acid
PFOA – perfluorooctanoic acid
PFOS – perfluorooctane sulfonate
PFOSA – perfluorooctane sulfonamide
PFNA – perfluorononanoic acid
PFDA – perfluorodecanoic acid
PFUnA – perfluoroundecanoic acid
PFDoA – perfluorododecanoic acid
N-EtFOSE – N-ethyl perfluorooctanesulfonamidoethanol
N-MeFOSE – N-methyl perfluorooctanesulfonamidoethanol

Other Acronyms

AFFF – aqueous fire fighting foam
ECF – electrochemical fluorination
WWTP – wastewater treatment plant

Executive Summary

Perfluorochemicals (PFCs) are a group of fully-fluorinated carbon-based compounds that repel both oil and water and are very resistant to breakdown in the environment. These properties have led to their use in numerous industrial and consumer products. Specific PFCs of interest in Minnesota include PFOS (perfluorooctane sulfonate), PFOA (perfluorooctanoic acid) and PFBA (perfluorobutanoic acid).

Manufacture of PFCs in Minnesota began in the late 1950s by 3M Corporation at its Cottage Grove Facility. 3M ceased production of PFOS and PFOA in 2002 after several studies showed that PFCs were bioaccumulating in humans and wildlife worldwide. In 2004, PFCs were detected in drinking water supplies in several eastern Twin Cities suburbs; sources of the contamination were traced to legal disposal of 3M manufacturing wastes. The Minnesota Pollution Control Agency (MPCA) and the Minnesota Department of Health (MDH) have since identified contaminated wells and provided clean drinking water to affected consumers.

PFCs are released to the environment through manufacturing processes, industrial use, and the use of PFC-containing consumer products. PFCs, like PFOS and PFOA, are also formed from the breakdown of other fluorinated compounds such as fluorotelomer alcohols produced by DuPont. In order to identify potential sources of PFCs to the environment it is critical to understand the fate and transport processes governing these compounds.

It is now known that PFCs are ubiquitous environmental contaminants. This is a concern because some PFCs (such as PFOS and PFOA) are persistent, bioaccumulative and toxic. The worldwide presence of PFCs in humans and animals provides strong evidence that exposure to this group of chemicals is through general environmental exposure and is not limited to known point sources or areas of contamination. Although all routes of exposure have yet to be clearly defined, exposure likely occurs through a variety of pathways including drinking water, food and food packaging, and use of consumer products containing PFCs.

In Minnesota, it has been apparent since 2006 that PFCs may be present at concentrations of potential concern in the ambient environment (i.e., away from 3M disposal sites). The MPCA negotiated a Consent Order with 3M in May 2007. The Consent Order provided funding for additional monitoring of PFCs around Minnesota and intense remediation efforts at the 3M manufacturing and waste disposal sites. Since then, the MPCA has made a number of important discoveries regarding PFCs in Minnesota's ambient environment.

Some of the results to date presented in this report include the following findings. Several lakes in the Twin Cities and portions of the Mississippi River have elevated concentrations of PFOS in fish tissue, which has resulted in fish consumption advisories. Sampling indicates that, although present, PFC concentrations in shallow ambient ground water are well below health advisory concentrations. Most sampled waste water treatment plant influent, effluent, and sludge has detectable concentrations of PFCs. PFCs were detected in permitted landfills leachate, landfill gas, and landfill gas condensate, as well as in ground water upgradient and downgradient of the facility. More detail and additional results are presented in the report, including several extensive data sets in the appendices.

Introduction

Perfluorochemicals (PFCs) are a group of fully-fluorinated carbon-based compounds that repel both oil and water and are very resistant to breakdown in the environment. These properties have led to the use of PFCs in numerous industrial and consumer products. PFOS* (perfluorooctane sulfonate), PFOA (perfluorooctanoic acid), and PFBA (perfluorobutanoic acid) are examples of individual PFCs of concern in Minnesota. Common applications of PFCs include non-stick coatings for cookware, stain repellants, paper coatings, food packaging, fire-fighting foams, lubricants, wetting agents, corrosion inhibitors, cleaning products, cosmetics, and pesticide applications.

At this time, PFOS, PFOA, and PFBA are the PFCs of greatest interest in Minnesota due to their persistence, toxicity, and/or widespread detection in the environment and biota.

Manufacture of PFCs in Minnesota began in the late 1950's by 3M Corporation at its Cottage Grove Facility. After research found that PFOS could be measured in not just wildlife but also humans from around the world, 3M began the process of phasing out of the manufacture of the 8-carbon PFCs (PFOS and PFOA) and PFOS-related products in 2000. The phase out of PFOS production in Minnesota was completed in 2002. Since that time, 3M has worked to develop new technologies based on shorter chain PFCs such as perfluorobutane sulfonate (PFBS).

Although PFCs have been in commercial use for nearly 50 years they have only recently been detected in the global environment. It is now known that PFCs are ubiquitous environmental contaminants; they have been detected globally in lakes, rivers, oceans, sediment, soil, precipitation, air, biota, sewage sludge, and wastewater effluent. This is a concern because some PFCs are persistent, bioaccumulative and toxic. Several studies indicate that most wildlife and humans worldwide have at least some PFCs in their blood. While many sources of PFC exposure remain unknown, it is likely that exposure to PFCs occurs through consumption of contaminated food and water, and the use of numerous PFC-containing commercial products.

In 2004, PFCs detected in drinking water supplies in several eastern Twin Cities suburbs were traced to legal disposal of 3M manufacturing wastes, which occurred in the 1950s and later at four different locations. The Minnesota Pollution Control Agency (MPCA) and the Minnesota Department of Health (MDH) have since identified contaminated wells and provided clean drinking water to affected consumers. Most of the drinking-water problems have been characterized and brought under control. However, PFCs have been detected in all other environmental settings tested to date in Minnesota.

*Please refer to the acronym glossary at the beginning of this document for a complete list of acronyms used.

The May 2007 Consent Order with 3M paid for additional monitoring of PFCs around Minnesota as well as intense remediation efforts at the 3M manufacturing and waste disposal sites. From this work, the MPCA has learned that:

- The use of PFCs in industrial, commercial and consumer product applications continues even though 3M ceased production of PFOA and PFOS in 2002. Manufacturers in other countries continue to produce PFOA and PFOS for use in products that are legally exported and used for beneficial purposes in the U.S. and around the globe.

- Past and present PFC usage provides pathways for release into the environment that cannot be solely attributed to 3M, which developed the original PFC chemistry.

Consent Order with 3M

In 2007, the MPCA negotiated a Consent Order (legally binding agreement) with 3M on the PFC contamination in Minnesota. The issues addressed in the Consent Order are as follows:

- Rigorous, robust cleanup plan
- Recognition of MPCA jurisdiction
- Municipal and private drinking water supplies
- Future actions on PFBA
- Additional studies on health and environmental effects
- Cooperation from 3M on sharing research and information
- Preservation of MPCA's right to take action in the future

The MPCA is therefore pursuing a broader approach to addressing PFCs effectively, both in the short and long term:

- Investigations – ongoing studies to understand the presence, extent, sources, movement and fate of PFCs in the environment
- Remediation– vigorous and effective completion of cleanups at the 3M PFC waste disposal areas in Woodbury, Oakdale, Cottage Grove, and the Washington County Landfill
- Regulation – monitoring at wastewater treatment plants (WWTPs) and operating solid waste facilities; establishment of water quality criteria (site-specific standards) to protect fish for human consumption; permit requirements for facilities discharging into impaired waters
- Partnerships – with MDH, Minnesota Department of Natural Resources (MDNR), United States Environmental Protection Agency (EPA) and others to better characterize the risks of exposure to PFCs in the environment
- Data Management – efficient tracking, storage, retrieval and usage of all data including environmental samples; remedial investigations
- Communications – regular meetings with affected local officials and legislators; extensive web pages detailing agency actions and findings

The MPCA's investigation of PFCs in the ambient environment, along with supporting information gleaned from the scientific literature, is presented in this interim report. Several studies are still in progress, and more studies will likely be proposed in the future.

Investigation of PFCs in the Ambient Environment

A number of PFC projects have been completed or are underway. Brief descriptions of projects underway or completed by the MPCA and its partners are provided below, alphabetically.

Air and Precipitation Monitoring

Ambient air and precipitation samples are being collected to screen for PFC concentrations in urban and rural environments.

Aqueous Film-Forming Foam (AFFF) Use

Two AFFF projects are underway. One is a survey of PFC-containing AFFF users in Minnesota regarding their use of AFFF in fire fighting training. The other is a case study of PFC concentrations in sediment and shallow ground water at a site of known AFFF discharge during fire fighting training.

Fish Tissue and Surface Water Monitoring

Fish tissue and surface water samples are being collected in selected urban and rural lakes for two purposes. The first is to better understand the extent and magnitude of PFC contamination in commonly harvested fish species in lakes and rivers with high fishing pressure. Second, results will be used to evaluate bioaccumulation of PFCs in fish fillet tissue.

Food Web Studies

Two studies are underway at Lake Johanna to help develop better understanding about how PFCs move through the aquatic food web. Water, sediment, and aquatic organisms from Lake Johanna are being analyzed for PFC content as part of an aquatic food web study. Additionally, swallow eggs, chicks, and their food insects are being analyzed to determine differences in PFC concentrations in different locations and environmental media, identify which PFCs contribute to the differences, and to calculate accumulation rates.

Ground Water Monitoring

Samples of ground water were collected from wells in vulnerable, shallow aquifers in urban and agricultural areas. Sample results provided information about PFC impacts to ground water from potentially many different sources: industrial and municipal stormwater infiltration, land use, precipitation infiltration, surface water infiltration, pesticides, land application of biosolids, and/or atmospheric deposition.

Lake Calhoun PFOS Source Investigation

Elevated concentrations of PFOS in fish tissue from Lake Calhoun were a surprise. Storm water and rain water samples from the Lake Calhoun storm watershed will be collected to identify major sources of PFCs to Lake Calhoun, if major sources exist. This study is still in progress.

Land Use Influence of PFOS Concentrations in Fish Tissue

This project will utilize GIS, statistical analysis, and other information to analyze watershed characteristics and other factors that may influence PFOS concentrations in fish tissue.

Literature Reviews

On an ongoing basis, science indices, journals, reports, and regulatory news about PFC research results or policy development are searched. Review of the current literature keeps the MPCA and MDH up-to-date on research being conducted worldwide on PFC fate and transport, toxicology, risk assessment, and standard setting.

Mississippi River Sampling

The EPA is coordinating an effort to evaluate the range of concentrations of PFCs in water of the Mississippi River from the headwaters in Minnesota to the confluence with the Ohio River in Cairo, Illinois. In conjunction with the Water Quality Task Force members of the Upper Mississippi River Basin Association, approximately 200 surface water samples are being collected from key locations in the Mississippi River between Lake Itasca, Minnesota, and Cairo, Illinois.

Soil Microcosm Studies with EPA Labs

In cooperation with EPA, soil microcosms are being used to evaluate the potential for particular PFC compounds to break down in ground water and to measure the adsorption characteristics and mobility of PFCs in the ground water environment. Microcosms have been constructed using aquifer sediment spiked with PFC compounds. Periodic analysis of the microcosms will provide data on PFC fate and transport in ground water.

Urban Watershed Study

Stormwater inputs to PFC-impaired lakes will be sampled to develop better understanding about how PFCs move through an urban watershed to a lake.

Wastewater Treatment Plant PFC Release Assessment

Influent, effluent and sludge from WWTPs were sampled to assess the contribution of these facilities as potential sources of PFCs in Minnesota's environment. Facilities were selected to represent a variety of treatment technologies and influent sources (i.e. residential, commercial, industrial). Sources, environmental fate, and potential exposure pathways of PFCs detected at wastewater treatment facilities will be evaluated.

Water Quality Criteria Development

Water quality criteria were developed for PFOS and PFOA; PFBA is still in process. The process involves literature reviews of toxicity data, including 3M aquatic toxicity tests. Site-specific criteria are in place for PFOS and PFOA in Lake Calhoun and the Mississippi River. In Lake Calhoun, the chronic criteria (protective of both human health and aquatic life) are 12 ng/L for PFOS and 1.62 µg/L for PFOA. In the Mississippi River, the chronic criteria are 6 ng/L for PFOS and 2.7 µg/L for PFOA. Go to http://www.pca.state.mn.us/cleanup/pfc/index.html#pfos for more information.

Wildlife/Ecological Risk Assessment

To assess ecological risks from PFCs, MPCA filled a gap in National Park Service sampling, and expanded the study area for assessing targeted "persistent, bioaccumulative, toxicants" (PBTs), including PFCs, in bald eagles that nest along portions of the Mississippi and St. Croix Rivers. The sampling will allow monitoring of trends in PFC concentration and bald eagle nesting success over time. The number and development of young in nests are assessed in the study area, and eagle nestling blood samples were collected for analysis of PFCs.

The purpose of these studies is to determine the distribution and extent of PFC contamination in Minnesota's ambient environment. However, these studies can only assess concentrations of PFCs in various media. In order to give context and meaning to the data, it is critical to first understand the fate and transport of PFCs in the environment. The following section provides a brief discussion of direct and indirect sources of PFCs, as well as fate and transport in relevant environmental media.

Sources, Fate and Transport of PFCs in the Ambient Environment*

*Please refer to Appendix B for a more detailed discussion of the fate and transport of PFCs.

The variety and number of fluorinated compounds currently in production comprise an enormous number of chemicals. Drugs, anesthetics, chemotherapeutic agents, pesticides, refrigerants, such as chlorofluorocarbons (CFCs), as well polymers such as Teflon and Goretex, are a few of the thousands of products made from fluorinated carbon compounds [2].

***Perfluorinated compound** – a compound in which all available carbon atoms are bound to fluorine atoms.*

PFOA and PFOS are examples of perfluorinated surfactants. They are often found in surface water samples and are almost always found in wildlife and humans. While it is clear that these are not naturally occurring compounds – they are entirely human-made – how these compounds have become so widely distributed in our environment in often very remote locations is less understood. Studies have shown that PFOA, for example, is likely "ubiquitous in the northern hemisphere" [3].

The direct release of these compounds to the environment through manufacturing processes represents one way chemicals like PFOA or PFOS get into the environment. However, several recent studies show that PFOA and PFOS can be generated as byproducts when other fluorinated compounds break down. This means that the fate of other fluorinated compounds is important to understanding how chemicals like PFOA and PFOS are released to and persist in the environment.

Perfluorinated surfactants are made either through *electrochemical fluorination* (ECF) or through a *telomerization* manufacturing process [2, 4]. ECF is the process that 3M used to produce fluorinated compounds. ECF was used to produce the fluorinated surfactants PFOA and PFOS that are used in fire-fighting foams (AFFF), paints, polishes, films, and lubricants. ECF is the only process used to directly produce PFOA and PFOS, with over 6 million pounds produced in 2000 [4]. The major contributors to environmental loads appear to be through the use of PFOA and perfluorononanoic acid (PFNA) [5]. Other chemicals produced through ECF include the compounds used to make fabric stain repellents, carpet treatments, and paper coating materials [2, 4].

DuPont uses the telomerization process to make fluorinated compounds [2]. Unlike the PFCs made through 3M's ECF process, Dupont's method is often used to make *fluorotelomer alcohols* (FTOHs)[2]. FTOHs are not used directly in products. Instead, FTOHs are used as intermediates in the manufacture of other products, where they are often present in residual amounts of up to 4% by weight [6]. There are many types of fluorinated compounds that are used in a wide variety of products.

Chemicals like PFOA and PFOS are resistant to degradation which makes them persistent in the surface water, soil, and ground water. Moody *et al.* [7] studied a creek into which fire-fighting foam (AFFF) was spilled. PFOA, perfluorohexanoic acid (PFHxA, a chemical similar to PFOA), and PFOS were present in the surface water and in fish tissue for several years after the spill. They were also detected in ground water underneath a site where AFFF fire-fighting foam was used [8]. These studies focused on surface water or ground water contamination where there was a clear source or a spill. The widespread, low-level contamination of soil, ground water, and surface water in remote locations is difficult to explain, however, because it is unlikely that PFOA and similar chemicals that are non-volatile could be transported to areas far from a likely source.

Unlike PFOA, the FTOHs produced by DuPont are volatile and can be found in the air. FTOH will break down into PFOA (Fig. 1) and related chemicals in the atmosphere [3, 9] such as perfluorodecanoic acid (PFDA, a compound similar to PFOA). With over 10 million pounds of FTOH produced per year, enough FTOH is manufactured yearly to maintain the current observed concentrations of PFOA and related compounds in the environment [9]. FTOHs also break down in wastewater treatment plants, where up to 10% of FTOH can be converted to PFOA and similar compounds [10, 11].

$CF_3 - CF_2 - CF_2 - CF_2 - CF_2 - CF_2 - CF_2 - CF_2 - CH_2 - CH_2 - OH$ (8:2 FTOH)

↓

Degradation process in sewage treatment plant or atmosphere

↓

$CF_3 - CF_2 - CF_2 - CF_2 - CF_2 - CF_2 - CF_2 - COOH$ (PFOA)

Figure 1. Conversion of 8:2 fluorotelomer alcohol into PFOA.

The degradation of FTOHs to PFOA and related chemicals can explain other observations:

- The appearance of PFDA in fish samples in Minnesota is consistent with the breakdown of FTOH to PFDA, because PFDA has no significant history of intentional industrial production [12].
- According to DeSilva and Mabury (2006), 89% of PFOA in human blood samples from the Midwest is attributable to PFOA that originated from telomerization production methods [12].
- Recent MPCA studies show that various perfluorinated surfactants – including PFOA and PFOS – were present in air samples in 2008 [13]. The presence of these compounds in the air can be partially explained by the breakdown of FTOH molecules in the atmosphere. 3M discontinued manufacture of these PFCs in 2002.
- Minnesota ground water monitoring shows PFOA, perfluoropentanoic acid (PFPeA), perfluorohexanoic acid (PFHxA), perfluoroheptanoic acid (PFHpA), and perfluorononoic acid (PFNA) at trace or low concentrations that are widespread under ambient conditions, with no known or likely sources of these compounds [14]. The degradation of FTOH

compounds in the air or in the soil is a plausible source of these detections in the ambient environment.

Polymers made from fluorinated chemicals are produced in far greater volumes than the fluorinated surfactants discussed above. Very little information, however, has been published regarding their fate in the environment [4].

Polymers typically resist breaking down. The breakdown of polymers made from fluorinated chemicals is expected to add only a very slight amount of PFOA and similar chemicals to the environment [15]. However, the polymers used widely for oil and water-resistant coatings on food-contact paper products have been found to degrade into FTOH and subsequently to PFOA [16]. The degradation of this water-resistant coating chemical was found to occur in the intestinal tract and the blood of laboratory animals, representing a significant source of exposure to PFCs [16].

Indoor air concentrations of fluorinated chemicals used to make fabric and carpet coatings are roughly 10-20 times greater than outdoor concentrations of the same chemicals [17]. These compounds may, in turn, break down into PFOS [18]. This could expose people to PFOS through ingestion and inhalation inside of homes that contain fabric coating products.

In soil, PFOS has been found to adsorb to various minerals, with adsorption increasing with PFOS concentration[19]. However, PFOS apparently adsorbs to soil less than other pollutants [19]. Some research shows that the mobility of PFOS and PFOA in ground water can change depending on the ground water conditions [20]. Adsorption variability might be important in how far and how fast these contaminants spread in aquifers away from spills or disposal sites.

Distribution of PFCs in Minnesota's Environment

In Minnesota, it has been apparent since 2006 that PFCs may be present at concentrations of potential concern beyond the disposal sites and the groundwater contamination associated with them. Since then, the MPCA has made a number of important discoveries regarding PFCs in Minnesota's ambient environment. The following section provides a brief discussion of the results to date of several completed and on-going studies at the MPCA. For more detailed analytical results, please refer to Appendix A.

Twin Cities Metro Area Lakes - Fish and Water

In April 2007, the MPCA found elevated concentrations of PFOS in fish taken from Lake Calhoun in Minneapolis. PFOS is the most bioaccumulative PFC in fish, and this finding was of concern to the city of Minneapolis and people who fish in this popular lake. MDH issued new fish consumption advisories for the lake. Sampling was expanded to other metro-area fishing lakes, and additional findings were announced later in 2007 and early 2008. In addition to Calhoun, Lake Johanna and Lake Elmo received one meal per month fish-consumption advisories. For the most part these lakes have no groundwater connection with the waste sites, and the source(s) of contamination are still not identified [21]. Figure 2 illustrates the 2006-2008 Twin Cities metro area fish sampling results. MPCA has ongoing projects underway, including an aquatic food web study and a stormwater runoff study, to better understand the distribution of PFCs in Minnesota's aquatic environment.

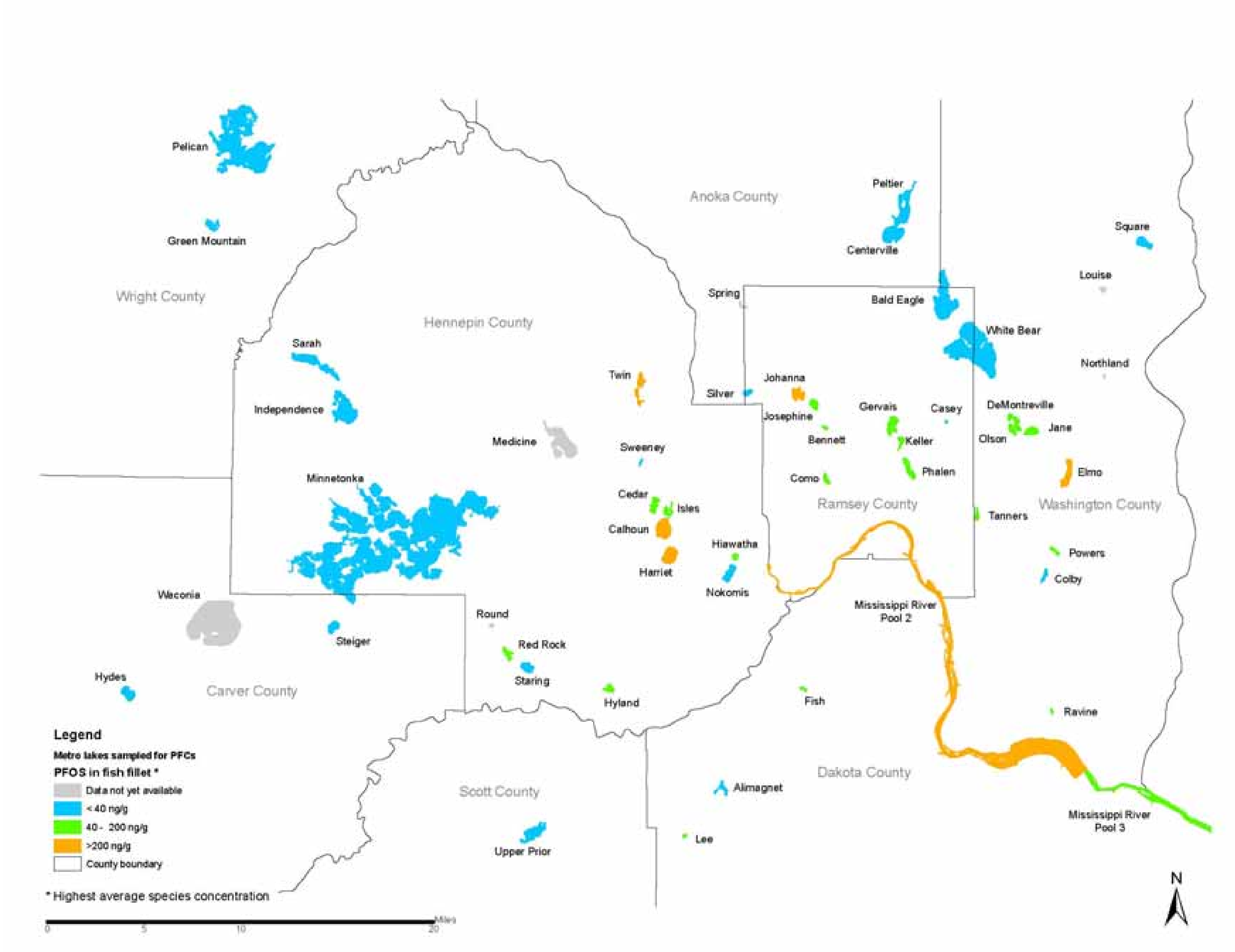

Figure 2. Fish Tissue Sampling Results for Twin Cities' Area Lakes (2006 – 2008).

Mississippi River Sampling

Fish have been collected from various reaches of the Mississippi River and analyzed for PFCs since 2005. Elevated concentrations of PFOS in fish tissue have resulted in MDH fish consumption advisories for at least one species in Pool 2, Pool 3, Pool 4, and Pools 5, 5a, and 6 (Fig. 2). Fish were sampled in the Mississippi River near Brainerd, and the PFOS concentrations in the Brainerd-area fish were low.

Ground Water

Ambient shallow ground water was sampled for PFCs in urban and agricultural areas of Minnesota during 2006 and 2007. Sampling was conducted by MPCA in cooperation with the Minnesota Department of Agriculture (MDA). Wells were selected in vulnerable aquifers. PFCs were detected in ambient shallow ground water at concentrations below MDH health guidelines. PFBA was the most commonly detected PFC, and it was the PFC detected at the highest concentration. Most of the PFC detections above the reporting limit were in the Twin Cities Metro Area. Land uses associated with the wells that had detected PFC concentrations were Industrial, Commercial, Sewered Residential, and Agricultural [22].

Air Monitoring

Air samples have been collected at two Minnesota sites, one urban and one rural. PFOS, PFOA, and PFBA were detected in air at both locations. Total concentrations were approximately 50% higher in the urban location. Additionally, 7 PFCs not detected in the rural location were detected at the urban location. Very few studies have measured and reported air concentrations of PFOS and PFOA. Minnesota's air results are within the range of PFOS and PFOA concentrations in air reported by others [23, 24]. A suburban location is currently being monitored for PFCs in air, but results are not yet available.

AFFF Fire-Fighting Foam

In 2008, MPCA hired a contractor to survey likely users of PFC-containing fire-fighting foam regarding their use of foam in both fire suppression training and in fire fighting. Survey questions were related to frequency of foam use, volume of foam used, location of foam used, and brands/types of foam used. Approximately 67% of municipal fire departments (522 of 785), all 16 fire training school, all three airports with fire departments, and both refineries with fire departments responded to the survey. Identified fire training locations were screened and ranked for relative risk based on type of foam used and proximity to potential human or environmental receptors: drinking water wells, well head protection areas and source water protection areas, surface water, wetlands, and karst geology.

Approximately 20 current or former fire training areas were identified as having a high potential for PFC contamination to drinking water, ground water, soil, and/or surface water. MDH and MPCA are conducting follow-up sampling and investigations of high-risk sites. The first round of sampling will focus on drinking water wells in proximity to fire training activities.

Wastewater Treatment Plants

The MPCA conducted a survey for PFCs in wastewater effluent at 28 municipal and industrial WWTPs across the state in 2007. A number of sample locations showed low concentrations of PFCs. The city of Brainerd's plant had elevated concentrations (see box). The Brainerd finding, traced to a chrome-plating facility, raised questions about the potential for PFCs to enter surface waters through permitted WWTP discharges to surface water. More facilities were sampled in 2008, and results were consistent with 2007 findings [21].

Permitted Landfills

Through monitoring conducted in 2006-7, the MPCA found PFCs in ground water, leachate, landfill gas, and gas condensate at a number of landfills. These findings suggest that PFCs may be released from consumer, commercial and demolition wastes. However, the concentrations were very low in ground water, and in most cases, results suggested that landfills were not acting as sources of PFC impacts to ground water. No drinking-water wells were affected [21].

Soil Microcosms

In collaboration with EPA's National Exposure Research Laboratory, MPCA is investigating the fate of PFCs in ground water. Soil collected from beneath the ground water table at the Washington County Landfill was brought to the laboratory.

Microcosms were prepared using this soil under anaerobic conditions, and PFOS and PFOA were added to the microcosms at known concentrations. Samples of these microcosms on a quarterly basis showed that, while these compounds resist degradation, the adsorption of these compounds to the soil changes with time. This is possibly due to changing oxidation/reduction conditions within the microcosms. These results have important implications to the fate of PFC in the vicinity of landfills where oxidation/reduction status changes spatially.

Brainerd WWTP Case Study

The PFOS concentrations in the Brainerd wastewater treatment plant influent, effluent and sludge were significantly higher than other WWTPs sampled around the state. In response to the noteworthy result, Brainerd Public Utilities (BPU), operator of the WWTP, hired a consultant to collect wastewater samples from locations around the city to try to determine the source of the PFOS. PFOS was detected in samples from five locations. Four concentrations ranged from 0.08 - 1.18 μg/L. The fifth sample concentration, collected at a manhole in an industrial park, had a PFOS concentration of 49.8 μg/L. **[1]**.

Keystone Automotive, a chrome plating operation specializing in automobile bumpers, is located in the industrial park adjacent to the manhole with the highest PFOS concentration sample. Keystone used a PFOS-containing surfactant product in its chrome plating bath. The PFOS-containing surfactant product reduces surface tension, which in turn helps reduce emissions of hexavalent chromium from the plating solution – an important worker-safety issue. In September 2007, Keystone switched to a different mist suppressant that does not contain PFCs. Ongoing monitoring is being conducted to monitor the effectiveness of the new mist suppressant. Monitoring will continue to document the effect that the product change has over time on PFOS discharge concentrations [1].

PFCs in Humans and Wildlife: Exposure and Effects

That PFCs are found throughout the world is not surprising due to their presence in a wide variety of industrial, commercial, and consumer products. The world-wide presence of PFCs in humans and animals provides strong evidence that exposure to this group of chemicals is through general environmental exposure and is not limited to known point sources or areas of contamination. The exact sources and routes of all exposures are unknown, although efforts are underway to evaluate the primary sources.

Several studies of human blood samples from around the world have found that nearly all people tested have some PFCs in their blood [25, 26]. A number of studies have also tried to assess potential routes of exposure [27-30]. Although all routes of exposure have yet to be clearly defined, exposure likely occurs through a variety of pathways, including drinking water, food and food packaging, and use of consumer products containing PFCs. Once people are exposed to PFCs, they are very slowly eliminated and stay in the body for many years [31].

PFCs have also been shown to bioaccumulate in wildlife, including top predators such as polar bears, bald eagles, mink, and seals; PFCs also bioaccumulate in fish. However, unlike other persistent organic pollutants, PFCs bind to protein rather than fatty tissues making it difficult to predict tissue concentrations using typical bioaccumulation models.

Human Exposure via Drinking Water

As a result of the manufacturing activities in Minnesota and the accompanying waste disposal, some eastern Twin Cities suburbs were found to have higher concentrations of PFCs in ground water when compared to the general environment. Several studies suggest that PFCs readily move through the soil and enter the ground water. Through investigations conducted by MDH and MPCA, it was discovered that some area residents were being exposed to PFCs through their drinking water (Table 1). Over 1,300 wells in the eastern Twin Cities suburbs have been tested, and MDH, MPCA, and 3M have worked with affected parties to provide safe drinking water by supplying alternative sources of water or assisting with water filtration to remove PFCs.

Testing of ground water in the eastern Twin Cities suburbs over the past several years suggests concentrations of PFCs have remained stable and have not increased. MDH and MPCA staff continues to test wells in the area to monitor any changes in concentrations or movement of the PFC ground water plume.

To date, most of the drinking water supplies located away from the eastern Twin Cities suburbs that have been tested have no detectable PFCs. Although PFBA was detected in several wells, the concentrations found were below levels of health concern established by the MDH. Testing of additional drinking water sources throughout Minnesota will continue to evaluate potential exposure to PFCs through drinking water.

Table 1. PFCs detected in Minnesota Drinking Water

	PFOS[a]	PFOA[a]	PFBA[a]
East Metro Area			
Municipal wells	ND[b] – 0.9	ND – 0.9	ND – 2.2
Private wells	ND - 3.5	ND - 2.2	ND - 12
Other Areas			
Municipal wells	ND	ND	ND – 0.4
Private wells	ND	ND	ND - 0.5
Criteria set by MDH			
Health Risk Limit (HRL)	0.3	0.5[c]	-
Health Based Value (HBV)	-	-	7

[a]Concentrations are in µg/L (ppb, parts per billion)
[b]ND = not detected
[c]In September 2008, MDH proposed lowering the HRL for PFOA to 0.3 µg/L.

Human Exposure via Fish Consumption

There are numerous reports documenting the presence of PFCs in fish and animals throughout the world [32-36]. In cooperation with the DNR and MDH, the MPCA has been testing fish in Twin Cities metro area lakes and rivers as well as selected outstate water bodies for the presence of PFCs to evaluate the potential for human exposure through the consumption of fish.

Fish from 56 different lakes as well as several reaches of the Mississippi and St. Croix Rivers have been tested for PFCs. PFOS, the primary PFC found to accumulate in fish fillet tissue, has been found in various fish species from several different lakes and river reaches at concentrations such that the MDH has issued site specific consumption guidelines for fish for the affected waters. Other PFCs detected in Minnesota fish include PFPeA, PFHxA, PFHxS, PFOSA, PFNA, PFDA, and PFUnA (Appendix A).

Human Health Risk

Although there are only a few studies investigating the effects of PFCs on human health, it is an area of active scientific research. The majority of studies evaluating the human health effects of PFCs have been conducted using animal models. While most studies have focused on PFOS and PFOA, information is growing for other PFCs such as PFBA and PFHxS.

In studies evaluating the health of 3M workers exposed to PFCs during manufacturing processes, no clear associations between adverse health effects and exposure were found [37]. It should be noted that the people evaluated in these studies were healthy workers who may not represent the average population. Three recent studies evaluated the health effects of PFCs on newborn babies associated with concentrations of PFCs in the blood of their mothers [38-40]. Each study found PFC concentrations in the mother's blood correlated to decreases in measures of growth in the newborns. Participants in these studies were exposed to PFCs through typical life activities, not as a result of known point sources of contamination.

As part of an agreement in a class action lawsuit against DuPont, a health study (The C8 Health Project) of 70,000 people in West Virginia and Ohio exposed to PFOA in drinking water is being undertaken to determine if there are any health effects related to PFOA exposure. Participants in this project live in areas of known drinking water contamination due to industrial activities.

Preliminary reports suggest a relationship between PFOA exposure and elevated cholesterol levels. Additional reports are pending [41].

In animal studies, PFCs have been associated with adverse effects including, but not limited to, altered cholesterol and thyroid hormone levels, suppression of the immune system, and developmental effects such as increased neonatal mortality, decreased body weight and weight gain in newborns and delayed eye opening. Animal studies generally form the basis of establishing human health criteria.

Human Health Criteria

Minnesota Department of Health

Following the discovery of PFCs in ground water in the East Metro Area, the MDH developed drinking water criteria for PFOS, PFOA and PFBA. Under emergency rule making authority enacted by the Minnesota Legislature, the MDH promulgated in rule Health Risk Limits (HRLs) of 0.3 μg/L* for PFOS and 0.5 μg/L for PFOA in August 2007. In September 2008, MDH proposed lowering the HRL for PFOA from 0.5 μg/L to 0.3 μg/L. In February 2008, MDH established a health based value (HBV) of 7 μg/L for PFBA. PFBA is thought to be less toxic than PFOS and PFOA because of its shorter half-life in rodents. HRLs and HBVs are concentrations of chemical-specific ground water contaminants that MDH has determined would result in little or no appreciable harm to people drinking the water daily over a lifetime. The process of determining HRLs and HBVs are the same; however, HBVs have not been promulgated in rule.

Due to limited toxicity information available for other PFCs, such as PFBS, PFHxS, and PFHxA, which have been found at very low concentrations in some wells, drinking water criteria cannot be developed for these chemicals at this time. The MDH continues to monitor PFC research activities and will re-evaluate criteria as new information becomes available.

In addition to the health criteria for PFOA, PFOS and PFBA established by the MDH for drinking water, values for the protection of human health have also been developed by other regulatory and health agencies in the U.S as well as in Europe. As described below, drinking water values developed by other agencies range from 0.04 - 9 μg/L for PFOA and 0.1 - 0.9 μg/L for PFOS.

New Jersey

In 2007, the New Jersey Department of Environmental Protection (NJDEP) provided preliminary guidance to the Pennsgrove Water Supply Company to assess public health implications due to PFOA in the system's drinking water [42]. The NJDEP recommended a preliminary health-based guidance in drinking water of 0.04 μg/L PFOA, which is the lower end of the range of several values derived from non-cancer and cancer endpoints in different species.

The drinking water value the NJDEP developed is based on comparisons between target blood levels of humans and actual or predicted blood levels of experimental animals. The difference between the New Jersey and the Minnesota values for PFOA is primarily due to use of a larger uncertainty factor and different water intake rates.

MDH had several concerns regarding the New Jersey approach, including the ability to accurately estimate a serum concentration associated with observed effects, the potential for episodic serum

*μg/L (micrograms per liter) = ppb (parts per billion) concentrations given the short half-life of PFOA in the female rat, and the uncertainty regarding the serum to water ratio. In developing its HBVs for PFOA and PFOS, MDH has chosen to utilize an animal model that it believes is more relevant to humans and a more traditional risk assessment methodology.

EPA

In 2006, the EPA set a site-specific drinking water action level of 0.5 μg/L for PFOA for the communities surrounding the DuPont Washington Works Facility in West Virginia [43]. Based on the scientific information available regarding the toxicity and the toxicokinetics of PFOA, EPA recommends that steps be taken to eliminate or reduce exposure to PFOA in the vicinity of the Washington Works Facility. Through a Consent Order, the EPA determined, "As required by Section 1431 of the SDWA (Safe Drinking Water Act) and for purposes of this Order, EPA has determined that C-8 [PFOA and its salts] is a contaminant present in or likely to enter a PWA [public water system] or a USDW [under ground source of drinking water] which may present an imminent and substantial endangerment to human health at concentrations at or above 0.50 μg/L in drinking water"[44]. In 2009, the EPA established provisional health advisories for PFOS and PFOA of 0.2 μg/L and 0.4 μg/L, respectively.

North Carolina

In 2007, the North Carolina Division of Water Quality in the Department of Environment and Natural Resources established a Public Health Goal of 0.63 μg/L for PFOA [45, 46] based on the same studies used by MDH. The difference between the North Carolina and the Minnesota values for PFOA is primarily due to use of a different water intake rate.

United Kingdom

The Food Standards Agency issued Tolerable Daily Intakes (TDIs) that are equivalent to drinking water concentrations of 9 μg/L for PFOA and 0.9 μg/L for PFOS. The evaluation conducted by the Food Standards Agency was based on the same experimental studies used by MDH; however, a dose-metric (a measurable physical/chemical property that corresponds to a compound's ability to cause a biological effect, such as toxicity) adjustment to account for species differences in half-life was not included [47-49].

Germany

In 2006, the German Ministry of Health established maximum tolerable concentrations for combined total exposure to PFOA and PFOS in drinking water and recommended that concentrations of PFOA and PFOS be combined in evaluations as they are considered to have comparable toxicity[50]. The Ministry issued a "strictly health-based guide value" for combined total exposure to PFOA and PFOS in drinking water of 0.3 μg/L. As a "health-based precautionary value", the Ministry established a drinking water value of 0.1 μg/L to account for exposure to other perfluorinated chemicals in addition to PFOA and PFOS due to the possibility of toxic risks which have yet to be identified and which may be attributed to additional perfluorinated chemicals with shorter or longer carbon chains than PFOA and PFOS. The Ministry recommends that efforts are to be made to reduce levels of total perfluorinated chemicals to less than the health-based precautionary value.

Ecotoxicity of PFCs

Several laboratory studies have demonstrated the toxicity of PFOS to aquatic organisms such as algae, invertebrates, fish, and ducks; PFOS toxicity in bobwhite quail has also been determined[51]. Mysid shrimp and chironomids, aquatic invertebrates that are important components in fresh water food webs, appear to be the most sensitive aquatic organisms tested to date. PFOS exhibits moderately acute toxicity in fathead minnows (*Pimephales promelas*). See Appendix C for a more detailed description of the available toxicity data.

A recent study of the effects of PFCs on marine mussels indicated that some PFCs (PFOA, PFNA, PFDA, and PFHxS) act as *chemosensitizers* (compounds that increase sensitivity to other chemicals) by interfering with a cell's ability to rid itself of toxic chemicals [52]. This interference could allow toxic substances that would normally be excreted to accumulate in the cell where they may have an adverse effect. Humans and other animals have cellular defense mechanisms similar to marine mussels.

PFCs as Potential Endocrine Disruptors

Several studies have shown that various PFCs have the potential to disrupt the endocrine systems of animals [53-59]. Laboratory studies of rats indicate that exposure to PFDA interfered with cholesterol transport and the production of steroid hormones, which resulted in reduced serum testosterone [56]. Exposure of rodents to PFOA has been associated with adverse effects on the testes [54]. PFOS has been shown to disrupt circulating levels of thyroid hormones in rats [57]. In cell cultures, FTOHs increased the number of estrogen receptors and induced MCF-7 breast cancer cell proliferation [55]. FTOHs were shown to be estrogenic *in vivo* in the male medaka (*Oryzias latipes*) as indicated by the induction of vitellogenin (a protein typically produced only in females) [58]. PFOS, PFOA, and certain FTOHs were also shown to be estrogenic *in vitro* [59].

Summary and Outlook

PFCs have a number of beneficial uses in myriad industrial, commercial, and consumer products due to their unique ability to repel both water and oil, and to resist breakdown. However, these same properties also contribute to their persistence, toxicity, ability to travel long distances to remote areas, and propensity to bioaccumulate in animals and humans. It is now known that PFCs are ubiquitous environmental contaminants that have been detected in a variety of settings, including humans and biota, worldwide.

There are many potential sources of PFC release to the environment, and humans and wildlife are exposed to PFCs through a variety of pathways. Several effects of exposure to PFCs have been documented in laboratory studies, including decreased growth and altered development in newborns, immune suppression, endocrine disruption, and increased sensitivity to other chemicals. Drinking water criteria and fish consumption advisories have been established to protect human health in Minnesota.

MPCA has conducted a number of studies of PFCs in the ambient environment, and several studies are still in progress. The goal of these studies is to determine the extent and distribution of PFC contamination in MN, and to determine likely sources of contamination. To date, PFCs have been detected in variety of environmental settings in Minnesota including surface water, ground water, air, soil, and fish.

The current PFC investigations are providing important clues to the origins, fate and consequences of PFCs in Minnesota's ambient environment, and will guide follow-up studies in the coming year. There is still much to learn, however. What do detections in fish, water, blood and other settings mean to people and the environment? How do PFCs move to remote parts of the planet? What are the ongoing sources of PFC release to the environment?

Despite having few human health studies, enough concerns are raised from existing human- and animal-based PFC toxicity studies to suggest that further environmental monitoring and health risk assessments are appropriate and necessary to answer questions of human and ecological risk. There are few established benchmarks against which to compare concentrations found in sampling work. Fortunately, the MPCA and MDH are not alone researching these challenging questions.

As is fitting for a global problem, scientists in government, academia and industry around the world are regularly adding to the scientific knowledge about environmental fate, movement, degradation, exposure and risks to humans and animals. The EPA is also becoming more active in the analytical and regulatory aspects of PFCs.

Minnesota agencies are in frequent contact with researchers worldwide and are partnering in some projects to represent Minnesota's interests. These complementary efforts at the state, national and international levels are key to solving the complex scientific questions about PFCs, and providing reliable information that citizens, government and industry are counting on to make good decisions.

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Appendix A

PFC Monitoring Data Collected by the MPCA

Table A1. Perfluorinated Compounds in Rural Ambient Shallow Ground Water, October 2007

Location ID	Type	PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnA	PFDoA	PFBS	PFHxS	PFOS	PFOSA
FINE	Spring	< 2.51	< 2.51	< 2.51	< 2.51	< 2.51	< 2.51	< 2.51	< 2.51	< 2.51	< 5.01	< 5.01	< 5.01	< 2.51
BURR	Spring	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46	< 4.92	< 4.92	< 4.92	< 2.46
RAINY	Spring	2.43	< 2.43	< 2.43	< 2.43	< 2.43	< 2.43	< 2.43	< 2.43	< 2.43	< 4.86	< 4.86	< 4.86	< 2.43
747009	Monitoring Well	22	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54	< 5.07	< 5.07	< 5.07	< 2.54
492127	Monitoring Well	< 2.55	< 2.55	< 2.55	< 2.55	< 2.55	< 2.55	< 2.55	< 2.55	< 2.55	< 5.09	< 5.09	< 5.09	< 2.55
747010	Monitoring Well	< 2.47	< 2.47	< 2.47	< 2.47	< 2.47	< 2.47	< 2.47	< 2.47	< 2.47	< 4.95	< 4.95	< 4.95	< 2.47
244529	Monitoring Well	< 2.47	< 2.47	< 2.47	< 2.47	< 2.47	< 2.47	< 2.47	< 2.47	< 2.47	< 4.94	< 4.94	< 4.94	< 2.47
431151	Monitoring Well	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46	< 4.91	< 4.91	< 4.91	< 2.46
244492	Monitoring Well	< 2.50	< 2.50	< 2.50	< 2.50	< 2.50	< 2.50	< 2.50	< 2.50	< 2.50	< 5.00	< 5.00	< 5.00	< 2.50
747014	Monitoring Well	**32.2**	< 2.50	< 2.50	< 2.50	< 2.50	< 2.50	< 2.50	< 2.50	< 2.50	< 4.99	< 4.99	< 4.99	< 2.50
747011	Monitoring Well	6.38	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54	< 5.08	< 5.08	< 5.08	< 2.54
747012	Monitoring Well	3.14	< 2.45	< 2.45	< 2.45	< 2.45	< 2.45	< 2.45	< 2.45	< 2.45	< 4.89	< 4.89	< 4.89	< 2.45
747014	Monitoring Well	20.4	< 2.45	< 2.45	< 2.45	< 2.45	< 2.45	< 2.45	< 2.45	< 2.45	< 4.89	< 4.89	< 4.89	< 2.45
747015	Monitoring Well	3.37	< 2.38	< 2.38	< 2.38	< 2.38	< 2.38	< 2.38	< 2.38	< 2.38	< 4.76	< 4.76	< 4.76	< 2.38
747016	Monitoring Well	**63**	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 4.98	< 4.98	< 4.98	< 2.49
747018	Monitoring Well	< 2.51	< 2.51	< 2.51	< 2.51	< 2.51	< 2.51	< 2.51	< 2.51	< 2.51	< 5.01	< 5.01	< 5.01	< 2.51
747019	Monitoring Well	< 2.61	< 2.61	< 2.61	< 2.61	< 2.61	< 2.61	< 2.61	< 2.61	< 2.61	< 5.22	< 5.22	< 5.22	< 2.61
639515 [a]	Monitoring Well	23.3	< 11.6	< 3.88	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 4.98	< 4.98	< 4.98	< 2.49
639515 [b]	Monitoring Well	22	< 9.04	< 4.26	< 2.45	< 2.45	< 2.45	< 2.45	< 2.45	< 2.45	< 4.89	< 4.89	< 4.89	< 2.45
623617 [a]	Monitoring Well	6.65	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 4.98	< 4.98	< 4.98	< 2.49
623617 [a,c]	Monitoring Well	4.21	< 2.50	< 2.50	< 2.50	< 2.50	< 2.50	< 2.50	< 2.50	< 2.50	< 5.01	< 5.01	< 5.01	< 2.50
623617 [b]	Monitoring Well	3.97	< 2.55	< 2.55	< 2.55	< 2.55	< 2.55	< 2.55	< 2.55	< 2.55	< 5.10	< 5.10	< 5.10	< 2.55
equipment blank [c]	N/A	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 4.99	< 4.99	< 4.99	< 2.49

All units are nanograms per liter (parts per trillion)

[a] sample collected early in the purge

[b] sample collected late in the purge

[c] dedicated teflon tubing used for this sample

< indicates less than the detection limit. Number following the symbol represents the detection limit

Grayed detected values indicate that the detected concentration is below the Reporting Level of 25 ng/L

PFBA in Shallow Ground Water in Rural Areas
October 2007

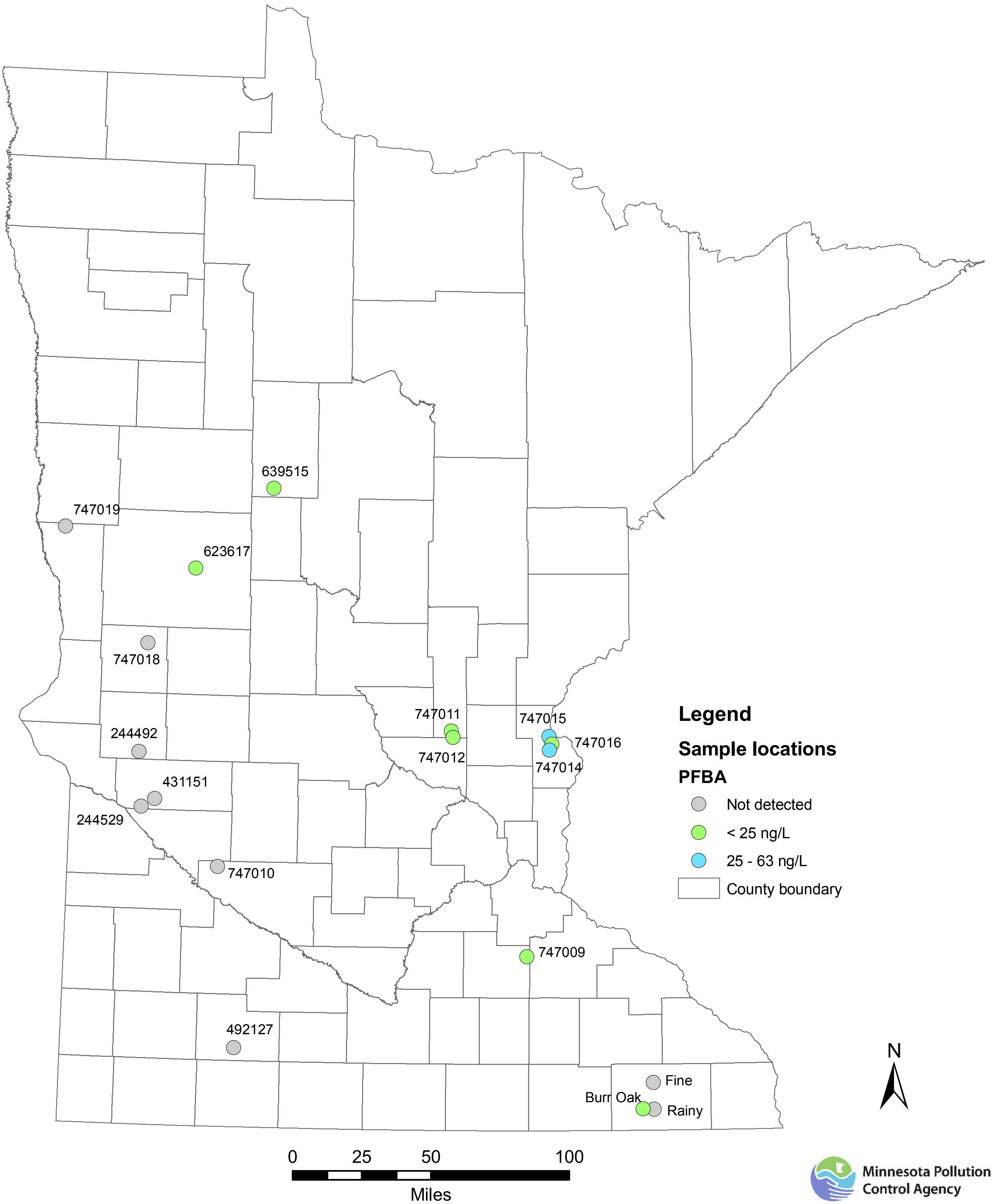
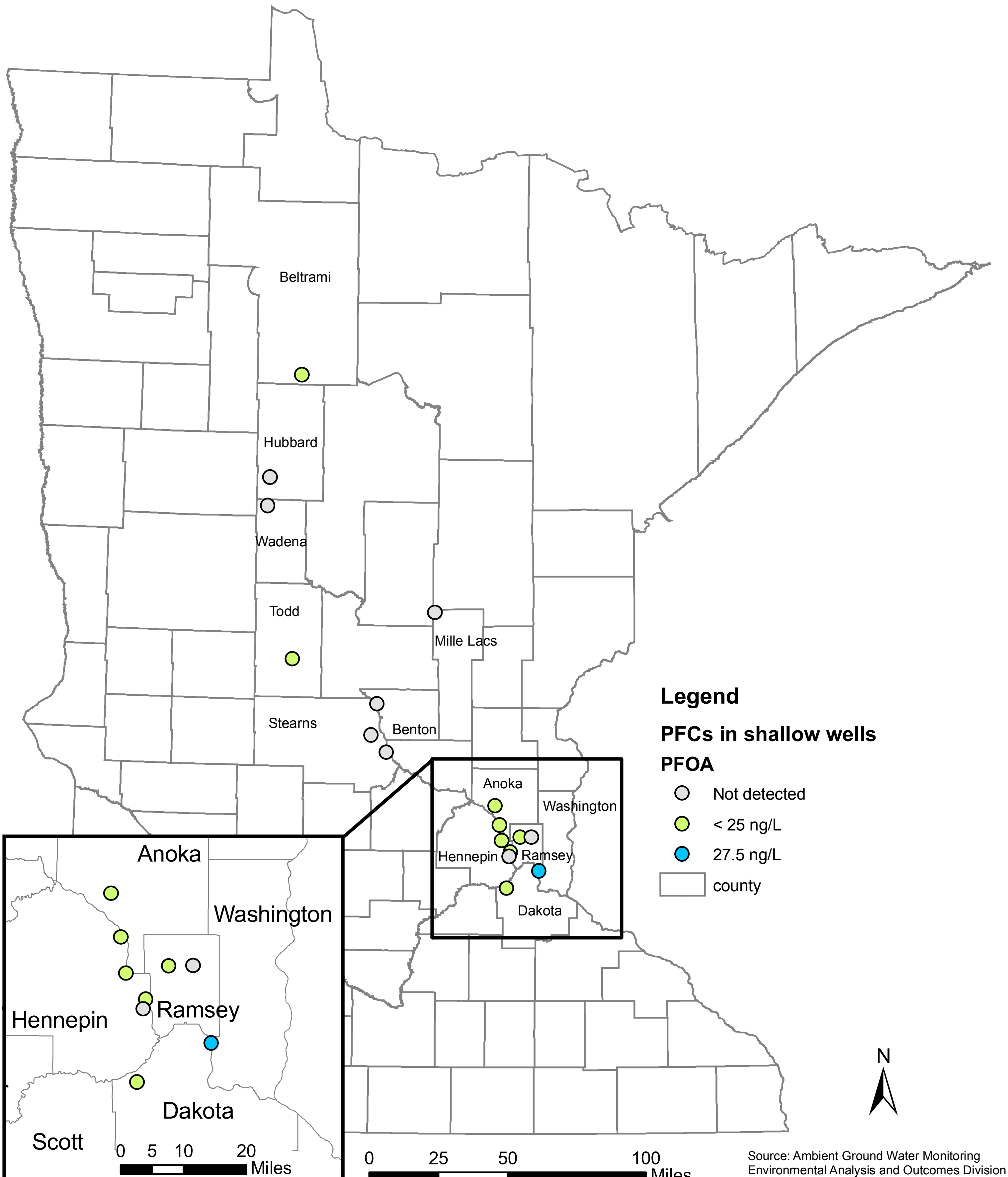


Table A2. Perfluorinated Compounds in Urban Ambient Shallow Ground Water, 2006 - 2007

Ambient ID	Sample Date [a]	Land Use	City	County	PFBA	PFOA	PFOS	PFPeA	PFHxA	PFHpA	PFBS	PFHxS	PFNA
2495	November 2006	Sewered residential	Anoka	Anoka	**43.4**	17.2	< 2.29	8.54	7.72	15.1	< 2.80	9.85	< 0.929
2495	December 2006	Sewered residential	Anoka	Anoka	12.5	12.7	< 2.22	3.05	2.66	6.86	3.1	3.64	< 1.14
2495	November 2007	Sewered residential	Anoka	Anoka	14.8	19.7	< 5.07	4.61	4.15	2.92	< 5.07	< 5.07	< 2.54
1071	November 2006	Industrial	Minneapolis	Hennepin	**61.3**	< 1.11	< 2.31	1.71	1.35	< 2.63	5.37	< 2.57	< 0.934
1071	December 2006	Industrial	Minneapolis	Hennepin	**59.5**	1.33	< 2.24	2.75	1.38	< 1.38	7.05	< 2.24	< 1.14
1071	November 2007	Industrial	Minneapolis	Hennepin	**61.8**	< 2.64	< 5.27	< 3.05	< 3.27	< 4.54	< 5.27	< 5.27	< 2.64
1070	November 2006	Industrial	Arden Hills	Ramsey	**279**	17	3.49	< 53.7	10.5	8.37	< 2.83	4.66	< 1.55
1070	December 2006	Industrial	Arden Hills	Ramsey	**266**	24.8	< 2.25	13.4	14.8	6.94	< 14.3	7.46	1.21
8180	November 2006	Sewered residential	Vadnais Heights	Ramsey	**347**	< 1.11	< 2.41	6.87	< 0.946	1.58	< 2.81	< 2.56	< 0.930
8180	December 2006	Sewered residential	Vadnais Heights	Ramsey	**468**	1.1	< 2.23	6.33	< 1.05	< 1.05	< 2.21	< 2.23	< 1.14
8180	November 2007	Sewered residential	Vadnais Heights	Ramsey	**230**	< 2.55	< 5.10	5.8	< 2.55	< 2.98	< 5.10	< 5.10	< 2.55
1069	November 2006	Industrial	Newport	Washington	**716**	**27.5**	**37**	**38.8**	24.1	7.07	24.4	**77.8**	< 0.929
1069	December 2006	Industrial	Newport	Washington	**922**	23	19.7	**55.8**	**31.1**	5.91	**39.9**	**69.6**	< 1.14
1069	November 2007	Industrial	Newport	Washington	**51.1**	32.4	7.26	10.2	6.82	2.78	< 5.12	< 5.12	< 2.56
1060	November 2006	Commercial	Burnsville	Dakota	22	8.84	2.79	5.01	2.38	3.7	< 2.83	< 2.58	< 0.938
1021	November 2006	Industrial	Minneapolis	Hennepin	**43.6**	8.58	< 2.28	3.1	2.94	2.16	< 2.79	2.92	< 0.923
1021	November 2007	Industrial	Minneapolis	Hennepin	**30.5**	7.17	< 10.3	< 5.13	< 5.13	< 5.13	< 10.3	< 10.3	< 5.13
2505	November 2006	Sewered residential	Minneapolis	Hennepin	**43.9**	1.36	2.39	2.91	< 0.944	< 1.10	< 2.80	< 2.56	< 0.929
2505	November 2007	Sewered residential	Minneapolis	Hennepin	**49.7**	< 2.54	< 5.08	< 2.54	< 2.54	< 2.54	< 5.08	< 5.08	< 2.54
2522	November 2006	Sewered residential	Minneapolis	Hennepin	20.4	6.64	**31**	4.78	3.11	< 2.73	< 5.77	24.4	< 2.98
2522	November 2007	Sewered residential	Minneapolis	Hennepin	11.6	4.06	13.7	< 4.81	< 4.08	< 5.60	< 5.17	6.01	< 2.59
12702	November 2006	Sewered residential	Bemidji	Beltrami	1.34	7.28	18.2	1.44	2.45	1.4	< 2.28	6.7	< 1.18
8192	November 2006	Transitional	Rice	Benton	< 2.87	< 2.39	< 5.53	< 2.51	< 2.59	< 2.59	< 5.47	< 5.53	< 2.83
12731	November 2006	Non-sewered residential	Garrison	Mille Lacs	23.4	< 1.00	< 2.30	< 1.05	< 1.22	< 1.37	< 2.28	< 2.30	< 1.18
1097	November 2006	Undeveloped	St. Cloud	Stearns	< 2.86	< 2.39	< 5.52	< 2.50	< 2.58	< 2.58	< 5.46	< 5.52	< 2.82
1099	November 2006	Commercial	St. Cloud	Stearns	5.02	< 2.52	< 5.82	< 2.64	< 2.72	< 2.72	< 5.76	< 5.82	< 2.97
8177	November 2006	Commercial	Long Praire	Todd	3.76	7.86	2.78	1.06	3.64	1.15	< 2.23	**45.7**	< 1.15
1107	November 2006	Undeveloped	Bemidji	Wadena	< 1.18	< 0.988	< 2.28	< 1.03	< 1.07	< 1.07	< 2.25	< 2.28	< 1.16
8176	November 2006	Sewered residential	Park Rapids	Wadena	< 1.21	< 1.02	< 2.34	< 1.06	< 1.10	< 1.10	< 2.32	< 2.34	< 1.20

All units are nanograms per liter (parts per trillion)
PFDA, PFUnA, PFDoA, and PFOSA were also analyzed, but were not detected in any sample
< indicates less than the detection limit. Number following the symbol represents the detection limit
Grayed detected values indicate that the detected concentration is below the Reporting Level of 25 ng/L
QA/QC of these results are in-process
[a] November 2006 samples were collected using a minimum purge protocol; Other samples were collected using a standard purge protocol

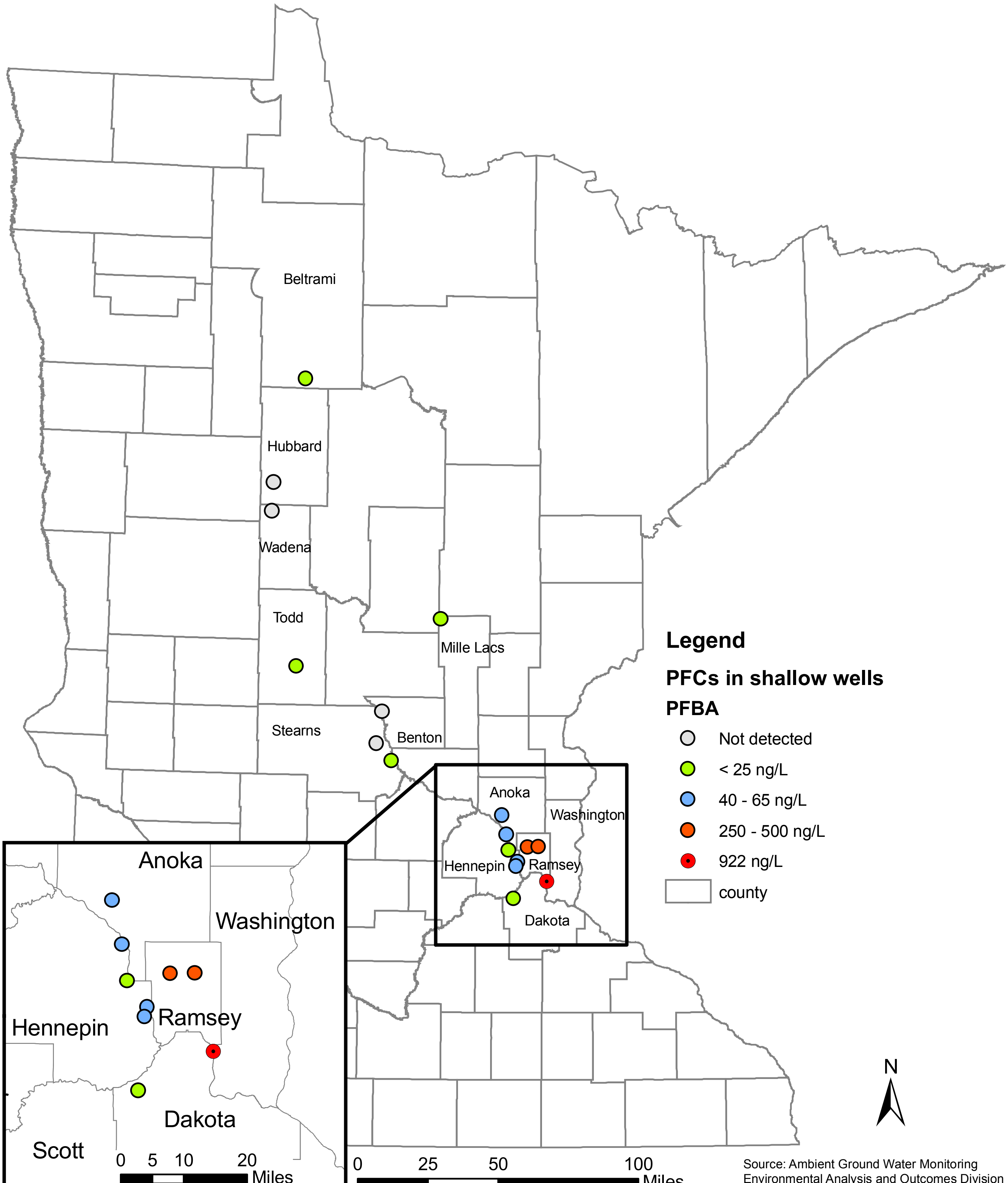
PFOA in Shallow Ground Water
November/December 2006 Sampling



Source: Ambient Ground Water Monitoring
Environmental Analysis and Outcomes Division
January 2007

Minnesota Pollution Control Agency

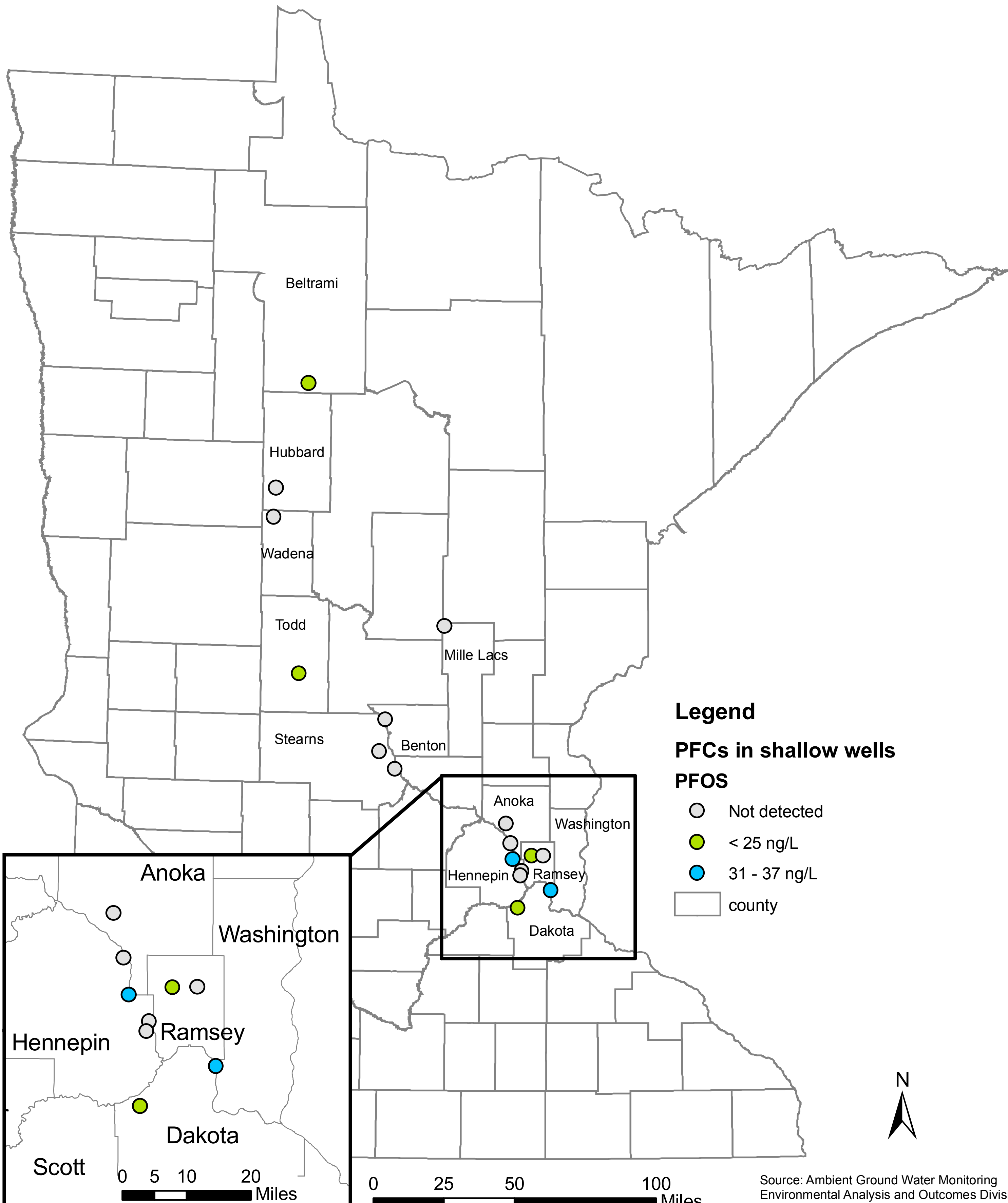
PFBA in Shallow Ground Water
November/December 2006 Sampling



Source: Ambient Ground Water Monitoring
Environmental Analysis and Outcomes Division
January 2007

Minnesota Pollution Control Agency

PFOS in Shallow Ground Water
November/December 2006 Sampling



Source: Ambient Ground Water Monitoring
Environmental Analysis and Outcomes Division
January 2007

Minnesota Pollution Control Agency

Table A3. 2006 Surface Water Samples

				ng/L (ppt)												
	location	date	depth	PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnA	PFDoA	PFBS	PFHxS	PFOS	PFOSA
St. Croix River #1	1mile North of Wildriver State Park access (Nevers Dam) and 4 miles South of Wildriver State Park access	11/8/2006	surface	3.37	< 2.54	< 2.62	< 2.62	< 2.42	< 2.86	< 2.77	< 3.24	< 2.48	< 5.54	< 5.60	< 5.60	< 2.26
St. Croix River #2		11/8/2006	surface	< 4.82	< 4.22	< 4.35	< 4.35	< 4.02	< 4.75	< 4.60	< 5.38	< 4.12	< 9.20	< 9.30	< 9.30	< 3.75
St. Croix River #3		11/8/2006	surface	5.77	< 2.52	< 2.60	< 2.60	< 2.41	< 2.84	< 2.75	< 3.22	< 2.47	< 5.51	< 5.57	< 5.57	< 2.25
Mississippi River Pool 3 #1	dock 5	11/9/2006	surface	547	31.3	16.4	4.14	32.5	< 2.94	< 2.85	< 3.33	< 2.55	47.3	26.5	19	< 2.33
Mississippi River Pool 3 #2	Kings Cove - mid channel	11/9/2006	surface	412	29.5	15.8	4.76	31.4	< 2.94	< 2.84	< 3.33	< 2.55	55.2	27.1	23.1	< 2.32
Mississippi River Pool 3 #3	Kings Cove - lower	11/9/2006	surface	192	24	14.7	3.3	27.3	< 2.95	< 2.86	< 3.35	< 2.56	67.1	17.7	37.8	< 2.33
Calhoun (Hennepin) #1	north	11/15/2006	surface	25.4	5.07	4.35	3.3	18.1	< 2.81	< 2.72	< 3.18	< 2.44	< 5.44	< 5.50	105	< 2.22
Calhoun (Hennepin) #2	middle	11/15/2006	surface	24.2	4.43	4.41	3.72	20.5	< 2.86	< 2.77	< 3.24	< 2.48	< 5.54	< 5.60	115	2.57
Calhoun (Hennepin) #3	south	11/15/2006	surface	26.7	< 4.59	5.25	3.57	20.7	< 2.84	< 2.75	< 3.22	< 2.47	< 5.51	< 5.57	104	< 2.25
	Lake ID															
Tettegouche (Lake) A	38-0231	11/9/2006	surface	< 11.2	< 1.49	< 1.08	< 1.08	1.42	1.32	< 1.14	< 1.34	< 1.02	< 2.28	< 2.31	< 2.31	< 0.932
Tettegouche (Lake) B	38-0231	11/9/2006	12"	< 6.48	< 1.02	< 1.24	< 1.16	1.19	< 1.15	< 1.11	< 1.30	< 0.994	< 2.22	< 2.24	< 2.24	< 0.906
Dyers (Cook)	16-0634	11/9/2006	surface	< 4.88	< 1.36	< 1.02	< 1.76	< 0.947	< 1.12	< 1.08	< 1.26	< 0.967	< 2.16	< 2.18	< 2.18	< 0.881
Long Lake (Kandiyohi)	34-0066	11/8/2006	surface	10.3	< 1.04	< 1.07	< 1.07	< 0.992	< 1.17	< 1.13	< 1.32	< 1.01	< 2.26	< 2.29	< 2.29	< 0.922
Sagatagan (Sterns) A	73-0092	11/8/2006	surface	11.7	< 1.70	< 1.10	1.34	1.85	< 1.20	< 1.17	< 1.36	< 1.04	< 2.33	< 2.36	< 2.36	< 0.952
Sagatagan (Sterns) B	73-0092	11/8/2006	12"	15.2	< 1.04	< 1.07	< 1.07	1.39	< 1.17	< 1.14	< 1.33	< 1.02	< 2.27	< 2.30	< 2.30	< 0.926
Long Lake (Itasca)	31-0570	11/9/2006	surface	11.3	< 1.02	< 1.05	< 1.05	0.988	< 1.15	< 1.11	< 1.30	< 0.998	< 2.23	< 2.25	< 2.25	< 0.909

Table A4. 2007 Brainerd Area Mississippi River Surface Water Samples

Sample ID	Collection Date	Collection Time	Site Description	Lat	Lon	PFOS	PFOA	PFBA	PFBS	PFPeA	PFHxA	PFHpA	PFNA	PFDA	PFUnA	PFDoA	PFHxS	PFOSA
BR101707-01	10/17/2007	14:12	above paper plant	46.38189	94.17927	< 9.87	< 4.94	6.29	< 9.87	< 4.94	< 4.94	< 5.36	< 4.94	< 4.94	< 4.94	< 4.94	< 9.87	< 4.94
BR101707-02	10/17/2007	14.14	above paper plant (dup)	46.38189	94.17927	< 5.04	< 2.52	5.37	< 5.04	< 2.52	< 2.52	< 4.41	< 2.52	< 2.52	< 2.52	< 2.52	< 5.04	< 2.52
BR101707-03	10/17/2007	16:15	monitoring station S002-640	46.34826	94.20765	< 4.97	< 2.49	5.43	< 4.97	< 4.75	< 2.76	< 2.87	< 2.49	< 2.49	< 2.49	< 2.49	< 4.97	< 2.49
BR101707-04	10/17/2007	16:16	monitoring station S002-640 (dup)	46.34826	94.20765	< 4.94	< 2.47	4.45	< 4.94	< 2.47	< 2.68	< 3.07	< 2.47	< 2.47	< 2.47	< 2.47	< 4.94	< 2.47
BR101707-05	10/17/2007	16:00	at WWTP discharge	46.33363	94.23067	93.6	5.67	4.35	20.2	< 4.15	3.56	< 2.61	2.58	< 2.51	< 2.51	< 2.51	< 5.02	< 2.51
BR101707-06	10/17/2007	16:01	at WWTP discharge (dup)	46.33363	94.23067	102	4.99	5.55	26	< 3.53	4.49	< 2.95	3.07	< 2.54	< 2.54	< 2.54	< 5.09	< 2.54
BR101707-07	10/17/2007	15:53	below WWTP discharge	46.33114	94.23488	< 5.06	< 2.53	3.9	< 5.06	< 2.88	< 2.53	< 3.40	< 2.53	< 2.53	< 2.53	< 2.53	< 5.06	< 2.53
BR101707-08	10/17/2007	15:55	below WWTP discharge (dup)	46.33114	94.23488	< 5.10	< 2.55	6.97	< 5.10	< 2.73	< 2.55	< 2.55	< 2.55	< 2.55	< 2.55	< 2.55	< 5.10	< 2.55
BR101707-09			Trip Blank			< 4.97	< 2.49	< 2.49	< 4.97	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 4.97	< 2.49

Table A5. Mississippi River Surface Water Samples, June 2008
all samples collected at approximately 12 inches below surface

	ng/L (ppt)												
	PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnA	PFDoA	PFBS	PFHxS	PFOS	PFOSA
Pool 3	23.1	3.99	3.6	3.56	5.95	< 2.53	< 2.53	< 2.53	< 2.53	< 5.06	< 5.06	5.32	< 2.53
Pool 3	24.1	< 4.06	5.22	< 2.96	6.34	< 2.66	< 2.56	< 2.56	< 2.56	< 5.11	6.6	6.44	< 2.56
Pool 3	26.1	< 3.17	4.22	3.47	11	< 2.45	< 2.45	< 2.45	< 2.45	< 4.89	5.31	5.82	< 2.45
Pool 3	33.5	< 4.03	4.82	3.37	8.62	< 2.92	< 2.51	< 2.51	< 2.51	< 5.01	6.52	6.95	< 2.51
Pool 3	36.1	7.18	5.43	< 4.80	8.96	< 4.80	< 4.80	< 4.80	< 4.80	< 9.61	< 9.61	< 9.61	< 4.80
Pool 3	35.4	5.97	4.26	< 2.81	8.79	< 2.41	< 2.41	< 2.41	< 2.41	< 4.82	< 4.82	5.98	< 2.41
Pool 3	31.6	< 2.51	4.18	< 2.51	10.1	< 2.51	< 2.51	< 2.51	< 2.51	< 5.02	5.55	5.66	< 2.51
Pool 3	15.2	< 3.65	3.79	< 2.60	3	< 2.49	< 2.49	< 2.49	< 2.49	< 4.98	< 4.98	< 4.98	< 2.49
Pool 3	14.7	< 3.77	< 2.62	< 2.68	5.18	< 2.50	< 2.50	< 2.50	< 2.50	< 5.01	< 5.01	6.11	< 2.50
Pool 3	12.4	< 2.47	< 2.47	< 2.58	3.93	< 2.47	< 2.47	< 2.47	< 2.47	< 4.94	5.04	4.95	< 2.47
Pool 3	9.7	< 2.50	3.11	< 2.50	3.19	< 2.50	< 2.50	< 2.50	< 2.50	< 5.00	< 5.00	6.75	< 2.50
Pool 2	8.06	< 2.76	3	< 2.50	4.24	< 3.50	< 2.50	< 2.50	< 2.50	< 4.99	< 4.99	< 4.99	< 2.50
Pool 2	8.44	< 5.84	< 2.47	3.58	3.96	< 3.10	< 2.47	< 2.47	< 2.47	< 4.94	< 4.94	< 4.94	< 2.47
Pool 2	6.38	< 2.47	3.09	< 3.03	< 2.47	< 2.47	< 2.47	< 2.47	< 2.47	< 4.94	< 4.94	< 4.94	< 2.47
Pool 2	14.7	< 2.44	4.72	< 2.44	5.86	< 2.44	< 2.44	< 2.44	< 2.44	< 4.88	< 4.88	< 4.88	< 2.44
Pool 2	11.2	< 4.90	5.62	< 4.90	< 4.90	< 4.90	< 4.90	< 4.90	< 4.90	< 9.79	< 9.79	< 9.79	< 4.90
Pool 2	12.3	< 2.47	4.12	< 2.47	3.2	< 2.47	< 2.47	< 2.47	< 2.47	< 4.95	< 4.95	< 4.95	< 2.47
Pool 2	12.3	< 2.88	4.5	< 2.72	3.73	< 2.52	< 2.52	< 2.52	< 2.52	< 5.05	< 5.05	< 5.05	< 2.52
Pool 2	10	< 2.55	< 2.55	< 2.55	3.44	< 2.55	< 2.55	< 2.55	< 2.55	< 5.10	< 5.10	< 5.10	< 2.55
Pool 2	16.7	< 2.47	2.53	< 2.47	5.11	< 2.47	< 2.47	< 2.47	< 2.47	< 4.94	< 4.94	< 4.94	< 2.47
Pool 2	14.5	< 2.48	2.59	< 2.48	3.68	< 2.48	< 2.48	< 2.48	< 2.48	< 4.96	< 4.96	< 4.96	< 2.48
Pool 2	14.6	< 2.42	5.23	< 2.42	4.18	< 2.42	< 2.42	< 2.42	< 2.42	< 4.83	< 4.83	< 4.83	< 2.42

Table A6. 2008 Surface Water

	Cty Rd 9 Drainage Ditch ng/L (ppt)							Rice Lake ng/L (ppt)							Fish Lake ng/L (ppt)						
	1	2	3	**avg**	**median**	**min**	**max**	1	2	3	**avg**	**median**	**min**	**max**	1	2	3	**avg**	**median**	**min**	**max**
PFBA	18.6	15.3	14.1	16.0	15.3	14.1	18.6	12.9	12.1	10.9	12.0	12.1	10.9	12.9	3.46	3.81	3.74	3.7	3.7	3.5	3.8
PFPeA	24	25.7	26.9	25.5	25.7	24	26.9	16.5	18.5	18.3	17.8	18.3	16.5	18.5	< 4.20	< 2.53	< 2.55	<dl	<dl	<dl	<dl
PFHxA	81.6	80.5	76.3	79.5	80.5	76.3	81.6	43.2	56.6	54	51.3	54.0	43.2	56.6	5.2	4.82	4.56	4.9	4.8	4.6	5.2
PFHpA	18.7	19.7	19	19.1	19	18.7	19.7	15	17.9	15.2	16.0	15.2	15.0	17.9	< 5.96	< 7.60	< 6.09	<dl	<dl	<dl	<dl
PFOA	59	56.5	48.1	54.5	56.5	48.1	59	38.2	38.8	42	39.7	38.8	38.2	42.0	4.6	3.67	4.23	4.2	4.2	3.7	4.6
PFNA	< 2.54	3.06	< 5.04	3.1	3.06	3.06	3.06	< 2.54	< 2.49	< 2.53	<dl	<dl	<dl	<dl	< 2.53	< 2.53	< 2.55	<dl	<dl	<dl	<dl
PFDA	< 2.54	< 2.49	< 5.04	<dl	<dl	<dl	<dl	< 2.54	< 2.49	< 2.53	<dl	<dl	<dl	<dl	< 2.53	< 2.53	< 2.55	<dl	<dl	<dl	<dl
PFUnA	< 2.54	< 2.49	< 5.04	<dl	<dl	<dl	<dl	< 2.54	< 2.49	< 2.53	<dl	<dl	<dl	<dl	< 2.53	< 2.53	< 2.55	<dl	<dl	<dl	<dl
PFDoA	< 2.54	< 2.49	< 5.04	<dl	<dl	<dl	<dl	< 2.54	< 2.49	< 2.53	<dl	<dl	<dl	<dl	< 2.53	< 2.53	< 2.55	<dl	<dl	<dl	<dl
PFBS	37	42.9	48.4	42.8	42.9	37	48.4	28.6	27.5	27.3	27.8	27.5	27.3	28.6	< 5.06	< 5.06	< 5.10	<dl	<dl	<dl	<dl
PFHxS	353	384	363	367	363	353	384	236	255	253	248	253	236	255	15.1	17.6	17.3	16.7	17.3	15.1	17.6
PFOS	132	140	102	125	132	102	140	110	108	122	113	110	108	122	19.7	9.78	8.84	12.8	9.8	8.8	19.7
PFOSA	< 2.54	< 2.49	< 5.04	<dl	<dl	<dl	<dl	< 2.54	< 2.49	< 2.53	<dl	<dl	<dl	<dl	< 2.53	< 2.53	< 2.55	<dl	<dl	<dl	<dl

Table A7. Mississippi and Minnesota River water samples collected for PFC analysis, April 2008

Note: data from other rivers (Elk and Snake rivers are tributaries of the Mississippi; MN-16 is removed from the watersheds)

Site Description — estimated value — **ng/L (ppt)**

Minnesota	Collection Date	Collection Time	PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnA	PFDoA	PFBS	PFHxS	PFOS	PFOSA
Mississippi River: County Road 7 near Bemidji, MN	4/29/2008	7:38	< 2.58	< 3.69	< 2.58	< 2.58	< 2.58	< 2.58	< 2.58	< 2.58	< 2.58	< 5.15	< 5.15	< 5.15	< 2.58
Mississippi River: State Hwy 197 in Bemidji, MN	4/29/2008	8:25	< 3.39	< 4.66	< 2.57	< 2.57	< 2.57	< 2.57	< 2.57	< 2.57	< 2.57	< 5.13	< 5.13	< 5.13	< 2.57
Mississippi River: Grand Rapids, MN	4/29/2008	10:45	6.57	< 3.58	< 2.52	< 2.52	< 2.52	3.18	< 2.52	< 2.52	< 2.52	< 5.03	< 5.03	< 5.03	< 2.52
Mississippi River: Grand Rapids, MN (dup)	4/29/2008	10:46	< 3.80	< 3.73	< 2.55	< 2.55	< 2.55	< 2.55	< 2.55	< 2.55	< 2.55	< 5.10	< 5.10	< 5.10	< 2.55
Mississippi River: County Hwy 1 in Aitkin, MN	4/29/2008	12:58	< 3.77	< 3.32	< 2.47	< 3.52	< 2.47	< 2.47	< 2.47	< 2.47	< 2.47	< 4.94	< 4.94	< 4.94	< 2.47
Mississippi River: above paper plant in Brainerd, MN	4/29/2008	15:05	5.42	< 3.43	< 2.58	< 4.99	< 2.58	< 2.58	< 2.58	< 2.58	< 2.58	< 5.15	< 5.15	< 5.15	< 2.58
Mississippi River: boat landing below paper plant in Brainerd, MN	4/29/2008	16:05	< 3.35	< 3.51	< 2.53	< 2.53	< 2.53	< 2.53	< 2.53	< 2.53	< 2.53	< 5.06	< 5.06	< 5.06	< 2.53
Mississippi River: park dock near monitoring station S002-640 in Brainerd, MN	4/29/2008	16:45	6.7	< 4.63	< 2.54	< 2.73	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54	< 5.09	< 5.09	< 5.09	< 2.54
Mississippi River: near Fort Ripley, MN	4/30/2008	7:37	5.34	< 5.68	< 5.07	< 4.84	< 4.97	< 2.50	< 2.50	< 2.50	< 2.50	< 5.01	< 5.01	< 5.01	< 2.50
Mississippi River: downstream of Platte River near Rice, MN	4/30/2008	8:48	3.95	< 3.04	< 2.56	< 4.85	< 4.97	< 2.56	< 2.56	< 2.56	< 2.56	< 5.12	< 5.12	< 5.12	< 2.56
Mississippi River: at Sauk Rapids, MN	4/30/2008	9:34	6.87	< 5.36	< 6.37	< 5.15	< 7.13	< 7.80	< 2.54	< 2.54	< 2.54	< 5.08	< 5.08	< 5.08	< 2.54
Mississippi River: near Clearwater, MN, downstream of St. Cloud WWTP	4/30/2008	10:20	4.23	< 3.90	< 3.84	< 5.77	< 2.80	< 2.59	< 2.59	< 2.59	< 2.59	< 5.18	< 5.18	< 5.18	< 2.59
Mississippi River: near Clearwater, MN, downstream of St. Cloud WWTP (dup)	4/30/2008	10:21	7.07	< 6.88	< 2.54	< 3.38	< 2.54	< 6.72	< 2.54	< 2.54	< 2.54	< 5.07	< 5.07	< 5.07	< 2.54
Elk River: north of Clear Lake – junction cty #20 & #16	4/30/2008	11:15	6.57	< 5.11	< 7.54	< 5.06	< 4.11	< 7.38	< 2.50	< 2.50	< 2.50	< 4.99	< 4.99	< 4.99	< 2.50
Snake River: near Mora, MN – boat landing on cty #6	4/30/2008	12:50	4.1	< 3.20	< 5.90	< 5.82	< 2.52	< 2.52	< 2.52	< 2.52	< 2.52	< 5.04	< 5.04	< 5.04	< 2.52
Creek to Rice Lake: near Duluth, MN – cty #9 crossing	4/30/2008	16:05	< 5.16	11.9	31.3	16.2	36.4	< 5.51	< 5.16	< 5.16	< 5.16	16.2	168	58.2	< 5.16
Rum River: just above the confluence with Miss. River	5/9/2008	17:30	8.31	< 3.56	< 2.53	< 4.26	< 2.53	< 2.53	< 2.53	< 2.53	< 2.53	< 5.06	< 5.06	< 5.06	< 2.53
Mississippi River: Elk River	5/9/2008	18:00	6.14	< 2.49	< 2.58	< 3.49	< 2.49	< 5.65	< 2.49	< 2.49	< 2.49	< 4.98	< 4.98	< 4.98	< 2.49
Mississippi River: Brooklyn Park	5/9/2008	4:30	< 4.83	< 6.61	< 4.83	< 6.39	< 4.83	< 4.83	< 4.83	< 4.83	< 4.83	< 9.66	< 9.66	< 9.66	< 4.83
Mississippi River: Hidden Falls, above Minn River	5/9/2008	1:30	5.51	< 3.51	< 2.46	< 4.03	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46	< 4.93	< 4.93	< 4.93	< 2.46
Minnesota River: at Fort Snelling before confluence	5/9/2008	12:30	3.41	< 2.51	< 2.51	< 4.33	< 2.51	< 2.51	< 2.51	< 2.51	< 2.51	< 5.03	< 5.03	< 5.03	< 2.51
Minnesota River: at Fort Snelling before confluence (dup)	5/9/2008	12:30	< 2.57	< 2.57	< 2.57	< 2.57	< 2.57	< 2.57	< 2.57	< 2.57	< 2.57	< 5.14	< 5.14	< 5.14	< 2.57
Mississippi River: St. Paul, 494 Bridge below WWTP	5/9/2008	11:30	6.89	< 6.91	< 2.51	< 6.85	< 2.51	< 3.92	< 2.51	< 2.51	< 2.51	< 5.02	< 5.02	< 5.02	< 2.51
Mississippi River: St. Paul, 494 Bridge below WWTP (dup)	5/9/2008	11:30	3.64	< 2.52	< 2.52	< 2.92	< 2.52	< 3.60	< 2.52	< 2.52	< 2.52	< 5.05	< 5.05	< 5.05	< 2.52
Mississippi River: Nininger, above 3M	5/9/2008	10:30	9.64	< 6.98	< 2.49	< 5.16	2.79	< 2.49	< 2.49	< 2.49	< 2.49	< 4.98	< 4.98	< 4.98	< 2.49
Mississippi River: Nininger, above 3M (dup)	5/9/2008	10:30	6.11	< 3.09	< 2.54	< 5.16	< 2.54	< 3.28	< 2.54	< 2.54	< 2.54	< 5.07	< 5.07	< 5.07	< 2.54
Mississippi River: Hastings below 3M	5/9/2008	9:30	13.5	< 2.92	< 2.57	< 4.87	2.8	< 2.57	< 2.57	< 2.57	< 2.57	< 5.13	< 5.13	5.23	< 2.57
Mississippi River: Hastings below 3M (dup)	5/9/2008	9:30	11.3	< 2.49	< 2.49	< 4.83	3.75	< 3.45	< 2.49	< 2.49	< 2.49	< 4.98	< 4.98	< 4.98	< 2.49
Minnesota River: Ortonville	5/7/2008	13:30	5.47	< 2.69	< 2.54	< 2.89	< 2.54	< 3.08	< 2.54	< 2.54	< 2.54	< 5.07	< 5.07	5.16	< 2.54
Minnesota River: Granite Falls	5/7/2008	10:00	4.4	< 2.84	< 2.48	< 3.30	< 2.48	< 5.04	< 2.48	< 2.48	< 2.48	< 4.97	< 4.97	< 4.97	< 2.48
Minnesota River: Mankato, above Blue Earth	5/6/2008	4:30	2.72	< 3.40	< 2.52	< 3.24	< 2.52	< 3.15	< 2.52	< 2.52	< 2.52	< 5.05	< 5.05	< 5.05	< 2.52
Minnesota River: Mankato, downriver of Blue Earth	5/6/2008	3:30	< 2.48	< 2.48	< 2.48	< 3.82	< 2.48	< 2.48	< 2.48	< 2.48	< 2.48	< 4.96	< 4.96	< 4.96	< 2.48
Minnesota River: Mankato, downriver of Blue Earth (dup)	5/6/2008	3:30	3.05	< 6.85	< 2.53	< 3.43	< 2.53	< 2.53	< 2.53	< 2.53	< 2.53	< 5.06	< 5.06	< 5.06	< 2.53
Minnesota River: Downriver of Seven Mile Creek	5/6/2008	2:30	3.39	< 2.49	< 2.49	< 2.92	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 4.98	< 4.98	< 4.98	< 2.49

Table A8. Mississippi and Minnesota River water samples collected for PFC analysis, August 2008

estimated value

Minnesota

Site Description	Collection Date	Collection Time	PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnA	PFDoA	PFBS	PFHxS	PFOS	PFOSA
Mississippi River: County Road 7 near Bemidji, MN	8/18/2008	17:02	2.62	< 2.48	< 2.48	< 3.29	< 2.48	3.01	< 2.48	< 2.48	< 2.48	< 4.96	< 4.96	< 4.96	< 2.48
Mississippi River: State Hwy 197 in Bemidji, MN	8/18/2008	17:30	3.29	< 2.51	< 2.51	< 2.51	2.62	< 2.51	< 2.51	< 2.51	< 2.51	< 5.03	< 5.03	< 5.03	< 2.51
Mississippi River: Grand Rapids, MN	8/19/2008	8:45	3.94	< 2.53	< 2.53	< 2.53	< 2.53	< 2.53	< 2.53	< 2.53	< 2.53	< 5.06	< 5.06	< 5.06	< 2.53
Mississippi River: Grand Rapids, MN (dup)	8/19/2008	8:46	3.56	< 2.50	< 2.50	< 2.50	< 2.50	< 2.50	< 2.50	< 2.50	< 2.50	< 5.01	< 5.01	< 5.01	< 2.50
Mississippi River: County Hwy 1 in Aitkin, MN	8/19/2008	11:15	4.83	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 4.97	< 4.97	< 4.97	< 2.49
Mississippi River: above paper plant in Brainerd, MN	8/19/2008	12:40	3.52	< 2.56	< 2.56	< 2.56	< 2.56	4.24	< 2.56	< 2.56	< 2.56	< 5.12	< 5.12	< 5.12	< 2.56
Mississippi River: near paper plant in Brainerd, MN	8/19/2008	14:15	4.73	< 2.47	< 2.47	< 2.47	< 2.47	< 2.47	< 2.47	< 2.47	< 2.47	< 4.94	< 4.94	< 4.94	< 2.47
Mississippi River: monitoring station S002-640 in Brainerd, MN	8/19/2008	15:02	4.36	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 4.97	< 4.97	< 4.97	< 2.49
Mississippi River: at WWTP discharge in Brainerd, MN	8/19/2008	15:47	5.28	< 4.92	< 4.92	< 4.92	9.5	7.19	< 4.92	< 4.92	< 4.92	83	< 9.84	151	< 4.92
Mississippi River: at WWTP discharge in Brainerd, MN (dup)	8/19/2008	15:48	6.07	< 2.47	3.35	< 2.47	4.42	5.88	< 2.47	< 2.47	< 2.47	87.8	< 4.94	170	< 2.47
Mississippi River: below WWTP discharge in Brainerd, MN	8/19/2008	15:58	4.96	< 2.50	< 2.50	< 2.50	< 2.50	3.01	< 2.50	< 2.50	< 2.50	< 4.99	< 4.99	< 4.99	< 2.50
Mississippi River: below WWTP discharge in Brainerd, MN (dup)	8/19/2008	15:59	4.4	< 2.50	< 2.50	< 2.50	< 2.50	< 2.50	< 2.50	< 2.50	< 2.50	< 5.01	< 5.01	< 5.01	< 2.50
Mississippi River: near Fort Ripley, MN	8/19/2008	18:00	3.51	< 2.50	< 2.50	< 2.50	< 2.50	4.19	< 2.50	< 2.50	< 2.50	< 5.00	< 5.00	< 5.00	< 2.50
Mississippi River: downstream of Platte River near Rice, MN	8/20/2008	8:06	3.65	< 2.48	< 2.48	< 2.48	< 2.48	2.65	< 2.48	< 2.48	< 2.48	< 4.96	< 4.96	< 4.96	< 2.48
Mississippi River: at Sauk Rapids, MN	8/20/2008	9:15	5.48	< 2.50	< 2.50	< 2.50	< 2.50	3.92	< 2.50	< 2.50	< 2.50	< 4.99	< 4.99	< 4.99	< 2.50
Mississippi River near Clearwater, downstream of St. Cloud WWTP	8/20/2008	10:40	3.9	< 2.48	< 2.48	< 2.48	2.5	< 2.48	< 2.48	< 2.48	< 2.48	< 4.96	< 4.96	< 4.96	< 2.48
Mississippi River near Clearwater, downstream of St. Cloud WWTP (dup)	8/20/2008	10:41	5.1	< 2.48	< 2.48	< 2.48	< 2.48	2.79	< 2.48	< 2.48	< 2.48	< 4.96	< 4.96	< 4.96	< 2.48
Mississippi River: Elk River	8/19/2008		11.1	< 2.50	< 2.50	< 2.50	2.97	< 2.50	< 2.50	< 2.50	< 2.50	< 5.01	< 5.01	< 5.01	< 2.50
Rum River: just above the confluence with Miss. River	8/19/2008	16:43	7.2	< 2.52	< 2.52	< 2.52	< 2.52	< 2.52	< 2.52	< 2.52	< 2.52	< 5.04	< 5.04	< 5.04	< 2.52
Mississippi River: Brooklyn Park	8/19/2008	10:04	8.15	< 2.52	< 2.52	3.98	2.54	< 2.52	< 2.52	< 2.52	< 2.52	< 5.03	< 5.03	< 5.03	< 2.52
Mississippi River: Hidden Falls, above Minn River	8/19/2008	14:36	10.2	< 2.50	2.58	3.87	7.66	< 2.50	< 2.50	< 2.50	< 2.50	< 4.99	< 4.99	< 4.99	< 2.50
Minnesota River: at Fort Snelling before confluence	8/19/2008	13:57	6.64	< 2.54	3.18	< 2.54	4.5	< 2.54	< 2.54	< 2.54	< 2.54	< 5.08	< 5.08	< 5.08	< 2.54
Minnesota River: at Fort Snelling before confluence (dup)	8/19/2008	13:57	5.94	2.84	2.72	< 2.58	4.02	< 2.58	< 2.58	< 2.58	< 2.58	< 5.15	< 5.15	< 5.15	< 2.58
Mississippi River: St. Paul, 494 Bridge below WWTP	8/19/2008	11:56	14.2	< 2.53	4.96	3.81	7.19	< 2.53	< 2.53	< 2.53	< 2.53	< 5.06	< 5.06	6.02	< 2.53
Mississippi River: St. Paul, 494 Bridge below WWTP (dup)	8/19/2008	11:56	15.3	3	6.03	2.72	7.25	< 2.61	< 2.61	< 2.61	< 2.61	< 5.22	< 5.22	6.2	< 2.61
Mississippi River: Nininger, above 3M	8/19/2008	10:48	23.2	3.69	6.29	4.42	8.55	< 2.57	< 2.57	< 2.57	< 2.57	< 5.15	< 5.15	7.95	< 2.57
Mississippi River: Nininger, above 3M (dup)	8/19/2008	10:48	21.1	3.41	4.87	3.18	8	< 2.54	< 2.54	< 2.54	< 2.54	5.61	< 5.07	8.13	< 2.54
Mississippi River: Hastings below 3M	8/19/2008	10:00	69.9	4.68	8.12	4.15	19.3	< 2.55	< 2.55	< 2.55	< 2.55	13.4	9.36	17.7	< 2.55
Mississippi River: Hastings below 3M (dup)	8/19/2008	10:00	63.9	7.1	8.44	3.19	19.6	< 2.58	< 2.58	< 2.58	< 2.58	13.6	9.87	16.7	< 2.58
Minnesota River: Ortonville	8/22/2008	10:50	3.01	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54	< 5.08	< 5.08	< 5.08	< 2.54
Minnesota River: Granite Falls	8/22/2008	9:00	3.37	< 2.55	< 2.55	< 2.55	< 2.55	< 2.55	< 2.55	< 2.55	< 2.55	< 5.10	< 5.10	< 5.10	< 2.55
Minnesota River: Mankato, above Blue Earth	8/21/2008	12:00	2.82	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 4.98	< 4.98	< 4.98	< 2.49
Minnesota River: Mankato, downriver of Blue Earth	8/21/2008	12:05	< 2.55	< 2.55	< 2.55	< 2.55	< 2.55	< 2.55	< 2.55	< 2.55	< 2.55	< 5.10	< 5.10	< 5.10	< 2.55
Minnesota River: Downriver of Blue Earth (dup)	8/21/2008	11:20	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54	< 2.54	< 5.09	< 5.09	< 5.09	< 2.54
Minnesota River: Downriver of Seven Mile Creek	8/21/2008	11:20	< 5.17	< 5.17	< 5.17	< 5.17	< 5.17	< 5.17	< 5.17	< 5.17	< 5.17	< 10.3	< 10.3	< 10.3	< 5.17

2005 MPCA PFC Fish Data

Mississippi River Pool 2 Fish PFC analysis												
MPCA Species & Sample ID #	Sample Date	Analyzed as Fillet or Whole Fish	Wt (g)	Ln (cm)	Age/ sex (yrs/ m-f)	PFOA ng/g (ppb)	PFOS ng/g (ppb)	PFOSA ng/g (ppb)	PFPeA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Walleye												
WE-1	10/3/05	Fillet	3275	70	7/m	<0.581	13.1	1.35	<1.42	<0.644	<0.572	<0.682
WE-2	10/3/05	Fillet	1079	54	3/f	<0.614	75.5	3.61	<1.79	0.789	<0.604	1.21
WE-3	10/3/05	Fillet	1230	49	2/f	<0.591	180	26.4	<1.44	1.67	<0.581	1.03
WE-4	10/3/05	Fillet	3125	70	7/f	<0.538	45.5	3.35	<1.31	1.43	<0.529	<0.631
Carp												
Carp-1	10/3/05	Fillet	1771	53	4/m	1.24	347	21.4	<5.96	3.85	2.19	3.01
Carp-2	10/3/05	Fillet	2532	55	5/f	<0.602	73.5	<0.572	<5.87	1.26	<0.592	<0.706
Carp-3	10/3/05	Fillet	2416	57	5/m	<0.590	175	2.02	5.76	2.16	0.992	<0.693
Carp-4	10/3/05	Fillet	4675	61	6/f	<0.608	420	7.67	<5.93	4.06	1.36	0.957
Carp-5	10/3/05	Fillet	5175	62	6/f	<0.605	66.4	0.908	<5.90	1.68	0.803	<0.710
SM Bass												
SMB-1	10/3/05	Fillet	285	26	5/m	<0.619	269	34.1	<1.51	4.4	3.38	8.35
SMB-2	10/3/05	Fillet	252	26	4/m	<0.596	336	22.7	<1.45	5.05	3.36	6.03
SMB-3	10/3/05	Fillet	165	22	4/f	<0.607	167	6.77	<1.48	4.33	3.5	4
SMB-4	10/3/05	Fillet	303	28	5/m	<0.615	158	20.4	<1.50	3.4	2.47	3.81
SMB-5	10/3/05	Fillet	135	22	4/f	<0.591	122	6.16	<1.44	2.75	2.33	3.71
SMB-6	10/3/05	Fillet	215	26	4/f	<0.578	156	8.43	<1.41	3.79	3.17	5.17
White Bass												
WB-1	10/3/05	Fillet	416	31	2/f	<0.609	510	8.43	<1.48	6.55	3.08	2.31
WB-2	10/3/05	Fillet	780	37	4/f	<0.600	102	2.75	<1.83	2.6	<0.591	<0.705
WB-3	10/3/05	Fillet	441	32	2/f	<0.605	240	3.28	<1.48	3.88	1.71	1.27
WB-4	10/3/05	Fillet	219	24	1/f	1.17	1860	166	<1.53	17.5	9.07	11.1
WB-5	10/3/05	Fillet	665	38	4/f	<0.602	83.6	2.35	<1.47	1.88	0.93	1.02
Other												
SMBuffalo	10/3/05	fillet	2633	49	?/f	<0.605	374	32.7	<5.90	2.79	2.65	4.17
Emerald Shiner	10/3/05	Composite of 16 whole fish	28	3 to 5 cm	na	<0.603	93.5	8.63	<5.87	1.76	0.734	<0.706
Gizzard Shad	10/3/05	Composites of 29 whole fish from L8616-13	149 166 157	8 to 15 cm	na	A<0.618 B<0.605 C<0.598	52.7 71.5 120	10.7 11.1 18.5	19.1 15.3 13.7	<0.684 <0.670 0.841	<0.608 <0.595 <0.588	<0.725 <0.710 0.861

< = less than the detection limit; number following this symbol represents the detection limit

2005 MPCA PFC Fish Data

Mississippi River Lake Pepin Fish PFC analysis												
MPCA Species & Sample ID #	Sample Date	Analyzed as Fillet or Whole Fish	Wt (g)	Ln (cm)	Age/ sex (yrs/ m-f)	PFOA ng/g (ppb)	PFOS ng/g (ppb)	PFOSA ng/g (ppb)	PFPeA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Walleye												
WE-1	10/4/05	Fillet	741	42	1/f?	<0.603	47	1.52	<5.88	<0.668	<0.593	<0.708
WE-2	10/4/05	Fillet	861	47	2/f	<0.574	63.1	2.34	<5.60	1.53	<0.565	<0.674
WE-3	10/5/05	Fillet	2483	55	3/f	<0.605	49.4	1.77	<5.90	<0.670	<0.595	<0.710
WE-4	10/5/05	Fillet	1079	47	2/f	<0.579	83.4	2.14	<5.65	1.2	<0.569	<0.679
WE-5	10/5/05	Fillet	2252	60	5/f	<0.907	39.3	1.38	<1.86	<0.670	<0.595	<0.710
WE-6	10/5/05	Fillet	1180	47	3/m	<0.581	47.4	1.83	<1.50	1.07	<0.572	<0.682
Carp												
Carp-1	9/27/05	Whole Fish	3011	52	4/f	<0.587	65.5	2.9	<5.72	1.2	1.12	<0.688
Carp-2	9/27/05	Whole Fish	2626	53	4/m	<0.585	90.7	1.6	<5.71	2	1.21	<0.687
Carp-3	9/27/05	Whole Fish	3019	54	4/m	<0.594	99.6	1.64	<5.79	3.07	1.6	0.876
Carp-4	9/27/05	Fillet	4975	59	6/f	<0.603	46.3	<0.573	<5.88	<0.668	<0.593	<0.708
Carp-5	9/27/05	Fillet	2730	56	6/m	<0.598	59.9	0.724	<5.83	1.17	0.662	<0.701
Carp-5 (dup)	9/27/05	Fillet(duplicate)	2730	56	6/m	<0.607	51.1	0.581	<5.92	0.926	0.602	<0.712
SM Bass												
SMB-1	9/27/05	Fillet	792	35	3/m	<0.583	103	2.69	<1.42	1.92	1.07	0.82
SMB-1(dup)	9/27/05	Fillet (duplicate)	792	35	3/m	<0.647	116	2.56	<2.05	2.31	1.21	0.928
SMB-2	9/27/05	Fillet	553	35	4/f	<0.592	66.2	1.19	<1.45	1.04	<0.582	<0.694
SMB-3	9/27/05	Fillet	729	36	4/f	<0.673	95.6	1.79	<2.56	1.85	0.692	1.06
SMB-4	9/27/05	Whole Fish	303	27	3/m	<0.584	175	3.98	<2.52	3.57	1.28	0.924
SMB-5	9/27/05	Whole Fish	1205	39	5/f	<0.611	172	3.28	<1.49	3.2	1.25	1.35
White Bass												
WB-1	10/4/05	Fillet	640	33	4/m	<0.603	114	3.37	<2.78	1.06	<0.594	<0.708
WB-2	10/4/05	Fillet	812	36	4/f	<0.605	100	2.08	<1.80	1.45	<0.595	<0.710
WB-3	10/4/05	Whole Fish	692	33	3/m	<0.604	223	5.71	<1.77	4.26	1.89	1.61
WB-4	10/5/05	Whole Fish	446	28	1/f	<0.599	194	4.45	<1.46	3.3	1.1	1.12
WB-4(dupl)	10/5/05	Whole fish(dup)	446	28	1/f	<0.585	165	4.24	<1.43	3.11	1.52	1.14
WB-5	10/5/05	Whole Fish	664	33	4/m	<0.576	248	4.92	<1.40	3.37	1.47	1.26
Other												
Gizzard Shad	9/23/05	Composites of 38 whole fish	1436	~15	na	A<0.672 B<0.581 C<0.588	37.9 33.4 47.1	2.27 1.87 2.45	18.5 17.2 17.8	0.694 0.817 <0.651	<0.594 <0.571 <0.578	<0.709 <0.681 <0.690
Emerald Shiner	9/27/05	Composites of 40 whole fish	117	~8	na	A<0.579 B<0.607 C<0.602	105 107 90.9	2.15 0.706 1.4	2.17 2.44 2.02	2.57 2.6 2.59	0.877 1.17 0.927	<0.679 <0.712 <0.707

< = less than the detection limit; number following this symbol represents the detection limit

	Average PFOS Concentration [ng/g; ppb]							
	Bluegill	**Smallmouth Bass**	**Largemouth Bass**	**White Bass**	**Walleye**	**Northern Pike**	**White Sucker**	**Channel Catfish**
Mississippi River pool 3	170 (5)	ns	ns	132 (5)	ns	ns	ns	ns
Mississippi River pool 4	85 (5)	ns	ns	ns	ns	ns	ns	ns
Mississippi River pool 5	65 (5)	96 (5)	85 (5)	ns	54 (4)	111 (5)	ns	10 (2)
Mississippi River pool 5a	61 (5)	73 (5)	ns	ns	65 (5)	ns	ns	14 (4)
St. Croix River: Taylors Falls to Danbury	<dl (5)	<dl (5)	ns	ns	<dl (5)	<dl (5)	<dl (5)	ns
Lake Calhoun	319 (5)	ns	ns	ns	ns	ns	49 (5)	ns

numbers listed are: average PFOS concentration (# of fish)
<dl – less than the detection limit ≈ 5 ng/g
ns – not sampled

Samples were analyzed for the 13 different perfluorochemicals listed.

			CAS #
PFBA	C-4	perfluorobutanoic acid	375-22-4
PFBS	C-4	perfluorobutane sulfonate	375-73-5
PFPeA	C-5	perfluoropentanoic acid	2706-90-3
PFHxA	C-6	perfluorohexanoic acid	307-24-4
PFHxS	C-6	perfluorohexane sulfonate	355-46-4
PFHpA	C-7	perfluoroheptanoic acid	375-85-9
PFOA	C-8	perfluorooctanoic acid	335-67-1
PFOS	C-8	perfluorooctane sulfonate	1763-23-1
PFOSA	C-8	perfluorooctane sulfonamide	754-91-6
PFNA	C-9	perfluorononanoic acid	375-95-1
PFDA	C-10	perfluorodecanoic acid	335-76-2
PFUnA	C-11	perfluoroundecanoic acid	2058-94-8
PFDoA	C-12	perfluorododecanoic acid	307-55-1

Mississippi River Pool 3 Fish PFC analysis												
MPCA Species & Sample ID	Sample Date	Fillet or Whole Fish	Wt (g)	Ln (cm)	Age/ sex (yrs/ m-f)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BG-1	11/9/06	Fillet	102	17	3/M	440	<1.52	<6.70	1.42	8.05	5.09	4.41
BG-1	11/9/06	Whole Fish	102	17	3/M	815	<1.46	<1.75	6.5	12.3	6.13	4.70
BG-2	11/9/06	Fillet	135	17	3/M	108	<1.46	<8.68	3.62	5.36	5.79	14.6
BG-2	11/9/06	Whole Fish	135	17	3/M	187	<1.48	<1.76	10.2	7.6	6.46	14.2
BG-3	11/9/06	Fillet	152	18	3/M	123	<1.51	<1.81	<1.41	3.17	<2.01	1.55
BG-3	11/9/06	Whole Fish	152	18	3/M	186	<1.28	0.91	1.03	5.59	2.17	2.34
BG-4	5/2006	Fillet	177	18.5	3/F	87.5	<1.48	<1.77	<1.38	2.36	<1.98	<1.51
BG-5	5/2006	Fillet	160	18	3/M	92.1	<1.47	<1.75	<1.37	<1.67	<1.96	<1.50
White Bass												
WB-1	11/9/06	Fillet	33	12.5	1/J	122	<1.48	<8.00	11.5	4.88	<1.98	2.28
WB-1	11/9/06	Whole Fish	33	12.5	1/J	134	<1.79	<1.70	14.5	6.11	1.73	3.09
WB-2	11/9/06	Fillet	34	13	1/J	154	<1.49	<3.14	8.75	5.9	2.83	2.23
WB-2	11/9/06	Whole Fish	34	13	1/J	161	<1.51	<2.86	10.3	9.5	2.53	2.73
WB-3	11/9/06	Fillet	34	13	1/J	150	<2.51	<1.80	10.9	5.28	2.09	2.92
WB-3	11/9/06	Whole Fish	34	13	1/J	148	<1.51	<6.58	15.1	7.3	2.75	4.06
WB-4	11/9/06	Fillet	44	13	1/J	148	<1.48	<2.65	10.6	4.55	<1.90	2.71
WB-4	11/9/06	Whole Fish	44	13	1/J	153	<1.48	<4.99	17	7	2.06	4.13
WB-5	11/9/06	Fillet	41	14.5	1/J	86.7	<1.51	<6.24	6.58	4.14	<2.01	<1.54
WB-5	11/9/06	Whole Fish	41	14.5	1/J	114	<2.10	1.3	7.9	6.33	1.34	1.18
Other												
Emerald Shiner	11/9/06	Composite of 38 whole fish		~4.5		84.2	<1.43	<1.71	5.21	4.33	<1.91	2.17
Gizzard Shad	11/9/06	Composite of 33 whole fish		~9		17.9	<1.25	<1.94	1.53	<1.42	<1.66	<1.27

Mississippi River Pool 4 Fish PFC analysis												
MPCA Species & Sample ID	Sample Date	Fillet or Whole Fish	Wt (g)	Ln (cm)	Age/ sex (yrs/ m-f)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BG-1	5/2006	Fillet	262	20	4/F	98.3	<1.43	<1.70	<1.33	2.51	<1.90	<1.46
BG-2	5/2006	Fillet	152	17.5	3/M	28.1	<1.47	<1.75	<1.37	<1.67	<1.96	<1.50
BG-3	5/2006	Fillet	158	18	3/F	45.5	<1.52	<1.82	<1.42	<1.73	<2.03	<1.55
BG-4	5/2006	Fillet	125	16	3/M	152	<1.48	<1.76	<1.37	3.26	2.76	2.7
BG-5	5/2006	Fillet	146	18	3/M	101	<1.39	<1.66	<1.29	2.04	2.46	2.13

Mississippi River Pool 5 Fish PFC analysis												
MPCA Species & Sample ID	Sample Date	Fillet or Whole Fish	Wt (g)	Ln (cm)	Age/ sex (yrs/ m-f)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BG-1	11/6/06	Fillet	172	19	4/F	40.3	<1.51	<1.81	<1.41	<1.72	<2.01	<1.54
BG-2	11/6/06	Fillet	252	20	4/J	94.7	<1.38	<1.64	<1.28	2.17	<1.83	<1.40
BG-3	11/6/06	Fillet	199	21	4/M	42.7	<1.43	<1.71	<1.33	1.74	<1.91	<1.46
BG-4	11/6/06	Fillet	189	19	4/F	69.6	<1.54	<1.84	<1.44	1.97	<2.06	<1.57
BG-5	11/6/06	Fillet	114	17	3/F	77.2	<1.51	<1.81	<1.41	2.4	<2.01	<1.54
Smallmouth Bass												
SMB-1	5/2006	Fillet	1512	45	8/F	150	<1.48	<1.76	1.63	3.27	<1.97	<1.50
SMB-2	5/2006	Fillet	131	19	2/J	83.5	<1.45	<1.73	<1.35	2.49	<1.93	<1.48
SMB-3	5/2006	Fillet	449	29	4/M	47.7	<1.50	<1.80	1.86	2.13	<2.00	<1.53
SMB-4	5/2006	Fillet	262	26.5	3/F	93.5	<1.48	<1.77	<1.38	2.59	<1.98	<1.51
SMB-5	5/2006	Fillet	565	33	5/M	104	<1.45	<1.74	1.35	2.25	<1.94	<1.48
Largemouth Bass												
LMB-1	5/2006	Fillet	456	30	6/F	82.9	<1.43	<1.70	<1.33	2.59	<1.90	<1.46
LMB-2	5/2006	Fillet	1043	39	7/M	74.3	<1.45	<1.73	<1.35	1.66	<1.93	<1.48
LMB-3	5/2006	Fillet	689	34	6/F	85.8	<1.38	<1.64	<1.28	2.48	<1.83	<1.40
LMB-3 (dup)	5/2006	Fillet	689	34	6/F	96.5	<1.36	<2.56	<1.27	2.74	<1.82	<1.39
LMB-4	5/2006	Fillet	455	29	4/M	107	<1.41	<1.69	<1.32	3.74	<1.88	<1.44
LMB-5	5/2006	Fillet	502	31	5/M	74.6	<1.50	<1.80	<1.40	2.57	<2.00	<1.53
Walleye												
WAE-1	5/2006	Fillet	1000	47	7/M	34.3	<1.54	<1.83	<1.43	<1.75	<2.05	<1.57
WAE-1 (dup)	5/2006		1000	47	7/M	26.5	<1.54	<1.84	<1.44	<1.76	<2.06	<1.57
WAE-2	5/2006	Fillet	339	31	3/J	60.6	<1.48	<1.76	1.94	1.73	<1.97	<1.50
WAE-3	5/2006	Fillet	362	33	3/J	93.2	<1.47	<1.75	1.49	<1.67	<1.96	<1.50
WAE-4	5/2006	Fillet	965	43	5/M	27.1	<1.48	<1.77	1.97	<1.69	<1.98	<1.51
Northern Pike												
NOP-1	5/2006	Fillet	1457	58	8/F	91.2	<1.45	<1.74	3.43	1.79	<1.94	<1.48
NOP-2	5/2006	Fillet	2568	64	8/F	224	<1.47	<1.75	5.54	2.34	<1.96	<1.50
NOP-2 (dup)	5/2006	Fillet	2568	64	8/F	235	<1.37	<1.64	4.98	2.39	<1.82	<1.40
NOP-3	5/2006	Fillet	214	28	2J	130	<1.47	<1.75	2.87	2.63	<1.96	<1.50
NOP-4	5/2006	Fillet	710	45	6/J	12.2	<1.42	<1.70	2.52	<1.62	<1.89	<1.45
NOP-5	5/2006	Fillet	1498	42	6/F	97.5	<1.5	<1.80	2.86	1.93	<2.00	<1.53
Channel Catfish												
CCF-1	5/2006	Fillet	485	31	?/J	9.59	<1.51	<1.81	<1.41	<1.72	<2.01	<1.54
CCF-2	5/2006	Fillet	1956	52	5/M	<3.32	<1.44	<1.72	<1.34	<1.64	<1.92	<1.47
Other												
Gizzard Shad	11/6/06	Composites of 40 whole fish		~13		20.1	<1.48	<1.76	<1.37	<1.68	<1.97	<1.50

Mississippi River Pool 5a Fish PFC analysis													
MPCA Species & Sample ID	Sample Date	Fillet or Whole Fish	Wt (g)	Ln (cm)	Age/ sex (yrs/ m-f)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BG-1	5/2006	Fillet	164	17	3/M	34.6	<1.32	<1.58	<1.23	<1.50	<1.76	<1.35
BG-2	5/2006	Fillet	168	18	3/M	99.2	<1.50	<2.18	<1.39	<1.70	<2.00	<1.53
BG-3	5/2006	Fillet	284	20	4/M	82.9	<1.26	<1.55	<1.17	1.65	<1.68	<1.29
BG-4	5/2006	Fillet	199	20	4/M	34	<1.60	<1.91	<1.49	<1.82	<2.13	<1.63
BG-5	5/2006	Fillet	188	19	4/F	55.5	<1.36	<1.63	<1.27	<1.55	<1.82	<1.39
Smallmouth Bass												
SMB-1	5/2006	Fillet	813	36	7/M	52.3	<1.50	<1.79	<1.39	<1.70	<2.00	<1.53
SMB-2	5/2006	Fillet	819	36	7/M	116	<1.41	<1.68	1.39	2.89	<1.88	<1.44
SMB-3	5/2006	Fillet	746	35	6/F	67.1	<1.50	<1.79	1.43	<1.70	<2.00	<1.53
SMB-4	5/2006	Fillet	377	28	4/M	84.6	<1.48	<1.77	<1.38	2.74	<1.98	<1.51
SMB-5	5/2006	Fillet	672	34	6/M	45	<1.45	<2.38	<1.35	<1.65	<1.93	<1.48
Walleye												
WAE-1	5/2006	Fillet	740	41	5/F	56.4	<1.48	<1.76	1.83	<1.68	<1.97	<1.50
WAE-2	5/2006	Fillet	1454	49	6/F	49.3	<1.49	<1.78	2.15	<1.70	<1.99	<1.52
WAE-3	5/2006	Fillet	1125	47	6/F	41	<1.54	<1.84	1.53	<1.76	<2.06	<1.57
WAE-4	5/2006	Fillet	195	25.5	2/J	75.4	<1.41	<2.14	<1.32	<1.61	<1.88	<1.44
WAE-5	5/2006	Fillet	2158	55	9/F	103	<1.47	<1.75	1.66	2.74	<1.96	<1.50
Channel Catfish												
CCF-1	5/2006	Fillet	2086	57	6/M	<3.26	<1.41	<1.69	<1.32	<1.61	<1.88	<1.44
CCF-2	5/2006	Fillet	1489	46	4/F	18.3	<1.38	<1.64	<1.28	2.34	<1.83	<1.40
CCF-3	5/2006	Fillet	1147	41	3/F	9.55	<1.55	<1.85	<1.44	<1.77	<2.07	<1.58
CCF-4	5/2006	Fillet	738	39	2/F	13.4	<1.46	<1.99	<1.36	<1.66	<1.95	<1.49

St. Croix River Fish PFC analysis												
MPCA Species & Sample ID	Sample Date	Fillet or Whole Fish	Wt (g)	Ln (cm)	Age/ sex (yrs/ m-f)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BG-1	8/11/06	Fillet	94	16.5	3/F	<3.57	<1.93	<3.85	<1.44	<1.77	<2.07	<1.58
BG-1(Dup)	8/11/06	Fillet	94	16.5	3/F	<3.48	<1.51	<1.81	<1.41	<1.72	<2.01	<1.54
BG-1	8/11/06	Whole Fish	94	16.5	3/F	<3.38	<1.47	<1.75	<1.37	<1.67	<1.96	<1.50
BG-2	8/11/06	Fillet	60	13	2/M	<4.21	<1.54	<4.56	<1.44	<1.76	<2.06	<1.57
BG-2	8/11/06	Whole Fish	60	13	2/M	4.22	<1.46	<1.75	<1.36	<1.66	<1.95	<1.49
BG-3	8/11/06	Fillet	78	14.5	2/F	<3.38	<1.47	<1.88	<1.37	<1.67	<1.96	<1.50
BG-3	8/11/06	Whole Fish	78	14.5	2/F	3.40	<1.53	<1.82	<1.42	<1.74	<2.04	<1.56
BG-4	8/11/06	Fillet	76	14	2/M	<3.37	<1.46	<2.49	<1.36	<1.66	<1.95	<1.49
BG-4	8/11/06	Whole Fish	76	14	2/M	4.07	<1.41	<1.69	<1.32	<1.61	<1.88	<1.44
BG-5	8/11/06	Fillet	73	15	2/J	<3.48	<1.51	<4.78	<1.41	<1.72	<2.01	<1.54
BG-5	8/11/06	Whole Fish	73	15	2/J	<3.54	<1.54	<1.83	<1.43	<1.75	<2.05	<1.57
Smallmouth Bass												
SMB-1	8/11/06	Fillet	926	37	6/M	<3.41	<1.51	<8.80	<1.38	<1.69	<1.98	<1.51
SMB-1	8/11/06	Whole Fish	926	37	6/M	1.52	<1.50	<1.80	<1.40	<1.71	<2.00	<1.53
SMB-2	8/11/06	Fillet	435	29	4/M	<3.50	<1.52	<1.82	<1.42	<1.73	<2.03	<1.55
SMB-2	8/11/06	Whole Fish	435	29	4/M	1.16	<1.45	<1.74	<1.35	<1.66	<1.94	<1.48
SMB-3	8/11/06	Fillet	428	30	4/F	<3.41	<1.48	<1.77	<1.38	<1.69	<1.98	<1.51
SMB-3	8/11/06	Whole Fish	428	30	4/F	<3.32	<1.44	<2.80	<1.34	<1.64	<1.92	<1.47
SMB-4	8/7/06	Fillet	419	27	4/F	<3.48	<1.51	<1.81	<1.41	<1.72	<2.01	<1.54
SMB-5	8/7/06	Fillet	440	28	4/M	<3.52	<1.53	<1.82	<1.42	<1.74	<2.04	<1.56
Walleye												
WE-1	8/15/06	Fillet	796	40	5/M	<3.48	<1.51	<1.81	<1.41	<1.72	<2.01	<1.54
WE-2	8/4/06	Fillet	1124	46	6/F	<3.57	<1.55	<1.85	<1.44	<1.77	<2.07	<1.58
WE-3	8/4/06	Fillet	401	33	3/J	<3.37	<1.46	<1.75	<1.36	<1.66	<1.95	<1.49
WE-4	8/4/06	Fillet	287	28	3/J	<3.40	<1.48	<2.38	<1.37	<1.68	<1.97	<1.50
WE-5	8/7/06	Fillet	405	32	3/J	<3.29	<1.43	<1.70	<1.33	<1.62	<1.90	<1.46
Northern Pike												
NOP-1	8/16/06	Fillet	629	43	6/J	<3.33	<1.45	<1.73	<1.35	<1.65	<1.93	<1.48
NOP-2	8/15/06	Fillet	476	42	6/F	<3.17	<1.38	<1.64	<1.28	<1.57	<1.83	<1.40
NOP-3	8/16/06	Fillet	1068	48	7?/ M	<3.30	<1.43	<1.71	<1.33	<1.63	<1.91	<1.46
NOP-3 (dup)	8/16/06	Fillet	1068	48	7?/ M	<3.27	<1.42	<1.70	<1.32	<1.62	<1.89	<1.45
NOP-4	8/7/06	Fillet	1365	58	8/M	<3.27	<1.42	<1.70	<1.32	<1.62	<1.89	<1.45
NOP-5	8/16/06	Fillet	526	43	6/F	<3.48	<1.51	<1.81	<1.41	<1.72	<2.01	<1.54
White Sucker												
WTS-1	8/15/06	Fillet	358	31	3/J	<3.33	<1.45	<1.73	<1.35	<1.65	<1.93	<1.48
WTS-2	8/15/06	Fillet	572	36	3/F	<3.21	<1.39	<1.67	<1.30	<1.59	<1.86	<1.42
WTS-3	8/15/06	Fillet	519	33	3/F	<3.33	<1.45	<1.73	<1.35	<1.65	<1.93	<1.48

Lake Calhoun Fish PFC analysis												
MPCA Species & Sample ID	Sample Date	Fillet or Whole Fish	Wt (g)	Ln (cm)	Age/ sex (yrs/ m-f)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BG-1	11/15/06	Fillet	59	15.5	3/F	373	<1.40	<1.88	1.63	7.13	2.92	4.23
BG-1	11/15/06	Whole Fish	59	15.5	3/F	493	<1.43	1.38	2.60	14.9	4.92	5.53
BG-2	11/15/06	Fillet	62	13	2/F	356	<1.42	<1.70	3.46	7	4.1	6.18
BG-2	11/15/06	Whole Fish	62	13	2/F	438	<1.43	<2.74	4.27	13.34	6.82	9.19
BG-3	11/15/06	Fillet	65	15	3/F	181	<1.50	<1.80	1.95	3.28	2.79	4.49
BG-3	11/15/06	Whole Fish	65	15	3/F	280	<1.39	<2.09	5.51	6.9	4.63	5.92
BG-4	11/15/06	Fillet	60	16	3/F	311	<1.46	<1.75	4.69	5.64	3.34	4.72
BG-4	11/15/06	Whole Fish	60	16	3/F	590	<1.50	<2.79	6.43	12.0	5.67	8.10
BG-5	11/15/06	Fillet	68	16	3/F	373	<1.51	<1.81	3.92	8.02	4.01	5.9
BG-5	11/15/06	Whole Fish	68	16	3/F	528	<1.45	<1.97	3.47	13.9	7.73	9.96
White Sucker												
WTS-1	11/15/06	Fillet	250	29	2/M	<3.52	<1.53	<1.82	<1.42	<1.74	<2.04	<1.56
WTS-1	11/15/06	Whole Fish	250	29	2/M	2.91	<1.50	<1.79	<1.39	0.92	<2.00	<1.53
WTS-1 (dup)	11/15/06	Whole Fish	250	29	2/M	1.96	<1.52	<1.82	<1.42	<1.73	<2.03	<1.55
WTS-2	11/15/06	Fillet	309	31	2/J	<3.40	<1.48	<1.76	<1.37	<1.68	<1.97	<1.50
WTS-2 (dup)	11/15/06	Fillet	309	31	2/J	<3.37	<1.46	<1.75	<1.36	<1.66	<1.95	<1.49
WTS-2	11/15/06	Whole Fish	309	31	2/J	<3.23	<2.29	<1.67	<1.30	<1.59	<1.87	<1.43
WTS-3	11/15/06	Fillet	179	27	2/J	<3.54	<1.54	<1.83	<1.43	<1.75	<2.05	<1.57
WTS-3	11/15/06	Whole Fish	179	27	2/J	<3.24	<1.41	<1.68	<1.60	<1.60	<1.88	<1.44
WTS-4	11/15/06	Fillet	660	35	3/J	49.1	2.39	<1.82	<1.42	4.39	<2.04	1.98
WTS-4	11/15/06	Whole Fish	660	35	3/J	77	2.28	<1.82	3.72	5.44	1.76	2.65
WTS-5	11/15/06	Fillet	335	29	2/J	<3.26	<1.41	<1.69	<1.32	<1.61	<1.88	<1.44
WTS-5	11/15/06	Whole Fish	335	29	2/J	<3.40	<1.48	<6.33	<1.47	<1.68	<1.97	<1.50

< = less than the detection limit; number following this symbol represents the detection limit

Twin Cities Metro Lakes

	Average PFOS Concentration [ng/g; ppb]								
	Bluegill	**Bluegill (comp)**	**Black Crappie**	**Black Crappie (comp)**	**Largemouth Bass**	**Northern Pike**	**Walleye**	**White Sucker**	**Yellow Perch (comp)**
Bald Eagle	<dl (5)	<dl (5)	8 (5)	ns	6 (5)	ns	ns	ns	ns
Cedar (Hennepin)	28 (5)	34 (5)	ns	ns	72 (4)	ns	ns	ns	ns
Cedar (Scott)	<dl (5)	<dl (5)	ns	ns	6 (5)	ns	<dl (1)	ns	ns
Centerville	9 (5)	9 (5)	ns	ns	Ns	9 (7)	ns	ns	ns
Colby	22 (5)	23 (5)	14 (5)	14(5)	Ns	ns	ns	ns	ns
Como	26 (5)	28 (5)	66 (5)	ns	30 (1)	42 (4)	ns	ns	ns
Demontreville	12 (5)	8 (5)	ns	ns	46 (5)	ns	ns	ns	ns
Elmo	242 (5)	302 (5)	495 (5)	ns	544 (5)	ns	ns	ns	ns
Gervais	93 (5)	100 (5)	157 (5)	ns	184 (5)	ns	ns	ns	ns
Green Mountain	<dl (5)	<dl (5)	ns	ns	ns	ns	ns	ns	ns
Harriet	114 (5)	89 (5)	ns	ns	148 (5)	ns	ns	ns	ns
Hiawatha	26 (5)	27 (5)	40 (5)	ns	ns	28 (6)	ns	ns	ns
Hydes	<dl (5)	<dl (5)	<dl (6)	ns	ns	5 (5)	ns	ns	ns
Independence	5 (5)	<dl (5)	<dl (5)	ns	ns	<dl (2)	ns	ns	ns
Jane	22 (5)	8 (5)	25 (8)	ns	47 (5)	ns	ns	ns	ns
Johanna	212 (6)	250 (5)	222 (3)	ns	ns	ns	ns	ns	ns
Josephine	87 (6)	93 (6)	ns	ns	ns	ns	ns	ns	ns
Keller	69 (5)	70 (5)	ns	ns	ns	ns	ns	ns	ns
Minnetonka	<dl (5)	7 (5)	8 (5)	ns	ns	9 (3)	ns	ns	ns
Nokomis	10 (7)	ns	10 (5)	ns	ns	ns	ns	ns	ns
Olson	17 (5)	15 (5)	ns	ns	42 (5)	ns	ns	ns	ns
Peltier	12 (5)	ns	ns	ns	ns	14 (5)	ns	ns	ns
Phalen	69 (5)	50 (5)	104 (3)	ns	142 (5)	ns	ns	ns	ns
Powers	40 (5)	65 (5)	51 (5)	ns	ns	69 (3)	ns	ns	42 (5)
Prior (Upper)	5 (5)	<dl (5)	ns	ns	6 (5)	ns	ns	ns	ns
Ravine	23 (5)	19 (5)	60 (5)	ns	63 (5)	ns	ns	ns	ns
Red Rock	41 (5)	35 (5)	103 (5)	ns	69 (5)	ns	ns	ns	ns
Sarah	7 (5)	<dl (4)	<dl (5)	ns	ns	10 (5)	ns	ns	ns
Silver	24 (5)	34 (5)	33 (5)	35 (5)	ns	ns	17 (4)	ns	ns
Square	<dl (5)	<dl (5)	5 (5)	ns	<dl (5)	ns	ns	ns	ns
Tanners	76 (5)	55 (5)	118 (5)	ns	80 (5)	ns	ns	ns	ns
White Bear	5 (5)	6 (5)	25 (2)	ns	9 (5)	ns	ns	ns	ns

River Reaches

	Average PFOS Concentration [ng/g; ppb]								
	Bluegill	**Bluegill (comp)**	**Smallmouth Bass**	**Largemouth Bass**	**White Bass**	**Walleye**	**Northern Pike**	**White Sucker**	**Channel Catfish**
Mississippi River									
Brainerd area	10 (2)	ns	13 (5)	ns	ns	9 (5)	7 (3)	ns	ns
St. Croix River									
Washington County Bluff Park area	23 (5)	12 (5)	15 (5)	ns	82 (1)	17 (5)	ns	ns	ns

numbers listed are: average PFOS concentration (# of fish)
<dl – less than the detection limit ≈ 5 ng/g
ns – not sampled
comp – composite; tissue from several fish is combined then PFCs are measured

Samples were analyzed for the 13 different perfluorochemicals listed.

			CAS #
PFBA	C-4	perfluorobutanoic acid	375-22-4
PFBS	C-4	perfluorobutane sulfonate	375-73-5
PFPeA	C-5	perfluoropentanoic acid	2706-90-3
PFHxA	C-6	perfluorohexanoic acid	307-24-4
PFHxS	C-6	perfluorohexane sulfonate	355-46-4
PFHpA	C-7	perfluoroheptanoic acid	375-85-9
PFOA	C-8	perfluorooctanoic acid	335-67-1
PFOS	C-8	perfluorooctane sulfonate	1763-23-1
PFOSA	C-8	perfluorooctane sulfonamide	754-91-6
PFNA	C-9	perfluorononanoic acid	375-95-1
PFDA	C-10	perfluorodecanoic acid	335-76-2
PFUnA	C-11	perfluoroundecanoic acid	2058-94-8
PFDoA	C-12	perfluorododecanoic acid	307-55-1

Bald Eagle Lake Fish PFC analysis												
Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-1	5/2/07	Fillet	22	9.5	2/J	<4.98	<2.49	<2.49*	<2.49	<2.49	<2.49	<2.49
BGS-4	5/2/07	Fillet	11	8	1/J	<4.39	<2.19	<2.19*	<2.19	<2.19	<2.19	<2.19
BGS-5	5/2/07	Fillet	25	11	2/M	<4.93	<2.46	<2.46*	<2.46	<2.46	<2.46	<2.46
BGS-6	5/2/07	Fillet	79	15.5	5/M	<4.76	<2.38	<2.38*	<2.38	<2.38	<2.38	<2.38
BGS-9	5/2/07	Fillet	88	16	5/M	<4.61	<2.30	<2.30*	<2.30	<2.30	<2.30	<2.30
BGS-comp	5/2/07	Fillet	50a	12a		<4.78	<2.39	<2.39	<2.39	<2.39	<2.39	<2.39
Black Crappie												
BKS-1	5/2/07	Fillet	95	17.5	4/F	10.5	<2.50	<2.50*	<2.50	<2.50	<2.50	<2.50
BKS-2	5/2/07	Fillet	98	17	4/F	7.24	<2.39	<2.39*	<2.39	<2.39	<2.39	<2.39
BKS-3	5/2/07	Fillet	236	24	7/F	7.89	<2.35	<2.35	<2.35	<2.35	<2.35	<2.35
BKS-4	5/2/07	Fillet	104	19	5/J	4.69	<2.30	<2.30	<2.30	<2.30	<2.30	<2.30
BKS-5	5/2/07	Fillet	97	18	5/F	7.54	<2.58	<2.58	<2.58	<2.58	<2.58	<2.58
Largemouth Bass												
LMB-1	5/2/07	Fillet	992	38	7/F	<5.00	<2.50	<2.50*	<2.50	<2.50	<2.50	<2.50
LMB-2	5/2/07	Fillet	684	34	6/F	<4.69	<2.35	<2.35*	<2.35	<2.35	<2.35	<2.35
LMB-3	5/2/07	Fillet	764	34	6/F	6.18	<2.35	<2.35*	<2.35	<2.35	<2.35	<2.35
LMB-4	5/2/07	Fillet	452	31	5/F	<4.81	<2.40	<2.40*	<2.40	<2.40	<2.40	<2.40
LMB-5	5/2/07	Fillet	560	31.5	5/M	<5.03	<2.51	<2.51*	<2.51	<2.51	<2.51	<2.51

Cedar Lake Fish PFC analysis (Hennepin County)												
Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-1	2007	Fillet	24	12	3/F	33.5	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50
BGS-5	2007	Fillet	56	15.5	5/J	31	<2.39	<2.39	<2.39	2.46	<2.39	<2.39
BGS-6	2007	Fillet	25	11.5	2/F	17.9	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50
BGS-8	2007	Fillet	47	14.5	4/F	30.9	<2.37	<2.37	<2.37	3.11	<2.37	<2.37
BGS-10	2007	Fillet	24	12	2/J	27.8	<2.51	<2.51	<2.51	5.25	3.77	<2.51
BGS-comp	2007	Fillet	31a	12a		34	<2.42	<2.42	<2.42	2.99	<2.42	2.56
Largemouth Bass												
LMB-1	2007	Fillet	531	33	5/M	53.8	<2.46	<2.46	<2.46	4.88	3.54	2.58
LMB-2	2007	Fillet	488	31	5/F	70.8	<2.40	<2.40	<2.40	6.7	3.49	3.39#
LMB-3	2007	Fillet	1166	43	10/F	56.3	<2.48	<2.48	<2.48	8.27	4.61	3.25#
LMB-4	2007	Fillet	1592	46	11/F	108	<2.42	<2.42	<2.42	5.22	3.67	5.27#
LMB-4(dup)		Fillet				103	<2.45	<2.45	<2.45	6.37	4.05	5.02#

Cedar Lake Fish PFC analysis (Scott County)											
Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-1	8/24/07	Fillet	16	9	1/J	<4.81	<2.40	<2.40	<2.40	<2.40	<2.40	<2.40
BGS-4	8/24/07	Fillet	19	10	2/J	<6.76	<2.49	<2.49	<2.49	<2.49	<2.49	<2.49
BGS-5	8/24/07	Fillet	97	17	6/M	<4.81	<2.40	<2.40	<2.40	<2.40	<2.40	<2.40
BGS-6	8/24/07	Fillet	31	NA	4/M	<4.95	<2.48	<6.43	<2.48	<2.48	<2.48	<2.48
BGS-9	8/24/07	Fillet	82	16	5/M	<4.81	<2.40	<2.40	<2.40	<2.40	<2.40	<2.40
BGS-comp	8/24/07	Fillet	59a	12a		<4.85	<2.43	<2.43	<2.43	<2.43	<2.43	<2.43
Largemouth Bass												
LMB-1	8/24/07	Fillet	1292	41	9/M	6.24	<2.46	<2.46	<2.46	<2.46	<2.46	<2.46
LMB-2	8/24/07	Fillet	1528	NA	9/F	<4.90	<2.45	<2.45	<2.45*	<2.45	<2.45	<2.45
LMB-3	8/24/07	Fillet	1264	40	8/F	<4.67	<2.34	<2.34	<2.34*	<2.34	<2.34	<2.34
LMB-4	8/24/07	Fillet	857	40	8/M	<4.88	<2.44	<2.44	<2.44*	<2.44	<2.44	<2.44
LMB-5	8/24/07	Fillet	1110	42	9/M	<4.74	<3.85	<2.37	<2.37*	<2.37	<2.37	<2.37
LMB-5(dup)		Fillet				<5.03	<2.51	<2.51	<2.51*	<2.51	<2.51	<2.51
Walleye												
WE-1	8/24/07	Fillet	714	43	7/M	<4.95	<2.48	<4.04	<2.48*	<2.48	<2.48	<2.48

Centerville Lake Fish PFC analysis												
Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-1	2007	Fillet	69	15	4/F	12.8	<2.43	<2.43	<2.43	<2.43	<2.43	<2.43
BGS-2	2007	Fillet	62	14.5	4/M	6.24	<2.45	<2.45	<2.45	<2.45	<2.45	<2.45
BGS-4	2007	Fillet	42	12.5	3/J	9.94	<2.45	<2.45	<2.45	<2.45	<2.45	<2.45
BGS-8	2007	Fillet	61	15	4/F	<4.95	<2.48	<2.48	<2.48	<2.48	<2.48	<2.48
BGS-9	2007	Fillet	74	15	4/M	6.74	<2.48	<2.48	<2.48	<2.48	<2.48	<2.48
BGS-comp	2007	Fillet	72a	15a		8.71	<2.23	<2.23	<2.23	<2.23	<2.23	<2.23
Northern Pike												
NP-1	2007	Fillet	1609	58	4/F	9.01	<2.49	<2.49	<2.49	<2.49	<2.49	<2.49
NP-2	2007	Fillet	878	49	4/J	10.2	<2.48	<2.48	<2.48	<2.48	<2.48	<2.48
NP-3	2007	Fillet	793	46	4/J	9.03	<2.43	<2.43	<2.43	<2.43	<2.43	<2.43
NP-4	2007	Fillet	1067	56.5	4/J	6.3	<2.74	<2.50	<2.50	<2.50	<2.50	<2.50
NP-5	2007	Fillet	1183	54	4/M	7.84	<2.51	<2.51	<2.51	<2.51	<2.51	<2.51
NP-6	2007	Fillet	1546	65	5/M	11.4	<2.40	<2.40	<2.40	<2.40	<2.40	<2.40
NP-7	2007	Fillet	896	51	4/M	10.6	<2.44	<2.44	<2.44	<2.44	<2.44	<2.44

Colby Lake Fish PFC analysis												
Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-4	6/6/07	Fillet	21	9.5	1/M	21.7	<2.44	<2.44*	<2.44	3.01	<2.44	<2.44
BGS-5	6/6/07	Fillet	31	12	2/F	23.9#	<2.46	<4.03*	<2.46	<2.46	<2.46	<2.46
BGS-7	6/6/07	Fillet	34	12.5	2/J	32.8	<2.49	<3.10*	<2.49	<2.49	<2.49	<2.49
BGS-9	6/6/07	Fillet	35	12	2/F	13#	<2.50	<2.50*	<2.50	<2.50	<2.50	<2.50
BGS-10	6/6/07	Fillet	29	11	2/F	18.9#	<2.49	<2.49*	<2.49	<2.49	<2.49	<2.49
BGS-comp	6/6/07	Fillet	23a	NA		23.4	<2.40	<2.40	<2.40	<2.40	<2.40	<2.40
Black Crappie												
BKS-2	6/6/07	Fillet	42	14	3/F	16.6	<2.50	<2.50*	<2.50	2.84	<2.50	<2.50
BKS-4	6/6/07	Fillet	47	14.5	3/M	13.2#	<2.45	<2.45	<2.45	<2.45	<2.45	<2.45
BKS-5	6/6/07	Fillet	47	14.5	3/M	12.6#	<2.35	<2.35	<2.35	<2.35	<2.35	<2.35
BKS-7	6/6/07	Fillet	46	15	3/M	14.6	<2.44	<2.44	<2.44	<2.44	<2.44	<2.44
BKS-8	6/6/07	Fillet	34	13.8	3/F	12	<2.48	<2.48	<2.48	<2.48	<2.48	<2.48
BKS-comp	6/6/07	Fillet	37a	13a		14.3	<2.43	<2.43	<2.43	<2.43	<2.43	<2.43

Como Lake Fish PFC analysis												
Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-3	5/1/07	Fillet	31	11	2/F	39#	<2.34	<2.34*	3.54	3.71	4.66	5.99
BGS-4	5/1/07	Fillet	29	11	2/J	32.6#	<2.50	<2.50*	3.8	3.88	3.84	5.21
BGS-6	5/1/07	Fillet	99	16	5/M	34.2	<2.50	<2.50*	4.2	<2.50	<2.50	4.03
BGS-8	5/1/07	Fillet	61	14.5	4/M	20.6	<2.43	<2.43*	2.84	<2.43	2.75	3.72
BGS-10	5/1/07	Fillet	93	16	5/F	23.1	<2.49	<2.49*	<2.49	<2.49	2.65	3.08
BGS-comp	5/1/07	Fillet	47a	13a		28.1	<2.49	<2.49	2.98	<2.49	<2.49	4.45
Black Crappie												
BKS-1	5/1/07	Fillet	141	17	4/M	59.7	<2.42	<2.42*	3.09	10.6	6.52	7.93
BKS-2	5/1/07	Fillet	69	16	4/M	44.9	<2.53	<2.53*	<2.53	6.69	3.16	6.07
BKS-3	5/1/07	Fillet	408	28	8/F	104	<2.36	<2.36*	3.14	15.2	9.09	10.5
BKS-4	5/1/07	Fillet	158	20.5	5/M	57.6	<2.30	<2.30*	<2.30	10.6	5.96	6.95
BKS-5	5/1/07	Fillet	817	32	10/F	63.4	<2.50	<2.50*	<2.50	10.3	4.97	5.88
Largemouth Bass												
LMB-1	5/1/07	Fillet	867	37	7/F	29.5	<2.40	<2.40*	2.42	4.04	4.35	6.68
Northern Pike												
NP-1	5/1/07	Fillet	2129	66	5/M	54.4	<2.48	<2.48*	20	7.7	3.93	5.08
NP-1(dup)	5/1/07	Fillet				45.2	<2.36	<2.36*	18.6	7.69	5.03	6.22
NP-2	5/1/07	Fillet	838	49	4/M	34.6	<2.45	<2.45*	15.8	5.92	4.83	8.47
NP-3	5/1/07	Fillet	858	48	4/M	44.7	<2.48	<2.48*	15.6	5.5	5.12	6.45
NP-4	5/1/07	Fillet	746	49	4/M	47.3	<2.43	<2.43*	19.1	7.51	5.23	7.42

Demontreville Lake Fish PFC analysis												
Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-1	4/30/07	Fillet	26	11	2/F	27.1#	<2.49	<2.49*	<2.49	3.04	<2.49	<2.49
BGS-5	4/30/07	Fillet	20	11	2/F	35.3#	<2.42	<2.42*	<2.98	<2.42	<2.42	<2.42
BGS-6	4/30/07	Fillet	75	14	4/M	<5.00	<2.50	<2.50*	<2.50	<2.50	<2.50	<2.50
BGS-8	4/30/07	Fillet	137	17.5	6/M	11.9	<2.42	<2.42*	<2.42	<2.42	<2.42	<2.42
BGS-10	4/30/07	Fillet	134	18.5	7/M	<5.00	<2.50	<2.50*	<2.50	<2.50	<2.50	<2.50
BGS-comp	4/30/07	Fillet	64a	13a		8.46	<2.42	<2.42	<2.42	<2.42	<2.42	<2.42
Largemouth Bass												
LMB-1	4/30/07	Fillet	686	33	5/M	41.8	<2.42	<2.42*	<2.42	<2.42	<2.42	<2.42
LMB-2	4/30/07	Fillet	1012	39	7/F	32.9	<2.50	<2.5*	<2.50	<2.50	<2.50	<2.50
LMB-2(dup)	4/30/07	Fillet				25.8	<2.43	<2.43*	<2.43	<2.43	<2.43	<2.43
LMB-3	4/30/07	Fillet	612	33	5/F	27	<2.40	<2.40*	<2.40	<2.40	<2.40	<2.40
LMB-4	4/30/07	Fillet	1023	39	7/M	44.9	<2.48	<2.48*	<2.48	<2.48	<2.48	<2.48
LMB-5	4/30/07	Fillet	877	37.5	7/M	84.4	<2.30	<2.30*	<2.30	<2.30	2.88	<2.30

Elmo Lake Fish PFC analysis												
Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-2	5/2/07	Fillet	16	10	2/J	291#	<2.48	<2.48*	<2.48	<2.48	<2.48	<2.48
BGS-4	5/2/07	Fillet	19	10	2/M	217#	<2.49	<2.49*	<2.49	<2.49	<2.49	<2.49
BGS-8	5/2/07	Fillet	42	13	3/J	149	<2.48	<2.48	<2.48	<2.48	<2.48	<2.48
BGS-9	5/2/07	Fillet	30	12.5	3/J	233	20.1	<4.24	<4.24	<4.24	<4.24	<4.24
BGS-10	5/2/07	Fillet	35	13	3/F	345	<3.11	<3.11	<3.11	<3.11	<3.11	<3.11
BGS-comp	5/2/07	Fillet	25a	11a		302	<2.43	<2.43	<2.43	<2.43	<2.43	<2.43
Black Crappie												
BKS-1	5/2/07	Fillet	228	24	7/F	374	<2.36	<2.36	<2.36	3.13	<2.36	<2.36
BKS-2	5/2/07	Fillet	369	28	8/F	574	<2.42	<2.42	<2.42	6.38	<2.42	<2.42
BKS-3	5/2/07	Fillet	292	25.5	7/F	550	<2.34	<2.34	<2.34	3.42	<2.34	<2.34
BKS-4	5/2/07	Fillet	209	22	6/F	534	<2.63	<2.36	<2.36	3.82	<2.36	<2.36
BKS-5	5/2/07	Fillet	189	23	6/F	443	<2.56	<2.56	<2.56	3.14	<2.56	<2.56
Largemouth Bass												
LMB-1	5/2/07	Fillet	470	31	5/M	643	<2.54	<2.54	<2.54	4.44	<2.54	<2.54
LMB-2	5/2/07	Fillet	672	35	6/F	431	<2.43	<2.43*	<2.43	<2.43	<2.43	<2.43
LMB-3	5/2/07	Fillet	894	37	7/F	653	<2.50	<2.50*	<2.50	3.94	<2.50	<2.50
LMB-3(dup)	5/2/07	Fillet				660	<2.51	<2.51*	<2.51	4.06	<2.51	<2.51
LMB-4	5/2/07	Fillet	1062	39	7/F	711	<2.40	<2.40*	<2.40	4.32	<2.40	<2.40
LMB-5	5/2/07	Fillet	698	33	5/M	281	<2.55	<2.55	<2.55	<2.55	<2.55	<2.55

Gervais Lake Fish PFC analysis

Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-2	5/1/07	Fillet	6	7.5	1/J	175#	<2.69	<2.69*	<2.69	5.73	2.7	<2.69
BGS-5	5/1/07	Fillet	6	7	1/J	107#	<3.50	<3.50*	<3.50	5.43	3.57	<3.50
BGS-7	5/1/07	Fillet	75	16	5/F	148	<2.31	<2.31	<2.31	6.44#	<2.31	<2.31
BGS-9	5/1/07	Fillet	90	17	6/F	90.5	<2.46	<2.46	<2.46	2.57#	<2.46	<2.46
BGS-10	5/1/07	Fillet	68	15	4/F	39.9	<2.30	<2.30	<2.30	<2.30	<2.30	<2.30
BGS-comp	5/1/07	Fillet	34a	10a		100	<2.45	<2.45	<7.35	3.8	<2.45	<2.45
Black Crappie												
BKS-1	5/1/07	Fillet	171	23	6/F	132	<2.36	<2.36	<2.36	4.33	<2.36	<2.36
BKS-2	5/1/07	Fillet	86	16	4/M	166	<2.31	<2.31*	<2.31	9.5	3.37	<2.31
BKS-3	5/1/07	Fillet	122	19	5/M	206	<2.35	<2.35	<2.35	11.4	4.08	2.78
BKS-4	5/1/07	Fillet	180	22	6/M	170	<2.29	<2.29*	<2.29	10.9	5.09	8.41
BKS-5	5/1/07	Fillet	65	16	4/F	112	<2.38	<2.38*	<2.38	4.65	<2.38	<2.38
Largemouth Bass												
LMB-1	5/1/07	Fillet	2268	47	11/F	159	<2.49	<2.49*	<2.49	6.23	2.97	<2.49
LMB-2	5/1/07	Fillet	488	31	5/M	153	<2.31	<2.31	<2.31	6.24	3.95	<2.31
LMB-3	5/1/07	Fillet	385	29	4/M	227	<2.36	<2.36*	<2.36	10.7	5.79	2.38
LMB-4	5/1/07	Fillet	661	33	5/M	221	<2.13	<2.13	<2.13	8.67	6.23	5.87
LMB-5	5/1/07	Fillet	311	28	4/F	158	<2.19	<2.19	<2.19	7.42	3.85	<2.19

Green Mountain Lake Fish PFC analysis

Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-1	5/9/07	Fillet	50	13.5	3/J	<4.85	<2.43	<2.43	<2.43	<2.43	<2.43	<2.43
BGS-3	5/9/07	Fillet	118	17.5	6/M	<4.98	<2.49	<2.49	<2.49	<2.49	<2.49	<2.49
BGS-5	5/9/07	Fillet	133	19	7/M	<4.90	<2.45	<2.45	<2.45	<2.45	<2.45	<2.45
BGS-6	5/9/07	Fillet	85	16	5/F	<4.85	<2.43	<2.43	<2.43	<2.43	<2.43	<2.43
BGS-8	5/9/07	Fillet	50	13.5	3/M	<4.85	<2.43	<2.43	<2.43	<2.43	<2.43	<2.43
BGS-comp	5/9/07	Fillet	65a	14a		<4.88	<2.44	<2.46	<2.44	<2.44	<2.44	<2.44

Harriet Lake Fish PFC analysis

Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-5	8/17/07	Fillet	17	9	1/J	108	<2.40	<2.40	<2.40	4.91	<2.40	<2.40
BGS-6	8/17/07	Fillet	42	10	2/F	78.1	<2.48	<2.48	<2.48	<2.48	<2.48	<2.48
BGS-7	8/17/07	Fillet	12	7	1/J	124	<2.43	<2.43	<2.43	6.98	<2.43	<2.43
BGS-9	8/17/07	Fillet	30	11	2/M	95.9	<2.46	<2.46	<2.46	<2.46	<2.46	<2.46
BGS-10	8/17/07	Fillet	73	NA	4/M	163	<2.40	<2.40	<2.40	4.98	5.27#	4.12
BGS-comp	8/17/07	Fillet	41a	13a		89.3	<2.44	<2.44	<2.44	2.59	<2.44	<2.44
Largemouth Bass												
LMB-1	8/17/07	Fillet	373	30	4/F	146	<5.38	<2.49	<2.49*	8.74	4.59	2.78
LMB-2	8/17/07	Fillet	554	34	6/F	20.5	<3.66	<2.46	<2.46*	5.4	<2.46	<2.46
LMB-3	8/17/07	Fillet	355	29	4/J	150	<2.39	<2.39	<2.39*	9.25	3.71	3.64
LMB-4	8/17/07	Fillet	963	39	8/M	254	<4.20	<2.43	<2.43*	10	5.28	7.1
LMB-5	8/17/07	Fillet	866	40	8/F	170	<2.42	<2.42	<2.42	10.1	4.65	3.66

Hiawatha Lake Fish PFC analysis												
Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-2	2007	Fillet	73	16	5/M	35	<2.48	<2.48	<2.48	<2.48	<2.48	<2.48
BGS-6	2007	Fillet	94	18	6/M	15.7	<2.48	<2.48	<2.48	<2.48	<2.48	<2.48
BGS-7	2007	Fillet	36	13	3/F	15.5	<2.48	<2.48	<2.48	<2.48	<2.48	<2.48
BGS-9	2007	Fillet	8	8	1/J	31.8	<2.43	<2.43	<2.43	<2.43	<2.43	<2.43
BGS-10	2007	Fillet	5	7.8	1/J	31.9	<3.55	<3.55	<3.55	<3.55	<3.55	<3.55
BGS-comp	2007	Fillet	42a	12a		27.3	<2.42	<2.42	<2.42	<2.42	<2.42	<2.42
Black Crappie												
BKS-1	2007	Fillet	73	19	5/F	36.6	<2.50	<2.50	<2.50	2.7	<2.50	<2.50
BKS-2	2007	Fillet	103	21.5	6/M	71.7	<2.35	<2.35	<2.35	3.94	<2.35	4.75
BKS-3	2007	Fillet	71	18	4/F	35.1	<2.30	<2.30	<2.30	2.32	<2.30	<2.30
BKS-4	2007	Fillet	83	18	4/F	33.5	<2.45	<2.45	<2.45	<2.45	<2.45	<2.45
BKS-5	2007	Fillet	64	17	4/F	21	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50
Northern Pike												
NP-1	6/19/07	Fillet	1140	56	4/M	17.1	< 2.49	< 2.49	3.65	< 2.49	< 2.49	< 2.49
NP-2	6/19/07	Fillet	738	46	4/F	36.7	< 4.60	< 2.49	2.64	< 2.49	2.98	2.58
NP-3	6/19/07	Fillet	927	51	4/M	16.7	< 2.51	< 2.51	2.95	< 2.51	< 2.51	< 2.51
NP-4	6/19/07	Fillet	1192	NA	4/F	59.5	< 2.46	< 2.46	6.2	4.33	3.6	4.99
NP-4(dup)						65.4	< 2.46	< 2.46	5.25	4.86	3.06	5.58
NP-5	6/19/07	Fillet	2530	74	6/F	14.5	< 2.46	< 2.46	4.17	< 2.46	< 2.46	< 2.46
NP-6	6/19/07	Fillet	3700	77	6/F	25.6	< 2.49	< 2.49	3.86	< 2.49	2.72	< 2.49

Hydes Lake Fish PFC analysis

Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-1	7/24/07	Fillet	9	7	1/J	<5.05	<2.53	<2.53	<2.53	<2.53	<2.53	<2.53
BGS-5	7/24/07	Fillet	9	9	1/J	<5.08	<2.54	<2.54	<2.54	<2.54	<2.54	<2.54
BGS-6	7/24/07	Fillet	130	17	6/F	<4.85	<2.43	<2.43	<2.43	<2.43	<2.43	<2.43
BGS-7	7/24/07	Fillet	127	17	6/M	<4.83	<2.42	<2.42	<2.42	<2.42	<2.42	<2.42
BGS-10	7/24/07	Fillet	123	17.5	6/F	<4.95	<2.48	<2.48	<2.48	<2.48	<2.48	<2.48
BGS-10(dup)		Fillet				<4.90	<2.45	<2.45	<2.45	<2.45	<2.45	<2.45
BGS-comp	7/24/07	Fillet	62a	12a		<4.41	<2.20	<2.20	<2.20	<2.20	<2.20	<2.20
Black Crappie												
BKS-1	7/24/07	Fillet	124	20	5/F	<4.88	<2.44	<2.45	<2.44*	<2.44	<2.44	<2.44
BKS-1(dup)		Fillet				<4.93	<2.46	<2.46	<2.46*	<2.46	<2.46	<2.46
BKS-2	7/24/07	Fillet	178	23	6/F	<4.90	<2.95	<2.45	<2.45*	<2.45	<2.45	<2.45
BKS-3	7/24/07	Fillet	167	22.5	6/F	<4.78	<4.24	<2.39	<2.39*	<2.39	<2.39	<2.39
BKS-4	7/24/07	Fillet	206	24	7/F	<4.88	<2.44	<2.44	<2.44*	<2.44	<2.44	<2.44
BKS-5	7/24/07	Fillet	224	25	7/M	<4.90	<2.45	<2.45	<2.45*	<2.45	<2.45	<2.45
BKS-6	7/24/07	Fillet	220	25	7/F	<4.90	<2.87	<2.45	<2.45*	<2.45	<2.45	<2.45
Northern Pike												
NP-1	7/24/07	Fillet	2170	68	5/M	<4.93	<2.46	<2.46	<2.46	<2.46	<2.46	<2.46
NP-2	7/24/07	Fillet	631	48	4/M	<4.41	<2.20	<2.20	<2.20	<2.20	<2.20	<2.20
NP-3	7/24/07	Fillet	741	46	4/F	<4.52	<2.26	<2.26	<2.26	<2.26	<2.26	<2.26
NP-4	7/24/07	Fillet	2342	68	6/J	<4.69	<2.35	<2.35	<2.35	<2.35	<2.35	<2.35
NP-4(dup)						<4.65	<2.33	<2.33	<2.33	<2.33	<2.33	<2.33
NP-5	7/24/07	Fillet	3445	74	6/F	4.76	<2.37	<2.37	<2.37	<2.37	<2.37	<2.37

Independence Lake Fish PFC analysis

Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-4	7/24/07	Fillet	13	10	2/J	5.1	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50
BGS-6	7/24/07	Fillet	14	10	2/J	<4.88	<2.44	<2.44	<2.44	<2.44	<2.44	<2.44
BGS-7	7/24/07	Fillet	14	9.5	1/J	5.41	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50
BGS-8	7/24/07	Fillet	45	14	4/F	<4.83	<2.42	<2.42	<2.42	<2.42	<2.42	<2.42
BGS-9	7/24/07	Fillet	55	15	4/M	<4.85	<2.43	<2.43	<2.43	<2.43	<2.43	<2.43
BGS-comp	7/24/07	Fillet	45a	13a		<4.88	<2.44	<2.44	<2.44	<2.44	<2.44	<2.44
Black Crappie												
BKS-1	7/24/07	Fillet	70	18	4/F	<4.95	<2.48	<2.48	<2.48	<2.48	<2.48	<2.48
BKS-2	7/24/07	Fillet	78	19	5/F	<4.65	<2.33	<2.33	<2.33	<2.33	<2.33	<2.33
BKS-3	7/24/07	Fillet	81	18	4/M	<5.00	<2.50	<3.22	<2.50	<2.50	<2.50	<2.50
BKS-4	7/24/07	Fillet	81	19	5/M	<4.93	<2.46	<2.46	<2.46	<2.46	<2.46	<2.46
BKS-5	7/24/07	Fillet	139	22	6/F	<4.93	<2.46	<2.46	<2.46	<2.46	<2.46	<2.46
Northern Pike												
NP-1	7/24/07	Fillet	2000	57	4/F	<5.54	<2.40	<2.40	<2.40	<2.40	<2.40	<2.40
NP-2	7/24/07	Fillet	3700	76	6/M	<4.90	<2.45	<2.45	<2.45	<2.45	<2.45	<2.45
NP-2(dup)						<4.95	<2.48	<2.48	<2.48	<2.48	<2.48	<2.48

Jane Lake Fish PFC analysis												
Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-4	6/07	Fillet	16	10.5	2/J	20.7	<2.46	<2.46*	<2.46	<2.46	<2.46	<2.46
BGS-6	6/07	Fillet	99	18	6/F	8.62#	<2.50	<2.50*	<2.50	<2.50	<2.50	<2.50
BGS-7	6/07	Fillet	73	17.2	6/M	46.3	<2.44	<2.44*	<2.44	<2.44	<2.44	<2.44
BGS-7(dup)						36.5#	<2.48	<2.48*	<2.48	<2.48	<2.48	<2.48
BGS-8	6/07	Fillet	18	10.6	2/J	12.2#	<2.50	<2.50*	<2.50	<2.50	<2.50	<2.50
BGS-10	6/07	Fillet	95	NA	4/M	<4.95	<2.48	<2.48*	<2.48	<2.48	<2.48	<2.48
BGS-comp	6/07	Fillet	43a	13a		7.76	<2.46	<2.46	<2.46	<2.46	<2.46	<2.46
Black Crappie												
BKS-1	6/07	Fillet	65	15	3/M	13.6#	<2.40	<2.40*	<2.40	<2.40	<2.40	<2.40
BKS-2	6/07	Fillet	109	18.2	5/M	26.2	<2.40	<2.40*	<2.40	<2.40	<2.40	<2.40
BKS-3	6/07	Fillet	78	17.8	4/F	10.2#	<2.48	<2.48*	<2.48	<2.48	<2.48	<2.48
BKS-4	6/07	Fillet	63	16.5	4/M	39.7	<2.48	<2.48	<2.48	<2.48	<2.48	<2.48
BKS-5	6/07	Fillet	96	19.5	5/M	34.2	<2.45	<2.45	<2.45	<2.45	<2.45	<2.45
BKS-6	6/07	Fillet	99	21	6/F	19.5	<2.46	<2.46	<2.46	<2.46	<2.46	<2.46
BKS-7	6/07	Fillet	115	20	5/M	34.8#	<2.43	<2.43	<2.43	<2.43	<2.43	<2.43
BKS-7(dup)						21.9#	<2.42	<2.42	<2.42	<2.42	<2.42	<2.42
BKS-8	6/07	Fillet	108	19	5/M	21.7	<2.46	<2.46	<2.46	<2.46	<2.46	<2.46
Largemouth Bass												
LMB-1	6/07	Fillet	507	33	5/M	35.1	<2.49	<2.49	<2.49	<2.49	<2.49	<2.49
LMB-2	6/07	Fillet	535	36	7/M	38.1	<2.49	<2.49	<2.49	<2.49	<2.49	<2.49
LMB-3	6/07	Fillet	599	33	5/M	83.4	<3.65	<5.00	<2.49	3.32	2.82	<2.49
LMB-4	6/07	Fillet	525	36	7/M	25.8	<2.43	<2.43	<2.43	<2.43	<2.43	<2.43
LMB-5	6/07	Fillet	809	NA	6/F	53.6	<2.44	<2.97	<2.44	<2.44	<2.44	<2.44

Johanna Lake Fish PFC analysis												
Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-1	6/19/07	Fillet	71	16	5/M	183	<2.44	<2.44*	<2.44	<2.44	<2.44	<2.44
BGS-2	6/19/07	Fillet	56	14.5	4/M	184#	<2.43	<2.43*	<2.43	4.02	<2.43	<2.43
BGS-3	6/19/07	Fillet	94	18	6/M	176#	<2.40	<2.40*	<2.40	3.85	3.86	7.34
BGS-6	6/19/07	Fillet	42	13	3/M	207#	<2.46	<2.46*	<2.46	5.69	4.3	3.58
BGS-7	6/19/07	Fillet	55	16	4/M	230	<2.49	<2.52*	<2.49	3.73	<2.49	<2.49
BGS-8	6/19/07	Fillet	57	15.5	4/M	292	<2.44	<2.44*	<2.44	<2.44	<2.44	<2.44
BGS-comp	6/19/07	Fillet	55a	14a		250	<2.45	<2.45	<2.45	3.24	<2.45	2.65
Black Crappie												
BKS-1	6/19/07	Fillet	89	NA	4/M	384	<2.34	<2.34	<2.34	8.92	3.94	3.31
BKS-2	6/19/07	Fillet	83	20	5/F	213	<2.44	<3.06	<2.44	4.51	<2.44	<2.44
BKS-3	6/19/07	Fillet	94	20	5/F	70.3	<2.48	<2.48	<2.48	2.66	<2.48	<2.48

Josephine Fish PFC analysis												
Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-1	5/24/06	Fillet	37	11	2M	73.4	< 2.43	< 2.43	< 2.43	< 2.43	< 2.43	< 2.43
BGS-2	5/24/06	Fillet	58	14	4/F	52.5	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49
BGS-4	5/24/06	Fillet	68	16	5/M	50.2	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46
BGS-5	5/24/06	Fillet	44	13.1	3/F	102	< 2.51	< 2.51	< 2.51	< 2.51	< 2.51	< 2.51
BGS-10	5/24/06	Fillet	38	13.2	3M	55.6	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46#
BGS-12	5/24/06	Fillet	36	13	3/M	188	< 2.50	< 2.50	< 2.50	3.07	< 2.50	< 2.50
BGS-comp	5/24/06	Fillet	42a	14a		92.6	< 2.48	< 2.48	< 2.49	< 2.48	2.98	< 2.48

Keller Lake Fish PFC analysis												
Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-1	7/07	Fillet	50	13.5	3/M	26.2	<2.45	<2.45	<2.45	<2.45	<2.45	<2.45
BGS-2	7/07	Fillet	54	14.5	4/J	64.6	<2.35	<2.35	<2.35	2.5	<2.35	<2.35
BGS-5	7/07	Fillet	56	14	4/M	97.1	<2.46	<2.46	<2.46	4.88	4.31	<2.46
BGS-7	7/07	Fillet	58	15	4/F	50.1	<2.46	<2.46	<2.46	4.47	2.99	<2.46
BGS-10	7/07	Fillet	58	15	4/M	106	<2.49	<2.49	<2.49	4.81	3.77	2.73
BGS-comp	7/07	Fillet	53a	15a		70	<2.10	<2.10	<2.10	2.67	<2.10	<2.10

Minnetonka Fish PFC analysis												
Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-1	6/21/07	Fillet	72	15.5	5/F	< 4.90	< 2.45	< 2.45	< 2.45	< 2.45	< 2.45	< 2.45
BGS-4	6/21/07	Fillet	69	13.2	3/F	< 4.93	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46
BGS-5	6/21/07	Fillet	54	12	2/F	< 4.98	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49
BGS-9	6/21/07	Fillet	16	10	2/J	< 5.03	< 2.51	< 2.51	< 2.51	< 2.51	< 2.51	< 2.51
BGS-10	6/21/07	Fillet	15	10	2/J	< 4.98	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49
BGS-comp		Fillet	49a	13a		7.47	< 2.50	< 2.50	< 2.50	< 2.50	< 2.50	< 2.50
Black Crappie												
BKS-1	6/22/07	Fillet	464	34	11/F	7.16	< 2.51	< 2.51	< 2.51	< 2.51	< 2.51	< 2.51
BKS-1(dup)						8.04	< 2.37	< 2.37	< 2.37	< 2.37	< 2.37	< 2.37
BKS-2	6/22/07	Fillet	300	28	8/F	6.22	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49
BKS-3	6/22/07	Fillet	192	24	7/M	10.9	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46
BKS-4	6/22/07	Fillet	121	21	6/F	< 4.92	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46	< 2.46
BKS-5	6/22/07	Fillet	90	19	5/F	< 5.03	< 2.51	< 4.18	< 2.51	< 2.51	< 2.51	< 2.51
Northern Pike												
NP-1	6/15/07	Fillet	2987	71	5/F	10.3	< 2.48	< 2.48	< 2.48	< 2.48	< 2.48	< 2.48
NP-2	6/15/07	Fillet	3700	80	6/M	7.83	< 2.50	< 2.50	< 2.50	< 2.50	< 2.50	< 2.50
NP-3	6/15/07	Fillet	1830	62	4/F	7.61	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49	< 2.49

Nokomis Fish PFC analysis												
Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-1	7/17/07	Fillet	25	11	2/M	10.8	<2.44	<2.44	<2.44	<2.44	<2.44	<2.44
BGS-2	7/17/07	Fillet	73	16	5/M	9.21	<2.38	<2.38	<2.38	<2.38	<2.38	<2.38
BGS-3	7/17/07	Fillet	58	15	4/M	13.4	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50
BGS-4	7/17/07	Fillet	31	11	2/M	7.71	<2.49	<3.00	<2.49	<2.49	<2.49	<2.49
BGS-5	7/17/07	Fillet	55	14	4/F	6.45	<2.45	<2.45	<2.45	<2.45	<2.45	<2.45
BGS-6	7/17/07	Fillet	49	14.5	4/F	7.23	<2.43	<2.43	<2.43	<2.43	<2.43	<2.43
BGS-7	7/17/07	Fillet	69	15	4/M	11.4	<2.45	<2.45	<2.45	<2.45	<2.45	<2.45
Black Crappie												
BKS-1	7/17/07	Fillet	84	18.5	5/M	11.7	<2.49	<2.49	<2.49*	<2.49	<2.49	<2.49
BKS-2	7/17/07	Fillet	74	17.8	4/M	10.1	<2.46	<2.46	<2.46*	<2.46	<2.46	<2.46
BKS-3	7/17/07	Fillet	72	17.5	4/F	12.3	<2.45	<2.45	<2.45*	<2.45	<2.45	<2.45
BKS-4	7/17/07	Fillet	67	16.2	4/M	7.66	<2.45	<4.34	<2.45*	<2.45	<2.45	<2.45
BKS-5	7/17/07	Fillet	91	19	5/M	8.18	<2.79	<2.44	<2.44*	<2.44	<2.44	<2.44

Olson Lake Fish PFC analysis												
Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-1	4/30/07	Fillet	19	10	2/F	7.8#	<2.34	<2.34*	<2.34	<2.34	<2.34	<2.34
BGS-2	4/30/07	Fillet	21	10	2/J	21.1#	<2.50	<2.50*	<2.50	<2.50	<2.50	<2.50
BGS-5	4/30/07	Fillet	33	13	3/J	24.7	<3.97	<3.97	<3.97	<3.97	<3.97	<3.97
BGS-8	4/30/07	Fillet	51	15	4/J	9.28	<2.44	<2.44	<2.44	<2.44	<2.44	<2.44
BGS-9	4/30/07	Fillet	85	15	4/F	<4.85	<2.43	<2.43	<2.43	<2.43	<2.43	<2.43
BGS-comp	4/30/07	Fillet	40a	13a		14.5	<2.46	<2.46	<2.46	<2.46	<2.46	<2.46
Largemouth Bass												
LMB-1	4/30/07	Fillet	1148	41	9/M	45.7	<2.40	<2.40*	<2.40	2.84	2.87	<2.40
LMB-2	4/30/07	Fillet	1170	39	7/M	43.6	<2.44	<2.44*	<2.44	2.51	2.85	<2.44
LMB-3	4/30/07	Fillet	1159	39	7/M	19.7	<2.45	<2.45*	<2.45*	<2.45	3.04	<2.45
LMB-4	4/30/07	Fillet	1379	42	9/M	77.5	<2.40	<2.40*	<2.40*	2.87	<2.40	<2.40
LMB-5	4/30/07	Fillet	1024	37	7/F	24.9	<2.40	<2.40*	<2.40	<2.40	<2.40	<2.40
LMB-5(dup)	4/30/07	Fillet				24.5	<2.49	<2.49*	<2.49	<2.49	<2.49	<2.49

Peltier Lake Fish PFC analysis												
Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-1	2007	Fillet	58	15	4/M	17.6	<2.44	<2.44	<2.44*	<2.44	<2.44	<2.44
BGS-2	2007	Fillet	87	15.8	5/F	9.52	<2.48	<2.48	<2.48*	<2.48	<2.48	<2.48
BGS-3	2007	Fillet	50	13	3/F	15.1	<4.27	<2.45	<2.45*	<2.45	<2.45	<2.45
BGS-4	2007	Fillet	34	12.3	3/J	10.9	<2.50	<2.50	<2.50*	<2.50	<2.50	<2.50
BGS-5	2007	Fillet	30	11.5	2/F	7.53	<3.43	<2.50	<2.50*	<2.50	<2.50	<2.50
Northern Pike												
NP-1	2007	Fillet	607	45	4/J	20.7	<2.78	<2.65	<2.49	<2.49	<2.49	<2.49
NP-2	2007	Fillet	658	43	4/J	14.5	<2.43	<2.43	<2.43	<2.43	<2.43	<2.43
NP-3	2007	Fillet	764	51	4/J	8.2	<2.40	<2.40	<2.40	<2.40	<2.40	<2.40
NP-4	2007	Fillet	883	50	4/F	13.6	<2.49	<2.49	<2.49	<2.49	<2.49	<2.49
NP-5	2007	Fillet	1161	54	4/J	13.1	<2.48	<2.48	<2.48	<2.48	<2.48	<2.48

Lake Phalen Fish PFC analysis												
Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-2	5/1/07	Fillet	19	10	2/J	156#	<2.49	<2.49*	<2.49	5.23	2.99	<2.49
BGS-4	5/1/07	Fillet	25	11.5	2/J	82.7#	<2.50	<2.50*	<2.50	3.14	<2.50	<2.50
BGS-6	5/1/07	Fillet	55	11.5	2/F	60.6	<2.36	<2.36	<2.36	<2.36	<2.36	<2.36
BGS-9	5/1/07	Fillet	101	16	5/M	93.4	<2.48	<2.48	<2.48	2.48#	<2.48	<2.48
BGS-10	5/1/07	Fillet	73	15	4/F	53.8	<2.38	<2.38	<2.38	2.61#	<2.38	<2.38
BGS-comp	5/1/07	Fillet	53a	12a		45.3	<2.42	<2.42	<2.42	<2.42	<2.42	<2.42
BGS-comp(dup)	5/1/07	Fillet				55	<2.24	<2.24	<2.24	<2.24	<2.24	<2.24
Black Crappie												
BKS-1	5/1/07	Fillet	26	12	2/J	42.1#	<2.39	<2.39*	<2.39	<2.39	<2.39	<2.39
BKS-2	5/1/07	Fillet	58	14	3/M	104	<2.42	<2.42*	<2.42	5.29	<2.42	<2.42
BKS-3	5/1/07	Fillet	67	17	4/M	67.7#	<2.36	<2.36*	<2.36	3.05	<2.36	<2.36
Largemouth Bass												
LMB-1	5/1/07	Fillet	1212	41	9/F	183	<2.49	<2.49*	<2.49	9.46	3.99	2.66
LMB-2	5/1/07	Fillet	596	33.5	5/M	136	<2.45	<2.45	<2.45	7.64	4.67	<2.45
LMB-2(dup)	5/1/07	Fillet				129	<2.48	<2.48	<2.48	6.14	3.88	<2.48
LMB-3	5/1/07	Fillet	1279	43	10/F	128	<2.34	<2.34*	<2.34	5.38	3.08	<2.34
LMB-4	5/1/07	Fillet	1415	42	9/F	147#	<2.35	<2.35*	<2.35	4.96	<2.35	<2.35
LMB-4(dup)	5/1/07	Fillet				147#	<2.44	<2.44*	<2.44	5.28	3.61	<2.44
LMB-5	5/1/07	Fillet	1872	43	10/F	120	<2.34	<2.34*	<2.34	3.63	<2.34	<2.34

Powers Lake Fish PFC analysis

Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-1	7/07	Fillet	31	13	3/F	48.5	<2.48	<2.48	<2.48	<2.48	<2.48	<2.48
BGS-2	7/07	Fillet	66	15	4/M	45	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50
BGS-6	7/07	Fillet	59	16.5	6/M	44.8	<2.48	<2.48	<2.48	<2.48	<2.48	<2.48
BGS-9	7/07	Fillet	58	17	6/M	26.6	<2.40	<2.40	<2.40	<2.40	<2.40	<2.40
BGS-10	7/07	Fillet	40	NA	5/F	32.7	<2.45	<2.45	<2.45	<2.45	<2.45	<2.45
BGS-comp	7/07	Fillet	43a	13a		65.3	<2.48	<2.48	<2.48	<2.48	<2.48	<2.48
Black Crappie												
BKS-1	7/07	Fillet	99	20	5/M	63.9	<2.39	<2.39	<2.39*	<2.39	<2.39	<2.39
BKS-2	7/07	Fillet	100	20	5/F	59.9	<2.35	<2.35	<2.35*	2.49	<2.35	<2.35
BKS-3	7/07	Fillet	109	19	5/F	53.3	<4.84	<2.45	<2.45*	2.47	<2.45	<2.45
BKS-4	7/07	Fillet	108	20	5/F	33.6	<2.49	<4.64	<2.49	<2.49	<2.49	<2.49
BKS-5	7/07	Fillet	105	19	5/F	42.9	<2.34	<2.34	<2.34	<2.34	<2.34	<2.34
Northern Pike												
NP-1	7/07	Fillet	2233	70	6/M	71.1	<2.49	<2.49	<2.49	3.08	2.64	<2.49
NP-2	7/07	Fillet	1680	64	5/M	71.9	<2.50	<2.50	<2.50	3.04	<2.50	<2.50
NP-3	7/07	Fillet	NA	70	6/J	62.8	<2.48	<2.48	<2.48	2.73	2.56	<2.48
Yellow Perch												
YP-comp	7/07	Fillet	34a	15a		41.6	<2.36	<2.36	<2.36	<2.36	<2.36	<2.36

Prior (Upper) Lake Fish PFC analysis

Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-2	8/23/07	Fillet	29	12	3/M	5.25	<2.46	<2.46	<2.46	<2.46	<2.46	<2.46
BGS-4	8/23/07	Fillet	27	11	2/F	<4.95	<2.48	<2.48	<2.48	<2.48	<2.48	<2.48
BGS-6	8/23/07	Fillet	41	13	3/F	<4.81	<2.40	<2.40	<2.40	<2.40	<2.40	<2.40
BGS-8	8/23/07	Fillet	48	13	3/F	<5.00	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50
BGS-10	8/23/07	Fillet	85	16	5/M	<4.98	<2.49	<2.49	<2.49	<2.49	<2.49	<2.49
BGS-comp	8/23/07	Fillet	38a	12a		<4.98	<2.49	<2.49	<2.49	<2.49	<2.49	<2.49
Largemouth Bass												
LMB-1	8/23/07	Fillet	576	33	5/M	<4.90	2.8	<2.45	<2.45*	<2.45	<2.45	<2.45
LMB-2	8/23/07	Fillet	653	35	6/F	6.14	<2.49	<19.6	<2.49*	2.62	<2.49	<2.49
LMB-3	8/23/07	Fillet	503	32	5/M	<4.93	<2.46	<2.46	<2.46*	<2.46	<2.46	<2.46
LMB-4	8/23/07	Fillet	370	31	5/F	<4.76	<2.38	<2.38	<2.38*	<2.38	<2.38	<2.38
LMB-5	8/23/07	Fillet	744	37	7/F	<4.95	<2.48	<2.48	<2.48*	<2.48	<2.48	<2.48

Ravine Lake Fish PFC analysis												
Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-1	4/30/07	Fillet	30	10	2/M	10.3	<2.46	<2.46	<2.46	<2.46	<2.46	<2.46
BGS-4	4/30/07	Fillet	35	12	3/J	10.8	<4.67	<4.67	<4.67	<4.67	<4.67	<4.67
BGS-5	4/30/07	Fillet	23	10	2/M	45.1	<2.49	<2.49	<2.49	<2.49	<2.49	<2.49
BGS-9	4/30/07	Fillet	206	19.5	7/M	29.3	<2.29	<2.29	<2.29	<2.29	<2.29	<2.29
BGS-9(dup)	4/30/07	Fillet				30.3	<2.45	<2.45	<2.45	<2.45	<2.45	<2.45
BGS-10	4/30/07	Fillet	97	16	5/M	19.3	<2.48	<2.48	<2.48	<2.48	<2.48	<2.48
BGS-comp	4/30/07	Fillet	60a	13a		19.4	<2.43	<2.43	<2.43	<2.43	<2.43	<2.43
Black Crappie												
BKS-1	4/30/07	Fillet	52	15	3/F	55.9	<2.48	<2.48*	<2.48*	<2.48	<2.48	<2.48
BKS-2	4/30/07	Fillet	43	15	3/J	64.5	<2.42	<2.42*	<2.42*	<2.42	<2.42	<2.42
BKS-3	4/30/07	Fillet	42	14	3/J	77.8	2.69	<2.56*	<2.56	<2.56	<2.56	<2.56
BKS-4	4/30/07	Fillet	50	15	3/J	60.4	<2.31	<2.31*	<2.31	<2.31	<2.31	<2.31
BKS-5	4/30/07	Fillet	45	14	3/F	41.3	<2.35	<2.35*	<2.35*	<2.35	<2.35	<2.35
Largemouth Bass												
LMB-1	4/30/07	Fillet	725	32.5	5/M	50.6	<2.40	<2.40*	<2.40*	<2.40	<2.40	<2.40
LMB-2	4/30/07	Fillet	890	35	6/M	36	<2.13	<2.13*	<2.13*	<2.13	<2.13	<2.13
LMB-3	4/30/07	Fillet	911	34.5	6/F	65.2	<2.38	<2.38*	<2.38*	<2.38	<2.38	<2.38
LMB-4	4/30/07	Fillet	1084	36.5	7/M	107	<2.40	<2.40*	<2.40*	<2.40	<2.40	<2.40
LMB-5	4/30/07	Fillet	1011	33	5/M	53.8	<2.31	<2.31*	<2.31*	<2.31	<2.31	<2.31

Red Rock Lake Fish PFC analysis												
Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-6	8/17/07	Fillet	5	10	2/J	42	<2.40	<2.40	<2.40	<2.40	<2.40	<2.40
BGS-7	8/17/07	Fillet	43	13.9	4/J	32.7	<2.48	<2.48	<2.48	<2.48	<2.48	<2.48
BGS-8	8/17/07	Fillet	61	15.2	5/M	42.2	<2.43	<2.43	<2.43	<2.43	<2.43	<2.43
BGS-9	8/17/07	Fillet	130	18.2	7/M	58.3	<2.45	<2.45	<2.45	<2.45	<2.45	<2.45
BGS-10	8/17/07	Fillet	57	14	4/F	29.2	<2.44	<2.44	<2.44	<2.44	<2.44	<2.44
BGS-comp	8/17/07	Fillet	27a	11a		35.2	<2.38	<3.02	<2.38	<2.38	<2.38	<2.38
Black Crappie												
BKS-1	8/17/07	Fillet	81	17	4/F	79.9	<2.48	<2.48	<2.48	2.73	<2.48	<2.48
BKS-2	8/17/07	Fillet	102	20	5/F	97.1	<2.48	<2.48	<2.48	3.07	<2.48	<2.48
BKS-3	8/17/07	Fillet	149	21	6/M	153	<2.49	<2.49	<2.49	3.69	<2.49	<2.49
BKS-4	8/17/07	Fillet	283	27	8/F	115	<2.43	<2.43	<2.43	3.62	<2.43	<2.43
BKS-5	8/17/07	Fillet	122	19	5/F	68.6	<2.49	<2.49	<2.49	2.95	<2.49	<2.49
Largemouth Bass												
LMB-1	8/17/07	Fillet	666	38	7/M	85.7	<2.76	<2.42	<2.42*	2.67	<2.42	<2.42
LMB-2	8/17/07	Fillet	527	33	5/F	60.6	<2.60	<2.44	<2.44*	2.69	<2.44	<2.44
LMB-3	8/17/07	Fillet	566	33	5/J	64.5	<2.46	<2.46	<2.46*	3.22	<2.46	<2.46
LMB-4	8/17/07	Fillet	591	33	5/F	57.4	<2.48	<2.48	<2.48*	<2.48	<2.48	<2.48
LMB-5	8/17/07	Fillet	716	36	7/M	74.4	<3.99	<2.33	<2.33*	3.07	<2.33	<2.33

Sarah Lake Fish PFC analysis

Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-3	7/16/07	Fillet	70	17	6/F	6.12	<2.48	<2.48	<2.48	<2.48	<2.48	<2.48
BGS-4	7/16/07	Fillet	86	18	7/M	6.21#	<2.49	<2.49	<2.49	<2.49	<2.49	<2.49
BGS-6	7/16/07	Fillet	74	17	6/F	7.97	<2.49	<2.49	<2.49	<2.49	<2.49	<2.49
BGS-7	7/16/07	Fillet	10	7	1/J	8.51	<2.43	<2.43	<2.43	<2.43	<2.43	<2.43
BGS-9	7/16/07	Fillet	15	9.2	1/J	<5.00	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50
BGS-comp	7/16/07	Fillet	52a	13a		<4.90	<2.45	<2.45	<2.45	<2.45	<2.45	<2.45
Black Crappie												
BKS-1	7/16/07	Fillet	NA	21	6/F	<4.95	<2.48	<2.48	<2.48	<2.48	<2.48	<2.48
BKS-2	7/16/07	Fillet	NA	20	5/M	<5.00	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50
BKS-3	7/16/07	Fillet	NA	24	7/F	<4.83	<2.42	<2.42	<2.42	<2.42	<2.42	<2.42
BKS-4	7/16/07	Fillet	NA	20	5/M	<4.76	<2.38	<9.45	<2.38	<2.38	<2.38	<2.38
BKS-5	7/16/07	Fillet	NA	21	6/M	<4.93	<2.46	<2.46	<2.46	<2.46	<2.46	<2.46
Northern Pike												
NP-1	7/16/07	Fillet	3440	70.7	6/F	7.88	<2.64	<2.45	<2.45	<2.45	<2.45	<2.45
NP -2	7/16/07	Fillet	4052	85	7/F	10.8	<2.49	<2.49	<2.49	<2.49	<2.49	<2.49
NP -2(dup)		Fillet				14.4	<2.43	<2.43	<2.43	<2.43	<2.43	<2.43
NP -3	7/16/07	Fillet	3821	85	8/F	13.6	<2.45	<2.45	<2.45	<2.45	<2.45	<2.45
NP -4	7/16/07	Fillet	3229	81.5	7/F	7.45	<2.42	<2.42	<2.42	<2.42	<2.42	<2.42
NP -5	7/16/07	Fillet	1757	66	5/M	9.6	<2.39	<2.39	<2.39	<2.39	<2.39	<2.39

Silver Lake Fish PFC analysis

Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-3	5/4/07	Fillet	64	16	5/M	24	<2.40	<2.40	<2.40	<2.40	3.38	<2.40
BGS-4	5/4/07	Fillet	38	13	3/F	19.6	<2.43	<2.43	<2.43	<2.43	2.53	<2.43
BGS-5	5/4/07	Fillet	36	13	3/F	24.4#	<2.42	<2.42	<2.42	<2.42	<2.42	<2.42
BGS-7	5/4/07	Fillet	43	14	4/F	31.3	<2.48	<2.48	<2.48	<2.48	<2.48	<2.48
BGS-9	5/4/07	Fillet	32	13	3/F	21.4	<2.42	<2.42	<2.42	<2.42	<2.42	<2.42
BGS-comp	5/4/07	Fillet	59a	14a		33.7	<2.44	<2.44	<2.44	<2.44	<2.44	2.89
Black Crappie												
BKS-1	5/4/07	Fillet	69	16	5/F	26.6#	<2.46	<2.46	<2.46	2.92	<2.46	<2.46
BKS-4	5/4/07	Fillet	63	17	4/M	36.6	<2.48	<2.48	<2.48	3.39	<2.48	3.38
BKS-6	5/4/07	Fillet	67	18	5/M	45	<2.49	<2.49	<2.49	4.52	<2.49	2.89
BKS-7	5/4/07	Fillet	67	18	5/M	28.6	<2.50	<2.50	<2.50	3.88	3.11	3.05
BKS-10	5/4/07	Fillet	296	27	8/F	29.3#	<2.43	<2.43	<2.43	3.77	3.08	<2.43
BKS-10(dup)						26.2	<2.44	<2.44	2.65	<2.44	<2.44	<2.44
BKS-comp	5/4/07	Fillet	110	19		34.9	<2.45	<2.45	<2.45	<2.45	<2.45	<2.45
BKS-comp(dup)						33.5	<2.48	<2.48	<2.48	<2.48	<2.48	<2.48
Walleye												
WE-1	5/4/07	Fillet	453	50	9/M	10.2	<2.40	<4.84	2.71	<2.40	<2.40	<2.40
WE-1(dup)						10.8	<2.42	<2.42	4.2	<2.42	<2.42	<2.42
WE-2	5/4/07	Fillet	486	52	10/M	18.8	<2.44	<2.44	4.65	2.8	2.85	<2.44
WE-3	5/4/07	Fillet	371	27	4/M	10.5	<2.49	<2.49	5.31	<2.49	<2.49	<2.49
WE-4	5/4/07	Fillet	1200	46	8/M	26.6	<2.33	<2.33	4.82	2.99	2.49	2.96

Square Lake Fish PFC analysis

Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-2	5/2/07	Fillet	15	18.5	7/F	<4.57	<2.28	<2.28*	<2.28	<2.28	<2.28	<2.28
BGS-4	5/2/07	Fillet	21	10	2/F	<4.69	<2.35	<2.35*	<2.35	<2.35	<2.35	<2.35
BGS-8	5/2/07	Fillet	44	12.5	3/F	<4.72	<2.36	<2.36*	<2.36	<2.36	<2.36	<2.36
BGS-9	5/2/07	Fillet	84	16	5/M	<4.88	<2.44	<2.44*	<2.44	<2.44	<2.44	<2.44
BGS-10	5/2/07	Fillet	111	17.5	6/M	<4.95	<2.48	<2.48*	<2.48	<2.48	<2.48	<2.48
BGS-comp	5/2/07	Fillet	53a	13a		<4.72	<2.36	<2.36	<2.36	<2.36	<2.36	<2.36
Black Crappie												
BKS-1	5/2/07	Fillet	74	16.5	4/M	<4.93	<2.46	<2.46*	<2.46	<2.46	<2.46	<2.46
BKS-2	5/2/07	Fillet	125	18.5	5/M	5.2	<2.44	<2.44*	<2.44	<2.44	<2.44	<2.44
BKS-3	5/2/07	Fillet	94	18	5/M	<4.76	<2.38	<2.38*	<2.38	<2.38	<2.38	<2.38
BKS-4	5/2/07	Fillet	80	17	4/F	<4.90	<2.45	<2.45	<2.45	<2.45	<2.45	<2.45
BKS-5	5/2/07	Fillet	126	20	5/M	<4.98	<2.49	<2.49	<2.49	<2.49	<2.49	<2.49
Largemouth Bass												
LMB-1	5/2/07	Fillet	309	26.5	3/M	<4.67	<2.34	<2.34*	<2.34	<2.34	<2.34	<2.34
LMB-2	5/2/07	Fillet	301	28	3/M	<4.88	<2.44	<2.44*	<2.44	<2.44	<2.44	<2.44
LMB-3	5/2/07	Fillet	284	27.5	3/F	<4.81	<2.40	<2.40*	<2.40	<2.40	2.88	<2.40
LMB-4	5/2/07	Fillet	383	29.5	4/F	<5.00	<2.50	<2.50*	<2.50	<2.50	<2.50	<2.50
LMB-5	5/2/07	Fillet	316	28	3/M	<5.03	<2.51	<2.51*	<2.51	<2.51	<2.51	<2.51

Tanners Lake Fish PFC analysis

Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-1	6/12/07	Fillet	89	17	6/M	61.1#	<2.46	<2.46	<2.46	<2.46	<2.46	<2.46
BGS-2	6/12/07	Fillet	32	12.5	3/F	87#	<2.30	<2.30	<2.30	<2.30	<2.30	<2.30
BGS-5	6/12/07	Fillet	93	18	7/F	56.6	<2.48	<2.48	<2.48	<2.48	<2.48	<2.48
BGS-7	6/12/07	Fillet	89	16.5	6/F	70.4	<2.44	<2.44	<2.44	<2.44	<2.44	<2.44
BGS-10	6/12/07	Fillet	12	10	2/J	105	<2.49	<2.49	<2.49	4.36	<2.49	<2.49
BGS-comp	6/12/07	Fillet	50a	13a		55	<2.44	<2.59	<2.44	<2.44	<2.44	<2.44
Black Crappie												
BKS-1	6/12/07	Fillet	69	18	4/M	265	<2.45	<2.45	<2.45*	6.3	<2.45	<2.45
BKS-2	6/12/07	Fillet	63	15	3/M	75.9	<2.46	<2.46	<2.46	<2.46	<2.46	<2.46
BKS-3	6/12/07	Fillet	56	18	4/F	91.2	<2.38	<3.96	<2.38	2.82	<2.38	<2.38
BKS-4	6/12/07	Fillet	80	18.5	4/M	94.6	<2.39	<2.39	<2.39	<2.39	<2.39	<2.39
BKS-5	6/12/07	Fillet	56	17	4/F	64	<2.81	<2.40	<2.40	<2.40	<2.40	<2.40
Largemouth Bass												
LMB-1	6/12/07	Fillet	378	NA	4/F	96.5	<2.43	<3.18	<2.43	6.05	4.62	4.11
LMB-2	6/12/07	Fillet	619	NA	5/F	75.7	<2.44	<2.44	<2.44	4.86	4.42	8.37
LMB-3	6/12/07	Fillet	576	35	6/F	76.6	<2.39	<2.39	<2.39	3.56	4.73	3.4
LMB-4	6/12/07	Fillet	823	37	7/M	74.9	<2.44	<2.44	<2.44	3.44	<2.44	4.2
LMB-5	6/12/07	Fillet	1570	50	12/F	74.1	<2.56	<2.56	<2.56*	3.33	<2.56	<2.56

White Bear Lake Fish PFC analysis												
Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-2	5/2/07	Fillet	26	10	2/F	<4.88	<2.44	<2.44*	<2.44	<2.44	<2.44	<2.44
BGS-3	5/2/07	Fillet	8	7	1/J	<8.13	<4.07	<4.07*	<4.07	<4.07	<4.07	<4.07
BGS-5	5/2/07	Fillet	32	12	3/J	<4.81	<2.40	<2.40*	<2.40	<2.40	<2.40	<2.40
BGS-7	5/2/07	Fillet	171	19	7/M	4.77	<2.28	<2.28*	<2.28	<2.28	<2.28	<2.28
BGS-8	5/2/07	Fillet	111	25.5	5/F	5.08	<2.34	<2.34*	<2.34	<2.34	<2.34	<2.34
BGS-comp	5/2/07	Fillet	64a	13a		6.06	<2.31	<2.31	<2.31	<2.31	<2.31	<2.31
Black Crappie												
BKS-1	5/2/07	Fillet	172	21	6/F	18.4	<2.44	<2.44*	<2.44	<2.44	<2.44	<2.44
BKS-2	5/2/07	Fillet	525	30	10/F	30.8	<2.54	<2.54*	<2.54	3.51	<2.54	<2.54
Largemouth Bass												
LMB-1	5/2/07	Fillet	811	35	6/M	<4.81	<2.40	<2.40*	<2.40	<2.40	<2.40	<2.40
LMB-2	5/2/07	Fillet	845	36.5	7/F	9.07	<2.49	<2.49*	<2.49	<2.49	<2.49	<2.49
LMB-3	5/2/07	Fillet	638	34	6/M	<4.76	<2.38	<2.38*	<2.38	<2.38	<2.38	<2.38
LMB-4	5/2/07	Fillet	515	31	5/M	<4.85	<2.43	<2.43*	<2.43	<2.43	<2.43	<2.43
LMB-5	5/2/07	Fillet	503	31	5/M	<4.85	<2.43	<2.43*	<2.43	<2.43	<2.43	<2.43

St. Croix River Fish PFC analysis												
Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-3	7/19/07	Fillet	86	15.5	5/F	<4.83	<2.42	<2.42	<2.42	<2.42	<2.42	<2.42
BGS-5	7/19/07	Fillet	83	14.5	4/F	33.1	<2.45	<2.45	<2.45	<2.45	<2.45	<2.45
BGS-7	7/19/07	Fillet	122	18.5	7/M	<4.95	<2.48	<2.48	<2.48	<2.48	<2.48	<2.48
BGS-8	7/19/07	Fillet	76	15	4/M	22.3	<2.40	<2.40	<2.40	<2.40	<2.40	<2.40
BGS-10	7/19/07	Fillet	80	15	4/M	13.1	<2.44	<2.65	<2.44	<2.44	<2.44	<2.44
BGS-comp	7/19/07	Fillet	82a	15a		12	<2.42	<2.42	<2.42	<2.42	<2.42	<2.42
BGS-comp(dup)						16.4	<2.46	<2.46	<2.46	<2.46	<2.46	<2.46
Walleye												
WE-1	7/19/07	Fillet	670	45	8/M	8.34	<2.45	<3.85	<2.45*	<2.45	<2.45	<2.45
WE-2	7/19/07	Fillet	695	44	7/M	13.8	<2.35	<2.35	<2.35*	<2.35	<2.35	<2.35
WE-3	7/19/07	Fillet	641	42	6/M	12	<2.42	<2.42	<2.42*	<2.42	<2.42	<2.42
WE-4	7/19/07	Fillet	919	48	9/M	40.2	<2.42	<2.42	<2.42*	<2.42	<2.42	<2.42
WE-5	7/19/07	Fillet	890	48	9/M	12.7	<2.49	<2.49	<2.49	<2.49	<2.49	<2.49
White Bass												
WHB-1	7/19/07	Fillet	403	34	5/F	81.8	<2.50	<2.50	<2.50	2.63	<2.50	<2.50
Smallmouth Bass												
SMB-1	7/19/07	Fillet	573	35	3/M	12.3	<2.29	<2.29	<2.29	<2.29	<2.29	<2.29
SMB-2	7/19/07	Fillet	730	38	4/M	29.1	<2.45	<2.45	<2.45	<2.45	<2.45	<2.45
SMB-2(dup)						31.4	<2.22	<2.22	<2.22	<2.22	<2.22	<2.22
SMB-3	7/19/07	Fillet	425	30	1/M	<4.90	<2.45	<2.45	<2.45	<2.45	<2.45	<2.45
SMB-4	7/19/07	Fillet	286	29	1/M	5.44	<2.33	<2.33	<2.33	<2.33	<2.33	<2.33
SMB-5	7/19/07	Fillet	252	27	1/M	11.2	<2.48	<2.48	<2.48	<2.48	<2.48	<2.48

Mississippi River Brainerd area Fish PFC analysis												
Species & Sample ID	Sample Date	Tissue	Wt (g)	Ln (cm)	Age/ sex (yrs)	PFOS ng/g (ppb)	PFOA ng/g (ppb)	PFBA ng/g (ppb)	PFOSA ng/g (ppb)	PFDA ng/g (ppb)	PFUnA ng/g (ppb)	PFDoA ng/g (ppb)
Bluegill												
BGS-1	8/13/07	Fillet	50	14	4/J	7.38	<2.44	<2.47	<2.44*	<2.44	<2.44	<2.44
BGS-2	8/13/07	Fillet	59	13.3	3/F	12.3	<2.45	<2.45	<2.45*	<2.45	<2.45	<2.45
Walleye												
WE-1	8/13/07	Fillet	225	31	5/J	9.42	<2.35	<2.35	<2.35*	<2.35	<2.35	<2.35
WE-2	8/13/07	Fillet	625	43	7/F	8	<2.48	<2.48	<2.48*	<2.48	<2.48	<2.48
WE-3	8/13/07	Fillet	325	32	5/F	7.69	<2.46	<2.46	<2.46*	<2.46	<2.46	<2.46
WE-4	8/13/07	Fillet	1425	49	9/M	10.4	<2.42	<2.42	<2.42*	<2.42	<2.42	<2.42
WE-5	8/13/07	Fillet	1850	54	11/ M	8.75	<2.35	<2.35	<2.35*	<2.35	<2.35	<2.35
WE-5(dup)						8.99	<2.43	<8.25	<2.43*	<2.43	<2.43	<2.43
Northern Pike												
NP-1	8/13/07	Fillet	301	33	3/J	7.15	<2.35	<2.35	<2.35*	<2.35	<2.35	<2.35
NP-2	8/13/07	Fillet	1050	51	4/F	6.29	<2.46	<2.46	<2.46*	<2.46	<2.46	<2.46
NP-3	8/13/07	Fillet	1450	54	4/F	7.62	<2.27	<2.27	<2.27*	<2.27	<2.27	<2.27
Smallmouth Bass												
SMB-1	8/13/07	Fillet	1275	44	6/F	12.5	<2.44	<3.29	<2.44*	<2.44	<2.44	<2.44
SMB-2	8/13/07	Fillet	1300	39	4/M	12.1	<2.27	<2.27	<2.27*	<2.27	<2.27	<2.27
SMB-3	8/13/07	Fillet	900	36	3/M	11.3	<2.33	<2.33	<2.33*	<2.33	<2.33	<2.33
SMB-4	8/13/07	Fillet	1850	41	5/M	8.82	<2.43	<2.43	<2.43*	<2.43	<2.43	<2.43
SMB-5	8/13/07	Fillet	225	23	2/J	18	<2.40	<11.8	<2.92*	<2.40	<2.40	<2.40

< = less than the detection limit; number following this symbol represents the detection limit
* estimated values with a negative bias
# estimated values with a positive bias

2008 MPCA Metro Lakes Fish PFC Data

Twin Cities Metro Lakes

	Average PFOS Concentration [ng/g; ppb]							
	Bluegill	**Bluegill (comp)**	**Black Crappie**	**Black Crappie (comp)**	**Largemouth Bass**	**Northern Pike**	**Pumpkinseed**	**Pumpkinseed (comp)**
Alimagnet	24.27 (6)	24.7 (6)	31.38 (6)	31.60 (6)	ns	ns	ns	ns
Bennett	40.12 (6)	36.8 (6)	46.52 (5)	58.50 (4)	ns	51.38 (5)	ns	ns
Calhoun	203.80 (5)	267 (4)	267.17 (6)	ns	425.60 (5)	ns	ns	ns
Casey	ns	ns	12.45 (5)	14.50 (5)	ns	ns	ns	ns
Cedar (Hennepin)	50.09 (8)	ns	68.15 (2)	ns	136.74 (5)	ns	ns	ns
Fish	76.08 (6)	73.70 (6)	101.68 (5)	98.60 (6)	ns	134.60 (5)	17.48 (5)	15.70 (6)
Harriet	137.00 (5)	ns	138.40 (5)	ns	227.40 (5)	ns	ns	ns
Hyland	12.44 (5)	ns	23.92 (5)	ns	43.06 (5)	ns	ns	ns
Isles	68.40 (3)	ns	166.97 (6)	ns	197.00 (5)	ns	ns	ns
Lee	22.47 (6)	20.80 (6)	38.24 (5)	29.30 (4)	ns	ns	ns	ns
Pelican	<dl (5)	ns	<dl (5)	ns	<dl (5)	ns	ns	ns
Starring (5/30/08)	22.27 (3)	ns	ns	ns	26.40 (4)	ns	ns	ns
Starring (6/24/08)	10.07 (2)	ns	15.86 (5)	ns	32.50 (1)	ns	ns	ns
Steiger	5.75 (3)	ns	5.69 (1)	ns	9.55 (5)	ns	ns	ns
Sweeney	26.20 (5)	ns	28.47 (3)	ns	49.52 (5)	ns	ns	ns
Twin	396.80 (6)	ns	419.00 (5)	ns	480.40 (5)	ns	ns	ns

Numbers listed are: average PFOS concentration (# of fish)
<dl – less than detection limit (approx. 2.5 ng/g)
ns – not sampled
comp – composite; tissue from several fish is combined prior to analysis

2008 MPCA Metro Lakes Fish PFC Data

Note: This summary table is only for concentrations of PFDA in fish from lakes listed below.

Twin Cities Metro Lakes

	Average PFDA Concentration [ng/g; ppb]							
	Bluegill	**Bluegill (comp)**	**Black Crappie**	**Black Crappie (comp)**	**Largemouth Bass**	**Northern Pike**	**Pumpkinseed**	**Pumpkinseed (comp)**
Alimagnet	3.69 (1)	<dl (5)	3.93 (5)	5.57 (6)	ns	ns	ns	ns
Bennett	4.74 (4)	3.38 (6)	6.67 (5)	6.66 (4)	ns	5.92 (5)	ns	ns
Calhoun	4.60 (5)	5.12 (4)	7.28 (6)	ns	11.00 (5)	ns	ns	ns
Casey	ns	ns	<dl (5)	<dl (5)	ns	ns	ns	ns
Cedar (Hennepin)	4.15 (6)	ns	5.23 (2)	ns	9.03 (5)	ns	ns	ns
Fish	2.91 (4)	4.16 (6)	5.48 (5)	6.17 (6)	ns	7.24 (5)	<dl (5)	<dl (5)
Harriet	4.03 (5)	ns	4.8 (5)	ns	8.03 (5)	ns	ns	ns
Hyland	2.55 (1)	ns	3.96 (4)	ns	4.83 (5)	ns	ns	ns
Isles	4.14 (3)	ns	8.87 (6)	ns	8.85 (5)	ns	ns	ns
Lee	3.03 (3)	<dl (6)	4.70 (5)	3.82 (4)	ns	ns	ns	ns
Pelican	<dl (5)	ns	<dl (5)	ns	<dl (5)	ns	ns	ns
Starring (5/30/08)	<dl (3)	ns	ns	ns	2.59 (1)	ns	ns	ns
Starring (6/24/08)	<dl (2)	ns	<dl (5)	ns	<dl (1)	ns	ns	ns
Steiger	<dl (4)	ns	<dl (2)	ns	<dl (5)	ns	ns	ns
Sweeney	3.17 (4)	ns	5.00 (3)	ns	5.66 (5)	ns	ns	ns
Twin	3.04 (6)	ns	5.04 (5)	ns	5.02 (5)	ns	ns	ns

Numbers listed are: average PFDA concentration (# of fish)
<dl – less than detection limit (approx. 2.5 ng/g)
ns – not sampled
comp – composite; tissue from several fish is combined prior to analysis

2008 MPCA Metro Lakes Fish PFC Data

Note: This summary table is only for concentrations of PFUnA in fish from lakes listed below.

Twin Cities Metro Lakes

	Average PFUnAConcentration [ng/g; ppb]							
	Bluegill	**Bluegill (comp)**	**Black Crappie**	**Black Crappie (comp)**	**Largemouth Bass**	**Northern Pike**	**Pumpkinseed**	**Pumpkinseed (comp)**
Alimagnet	3.65 (2)	<dl (5)	<dl (5)	2.65 (6)	ns	ns	ns	ns
Bennett	3.06 (6)	3.09 (6)	<dl (5)	3.01 (4)	ns	4.51 (3)	ns	ns
Calhoun	2.71 (2)	2.93 (4)	3.28 (3)	ns	6.21 (5)	ns	ns	ns
Casey	ns	ns	<dl (5)	<dl (5)	ns	ns	ns	ns
Cedar (Hennepin)	2.66 (2)	ns	3.05 (1)	ns	5.75 (5)	ns	ns	ns
Fish	2.74 (3)	<dl (6)	<dl (5)	<dl (6)	ns	5.11 (5)	<dl (5)	<dl (5)
Harriet	2.84 (3)	ns	<dl (5)	ns	3.85 (5)	ns	ns	ns
Hyland	<dl (5)	ns	<dl (5)	ns	3.80 (3)	ns	ns	ns
Isles	2.62 (2)	ns	5.49 (4)	ns	6.67 (5)	ns	ns	ns
Lee	<dl (6)	<dl (6)	3.61 (1)	<dl (4)	ns	ns	ns	ns
Pelican	<dl (5)	ns	<dl (5)	ns	<dl (5)	ns	ns	ns
Starring (5/30/08)	<dl (3)	ns	ns	ns	<dl (4)	ns	ns	ns
Starring (6/24/08)	<dl (2)	ns	<dl (5)	ns	<dl (1)	ns	ns	ns
Steiger	<dl (4)	ns	<dl (2)	ns	<dl (5)	ns	ns	ns
Sweeney	4.44 (3)	ns	4.87 (1)	ns	4.73 (5)	ns	ns	ns
Twin	4.58 (6)	ns	4.58 (4)	ns	6.07 (5)	ns	ns	ns

Numbers listed are: average PFUnA concentration (# of fish)
<dl – less than detection limit (approx. 2.5 ng/g)
ns – not sampled
comp – composite; tissue from several fish is combined prior to analysis

2008 MPCA Metro Lakes Fish PFC Data

Note: This summary table is only for concentrations of PFDoA in fish from lakes listed below.

Twin Cities Metro Lakes

	Average PFDoA Concentration [ng/g; ppb]							
	Bluegill	**Bluegill (comp)**	**Black Crappie**	**Black Crappie (comp)**	**Largemouth Bass**	**Northern Pike**	**Pumpkinseed**	**Pumpkinseed (comp)**
Alimagnet	2.57 (1)	<dl (5)	<dl (5)	<dl (6)	ns	ns	ns	ns
Bennett	3.02 (1)	<dl (6)	<dl (5)	<dl (4)	ns	3.26 (4)	ns	ns
Calhoun	3.68 (2)	4.15 (4)	2.90 (2)	ns	6.32 (5)	ns	ns	ns
Casey	ns	ns	<dl (5)	<dl (5)	ns	ns	ns	ns
Cedar (Hennepin)	2.76 (1)	ns	2.68 (1)	ns	5.51 (5)	ns	ns	ns
Fish	3.21 (1)	<dl (6)	<dl (5)	<dl (6)	ns	3.84 (5)	<dl (5)	<dl (5)
Harriet	2.80 (1)	ns	<dl (5)	ns	3.38 (3)	ns	ns	ns
Hyland	<dl (5)	ns	<dl (5)	ns	<dl (5)	ns	ns	ns
Isles	<dl (3)	ns	6.24 (5)	ns	7.27 (5)	ns	ns	ns
Lee	<dl (6)	<dl (6)	<dl (5)	<dl (4)	ns	ns	ns	ns
Pelican	<dl (5)	ns	<dl (5)	ns	<dl (5)	ns	ns	ns
Starring (5/30/08)	<dl (3)	ns	ns	ns	<dl (4)	ns	ns	ns
Starring (6/24/08)	<dl (2)	ns	<dl (5)	ns	<dl (1)	ns	ns	ns
Steiger	<dl (4)	ns	<dl (2)	ns	<dl (5)	ns	ns	ns
Sweeney	3.66 (5)	ns	4.49 (1)	ns	5.90 (5)	ns	ns	ns
Twin	2.84 (1)	ns	2.88 (3)	ns	3.46 (4)	ns	ns	ns

Numbers listed are: average PFDoA concentration (# of fish)
<dl – less than detection limit (approx. 2.5 ng/g)
ns – not sampled
comp – composite; tissue from several fish is combined prior to analysis

Table A9. 2007 Wastewater Treatment Plant Influent (ng/L)

AREA	PLANT NAME	Sample ID	PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnA	PFDoA	PFBS	PFHxS	PFOS	PFOSA
North	ALSSD	ALS	12	< 4.39	8.98	4.59	30.4	< 4.95	< 4.79	< 5.60	< 4.29	15.6	32.2	21.9	< 3.91
South	Austin	AUS-D	22.1	2.63	3.35	< 2.68	6.46	< 2.92	< 2.83	< 3.31	< 2.53	< 5.66	8.03	6.52	< 2.31
South	Austin	AUS-I	19.6	3.51	2.95	< 2.42	4.39	< 2.52	< 2.44	< 3.62	< 2.19	< 4.89	< 4.94	< 9.39	< 1.99
North	BoiseCascade	BOI	362	< 4.28	< 4.41	< 4.41	< 4.08	< 4.82	< 4.67	< 5.46	< 4.18	< 4.67	< 9.43	< 9.43	< 3.81
North	Brainerd	BRA	< 11.6	< 4.39	8.47	4.88	9.93	< 4.94	< 4.78	< 5.60	< 4.28	109	45.9	811	< 3.90
Central	DodgeCenter	DOD	83.3	< 2.76	< 2.85	< 2.85	6.27	< 3.11	< 3.01	< 3.52	< 2.70	< 6.02	7.14	19	< 2.46
Central	Eagle Point	EAG	656	31.3	22.9	5.59	17.1	< 4.13	< 4.13	< 4.13	< 4.13	67.1	19.9	< 8.28	< 4.13
North	Fergus Falls	FER	33	< 4.19	< 4.32	< 4.32	5.08	< 4.72	< 4.57	< 5.34	< 4.09	< 14.5	< 9.24	14.7	< 3.73
Central	Flint Hills	FLI	40.2	< 17.6	17.2	< 16.7	9.08	< 6.19	< 6.19	< 6.19	< 6.19	31.6	27.5	54.6	< 6.19
North	Hibbing	HIB	20.2	< 4.15	< 4.28	< 4.28	61.1	9.44	< 4.52	< 5.29	< 4.05	< 13.3	16.4	< 17.9	< 3.69
Central	Hutchinson	HUT	37	< 3.90	< 4.02	< 4.02	4.95	< 4.39	< 4.25	< 4.97	< 3.81	75.8	11.5	80.8	< 3.47
Central	Marathon-Ashland	MAR	1020	62.6	44.8	15	20	4.21	< 4.07	< 4.07	< 4.07	180	131	256	< 4.07
Central	Maynard	MAY	26	4.13	4.99	< 2.70	8.51	< 2.95	< 2.86	< 3.34	< 2.56	< 5.72	< 5.78	< 5.78	4.43
Central	Melrose	MEL	< 12.0	< 4.38	< 4.52	< 4.52	5.18	< 4.93	< 4.78	< 5.59	< 4.28	< 9.56	< 9.66	< 9.66	< 3.90
Central	Metro Plant	MET-1	58.1	8.58	12.9	6.52	21	< 4.38	< 4.38	< 4.38	< 4.38	38.8	12.4	35.3	< 4.38
Central	Metro Plant	MET-2	86.8	9.09	14.1	6.64	21.8	< 4.14	< 4.14	< 4.14	< 4.14	32.7	14.1	34.9	< 4.14
Central	Montivedeo	MON	32.9	< 3.17	< 3.27	< 3.27	9.47	6.82	7.74	< 4.04	< 3.10	< 6.91	< 8.28	< 6.99	< 2.82
South	Morton	MOR-1	< 4.03	< 4.03	< 4.03	< 4.03	< 4.03	< 4.03	< 4.03	< 4.03	< 4.03	21.2	< 8.06	< 8.06	< 4.03
South	Morton	MOR-2	< 4.05	< 4.05	< 4.05	< 4.05	< 4.05	< 4.05	< 4.05	< 4.05	< 4.05	9.38	< 8.11	< 8.11	< 4.05
South	Owatonna	OWA	35.2	9.29	15.4	< 3.85	19.5	< 4.20	< 4.07	< 4.76	< 3.65	< 8.14	< 8.23	< 8.23	< 3.32
North	Paynesville	PAY	38	< 4.39	< 4.53	< 4.53	< 4.18	< 4.95	< 4.79	< 5.60	< 4.29	< 9.58	< 9.68	< 9.68	< 3.91
South	Pipestone	PIP	18.9	52.4	< 2.57	< 2.57	3.32	3.4	< 2.72	< 3.18	< 2.44	< 5.44	< 5.50	< 5.50	< 2.22
South	Red Wing	RED	97.7	< 3.79	9.59	< 3.91	13.5	6.65	< 4.14	< 4.84	< 3.70	< 13.2	< 8.36	< 8.36	< 3.37
South	Rochester	ROC	36.8	< 4.04	5.06	< 4.17	17.7	< 4.55	< 4.41	< 5.15	< 3.94	< 8.81	10.4	< 10.7	< 3.59
Central	Me.CoSeneca	SEN	110	< 3.38	9.31	< 3.48	28.7	8.53	< 3.68	< 4.31	< 3.30	118	187	171	< 3.01
Central	St. Cloud	STC	< 12.0	< 4.41	6.81	6.81	16.5	< 4.96	< 4.80	< 5.62	< 4.30	< 11.2	21.5	< 9.71	< 3.92
North	Thief River F	THI	< 13.8	< 4.23	< 4.37	< 5.57	43.6	5.36	< 4.62	< 5.40	< 4.13	< 12.9	< 9.33	< 9.33	< 3.77
Central	Willmar	WIL	45.7	< 3.70	< 3.81	< 3.81	7.25	4.87	< 4.03	< 4.72	< 3.61	< 8.07	< 8.15	< 8.15	< 3.29
North	WLSSD	WLS	71.8	< 9.21	5.84	7.3	14	< 4.80	< 4.65	< 5.44	< 4.16	< 14.8	< 9.39	< 9.39	< 3.79
South	Worthington	WOR	61.9	< 3.90	< 4.02	< 4.02	4.28	< 4.39	< 4.25	< 4.97	< 3.80	< 8.50	< 8.59	< 8.59	< 3.47

Estimated values based on QA review

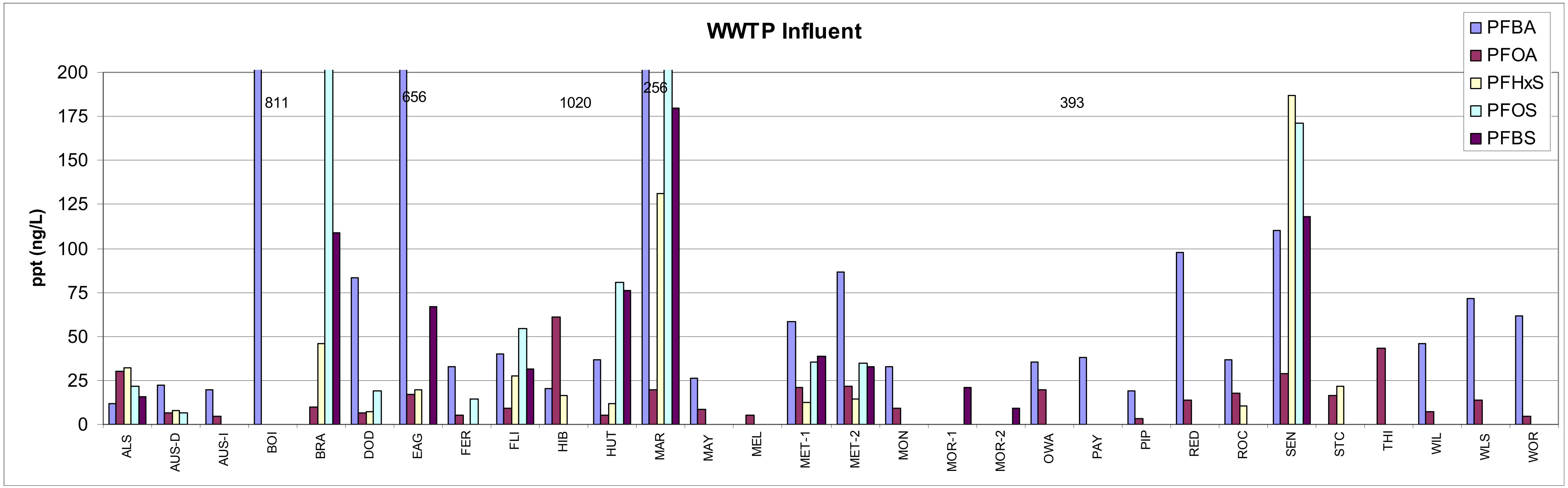


Figure A1. PFCs in WWTP Influent, 2007.

Table A10. 2007 Wastewater Treatment Plant Effluent in (ng/L)

AREA	PLANT NAME	Sample ID	PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnA	PFDoA	PFBS	PFHxS	PFOS	PFOSA
North	ALSSD	ALS	32.4	4.9	11.5	2.78	13.2	5.31	< 2.87	< 3.36	< 2.57	17.3	40.8	18.4	< 2.35
South	Austin	AUS	21.5	5.12	5.27	< 2.65	5.99	< 2.90	< 2.81	< 3.28	< 2.51	< 5.61	< 5.67	< 6.54	< 2.29
North	BoiseCascade	BOI	68.3	< 4.26	< 4.39	< 4.39	4.99	< 4.80	< 4.64	< 5.43	< 4.16	< 9.29	< 9.39	< 9.39	< 3.79
North	Brainerd	BRA	50.3	< 2.49	12.3	6.25	19	14.1	< 2.71	< 3.17	< 2.43	107	10.6	1510	< 2.21
Central	DodgeCenter	DOD	23.4	9.88	4.8	< 2.57	7.56	< 2.81	< 2.72	< 3.18	< 2.44	< 5.44	< 5.50	< 5.50	< 2.22
Central	Eagle Point	EAG	565	21.2	27.6	6.57	22.5	4.38	3.53	< 2.57	< 2.57	29.6	21.9	< 5.14	< 2.57
North	Fergus Falls	FER	18.2	2.73	10.5	3.07	9.03	10.3	< 2.81	< 3.29	< 2.52	8.1	< 5.68	< 5.68	< 2.29
Central	Flint Hills	FLI	148	< 9.91	23.6	6.86	10	< 2.59	< 2.59	< 2.59	< 2.59	< 5.17	45	57.5	5.21
North	Hibbing	HIB	22	48.1	30.7	8.24	63.5	31.4	7.33	< 3.29	< 2.52	7.2	8.57	12.8	< 2.29
Central	Hutchinson	HUT	35	40.5	40.2	4.87	31.8	< 2.93	3.7	< 3.32	< 2.54	26.6	12.9	42.6	< 2.32
Central	Marathon-Ashland	MAR	79.3	< 6.26	< 6.26	< 6.26	< 6.26	< 6.26	< 6.26	< 6.26	< 6.26	< 12.5	< 12.5	< 12.5	< 6.26
Central	Maynard	MAY	27	4.55	7.82	3.37	15	< 3.10	< 3.00	< 3.51	< 2.69	< 6.01	< 6.07	< 6.07	2.57
Central	Melrose	MEL	13.6	< 2.60	< 2.68	< 2.68	3.54	4.22	< 2.83	< 3.31	< 2.54	< 5.67	< 5.73	< 5.73	< 2.31
Central	Metro Plant	MET-1	120	16	27.4	15	50.5	15.2	7.56	< 2.64	< 2.64	25.7	26.5	110	< 2.64
Central	Metro Plant	MET-2	75.2	12.5	25.9	15	50.4	12.1	6.68	< 2.56	< 2.56	22	25.7	87.4	< 2.56
Central	MSP Airport	MSP-1	23.5	18.8	53.9	31.3	120	18.1	82.8	6.61	8.02	7.17	28.5	23.8	5.82
Central	MSP Airport	MSP-2	41.1	63.2	108	51.8	148	30.4	115	12.5	13	18	74.9	393	< 2.53
Central	Montivedeo	MON	17.8	36.5	14.7	2.86	26.5	3.78	3.29	< 3.30	< 2.52	< 5.64	9.55	< 5.70	< 2.30
South	Morton	MOR-1	< 2.60	< 2.60	< 2.60	< 2.60	3.38	< 2.60	< 2.60	< 2.60	< 2.60	< 5.20	< 5.20	< 5.20	< 2.60
South	Morton	MOR-2	< 4.45	< 4.45	< 4.45	< 4.45	< 4.45	< 4.45	< 4.45	< 4.45	< 4.45	< 8.91	< 8.91	< 8.91	< 4.45
South	Owatonna	OWA	17.9	39.8	20.9	3.73	32.1	< 2.88	4.33	< 3.27	< 2.50	< 5.58	< 5.64	< 6.79	< 2.28
North	Paynesville	PAY	75.6	14.9	19.6	10.6	33.5	9.3	< 4.53	< 5.30	< 4.06	< 9.06	10.8	< 9.16	< 3.70
South	Pipestone	PIP	50.3	6.05	8.16	4.15	18.7	4.41	< 2.93	< 3.42	< 2.62	< 5.85	< 5.92	10.1	2.95
South	Red Wing	RED	53.6	8.79	30.2	4.97	22.7	< 4.76	< 4.61	< 5.39	< 4.13	13.9	20.2	< 12.1	< 3.76
South	Rochester	ROC	31.3	79.2	28.8	45.6	39.9	8.01	5.44	< 3.30	< 2.52	< 5.64	10.9	15.3	3.03
Central	Me.CoSeneca	SEN	42.4	40.1	39.3	13.3	64.1	7.92	4	< 3.28	< 2.51	39.8	53.1	58.5	< 2.29
Central	St. Cloud	STC	43.7	5.66	23.9	4.32	27.1	10.2	< 2.81	< 3.28	< 2.51	12.4	27.7	6.84	< 2.29
Central	Willmar	WIL	36.8	< 2.57	4.99	2.74	5.86	< 2.90	< 2.81	< 3.28	< 2.51	< 5.61	< 5.67	< 11.4	< 2.29
North	WLSSD	WLS	31.1	3.18	6.53	3.48	14.2	8.48	< 2.76	< 3.23	< 2.47	16.2	< 5.58	16	< 2.25
South	Worthington	WOR	14.9	7.36	3.44	< 2.66	6.04	< 2.90	< 2.81	< 3.29	< 2.52	< 5.63	< 5.69	< 5.69	< 2.30

Estimated values based on QA review

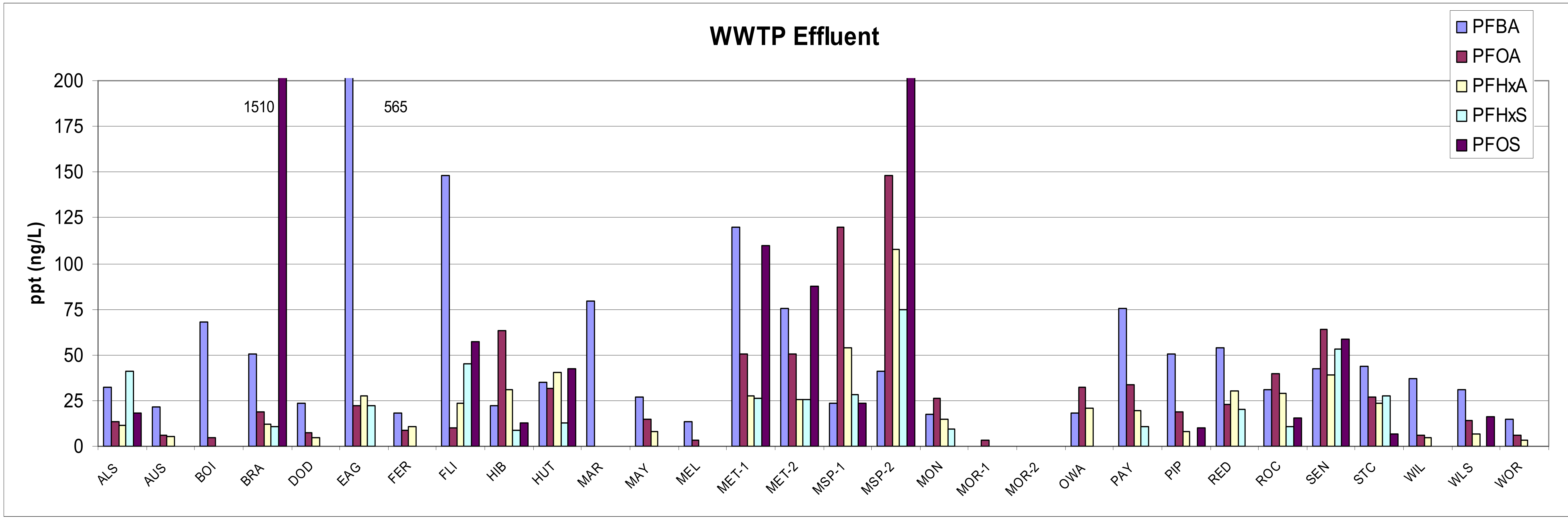


Figure A2. PFCs in WWTP Effluent, 2007.

Table A11. 2007 Wastewater Treatment Plant Sludge (ng/g dry weight)

AREA	PLANT NAME	Sample ID	PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnA	PFDoA	PFBS	PFHxS	PFOS	PFOSA	% Moisture
North	ALSSD	ALS	< 4.59	< 4.59	< 4.59	< 4.59	17.3	18.7	13.8	9.76	< 4.59	< 9.18	< 9.18	99	14.2	90.1
South	Austin	AUS	-	< 0.770	< 0.817	< 0.794	1.06	3.89	1.92	< 0.982	< 0.752	< 5.05	< 5.09	< 5.09	< 2.05	96.8
North	BoiseCascade	BOI-A	< 0.194	< 0.194	< 0.194	< 0.194	< 0.194	< 0.194	< 0.194	< 0.194	< 0.194	< 0.389	< 0.389	< 0.389	< 0.194	17.2
North	BoiseCascade	BOI-P	0.254	< 0.191	< 0.191	< 0.191	< 0.191	< 0.191	< 0.191	< 0.191	< 0.191	< 0.382	< 0.382	< 0.382	< 0.191	50.6
North	BoiseCascade	BOI-S	< 0.401	< 1.15	< 0.849	< 0.299	< 0.266	0.45	< 0.201	< 0.201	< 0.201	< 0.818	< 0.703	< 0.713	< 0.201	0.37
North	Brainerd	BRA	< 0.869	< 0.677	3.47	0.877	3.68	20.1	3.99	5.9	2.22	< 11.3	2.77	861	2.98	95
Central	DodgeCenter	DOD	-	1.33	< 0.624	< 0.624	5.6	7.6	18.8	5.16	3.91	< 1.32	2.46	24.6	6.87	95.8
Central	Eagle Point	EAG	2.47	0.617	2.7	< 0.590	6.02	2.21	20.7	4.65	4.65	< 1.25	< 2.58	22.4	4	95.3
North	Fergus Falls	FER	2.74	< 1.33	3.15	< 0.727	4.04	62.7	6.16	11.8	1.43	< 1.45	< 1.45	21.4	3.52	98.1
North	Hibbing	HIB	< 1.80	< 0.799	< 0.778	< 0.752	2.48	2.67	1.72	2.04	2.17	< 2.04	< 1.50	8.18	< 0.752	93.9
Central	Hutchinson	HUT	-	29.4	13	4.73	54.6	10.1	57.2	6.16	11.6	5.6	3.99	304	10.8	97.9
Central	Melrose	MEL	1.56	< 0.595	< 0.676	< 0.532	2.17	6.69	2.82	3.29	0.976	< 1.09	< 1.38	3.94	3.28	94.4
Central	Metro Plant	MET-1	7.27	4.52	6.58	< 2.73	24.5	23.3	36.9	19.2	19.2	< 5.46	< 8.33	267	16.3	98.7
Central	Metro Plant	MET-2	10.6	3.72	9.8	< 3.31	22.9	14.3	29.7	15.3	13.6	< 6.62	< 15.0	261	12.3	98.7
Central	Montivedeo	MON	-	4.17	2.88	1.03	19	22.4	73.5	15.6	13	< 2.39	3.45	39.7	28	96.7
South	Owatonna	OWA		4.48	17	3.05	32.1	4.13	89.1	3.55	11.7	< 4.23	< 3.95	30.8	17.4	96.1
South	Red Wing	RED	-	< 0.941	2.97	< 0.970	3.14	2.86	2.93	< 1.20	< 0.919	< 6.17	< 6.22	< 6.22	< 2.51	97.4
South	Rochester	ROC	1.65	< 0.633	0.952	< 0.633	3.76	3.31	6.29	2.64	2.06	< 3.21	4.83	21.2	3.88	93
Central	Me.CoSeneca	SEN	-	< 0.493	1.12	0.548	6.8	3.59	10.7	3.81	2.19	< 3.23	< 3.26	141	4.53	94.9
Central	St. Cloud	STC	< 0.792	< 1.03	4.55	< 0.792	7.32	4.89	15.7	3.86	1.39	< 5.32	3.59	20.4	2.4	96.6
Central	Willmar	WIL	-	< 0.958	1.85	1.29	3.1	5.87	2.24	1.93	< 0.936	< 6.28	< 6.34	< 6.34	< 2.56	97.5
North	WLSSD	WLS	6.75	< 1.85	< 1.85	< 1.85	4.43	4.12	4.72	4.24	< 1.85	< 4.14	< 3.69	18.7	11.5	98
South	Worthington	WOR	-	4.46	< 2.38	< 2.38	3.24	< 2.60	3.86	< 2.95	< 2.25	< 5.05	< 5.09	8.88	3.72	98.9

Estimated values based on QA review

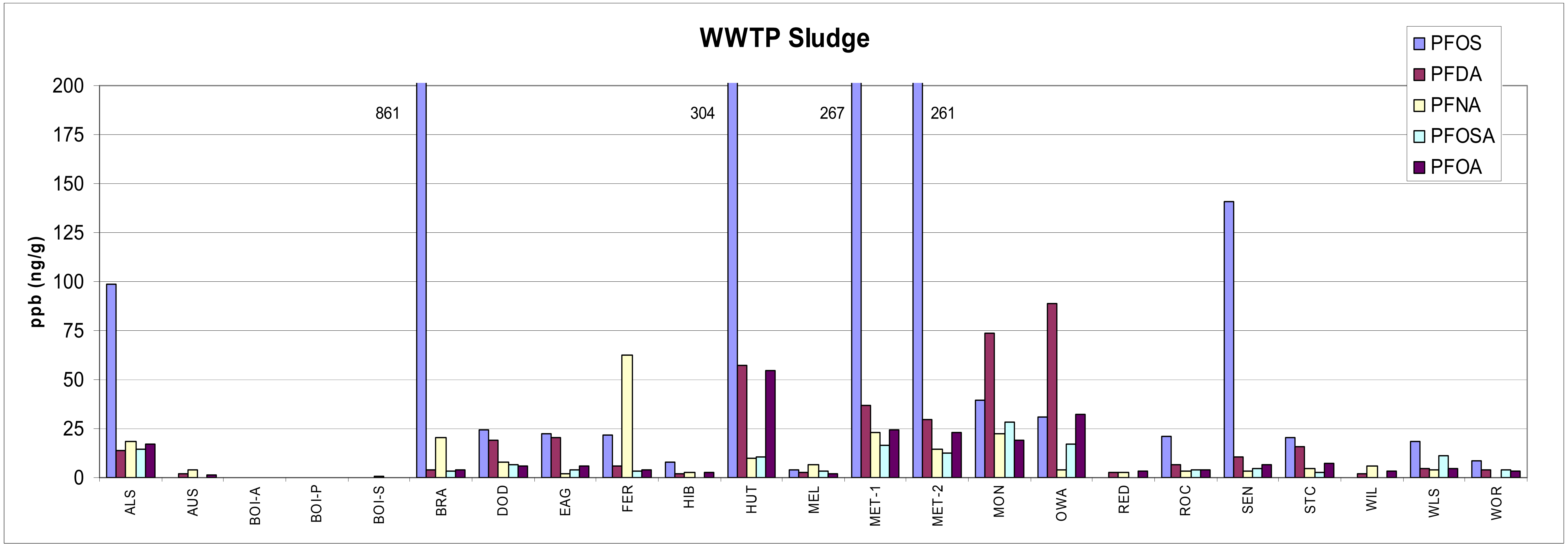


Figure A3. PFCs in WWTP Sludge, 2007.

Table A12. 2008 Wastewater Treatment Plant Influent in (ng/L)

		CLIENT ID	PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnA	PFDoA	PFBS	PFHxS	PFOS	PFOSA
ALL	Albert Lea	PF-ALL-IN	< 6.10	< 3.90	14.7	< 3.90	< 3.90	< 3.90	< 3.90	< 3.90	< 3.90	< 7.80	< 7.80	< 7.80	< 3.90
ALX	Alexandria Lakes Area	PF-ALX-IN	< 4.63	< 6.47	22.5	6.65	10.8	4.09	< 3.33	< 3.33	< 3.33	< 6.66	15.9	< 6.66	< 3.33
AUS	Austin	PF-AUS-IN	< 5.07	< 5.07	< 5.07	< 5.07	< 5.07	< 5.07	< 5.07	< 5.07	< 5.07	< 10.1	< 10.1	33.5	< 5.07
BIG	Big Lake	PF-BIG-IN	14.2	< 3.05	10.6	16	422	< 2.59	< 2.59	< 2.59	< 2.59	< 5.18	< 5.18	< 5.18	< 2.59
BRD	Brainerd	PF-BRD-IN	< 6.62	< 11.8	8.75	< 5.73	6.9	< 7.81	< 5.73	< 5.73	< 5.73	< 11.5	< 11.5	29.5	< 5.73
CNF	Cannon Falls	PF-CNF-IN	7.17	< 6.94	< 3.42	< 3.42	38.4	< 3.42	< 3.42	< 3.42	< 3.42	< 6.84	< 6.84	< 6.84	< 3.42
CRK	Crookston	PF-CRK-IN	< 2.52	< 2.79	34.2	10.4	25	25.4	6.51	< 2.52	< 2.52	< 5.04	< 5.04	11.7	3.03
DDC	Dodge Center	PF-DDC-IN	9.17	< 6.81	8.36	< 2.58	3.23	< 2.58	< 2.58	< 2.58	< 2.58	< 5.16	< 5.16	32.2	< 2.58
EVL	Eveleth	PF-EVL-IN	4.93	< 7.92	< 3.57	< 3.57	6.84	< 3.57	< 3.57	< 3.57	< 3.57	< 7.13	< 7.13	< 7.13	< 3.57
FAR	Faribault	PF-FAR-IN	9.92	< 2.56	< 2.56	< 2.56	7.19	< 2.56	< 2.56	< 2.56	< 2.56	< 5.11	< 5.11	< 5.11	< 2.56
FHR	Flint Hills Resources LP	PF-FHR-IN	NQ	487	< 14.7	< 7.91	< 2.80	< 2.80	< 2.80	< 2.80	< 2.80	130	18.1	43.5	< 2.80
GRR	Grand Rapids	PF-GRR-IN	<3.88	<12.1	<6.19	<19.8	<6.19	<6.19	<6.19	<6.19	<6.19	<12.4	<12.4	<12.4	<6.19
HIB	Hibbing	PF-HIB-IN	3.26	< 4.13	6.99	< 4.18	26.7	< 2.61	< 2.61	< 2.61	< 2.61	< 5.23	< 5.23	< 5.23	< 2.61
HUT	Hutchinson	PF-HUT-IN	24.6	< 8.18	11.5	< 5.48	< 5.48	< 5.48	< 5.48	< 5.48	< 5.48	< 11.0	11.2	19.8	< 5.48
ISL	Isle	PF-ISL-IN	7.86	< 3.30	5.11	< 3.30	3.95	< 3.30	< 3.30	< 3.30	< 3.30	< 6.59	< 6.59	< 6.59	< 3.30
LES	Le Sueur/Henderson	PF-LES-IN	< 6.02	< 6.02	< 6.02	< 6.02	98.9	< 6.02	< 6.02	< 6.02	< 6.02	< 12.0	< 12.0	< 12.0	< 6.02
MSP	MAC – Minneapolis/St. Paul Intl Airport														
MAN	Mankato	PF-MAN-IN	< 5.31	< 5.38	12.1	< 5.31	31.6	7.77	< 5.31	< 5.31	< 5.31	< 10.6	< 10.6	< 10.6	< 5.31
MPL	Maple Lake	PF-MPL-IN	8.03	< 2.54	4.93	< 2.54	< 4.05	< 2.54	< 2.54	< 2.54	< 2.54	< 5.08	< 8.59	< 5.08	< 2.54
EAP	Met Council – Eagles Point	PF-EAP-IN	401	18.8	13.8	< 5.36	14	< 5.36	< 5.36	< 5.36	< 5.36	< 10.7	< 10.7	34	< 5.36
MWP	Met Council – Metropolitan	PF-MWP-IN	58.3	< 8.70	10.8	< 6.05	16.1	< 6.05	< 6.05	< 6.05	< 6.05	< 12.1	< 12.1	16.4	< 6.05
RMT	Met Council – Rosemount	PF-RMT-IN	25.2	6.05	7.37	< 5.78	10.2	< 5.78	< 5.78	< 5.78	< 5.78	< 11.6	< 11.6	< 11.6	< 5.78
SEN	Met Council – Seneca	PF-SEN-IN	10.3	< 7.30	13.4	11.3	40.5	< 7.30	< 7.30	< 7.30	< 7.30	< 14.6	23.7	< 14.6	< 7.30
MON	Montevideo	PF-MON-IN	< 4.73	< 5.08	7.62	< 4.73	12	5.57	< 4.73	< 4.73	< 4.73	19.2	< 9.46	< 9.46	< 4.73
MOR	Moorhead	PF-MOR-IN	< 6.02	< 13.4	< 6.02	< 6.02	6.4	< 6.02	< 6.02	< 6.02	< 6.02	< 12.0	< 12.0	< 12.0	< 6.02
NUM	New Ulm	PF-NUM-IN	< 5.10	< 5.10	6.29	< 5.10	< 5.10	< 5.10	< 5.10	< 5.10	< 5.10	< 10.2	< 10.2	< 10.2	< 5.10
OWA	Owatonna	PF-OWA-IN	4.98	< 3.18	7.6	4.97	9.61	< 3.18	< 3.18	< 3.18	< 3.18	< 6.37	< 6.37	< 6.37	< 3.18
PAY	Paynesville	PF-PAY-IN	9.92	< 5.65	< 5.10	7.82	6.8	5.88	< 5.10	< 5.10	< 5.10	< 10.2	< 10.2	< 10.2	< 5.10
PNI	Pine Island	PF-PNI-IN	7.49	< 5.32	2.93	< 2.56	7.38	< 2.56	< 2.56	< 2.56	< 2.56	< 5.12	< 5.12	176	< 2.56
PRN	Princeton	PF-PRN-IN	21.4	< 6.63	3.67	< 2.79	4.17	< 3.36	< 2.79	< 2.79	< 2.79	< 5.58	< 5.58	< 5.58	< 2.79
ROC	Rochester (dups)	PF-ROC-INA	3.48	< 6.25	6.11	3.44	4.59	< 2.56	< 2.56	< 2.56	< 2.56	< 5.13	< 5.13	< 5.13	< 2.56
ROY	Royalton														
SIL	Silver Lake	PF-SIL-IN	< 4.78	< 6.13	< 4.78	< 4.78	5.18	< 5.64	< 4.78	< 4.78	< 4.78	< 9.57	< 9.57	36.4	< 4.78
STC	St. Cloud	PF-STC-IN	7.38	< 4.27	9.63	6.58	6.98	3.06	< 2.61	< 2.61	< 2.61	< 5.22	< 5.22	12.2	< 2.61
STJ	St. James	PF-STJ-IN	< 4.86	< 5.87	< 6.04	< 4.86	< 4.86	< 4.86	< 4.86	< 4.86	< 4.86	21.8	< 9.73	27.4	< 4.86
WAB	Wabasha	PF-WAB-IN	20.3	< 8.92	6.16	< 2.72	8.85	< 2.72	< 2.72	< 2.72	< 2.72	< 5.44	< 5.44	15.9	< 2.72
WAR	Warroad	PF-WAR-IN	< 3.47	< 2.60	21.7	5.2	16.3	5.51	< 2.60	< 2.60	< 2.60	< 5.21	< 5.21	< 5.21	< 2.60
WIN	Winona	PF-WIN-IN	12.7	4.18	10	5.04	13.5	< 2.72	< 2.72	< 2.72	< 2.72	< 5.43	12.2	8.63	< 2.72
WLS	WLSSD	PF-WLS-IN	< 16.8	< 12.0	< 12.0	< 12.0	< 12.0	< 12.0	< 12.0	< 12.0	< 12.0	< 24.0	< 24.0	< 24.0	< 12.0
XCL	Xcel Energy - Prairie Island Nuclear	PF-XCL-IN	20.3	< 3.38	5.47	< 2.50	5.53	< 2.50	< 2.50	< 2.50	< 2.50	< 4.99	< 4.99	< 4.99	< 2.50

not sampled

*Estimated value

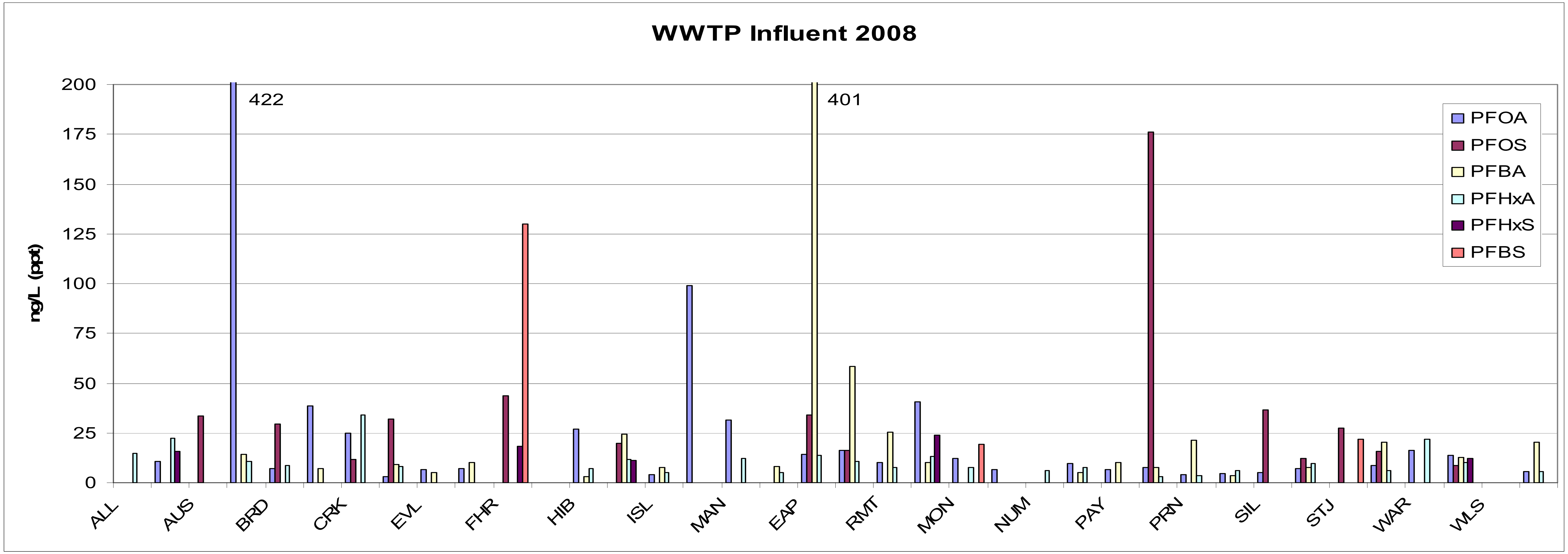


Figure A4. PFCs in WWTP Influent, 2008.

Table A13. 2008 Wastewater Treatment Plant Effluent in (ng/L)

		CLIENT ID	PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnA	PFDoA	PFBS	PFHxS	PFOS	PFOSA
ALL	Albert Lea	PF-ALL-EF	4.06	5.79	10.1	3.96	8.48	2.77	< 2.45	< 2.45	< 2.45	< 4.91	< 4.91	< 4.91	< 2.45
ALX	Alexandria Lakes Area	PF-ALX-EF	5.4	12.6	37.7	7.31	30.5	7.36	< 2.57	< 2.57	< 2.57	< 5.15	23.8	9.46	< 2.57
AUS	Austin	PF-AUS-EF	3.51	7.28	6.04	2.92	5.72	< 2.46	< 2.46	< 2.46	< 2.46	< 4.91	< 4.91	< 4.91	< 2.46
BIG	Big Lake	PF-BIG-EF	18.1	45.4	41.1	6.44	49	< 5.02	< 5.02	< 5.02	< 5.02	17.6	< 10.0	< 10.0	5.98
BRD	Brainerd	PF-BRD-EF	< 7.56	< 4.86	7.41	< 5.72	8.82	6.45	< 4.86	< 4.86	< 4.86	< 9.72	< 9.72	45	< 4.86
CNF	Cannon Falls	PF-CNF-EF	4.11	9.16	24.3	17.5	17.1	7.13	< 2.58	< 2.58	< 2.58	< 5.17	< 5.17	< 5.17	< 2.58
CRK	Crookston	PF-CRK-EF	< 10.5	< 10.3	45.8	10.6	33.3	33.3	5.25	< 2.67	< 2.67	< 5.34	21.1	8.02	2.89
DDC	Dodge Center	PF-DDC-EF	7.79	< 2.62	7.07	4.9	12.2	< 2.62	< 2.62	< 2.62	< 2.62	< 5.25	< 5.25	< 5.25	< 2.62
EVL	Eveleth	PF-EVL-EF	3.94	< 4.25	3.05	2.6	9.48	< 2.48	< 2.48	< 2.48	< 2.48	< 4.95	< 4.95	< 4.95	< 2.48
FAR	Faribault	PF-FAR-EF	< 6.14	2.83	5.02	< 2.61	5.66	< 2.61	< 2.61	< 2.61	< 2.61	< 5.22	< 5.22	< 5.22	< 2.61
FHR	Flint Hills Resources LP	PF-FHR-EF	128	< 5.50	12.2	5.87	5.48	< 2.63	< 2.49	< 2.49	< 2.49	18.5	42.9	32.5	3.06
GRR	Grand Rapids	PF-GRR-EF	7.38	<11	<3.48	<16.7	6.52	<2.58	<2.58	<2.58	<2.58	<5.16	<5.16	<5.16	<2.58
HIB	Hibbing	PF-HIB-EF	4.38	< 2.48	11.4	5.91	18.6	5.66	3.72	< 2.48	< 2.48	10.1	< 4.95	< 4.95	< 2.48
HUT	Hutchinson	PF-HUT-EF	7.19	9.52	22.7	4.5	20.4	< 2.55	< 2.55	< 2.55	< 2.55	5.39	11	52.3	< 2.55
ISL	Isle	PF-ISL-EF	15.7	15.7	69.1	19.2	43.8	20.2	9.51	< 4.95	< 4.95	< 9.91	< 9.91	13.8	< 4.95
LES	Le Sueur/Henderson	PF-LES-EF	31.1	< 4.84	6.34	< 5.53	11.9	4.18	< 2.52	< 2.52	< 2.52	< 5.04	< 5.04	< 5.04	< 2.52
MSP	MAC – Minneapolis/St. Paul Intl Airport	PF-MSP-P1	19.2	38.1	79.2	34.1	91.1	20.1	50.4	5.63	3.01	< 5.03	19.2	40.9	< 2.51
MSP	MAC – Minneapolis/St. Paul Intl Airport	PF-MSP-P2	9.78	11.6	25.9	9.89	33	50.3	12.2	20.4	2.84	5.62	27.2	60.3	2.84
MAN	Mankato	PF-MAN-EF	9.17	34	56	11.2	63.3	4.89	2.63	< 2.54	< 2.54	16.6	< 5.08	< 5.08	< 2.54
MPL	Maple Lake	PF-MPL-EF	7.23	< 2.78	6.72	3.42	3.98	< 2.58	< 2.58	< 2.58	< 2.58	20.4	< 5.15	< 5.15	< 2.58
EAP	Met Council – Eagles Point	PF-EAP-EF	541	18	34	13.1	34.5	3.8	< 2.60	< 2.60	< 2.60	53.2	105	489	< 2.60
MWP	Met Council – Metropolitan	PF-MWP-EF	61.1	11.1	28.7	17.8	43.5	60.6	4.8	9.38	< 2.57	19.8	13	80.2	< 2.57
RMT	Met Council – Rosemount	PF-RMT-EF	130	17.8	36.9	19.3	99.5	8.28	< 5.39	< 5.39	< 5.39	21	15.1	18.3	< 5.39
SEN	Met Council – Seneca	PF-SEN-EF	13.1	10.9	32.3	12.5	28.3	9.42	3.18	< 2.54	< 2.54	21.1	20.5	32.9	< 2.54
MON	Montevideo	PF-MON-EF	5.23	14.5	21.6	3.46	21.1	4.38	< 2.57	< 2.57	< 2.57	26.2	< 5.14	< 5.14	< 2.57
MOR	Moorhead	PF-MOR-EF	< 3.84	8.71	26	6.53	26.4	5.7	< 2.48	< 2.48	< 2.48	< 4.95	11.9	15.8	< 2.48
NUM	New Ulm	PF-NUM-EF	27.7	48.2	71.4	25.7	53	< 2.59	< 2.59	< 2.59	< 2.59	< 5.19	< 5.19	< 5.19	< 2.59
OWA	Owatonna	PF-OWA-EF	10.4	34.7	59.5	9.35	84.5	2.58	7	< 2.51	< 2.51	7.24	< 5.03	< 5.03	< 2.51
PAY	Paynesville	PF-PAY-EF	< 11.8	< 5.82	27.7	8.62	33.9	9.45	4	< 2.52	< 2.52	< 5.03	< 5.03	7.84	< 2.52
PNI	Pine Island	PF-PNI-EF	6	5.21	7.18	< 5.05	11.6	< 5.05	< 5.05	< 5.05	< 5.05	267	< 10.1	545	< 5.05
PRN	Princeton	PF-PRN-EF	9.19	26.5	34	6.02	34.1	< 2.57	3.83	< 2.57	< 2.57	5.44	< 5.15	< 5.15	< 2.57
ROC	Rochester	PF-ROC-EFA	12.8	31.7	40.7	30.2	37	7.9	4.1	< 2.49	< 2.49	13.8	< 4.97	< 4.97	< 2.49
ROY	Royalton	PF-ROY-EF	6.77	<4.94	<4.94	<4.94	<4.94	<4.94	<4.94	<4.94	<4.94	<9.87	<9.87	<9.87	<4.94
SIL	Silver Lake	PF-SIL-EF	< 4.65	< 5.30	10.6	4.84	17.8	4.88	< 3.27	< 3.27	< 3.27	< 6.55	8.83	20.5	< 3.27
STC	St. Cloud	PF-STC-EF	16.5	< 4.73	42.5	< 5.01	26.7	6.14	2.75	< 2.53	< 2.53	< 5.06	11	11	< 2.53
STJ	St. James	PF-STJ-EF	7.33	16.2	11.8	4.63	10.3	< 2.53	< 2.53	< 2.53	< 2.53	47.3	< 5.06	91.5	< 2.53
WAB	Wabasha	PF-WAB-EF	18.4	18.3	18.2	5.15	25.4	< 2.54	< 2.54	< 2.54	< 2.54	5.93	< 5.09	5.24	2.76
WAR	Warroad	PF-WAR-EF	4.41	< 4.42	47.6	13	21	8.13	< 2.48	< 2.48	< 2.48	< 4.96	< 4.96	6	4.32
WIN	Winona	PF-WIN-EF	10.8	5.79	22.1	3.64	20.9	2.98	< 2.64	< 2.64	< 2.64	< 5.28	14.5	16.4	< 2.64
WLS	WLSSD	PF-WLS-EF	29.6	< 5.88	11.5	10.5	21.7	6.1	4.37	< 2.48	< 2.48	39.1	< 4.97	15.2	< 2.48
XCL	Xcel Energy - Prairie Island Nuclear	PF-XCL-OUT	20.1	5.21	3.9	< 2.50	4.95	< 3.02	< 2.50	< 2.50	< 2.50	< 4.99	< 4.99	< 4.99	< 2.50

*Estimated value

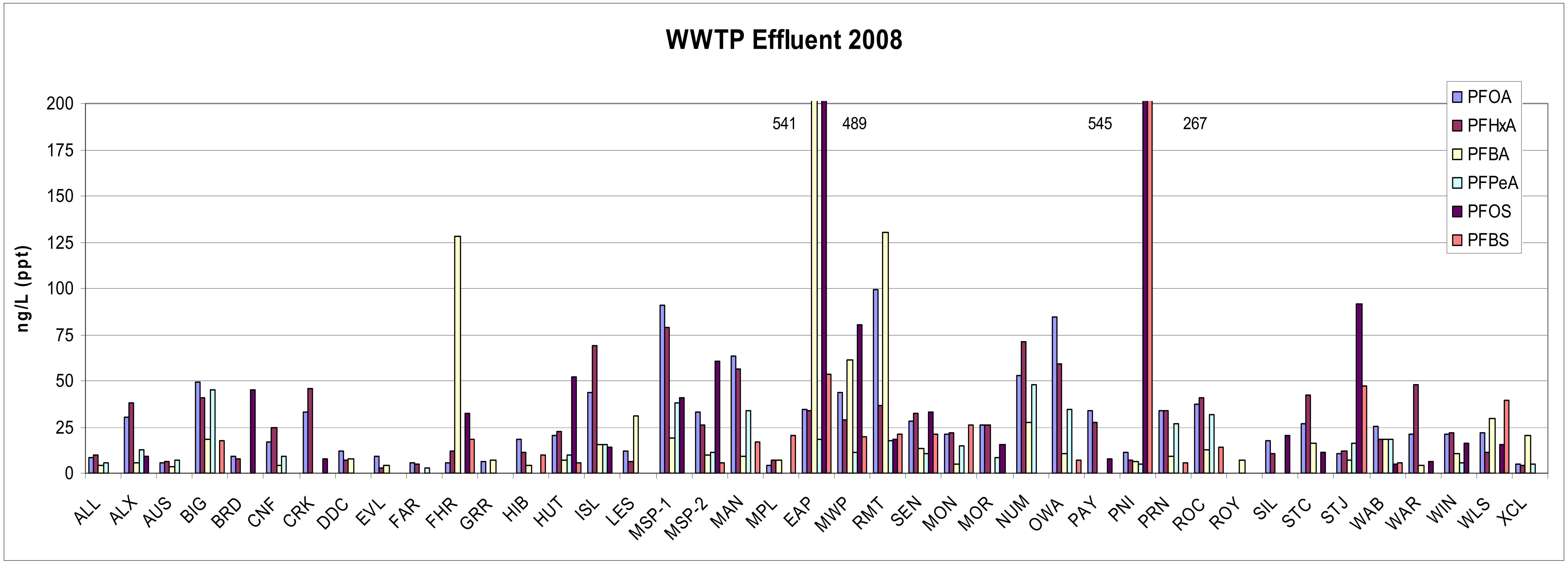


Figure A5. PFCs in WWTP Effluent, 2008.

Table A14. 2008 Wastewater Treatment Plant Sludge in (ng/g)

		CLIENT ID	PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnA	PFDoA	PFBS	PFHxS	PFOS	PFOSA	% Moisture
ALL	Albert Lea	PF-ALL-SL	< 3.36	< 3.36	< 3.36	< 3.36	5.9	6.78	14.7	4.95	3.45	< 6.71	< 6.71	18.5	14	99.3
ALX	Alexandria Lakes Area															
AUS	Austin	PF-AUS-SL	< 0.748	< 0.748	< 0.748	< 0.748	< 0.748	1.45	0.955	< 0.932	< 1.96	< 1.50	< 1.51	4.15	< 0.748	96.7
BIG	Big Lake															
BRD	Brainerd	PF-BRD-SL	<5.17	<5.17	10.6	<5.17	<5.17	11.6	5.89	10	5.19	<10.3	<10.3	442	<5.17	98.1
CNF	Cannon Falls															
CRK	Crookston															
DDC	Dodge Center															
EVL	Eveleth															
FAR	Faribault															
FHR	Flint Hills Resources LP															
GRR	Grand Rapids															
HIB	Hibbing															
HUT	Hutchinson	PF-HUT-SL	< 9.37	15.3	21.1	< 9.37	35.4	< 9.37	< 9.37	< 9.37	< 9.37	< 18.7	< 18.7	< 18.7	< 9.37	analyzed as aqueous sample
ISL	Isle															
LES	Le Sueur/Henderson															
MSP	MAC – Minneapolis/St. Paul Intl Airport															
MAN	Mankato	PF-MAN-SL	3.31	< 1.85	15.9	1.95	17.4	4.38	13.1	3.61	9.95	< 2.24	13.1	88.4	24.8	97.8
MPL	Maple Lake															
EAP	Met Council – Eagles Point															
MWP	Met Council – Metropolitan	PF-MWP-SL	9.2	< 2.31	8.27	3.87	14.2	49.7	17.3	297	11.2	< 4.61	4.98	253	19.4	98.9
RMT	Met Council – Rosemount															
SEN	Met Council – Seneca	PF-SEN-SL	< 0.512	< 0.551	5.5	1.26	9.15	9.86	26.3	13.5	10.2	< 1.02	11.4	350	6.04	95.1
MON	Montevideo	PF-MON-SL	< 1.67	< 1.67	3.18	< 1.67	15.9	31.7	51	41.5	16	< 3.35	< 3.35	36.4	23.4	98.5
MOR	Moorhead															
NUM	New Ulm	PF-NUM-SL	4.42	< 4.46	19.2	6.82	27.7	4.09	24.1	6.42	7.3	< 2.63	3.42	18.5	6.96	98.1
OWA	Owatonna															
PAY	Paynesville															
PNI	Pine Island															
PRN	Princeton															
ROC	Rochester	PF-ROC-SLA	0.43	< 0.321	1.82	< 0.321	3.75	4.92	13.6	4.73	6.16	< 0.641	< 5.23	7.42	2.42	92.2
ROY	Royalton															
SIL	Silver Lake															
STC	St. Cloud	PF-STC-SL	< 0.760	< 0.760	11.3	< 1.25	6.91	6.84	11	4.08	5.1	< 1.52	< 5.08	11.6	1.35	96.8
STJ	St. James	PF-STJ-SL	< 0.674	< 0.674	1.45	< 0.674	1.8	0.814	5.88	3.09	5.85	< 1.35	1.7	252	8.53	96.3
WAB	Wabasha															
WAR	Warroad															
WIN	Winona	PF-WIN-SL	< 4.48	< 3.46	12.3	< 1.79	14	26.3	23.4	12.7	15.4	< 3.58	6.6	91.1	6.94	98.6
WLS	WLSSD	PF-WLS-SL	< 0.848	< 0.848	1.94	< 0.848	3.2	3.3	5.14	4.48	2.14	< 1.70	< 1.70	16	1.31	70.7
XCL	Xcel Energy - Prairie Island Nuclear															

not sampled

*Estimated value

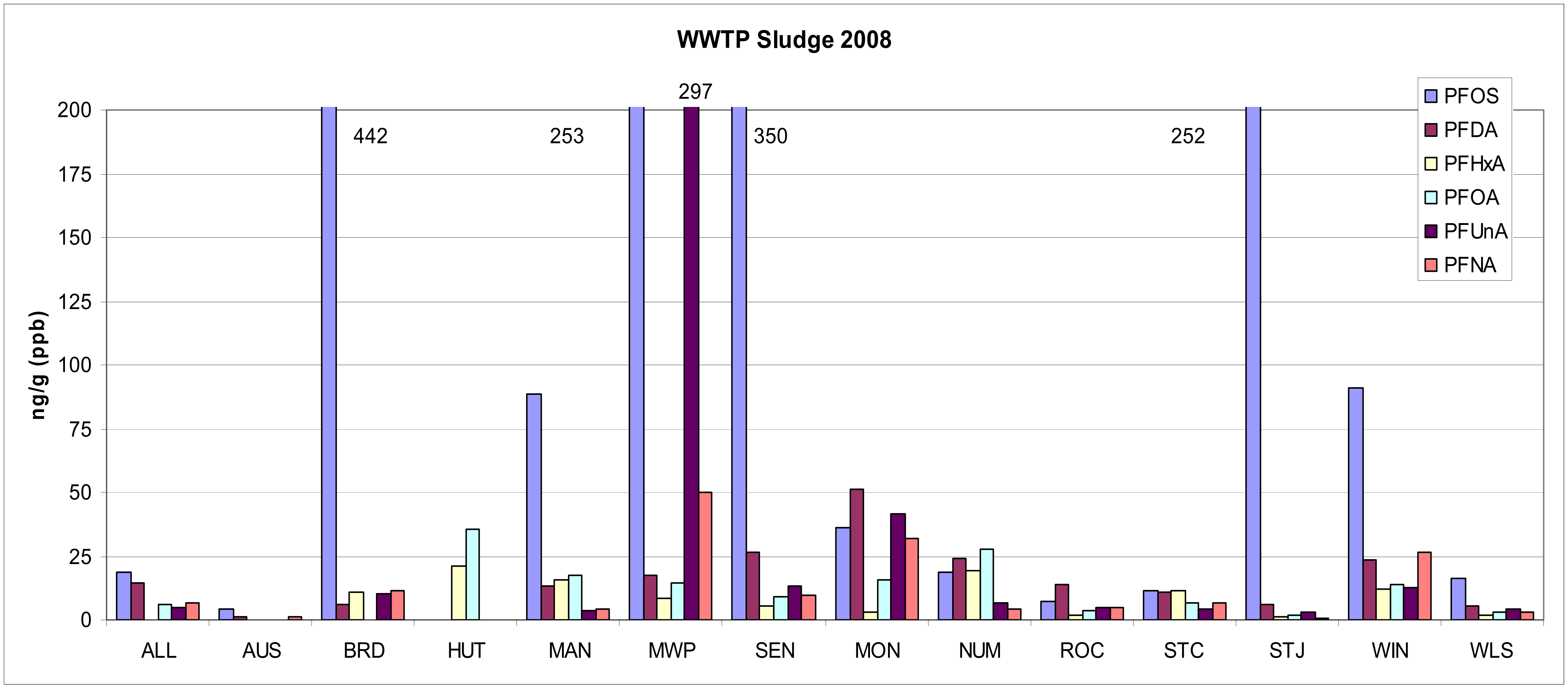


Figure A6. PFCs in WWTP Sludge, 2008.

Table A15. Draft Results from Red Rock Road Air Sampling Site

Sample 4	96hrs Filter *	96hrs Front puf/xad **	96hrs Back puf ***	Particulate	Gaseous	Total Air Concentration
UNITS	ng/sample	ng/sample	ng/sample	pg/m^3	pg/m^3	pg/m^3
PFBA	< 0.500	13.06	1.32	ND	11.4	11.4
PFPeA	< 0.500	0.542	< 0.500	ND	0.4	0.4
PFHxA	< 0.500	1.95	< 0.500	ND	1.6	1.6
PFHpA	< 0.500	0.542	< 0.500	ND	0.4	0.4
PFOA	2.77	20.2	< 0.500	2.2	16.1	18.3
PFNA	< 0.500	0.526	11.4	ND	9.5	9.5
PFDA	< 0.500	< 0.500	< 0.500	ND	ND	ND
PFUnA	< 0.500	< 0.500	< 0.500	ND	ND	ND
PFDoA	< 0.500	< 0.500	< 0.500	ND	ND	ND
PFBS	< 1.00	< 1.00	< 1.00	ND	ND	ND
PFHxS	< 1.00	< 1.00	< 1.00	ND	ND	ND
PFOS	2.63	2.29	< 1.00	2.1	1.8	3.9
PFOSA	< 0.500	1.7	< 0.500	ND	1.4	1.4

Total sample air volume was 1257.9 m^3 air

Sample 5	96hrs Filter *	96hrs Front puf/xad raw	96hrs Front puf/xad **	96hrs Back puf ***	96hrs Total	Total air volume	Particulate	Gaseous	Total Air Concentration
UNITS	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample	m^3 Air	pg/m^3	pg/m^3	pg/m^3
PFBA	< 0.500	19.9	18.56	1.04	19.60	1252.1	ND	15.7	15.7
PFPeA	< 0.500	0.627	0.627	< 0.500	0.63	1252.1	ND	0.5	0.5
PFHxA	< 0.500	1.01	1.01	< 0.500	1.01	1252.1	ND	0.8	0.8
PFHpA	< 0.500	0.554	0.554	< 0.500	0.55	1252.1	ND	0.4	0.4
PFOA	2.84	2.92	2.92	< 0.500	5.76	1252.1	2.3	2.3	4.6
PFNA	< 0.500	5.43	5.43	5.71	11.14	1252.1	ND	8.9	8.9
PFDA	< 0.500	< 0.500	< 0.500	< 0.500	< 0.5	1252.1	ND	ND	ND
PFUnA	< 0.500	< 0.500	< 0.500	< 0.500	< 0.5	1252.1	ND	ND	ND
PFDoA	< 0.500	< 0.500	< 0.500	< 0.500	< 0.5	1252.1	ND	ND	ND
PFBS	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	1252.1	ND	ND	ND
PFHxS	< 1.00	5.49	5.49	< 1.00	5.49	1252.1	ND	4.4	4.4
PFOS	3.22	2.72	2.72	< 1.00	5.94	1252.1	2.6	2.2	4.7
PFOSA	< 0.500	< 0.500	< 0.500	< 0.500	< 0.5	1252.1	ND	ND	ND

Total sample air volume was 1252.1 m^3 air

Sample 6	72hrs Filter *	72hrs Front puf/xad **	72hrs Back puf ***	Particulate	Gaseous	Total Air Concentration
UNITS	ng/sample	ng/sample	ng/sample	pg/m^3	pg/m^3	pg/m^3
PFBA	< 0.500	10.66	1.07	ND	12.4	12.4
PFPeA	< 0.515	0.653	< 0.500	ND	0.7	0.7
PFHxA	< 0.500	1.06	< 0.500	ND	1.1	1.1
PFHpA	< 0.500	0.636	< 0.500	ND	0.7	0.7
PFOA	1.82	6.21	< 0.500	1.9	6.6	8.5
PFNA	< 0.500	6.56	5.49	ND	12.7	12.7
PFDA	< 0.500	< 0.500	< 0.500	ND	ND	ND
PFUnA	< 0.500	< 0.500	< 0.500	ND	ND	ND
PFDoA	< 0.500	< 0.500	< 0.500	ND	ND	ND
PFBS	< 1.00	< 1.00	< 1.00	ND	ND	ND
PFHxS	< 1.11	< 1.00	< 1.00	ND	ND	ND
PFOS	6.46	2.19	< 1.00	6.8	2.3	9.1
PFOSA	< 0.500	0.926	< 0.500	ND	1.0	1.0

Total sample air volume was 945.8 m^3 air

Sample 7	72hrs Filter *	72hrs Front puf/xad raw	72hrs Front puf/xad **	72hrs Back puf ***	72hrs Total	Total air volume	Particulate	Gaseous	Total Air Concentration
UNITS	ng/sample	ng/sample	ng/sample	ng/sample	ng/sample	m^3 Air	pg/m^3	pg/m^3	pg/m^3
PFBA	< 0.500	13.1	11.76	1.96	13.72	937.8	ND	14.6	14.6
PFPeA	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	937.8	ND	ND	ND
PFHxA	< 0.500	2.13	2.13	< 0.500	2.13	937.8	ND	2.3	2.3
PFHpA	< 0.500	< 0.500	< 0.500	0.515	< 0.500	937.8	ND	ND	ND
PFOA	4.78	13.4	13.4	< 0.500	18.18	937.8	5.1	14.3	19.4
PFNA	< 0.500	6.46	6.46	7.12	13.58	937.8	ND	14.5	14.5
PFDA	< 0.500	< 0.500	< 0.500	1.1	< 0.5	937.8	ND	1.2	1.2
PFUnA	< 0.500	< 0.500	< 0.500	< 0.500	< 0.5	937.8	ND	ND	ND
PFDoA	< 0.500	< 0.500	< 0.500	< 0.500	< 0.5	937.8	ND	ND	ND
PFBS	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	937.8	ND	ND	ND
PFHxS	< 1.54	< 1.98	< 1.00	< 1.00	< 1.00	937.8	ND	ND	ND
PFOS	6.31	2.21	2.21	< 1.00	8.52	937.8	6.7	2.4	9.1
PFOSA	< 0.500	0.745	0.745	< 0.500	0.75	937.8	ND	0.8	0.8

Total sample air volume was 937.8 m^3 air

* Filter: Front end fiberglass filter captures most particulates and aerosols

** Front puf/xad: This section of sampling train will capture all PFCs in gaseous form and any ultra fine particles that may escape capture on filter. Blank-corrected.

*** Back puf: Secondary polyurethane packing designed to capture any breakthough of gaseous PFCs from front puf/xad. May also be used as a QC indicator of overall collection efficiency

Table A15. Continued

Sample 8	72hrs Filter *	72hrs Front puf/xad **	72hrs Back puf ***	Particulate	Gaseous	Total Air Concentration
UNITS	ng/sample	ng/sample	ng/sample	pg/m^3	pg/m^3	pg/m^3
PFBA	< 0.500	7.46	1.07	ND	8.6	8.6
PFPeA	< 0.500	< 0.500	< 0.500	ND	ND	ND
PFHxA	< 0.500	0.955	< 0.500	ND	1.0	1.0
PFHpA	< 0.500	0.636	< 0.500	ND	0.6	0.6
PFOA	1.62	1.67	< 0.500	1.6	1.7	3.3
PFNA	< 0.500	8.7	5.49	ND	14.3	14.3
PFDA	< 0.500	1.87	< 0.500	ND	ND	1.9
PFUnA	< 0.500	< 0.500	< 0.500	ND	ND	ND
PFDoA	< 0.500	< 0.500	< 0.500	ND	ND	ND
PFBS	< 1.00	< 1.00	< 1.00	ND	ND	ND
PFHxS	< 1.00	< 1.00	< 1.00	ND	ND	ND
PFOS	7.83	4.96	< 1.00	7.9	5.0	12.9
PFOSA	< 0.500	< 0.500	< 0.500	ND	ND	ND

Total sample air volume was 991.8 m^3 air

* Filter: Front end fiberglass filter captures most particulates and aerosols

** Front puf/xad: This section of sampling train will capture all PFCs in gaseous form and any ultra fine particles that may escape capture on filter. Blank-corrected.

*** Back puf: Secondary polyurethane packing designed to capture any breakthough of gaseous PFCs from front puf/xad. May also be used as a QC indicator of overall collection efficiency

Appendix B

Sources, Fate, and Transport of PFCs in the Environment

Direct Sources of Perfluorinated Chemicals to the Environment

The variety and number of fluorinated compounds currently in production comprise an enormous group of chemicals including drugs, anesthetics, chemotherapeutic agents, many pesticides, and refrigerants, as well polymers such as Teflon® and Goretex® [1]. The environmental fate of most of these compounds is unknown.

This summary is focused primarily on perfluorinated surfactants which include perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) and related compounds that have been the focus of intense environmental study. Perfluorinated surfactants are consistently detected in almost every surface and ground water sample and are almost always found in wildlife and humans. While it is clear that these are not naturally occurring compounds – they are entirely human-made – how these compounds have become so widely distributed in our environment in often very remote locations is less understood. Studies have shown that PFOA, for example, is likely "ubiquitous in the northern hemisphere" without a clear source of that widespread contamination [2]

The direct release of these compounds to the environment through manufacturing processes represents one route of exposure to chemicals like PFOA or PFOS. However, several recent studies show that they can also be generated through the degradation of other fluorinated compounds or products that are not of serious environmental concern.

Fluorinated surfactants are synthesized via two primary methods: through electrochemical fluorination (ECF) or through a telomerization manufacturing process[1, 3]. ECF is the process that 3M uses to produce fluorinated compounds. This process begins with sulfonyl fluorides, fluoroalkyl iodides, or carbonyl fluorides, and results in numerous perfluorinated carbon (PFC) compound isomers and byproducts. It results in isomeric mixtures of PFC that are typically 30% branched isomers and 70% straight carbon chain isomers [1, 3]. ECF was used to produce the fluorinated surfactants PFOA and PFOS, non-volatile perfluorinated surfactants that are used in fire-fighting foams (aqueous film-forming foams, or AFFF), paints, polishes, films, and lubricants. ECF is the only process used to directly produce PFOA and PFOS, with over 6 million pounds produced in 2000 [3].

The major contributors to environmental loads appear to be direct sources from the use of PFOA and the ammonia salts of perfluorononanoic acid (PFNA) in fluoropolymer manufacturing [4]. The chemicals produced through ECF from sulfonyl fluorides include PFOS, *N*-methylperfluorooctanesulfonamidoethanol (*N*-MeFOSE), and *N*-ethylperfluorooctanesulfonamidoethanol (*N*-EtFOSE)[1, 3]. The latter two volatile sulfonamide alcohols are themselves building blocks for a variety of polymers, chemical intermediates, and other perfluoroalkyl substances, and were used to produce carpet treatments and paper coating materials[3]. Due to their volatility, *N*-MeFOSE, and *N*-EtFOSE have been found in atmospheric samples.

A primary use of fluorinated chemicals is in the synthesis of fluorinated polymers. Polyfluoroalkylphosphate surfactants (PAPs), for example, are produced from *N*-EtFOSE and have been used in food contact paper products since 1974. *N*-MeFOSE was the primary ingredient in the production of polymers used for coating fabrics and carpets, such as 3M's ScotchGard® products [5]. sOf the compounds produced through the ECF process, 3% were used in fire-fighting foams, 10% were used as industrial surfactants and coatings, 37% were used in textile, leather, and carpet coatings, and 41% of fluorinated alkyl substances were used for paper and packaging.

Telomerization, is DuPont's process of manufacturing fluorinated alkyl compounds[1]. In this process, only chemicals that consist of straight-carbon chains are produced (as opposed to straight or branched perfluorinated chains produced by ECF process). This is the now the major fluorotelomer manufacturing process since 3M phased out production of PFOA and PFOS in 2000.

Unlike the ECF process, telomerization is often used to make fluorotelomer alcohols (FTOHs)[1], which are characterized by the presence of a terminal ethanol group. FTOHs vary in the number of fluorinated carbons that are attached to the alcohol group. Due to the feedstock and the chemical manufacturing method, they always contain an even number of carbons. FTOHs are not used directly in commercial applications. Rather, they are used as reactive intermediates in the manufacture of other fluorosurfactants and PFC polymer products, where they are often present in residual amounts of up to 4% by weight [6].

Indirect Sources of Fluorinated Chemicals to the Environment

Fluorotelomer Alcohols

The fate of fluorinated and perfluorinated compounds is dependent on the particular chemical in question and the surrounding environment. Due to the high strength of the fluorine-carbon bond, fluorinated chemicals are typically very stable and highly resistant to biological and abiotic degradation. However, some carbon-fluorine bonds are biodegradable under aerobic conditions [7], and recent studies have demonstrated that some fluorinated chemicals can degrade in ways that partially explain patterns of PFC contamination observed in the environment.

Several studies have demonstrated that perfluorocarboxylic acids (PFCAs, which include PFOA and PFBA, perfluorobutanoic acid) and perfluoroalkanesulfonates (such as PFOS and PFBS, perfluorobutane sulfonate) are extremely persistent in surface water, soil, and ground water, and are unlikely to break down. Moody, et al. [8] reported that the PFCAs PFOA and perfluorohexanoic acid (PFHxA) as well as PFOS, were very persistent in surface water into which fire-fighting foam was spilled, and were detected in fish liver tissue over years of sampling after the spill. PFCAs were also persistent in ground water where AFFF fire-fighting foam was used for training[9]. These studies focused on surface water or ground water contamination that was attributable to an identifiable source or spill. The reasons for widespread, low-level contamination of soil, ground water, and surface water in the ambient environment, however, are not clear, because it is difficult to explain how non-volatile PFCA salts such as PFOA could be transported to areas far from a likely source of these chemicals.

FTOHs are usually precursors to the production of fluoropolymers used in paper and carpet treatments, paints, adhesives, waxes, and polishes. They are considered semi-volatile, but their environmental fate is dictated by their partitioning behavior [10]. They have a vapor pressure of 140 – 990 Pa and partition into the atmosphere, where they have been detected at concentrations of 17 - 135 picograms m^{-3} [11]. FTOH is known to break down abiotically in the atmosphere with roughly a 20 day half-life, yielding the corresponding PFCAs such as perfluorodecanoic acid (PFDA) [2, 11]. With over 10 million pounds of FTOH produced per year, Ellis et al. [11] concluded that enough FTOH is manufactured yearly to maintain currently observed concentrations of PFCAs in the environment. The process of FTOH degrading to PFCAs may account for the estimated 0.4 tons of PFOA deposited in the arctic annually [2]. FTOHs can also undergo biological breakdown to PFCAs (e.g. PFOA), during aerobic treatment of wastewater treatment plant (WWTP) sludge via beta-oxidation. Between 1 – 10% of FTOH is converted to PFOA in this treatment process [7, 10].

The degradation of FTOHs to PFCAs is consistent with the observations made of the distribution of PFC in other studies:

- The appearance of PFDA in fish samples in Minnesota is consistent with the breakdown of 10:2 FTOH to PFDA. The longer chain PFCAs have no significant history of intentional industrial production [12], and there is no known natural source of long-chain PFCAs [11].

- DeSilva and Mabury [12] report that 98% of human blood samples from the Midwest in 2004-2005 consist of straight-chain, telomere-based PFOA, implying that only 11% of the PFOA exposure was to ECF-derived PFOA. They attributed 89% of the PFOA to fluorotelomer-based production methods.

- Recent MPCA studies show that various perfluorinated surfactants – including PFOA and PFOS – were present in the atmosphere in 2008. The presence of these compounds in the air can be explained by the photodecomposition of FTOH molecules in the atmosphere. 3M discontinued manufacture of these PFCs in 2000.

- Minnesota ground water monitoring shows PFOA, PFPeA (perfluoropentanoic acid), PFHxA, PFHpA (perfluoroheptanoic acid), and PFNA at low concentrations that are widespread under ambient conditions, with no known or likely sources of these compounds. The degradation of FTOH compounds to these corresponding PFCAs is a plausible source of these PFCA detections in the ambient environment.

Fluorinated Polymers

Fluorinated polymers are produced in far greater volumes than the fluorinated surfactants. However, very little has been published regarding the fate and behavior of fluorinated polymers in the environment [3]

Synthetic polymers in general are typically very resistant to biological or non-biological degradation. Studies on fluoroacrylate polymers indicate that these compounds have a 1200 year half-life and the biodegradation of fluoroacrylate polymers is expected to add only a very slight amount of PFCA to the global pool of PFCAs [13]. However, PAPs – polymers used extensively for oil and water-resistant coatings on food contact paper products – degrade into FTOHs and subsequently to a toxic fluorotelomer aldehyde intermediate, which, in turn, degrades to fluorotelomer carboxylic acids such as PFOA [5]. The degradation of PAPs was found to occur in the gastrointestinal tract and bloodstream of laboratory animals. *With PAPs representing 20% of all PFCs produced for paper coatings, this represents a significant source of exposure to PFCAs like PFOA.*[5].

PAPs are typically generated from monomers of *N*-EtFOSE, which are produced through the ECF process described above. Studies conducted by 3M indicated that *N*-EtFOSE can aerobically degrade to PFOS in wastewater in 35 days. Another study found that biodegradation of *N*-EtFOSE in wastewater did not generate PFOS in wastewater [14], although it did anaerobically degrade to related compounds. This work suggested that the transformation of *N*-EtFOSE to PFOS may not occur within the typical hydraulic residence time of a WWTP, and implied that any PFOS in WWTP effluent is likely due to PFOS present in the in influent. It appears that much of the PFOS in a WWTP is removed. Shultz et al [3] estimated that 98% of PFOS was removed in WWTPs.

N-MeFOSE was typically used to manufacture fluorinated-polymer coatings for fabric and carpet. Shoeib et al [15] found that indoor air concentrations of *N*-MeFOSE and *N*-EtFOSE were roughly 10-20 times greater than outdoor concentrations. It has been suggested that these compounds can break down into PFOS directly in the atmosphere [16] thereby providing a route of human exposure to PFOS ingestion and inhalation inside the home where these products have been used. The breakdown of *N*-MeFOSE and *N*-EtFOSE to PFOS may also explain in part the presence of PFOS in remote environments, since *N*-MeFOSE and *N*-EtFOSE volatilize and can be transported through the atmosphere, eventually breaking down to PFOS [17]. However, it may also be possible for PFOS to condense onto atmospherically mobile aerosol particles that are then transported over long distances and eventually deposited in remote locations [17].

In soil, PFOS has been found to adsorb to various iron minerals, with adsorption increasing with PFOS concentration [18]. However, PFOS apparently adsorbs to soil less than hydrocarbons of similar size [18]. Other studies with PFC surfactants show that the organic carbon concentrations in the soil and PFC size are the most important factors influencing sorption to soil [19]. In addition, low pH and high Ca^{+2} in soil solution increases the adsorption of these compounds, suggesting that electrostatic interactions are important in the sorption of PFOS and other PFC surfactants to soil and sediment [19]. Microcosm studies conducted on ground-water sediment collected from the Washington County landfill [20] indicated that adsorption of PFOS and PFOA may be dependent on the oxidation/reduction status of the ground water, implying that these compounds may become more mobile in highly reduced ground water aquifers.

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Appendix C

Summary of PFC Toxicity Studies

*Please note: This is not an exhaustive list and other studies may exist that the author was not aware of at the time of printing.

Species or Type of Assay	Compound and Exposure Concentrations (mg/kg bw/day unless otherwise noted)	Endpoint	Effect Concentration (mg/kg bw/day unless otherwise noted)	Reference
Rat 90 day oral exposure	PFOS potassium salt 0, 30, 100, 300, 1000, 3000	Death Changes in organ and body weight	LC_{50} = 100 LOAEL = 30	Goldenthal et al., 1978
Rat 2 generation reproductive toxicity	PFOS potassium salt 0.1, 0.4, 1.6, 3.2 by gavage	Significant reduction pup weight gain in F1 generation	LOAEL = 0.4 NOAEL = 0.1	Christian et al., 1999
Rat 2-year dietary study	PFOS 0.06 – 0.23 (males) 0.07 – 0.21 (females)	Histopathological changes in liver	LOAEL (both sexes) = 40.08 µg/g in liver And 13.9 mg/L in serum	Covance Laboratories, Inc. 2002
Rhesus monkeys 90 day gavage	PFOS potassium salt 0, 0.5, 1.5, 4.5	100% Death Gastrointestinal toxicity	4.5 LOAEL = 0.5	Goldenthal et al., 1978
Cynomolgus monkeys 26 weeks	PFOS	Thymic atrophy (females) Reduced HDL, cholesterol, triiodo-thyronine, total bilirubin (males)	LOEL = 0.03 Corresponding to mean concentrations in female and male sera and liver of 19.8 µg/mL and 14.5 µg/g, respectively	Covance Laboratories, Inc. 2002
Fathead minnow (*Pimephales promelas*) 96 h and 42 d	PFOS lithium salt	Death	LC_{50} (96h) = 4.7 mg/L NOEC (42d) = 0.3 mg/L	OECD, 2002
Mysid shrimp (*Mysis bahia*)	PFOS lithium salt	Death	LC_{50} (96h) = 3.6 mg/L NOEC = 0.25 mg/L	OECD, 2002
Aquatic midge (*Chironomous tentans*)	PFOS	Growth and survival	NOEC (10d) = 0.0491 mg/L	Macdonald et al., 2004
Green Algae (*Pseudokirchnerilla subcapitata*)	PFOS	Cell density	IC_{50} (96h) = 48.2 mg/L NOEC = 5.3 mg/L	Boudreau et al., 2003
Mallard duck (*Anas platyrhyncos*) 21 weeks in feed	PFOS	Reduced testes size and decreased spermatogenesis	10 mg/kg diet corresponding to serum and liver concentrations of 87.3 µg/mL and 60.9 µg/g, respectively	3M, 2003

Species or Type of Assay	Compound and Exposure Concentrations (mg/kg bw/day unless otherwise noted)	Endpoint	Effect Concentration (mg/kg bw/day unless otherwise noted)	Reference
Bobwhite quail (*Colinus virginianus*) 21 weeks in feed	PFOS	Increase in liver weight (female) Increased incidence of small testes size (male) Reduced chick survivability as a percentage of eggs set	10 mg/kg diet	3M, 2003
Marine Mussel (*Mytilus californianus*)	PFNA PFDA	Inhibition of p-glycoprotein cellular efflux transporter resulting in chemosensitization	IC50 (PFNA) = 4.8 μM IC50 (PFDA) = 7.1 μM	Stevenson et al., 2006
Male Rats 14 day oral	PFDoA 1, 5, 10	Decreased absolute testes weight Increased total serum cholesterol Increased luteinizing hormone Decreased testosterone Reduced mRNA expression of genes involved in cholesterol transport and steroid synthesis	10 10 10 5 and 10 5 and 10	Shi et al., 2007
Medaka (*Oryzias latipes*)				
MCF-7 Breast Cancer Cells *In vitro*	6:2 and 8:2 FTOH	Breast cancer cell proliferation	10 μM	Maras et al., 2006
Tilapia Hepatocytes *In vitro*	PFOS PFOA 6:2 FTOH 8:2 FTOH	Estrogenicity determined by vitellogenin induction	3.1×10^{-7} M 5.1×10^{-7} M 1.1×10^{-6} M 7.5×10^{-7} M	Liu et al., 2007

Other useful toxicity studies:

3M, **2008**. *Ecotoxicity of and Derivation of Preliminary Safe Water Concentrations for Perfluorobutyric Acid (PFBA)*. Presented at North American SETAC, Tampa, Florida, 2008.

Jensen, A and H. Leffers, 2008. *Review Article: Emerging endocrine disrupters: perfluoroalkylated substances*, International Journal of Andrology, **31**, 161-169.