REPORT OF SITE RECONNAISSANCE AND SAMPLING AT
SELECT FIREFIGHTING FOAM TRAINING AREAS IN MINNESOTA

DELTA PROJECT NO. 19382-DEL0

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1.0 INTRODUCTION

1.1 Purpose
Delta Consultants (Delta) was retained and authorized by the Minnesota Pollution Control Agency (MPCA) to conduct site reconnaissance and sampling activities related to the use of firefighting foams containing perfluorocarbons (PFCs) at select fire training areas in Minnesota. The additional activities were based on the conclusions and recommendations presented in Delta’s Perfluorocarbon (PFC)-Containing Firefighting Foams and Their Use In Firefighting Training in Minnesota report dated June 30, 2008 (the June 2008 Report), and the Addendum to Perfluorocarbon (PFC)-Containing Firefighting Foams and Their Use In Firefighting Training in Minnesota report dated October 22, 2008 (the 2008 Addendum Report).

Based on the previous reports, the purpose of this report is to present data and findings of site reconnaissance at fire training areas utilized by the following entities: the municipal fire departments in the cities of Bemidji, Brooklyn Center, Claremont, Fridley, Goodview, Harmony, Kenyon, Luverne, North St. Paul, Richfield, and Rochester; South Central College in North Mankato; and the fire department at the Minneapolis-St. Paul International (MSP) Airport. While site reconnaissance data and findings for the Flint Hills Pine Bend Refinery in Rosemount, the Marathon Refinery in St. Paul Park, and the Burnsville Fire Training Center were presented in Delta’s Firefighting Training Area Site Reconnaissance, Pine Bend Flint Hills Refinery, Marathon Refinery, Burnsville Fire Training Center, and Site Access for 21 Fire Departments report dated April 3, 2009 (the April 2009 Report), further discussion and/or sampling findings for these three sites are included in this report. Additionally, this report presents soil and/or groundwater sampling information and data for sampling conducted at the fire training areas utilized by the following entities: the municipal fire departments in the cities of Claremont, Fridley, Harmony, Kenyon, Luverne, North St. Paul, Richfield, and Rochester; and the fire department at the MSP Airport.

1.2 Background
As part of the June 2008 and 2008 Addendum Reports, municipal fire departments, airport and refinery fire departments, and colleges with fire training programs were surveyed regarding their firefighting foam use in training exercises. All of the airport and refinery fire departments, all of the colleges with fire training programs, and 522 of 785 municipal fire departments responded to the survey. Of the responding municipal fire departments, approximately 10% do not use any type of firefighting foam, 47% use only Class A fire foams, 22% use Class B foams for fire response but not for training, and 22% use and train with Class B fire foams. Of the municipal fire departments that use and train with Class B foam, only 72%,
or 79 municipal fire departments, regularly train, or presumably train, repeatedly at one location. The survey also identified two current and one former petroleum refinery that train with Class B foam on-site, three airport fire departments that train with Class B foam on-site, and three colleges that train on campus with Class B foam.

The June 2008 Report concluded that surfactants used in Class B firefighting foams are manufactured with PFCs. Firefighting foams formerly manufactured by 3M were made using a proprietary process and are known to contain or break down to perflurooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA). The surfactants in Class B firefighting foams manufactured by companies other than 3M are made using a telomerization process and cannot break down to PFOS, however, they contain and/or may break down to PFOA, perfluorobutanoic acid (PFBA), and other PFC compounds. Class A foams and training foams are not made with PFC-based surfactants and are therefore not a source of PFCs in the environment.

In Section 7.2 of the 2008 Addendum Report, Delta identified 21 fire training sites with high potential for PFC impacts to soils, groundwater and surface water, based on several factors: training site locations in wellhead or source water protection areas; training site locations in karst areas; the presence of surface waters, wetlands or water supply wells near the training sites; and the amount and type of Class B aqueous film-forming foam (AFFF) utilized in training. One of the sites, the Duluth International Airport, is currently under investigation by the MPCA, thus this site was not included in this scope of services. The MPCA requested that the Luverne Fire Department training site be added to the contact list even though it was not identified as one of the higher priority sites in the 2008 Addendum Report; the Minnesota Department of Health (MDH) had a concern regarding proximity of the Luverne Fire Department’s training site to public wells in town. The 21 fire training sites for which the scope of services was performed are as follows:

- Minneapolis-St. Paul (MSP) Intl. Airport
- Marathon Refinery, St. Paul Park
- Flint Hills Pine Bend Refinery, Rosemount
- South Central College, Mankato
- Kenyon Fire Department
- Pierz Fire Department
- Claremont Fire Department
- Cottage Grove Fire Department
- Alexandria Fire Department
- Myrtle Fire Department
- Harmony Fire Department
- Bemidji Fire Department
- Fridley Fire Department
- Brooklyn Center Fire Department
- Burnsville Fire Department
- Goodview Fire Department
North St. Paul Fire Department  Preston Fire Department
Richfield Fire Department  Rochester Fire Department
Luverne Fire Department

Delta’s April 2009 Report detailed site reconnaissance findings at the referenced refineries and the Burnsville fire training center and presented findings related to foam use by the municipal fire departments in Cottage Grove, Alexandria, Myrtle, Pierz, and Preston.

1.3 Scope of Work

The following scope of work was authorized and conducted under Master Contract Number B15536 and Contract Work Order Numbers SFDE0919, effective March 3 through June 30, 2009, and SFDE0920, effective April 10 through June 30, 2009.

Task 1 – Access to Fire Training Sites

As identified in Delta’s April 2009 Report, correspondence with the following entities was continued in order to facilitate the execution of site access agreements between them and the MPCA to enable site reconnaissance and site sampling at their fire foam training areas: the Marathon Refinery in St. Paul Park; the South Central College in Mankato; the Metropolitan Airport Commission for access to the MSP Airport former fire training areas; the City of Fridley for access to the North Metro Fire Training Center in Fridley; and Olmsted County for access to the Rochester Fire Department training area at the county fairgrounds in Rochester.

As reported in Delta’s April 2009 Report, a site reconnaissance was performed as part of a previous scope of work at the Marathon Refinery in St. Paul Park in the company of the Marathon Refinery Fire Chief and the Environmental Coordinator on March 17, 2009, without an executed access agreement. In order to obtain site access, Marathon required a work plan for groundwater sampling via existing on-site groundwater monitoring wells. Delta worked with Marathon personnel to prepare a work plan amenable to the MPCA and Marathon.

Similarly, as reported in Delta’s April 2009 Report, a site reconnaissance was performed at the Flint Hills Resources’ (FHR) Pine Bend Refinery in Rosemount as part of a previous scope of work, without an executed access agreement. Since personnel at FHR provided Delta and the MPCA with information and data regarding their sampling of existing groundwater monitoring wells in the area of the fire training area and influent and effluent from their on-site wastewater treatment plant for PFCs, it was decided that
attempts to execute an access agreement with FHR would be postponed pending sampling results at other fire foam training facilities.

As part of a previous scope of work, access agreements between the MPCA and the following municipal fire departments or applicable property owners were executed: Bemidji, Brooklyn Center, Burnsville, Claremont, Goodview, Harmony, Kenyon, Luverne, North St. Paul, and Richfield.

**Task 2 - Site Reconnaissance**

Site reconnaissance visits were conducted at the training areas where the identified select fire departments have trained with Class B foam, in the company of the Fire Chief or other knowledgeable members of the fire department. The Fire Chief or knowledgeable person was interviewed to verify the types and amounts of Class B foam used in training and training practices. The latitude and longitude coordinates for the perimeter of the training areas where Class B foam was sprayed were collected using a hand-held global positioning system device (GPS). The training areas were observed to determine the surface runoff direction from the training site and to identify any potential receptors such as nearby surface waters, drainage pathways, residential water wells, and other potential community water supply system locations such as rest stops, trailer parks, etc., located in the area. The locations of future soil/groundwater/surface water sampling points were discussed with the Fire Chief or knowledgeable person. Photographs of the training sites and other pertinent area features were taken.

**Task 3 – On-Site Sample Collection**

Delta contracted with various State-contracted drilling subcontractors to conduct drilling as determined during the site reconnaissance in order to obtain soil and groundwater samples at the fire foam training areas. Up to three soil borings were advanced via direct push method at each training location. GPS coordinates of the soil boring locations were collected using a hand-help GPS. Based on Delta’s previous review of area geologic atlas and area well logs available on the MDH County Well Index (CWI), the borings were advanced to the estimated depth of groundwater, where possible, or until drill refusal was experienced.

Two composite soil samples were collected from each boring from two intervals: from the surface to four feet below grade surface (bgs), and from four feet to eight feet bgs. A groundwater sample was collected from each boring, if groundwater was encountered. Soil and groundwater samples were submitted to a State-contracted laboratory, Axys Analytical Services LTD (Axys) for analysis of PFCs. As noted in individual site appendices, select sites were chosen for double sampling, with duplicate samples submitted to MPI Research laboratory for PFC analysis.
According to research conducted at a fire training area at the Wurtsmith Air Force Base in Michigan, one important factor for the transport of anionic perfluorinated surfactants in soil is the organic content of the soil; soil partition coefficients were found to be linearly related to organic carbon content, and sorption of the anionic perfluorinated surfactants to soil particles increased with increasing perfluorinated chain length (Occurrence and Persistence of Perfluorooctanesulfonate and Other Perfluorinated Surfactants in Groundwater at a Fire-training Area at Wurtsmith Air Force Base, Michigan, USA, Cheryl A. Moody, Gretchen N. Hebert, Steven H. Strauss, and Jennifer A. Field, 2003). Therefore, soil samples were also collected and submitted to Pace Analytical Services (Pace) for laboratory analysis of total organic carbon (TOC) via EPA Method SW9060 for potential additional data evaluation in the future.

Additional soil sampling included surficial soil or sediment samples collected from potential surface drainage pathways that may be associated with the fire foam training areas, as determined during the site reconnaissance. Sediment samples were collected at the entry point of the runoff to a surface water body and submitted to Axys for analysis of PFCs.

Based on a literature search, no field instruments are currently available for field screening soils for PFCs. Correspondence with Dr. Jennifer Field of Oregon State University, who has conducted field research into analytical methodologies for PFCs in soil and groundwater at fire foam training sites, confirmed that she is not aware of any field detectors for PFCs in soil. Therefore, soils could not be field screened for the presence of PFCs.

**Task 4 – GIS Layer**

A geographical information system (GIS) layer illustrating the outlines of the fire training areas identified in Task 1 were created as polygons.

**Task 5 – Report**

This report summarizing information gathered in Tasks 1 through 3 was prepared.

**1.4 Report Presentation**

For the purpose of readability and presentation, discussions, data and supporting documents for individual firefighting foam training area sites are presented as appendices to this report. The site-specific appendices are as follows:

Appendix A – Bemidji Fire Department
Appendix B – Brooklyn Center Fire Department
Appendix C – Burnsville Fire Department
Appendix D – Claremont Fire Department
Appendix E – Fridley Fire Department
Appendix F – Goodview Fire Department
Appendix G – Harmony Fire Department
Appendix H – Kenyon Fire Department
Appendix I – Luverne Fire Department
Appendix J – North St. Paul Fire Department
Appendix K – Richfield Fire Department
Appendix L – Rochester Fire Department
Appendix M – Flint Hills Pine Bend Refinery
Appendix N – Marathon Refinery
Appendix O – MSP Airport
Appendix P – South Central College, North Mankato

1.5 Limitations
Delta’s research and this report are subject to the following limitations:

- Delta obtained, reviewed, and evaluated information provided voluntarily by fire departments and other knowledgeable persons. Delta’s services do not include the verification of the accuracy or authenticity of this information.

2.0 FIREFIGHTING FOAM TRAINING SITE ACCESS
Fire chiefs or other representatives of the 21 fire departments and fire training school were contacted in order to obtain written permission to conduct a site reconnaissance and soil and groundwater sampling at the fire foam training sites. The access agreements were to be signed by the appropriate fire department personnel, city official or other property owner representative, and the MPCA. The fire chiefs or fire department representatives were informed that two visits to each site would be required: (1) to conduct an initial site reconnaissance of the training site, observe any runoff areas and ascertain the direction of surface runoff, scout the locations for proposed boreholes, survey the surrounding area for potential receptors (i.e. wells and surface waters), and geo-locate the fire foam training area and proposed borehole locations; and (2) to conduct soil and groundwater sampling via soil borings and collect surface soil or sediment samples if appropriate, for laboratory analysis of PFCs.

Access agreements were executed with the appropriate authority for access to fire foam training sites utilized by the following municipal fire departments: Bemidji, Brooklyn Center, Burnsville, Claremont, Fridley, Goodview, Harmony, Kenyon, Luverne, North St. Paul, Richfield, and Rochester. Access agreements were also put in place with the Metropolitan Airports Commission (MAC) for access to the
MSP Airport, and with Marathon Petroleum Company LLC for access to the Marathon refinery in St. Paul Park. Copies of the access agreements are included in the appropriate site-specific appendix.

Verbal access was granted for site reconnaissance to two sites: the Flint Hills Pine Bend Refinery in Rosemount, and South Central College in North Mankato. Based on information and data gathered during the site reconnaissance at these two sites, written access for sampling at these sites was not pursued at this time. Further discussion of these sites is presented in Appendices M and P, respectively.

As presented in Delta’s April 2009 Report, upon further telephone contact and discussion with some of the selected municipal fire departments, it was clarified that the department does not regularly train with Class B AFFF. The following municipal fire departments indicated that they do not regularly train with Class B AFFF: Alexandria, Cottage Grove, Myrtle, Pierz, and Preston. Based on information provided by fire department personnel at these municipal fire departments, Class B foam is not currently nor was historically used in training exercises by the departments. Therefore, access to the fire foam training areas utilized by the Alexandria, Cottage Grove, Myrtle, Pierz and Preston fire departments was not pursued at this time.

3.0 FIREFIGHTING FOAM TRAINING SITE RECONNAISSANCE

Site reconnaissance visits to sixteen of the select firefighting foam training areas (excluding sites in Alexandria, Cottage Grove, Myrtle, Pierz, and Preston for reasons noted above) were conducted in March, April and May of 2009. Site reconnaissance visits were conducted in the company of the Fire Chief or and/other knowledgeable fire department personnel. The Fire Chief or other knowledgeable personnel was interviewed to verify the types and amounts of AFFF used in training, training practices, and any other known significant releases of AFFF by the department. The latitude and longitude coordinates for the perimeter of the training area were obtained using a hand-held GPS. Several types of GPS units were used: the Garmin dMap, which is accurate to 15 meters; the Garmin Oregon 400T, with an accuracy of less than 3 meters; and, Magellan Meridian Gold, which is accurate to 3 meters. The fire foam training area was observed to determine the runoff direction from the training site, and identify any potential receptors such as nearby surface waters, drainage pathways, residential water wells, and other potential community water supply system locations such as rest stops, trailer parks, etc. The locations of future soil/groundwater/surface water sampling points were discussed with the Fire Chief/fire department personnel. The training sites and other pertinent area features were photographed.

Site reconnaissance visits for each of the sixteen firefighting foam training areas visited as part of this and the previous scope of work are discussed in the appropriate site-specific appendix. Although details of
Based on information gathered during site reconnaissance visits to two of the fire foam training sites, it was determined that Class B AFFF were not utilized in regular training exercises at the training areas, as discussed below.

- **Brooklyn Center Fire Department:** According to the Brooklyn Center Fire Chief, Class B foam is not currently nor was historically used in training exercises at the training areas described in their questionnaire. He indicated that the report of Class B foam use in training exercises during a previous telephone interview of the Brooklyn Center Fire Chief were incorrect. Further, the Fire Chief later related that he questioned the previous fire chief and chief officers, and they also stated that Class B foams have not been used for training purposes. Therefore, GIS maps of the training areas were not created, and soil and groundwater sampling was not conducted at the Brooklyn Center fire foam training areas as part of this scope of work. Details of the site reconnaissance at the Brooklyn Center fire training areas are presented in Appendix B.

- **South Central College, North Mankato:** The Fire and Rescue Program Manager at South Central College indicated that the firefighting program has been offered at the college for at least twenty years and that the majority of training with foam is conducted off-campus at various municipal department locations. He stated that while some Class B foam may have been used during off-campus training, only Class A foam and training foam have been used in training exercises conducted at the college campus. Further, he reported reviewing purchasing records for the last ten years and found that the college has not purchased Class B foam during that time. Therefore, GIS maps of the training areas were not created, and soil and groundwater sampling was not conducted at the South Central College campus fire foam training areas as part of this scope of work. Details of the site reconnaissance at the South Central College in North Mankato are presented in Appendix P.

### 4.0 SAMPLING AT FIREFIGHTING FOAM TRAINING SITES

#### 4.1 Sampled Fire Foam Training Sites

Soil and/or groundwater sampling, and sediment sampling as appropriate, was done as proposed in Task 3 of the Scope of Work (see Section 1.3) at the following firefighting foam training area sites:

- **Burnsville Fire Department:** Soil samples only were collected from two soil borings advanced within the fire foam training area; groundwater was not encountered prior to reaching bedrock or soil boring refusal.

- **Claremont Fire Department:** Soil samples only were collected from three soil borings which were advanced in/near two separate fire foam training areas. The depth to groundwater in the Claremont area was expected to be approximately 55 feet bgs, therefore, groundwater sampling via push probe drilling was not attempted.

- **Fridley Fire Department:** Soil and groundwater samples were collected from two soil borings advanced in or near a former fire foam training area, and one sediment sample was collected from an on-site wetland located downslope of the training area.
Harmony Fire Department: Soil and groundwater samples were collected from a fire foam training area at the municipal tree/brush dump. Only soil samples were collected from a second fire foam training area in front of the fire station, since groundwater was not encountered in these borings prior to encountering bedrock.

Kenyon Fire Department: Soil samples only were collected from two soil borings advanced within the fire foam training area; groundwater was not encountered prior to encountering bedrock.

Luverne Fire Department: Soil and groundwater samples were collected from three soil borings advanced in and downslope of the fire foam training area.

North St. Paul Fire Department: Soil and groundwater samples were collected from two soil borings advanced in the fire foam training area. Additionally, one surficial soil sample was collected downslope of the training area.

Richfield Fire Department: Soil and groundwater samples were collected from two soil borings advanced in the fire foam training area and from one soil boring located downslope and hydraulically downgradient of the training area.

Rochester Fire Department: Soil samples only were collected from two soil borings advanced within the fire foam training area; groundwater was not encountered prior to reaching bedrock.

MSP Airport: Groundwater samples only were collected from four borings advanced at two former fire foam training areas. Due to construction and replacement of the upper several feet of soil since the time the areas were used for training, soil samples were not collected.

Sampling details and data for each fire foam training site are included in the site-specific appendices. Drilling and sampling methodologies are presented in Appendix Q. Soil and groundwater samples for PFC analysis were submitted to Axys. Soil samples for TOC analysis via EPA Method SW9060 were submitted to Pace. As noted in individual site appendices, select sites were chosen for double sampling, with duplicate samples submitted to MPI Research laboratory for PFC analysis.

Laboratory results for all of the sites at which soil and groundwater samples were collected and analyzed are included in Table 1 – Soil Sample Results, PFCs and TOC and Table 2 – Groundwater Sample Results, PFCs, respectively. Detected PFC concentrations are also discussed in the individual site appendices.

4.2 Fire Foam Training Sites Where Sampling Did Not Occur

Soil and/or groundwater sampling was not completed at the following fire foam training areas during this scope of work:

Bemidji Fire Department: As per Federal Aviation Regulations (FAR) Part 77.13, an air space permit issued by the Federal Aviation Administration (FAA) is required if airspace is crossed at varying heights in and around varying areas of an airport. Due to the height of the push probe drill tower, further assessment as to the need for an FAA permit under FAR 77.13 is needed. Due to the upcoming end of the 2009 fiscal year for the State of Minnesota, there was insufficient time to complete this task as part of this scope of work.
Goodview Fire Department: The fire foam training area utilized by the Goodview Fire Department is a concrete apron in front of the fire station, and the concrete was observed to be in good condition. Runoff from the training area is directed along a concrete gutter to a storm sewer which discharges into the backwaters of the Mississippi River. The owner of the property at which the storm sewer discharges was not ascertained at the time of this report. An access agreement between this property owner and the MPCA will need to be executed prior to sampling. Due to the upcoming end of the 2009 fiscal year for the State of Minnesota, there was insufficient time to complete this task as part of this scope of work.

Flint Hills Pine Bend Refinery: In February 2009 personnel at the Flint Hills Pine Bend Refinery sampled existing groundwater monitoring wells in the vicinity of their on-site fire training area. Sampling results were provided to the MPCA and Delta and were included in Delta’s April 2009 report. The April 2009 report recommended that, based on (future) soil and groundwater sampling results at other fire training areas, groundwater sampling from existing wells, or soil and groundwater sampling from temporary wells at the Flint Hills Pine Bend Refinery would be considered if results indicated the use of Class B firefighting foams are resulting in the release of PFCs to the environment. Thus sampling at Flint Hills Pine Bend Refinery was not part of this scope of work.

Marathon Refinery: An access agreement between Marathon Petroleum Company LLC and the MPCA was executed on June 8, 2009. Due to the upcoming end of the 2009 fiscal year for the State of Minnesota, there was insufficient time to complete this task as part of this scope of work.

4.3 Sampling Results – Soils and Sediments

At the time of this report, laboratory reports were received for the soil samples collected at the following fire foam training areas: Burnsville, Harmony, North St. Paul, and Richfield. Laboratory results are summarized in Table 1, Soil Analytical Results, PFCs and TOC. Site-specific sample results are also presented and discussed in the site discussions included in the site-specific appendices. Laboratory reports were not available at the time of this report for soil samples collected at the following fire foam training areas: Claremont, Fridley, Kenyon, Luverne, and Rochester.

Laboratory analyses results received thus far detected PFC compounds in the following soil samples:

- All soil samples collected from the Burnsville Fire Department’s fire foam training area at the ABLE Fire Training Center.
- All soil samples collected from the Richfield Fire Department’s fire foam training area behind the Richfield Ice Arena.
- Shallow soil samples collected from the Harmony fire foam training area in front of the Harmony fire station. PFCs were not detected in the deep soil samples from this location.
- The surficial soil sample collected at a drainage point from the fire foam training area in North St. Paul.

No PFC compounds were detected in the soil borings advanced at the Harmony tree/brush dump fire foam training area.
In analyzing soil laboratory data and sample depths for soil samples collected from Burnsville, Harmony, North St. Paul and Richfield, Delta makes the following observations:

- The shorter chain perfluorocarboxylic acids (PFBA, PFPeA, PFHxA, PFHpA, and PFOA) were detected more often than the longer chain compounds (PFNA, PFDA, PFUnA, and PFDoA), and the longer chain compounds were only detected in the shallow soil samples. The trend is apparent in Graph 1, PFC Concentrations in Soils, Minnesota Fire Foam Training Sites.

- The shorter, four-carbon chain perfluorosulfonate (PFBS) was only detected in one soil sample, while the six and eight-chain PFHxS and PFOS were detected in one-third of the soil samples. The eight-chain PFOS was detected at concentrations at least 2.5 times higher than the six-chain PFHxS, except in the deep soil samples collected at the Burnsville fire foam training area, where PFHxS concentrations were higher than the PFOS concentrations.

- No trends are apparent in comparing shallow versus deep soil sample results (see Graph 1), except for soil samples collected from Richfield, where the concentrations of the shorter chain perfluorocarboxylic acids (PFBA, PFPeA, PFHxA, PFHpA) were lower in shallow soil samples than deeper soil samples (see Graph A, Richfield Soil Samples, Soil Depth vs. PFC Compound Concentration included in Appendix K).

- No trends are apparent between PFC compound concentrations and TOC concentrations. As expected, TOC concentrations are higher in the shallower soil samples.

- Generally, the boring exhibiting the highest concentrations of perfluorocarboxylic acids in soil samples also exhibited the highest perfluorocarboxylic acid groundwater concentrations, as depicted in Graph 2, Perfluorocarboxylic Acids Soil and Groundwater Concentrations, Minnesota Fire Foam Training Sites.

Laboratory reports were not available at the time of this report for soil samples collected at the following fire foam training areas: Claremont, Fridley, Kenyon, Luverne, and Rochester. Analytical results for these fire foam training areas will be presented in a forthcoming addendum report. Review and analysis of additional soil laboratory data may alter the afore-mentioned trend observations.

### 4.4 Soil Laboratory Results versus State PFC Soil Reference Values

The MPCA has defined soil reference values (SRVs) for a number of chemical compounds, which are soil contaminant concentrations above which an unacceptable risk to human health is predicted. Tier 1 SRVs assume human exposure to contaminants is chronic and occurs in a residential site setting. Tier 2 SRVs assume contaminant exposures for industrial and recreational property uses. The Tier 1 Residential and Tier 2 Recreational SRVs for PFOS and PFOA are 2 milligrams per kilogram (mg/kg) and 4 mg/kg, respectively, or 2,000 nanograms per gram (ng/g) and 4,000 ng/g. The Tier 2 Industrial SRVs for PFOS and PFOA are 12 mg/kg (12,000 ng/g) and 23 mg/kg (23,000 ng/g), respectively. SRVs are not currently defined for other PFC compounds.

None of the detected PFC soil concentrations reported thus far in any of the soil samples collected during this scope of work met or exceeded any of the MPCA SRVs.
4.5 Sampling Results - Groundwater

At the time of this report, laboratory reports were received for the groundwater samples collected at the following fire foam training areas: Harmony, North St. Paul, and Richfield. Laboratory results are summarized in Table 2, Groundwater Analytical Results, PFCs. Site-specific sample results are also presented and discussed in the site discussions included in the site-specific appendices. Laboratory reports were not available at the time of this report for groundwater samples collected at the fire foam training areas in Luverne, Fridley, and the MSP Airport.

Laboratory analyses results received thus far detected PFC compounds in all of the groundwater samples collected from the Harmony, North St. Paul and Richfield fire foam training areas.

In analyzing groundwater laboratory data received thus far, Delta makes the following observations:

- As with soil samples, the shorter chain perfluorocarboxylic acids (PFBA, PFPeA, PFHxA, PFHpA and PFOA) were detected more often in the groundwater samples than the longer chain compounds (PFNA, PFDA, PFUnA and PFDoA). The trend is apparent in Graph 3, PFC Concentrations in Groundwater, Minnesota Fire Foam Training Sites.

- No concentration trends are apparent between the shorter and longer chain perfluorosulfonates (PFBS, PFHxS, and PFOS).

Laboratory reports were not available at the time of this report for groundwater samples collected at the following fire foam training areas: Luverne, Fridley, and the MSP Airport. Analytical results for groundwater samples collected at these fire foam training areas will be presented in a forthcoming addendum report. Review and analysis of additional groundwater laboratory data may alter the aforementioned trend observations.

4.6 Groundwater Laboratory Results versus State PFC Health Risk Limits and Values

In 2008 the MDH set forth Health Risk Limits (HRLs) of 0.3 micrograms per liter (ug/L), or parts-per-billion (ppb), for PFOS and PFOA in drinking water, which is equivalent to 300 nanograms per liter (ng/L) or 300 parts-per-trillion (ppt). As of February 2008, the MDH established a health-based value (HBV) for PFBA of 8 ug/L (or 8,000 ng/L) for acute, one day exposures, and 7 ug/L (or 7,000 ng/L) for short-term exposures up to 30 days, subchronic (up to approximately 8 years), and chronic (lifetime) exposure durations. HRLs or HBVs have not been defined for other PFC compounds at the time of this report.

The PFOA concentration in two of the groundwater samples collected during this scope of work exceeded the PFOA HRL of 300 ng/L: 1,330 ng/L PFOA was detected in the groundwater sample collected from Richfield B-2, and 458 ng/L PFOA was detected in the Richfield B-3 groundwater sample. PFOA was also
detected in the groundwater samples collected from Richfield B-1 and the Harmony and North St. Paul training areas, but at concentrations less than 300 ng/L.

None of the PFOS groundwater concentrations reported thus far met or exceeded the HRLs. PFOS was only detected in groundwater samples collected from the Harmony tree/brush dump fire foam training area, at concentrations of 8.33 ng/L in the Harmony B-1 groundwater sample and 6.74 ng/L in the Harmony B-2 groundwater sample. PFOS was not detected in groundwater samples collected from North St. Paul and Richfield. However, PFOS laboratory detection limits for the groundwater samples collected from B-2 and B-3 in Richfield were 183 ng/L and 133 ng/L respectively, likely due to the high concentrations of other PFC compounds in these samples. Thus, PFOS may have been present at concentrations less than these detection limits in Richfield B-2 and B-3.

PFBA was detected in all of the groundwater samples for which laboratory results have been received at this point, but all concentrations were below the lowest HBV of 7,000 ng/L. The highest PFBA concentrations thus far were detected in groundwater samples collected from Richfield B-2 and Richfield B-1, at concentrations of 1,240 ng/L and 1,070 ng/L, respectively.

5.0 GIS MAPPING OF FIRE TRAINING SITE AREAS

As part of the June 2008 and 2008 Addendum Reports, Delta generated a GIS layer illustrating the point locations of the (ranked) fire training sites where Class B firefighting foams are used repeatedly in training exercises. The layer was constructed using latitude and longitude coordinates for each fire station’s location provided by the MPCA. A data attribute table that was integrated with the GIS layer included fire foam use information for each training site, including the types and amounts of foam used in training, the frequency of foam training and the site risk ranking and criteria.

As part of the current scope of work the GIS layer was updated with latitude and longitude coordinates of the perimeter of the fire training areas and the boring locations, collected as described throughout Section 2.0. The updated GIS layer depicts training areas as polygons instead of points on the map.

The GIS layer is attached as Appendix S as an electronic file on a compact disc. Individual maps of the fire foam training sites at which site reconnaissance were conducted, excluding those sites where Class B foam has reportedly not been used in training exercises, are included in the individual site appendices.
6.0 CONCLUSIONS

PFCs were detected in all seven of the groundwater samples for which laboratory results have been received at this point, and in thirteen of twenty-three soil samples. The PFOA HRL was exceeded in the two groundwater samples collected from the Richfield fire foam training area located behind the Richfield Ice Arena. The PFOA HRL was not exceeded in the other five groundwater samples, and the PFOS HRL and the PFBA HBV were not exceeded in any of the groundwater samples thus far. None of the reported PFOA or PFOS soil concentrations received at the time of this report met or exceeded Tier 1 or Tier 2 SRVs.

The highest soil concentrations of PFC compounds thus far were identified in soil samples collected at the Burnsville and Richfield fire foam training areas. The last fire foam training event was held in 2004. The last foam training event was held approximately ten to fifteen years ago in Richfield. PFCs were detected at lower concentrations at the Harmony fire station training area, where the last foam training event was approximately ten to fifteen years ago. No PFCs were detected in soil samples collected from the Harmony tree/brush dump fire foam training area, where foam training has occurred approximately annually over the last two to three years. The Burnsville and Harmony Fire Departments trained with Ansul-brand AFFF, while the Richfield Fire Department used 3M-brand foam in training. Forthcoming soil data from the other fire foam training areas will aid in drawing conclusions regarding PFC concentrations in the soil and the length of time since the last discharge of firefighting foam at a site.

Based on soil results received thus far, no conclusions could be definitively drawn with regards to PFC concentrations and soil depth.

Based on laboratory data received at the time of this report, the shorter chain perfluorocarboxylic acids (PFBA, PFPeA, PFHxA, PFHpA and PFOA) were detected more often than the longer chain compounds (PFNA, PFDA, PFUnA and PFDa) in both soil and groundwater samples, but not necessarily at higher concentrations.

7.0 OUTSTANDING TASKS

The following tasks of the scope of work presented in Section 1.3 of this report remain to be completed: soil and groundwater sample collection at the Bemidji fire foam training area located at the Bemidji Regional Airport; groundwater sample collection from existing monitoring wells at the Marathon Refinery in St. Paul Park; and, sampling at the storm sewer outflow in Goodview. Once these three tasks are completed, and once the outstanding laboratory data is received for the sampling already completed at the Claremont, Kenyon, Luverne, Fridley, Rochester and MSP Airport fire foam training areas, a
comprehensive report that incorporates all of the information and data collected at the 21 select fire foam training areas will be prepared.
8.0 REMARKS

The conclusions contained in this report represent Delta's professional opinions based upon the currently available information and are arrived at in accordance with currently accepted professional standards. This report is based upon a specific scope of work requested by the client. The contract between Delta and its client outlines the scope of work, and only those tasks specifically authorized by that contract or outlined in this report were performed. This report is intended only for the use of Delta's client and anyone else specifically identified in writing by Delta as a user of this report. Delta will not and cannot be liable for unauthorized reliance by any other third party. Other than as contained in this paragraph, Delta makes no express or implied warranty as to the contents of this report.

Nancy Rodning
Project Geologist

Reviewed by:

Linda Opperman
Project Manager

John Estes
Project Manager
TABLES

Table 1  Soil Analytical Results, PFCs and TOC
Table 2  Groundwater Analytical Results, PFCs
<table>
<thead>
<tr>
<th>Sample ID</th>
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<th>Sample Date</th>
<th>Laboratory</th>
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**TABLE 1**

Soil Analytical Results, PFCs and TOC
Minnesota Fire Foam Training Areas
Delta Project No. 19382DEL0

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**Laboratory Report for Kenyon soil samples not yet received.**
Perfluorobutanoic acid (PFBA)

Perfluoro-n-pentanoic acid (PFPeA)

Perfluorohexanoic acid (PFHxA)

Perfluoroheptanoic acid (PFHpA)

Perfluorooctanoic acid (PFOA)

Perfluorononanoic acid (PFNA)

Perfluorodecanoic acid (PFDA)

Perfluoroundecanoic acid (PFUnA)

Perfluorododecanoic acid (PFDoA)

Perfluorobutanoic sulfonate (PFBS)

Perfluorohexane sulfonate (PFHxS)

Perflourooctane sulfonate (PFOS)

Perfluorooctane sulfonylamide (PFOSA)

Mean Total Organic Carbon (TOC)

TABLE 1
Soil Analytical Results, PFCs and TOC
Minnesota Fire Foam Training Areas
Delta Project No. 19382DEL0

ng/g

ng/g

ng/g

ng/g

ng/g

ng/g

ng/g

ng/g

ng/g

ng/g

ng/g

ng/g

ng/g

mg/kg

Sample ID

Sample
Depth

Sample
Date

Laboratory

Claremont B-1 SL 0-4'
Claremont B-1 SL 0-4'
Claremont B-1 SL 4-8'
Claremont B-1 SL 4-8'
Claremont B-2 SL 0-4'
Claremont B-2 SL 4-8'
Claremont B-3 SL 0-4'
Claremont B-3 SL 4-8'

0-4 ft.
0-4 ft.
4-8 ft.
4-8 ft.
0-4 ft.
4-8 ft.
0-4 ft.
4-8 ft.

5/15/2009
5/15/2009
5/15/2009
5/15/2009
5/15/2009
5/15/2009
5/15/2009
5/15/2009

Axys
MPI
Axys
MPI
Axys
Axys
Axys
Axys

Laboratory Report for Claremont soil samples not yet received.

Luverne B-1 SL 0-4'
Luverne B-1 SL 0-4'
Luverne B-1 SL 4-8'
Luverne B-1 SL 4-8'
Luverne B-2 SL 0-4'
Luverne B-2 SL 0-4'
Luverne B-2 SL 4-8'
Luverne B-2 SL 4-8'
Luverne B-3 SL 0-4'
Luverne B-3 SL 0-4'
Luverne B-3 SL 4-8'
Luverne B-3 SL 4-8'

0-4 ft.
0-4 ft.
4-8 ft.
4-8 ft.
0-4 ft.
0-4 ft.
4-8 ft.
4-8 ft.
0-4 ft.
0-4 ft.
4-8 ft.
4-8 ft.

5/22/2009
5/22/2009
5/22/2009
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5/22/2009
5/22/2009

Axys
MPI
Axys
MPI
Axys
MPI
Axys
MPI
Axys
MPI
Axys
MPI

Laboratory Report for Luverne soil samples not yet received.

Fridley B-1 SL 0-4'
Fridley B-1 SL 4-8'
Fridley B-2 SL 0-4'
Fridley B-2 SL 4-8'
Fridley B-3 SL 6"

0-4 ft.
4-8 ft.
0-4 ft.
4-8 ft.
0.5 ft.

5/27/2009
5/27/2009
5/27/2009
5/27/2009
5/27/2009

Axys
Axys
Axys
Axys
Axys

Laboratory Report for Fridley soil samples not yet received.

Rochester B-1 SL 0-4'
Rochester B-1 SL 4-8'
Rochester B-2 SL 0-4'
Rochester B-2 SL 4-8'

0-4 ft.
4-8 ft.
0-4 ft.
4-8 ft.

5/28/2009
5/29/2009
5/28/2009
5/29/2009

Axys
Axys
Axys
Axys

Laboratory Report for Rochester soil samples not yet received.

Notes:

Page 2 of 3


## TABLE 1
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Minnesota Fire Foam Training Areas
Delta Project No. 19382DEL0

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<th>Perfluorodecanoic acid (PFDA)</th>
<th>Perfluoroundecanoic acid (PFUnA)</th>
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ng/g: nanograms per gram, which is equivalent to parts per billion.
mg/kg: milligrams per kilogram, which is equivalent to parts per million.
PFC compounds soil results reported on a dry weight basis.
Axys: Axys Analytical Services LTD
MPI: MPI Research
**Bolded** type indicates detection above the laboratory method detection limit.
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Groundwater Analytical Results, PFCs
Minnesota Fire Foam Training Areas
Delta Project No. 19382DEL0

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<td>&lt; 91.4</td>
<td>&lt; 91.4</td>
<td>&lt; 91.4</td>
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<td>Axys</td>
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<td>888</td>
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<tr>
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<td>5/22/2009</td>
<td>Axys</td>
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<td>Axys</td>
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<td>5/22/2009</td>
<td>MPI</td>
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<td>Axys</td>
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<td>MSP Airport B-1 GW</td>
<td>5/29/2009</td>
<td>Axys</td>
<td>Laboratory Report for MSP Airport groundwater samples not yet received.</td>
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<td>Axys</td>
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</table>

Notes:
ng/L: nanograms per liter, which is equivalent to parts per trillion.
Axys: Axys Analytical Services LTD
MPI: MPI Research
Bolded type indicates detection above the laboratory method detection limit.
GRAPHS

Graph 1  PFC Concentrations in Soils, Minnesota Fire Foam Training Sites
Graph 2  Perfluorocarboxylic Acids Soil and Groundwater Concentrations, Minnesota Fire Foam Training Sites
Graph 3  PFC Concentrations in Groundwater, Minnesota Fire Foam Training Sites
GRAPH 1
PFC Concentrations in Soils
Minnesota Fire Foam Training Sites

Concentration (ng/g)
GRAPH 2
Perfluorocarboxylic Acids Soil and Groundwater Concentrations
Minnesota Fire Foam Training Sites

Concentration, ppb

Harmony B-1 SL 0-4'
Harmony B-1 SL 4-8'
Harmony B-1 GW
Harmony B-2 SL 0-4'
Harmony B-2 SL 4-8'
Harmony B-2 GW
No St Paul B-1 SL 0-4'
No St Paul B-1 SL 4-8'
No St Paul B-1 GW
No St Paul B-2 SL 0-4'
No St Paul B-2 SL 4-8'
No St Paul B-2 GW
Richfield B-1 SL 0-4'
Richfield B-1 SL 4-8'
Richfield B-1 GW
Richfield B-2 SL 0-4'
Richfield B-2 SL 4-8'
Richfield B-2 GW
Richfield B-3 SL 0-4'
Richfield B-3 SL 4-8'
Richfield B-3 GW
GRAPH 3
PFC Concentrations in Groundwater
Minnesota Fire Foam Training Sites

Concentration, ng/L

Harmony B-1 GW
Harmony B-2 GW
No St Paul B-1 GW
No St Paul B-2 GW
Richfield B-1 GW
Richfield B-2 GW
Richfield B-3 GW
APPENDIX A

Bemidji Fire Department Discussion and Supporting Documents
Background and Access – Bemidji Fire Foam Training Area

In May 2008 the Bemidji Fire Chief returned a completed firefighting foam use questionnaire indicating the Bemidji Fire Department’s use of 3M-brand Class B AFFF in training. A copy of the questionnaire is included in Appendix A. The training area where Class B AFFF is used in training exercises is at the Bemidji Regional Airport, as shown on Figure 1, Fire Foam Training Area Location, Bemidji, also included in Appendix A.

An access agreement was signed by the Executive Director of the Bemidji Regional Airport Authority and the MPCA, allowing access for a site reconnaissance and sampling at the fire foam training area. A copy of the access agreement is included in Appendix A.

Site Reconnaissance – Bemidji Fire Foam Training Area

Site reconnaissance of the Bemidji fire foam training area was conducted on May 8, 2009. Delta representative Curt McKay was accompanied by the Bemidji Fire Chief. The Fire Chief was interviewed to verify the types and amounts of Class B foam used in training, training practices, and any other known significant releases of Class B foam by the department. The Fire Chief confirmed that approximately five gallons of 3M-brand Class B AFFF is utilized annually in training at the Bemidji Airport training area. He was not aware of any other large fires where significant quantities of Class B foam were used by the Bemidji Fire Department.

The Bemidji Fire Chief indicated a grassy area in front (northeast) of the Bemidji Airport fire department building where training with Class B AFFF takes place. Spent foam is collected into the airport’s glycol recovery system via several storm sewer grates present in the training area. The storm grates are connected to two 10,000-gallon capacity concrete tanks that are situated beneath the grates. However, it appears that spent foam may also break down at the surface and be absorbed into the soil. According to the Bemidji Regional Airport Manager, the glycol recovery tanks were installed approximately three years ago, and are pumped out approximately twice a year. Photos of the fire foam training area taken during the site reconnaissance are included in Appendix A. The training area is shown on the figure Bemidji Fire Department Fire Foam Training Area, which is included in Appendix A.

Sample Collection – Bemidji Fire Foam Training Area

While Delta recommends soil and groundwater sampling at the Bemidji fire foam training area, the sampling was not completed as part of this scope of work. As per Federal Aviation Regulations (FAR) Part 77.13, an air space permit issued by the Federal Aviation Administration (FAA) is required if airspace is crossed at varying heights in and around varying areas of an airport. Due to the height of the push probe drill tower, further assessment as to the need for a FAA permit under FAR 77.13 is needed. Due to the up coming end of the 2009 fiscal year for the State of Minnesota, there was insufficient time to complete this task.
FIGURE 1
FIRE FOAM TRAINING AREA LOCATION
BEMIDJI REGIONAL AIRPORT
BEMIDJI, MINNESOTA

LEGEND:
• Well Locations

SITE
Wellhead Protection Area

PROJECT NO. 19382DEL
PREPARED BY NR
DRAWN BY DD
DATE 5/12/09
REVIEWED BY
FILE NAME
Bemidji−1
Legend
- Foam Training Area
- Boring Location

0 50 100 200 300 400 Feet

Bemidji Fire Department
Fire Foam Training Area
Bemidji Regional Airport
Bemidji, MN
1. Does your Department currently or has your Department historically used Class A or Class B foams for firefighting operations?
   - Yes - Proceed to Question 2
   - No - Sign the back of this form and return to Delta Consultants

2. How often is Class B or Class A foam used in response to fire calls?
   - 0-25% of fires
   - 25-50% of fires
   - 75-100% of fires

3. Does the Department have a compressed air foam system (CAFS) with a built-in tank on its engine(s)?
   - Yes
   - No

4. How often is foam used in training exercises?
   - Weekly
   - Monthly
   - Quarterly
   - Semi-Annually
   - Annually
   - Bi-Annually
   - Other (please specify):

5. How much foam is used per training event?
   - Less than 5 gallons
   - 5 gallons
   - 5 to 10 gallons
   - More than 10 gallons (please specify):

6. In training, where does the spent foam go?
   - Storm Sewer
   - Sanitary Sewer
   - On-Site Septic
   - Ground
   - Other (please describe):

7. Where does/did the training take place? Please include address, intersection or other specific location information for current and past training areas.

   Meadow Ave
   Railroad St
8. What type(s) and brand(s) of foam are or were used now and in the past by the Department, both for fire response and in training (if applicable)? Please check all that apply.

<table>
<thead>
<tr>
<th>Type of Foam</th>
<th>Brand of Foam</th>
<th>Used in Training?</th>
<th>Amount Used Annually</th>
<th>Current Use or Historic Use?</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Yes</td>
<td>5 gal</td>
<td>Current</td>
</tr>
<tr>
<td>Class B Alcohol-Resistant (AR)-AFFF</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Class B Protein</td>
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<td></td>
</tr>
<tr>
<td>Class B Fluoroprotein (FP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Film-Forming Fluoroprotein (FFF)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B AR-FFF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class A-B Hi Expansion Foam</td>
<td>Silver</td>
<td>Yes</td>
<td>15 gal</td>
<td>Current</td>
</tr>
<tr>
<td>Class A Training Foam</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Thank you for your time and cooperation. Please contact Nancy Rodning at Delta Consultants (651-697-5152 or nrodnings@deltaenv.com) or Jim Stockinger at the Minnesota Pollution Control Agency (651-297-8666 or jim.stockinger@state.mn.us) if you have any questions regarding this questionnaire.

*Please return this questionnaire to Delta Consultants by May 9, 2008 in the enclosed stamped, self-addressed envelope.*

Questionnaire completed by:

Dick Sathers, Chief

Name and Title: Bemidji Fire Department

Phone Number: 218-751-8001

Date: 5-8-08

E-Mail Address: Xinogen
ACCESS AGREEMENT BETWEEN
THE MINNESOTA POLLUTION CONTROL AGENCY
AND THE BEMIDJI-BELTRAMI COUNTY AIRPORT COMMISSION

The Minnesota Pollution Control Agency (MPCA) is investigating firefighting training sites where Class B foams have been or are being utilized. The site reconnaissance and investigation will be conducted at the following site owned and operated by Bemidji-Beltrami County Airport Commission where firefighting training with Class B foams occurs:

Bemidji Regional Airport
Bemidji, Minnesota

The Property Owner hereby consents and authorizes the MPCA, its employees, agents and contractors, to enter this property for the purpose of performing reasonable and necessary investigations in response to the use of Class B firefighting foams that may or may not contain perfluorocarbons (PFCs). The MPCA is authorized to take these actions under Minn. Stat. § 115C.03, subd. 7 (2002).

The MPCA will notify the Property Owner at least 48 hours before entering the property. Work will be conducted during regular business hours (8:00 a.m. to 5:00 p.m.) unless the MPCA receives permission to and arrangements are made to conduct work during different hours. The MPCA will conduct its activities so as to minimize interference with the use of the property. If any portion of the property is disturbed as a result of the MPCA's sampling activities, the MPCA will restore the property as close to its original condition as is reasonably possible under the circumstances. The Property Owner will take reasonable precautions to ensure that the equipment of the MPCA and its contractors on the property is not damaged, and that the work being conducted by the MPCA, its employees, agents and contractors is not disrupted.

The MPCA will obtain all necessary permits for installation of soil borings and temporary monitoring wells, if such wells are installed. Upon completion of soil and/or groundwater sampling, the MPCA will seal the borings and monitoring wells in accordance with state law. Results of all testing conducted on the property will be provided to the Property Owner.

The MPCA shall be liable for injury to or loss of property, or personal injury or death, caused by an act or omission of any employee of the state in the performance of the work described above, under the circumstances where the state, if a private person, would be liable to the claimant, in accordance with Minn. Stat. § 3.736.

MINNESOTA POLLUTION CONTROL AGENCY

[Signature]
Title
Date

Bemidji Regional Airport Authority

[Signature]
Title
Date
Photograph 1
View of the grassy fire foam training area, located in front (northeast) of the airport fire station, view facing northeast.

Photograph 2
Catch basins for the airport’s glycol collection system are located in the fire foam training area.
APPENDIX B

Brooklyn Center Fire Department Discussion and Supporting Documents
Background and Access – Brooklyn Center Fire Foam Training Areas

In the summer of 2008, the Brooklyn Center Fire Department returned a partially-completed firefighting foam use questionnaire indicating their use of firefighting foam in training. A copy of the questionnaire is included in Appendix B. In a follow-up telephone conversation with the Brooklyn Center Fire Chief, he indicated that while the department currently does not train with firefighting foam, they had historically trained at both fire stations with foam, mainly Class A and some Class B foam. The Fire Chief did not know if the Class B foam was (regular) AFFF or alcohol resistant AFFF (AR-AFFF); he believed the foam was 3M-brand.

The City of Brooklyn Center utilizes two fire foam training areas, both located in Brooklyn Center, Minnesota: Fire Station 1 is located at 6250 Brooklyn Boulevard and Fire Station 2 is located at 650 Dupont Avenue North. An access agreement was signed by the Brooklyn Center Fire Chief and the MPCA, allowing access for a site reconnaissance and sampling at both training areas. A copy of the access agreement is included in Appendix B.

Site Reconnaissance – Brooklyn Center Fire Foam Training Areas

Site reconnaissance of both Brooklyn Center fire foam training areas were conducted on March 20, 2009. Delta representative Nancy Rodning and MPCA Project Manager Nile Fellows were accompanied by the Brooklyn Center Fire Chief. The Fire Chief was interviewed to verify the types and amounts of foam used in training, training practices, and any known significant releases of Class B foam by the department. The Fire Chief stated that the Brooklyn Center Fire Department has not trained with Class B foam at either of the identified fire foam training areas since 2002 when he joined the Brooklyn Center fire department and that only Class A foam has been used for training. Further, the Fire Chief questioned the previous fire chief and other chief officers, and they also stated that Class B foams have not been used for training purposes. The Fire Chief indicated that training with Class B foam related previously on their questionnaire was incorrect.

Based on information gathered during the site reconnaissance that indicates Class B foam is not currently nor was historically used in training exercises, the Brooklyn Center fire foam training areas are not considered a source of PFCs at this time. Therefore, GIS maps of the training areas were not created, and soil or ground water sampling was not conducted at the Brooklyn Center fire foam training areas as part of this scope of work.

The Brooklyn Center Fire Chief related that the department responded to a hangar fire at the Crystal Airport in 2006. While the Brooklyn Center Fire Department did not utilize Class B foam at the fire, the Fire Chief had no knowledge as to foam used by other responding departments.
1. Does your Department currently or has your Department historically used Class A or Class B foams for firefighting operations?
   - [X] Yes - Proceed to Question 2
   - [ ] No - Sign the back of this form and return to Delta Consultants

2. How often is Class B or Class A foam used in response to fire calls?
   - [X] 25-50% of fires
   - [ ] 0-25% of fires
   - [ ] 75-100% of fires

3. Does the Department have a compressed air foam system (CAFS) with a built-in tank on its engine(s)?
   - [X] Yes
   - [ ] No

4. How often is foam used in training exercises?
   - [X] Quarterly
   - [ ] Semi-Annually
   - [ ] Annually
   - [ ] Bi-Annually
   - [ ] Other (please specify):

5. How much foam is used per training event?
   - [X] 5 to 10 gallons
   - [ ] Less than 5 gallons
   - [ ] More than 10 gallons (please specify):

6. In training, where does the spent foam go?
   - [X] Storm Sewer
   - [ ] Sanitary Sewer
   - [ ] On-Site Septic
   - [X] Ground
   - [ ] Other (please describe):

7. Where does/did the training take place? Please include address, intersection or other specific location information for current and past training areas.
   - [ ] Fire Station #1
     - 6250 Brooklyn Blvd
     - Brooklyn Park
   - [ ] Fire Station #2
     - 6500 Dupont Ave N

[Signature]

Xinogen
5910 Rice Creek Parkway Suite 100 St. Paul, MN 55126 USA
Phone: 651.639.9449 / 800.477.7411 Fax: 651.639.9473 www.deltaenv.com
8. What type(s) and brand(s) of foam are or were used now and in the past by the Department, both for fire response and in training (if applicable)? Please check all that apply.

<table>
<thead>
<tr>
<th>Type of Foam</th>
<th>Brand of Foam</th>
<th>Used in Training? Yes or No</th>
<th>Amount Used Annually</th>
<th>Current Use or Historic Use?</th>
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</thead>
<tbody>
<tr>
<td>Class B Aqueous Film-Forming Foam (AFFF)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Alcohol-Resistant (AR)-AFFF</td>
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</tr>
<tr>
<td>Class B Protein</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Fluoroprotein (FP)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Film-Forming Fluoroprotein (FFFP)</td>
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<tr>
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<td>Class A-B Hi Expansion Foam</td>
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<tr>
<td>Class A Training Foam</td>
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<tr>
<td>Other</td>
<td></td>
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</tr>
</tbody>
</table>

Thank you for your time and cooperation. Please contact Nancy Rodning at Delta Consultants (651-697-5152 or nrodnig@deltaeqv.com) or Jim Stockinger at the Minnesota Pollution Control Agency (651-297-8666 or jim.stockinger@state.mn.us) if you have any questions regarding this questionnaire.

*Please return this questionnaire to Delta Consultants by May 9, 2008 in the enclosed stamped, self-addressed envelope.*

Questionnaire completed by:

Name and Title

(Brooklyn Center) Fire Department

Phone Number    Date

E-Mail Address

Xinogen
Date 1-21-09
Time 10:20

Person
Incoming □
Outgoing □
Fire Chief, Lee Grafhin

Phone 763-503-3100
Project No. 124

Project Name/Location Brooklyn Center

Contacted by Nancy

Participants

Subject Safe Video

Notes

VM VM
1/2 8:40 AM VM

Now decide on focus in training, used to issue, too expensive. Bar type, mostly closed, some closed. Not sure. AP-Aff or Aff

Used to train at Fire Station 1 and 2 or indicated on Survey.

Send out new award for new year. 1/2

2/3 20
Minnesota Pollution Control Agency

ACCESS AGREEMENT BETWEEN
THE MINNESOTA POLLUTION CONTROL AGENCY
AND CITY OF BROOKLYN CENTER, MINNESOTA

The Minnesota Pollution Control Agency (MPCA) is investigating firefighting training sites where Class B foams have been or are being utilized. The site reconnaissance and investigation will be conducted at the following firefighting training sites owned by the City of Brooklyn Center and utilized by the Brooklyn Center Fire Department:

Brooklyn Center Fire Station #1, 6250 Brooklyn Boulevard
Brooklyn Center Fire Station #2, 6500 Dupont Avenue North

The Property Owner hereby consents and authorizes the MPCA, its employees, agents and contractors, to enter these properties for the purpose of performing reasonable and necessary investigations in response to the use of Class B firefighting foams that may or may not contain perfluorocarbons (PFCs). The MPCA is authorized to take these actions under Minn. Stat. § 115C.03, subd. 7 (2002).

The MPCA will notify the Property Owner at least 48 hours before visiting the properties. Work will be conducted during regular business hours (8:00 a.m. to 5:00 p.m.) unless the MPCA receives permission to and arrangements are made to conduct work during different hours. The MPCA will conduct its activities so as to minimize interference with the use of the properties. If any portion of the properties must be disturbed as a result of the MPCA's activities, the MPCA will restore the property as close to its original condition as is reasonably possible under the circumstances. The Property Owner will take reasonable precautions to ensure that the equipment of the MPCA and its contractors on the properties is not damaged, and that the work being conducted by the MPCA, its employees, agents and contractors is not disrupted.

The MPCA will obtain all necessary permits for installation of soil borings and temporary monitoring wells, if such wells are installed. Upon completion of sampling, the MPCA will seal the borings and monitoring wells in accordance with state law. Results of all testing conducted on the properties will be provided to the Property Owner.

The MPCA shall be liable for injury to or loss of property, or personal injury or death, caused by an act or omission of any employee of the state in the performance of the work described above, under the circumstances where the state, if a private person, would be liable to the claimant, in accordance with Minn. Stat. § 3.736.

MINNESOTA POLLUTION CONTROL AGENCY

[Signature]

Title

Date: 3/10/09

City of Brooklyn Center

[Signature]

Title

Date: 3/11/09

TOTAL P.003
APPENDIX C

Burnsville Fire Department Discussion and Supporting Documents
Background and Access – Burnsville Fire Foam Training Area

The Burnsville Fire Department Assistant Fire Chief returned a completed firefighting foam use questionnaire to Delta in May 2008, indicating the departments’ use of Ansul-brand AFFF and AR-AFFF in annual training exercises conducted at the ABLE Fire Training Center in Burnsville. The ABLE Fire Training Center is jointly owned by the cities of Apple Valley, Burnsville, Lakeville and Eagan. A copy of the questionnaire returned by the Burnsville Fire Department is included in Appendix C.

The ABLE Fire Training Center is located at the southeast corner of the intersection of Cliff Road and River Ridge Boulevard in Burnsville; the location of the training center is shown on Figure 1, Fire Foam Training Area Location, Burnsville ABLE Fire Training Center, included in Appendix C. An access agreement was signed by the Burnsville Assistant Fire Chief and the MPCA, allowing access for a site reconnaissance and sampling at the ABLE Fire Training Center. A copy of the access agreement is included in Appendix C.

As presented in Delta’s April 2009 report, the inferred groundwater flow direction in the area of the Burnsville Fire Station area is to the north-northwest, with the water table expected at an approximate depth of 10 feet below grade.

Site Reconnaissance – Burnsville Fire Foam Training Area

Site reconnaissance of the ABLE Fire Training Center was conducted on March 31, 2009. Delta representative Nancy Rodning was accompanied by the Assistant Fire Chief and the Training Captain of the Burnsville Fire Department. They related that the Burnsville Fire Department trained with Class B foam approximately three times since the fire training center was built in 1989, and that they last trained with Class B foam at the training center in 2004. The Assistant Fire Chief and the Training Captain confirmed that five to ten gallons of foam concentrate are used per event. They showed Delta personnel where the fire foam was discharged into a grassy and wooded area beyond the west end of the training center parking lot. No burn pans or live fire were utilized in the training exercises. Spent foam is allowed to break down and dissipate in this area. Photographs of the area where Class B foam was discharged are included in Appendix C.

Delta recorded GPS locations of the corners of the foam training areas using a hand-held GPS unit with an accuracy of approximately 15 feet. The training area is shown on the figure Fire Foam Training Area, ABLE Fire Training Center, which is included in Appendix C. Surface drainage from the foam training area is down a hill toward the north.
A municipal well building was observed during the site reconnaissance, located approximately 325 feet to the northeast of the foam training area. No other potential community water supply systems such as those typically associated with rest stops, trailer parks, etc., were observed within 1/4-mile of the training areas. Nearby water wells identified via a search of the MDH CWI are shown on Fire Foam Training Area Location, Burnsville ABLE Fire Training Center, and are described on the Site Summary included in the April 2009 Report.

Locations for soil borings in the fire foam training area were discussed during the site reconnaissance.

Sample Collection – Burnsville Fire Foam Training Area

On April 24, 2009, two soil borings were advanced within the fire foam training area. Soil boring locations are shown on the figure Fire Foam Training Area, ABLE Fire Training Center, included in Appendix C. Soil borings were advanced by West Central Environmental Consultants using push probe drilling technology, under the oversight of Delta personnel. Soil samples were collected continuously and logged onto soil boring logs. Soil boring logs detailing soil descriptions, boring depths, and the GPS locations of the borings are included in Appendix C.

Borings B-1 and B-2 were advanced within the fire foam training area to depths of 27 and 18 feet below grade surface (bgs), respectively, where drill refusal presumably due to bedrock was experienced. Soils encountered in borings in B-1 and B-2 varied between the borings. In boring B-1 soils consisted of 2 feet of topsoil over 1.75 feet of black sandy silt, underlain by sand to the bottom of the boring. Soils in B-2 were comprised of 3.5 feet of top soil over black silt or silty sand to a depth of 8 feet bgs, followed by a one-foot thick clay seam and sand to the boring terminus. No staining, foul or unusual odors were noted in the soils. Soils were slightly moist to moist starting in the silty soils. Temporary wells with five-foot screens were placed in the borings to allow for accumulation and sampling of ground water, however, groundwater did not accumulate. The borings were grouted and sealed in accordance with applicable MDH requirements.

Soil samples were collected from the borings for laboratory analysis as described in Section 1.3 (Task 3) of the main body of the report.

Soil Sampling Results – Burnsville Fire Foam Training Area

Laboratory analysis detected PFC compound concentrations in soil samples collected from the Burnsville Fire Department's fire foam training area as listed in the table below. All soil sample results, including non-detect results, are summarized in Table 1, Soil Analytical Results, PFCs and TOC, of this report. A copy of the laboratory report with the chain-of-custody record is included in Appendix C.
<table>
<thead>
<tr>
<th>Soil Boring</th>
<th>Sample Depth</th>
<th>Compound Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-4 feet</td>
<td>1.73 ng/g PFBA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.32 ng/g PFPeA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.27 ng/g PFHxA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6.72 ng/g PFHpA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11.4 ng/g PFOA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10.2 ng/g PFNA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.37 ng/g PFDA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.537 ng/g PFUnA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.542 ng/g PFDoA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.63 ng/g PFHxS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>102 ng/g PFOS</td>
</tr>
<tr>
<td>B-1</td>
<td>4-8 feet</td>
<td>0.132 ng/g PFBA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.54 ng/g PFPeA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.77 ng/g PFHxA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8.46 ng/g PFHpA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14.8 ng/g PFOA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11 ng/g PFHxS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.62 ng/g PFOS</td>
</tr>
<tr>
<td>B-2</td>
<td>0-4 feet</td>
<td>0.796 ng/g PFBA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.08 ng/g PFPeA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.69 ng/g PFHxA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.05 ng/g PFHpA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.78 ng/g PFOA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.92 ng/g PFNA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.8 ng/g PFOS</td>
</tr>
<tr>
<td>B-2</td>
<td>4-8 feet</td>
<td>1.83 ng/g PFBA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.81 ng/g PFPeA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.97 ng/g PFHxA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.14 ng/g PFHpA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.355 ng/g PFOA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.2 ng/g PFHxS</td>
</tr>
</tbody>
</table>

ng/g = nanograms per gram, which is equivalent to parts per billion (ppb).
The MPCA Tier 1 Residential and Tier 2 Recreational SRVs for PFOS and PFOA are 2,000 ng/g and 4,000 ng/g, respectively. The Tier 2 Industrial SRVs for PFOS and PFOA are 12,000 ng/g and 23,000 ng/g. None of the detected soil concentrations in the Burnsville soil samples met or exceeded any of the MPCA SRVs.

**Discussion and Conclusion – Burnsville Fire Foam Training Area**

Based on information provided by the Burnsville Fire Department Assistant Fire Chief and the Training Officer, approximately 15 to 30 gallons of Ansul-brand AR-AFFF was discharged by the Burnsville Fire Department at the fire foam training area from 1989 through 2004. According to firefighting foam questionnaires returned by other municipal fire departments with joint ownership of the ABLE Fire Training Center, the other fire departments have not trained with Class B AFFF at the training center. The Apple Valley Fire Department reported that they train with Angus-brand Class B AFFF at their fire station #1 and at the Apple Valley Central Maintenance Facility. The Lakeville Fire Department reported that they train with Class B AFFF every other year at various places; the Lakeville Fire Chief was unsure as to the brand of AFFF utilized by the department. The Eagan Fire Department indicated that only Class A foam is utilized by the department. Thus, barring another source of PFCs in the soils at the Burnsville fire foam training area, it appears that the discharge of fire foam at the site resulted in the release of PFCs to the soil and that the PFCs have remained in the soils for approximately five years.

It was expected that the breakdown or degradation of only AFFF manufactured by 3M using their electrochemical fluorination (ECF) process would result in the release of PFOS. Yet PFOS was detected in three of the four soil samples. There has been no reported use of 3M-brand AFFF at the ABLE fire training center. Additional interviews with users of the ABLE Fire Training Center may help identify the source of PFOS at the site.

In analyzing PFC compound concentrations and sample depths, Delta makes the following observations:

- No trends are apparent in comparing shallow versus deep soil sample results (see **Graph A, Soil Depth vs. PFC Compound Concentration** included in **Appendix C**). It can not be said that concentrations were higher or lower in either the shallower or deeper soil samples.
- The shorter chain perfluorocarboxylic acids (PFBA, PFPeA, PFHxA, PFHpA and PFOA) were detected more often than the longer chain compounds (PFNA, PFDA, PFUnA and PFDoA), and the longer chain compounds were only detected in the shallow soil samples. The trend is apparent in **Graph 1**.
- No trends are apparent between the shorter and longer chain perfluorosulfonates (PFBS, PFHxS, and PFOS).
- No trends are apparent between PFC compound concentrations and TOC concentrations. As expected, TOC concentrations are higher in the shallower soil samples.
1. Does your Department currently or has your Department historically used Class A or Class B foams for firefighting operations?
   
   ☒ Yes - Proceed to Question 2
   
   ☐ No - Sign the back of this form and return to Delta Consultants

2. How often is Class B or Class A foam used in response to fire calls?
   
   ☐ 0-25% of fires  ☐ 25-50% of fires  ☒ 75-100% of fires

3. Does the Department have a compressed air foam system (CAFS) with a built-in tank on its engine(s)?
   
   ☐ Yes  ☒ No

4. How often is foam used in training exercises?
   
   ☐ Weekly  ☒ Monthly  ☐ Quarterly
   
   ☐ Semi-Annually  ☐ Annually  ☐ Bi-Annually
   
   ☐ Other (please specify):

5. How much foam is used per training event?
   
   ☒ Less than 5 gallons  ☐ 5 gallons  ☐ 5 to 10 gallons
   
   ☐ More than 10 gallons (please specify):

6. In training, where does the spent foam go?
   
   ☒ Storm Sewer  ☐ Sanitary Sewer  ☐ On-Site Septic
   
   ☐ Other (please describe):

7. Where does/did the training take place? Please include address, intersection or other specific location information for current and past training areas.
   
   Majority of training facility jointly owned by Burnsville, Apple Valley, Eagan & Lakeville. Located at intersection of Chief Road and River Ridge Blvd. in Burnsville.

---

5910 Rice Creek Parkway Suite 100 St. Paul, MN 55126 USA
Phone: 651.639.9449 / 800.477.7411 Fax: 651.639.9473 www.deltaenv.com
QUESTIONNAIRE
Firefighting Foam Use in Fire Training

8. What type(s) and brand(s) of foam are or were used now and in the past by the Department, both for fire response and in training (if applicable)? Please check all that apply.

<table>
<thead>
<tr>
<th>Type of Foam</th>
<th>Brand of Foam</th>
<th>Used in Training?</th>
<th>Amount Used Annually</th>
<th>Current Use or Historic Use?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class B Aqueous Film-Forming Foam (AFFF)</td>
<td>Amerifluid AFFF/ATC 3/6</td>
<td>yes</td>
<td>60 gal</td>
<td>current</td>
</tr>
<tr>
<td>Class B Alcohol-Resistant (AR)-AFFF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Protein</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Fluoroprotein (FP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Film-Forming Fluoroprotein (FFFP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B AR-FFFP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class A-B Hi Expansion Foam</td>
<td>Silvex</td>
<td>yes</td>
<td>140 gal</td>
<td>current</td>
</tr>
<tr>
<td>Class A Training Foam</td>
<td>Ansul (Form MAC Fire)</td>
<td>yes</td>
<td>55 gal</td>
<td>historic</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Thank you for your time and cooperation. Please contact Nancy Rodning at Delta Consultants (651-697-5152 or nrodnig@deltaenv.com) or Jim Stockinger at the Minnesota Pollution Control Agency (651-297-8666 or jim.stockinger@state.mn.us) if you have any questions regarding this questionnaire.

Please return this questionnaire to Delta Consultants by May 9, 2008 in the enclosed stamped, self-addressed envelope.

Questionnaire completed by:

Dan Hove, Asst. Chief

Burnsville

Fire Department

952 895 4522

Phone Number

Dan.Hove@ci.burnsville.mn.us

E-Mail Address
ACCESS AGREEMENT BETWEEN
THE MINNESOTA POLLUTION CONTROL AGENCY
AND CITY OF BURNVILLE, MINNESOTA

The Minnesota Pollution Control Agency (MPCA) is investigating firefighting training sites where Class B foams have been or are being utilized. The site reconnaissance and investigation will be conducted at the following firefighting training site owned wholly or in part by the City of Burnsville and utilized by the Burnsville Fire Department:

ABLE (Apple Valley, Burnsville, Lakeville, Eagan) Training Center located near Cliff Rd. and River Ridge Blvd., Burnsville, Minnesota

The Property Owner hereby consents and authorizes the MPCA, its employees, agents and contractors, to enter this property for the purpose of performing reasonable and necessary investigations in response to the use of Class B firefighting foams that may or may not contain perfluorocarbons (PFCs). The MPCA is authorized to take these actions under Minn. Stat. § 115B.17, subd. 4 and 115.04, subd. 3.

The MPCA will notify the Property Owner at least 48 hours before entering the property. Work will be conducted during regular business hours (8:00 a.m. to 5:00 p.m.) unless the MPCA receives permission to and arrangements are made to conduct work during different hours. The MPCA will conduct its activities so as to minimize interference with the use of the property. If any portion of the property must be disturbed as a result of the MPCA's activities, the MPCA will restore the property as close to its original condition as is reasonably possible under the circumstances. The Property Owner will take reasonable precautions regarding its own conduct and the conduct of its employees, agents and contractors on the property to avoid damage to the equipment of the MPCA and its contractors, and to avoid disrupting the work being conducted on the property by the MPCA, its employees, agents and contractors is not disrupted.

The MPCA will obtain all necessary permits for installation of soil borings and temporary monitoring wells, if such wells are installed. Upon completion of sampling, the MPCA will seal the borings and monitoring wells in accordance with state law. Results of all testing conducted on the property will be provided to the Property Owner. This access agreement shall expire on August 30, 2009.

The MPCA shall be liable for injury to or loss of property, or personal injury or death, caused by an act or omission of any employee of the state in the performance of the work described above, under the circumstances where the state, if a private person, would be liable to the claimant, in accordance with Minn. Stat. § 3.736.

Proof of insurance shall be provided to the City of Burnsville for $2 million minimum liability insurance; the Cities of Burnsville, Apple Valley, Eagan, and Lakeville be named as additional insureds for the project.

MINNESOTA POLLUTION CONTROL AGENCY

Signature

Supervisor

Title

Date

City of Burnsville

Signature

Assistant Fire Chief

Title

Date
**CERTIFICATE OF LIABILITY INSURANCE**

**PRODUCER**
877-945-7378
Willis HRH
26 Century Blvd.
P. O. Box 305191
Nashville, TN 37220-5191

**INSURED**
Delta Environmental Consultants, Inc.
DBA Delta Consultants
5510 Rice Creek Parkway, Ste 100
Shoreview, MN 55126

**INSCRIBER AFFORDING COVERAGE**
NAIC# 19410-901
INSURER: Commerce and Industry Insurance Company
INSURER B:
INSURER C:
INSURER D:
INSURER E:

**COVERAGES**

The Policies of Insurance listed below have been issued to the Insured named above for the Policy period indicated. Notwithstanding any requirement, term or condition of any contract or other document with respect to which this Certificate may be issued or may pertain, the Insurance afforded by the Policies described herein is subject to all the terms, exclusions and conditions of such policies. Aggregate limits shown may have been reduced by paid claims.

<table>
<thead>
<tr>
<th>INSURED APP.</th>
<th>TYPE OF INSURANCE</th>
<th>POLICY NUMBER</th>
<th>POLICY EFFECTIVE DATE</th>
<th>POLICY LIMITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>GENERAL LIABILITY</td>
<td>GL178814</td>
<td>10/1/2008</td>
<td>10/1/2009</td>
</tr>
</tbody>
</table>

**LIMITS**

- EACH OCCURRENCE: $1,000,000
- DAMAGE TO RENTED PROPERTY: $500,000
- MEDICAL (Per person): $5,000
- PERSONAL & ADJUDICATORY: $1,000,000
- GENERAL AGGREGATE: $2,000,000
- PRODUCTS & COMPCP AGG: $2,000,000

**PROPERTY**

- AUTOMOBILE LIABILITY
- ANY AUTO
- ALLOWED AUTOS
- SCHEDULED AUTOS
- HIRED AUTOS
- NON-OWNED AUTOS

- GARAGE LIABILITY
- ANY AUTO

- EXCESS UMBRELLA LIABILITY
- OCCUR CLAIMS MADE

- WORKERS COMPENSATION
- EMPLOYER'S LIABILITY

- DY: CONFIDENCE MEMBER

**DESCRIPTION**

Re: Site Access for work performed at ABLE (Apple Valley, Burnsville, Lakeville Ragan) Training Center located near Cliff Road and River Ridge Blvd in Burnsville, MN on behalf of the MPCA.

It is agreed that Cities of Burnsville, Apple Valley, Ragan and Lakeville are included as Additional Insureds as respects to General Liability when required by written contract, agreement or permit.

**CERTIFICATE HOLDER**
Burnsville Fire Department
Attn: Dan Hove, Assistant Fire Chief
10 Civic Center Parkway
Burnsville, MN 55337

**CANCELLATION**

Should any of the above described policies be cancelled before the expiration date thereof, the issuing insurer will endeavor to mail 30 days written notice to the certificate holder named to the left, but failure to do so shall impose no obligation or liability of any kind upon the insurer, its agents or representatives.

Authorized Representative

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IMPORTANT

If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

DISCLAIMER

This Certificate of Insurance does not constitute a contract between the issuing insurer(s), authorized representative or producer, and the certificate holder, nor does it affirmatively or negatively amend, extend or alter the coverage afforded by the policies listed thereon.
Photograph 1
Fire foam is sprayed from the edge of the asphalt into the wooded area. View facing northwest. Stakes mark the soil boring location: B-1 is at left, and B-2 is at right in the grassy area.

Photograph 2
View of the fire foam training area (at left) facing north. Runoff from the fire foam training area would drain downhill to the north.
**ENVIRONMENTAL BORING LOG**

**BORING ID:** B-1  
**TOTAL DEPTH:** 27’

### PROJECT INFORMATION
- **Project:** PFC’s in Fire Fighting Foam  
- **Site Location:** Burnsville, MN  
- **Job No.:** 19382DEL04  
- **Logged By:** Curt McKay  
- **Weather:** Partly Cloudy  
- **Date Completed:** 4/24/09  
  
- **Water Level During Drilling:** Dry

### DRILLING INFORMATION
- **Drilling Co.:** West Central Environmental Consultants  
- **Drill Crew Chief:**  
- **Rig Type:** Truck-Mounted Geoprobe  
- **Method of Drilling:** Direct Push Probe  
- **Soil Sampling Method:** 4’ samplers with liners  
- **Surface Elevation (feet):** NA  
- **Field Screening Instrument:** None

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>LITHOLOGY</th>
<th>DESCRIPTION</th>
<th>USCS</th>
<th>LAB SAMP.</th>
<th>PID ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>TOPSOIL</td>
<td>Grass and topsoil. Top 5 ft hand augered.</td>
<td>PT</td>
<td>SM</td>
<td>NA</td>
</tr>
<tr>
<td>2</td>
<td>SANDY SILT</td>
<td>Black sandy silt, moist.</td>
<td>GW</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>3.75</td>
<td>GRAVEL AND SAND</td>
<td>Brown medium sand and gravel, moist.</td>
<td>SW</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>4.00</td>
<td>SAND</td>
<td>Brown medium-fine sand, dry/loose.</td>
<td>SW</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>8.00</td>
<td>SAND</td>
<td>Brown fine sand, dry/loose.</td>
<td>SW</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>10.50</td>
<td>SAND</td>
<td>Brown medium-fine sand, slightly moist.</td>
<td>SW</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>12.00</td>
<td>SAND</td>
<td>Brown medium-fine sand, moist to slightly moist.</td>
<td>SW</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>19.75</td>
<td>SANDY CLAY</td>
<td>Brown sandy clay, fine.</td>
<td>CL</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>19.85</td>
<td>SAND</td>
<td>Brown medium sand, slightly moist.</td>
<td>SW</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>24.00</td>
<td>SAND</td>
<td>Brown medium-fine sand, slightly moist to dry.</td>
<td>SW</td>
<td>NA</td>
<td></td>
</tr>
</tbody>
</table>

**Comments:** Refusal and E.O.B. at 27’.  
**Boring Location:** 44 46.859’ N / 93 16.906’ W
**PROJECT INFORMATION**

- **Project:** PFC's in Fire Fighting Foam
- **Site Location:** Burnsville, MN
- **Job No.:** 19382DEL04
- **Logged By:** Curt McKay
- **Date Completed:** 4/24/09
  - **Weather:** Partly Cloudy
  - **Water Level During Drilling:** Dry

**DRILLING INFORMATION**

- **Drilling Co.:** West Central Environmental Consultants
- **Drill Crew Chief:** NA
- **Rig Type:** Truck-Mounted Geoprobe
- **Method of Drilling:** Direct Push Probe
- **Soil Sampling Method:** 4' samplers with liners
- **Surface Elevation (feet):** NA
- **Field Screening Instrument:** None

**DEPTH | LITHOLOGY | DESCRIPTION | USCS | LAB SAMP. | PID ppm**

<table>
<thead>
<tr>
<th>Depth</th>
<th>Lithology</th>
<th>Description</th>
<th>USCS</th>
<th>Lab Samp.</th>
<th>PID ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>TOPSOIL</td>
<td>Grass and topsoil. Top 5 ft hand augered.</td>
<td>PT</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.00, 3.50) TOPSOIL: Grass and topsoil. Top 5 ft hand augered.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>SILT</td>
<td>Black silt, moist.</td>
<td>ML</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3.50, 4.00) SILT: Black silt, moist.</td>
<td>SM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>SILTY SAND</td>
<td>Black silty sand, moist.</td>
<td>ML</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(4.00, 5.00) SILTY SAND: Black silty sand, moist.</td>
<td>PT</td>
<td>Composite Sample from 0' - 4'.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>SILT</td>
<td>Black silt, moist.</td>
<td>ML</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(5.00, 6.00) SILT: Black silt, moist.</td>
<td>SM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>SILTY SAND</td>
<td>Black silty sand, moist.</td>
<td>ML</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(6.00, 8.00) SILTY SAND: Black silty sand, moist.</td>
<td>PT</td>
<td>Composite Sample from 4' - 8'.</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>SAND</td>
<td>Dark brown sandy clay, moist.</td>
<td>CL</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(8.00, 9.00) SANDY CLAY: Dark brown sandy clay, moist.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>SAND</td>
<td>Dark brown medium sand, slightly moist.</td>
<td>SW</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(9.00, 10.00) SAND: Dark brown medium sand, slightly moist.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>SAND</td>
<td>Brown medium sand, slightly moist.</td>
<td>SW</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(10.00, 16.00) SAND: Brown medium sand, slightly moist.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>16</td>
<td>SAND</td>
<td>Brown medium-fine sand, dry to moist.</td>
<td>SW</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(16.00, 18.00) SAND: Brown medium-fine sand, dry to moist.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Comments:** Refusal and E.O.B. at 18'.

**Boring Location:** 44 46.865' N / 93 16.913' W
GRAPH A
Burnsville Soil Samples
Soil Depth vs. PFC Concentrations

Concentrations, ng/g

Burnsville B-1 SL 0-4'
Burnsville B-2 SL 0-4'
Burnsville B-1 SL 4-8'
Burnsville B-2 SL 4-8'

PFBA  PFPeA  PFHxA  PFHpA  PFOA  PFNA  PFDA  PFUnA  PFDaA  PFBS  PFHxS  PFOS  PFOSA
APPENDIX D

Claremont Fire Department Discussion and Supporting Documents
Background and Access – Claremont Fire Foam Training Areas

The Claremont Fire Department 2nd Assistant Fire Chief/Training Officer returned a completed firefighting foam use questionnaire to Delta in April 2008, indicating the departments’ use of 3M-brand AR-AFFF in annual training exercises conducted in front of the fire station on Front Street. A copy of the questionnaire returned by the Claremont Fire Department is included in Appendix D. In a follow-up telephone conversation the Assistant Fire Chief related that there was also a fire foam demonstration using a burn pan in the fall of 2008 conducted behind the fire station, and some training conducted at a nearby ethanol plant. The location of the Claremont fire station is shown in Figure 1, Fire Foam Training Area Locations, Claremont, also included in Appendix D.

An access agreement was signed by the Claremont City Administrator and the MPCA, allowing access for a site reconnaissance and sampling at both the training and demonstration areas. A copy of the access agreement is included in Appendix D.

As presented in Delta’s April 2009 report, the inferred groundwater flow direction in the area of the Claremont Fire Station area is to the south, and the depth to groundwater is estimated to be greater than fifty feet.

Site Reconnaissance – Claremont Fire Foam Training Areas

Site reconnaissance of the fire foam training and demonstration areas in Claremont was conducted on April 29, 2009. Delta representative Nancy Rodning was accompanied by the Claremont 2nd Assistant Fire Chief. The Assistant Fire Chief confirmed that training with 3M-brand AR-AFFF takes place approximately annually or less frequently, and that five gallons or less of foam concentrate are used per event. He showed Delta personnel where the fire foam was discharged onto the asphalt-paved area in front of the fire station and where the fire foam demonstration took place in a grassy area behind the fire station. Photographs of the training and demonstration areas are included in Appendix D. The Assistant Fire Chief related that the department has trained with foam in front of the fire station approximately two times in the last six years. The fire department typically does not practice with live fire but simply sprays foam onto the ground, except for the use of a burn pan at last year’s foam demonstration.

Delta recorded GPS locations of the corners of the foam training areas using a hand-held GPS unit with an accuracy of approximately 15 feet. The training areas are shown on the figure Claremont Fire Department Fire Foam Training Areas, Claremont, which is included in Appendix D. According to the Claremont Assistant Fire Chief, spent foam discharged in front of the fire station drains toward a storm water grate at the northeast corner of the property. The Assistant Fire Chief and the Claremont City
Administrator were unsure as to the outflow connection from this storm sewer pipe. The demonstration area behind the fire station is relatively flat, with no visual evidence of surface runoff.

The Claremont municipal water tower was observed during the site reconnaissance, located on e-half block to the east of the fire station. No other potential community water supply systems such as those typically associated with rest stops, trailer parks, etc., were observed within 1/4-mile of the training areas. Nearby houses may or may not utilize private wells; none were observed during the site reconnaissance. Nearby water wells identified via a search of the MDH CWI are shown on Figure 1, Fire Foam Training Area Locations, Claremont and are described in the Site Summary included in Delta’s April 2009 Report.

The Claremont Assistant Fire Chief could not recall any fires to which the department has responded where more than five or ten gallons of Class B foam were discharged.

Locations for soil borings near the storm water grate in front of the fire station and at the demonstration area behind the fire station were discussed during the site reconnaissance.

**Sample Collection – Claremont Fire Foam Training Areas**

On May 15, 2009, one soil boring was advanced adjacent to the storm sewer grate in front of the fire station and two borings were advanced in the one-time foam demonstration area behind the fire station. Soil boring locations are shown on the figure Claremont Fire Department Fire Foam Training Areas, Claremont, which is included in Appendix D. Soil borings were advanced by Glacier Inc. using push probe drilling technology, under the oversight of Delta personnel. Soil samples were collected continuously and logged onto soil boring logs. Soil boring logs detailing soil descriptions, boring depths, and the GPS locations of the borings are included in Appendix D.

Based on area well logs and geological and hydrogeological maps, the depth to groundwater in the area of Claremont was estimated to be greater than fifty feet. Drilling to depths greater than fifty feet was beyond the scope of work, therefore, borings were only advanced to a depth of 8 feet below grade surface (bgs) in order to collect soil samples for laboratory analysis. Groundwater was not encountered in any of the borings. Borings B-1 and B-2 were advanced behind the fire station in the one-time fire foam demonstration area. Boring B-3 was advanced adjacent to the storm sewer grate near the northeast corner of the fire station property. Soils encountered generally consisted of one to five feet of sand and gravel over clay. No staining, or foul or unusual odors were noted in the soils. Upon completion of soil sampling at each boring, the boring was sealed in accordance with applicable MDH requirements.
Soils samples were collected from all borings for laboratory analysis as described in Section 1.3 (Task 3) of the main body of the report. A second set of soil samples were also submitted to MPI Research for laboratory analysis of PFCs, for laboratory comparison purposes.

**Sampling Results – Claremont Fire Foam Training Areas**

Analytical results were not available from Axys Analytical Services LTD or MPI Research at the time of this report. Analytical results will be presented in a forthcoming report.
FIGURE 1
FIRE FOAM TRAINING AREA LOCATION
CLAREMONT FIRE STATION
CLAREMONT, MINNESOTA

LEGEND:
● Well Locations
QUESTIONNAIRE
Firefighting Foam Use in Fire Training

1. Does your Department currently or has your Department historically used Class A or Class B foams for firefighting operations?
   - Yes - Proceed to Question 2
   - No - Sign the back of this form and return to Delta Consultants

2. How often is Class B or Class A foam used in response to fire calls?
   - X 0-25% of fires
   - ___ 25-50% of fires
   - ___ 75-100% of fires

3. Does the Department have a compressed air foam system (CAFS) with a built-in tank on its engine(s)?
   - X Yes
   - No Built-in tank but not compressed

4. How often is foam used in training exercises?
   - ___ Weekly
   - ___ Semi-Annually
   - ___ Monthly
   - ___ Annually
   - ___ Quarterly
   - ___ Bi-Annually
   - ___ Other (please specify): Bursting In Tank

5. How much foam is used per training event?
   - ___ Less than 5 gallons
   - ___ 5 gallons
   - ___ 5 to 10 gallons
   - ___ More than 10 gallons (please specify): Would use more if not for cost

6. In training, where does the spent foam go?
   - X Storm Sewer
   - ___ Sanitary Sewer
   - ___ On-Site Septic
   - ___ Ground
   - ___ Other (please describe): Bursting in Tank

7. Where does/did the training take place? Please include address, intersection or other specific location information for current and past training areas.
   - In front of fire hall floor 3 street Clara mont

Xinogen
5910 Rice Creek Parkway Suite 100 St. Paul, MN 55126 USA
Phone: 651.639.9449 / 800.477.7411 Fax: 651.639.9473 www.deltaenv.com
8. What type(s) and brand(s) of foam are or were used now and in the past by the Department, both for fire response and in training (if applicable)? Please check all that apply.

<table>
<thead>
<tr>
<th>Type of Foam</th>
<th>Brand of Foam</th>
<th>Used in Training?</th>
<th>Amount Used Annually</th>
<th>Current Use or Historic Use?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class B Aqueous Film-Forming Foam (AFFF)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Alcohol-Resistant (AR)-AFFF</td>
<td>M</td>
<td>Yes</td>
<td>20 gal</td>
<td></td>
</tr>
<tr>
<td>Class B Protein</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Fluoroprotein (FP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Film-Forming Fluoroprotein (FFF)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B AR-FFF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class A-B Hi Expansion Foam</td>
<td>Wet water</td>
<td></td>
<td>5 gal</td>
<td></td>
</tr>
<tr>
<td>Class A Training Foam</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Thank you for your time and cooperation. Please contact Nancy Rodning at Delta Consultants (651-697-5152 or nrodnig@deltaenv.com) or Jim Stockinger at the Minnesota Pollution Control Agency (651-297-8666 or jim.stockinger@state.mn.us) if you have any questions regarding this questionnaire.

**Please return this questionnaire to Delta Consultants by May 9, 2008 in the enclosed stamped, self-addressed envelope.**

Questionnaire completed by:

![Signature]

Name and Title

![Signature]

Fire Department

507-528-2701

Phone Number

Date

E-Mail Address

Xinogen
ACCESS AGREEMENT BETWEEN
THE MINNESOTA POLLUTION CONTROL AGENCY
AND CITY OF CLAREMONT

The Minnesota Pollution Control Agency (MPCA) is investigating firefighting training sites where Class B foams have been or are being utilized. The site reconnaissance and investigation will be conducted at the following firefighting training site owned by the City of Claremont and utilized by the Claremont Fire Department:

Claremont Fire Hall located on Front Street in Claremont, Minnesota

The Property Owner hereby consents and authorizes the MPCA, its employees, agents and contractors, to enter this property for the purpose of performing reasonable and necessary investigations in response to the use of Class B firefighting foams that may or may not contain perfluorocarbons (PFCs). The MPCA is authorized to take these actions under Minn. Stat. § 115C.03, subd. 7 (2002).

The MPCA will notify the Property Owner at least 48 hours before entering the property. Work will be conducted during regular business hours (8:00 a.m. to 5:00 p.m.) unless the MPCA receives permission to and arrangements are made to conduct work during different hours. The MPCA will conduct its activities so as to minimize interference with the use of the property. If any portion of the property must be disturbed as a result of the MPCA’s activities, the MPCA will restore the property as close to its original condition as is reasonably possible under the circumstances. The Property Owner will take reasonable precautions to ensure that the equipment of the MPCA and its contractors on the property is not damaged, and that the work being conducted by the MPCA, its employees, agents and contractors is not disrupted.

The MPCA will obtain all necessary permits for installation of soil borings and temporary monitoring wells, if such wells are installed. Upon completion of sampling, the MPCA will seal the borings and monitoring wells in accordance with state law. Results of all testing conducted on the property will be provided to the Property Owner.

The MPCA shall be liable for injury to or loss of property, or personal injury or death, caused by an act or omission of any employee of the state in the performance of the work described above, under the circumstances where the state, if a private person, would be liable to the claimant, in accordance with Minn. Stat. § 3.736.

MINNESOTA POLLUTION CONTROL AGENCY

[Signature]
Title
Date 3/16/09

City of Claremont

[Signature]
Title City Administrator
Date 3-5-09
Photograph 1
Fire foam is sprayed on the asphalt pavement in front of the fire station doors. Spent foam drains toward the storm drain near the northeast corner of the property, near the utility pole in the photo. View facing southwest.

Photograph 2
Close-up of the storm drain in Photograph 1.
Photograph 3
Fire foam was sprayed on the east (left) side of the pole building at right, in and around the area where water is puddled in the photo. View facing south.

Photograph 4
View of the same training area as Photograph 3, view facing north. The Claremont Fire Station is in the background.
**ENVIRONMENTAL BORING LOG**

**BORING ID:** B-1  
**TOTAL DEPTH:** 8'

### PROJECT INFORMATION

- **Project:** PFC's in Fire Fighting Foam  
- **Site Location:** Claremont, MN  
- **Job No.:** 19382DEL04  
- **Logged By:** Kyle Von Spreecken  
- **Weather:** Sunny  
- **Date Completed:** 5/15/09  
- **Water Level During Drilling:** Dry

### DRILLING INFORMATION

- **Drilling Co.:** Glacier Drilling  
- **Drill Crew Chief:** Chris Niesen  
- **Rig Type:** Remote Controlled Track Geoprobe  
- **Method of Drilling:** Direct Push Probe  
- **Soil Sampling Method:** 5' samplers with liners  
- **Surface Elevation (feet):** NA  
- **Field Screening Instrument:** None

### DEPTH | LITHOLOGY | DESCRIPTION | USCS | LAB SAMP. | PID ppm
--- | --- | --- | --- | --- | ---
0 | (0.00, 1.00) FILL: Light brown sand and gravel fill. Top 5 ft hand augered. | SM | NA
1 | (1.00, 1.50) SILTY SAND: Black/dark brown silty sand and gravel, moist. | SW
2 | (1.50, 3.50) SAND AND GRAVEL: Brown medium sand and gravel, moist. | SM
3 | (3.50, 4.75) SILTY SAND: Black silty sand, moist. | SM
4 | (4.75, 5.50) CLAY: Dark brown to brown clay, moist | CL
5 | (5.50, 8.00) CLAY: Light brown clay, trace of silt, moist/soft. | CL

**Comments:** E.O.B. at 8'.

**Boring Location:** 44 02.626' N / 92 59.984' W
**ENVIRONMENTAL BORING LOG**

**BORING ID:** B-2  
**TOTAL DEPTH:** 8'

### PROJECT INFORMATION

**Project:** PFC's in Fire Fighting Foam  
**Site Location:** Claremont, MN  
**Job No.:** 19382DEL04  
**Logged By:** Kyle Von Spreecken  
**Weather:** Sunny  
**Date Began:** 5/15/09  
**Date Completed:**

### DRILLING INFORMATION

**Drilling Co.:** Glacier Drilling  
**Drill Crew Chief:** Chris Niesen  
**Rig Type:** Remote Controlled Track Geoprobe  
**Method of Drilling:** Direct Push Probe  
**Soil Sampling Method:** 5' samplers with liners  
**Surface Elevation (feet):** NA  
**Field Screening Instrument:** None

### DEPTH | LITHOLOGY | DESCRIPTION | USCS | LAB SAMP. | PID ppm
---|---|---|---|---|---
0.00 | Fill | Light brown sand and gravel fill. Top 5 ft hand augered. | SW | NA |  
0.50 | Sand and gravel | Dark brown to black medium sand and gravel, moist. | SW |  
1.00 | Sand and gravel | Black medium sand and large gravel, moist. Hand auger refusal at 1.5'. | SW |  
1.50 | Sand and gravel | Dark brown medium sand and gravel, moist, limited recovery. | SW |  
5.00 | Clay and silt | Light brown/rust clay and silty sand, moist/soft. | CL |  

Comments: E.O.B. at 8'.

Boring Location: 44°02.627' N / 92°59.991' W
<table>
<thead>
<tr>
<th>DEPTH</th>
<th>LITHOLOGY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-0</td>
<td>(0.00, 1.00) SAND AND GRAVEL: Light brown to dark brown sand and gravel, moist. Top 5 ft hand augered.</td>
<td></td>
</tr>
<tr>
<td>0-3</td>
<td>(1.00, 3.00) SILTY CLAY: Dark brown silty clay, trace of sand, moist/soft.</td>
<td></td>
</tr>
<tr>
<td>3-4.5</td>
<td>(3.00, 4.50) CLAY: Dark brown/black, clay and some silt, moist/soft.</td>
<td></td>
</tr>
<tr>
<td>4.5-4.7</td>
<td>(4.50, 4.70) SILTY SAND: Light brown silt and fine sand, moist/soft.</td>
<td></td>
</tr>
<tr>
<td>4.7-7</td>
<td>(4.70, 7.00) SANDY CLAY: Light brown/gray sandy clay, soft/moist.</td>
<td></td>
</tr>
<tr>
<td>7-8</td>
<td>(7.00, 8.00) SAND: Light brown medium sand, wet.</td>
<td></td>
</tr>
</tbody>
</table>

Comments: E.O.B. at 8'.

Boring Location: 44° 02.658' N / 92° 59.941' W
APPENDIX E

Fridley Fire Department Discussion and Supporting Documents
Background and Access – Fridley Fire Foam Training Area

The Fridley Fire Chief returned a completed firefighting foam use questionnaire form in May 2008 to Delta, indicating the department’s occasional historical use of 3M-brand AR-AFFF in training exercises conducted at the North Metro Fire Training Center in Fridley. The Fire Chief indicated no current use of Class B foam in training. A copy of the questionnaire returned by the Fridley Fire Department is included in Appendix E.

The location of the North Metro Fire Training Center is shown on Figure 1, Fire Foam Training Area Location, Fridley, also included in Appendix E. An access agreement was signed by the Fridley City Manager and the MPCA, allowing access for a site reconnaissance and sampling at the training center. A copy of the access agreement is included in Appendix E.

As presented in Delta’s April 2009 report, the inferred groundwater flow direction in the area of the North Metro Fire Training Center is to the west.

Site Reconnaissance – Fridley Fire Foam Training Area

Site reconnaissance of the North Metro Fire Training Center in Fridley was conducted on May 13, 2009. Delta representative Nancy Rodning and MPCA Project Manager Nile Fellows were accompanied by the Fridley Fire Chief and the Fridley Public Works Director. The Fridley Fire Chief related that, prior to construction of the fire training tower/building in approximately 1994 or 1995, there was a lined pit where the tower/building is currently located. During fire foam training exercises kerosene would be placed in the lined pit, set on fire, and Class B AR-AFFF would be used to extinguish the fire. The Fridley Fire Chief also stated that the department utilized 3M-brand AR-AFFF from at least 1981 through the mid 1990s, and that they disposed of any remaining expired foam in about 2003. The Fridley Fire Department has not trained with Class B foam since 1994 or 1995 when the training tower/building was built, except for a demonstration of F-500 firefighting foam conducted in 2008 on a concrete pad situated south of the fire tower/building. Photographs of the training area are included in Appendix E.

Delta recorded GPS locations of the corners of the fire tower/building, presuming the former lined pit was wholly beneath the building, using a hand-held GPS unit with an accuracy of approximately 15 feet. The training area is shown on the figure Fridley Fire Department Fire Foam Training Area, which is included in Appendix E. The existing surface grades would result in stormwater runoff toward the south, to an on-site wetland that drains to Rice Creek further to the south. A storm water grate located in the parking lot southwest of the fire tower/building appears to empty into the wetland.
The Public Works Director indicated that several groundwater monitoring wells are located on the eastadjoining property occupied by the Fridley Public Works Department. He was not aware of any water supply wells in the area. No other potential community water supply systems such as those typically associated with rest stops, trailer parks, etc., were observed within 1/4-mile of the training area. A trailer park located one-third mile to the north (upgradient) of the training center was observed. Nearby houses may or may not utilize private wells; none were observed during the site reconnaissance. Nearby water wells identified via a search of the MDH are shown on Figure 1, Fire Foam Training Area Location, Fridley and are described in the Site Summary included in Delta’s April 2009 Report.

The Fridley Fire Chief recalled one fire to which the Fridley Fire Department responded with a large quantity of Class B foam: high expansion foam was used to fill a retail gas station building located at the corner of University Avenue and 53rd, in the mid-1990s. High expansion foams are typically available as Class A-B foam, which may or may not be made fluorocarbon-based surfactants.

Locations for soil borings on the south side of the fire tower/building were discussed during the site reconnaissance.

Sample Collection – Fridley Fire Foam Training Area

On May 27, 2009, two soil borings were advanced in the grassy area south of the fire tower/building. Soil boring locations are shown on the figure Fridley Fire Department Fire Foam Training Area included in Appendix E. Soil borings were advanced by Glacier Inc. using push probe drilling technology, under the oversight of Delta personnel. Soil samples were collected continuously and logged onto soil boring logs. Soil boring logs detailing soil descriptions, groundwater depths, boring depths, and the GPS locations of the borings are included in Appendix E.

Borings B-1 and B-2 were advanced on the south side, or downslope, of the fire tower/building to depths of 20 feet and 18 feet below grade surface (bgs), respectively. Soils encountered in both borings consisted of approximately 6 feet of silty sand, over clay to a depth of 13 feet, underlain by stiff, sandy clay to the end of the borings. Groundwater was encountered in both borings at an approximate depth of 15.5 feet bgs. No staining, or foul or unusual odors were noted in the soils. Temporary wells with five-foot screens were set to the bottom of the borings for the collection of groundwater samples. Upon completion of groundwater sampling at each boring, the boring was g rerouted and sealed in accordance with applicable MDH requirements.
A sediment sample, B-3, was collected from the north edge of the on-site wetland located south of the fire/tower building and south of the concrete pad where the demonstration of F-500 firefighting foam occurred in 2008. The sediment sample consisted of a grab sample collected by hand approximately 6 inches bgs. The sediment consisted of wet sandy gravel.

Soil, sediment, and groundwater samples were collected and submitted for laboratory analysis as described in Section 1.3 (Task 3) of the main body of the report.

**Sampling Results – Fridley Fire Foam Training Area**

Analytical results were not available from Axys Analytical Services LTD at the time of this report. Analytical results will be presented in a forthcoming report.
FIGURE 1
FIRE FOAM TRAINING AREA LOCATION
NORTH METRO FIRE TRAINING CENTER
FRIDLEY, MINNESOTA

LEGEND:
• Well Locations
1. Does your Department currently or has your Department historically used Class A or Class B foams for firefighting operations?
   - X Yes - Proceed to Question 2
   - _____ No - Sign the back of this form and return to Delta Consultants

2. How often is Class B or Class A foam used in response to fire calls?
   - _____ 0-25% of fires
   - _____ 25-50% of fires
   - X _____ 75-100% of fires

3. Does the Department have a compressed air foam system (CAFS) with a built-in tank on its engine(s)?
   - _____ Yes
   - X _____ No

4. How often is foam used in training exercises?
   - _____ Weekly
   - _____ Monthly
   - _____ Quarterly
   - _____ Semi-Annually
   - _____ Annually
   - _____ Bi-Annually
   - _____ Other (please specify): ___________________________________________________________________________

   Not Very Often

5. How much foam is used per training event?
   - X _____ Less than 5 gallons
   - _____ 5 gallons
   - _____ 5 to 10 gallons
   - _____ More than 10 gallons (please specify): __________________________________________________________________________

6. In training, where does the spent foam go?
   - _____ Storm Sewer
   - _____ Sanitary Sewer
   - _____ On-Site Septic
   - _____ Ground
   - X _____ Other (please describe): __________________________________________________________________________

7. Where does/did the training take place? Please include address, intersection or other specific location information for current and past training areas.
   - 300 715 Ave
   - Faibyry, MN 55422

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
8. What type(s) and brand(s) of foam are or were used now and in the past by the Department, both for fire response and in training (if applicable)? Please check all that apply.

<table>
<thead>
<tr>
<th>Type of Foam</th>
<th>Brand of Foam</th>
<th>Used in Training?</th>
<th>Amount Used Annually</th>
<th>Current Use or Historic Use?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class B Aqueous Film-Forming Foam (AFFF)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Alcohol-Resistant (AR)-AFFF</td>
<td>Bm</td>
<td>Yes</td>
<td></td>
<td>Histories</td>
</tr>
<tr>
<td>Class B Protein</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Fluoroprotein (FP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Film-Forming Fluoroprotein (FFFP)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Class B AR-FFFP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class A-Hi Expansion Foam</td>
<td>Ansul Silver</td>
<td>No</td>
<td></td>
<td>Current</td>
</tr>
<tr>
<td>Training Foam</td>
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</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Thank you for your time and cooperation. Please contact Nancy Rodning at Delta Consultants (651-697-5152 or nrodnning@deltaeenv.com) or Jim Stockinger at the Minnesota Pollution Control Agency (651-297-8666 or jim.stockinger@state.mn.us) if you have any questions regarding this questionnaire.

*Please return this questionnaire to Delta Consultants by May 9, 2008 in the enclosed stamped, self-addressed envelope.*

Questionnaire completed by:

**John Berg Fire Chief**

**Fridley**

**763-572-3610**

**berg@e.ci.Fridley.mn.us**

**5/15/08**
The Minnesota Pollution Control Agency (MPCA) is investigating firefighting training sites where Class B foams have been or are being utilized. The site reconnaissance and investigation will be conducted at the following firefighting training site owned wholly or in part by the City of Fridley and utilized by the Fridley Fire Department:

North Metro Fire Training Center, 300 71st Avenue, Fridley, Minnesota

The Property Owner hereby consents and authorizes the MPCA, its employees, agents and contractors, to enter this property for the purpose of performing reasonable and necessary investigations in response to the use of Class B firefighting foams that may or may not contain perfluorocarbons (PFCs). The MPCA is authorized to take these actions under Minn. Stat. § 115C.03, subd. 7 (2002).

The MPCA will notify the Property Owner at least 48 hours before entering the property. Work will be conducted during regular business hours (8:00 a.m. to 5:00 p.m.) unless the MPCA receives permission to and arrangements are made to conduct work during different hours. The MPCA will conduct its activities so as to minimize interference with the use of the property. If any portion of the property must be disturbed as a result of the MPCA's activities, the MPCA will restore the property as close to its original condition as is reasonably possible under the circumstances. The Property Owner will take reasonable precautions to ensure that the equipment of the MPCA and its contractors on the property is not damaged, and that the work being conducted by the MPCA, its employees, agents and contractors is not disrupted.

The MPCA will obtain all necessary permits for installation of soil borings and temporary monitoring wells, if such wells are installed. Upon completion of sampling, the MPCA will seal the borings and monitoring wells in accordance with state law. Results of all testing conducted on the property will be provided to the Property Owner.

The MPCA shall be liable for injury to or loss of property, or personal injury or death, caused by an act or omission of any employee of the state in the performance of the work described above, under the circumstances where the state, if a private person, would be liable to the claimant, in accordance with Minn. Stat. § 3.736.

MINNESOTA POLLUTION CONTROL AGENCY

[Signature]

Title

Date 5/1/09

City of Fridley

[Signature]

City Manager

Date 6-16-09
Photograph 1
The fire tower/building is (approximately) situated over a historical lined burn pit, where Class B foam was sprayed in fire training exercises. View facing northwest.

Photograph 2
View of same building from the southwest, facing northeast.
Photograph 3
A wetland is located south of a concrete pad on the south side of the fire tower/building. View facing south.

Photograph 4
The north side of fire training building, view facing southeast.
# Environmental Boring Log

## Project Information

<table>
<thead>
<tr>
<th>Project</th>
<th>PFC's in Fire Fighting Foam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Location</td>
<td>Fridley, MN</td>
</tr>
<tr>
<td>Job No.</td>
<td>19382DELO3</td>
</tr>
<tr>
<td>Logged By</td>
<td>Curt McKay</td>
</tr>
<tr>
<td>Weather</td>
<td>Partly Cloudy</td>
</tr>
<tr>
<td>Date Completed</td>
<td>5/27/09</td>
</tr>
</tbody>
</table>

- Water Level During Drilling: **15.5’**

## Drilling Information

<table>
<thead>
<tr>
<th>Drilling Co.</th>
<th>Glacier Drilling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drill Crew Chief</td>
<td>NA</td>
</tr>
<tr>
<td>Rig Type</td>
<td>Remote Controlled Track Geoprobe</td>
</tr>
<tr>
<td>Method of Drilling</td>
<td>Direct Push Probe</td>
</tr>
<tr>
<td>Soil Sampling Method</td>
<td>5' samplers with liners</td>
</tr>
<tr>
<td>Surface Elevation (feet)</td>
<td>NA</td>
</tr>
<tr>
<td>Field Screening Instrument</td>
<td>None</td>
</tr>
</tbody>
</table>

## Lithology

<table>
<thead>
<tr>
<th>Depth</th>
<th>Lithology</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-0.5</td>
<td>Topsoil</td>
<td>Grass and topsoil. Top 5' hand augered.</td>
</tr>
<tr>
<td>0.5-3</td>
<td>Silty Sand</td>
<td>Brown silty sand, dry.</td>
</tr>
<tr>
<td>3-5</td>
<td>Silty Sand</td>
<td>Light brown silty sand, moist.</td>
</tr>
<tr>
<td>5-7</td>
<td>Sand</td>
<td>Brown medium sand, moist.</td>
</tr>
<tr>
<td>7-9</td>
<td>Clay</td>
<td>Gray clay, soft, moist.</td>
</tr>
<tr>
<td>9-14.25</td>
<td>Clay</td>
<td>Dark gray clay, medium-stiff.</td>
</tr>
<tr>
<td>15.5-17</td>
<td>Sandy Clay</td>
<td>Gray sandy clay, very moist to wet.</td>
</tr>
<tr>
<td>17-20</td>
<td>Sandy Clay</td>
<td>Gray sandy clay, stiff, slightly moist.</td>
</tr>
</tbody>
</table>

## Comments

- E.O.B. at 20’.

Boring Location: 45 05.728’ N / 93 15.621’ W
# Environmental Boring Log

## Project Information

- **Project**: PFC's in Fire Fighting Foam
- **Site Location**: Fridley, MN
- **Job No.**: 19382DEL03
- **Logged By**: Curt McKay
- **Date Completed**: 5/27/09
- **Weather**: Partly Cloudy
- **Water Level During Drilling**: 15.75' below ground level

## Drilling Information

- **Drilling Co.**: Glacier Drilling
- **Drill Crew Chief**: NA
- **Rig Type**: Remote Controlled Track Geoprobe
- **Method of Drilling**: Direct Push Probe
- **Soil Sampling Method**: 5' samplers with liners
- **Surface Elevation (feet)**: NA
- **Field Screening Instrument**: None

## Depth vs. Lithology

<table>
<thead>
<tr>
<th>Depth</th>
<th>Lithology</th>
<th>Description</th>
<th>USCS</th>
<th>Lab Samp.</th>
<th>PID ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>(0.00, 1.00)</td>
<td>TOPSOIL: Grass and topsoil. Top 5' hand augered.</td>
<td>PT</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>0.5</td>
<td>(1.00, 2.00)</td>
<td>SILTY SAND: Brown silty sand, dry.</td>
<td>SM</td>
<td>Composite Sample from 0' - 4'.</td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>(2.00, 3.50)</td>
<td>SAND: Light brown sand, moist.</td>
<td>SW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.5</td>
<td>(3.50, 5.00)</td>
<td>SILTY SAND: Light brown silty sand, moist.</td>
<td>SM</td>
<td>Composite Sample from 4' - 8'.</td>
<td></td>
</tr>
<tr>
<td>5.0</td>
<td>(5.00, 6.00)</td>
<td>SILTY SAND: Light brown silty sand and clay, moist.</td>
<td>SC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.0</td>
<td>(6.00, 8.00)</td>
<td>CLAY: Light brown clay, moist, semi-stiff.</td>
<td>CL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.0</td>
<td>(8.00, 9.50)</td>
<td>CLAY: Light brown clay, semi-stiff.</td>
<td>CL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.0</td>
<td>(9.50, 15.00)</td>
<td>CLAY: Light brown clay, soft, moist.</td>
<td>CL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.0</td>
<td>(15.00, 17.00)</td>
<td>SANDY CLAY: Brown sandy clay, moist, wet at 15.75'.</td>
<td>CL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.5</td>
<td>(17.00, 18.00)</td>
<td>SANDY CLAY: Dark gray sandy clay, stiff.</td>
<td>CL</td>
<td>Water Sample from 13' - 18'.</td>
<td></td>
</tr>
</tbody>
</table>

Comments: E.O.B. at 18'.

Boring Location: 45 05.724' N / 93 15.612' W
APPENDIX F

Goodview Fire Department Discussion and Supporting Documents
Background and Access – Goodview Fire Foam Training Area

The Goodview Fire Department Fire Chief completed a firefighting foam use questionnaire via a telephone interview in September 2008, indicating the departments’ historical use of Ansul-brand AFFF in training exercises at the Goodview fire station. The Fire Chief indicated that the department no longer uses Class B foam in training, and that they switched to F-500 foam in March 2008. A copy of the questionnaire is included in Appendix F.

The Goodview fire station is located at 4140 W. 5th Street in Goodview, as shown on Figure 1, Fire Foam Training Area Location, Goodview. An access agreement was signed by the Goodview City Administrator and the MPCA, allowing access for a site reconnaissance and sampling at the fire foam training area. A copy of the access agreement is included in Appendix F.

Site Reconnaissance – Goodview Fire Foam Training Area

Site reconnaissance of the Goodview fire foam training area was conducted on April 7, 2009. Delta representative Nancy Rodning was accompanied by the Goodview Fire Chief. The Goodview Fire Chief related that the department trained with Class B AFFF approximately six times in twenty years at the fire station, and that the last foam training event was approximately four to five years ago. Class B foam was sprayed on the concrete apron in front (northeast) of the fire station toward the street. Spent foam was allowed to dissipate over time, with some drainage to a storm sewer drain located on the southwest side of West 5th Street, approximately 60 feet to the southeast.

Delta recorded GPS locations of the corners of the training area using a hand-held GPS unit with an accuracy of approximately 15 feet. Photographs taken during the site reconnaissance, and the figure Goodview Fire Department Fire Foam Training Area illustrating the training area, are included in Appendix F.

The Goodview Fire Chief could not recall any large fires in the last twenty years where more than five gallons of firefighting foam were used for a fire response.

The Goodview Fire Chief indicated that there may be scattered private water wells in the area, but that municipal water is available in the area of the fire foam training area at the fire station. He suggested contacting the Goodview Public Works department for further information on private wells. No potential community water supply systems such as those typically associated with rest stops, trailer parks, etc., were observed within 1/4-mile of the training area. Nearby water wells identified via a search of the MDH CWI are shown on Figure 1, Fire Foam Training Area Locations, Goodview and are described in the Site Summary included in Delta’s April 2009 Report.
Sample Collection – Goodview Fire Foam Training Area

The fire foam training area utilized by the Goodview Fire Department is concrete-paved, and the pavement was observed to be in good condition. As previously stated, run off from the area is directed along concrete gutter to a storm sewer, which, according to the Goodview Director of Public Works, is owned by Winona County and discharges into the backwaters of the Mississippi River. Contact with the Goodview Public Works department, the Winona County Tax Assessor’s Office, and the Winona County Land Survey department did not result in identification of the owner of the property where the storm sewer discharges. An access agreement between this property owner and the MPCA will need to be executed in order for sampling to occur. Due to the upcoming end of the 2009 fiscal year for the State of Minnesota, there was insufficient time to complete this task as part of this scope of work.
1. Does your Department currently or has your Department historically used Class A or Class B foams for firefighting operations?
   - Yes - Proceed to Question 2
   - No - Sign the back of this form and return to Delta Consultants

2. How often is Class B or Class A foam used in response to fire calls?
   - 0-25% of fires
   - 25-50% of fires
   - 75-100% of fires
   - Every time there's a fire

3. Does the Department have a compressed air foam system (CAFS) with a built-in tank on its engine(s)?
   - Yes
   - No - not compressed

4. How often is foam used in training exercises?
   - Never
   - Weekly
   - Monthly
   - Quarterly
   - Semi-Annually
   - Annually
   - Bi-Annually
   - Other (please specify):

5. How much foam is used per training event?
   - Less than 5 gallons
   - 5 gallons
   - 5 to 10 gallons
   - More than 10 gallons (please specify):

6. In training, where does the spent foam go?
   - Storm Sewer
   - Sanitary Sewer
   - On-Site Septic
   - Ground
   - Other (please describe):

7. Where does/did the training take place? Please include address, intersection or other specific location information for current and past training areas.
   - at fire station across the street at
   - 4140 w. 5th st. (Goodview)
   - 6044 78
   - 4879 78 1 11

OVER
8. What type(s) and brand(s) of foam are or were used now and in the past by the Department, both for fire response and in training (if applicable)? Please check all that apply.

<table>
<thead>
<tr>
<th>Type of Foam</th>
<th>Brand of Foam</th>
<th>Used in Training?</th>
<th>Amount Used Annually</th>
<th>Currently Used?</th>
<th>Historically Used?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class B Aqueous Film-Forming Foam</td>
<td>Ansul</td>
<td>Yes</td>
<td>0</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>(AFFFF)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Alcohol-Resistant (AR)-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AFFF</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Class B Protein</td>
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<td></td>
</tr>
<tr>
<td>Class B Fluoroprotein (FP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Film-Forming Fluoroprotein</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(FFFP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B AR-FFFP</td>
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<td></td>
<td></td>
<td></td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class A</td>
<td>Silt - Ex</td>
<td>Yes</td>
<td>0</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Training Foam</td>
<td>F-520</td>
<td>Yes</td>
<td>20 gal</td>
<td>Yes</td>
<td>No - As of Mar. 2008</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Thank you for your time and cooperation. Please contact Nancy Rodning at Delta Consultants (651-697-5152 or nrodnings@deltainv.com) or Jim Stockinger at the Minnesota Pollution Control Agency (651-297-8666 or jim.stockinger@state.mn.us) if you have any questions regarding this questionnaire.

Please return this questionnaire to Delta Consultants by June 6, 2008 in the enclosed stamped, self-addressed envelope.

Questionnaire completed by:

Fire Chief Rick Bambeneck

Name and Title

Goodview F.D.

Fire Department

507-312-0031  9.23.08

Phone Number  Date

E-Mail Address

Xinogen
ACCESS AGREEMENT BETWEEN
THE MINNESOTA POLLUTION CONTROL AGENCY
AND CITY OF GOODVIEW

The Minnesota Pollution Control Agency (MPCA) is investigating firefighting training sites where Class B foams have been or are being utilized. The site reconnaissance and investigation will be conducted at the following firefighting training site owned by the City of Goodview and utilized by the Goodview Fire Department:

Goodview Fire Station, 4140 W. 5th Street, Goodview, Minnesota

The Property Owner hereby consents and authorizes the MPCA, its employees, agents and contractors, to enter this property for the purpose of performing reasonable and necessary investigations in response to the use of Class B firefighting foams that may or may not contain perfluorocarbons (PFCs). The MPCA is authorized to take these actions under Minn. Stat. § 115C.03, subd. 7 (2002).

The MPCA will notify the Property Owner at least 48 hours before entering the property. Work will be conducted during regular business hours (8:00 a.m. to 5:00 p.m.) unless the MPCA receives permission to and arrangements are made to conduct work during different hours. The MPCA will conduct its activities so as to minimize interference with the use of the property. If any portion of the property must be disturbed as a result of the MPCA's activities, the MPCA will restore the property as close to its original condition as is reasonably possible under the circumstances. The Property Owner will take reasonable precautions to ensure that the equipment of the MPCA and its contractors on the property is not damaged, and that the work being conducted by the MPCA, its employees, agents and contractors is not disrupted.

The MPCA will obtain all necessary permits for installation of soil borings and temporary monitoring wells, if such wells are installed. Upon completion of sampling, the MPCA will seal the borings and monitoring wells in accordance with state law. Results of all testing conducted on the property will be provided to the Property Owner.

The MPCA shall be liable for injury to or loss of property, or personal injury or death, caused by an act or omission of any employee of the state in the performance of the work described above, under the circumstances where the state, if a private person, would be liable to the claimant, in accordance with Minn. Stat. § 3.736.

MINNESOTA POLLUTION CONTROL AGENCY

Danjel Watagan
Signature
Supervisor
Title
Date 2/19/09

City of Goodview

Dan Matejka
Signature
City Administrator
Title
Date 2–10–09
Photograph 1
Fire foam is sprayed onto the concrete apron in front of the fire station. Drainage is to 5th Street West at left. Photo view facing southeast.

Photograph 2
Spent foam and water drain to a storm sewer grate in 5th Street West, approximately 60 feet to the southeast of the fire station (beyond the yellow curb in the photograph).
APPENDIX G

Harmony Fire Department Discussion and Supporting Documents
Background and Access – Harmony Fire Foam Training Areas

The Harmony Fire Department Fire Chief returned a completed firefighting foam use questionnaire in April 2008 to Delta, indicating the department’s use of a variety of firefighting foams for training in annual training exercises, including Ansulite Class B AR-AFFF. The Harmony Fire Chief also indicated that training with Class B AFFF has occurred at two locations: in front of the fire station and at the municipal tree/brush dump. A copy of the questionnaire returned by the Harmony Fire Department is included in Appendix G.

The Harmony Fire Station is located at 930 Main Avenue South, at the northeast corner of Main Avenue South (aka Highway 139) and Garden Road (aka Highway 44). The municipal tree/brush dump is located at 32326 Garden Road, approximately 1/5 mile east of the fire station. The locations of the training areas utilized by the Harmony Fire Department are shown on Figure 1, Fire Foam Training Area Locations, Harmony, included in Appendix G. An access agreement was signed by the Mayor of the City of Harmony and the MPCA, allowing access for a site reconnaissance and sampling at both training areas. A copy of the access agreement is included in Appendix G.

As presented in Delta’s April 2009 report, the inferred groundwater flow direction in the area of the Harmony fire foam training areas is to the south or southeast.

Site Reconnaissance – Harmony Fire Foam Training Areas

Site reconnaissance of the fire foam training areas in Harmony was conducted on April 7, 2009. Delta representative Nancy Rodning was accompanied by the Harmony Fire Department Fire Chief. The Fire Chief confirmed that training with Ansulite AR-AFFF takes place approximately annually or less frequently, and that five gallons or less of foam concentrate are used per event. He showed Delta personnel where the fire foam was discharged in front of the fire station and at the tree/brush dump. The Fire Chief stated that the department last trained with foam at the fire station approximately 10 to 15 years ago, and that the last two or three annual foam training events took place at the tree/brush dump. The fire department does not practice with live fire, but simply sprays the foam onto the ground. Photographs of the training areas are included in Appendix G.

Delta recorded GPS locations of the corners of the foam training areas using a hand-held GPS unit with an accuracy of approximately 15 feet. The training areas are shown on the figure Harmony Fire Department Fire Foam Training Areas, which is included in Appendix G. Though the training area at the fire station is relatively flat, surface water drainage is expected to flow to a stormwater culvert located just beyond the east end of the training area. The culvert extends beneath Highway 44 to a small, apparently in intermittent, creek. The training area at the tree/brush dump is also relatively flat, and it
appears that surface water would pool in the approximate center of the site, where the brush and tree limbs are collected. A culvert at the west side of this central area extends beneath the circular drive around the tree/brush pile to the same small, apparently intermittent creek as previously referenced. The Fire Chief related that spent foam remains on the ground where sprayed and breaks down and dissipates over several hours.

The Harmony Fire Chief, who has been with the fire department for more than fifteen years, could not recall any fires to which the department has responded where more than five or ten gallons of Class B foam were discharged.

The Harmony Fire Chief was not aware of any nearby water supply wells, and no potential community water supply systems such as those typically associated with rest stops, trailer parks, etc., were observed within 1/4-mile of the training areas. Nearby houses may or may not utilize private wells; none were observed during the site reconnaissance. Nearby water wells identified via a search of the MDH CWI are shown on Figure 1, Fire Foam Training Area Locations, Harmony and are described on the Site Summary included in the April 2009 Report.

Locations for soil borings in the fire foam training areas were discussed during the site reconnaissance.

Sample Collection – Harmony Fire Foam Training Areas

On April 23, 2009, two soil borings were advanced within each of the two fire foam training areas in Harmony. Soil boring locations are shown on the Harmony Fire Department Fire Foam Training Areas figure. Soil borings were advanced by West Central Environmental Consultants using push probe drilling technology, under the oversight of Delta personnel. Soil samples were collected continuously and logged onto soil boring logs. Soil boring logs detailing soil descriptions, groundwater depths, boring depths, and the GPS locations of the borings are included in Appendix G.

Borings B-1 and B-2 were advanced through the training area at the municipal tree/brush dump to depths of 22 and 20 feet below grade surface (bgs), respectively, where drill refusal presumably due to bedrock was experienced. Soils encountered in borings in B-1 and B-2 consisted of topsoil over silt to a depth of 17.5 to 18 feet bgs, over layers of silty clay, silty sand, and sandy clay to the bottoms of the borings. No staining or foul or unusual odors were noted in the soils. Soils were slightly moist to moist starting at 4 feet bgs to the end of the borings. Temporary wells with five-foot screens were placed in borings B-1 and B-2 to allow for accumulation of groundwater. Groundwater was measured in B-1 and B-2 at depths of 18 and 16 feet bgs, respectively. A sufficient volume of water did not enter B-2 to allow for sampling, so
boring B-2A was drilled adjacent to B-2 for the purpose of collecting a groundwater sample; soil samples were not collected from boring B-2A.

Borings B-3 and B-4 were advanced through the training area in front of the Harmony fire station to depths of 18.5 and 16 feet bgs, respectively, where refusal presumably due to bedrock was experienced. Soils encountered in borings B-3 and B-4 were comprised of topsoil over silt and clay to depths of 15 and 15.5 feet bgs, underlain by sandy clay and gravelly clay to the bottom of the borings. No staining or foul or unusual odors were noted in the soils. Groundwater was not encountered in borings B-3 and B-4. A temporary well was placed into boring B-3 for approximately ninety minutes to allow groundwater to seep into the boring; however, groundwater did not accumulate in the well.

Upon completion of soil and groundwater sampling at each boring, the boring was grouted and sealed in accordance with applicable MDH requirements. Soil samples were collected from all four borings and groundwater samples were collected from B-1 and B-2, for laboratory analysis as described in Section 1.3 (Task 3) of the main body of the report.

**Sampling Results – Harmony Fire Foam Training Areas**

Laboratory analysis detected PFC compound concentrations in soil samples collected from the fire foam training area in front of the Harmony Fire Station, and in groundwater samples collected from the fire foam training area at the municipal tree/brush dump. PFCs were not detected in the soil samples collected at the tree/brush dump training site. Detected compound concentrations are summarized in the tables below. All soil and groundwater sample analytical results, including non-detected results, are summarized in Table 1, Soil Analytical Results, PFCs and TOC, and Table 2, Groundwater Analytical Results, PFCs, of this report. A copy of the laboratory report with the chain-of-custody record is included in Appendix G.

<table>
<thead>
<tr>
<th>Soil Boring</th>
<th>Sample Depth</th>
<th>Compound Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-3 0-4</td>
<td>feet</td>
<td>0.2 ng/g PFPeA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.161 ng/g PFHpA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.125 ng/g PFNA</td>
</tr>
<tr>
<td>B-4 0-4</td>
<td>feet</td>
<td>0.253 ng/g PFPeA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.133 ng/g PFHxA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.15 ng/g PFHpA</td>
</tr>
</tbody>
</table>

ng/g = nanograms per gram, which is equivalent to parts per billion (ppb).
The MPCA Tier 1 Residential and Tier 2 Recreational SRVs for PFOS and PFOA are 2,000 ng/g and 4,000 ng/g, respectively. The Tier 2 Industrial SRVs for PFOS and PFOA are 12,000 ng/g and 23,000 ng/g. None of the detected soil concentrations in the Harmony soil samples met or exceeded any of the MPCA SRVs.

The MPCA Tier 1 Residential and Tier 2 Recreational SRVs for PFOS and PFOA are 2,000 ng/g and 4,000 ng/g, respectively. The Tier 2 Industrial SRVs for PFOS and PFOA are 12,000 ng/g and 23,000 ng/g. None of the detected soil concentrations in the Harmony soil samples met or exceeded any of the MPCA SRVs.

### Groundwater Sample PFC Detections – Harmony Fire Department Fire Foam Training Areas

<table>
<thead>
<tr>
<th>Soil Boring</th>
<th>Compound Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-1</td>
<td>7.3 ng/L PFBA</td>
</tr>
<tr>
<td></td>
<td>3.27 ng/L PFPeA</td>
</tr>
<tr>
<td></td>
<td>2.67 ng/L PFHxA</td>
</tr>
<tr>
<td></td>
<td>7 ng/L PFOA</td>
</tr>
<tr>
<td></td>
<td>8.33 ng/L PFOS</td>
</tr>
<tr>
<td>B-2</td>
<td>9.04 ng/L PFBA</td>
</tr>
<tr>
<td></td>
<td>2.52 ng/L PFPeA</td>
</tr>
<tr>
<td></td>
<td>6.92 ng/L PFOA</td>
</tr>
<tr>
<td></td>
<td>6.74 ng/L PFOS</td>
</tr>
</tbody>
</table>

ng/L = nanograms per liter, which is equivalent to parts per trillion (ppt).

The MDH HRL for both PFOS and PFOA in drinking water is 300 ng/L. The MDH HBV for PFBA for acute, one day exposure is 8,000 ng/L; the HBV for short-term, subchronic and chronic exposures is 7,000 ng/L. The detected concentrations in the Harmony groundwater samples did not meet or exceed the HRLs for PFOS or PFOA nor the HBV for PFBA.

**Discussion and Conclusion – Harmony Fire Foam Training Area**

Based on information provided by the Harmony Fire Chief, the last fire foam training at the tree/bush dump occurred within the last year, where borings B-1 and B-2 were advanced. While no PFCs were detected in the soil samples collected from B-1 and B-2, PFCs were detected in the groundwater samples. The most likely source of PFCs in groundwater at B-1 and B-2 is the firefighting foam discharged at the site, or due to migration from an off-site source such as the fire foam training area and the Harmony fire station.

The last fire foam training in front of the fire station occurred ten to fifteen years ago, where borings B-3 and B-4 were drilled. PFCs were detected in the shallow soil samples collected from B-3 and B-4. Thus,
barring another source of PFCs in the soils at the Harmony fire station, it appears that the discharge of fire foam at the site resulted in the release of PFCs to the soil and that the PF Cs have remained in the shallow soils for approximately ten to fifteen years.
FIGURE 1
FIRE FOAM TRAINING AREA LOCATION
HARMONY FIRE STATION AND TREE/BRUSH DUMP
HARMONY, MINNESOTA

LEGEND:
- Well Locations

PROJECT NO. 19382DE
PREPARED BY NR
DRAWN BY DD
DATE 5/12/09
REVIEWED BY
FILE NAME Harmony-1
1. Does your Department currently or has your Department historically used Class A or Class B foams for firefighting operations?
   - Yes - Proceed to Question 2
   - No - Sign the back of this form and return to Delta Consultants

2. How often is Class B or Class A foam used in response to fire calls?
   - 0-25% of fires
   - 25-50% of fires
   - 75-100% of fires

3. Does the Department have a compressed air foam system (CAFS) with a built-in tank on its engine(s)?
   - Yes
   - No

4. How often is foam used in training exercises?
   - Weekly
   - Monthly
   - Quarterly
   - Semi-Annually
   - Annually
   - Bi-Annually
   - Other (please specify):

5. How much foam is used per training event?
   - Less than 5 gallons
   - 5 gallons
   - 5 to 10 gallons
   - More than 10 gallons (please specify):

6. In training, where does the spent foam go?
   - Storm Sewer
   - Sanitary Sewer
   - On-Site Septic
   - Ground
   - Other (please specify):

7. Where does/did the training take place? Please include address, intersection or other specific location information for current and past training areas.
   - Fire Hall, Main Ave.
   - Brush Dump, Exit 135, Garden Road

---

Xinogen
5910 Rice Creek Parkway Suite 100 St. Paul, MN 55126 USA
Phone: 651.639.9449 / 800.477.7411 Fax: 651.639.9473 www.deltaenv.com
8. What type(s) and brand(s) of foam are or were used now and in the past by the Department, both for fire response and in training (if applicable)? Please check all that apply.

<table>
<thead>
<tr>
<th>Type of Foam</th>
<th>Brand of Foam</th>
<th>Used in Training?</th>
<th>Amount Used</th>
<th>Current Use or Historic Use?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class B Aqueous Film-Forming Foam (AFFF)</td>
<td></td>
<td>Yes</td>
<td>Under 5 gal</td>
<td>Current</td>
</tr>
<tr>
<td>Class B Alcohol-Resistant (AR)-AFFF</td>
<td>Ansul FLX</td>
<td>Yes</td>
<td>Under 5 gal</td>
<td></td>
</tr>
<tr>
<td>Class B Protein</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Fluoroprotein (FP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Class B Film-Forming Fluoroprotein (FFF)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Class B AR-FFF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class A-B Hi Expansion Foam</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class A</td>
<td>Silva-Ex</td>
<td>Yes</td>
<td>Under 5 gal</td>
<td>Current</td>
</tr>
<tr>
<td>Training Foam</td>
<td>Aque-Ex</td>
<td>Yes</td>
<td>Under 5 gal</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>Aqua-Ex</td>
<td>Yes</td>
<td>1 Stick</td>
<td>Current</td>
</tr>
</tbody>
</table>

Thank you for your time and cooperation. Please contact Nancy Rodning at Delta Consultants (651-697-5152 or nrodnin@deltamn.com) or Jim Stockinger at the Minnesota Pollution Control Agency (651-297-8666 or jim.stockinger@state.mn.us) if you have any questions regarding this questionnaire.

*Please return this questionnaire to Delta Consultants by May 9, 2008 in the enclosed stamped, self-addressed envelope.*

Questionnaire completed by:

**Bill Heaton Chief**

Name and Title

**Harmony Fire Dept.**

Fire Department

507-886-4600 D (5211 H) 4-29-08

Phone Number

Date

E-Mail Address

**HarmonyVF00@yahoo.com**
ACCESS AGREEMENT BETWEEN
THE MINNESOTA POLLUTION CONTROL AGENCY
AND CITY OF HARMONY, MINNESOTA

The Minnesota Pollution Control Agency (MPCA) is investigating firefighting training sites where Class B foams have been or are being utilized. The site reconnaissance and investigation will be conducted at the following firefighting training sites owned by the City of Harmony and utilized by the Harmony Fire Department:

(1) Harmony Fire Hall, Main Avenue South
(2) Brush dump located east of the intersection of 139 and Garden Road

The Property Owner hereby consents and authorizes the MPCA, its employees, agents and contractors, to enter these properties for the purpose of performing reasonable and necessary investigations in response to the use of Class B firefighting foams that may or may not contain perfluorocarbons (PFCs). The MPCA is authorized to take these actions under Minn. Stat. § 115C.03, subd. 7 (2002).

The MPCA will notify the Property Owner at least 48 hours before visiting the properties. Work will be conducted during regular business hours (8:00 a.m. to 5:00 p.m.) unless the MPCA receives permission to and arrangements are made to conduct work during different hours. The MPCA will conduct its activities so as to minimize interference with the use of the properties. If any portion of the properties must be disturbed as a result of the MPCA's activities, the MPCA will restore the property as close to its original condition as is reasonably possible under the circumstances. The Property Owner will take reasonable precautions to ensure that the equipment of the MPCA and its contractors on the properties is not damaged, and that the work being conducted by the MPCA, its employees, agents and contractors is not disrupted.

The MPCA will obtain all necessary permits for installation of soil borings and temporary monitoring wells, if such wells are installed. Upon completion of sampling, the MPCA will seal the borings and monitoring wells in accordance with state law. Results of all testing conducted on the properties will be provided to the Property Owner.

The MPCA shall be liable for injury to or loss of property, or personal injury or death, caused by an act or omission of any employee of the state in the performance of the work described above, under the circumstances where the state, if a private person, would be liable to the claimant, in accordance with Minn. Stat. § 3.736.

MINNESOTA POLLUTION CONTROL AGENCY

Signature

Title

Date

2/23/09

City of Harmony

Signature

Title

Date

2-11-09
Photograph 1
The entrance to the brush/tree dump off of County Road 44, view facing southwest. The brush/tree pile is situated beneath overhead power lines. The location of the small intermittent creek is marked by the tree line in the distance.

Photograph 2
Soil borings B-1 and B-2 were advanced in the fire foam training area situated on the northeast side of the brush/tree pile. Soil boring location stakes are circled in the photo; B-1 is at right and B-2 is at left.
Photograph 1
Fire foam was sprayed onto the asphalt pavement in front of the fire station and the adjoining grassy area, in a roughly triangular area. Photo view facing northeast.

Photograph 2
Soil borings B-1 and B-2 were advanced in the fire foam training area situated in front (west) of the fire station. Soil boring location stakes are circled in the photo; B-3 is at left and B-4 is at right.
**ENVIRONMENTAL BORING LOG**

**BORING ID:** B-1  
**TOTAL DEPTH:** 22'

### PROJECT INFORMATION

- **Project:** PFC's in Fire Fighting Foam  
- **Site Location:** Harmony, MN  
- **Job No.:** 19382DEL03  
- **Logged By:** Curt McKay  
- **Weather:** Partly Cloudy  
- **Date Completed:** 4/23/09  
  
- **Water Level During Drilling:** 18'

### DRILLING INFORMATION

- **Drilling Co.:** West Central Environmental Consultants  
- **Drill Crew Chief:**  
- **Rig Type:** Truck-Mounted Geoprobe  
- **Method of Drilling:** Direct Push Probe  
- **Soil Sampling Method:** 4' samplers with liners  
- **Surface Elevation (feet):** NA  
- **Field Screening Instrument:** None

### DEPTH | LITHOLOGY | DESCRIPTION | USCS | LAB SAMP. | PID ppm
--- | --- | --- | --- | --- | ---
0 | TOPSOIL | (0.00, 4.00) Topsoil and gravel, dry. Top 5 ft hand augered. | PT | Composite Sample from 0' - 4'. | NA
5 | SILT | (4.00, 16.00) Brown silt, moist/soft. | ML | Composite Sample from 4' - 8'. | 
10 | SILT | (16.00, 17.50) Light brown silt, moist/soft. | ML |  | 
15 | SILTY SAND | (17.50, 17.70) Brown silty sand, medium grain size, moist. | SM |  | 
20 | SANDY CLAY | (17.70, 20.00) Brown sandy clay, gravel < 1/2 inch, moist/slightly wet. | CL | Water Sample from 17' - 22'. | 
| | (20.00, 21.00) CLAY | Brown clay, soft/moist. | SC |  | 
| | (21.00, 21.75) CLAYEY SAND | Brown clay and sand, soft. | GW |  | 
| | (21.75, 22.00) GRAVEL | Light brown gravel, slightly moist. |  |  | 

**Comments:** Refusal and E.O.B. at 22'.  
**Boring Location:** 43 32.594' N / 92 00.347' W
## Project Information

- **Project:** PFC's in Fire Fighting Foam
- **Site Location:** Harmony, MN
- **Job No.:** 19382DEL03
- **Logged By:** Curt McKay
- **Weather:** Partly Cloudy
- **Date Completed:** 4/23/09
- **Water Level During Drilling:** 16'

## Drilling Information

- **Drilling Co.:** West Central Environmental Consultants
- **Drill Crew Chief:**
- **Rig Type:** Truck-Mounted Geoprobe
- **Method of Drilling:** Direct Push Probe
- **Soil Sampling Method:** 4' samplers with liners
- **Surface Elevation (feet):** None
- **Field Screening Instrument:** None

## Depth Log

<table>
<thead>
<tr>
<th>Depth</th>
<th>Lithology</th>
<th>Description</th>
<th>USCS</th>
<th>Lab Samp.</th>
<th>PID ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>(0.00, 4.00) TOPSOIL</td>
<td>Topsoil and gravel. Top 5 ft hand augered.</td>
<td>PT</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>(4.00, 8.00) SILT</td>
<td>Brown silt, moist.</td>
<td>ML</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>(8.00, 12.00) SILT</td>
<td>Brown silt, soft/moist.</td>
<td>ML</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>(12.00, 15.00) SILTY CLAY</td>
<td>Brown silty clay, soft/moist.</td>
<td>CL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>(15.00, 16.00) SILT</td>
<td>Light brown silt, soft.</td>
<td>ML</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(16.00, 18.00) SILT</td>
<td>Light brown silt, soft/slightly wet.</td>
<td>ML</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(18.00, 18.50) SILTY CLAY</td>
<td>Brown silty clay, moist.</td>
<td>CL</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(18.50, 18.70) SANDY CLAY</td>
<td>Brown sandy clay, gravel &lt;1/2 inch, moist to wet.</td>
<td>CL</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(18.70, 20.00) CLAY</td>
<td>Brown clay, slightly moist.</td>
<td>CL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Comments:** E.O.B. at 20’. Boring Location: 43 32.595' N / 92 00.341' W

Could not collect water sample. Drill boring B-2A.
### Project Information

- **Project:** PFC's in Fire Fighting Foam
- **Site Location:** Harmony, MN
- **Job No.:** 19382DEL03
- **Logged By:** Curt McKay
- **Date Completed:** 4/23/09
- **Weather:** Partly Cloudy
- **Water Level During Drilling:** 16'

### Drilling Information

- **Drilling Co.:** West Central Environmental Consultants
- **Drill Crew Chief:**
- **Rig Type:** Truck-Mounted Geoprobe
- **Method of Drilling:** Direct Push Probe
- **Soil Sampling Method:** 4' samplers with liners
- **Surface Elevation (feet):** NA
- **Field Screening Instrument:** None

### DEPTH | LITHOLOGY | DESCRIPTION | USCS | LAB SAMP. | PID ppm
--- | --- | --- | --- | --- | ---
0 | TOPSOIL | Topsoil and gravel. Top 5 ft hand augered. | PT | Soil Samples from B-2. | NA
5 | SILT | Brown silt, moist. | ML | | |
10 | SILT | Brown silt, soft/moist. | ML | | |
15 | SILTY CLAY | Brown silty clay, soft/moist. | CL | | |
20 | SILTY CLAY | Brown silty clay, moist. | CL | | |
24 | SANDY CLAY | Brown sandy clay, gravel <1/2 inch, moist to wet. | CL | Water Sample from 19' - 24'. | |
25 | CLAY | Brown clay, slightly moist. | CL | | |
20.00 | GRAVEL | Light brown gravel, slightly moist. | GW | | |

**Comments:** E.O.B. at 24'.

**Boring Location:** 43 32.595' N / 92 00.341' W
## PROJECT INFORMATION

- **Project:** PFC's in Fire Fighting Foam
- **Site Location:** Harmony, MN
- **Job No.:** 19382DEL03
- **Logged By:** Curt McKay
- **Weather:** Partly Cloudy
- **Date Completed:** 4/23/09
- **Water Level During Drilling:** Dry

## DRILLING INFORMATION

- **Drilling Co.:** West Central Environmental Consultants
- **Drill Crew Chief:** Jake
- **Rig Type:** Truck-Mounted Geoprobe
- **Method of Drilling:** Direct Push Probe
- **Soil Sampling Method:** 4' samplers with liners
- **Surface Elevation (feet):** NA
- **Field Screening Instrument:** None

## DEPTH | LITHOLOGY | DESCRIPTION | USCS | LAB SAMP. | PID ppm
--- | --- | --- | --- | --- | ---
0 | TOPSOIL | Grass and topsoil. Top 5 ft hand augered. | PT | ML | NA
5 | SILT | Brown silt, very moist/soft. | ML | | |
10 | SILT | Brown silt, moist/soft. | CL | CL | CL
15 | SILTY CLAY | Light brown silty clay, firm. | CL | CL | CL
16 | SANDY CLAY | Brown sandy clay, gravel/rock, tight, refusal, offset boring 1'. | CL | CL | CL
18.5 | CLAY AND GRAVEL | Light brown clay and gravel, moist/slightly wet. | CL | CL | CL

**Comments:** Refusal and E.O.B. at 18.5'.

**Boring Location:** 43 32.657' N / 92 00.577' W
**ENVIRONMENTAL BORING LOG**

**BORING ID:** B-4

**TOTAL DEPTH:** 16'

### PROJECT INFORMATION

- **Project:** PFC's in Fire Fighting Foam
- **Site Location:** Harmony, MN
- **Job No.:** 19382DEL03
- **Logged By:** Curt McKay
- **Weather:** Partly Cloudy
- **Date Completed:** 4/23/09
- **Water Level During Drilling:** Dry

### DRILLING INFORMATION

- **Drilling Co.:** West Central Environmental Consultants
- **Drill Crew Chief:**
- **Rig Type:** Truck-Mounted Geoprobe
- **Method of Drilling:** Direct Push Probe
- **Soil Sampling Method:** 4' samplers with liners
- **Surface Elevation (feet):** NA
- **Field Screening Instrument:** None

### DEPTH | LITHOLOGY | DESCRIPTION
--- | --- | ---
0 | TOPSOIL: Grass and topsoil. Top 5 ft hand augered. | PT
5 | SILT: Brown silt, moist/soft. | ML
10 | CLAY: Brown clay, tight. | CL
15 | SANDY CLAY: Brown sandy clay, tight. | CL

**Comments:** Refusal and E.O.B. at 16'.

**Boring Location:** 43 32.661' N / 92 00.582' W
APPENDIX H

Kenyon Fire Department Discussion and Supporting Documents
Background and Access – Kenyon Fire Foam Training Area

The former Kenyon Fire Department Fire Chief completed a firefighting foam use questionnaire via a telephone interview in September 2008, indicating the department's use of a variety of Class B firefighting foams for training, including 3M-brand AFFF. The Fire Chief indicated that less than five gallons of foam is used per training event. A copy of the questionnaire is included in Appendix H.

The former Fire Chief indicated that they train with foam at the fire station. In a follow-up telephone conversation with the current Fire Chief, he stated that the foam training is actually conducted on Slee Street, between Cross and Pine Streets at the east end of town. The Kenyon Fire Department reportedly elects a new fire chief every year. The current fire chief has been with the department for twenty years. The location of the fire training area on Slee Street is shown on Figure 1, Fire Foam Training Area Location, Kenyon, also included in Appendix H. An access agreement was signed by the Kenyon City Administrator, the Kenyon Mayor, and the MPCA, allowing access for a site reconnaissance and sampling at the fire foam training area. A copy of the access agreement is included in Appendix H.

As presented in Delta’s April 2009 report, the inferred groundwater flow direction in the area of the fire foam training area is to the north.

Site Reconnaissance – Kenyon Fire Foam Training Area

Site reconnaissance of the Kenyon fire foam training area was conducted on April 29, 2009. Delta representative Nancy Rodning was accompanied by the current Kenyon Fire Chief. The Fire Chief showed Delta where fire foam training takes place along the east side of Slee Street, approximately between Cross and Pine Streets. All of these streets are asphalt-paved, with a slight grade to the north. He indicated that some foam may run over the street into the grassy right-of-way along the street, and the last time the department trained with firefighting foam was approximately five years ago. Photographs of the training area are included in Appendix H.

Delta recorded GPS locations of the fire training area using a hand-held GPS unit with an accuracy of approximately 15 feet. The training area is shown on the figure Kenyon Fire Department Fire Foam Training Area, which is included in Appendix H.

The Kenyon Fire Chief could not recall any large fires in the last twenty years where more than five gallons of Class B firefighting foam would have been used.

The Kenyon Fire Chief was not aware of any water wells in the area of the fire foam training location, and related that the city well is located several blocks to the south. No other potential community water supply
systems such as those typically associated with rest stops, trailer parks, etc., were observed within 1/4-mile of the training area. Nearby houses may or may not utilize private wells; none were observed during the site reconnaissance. Nearby water wells identified via a search of the MDH CWI are shown on Figure 1, Fire Foam Training Area Location, Kenyon and are described in the Site Summary included in Delta’s April 2009 Report.

Locations for soil borings along the east side of Slee Street were discussed during the site reconnaissance.

Sample Collection – Kenyon Fire Foam Training Area

On May 15, 2009, two soil borings were advanced in the grassy right-of-way within two to three feet of the east edge of Slee Street. Soil boring locations are shown on the figure Kenyon Fire Department Fire Foam Training Area included in Appendix H. Soil borings were advanced by Glacier Inc. using push probe drilling technology, under the oversight of Delta personnel. Soil samples were collected continuously and logged onto soil boring logs. Soil boring logs detailing soil descriptions, boring depths, and the GPS locations of the borings are included in Appendix H.

Borings B-1 and B-2 were advanced to depths of 20 feet and 15 feet below grade (bgs), respectively. Soils encountered in both borings consisted of varying layers of silty sand, silty clay, and sandy silt to an approximate depth of 15 feet bgs, where weathered shale bedrock was encountered. Boring B-2 was advanced five feet into the weathered bedrock; groundwater was not encountered in the either boring. Upon completion of soil sampling at each boring, the boring was grouted and sealed in accordance with applicable MDH requirements.

Soil samples were collected and submitted for laboratory analysis as described in Section 1.3 (Task 3) of the main body of the report. A second set of soil samples were also submitted to MPI Research for laboratory analysis of PFCs, for laboratory comparison purposes.

Sampling Results – Kenyon Fire Foam Training Area

Analytical results were not available from Axys Analytical Services LTD or MPI Research at the time of this report. Analytical results will be presented in a forthcoming report.
1. Does your Department currently or has your Department historically used Class A or Class B foams for firefighting operations?
   ☑ Yes - Proceed to Question 2
   ☐ No - Sign the back of this form and return to Delta Consultants

2. How often is Class B or Class A foam used in response to fire calls?
   ☑ 0-25% of fires
   ☐ 25-50% of fires
   ☐ 75-100% of fires

3. Does the Department have a compressed air foam system (CAFS) with a built-in tank on its engine(s)?
   ☑ Yes
   ☐ No

4. How often is foam used in training exercises?
   ☑ Never
   ☐ Weekly
   ☐ Monthly
   ☑ Quarterly
   ☐ Semi-Annually
   ☐ Annually
   ☑ Bi-Annually
   ☐ Other (please specify): _______________________

5. How much foam is used per training event?
   ☑ Less than 5 gallons
   ☐ 5 gallons
   ☐ 5 to 10 gallons
   ☐ More than 10 gallons (please specify): _______________________

6. In training, where does the spent foam go?
   ☑ Storm Sewer
   ☐ Sanitary Sewer
   ☐ On-Site Septic
   ☐ Ground
   ☐ Other (please describe): _______________________

7. Where does/did the training take place? Please include address, intersection or other specific location information for current and past training areas.
   _______________________
   _______________________
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OVER→
8. What type(s) and brand(s) of foam are or were used now and in the past by the Department, both for fire response and in training (if applicable)? Please check all that apply.

<table>
<thead>
<tr>
<th>Type of Foam</th>
<th>Brand of Foam</th>
<th>Used in Training?</th>
<th>Amount Used Annually</th>
<th>Currently Used?</th>
<th>Historically Used?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class B Aqueous Film-Forming Foam</td>
<td>Varies, mostly 3M</td>
<td>Yes</td>
<td>20</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>(AFFF)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Alcohol-Resistant (AR)-</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>AFFF</td>
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<tr>
<td>Class B Protein</td>
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<tr>
<td>Class B Fluoroprotein (FP)</td>
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<tr>
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<td>(FFF)</td>
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<td>Class A Training Foam</td>
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<td>25</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

Thank you for your time and cooperation. Please contact Nancy Rodning at Delta Consultants (651-697-5152 or nrodnning@deltaenv.com) if you have any questions regarding this questionnaire.

Please return this questionnaire to Delta Consultants by September 19, 2008 in the enclosed stamped, self-addressed envelope.

Questionnaire completed by:

[Signature]

Name and Title

[Signature]

Fire Department

507-838-9057

Phone Number

Date

E-Mail Address

[Signature]
ACCESS AGREEMENT BETWEEN
THE MINNESOTA POLLUTION CONTROL AGENCY
AND CITY OF KENYON

The Minnesota Pollution Control Agency (MPCA) is investigating firefighting training sites where Class B foams have been or are being utilized. The site reconnaissance and investigation will be conducted at the following firefighting training site owned by the City of Kenyon and utilized by the City of Kenyon Fire Department:

Training Site on Slee Street
Kenyon, Minnesota

The Property Owner hereby consents and authorizes the MPCA, its employees, agents and contractors, to enter this property for the purpose of performing reasonable and necessary investigations in response to the use of Class B firefighting foams that may or may not contain perfluorochemicals (PFCs). The MPCA is authorized to take these actions under Minn. Stat. § 115B.17, subd. 4 and 115.4, subd. 3.

The MPCA will notify the Property Owner at least 48 hours before entering the property. Work will be conducted during regular business hours (8:00 a.m. to 5:00 p.m.) unless the MPCA receives permission to and arrangements are made to conduct work during different hours. The MPCA will conduct its activities so as to minimize interference with the use of the property. If any portion of the property must be disturbed as a result of the MPCA's activities, the MPCA will restore the property as close to its original condition as is reasonably possible under the circumstances. The Property Owner will take reasonable precautions to ensure that the equipment of the MPCA and its contractors on the property is not damaged, and that the work being conducted by the MPCA, its employees, agents and contractors is not disrupted.

The MPCA will obtain all necessary permits for installation of soil borings and temporary monitoring wells, if such wells are installed. Upon completion of sampling, the MPCA will seal the borings and monitoring wells in accordance with state law. Results of all testing conducted on the property will be provided to the Property Owner.

The MPCA shall be liable for injury to or loss of property, or personal injury or death, caused by an act or omission of any employee of the state in the performance of the work described above, under the circumstances where the state, if a private person, would be liable to the claimant, in accordance with Minn. Stat. § 3.736.

MINNESOTA POLLUTION CONTROL AGENCY

Signature

Title

Date

3/19/09

City of Kenyon

Signature

Date

3/10/09
Photograph 1
Fire foam was sprayed on the east (left) side of the Slee Street, between Cross and and Pine Streets. View from north of the training area facing south.

Photograph 2
View of the same training area along the east (right) side of Slee Street, from the south facing north.
### ENVIRONMENTAL BORING LOG

**BORING ID:** B-1  
**TOTAL DEPTH:** 20'

#### PROJECT INFORMATION
- **Project:** PFC's in Fire Fighting Foam  
- **Site Location:** Kenyon, MN  
- **Job No.:** 19382DEL04  
- **Logged By:** Kyle Von Spreecken  
- **Weather:** Sunny  
- **Date Completed:** 5/15/09  
- **Water Level During Drilling:** Dry  

#### DRILLING INFORMATION
- **Drilling Co.:** Glacier Drilling  
- **Drill Crew Chief:** Chris Niesen  
- **Rig Type:** Remote Controlled Track Geoprobe  
- **Method of Drilling:** Direct Push Probe  
- **Soil Sampling Method:** 5' samplers with liners  
- **Surface Elevation (feet):** NA  
- **Field Screening Instrument:** None

#### DEPTH | LITHOLOGY | DESCRIPTION | USCS | LAB SAMP. | PID ppm
---|---|---|---|---|---
0 | (0.00, 0.50) TOPSOIL | Grass and black topsoil. Top 5 ft hand augered. | PT | SM | NA
(0.50, 2.00) SILTY SAND | Dark brown silty sand, trace of gravel <1/2", moist. | SM | | |
(2.00, 3.00) SILTY SAND | Brown silty sand and gravel, moist. | ML | | |
(3.00, 3.25) Silt | Dark brown/black silt, trace of clay, moist. | CL | | |
(3.25, 4.00) SILTY CLAY | Light brown silty clay, trace of sand, moist. | CL | | |
(4.00, 7.00) SILTY CLAY | Brown silty clay, trace of sand, moist. | CL | | |
(7.00, 10.00) SANDY CLAY | Light brown sandy clay, moist/soft. | CL | | |
(10.00, 12.00) SILTY CLAY | Light brown/rust silty clay, wet | CL | Composite Sample from 0' - 4'. |
(12.00, 15.00) SANDY SILT | Light brown sandy silt, trace of clay, moist to dry. | SM | | |
(15.00, 17.50) SILTACEOUS SHALE | Light brown/gray silt, some weathered bedrock (shale), dry. | ML | | |
(17.50, 20.00) SHALE | Gray, weathered bedrock, trace of silt, dry, crumbly. | | | |

**Comments:** E.O.B. and refusal at 20'.

**Boring Location:** 44 16.481' N / 92 58.952' W
### ENVIRONMENTAL BORING LOG

**BORING ID:** B-2  
**TOTAL DEPTH:** 15'

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>LITHOLOGY</th>
<th>DESCRIPTION</th>
<th>USCS</th>
<th>LAB SAMP.</th>
<th>PID ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>FILL</td>
<td>Light brown sand and gravel fill. Top 5 ft hand augered.</td>
<td>SW</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SAND AND GRAVEL</td>
<td>Brown sand and gravel, dry/moist.</td>
<td>SM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.25</td>
<td>SILTY SAND</td>
<td>Dark brown silty sand, moist.</td>
<td>CL</td>
<td>CL</td>
<td></td>
</tr>
<tr>
<td>2.00</td>
<td>SILTY CLAY</td>
<td>Black silty clay, moist.</td>
<td>CL</td>
<td>CL</td>
<td></td>
</tr>
<tr>
<td>3.25</td>
<td>SILTY CLAY</td>
<td>Brown silty clay, moist.</td>
<td>SW</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>5.50</td>
<td>SILTY CLAY</td>
<td>Light brown silty clay, moist/soft.</td>
<td>SM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.00</td>
<td>SANDY SILT</td>
<td>Light brown/rust sandy silt, dry to moist, hard.</td>
<td>SM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.50</td>
<td>SANDY SILT</td>
<td>Light brown/gray sandy silt, trace of gravel &lt; 1/2&quot;, dry/moist.</td>
<td>SM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.00</td>
<td>SILTY CLAY</td>
<td>Brown silty clay, moist.</td>
<td>ML</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.20</td>
<td>SILTACEOUS SHALE</td>
<td>Light brown/gray silt and weathered bedrock (shale), dry, hard.</td>
<td>ML</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Project Information**
- **Project:** PFC's in Fire Fighting Foam  
- **Site Location:** Kenyon, MN  
- **Job No.:** 19382DEL04  
- **Logged By:** Kyle Von Spreecken  
- **Weather:** Sunny  
- **Date Completed:** 5/15/09
- **Water Level During Drilling:** Dry

**Drilling Information**
- **Drilling Co.:** Glacier Drilling  
- **Drill Crew Chief:** Chris Niesen  
- **Rig Type:** Remote Controlled Track Geoprobe  
- **Method of Drilling:** Direct Push Probe  
- **Soil Sampling Method:** 5' samplers with liners  
- **Surface Elevation (feet):** NA  
- **Field Screening Instrument:** None

**Comments:** E.O.B. and refusal at 15'.

**Boring Location:** 44 16.498' N / 92 58.958' W
APPENDIX I
Luverne Fire Department Discussion and Supporting Documents
Background and Access – Luverne Fire Foam Training Area

The former Luverne Fire Department Fire Chief completed a firefighting foam use questionnaire via a telephone interview in September 2008, indicating the department’s occasional use of AR-AFFF for training. The former Fire Chief was unsure of the AR-AFFF foam brand, but related they only have AR-AFFF on hand due to the presence of a nearby ethanol plant. He indicated that they mostly train with Class A foam. A copy of the questionnaire is included in Appendix I.

The former Fire Chief indicated that they trained with AR-AFFF at a tree/bush dump situated one-half mile south of town, on the east side of Highway 75. He related that a burn pan was used for fire training, and that a city payloader was used to pick up the burn pan and surrounding gravel. The location of the fire foam training area is shown on Figure 1, Fire Foam Training Area Location, Luverne, also included in Appendix I. An access agreement was signed by the current Luverne Fire Chief and the MPCA, allowing access for a site reconnaissance and sampling at the fire foam training area. A copy of the access agreement is included in Appendix I.

The former Luverne Fire Chief who completed the questionnaire died in early 2009; the current Fire Chief has been with the Luverne Fire Department for twenty-five years. In a follow-up telephone conversation with the current fire chief in April 2009, he indicated that training with AR-AFFF at the tree/bush dump was a one-time event that occurred approximately four years ago.

As presented in Delta’s April 2009 report, the inferred groundwater flow direction in the area of the fire foam training area is easterly in the surficial deposits aquifer, and southerly in the uppermost bedrock aquifer.

Site Reconnaissance – Luverne Fire Foam Training Area

Site reconnaissance of the Luverne fire foam training area was conducted on April 21, 2009. Delta representative Curt McKay was accompanied by the current Luverne Fire Chief. The Fire Chief showed Delta where fire foam training took place at the municipal tree/bush dump, which is located at the southeast corner of the intersection of Highway 75 and 101st Street. The burn pan was placed toward the east end of an unpaved driveway leading to the brush/tree pile, on the south side of the driveway. The site is relatively flat, with a slight grade from the area where the burn pan was used down toward a south-adjoining pond. The pond is located approximately 150 feet south of the area where the burn pan was placed. Photographs of the training area are included in Appendix I.
Delta recorded GPS locations of the fire training area using a hand-held GPS unit with an accuracy of approximately 15 feet. The training area is shown on the figure **Luverne Fire Department Fire Foam Training Area**, which is included in **Appendix I**.

A municipal well labeled "Well 2A" was observed on the northeast corner of the tree/brush dump, approximately 325 feet northeast of the spot where the burn pan was situated during the foam training exercise. While this well was labeled 2A, a map provided by the Minnesota Department of Health indicates this is municipal well 23. A residential well was observed on the north-adjoining property. No other potential community water supply systems such as those typically associated with rest stops, trailer parks, etc., were observed within 1/4-mile of the training area. Nearby houses and businesses may or may not utilize private wells; none were observed during the site reconnaissance except as previously noted. Nearby water wells identified via a search of the MDH CWI are shown on Figure 1, **Fire Foam Training Area Location, Luverne** and are described in the Site Summary included in Delta’s April 2009 Report.

Locations for soil borings in the fire foam training area were discussed during the site reconnaissance.

**Sample Collection – Luverne Fire Foam Training Area**

On May 22, 2009, three soil borings were advanced at the Luverne tree/brush dump. Soil boring locations are shown on the figure **Luverne Fire Department Fire Foam Training Area** included in **Appendix I**. Soil borings were advanced by West Central Environmental Consultants using push probe drilling technology, under the oversight of Delta personnel. Soil samples were collected continuously and logged onto soil boring logs. Soil boring logs detailing soil descriptions, groundwater depths, boring depths, and the GPS locations of the borings are included in **Appendix I**.

Boring B-2 was located at the spot where the burn pan was situated and was advanced to a depth of 12 feet below the ground surface (bgs). Soils in B-2 consisted of one foot of topsoil and sandy clay to a depth of 4 feet bgs, over gravelly sand; groundwater was encountered at a depth of 9 feet bgs. B-1 and B-3 were located to the north and south of B-2, respectively. B-1 was advanced to a depth of 8 feet bgs, and B-3 was advanced to a depth of 12 feet bgs. Soils in B-1 and B-3 consisted of varying depths of topsoil and sandy clay over gravelly sand; groundwater in borings B-1 and B-3 was encountered at depths of 7 feet and 10 feet bgs, respectively. Upon completion of groundwater sampling at each boring, the boring was grouted and sealed in accordance with applicable MDH requirements.
Soil and groundwater samples were collected from all three borings and submitted for laboratory analysis as described in Section 1.3 (Task 3) of the main body of the report. A second set of soil and groundwater samples were also submitted to MPI Research for laboratory analysis of PFCs, for laboratory comparison purposes.

**Sampling Results – Luverne Fire Foam Training Area**

Analytical results were not available from Axys Analytical Services LTD or MPI Research at the time of this report. Analytical results will be presented in a forthcoming report.
1. Does your Department currently or has your Department historically used Class A or Class B foams for firefighting operations?
   - X Yes - Proceed to Question 2
   - No - Sign the back of this form and return to Delta Consultants

2. How often is Class B or Class A foam used in response to fire calls?
   - Class A
     - 0-25% of fires
     - 25-50% of fires
     - 50-75% of fires
     - 75-100% of fires

3. Does the Department have a compressed air foam system (CAFS) with a built-in tank on its engine(s)?
   - Yes
   - No

4. How often is foam used in training exercises?
   - Never
   - Weekly
   - Monthly
   - Quarterly
   - Semi-Annually
   - Annually
   - Bi-Annually
   - Other (please specify):

5. How much foam is used per training event?
   - Less than 5 gallons
   - 5 gallons
   - 5 to 10 gallons
   - More than 10 gallons (please specify):

6. In training, where does the spent foam go?
   - Storm Sewer
   - Sanitary Sewer
   - On-Site Septic
   - Ground
   - Other (please describe):

7. Where does/did the training take place? Please include address, intersection or other specific location information for current and past training areas.
   - [Handwritten location information]

   [Handwritten location information]

   [Handwritten location information]

   [Handwritten location information]

   [Handwritten location information]

   [Handwritten location information]

   OVER
8. What type(s) and brand(s) of foam are or were used now and in the past by the Department, both for fire response and in training (if applicable)? Please check all that apply.

<table>
<thead>
<tr>
<th>Type of Foam</th>
<th>Not Sure</th>
<th>Used in Training?</th>
<th>Amount Used Annually</th>
<th>Currently Used?</th>
<th>Historically Used?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class B Aqueous Film-Forming Foam (AFFF)</td>
<td></td>
<td>Yes</td>
<td>~5gal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Alcohol-Resistant (AR)-AFFF</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Protein</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Fluoroprotein (FP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Film-Forming Fluoroprotein (FFFP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B AR-FFFP</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Class A-B Hi Expansion Foam</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Class A</td>
<td>X</td>
<td>Yes</td>
<td>20-30 gal</td>
<td></td>
<td></td>
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<tr>
<td>Training Foam</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Thank you for your time and cooperation. Please contact Nancy Rodning at Delta Consultants (651-697-5152 or nrodnig@deltanv.com) or Jim Stockinger at the Minnesota Pollution Control Agency (651-297-8666 or jim.stockinger@state.mn.us) if you have any questions regarding this questionnaire.

**Please return this questionnaire to Delta Consultants by June 6, 2008 in the enclosed stamped, self-addressed envelope.**

Questionnaire completed by: 

[Signature]

Name and Title

[Signature]

Fire Department

507-283-9141 (work) 9-5-05

Phone Number

[Signature]

Date

E-Mail Address

[Signature]

5910 Rice Creek Parkway Suite 100 St. Paul, MN 55126 USA

Phone: 651.639.9449 / 800.477.7411 Fax: 651.639.9473 www.deltanv.com
ACCESS AGREEMENT BETWEEN
THE MINNESOTA POLLUTION CONTROL AGENCY
AND CITY OF LUVERNE

The Minnesota Pollution Control Agency (MPCA) is investigating firefighting training sites where Class B foams have been or are being utilized. The site reconnaissance and investigation will be conducted at the following firefighting training site owned by the City of Luverne and utilized by the Luverne Fire Department:

City Property located on the east side of Highway 75, ½ mile south of Luverne

The Property Owner hereby consents and authorizes the MPCA, its employees, agents and contractors, to enter this property for the purpose of performing reasonable and necessary investigations in response to the use of Class B firefighting foams that may or may not contain perfluorocarbons (PFCs). The MPCA is authorized to take these actions under Minn. Stat. § 115B.17, subd. 4 and 115.04, subd. 3.

The MPCA will notify the Property Owner at least 48 hours before entering the property. Work will be conducted during regular business hours (8:00 a.m. to 5:00 p.m.) unless the MPCA receives permission to and arrangements are made to conduct work during different hours. The MPCA will conduct its activities so as to minimize interference with the use of the property. If any portion of the property must be disturbed as a result of the MPCA’s activities, the MPCA will restore the property as close to its original condition as is reasonably possible under the circumstances. The Property Owner will take reasonable precautions to ensure that the equipment of the MPCA and its contractors on the property is not damaged, and that the work being conducted by the MPCA, its employees, agents and contractors is not disrupted.

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The MPCA shall be liable for injury to or loss of property, or personal injury or death, caused by an act or omission of any employee of the state in the performance of the work described above, under the circumstances where the state, if a private person, would be liable to the claimant, in accordance with Minn. Stat. § 3.736.

MINNESOTA POLLUTION CONTROL AGENCY

Signature

Title

Date

City of Luverne

Signature

Title

Date
Photograph 1
Location of soil boring B-1, view facing east toward the tree/brush pile. B-1 was placed between the spot where the burn pan was situated and a nearby municipal well.

Photograph 2
Location of soil boring B-2, view facing northeast toward the tree/brush pile. B-2 was placed at the spot where the burn pan was situated during the fire foam training event.
Soil boring B-3 was located between B-2 and the south-adjoining pond, view facing east.

Boring B-2 is in the foreground and B-3 is near the tree line. View facing south.
**PROJECT INFORMATION**

<table>
<thead>
<tr>
<th>Project:</th>
<th>PFC's in Fire Fighting Foam</th>
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<tbody>
<tr>
<td>Site Location:</td>
<td>Luverne, MN</td>
</tr>
<tr>
<td>Job No.:</td>
<td>19382DEL04</td>
</tr>
<tr>
<td>Logged By:</td>
<td>Cheryl Sorensen</td>
</tr>
<tr>
<td>Weather:</td>
<td>60 degrees. Cloudy</td>
</tr>
<tr>
<td>Date Completed:</td>
<td>5/22/09</td>
</tr>
<tr>
<td></td>
<td>Water Level During Drilling: 7'</td>
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**DRILLING INFORMATION**

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<tr>
<th>Drilling Co.:</th>
<th>West Central Environmental Consultants</th>
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<tbody>
<tr>
<td>Drill Crew Chief:</td>
<td>NA</td>
</tr>
<tr>
<td>Rig Type:</td>
<td>Truck-Mounted Geoprobe</td>
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<tr>
<td>Method of Drilling:</td>
<td>Direct Push Probe</td>
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<tr>
<td>Soil Sampling Method:</td>
<td>4' samplers with liners</td>
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<tr>
<td>Surface Elevation (feet):</td>
<td>NA</td>
</tr>
<tr>
<td>Field Screening Instrument:</td>
<td>None</td>
</tr>
</tbody>
</table>

**DEPTH | LITHOLOGY | DESCRIPTION | USCS | LAB SAMP. | PID ppm**

<table>
<thead>
<tr>
<th>Depth</th>
<th>Lithology</th>
<th>Description</th>
<th>USCS</th>
<th>Lab Samp.</th>
<th>PID Ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>TOPSOIL</td>
<td>Grass and black/dark brown topsoil, moist. Top 5 ft hand augered.</td>
<td>PT</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>GRAVEL AND SAND</td>
<td>Light brown gravelly sand fine to very coarse, rounded to well rounded gravel, moist.</td>
<td>SW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td>(1.00, 4.00) GRAVEL AND SAND: Same as above, wet at 7'.</td>
<td>SW</td>
<td>Composite Sample from 0' - 4'.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>GRAVEL AND SAND</td>
<td>Same as above, wet at 7'.</td>
<td>SW</td>
<td>Composite Sample from 4' - 8'.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Water Sample from 3' - 8'.</td>
<td>SW</td>
<td>Water Sample from 3' - 8'.</td>
<td></td>
</tr>
</tbody>
</table>

Comments: E.O.B. at 8'.

Boring Location: 43 37.812' N / 96 12.652' W
## ENVIRONMENTAL BORING LOG

### BORING ID: B-2
### TOTAL DEPTH: 12'

<table>
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<tr>
<th>DEPTH</th>
<th>LITHOLOGY</th>
<th>DESCRIPTION</th>
<th>USCS</th>
<th>LAB SAMP.</th>
<th>PID ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>PT</td>
<td>NA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.00, 3.00</td>
<td>TOPSOIL: Gravel and dark brown/black topsoil, moist. Top 5 ft hand augered.</td>
<td>PT</td>
<td>Composite Sample from 0' - 4'.</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>3.00, 4.00</td>
<td>SANDY CLAY: Light brown sandy clay, soft, plastic, moist.</td>
<td>CL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.00, 8.00</td>
<td>GRAVEL AND SAND: Light brown gravelly sand, rounded fine to medium gravel, very fine to very coarse sand, moist.</td>
<td>SW</td>
<td>Composite Sample from 4' - 8'.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.00, 12.00</td>
<td>GRAVEL AND SAND: As above. Wet at 9'. Dark brown at 11.75'.</td>
<td>SW</td>
<td>Water Sample from 7' - 12'.</td>
<td></td>
<td></td>
</tr>
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</table>

Comments: E.O.B. at 12'.

Boring Location: 43 37.796' N / 96 12.654' W
<table>
<thead>
<tr>
<th>DEPTH</th>
<th>LITHOLOGY</th>
<th>DESCRIPTION</th>
<th>USCS</th>
<th>LAB SAMP.</th>
<th>PID ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>TOPSOIL</td>
<td>Grass, dark brown/black topsoil, roots, moist. Top 5 ft hand augered.</td>
<td>PT</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>3</td>
<td>CLAYEY SAND</td>
<td>Light brown/light gray clayey sand and silt, moist.</td>
<td>SC</td>
<td>SW</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>GRAVEL AND SAND</td>
<td>Light brown gravelly sand, rounded to well rounded sand and gravel, moist.</td>
<td>SW</td>
<td></td>
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<tr>
<td>12</td>
<td>GRAVEL AND SAND</td>
<td>As above. Wet at 10’.</td>
<td>SW</td>
<td></td>
<td></td>
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</tbody>
</table>

Comments: E.O.B. at 12’.

Boring Location: 43 37.785’ N / 96 12.660’ W
APPENDIX J
North St. Paul Fire Department Discussion and Supporting Documents
Background and Access – North St. Paul Fire Foam Training Area

The North St. Paul Deputy Fire Chief returned a completed firefighting foam use questionnaire to Delta in April 2008, indicating the departments’ use of 3M -brand AF FF in semi -annual training exercises conducted at the North St. Paul Public Works facility. Five to ten gallons of foam concentrate are reportedly used per training event. A copy of the questionnaire is included in Appendix J.

The North St. Paul Public Works facility is located at 2303 1st Street North in North St. Paul, as shown on Figure 1, Fire Foam Training Area Location, North St. Paul, also included in Appendix J. An access agreement was signed by the North St. Paul Fire Chief and the MPCA, allowing access for a site reconnaissance and sampling at the fire training area. A copy of the access agreement is included in Appendix J.

As presented in Delta’s April 2009 report, the inferred groundwater flow direction in the area of the North St. Paul fire foam training area is to the west.

Site Reconnaissance – North St. Paul Fire Foam Training Area

Site reconnaissance of the North St. Paul fire foam training area was conducted on March 30, 2009. Delta representative Nancy Rodning and MPCA Project Manager Nile Fellows were accompanied by the North St. Paul Fire Chief. The North St. Paul Fire Chief indicated an asphalt-paved area directly southwest of a domed salt shed at the public works facility where training with Class B AF FF has taken place, and related that they utilize a burn pan for foam training exercises. He related that the department has trained a total of approximately five to ten times at this location, and the last foam training event was approximately one year ago. Delta recorded GPS locations of the corners of the training area using a hand-held GPS unit with an accuracy of approximately 15 feet. Photographs and a mapped figure (North St. Paul Fire Department Fire Foam Training Area) of the training area are included in Appendix J.

The surface grade at the training area would result in stormwater runoff flowing to the north, toward an off-site, recently-constructed storm water retention pond. This area adjacent north of the public works facility was re-configured in 2008 with road and bridge construction along Highway 36; previously commercial buildings and a small wooded area were situated in that area.

The North St. Paul Fire Chief indicated the presence of a groundwater monitoring well located near the southeast corner of the North St. Paul Public Works property, approximately 350 feet southeast of the fire foam training area. Additionally, a North St. Paul municipal well is located approximately 750 feet east of the North St. Paul fire foam training area. No other potential community water supply systems such as those typically associated with rest stops, trailer parks, etc., were observed within 1/4-mile of the training.
Nearby water wells identified via a search of the MDH CWI are shown on Figure 1, *Fire Foam Training Area Locations, North St. Paul* and are described in the Site Summary included in Delta’s April 2009 Report.

The North St. Paul Fire Chief recalled one tanker rollover fire in Stillwater that the department responded to with Class B AFFF. That fire occurred a few years ago on Highway 36, in the area of Manning Avenue. He could not recall any large fires in the city of North St. Paul where a significant quantity of AFFF was used for fire response.

Locations for soil borings in the fire foam training area were discussed during the site reconnaissance. The North St. Paul Fire Chief indicated that the public works buildings on-site were scheduled for demolition in late May or early June 2009. For geotechnical reasons site soils were going to be removed.

**Sample Collection – North St. Paul Fire Foam Training Area**

On May 6, 2009, two soil borings, B-1 and B-2, were advanced within the fire foam training area, and a surficial soil sample, B-3, was collected downslope of the training area. Soil boring and sample locations are shown on the *North St. Paul Fire Department Fire Foam Training Areas* figure included in Appendix J. Soil borings were advanced by Thein Well Company using push probed drilling technology under the oversight of Delta personnel. Soil samples were collected continuously and logged onto soil boring logs. Soil boring logs detailing soil descriptions, groundwater depths, boring depths, and the GPS locations of the borings are included in Appendix J.

Borings B-1 and B-2 were advanced in the asphalt-covered fire foam training area directly southwest of the domed salt storage shed, to a depth of 16 feet below grade surface (bgs). Soils encountered in both borings consisted of varying layers of sandy clay, clay, and sand to the bottom of the borings. Groundwater was present at an approximate depth of 13 to 13.5 feet bgs. No staining, or foul or unusual odors were noted in the soils. Temporary wells with five-foot screens were set to the bottom of the borings for the collection of groundwater samples. Upon completion of groundwater sampling at each boring, the boring was grouted and sealed in accordance with applicable MDH requirements.

A surficial soil sample, B-3, was collected downslope of the fire foam training area, at the north property boundary where runoff drainage was apparent in the soil surface. The soil sample was collected by hand-augering to a depth of 2 feet bgs and compositing a soil sample from the surface to 2 feet bgs. The soil was coarse to medium-grained sand.
Soil and groundwater samples were collected for laboratory analysis as described in Section 1.3 (Task 3) of the main body of the report.

**Sampling Results – North St. Paul Fire Foam Training Area**

Laboratory analysis detected PFC compound concentrations in soil and groundwater samples collected from the North St. Paul Fire Department’s fire foam training area as listed in the tables below. All soil and groundwater sample analytical results, including no-detect results, are summarized in Table 1, *Soil Analytical Results, PFCs and TOC*, and Table 2, *Groundwater Analytical Results, PFCs*, of this report. A copy of the laboratory report with the chain-of-custody record is included in Appendix J.

| Soil Sample PFC Detections – North St. Paul Fire Department Fire Foam Training Area |
|-------------------------------|-------------------|
| Soil Boring | Sample Depth | Compound Concentration |
| B-3 0-2 | feet | 0.107 ng/g PFOA |
| | | 0.623 ng/g PFOS |

ng/g = nanograms per gram, which is equivalent to parts per billion (ppb).

The MPCA Tier 1 Residential and Tier 2 Recreational SRVs for PFOS and PFOA are 2,000 ng/g and 4,000 ng/g, respectively. The Tier 2 Industrial SRVs for PFOS and PFOA are 12,000 ng/g and 23,000 ng/g. None of the detected soil concentrations in the North St. Paul soil samples met or exceeded any of the MPCA SRVs.

| Groundwater Sample PFC Detections – North St. Paul Fire Department Fire Foam Training Area |
|---------------------------------------------|-----------------|
| Soil Boring | Compound Concentration |
| B-1 | 137 ng/L PFBA |
| | 13.3 ng/L PFPeA |
| | 13.2 ng/L PFHxA |
| | 8.83 ng/L PFHpA |
| | 13.8 ng/L PFOA |
| | 14.1 ng/L PFHxS |
| B-2 | 145 ng/L PFBA |
| | 15.5 ng/L PFPeA |
| | 14.1 ng/L PFHxA |
| | 8.22 ng/L PFHpA |
Groundwater Sample PFC Detections – North St. Paul Fire Department Fire Foam Training Area

<table>
<thead>
<tr>
<th>Soil Boring</th>
<th>Compound Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>13.2 ng/L PFOA</td>
</tr>
<tr>
<td></td>
<td>14.8 ng/L PFHxS</td>
</tr>
</tbody>
</table>

ng/L = nanograms per liter, which is equivalent to parts per trillion (ppt).

The MDH HRL for both PFOS and PFOA in drinking water is 300 ng/L. The MDH HBV for PFBA for acute, one day exposure is 8,000 ng/L; the HBV for short-term, subchronic and chronic exposures is 7,000 ng/L. The detected concentrations in the North St. Paul groundwater samples did not meet or exceed the HRLs for PFOS or PFOA nor the HBV for PFBA.

Discussion and Conclusion – North St. Paul Fire Foam Training Area

Based on information provided by the North St. Paul Fire Chief, the last fire foam training at the North St. Paul fire foam training area occurred approximately one year ago, and 3M-brand AFFF was used. PFC compounds were detected in groundwater samples collected from borings B-1 and B-2, but PFCs were not detected in the soil samples collected from B-1 and B-2. Low levels of PFOA and PFOS were detected in the surface soil sample collected at B-3. The absence of PFC compounds in the soil samples collected from B-1 and B-2 may be due to the asphalt cover over the fire foam training area.
QUESTIONNAIRE
Firefighting Foam Use in Fire Training

1. Does your Department currently or has your Department historically used Class A or Class B foams for firefighting operations?
   
   X  Yes - Proceed to Question 2
   
   No - Sign the back of this form and return to Delta Consultants

2. How often is Class B or Class A foam used in response to fire calls?
   
   X  25-50% of fires
   
   0-25% of fires
   
   75-100% of fires

3. Does the Department have a compressed air foam system (CAFS) with a built-in tank on its engine(s)?
   
   X  Yes
   
   No

4. How often is foam used in training exercises?
   
   X  Semi-Annually
   
   Weekly
   
   Monthly
   
   Annually
   
   Quarterly
   
   Bi-Annually
   
   Other (please specify):

5. How much foam is used per training event?
   
   X  5 to 10 gallons
   
   5 gallons
   
   Less than 5 gallons
   
   More than 10 gallons (please specify):

6. In training, where does the spent foam go?
   
   X  Ground
   
   Storm Sewer
   
   Sanitary Sewer
   
   On-Site Septic
   
   Other (please describe):

7. Where does/did the training take place? Please include address, intersection or other specific location information for current and past training areas.

   North St. Paul Public Works
   
   2303 1st Street N. North St. Paul, MN

   X inogen
8. What type(s) and brand(s) of foam are or were used now and in the past by the Department, both for fire response and in training (if applicable)? Please check all that apply.

<table>
<thead>
<tr>
<th>Type of Foam</th>
<th>Brand of Foam</th>
<th>Used in Training?</th>
<th>Amount Used Annually</th>
<th>Current Use or Historic Use?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class B Aqueous Film-Forming Foam (AFFF)</td>
<td>S.M. LightWater</td>
<td>Yes</td>
<td>5 gal</td>
<td>both</td>
</tr>
<tr>
<td>Class B Alcohol-Resistant (AR)-AFFF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Protein</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Fluoroprotein (FP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Film-Forming Fluoroprotein (FFF)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B AR-FFF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class A-B Hi Expansion Foam</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class A Training Foam</td>
<td>S.M. LightWater (3.5 gal)</td>
<td>Yes</td>
<td>15 gal</td>
<td>both</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Thank you for your time and cooperation. Please contact Nancy Rodning at Delta Consultants (651-697-5152 or nrodnin@deltaevn.com) or Jim Stockinger at the Minnesota Pollution Control Agency (651-297-8666 or jim.stockinger@state.mn.us) if you have any questions regarding this questionnaire.

Please return this questionnaire to Delta Consultants by May 9, 2008 in the enclosed stamped, self-addressed envelope.

Questionnaire completed by:

Jason Mallinger Deputy Fire Chief
North St. Paul Fire Department

Phone Number: 651-747-2552 Date: 4-28-08
E-Mail Address: MALLINGER@ci.north-saint-paul.mn.us

Xinogen
ACCESS AGREEMENT BETWEEN
THE MINNESOTA POLLUTION CONTROL AGENCY
AND CITY OF NORTH SAINT PAUL

The Minnesota Pollution Control Agency (MPCA) is investigating firefighting training sites where Class B foams have been or are being utilized. The site reconnaissance and investigation will be conducted at the following firefighting training site owned by the City of North St. Paul and utilized by the North St. Paul Fire Department:

Public Works facility located at 2303 1st Street North, North St. Paul, Minnesota

The Property Owner hereby consents and authorizes the MPCA, its employees, agents and contractors, to enter this property for the purpose of performing reasonable and necessary investigations in response to the use of Class B firefighting foams that may or may not contain perfluorocarbons (PFCs). The MPCA is authorized to take these actions under Minn. Stat. § 115C.03, subd. 7 (2002).

The MPCA will notify the Property Owner at least 48 hours before entering the property. Work will be conducted during regular business hours (8:00 a.m. to 5:00 p.m.) unless the MPCA receives permission to and arrangements are made to conduct work during different hours. The MPCA will conduct its activities so as to minimize interference with the use of the property. If any portion of the property must be disturbed as a result of the MPCA's activities, the MPCA will restore the property as close to its original condition as is reasonably possible under the circumstances. The Property Owner will take reasonable precautions to ensure that the equipment of the MPCA and its contractors on the property is not damaged, and that the work being conducted by the MPCA, its employees, agents and contractors is not disrupted.

The MPCA will obtain all necessary permits for installation of soil borings and temporary monitoring wells, if such wells are installed. Upon completion of sampling, the MPCA will seal the borings and monitoring wells in accordance with state law. Results of all testing conducted on the property will be provided to the Property Owner.

The MPCA shall be liable for injury to or loss of property, or personal injury or death, caused by an act or omission of any employee of the state in the performance of the work described above, under the circumstances where the state, if a private person, would be liable to the claimant, in accordance with Minn. Stat. § 3.736.

MINNESOTA POLLUTION CONTROL AGENCY

Signature: Doug Wetjen
Title: Supervisor
Date: 2/11/09

City of North St. Paul

Signature: Scott Deedrick
Title: Fire Chief
Date: 2/6/09
Photograph 1
The fire foam training area at the North St. Paul Public Works facility is located to the southwest of the domed salt storage shed at right. Photo view facing north. Surface run-off is to the north, toward the north property boundary near the gray piece of equipment in the center of the photo.

Photograph 2
Surficial soil sample B-3 was collected downslope of the fire foam training area, where surface runoff appears to flow off-site.
## ENVIRONMENTAL BORING LOG

### PROJECT INFORMATION

- **Project:** PFC's in Fire Fighting Foam
- **Site Location:** North St. Paul, MN
- **Job No.:** 19382DEL03
- **Logged By:** Curt McKay
- **Weather:** Cloudy, light rain
- **Date Completed:** 5/6/09
- **Water Level During Drilling:** 13'

### DRILLING INFORMATION

- **Boring ID:** B-1
- **Total Depth:** 16'
- **Drilling Co.:** Thein Well
- **Drill Crew Chief:**
- **Rig Type:** Truck-Mounted Geoprobe
- **Method of Drilling:** Direct Push Probe
- **Soil Sampling Method:** 4' samplers with liners
- **Surface Elevation (feet):** NA
- **Field Screening Instrument:** None

### DEPTH | LITHOLOGY | DESCRIPTION | USCS | LAB SAMP. | PID ppm
--- | --- | --- | --- | --- | ---
0 | | (0.00, 0.50) ASPHALT: Top 5 ft hand augered. | CL | NA | 0.00 |
0.50 | | (0.50, 4.00) SANDY CLAY: Black sandy clay, moist. | CL | NA | 0.50 |
5 | | (4.00, 5.00) SANDY CLAY: Brown medium sand and clay, moist. | CL | NA | 5.00 |
5 | | (5.00, 6.00) SAND: Brown medium sand, moist. | SW | NA | 5.00 |
6 | | (6.00, 6.50) SANDY CLAY: Brown sandy clay, moist. | CL | NA | 6.00 |
6.50 | | (6.50, 7.50) SAND: Brown medium sand, moist. | SW | NA | 6.50 |
8 | | (7.50, 8.75) CLAYEY SAND: Brown clay and sand, soft/moist. | SC | NA | 8.00 |
10 | | (8.75, 13.00) CLAY: Brown clay, soft/moist. | CL | NA | 10.00 |
13 | | (13.00, 16.00) SAND: Brown medium sand, wet. | SW | NA | 13.00 |
15 | | Composite Sample from 0' - 4'. | CL | NA | 15.00 |
| | Composite Sample from 4' - 8'. | SW | NA | 15.00 |
| | Water Sample from 11' - 16'. | CL | NA | 15.00 |

Comments: E.O.B. at 16'.

Boring Location: 45 00.680' N / 92 59.892' W
**PROJECT INFORMATION**

- **Project:** PFC's in Fire Fighting Foam
- **Site Location:** North St. Paul, MN
- **Job No.:** 19382DELI03
- **Logged By:** Curt McKay
- **Weather:** Cloudy, light rain
- **Date Completed:** 5/6/09

**DRILLING INFORMATION**

- **Drilling Co.:** Thein Well
- **Drill Crew Chief:**
- **Rig Type:** Truck-Mounted Geoprobe
- **Method of Drilling:** Direct Push Probe
- **Soil Sampling Method:** 4' samplers with liners
- **Surface Elevation (feet):** NA
- **Field Screening Instrument:** None

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>LITHOLOGY</th>
<th>DESCRIPTION</th>
<th>USCS</th>
<th>LAB SAMP.</th>
<th>PID ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>CL</td>
<td>(0.00, 0.50) ASPHALT: Top 5 ft hand augered.</td>
<td>CL</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.50, 4.00) SANDY CLAY: Dark brown sandy clay, moist.</td>
<td>CL</td>
<td>SW</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>SW</td>
<td>(4.00, 7.50) SAND: Brown medium sand, moist.</td>
<td>CL</td>
<td>CL</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CL</td>
<td>(7.50, 7.85) SANDY CLAY: Brown sandy clay, moist.</td>
<td>SW</td>
<td>SW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CL</td>
<td>(7.85, 10.00) SAND: Brown medium-fine sand, moist.</td>
<td>SW</td>
<td>SW</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>SW</td>
<td>(10.00, 12.00) CLAY: Brown clay, soft/moist.</td>
<td>CL</td>
<td>SW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CL</td>
<td>(12.00, 12.50) SANDY CLAY: Brown sandy clay, moist.</td>
<td>CL</td>
<td>SW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CL</td>
<td>(12.50, 13.50) SAND: Brown medium-fine sand, moist.</td>
<td>CL</td>
<td>SW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SW</td>
<td>(13.50, 14.00) SAND: Brown sand, wet.</td>
<td>CL</td>
<td>CL</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>SW</td>
<td>(14.00, 14.50) CLAY: Brown clay, moist.</td>
<td>CL</td>
<td>SW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CL</td>
<td>(14.50, 16.00) SAND: Brown sand, wet.</td>
<td>CL</td>
<td>SW</td>
<td></td>
</tr>
</tbody>
</table>

Comments: E.O.B. at 16'.

Boring Location: 45 00.681' N / 92 59.899' W
## ENVIRONMENTAL BORING LOG

**BORING ID:** B-3  
**TOTAL DEPTH:** 2'

### PROJECT INFORMATION
- **Project:** PFC’s in Fire Fighting Foam  
- **Site Location:** North St. Paul, MN  
- **Job No.:** 19382DEL03  
- **Logged By:** Curt McKay  
- **Weather:** Cloudy, light rain  
- **Date Completed:** 5/6/09  
- **Water Level During Drilling:** NA

### DRILLING INFORMATION
- **Drilling Co.:** Thein Well  
- **Drill Crew Chief:**  
- **Rig Type:** NA  
- **Method of Drilling:** Hand Auger  
- **Soil Sampling Method:** Grab  
- **Surface Elevation (feet):** NA  
- **Field Screening Instrument:** None

### DEPTH | LITHOLOGY | DESCRIPTION | USCS | LAB SAMP. | PID ppm
--- | --- | --- | --- | --- | ---
0 | (0.00, 1.00) SAND | Dark brown coarse sand, moist. | SW | NA |  
2 | (1.00, 2.00) SAND | Brown medium sand, moist. | SW | Composite Sample from 0' - 2'. | 

**Comments:** Surface Soil Sample. E.O.B. at 2'.  
**Boring Location:** 45 00.693' N / 92 59.907' W
APPENDIX K

Richfield Fire Department Discussion and Supporting Documents
Background and Access – Richfield Fire Foam Training Area
The Richfield Fire Chief completed a firefighting foam use questionnaire via telephone interview in September 2008, indicating the department’s occasional historical use of 3M-brand AFF in training exercises conducted behind the Richfield Ice Arena. The Fire Chief indicated that the department no longer uses Class B foam in training and that they now use training foam. A copy of the questionnaire is included in Appendix K.

The Richfield Ice Arena is located at 636 East 66th Street in Richfield, as shown on Figure 1, Fire Foam Training Area Location, Richfield, also included in Appendix K. An access agreement was signed by the Richfield City Manager and the MPCA, allowing access for a site reconnaissance and sampling at the fire foam training area. A copy of the access agreement is included in Appendix K.

As presented in Delta’s April 2009 report, the inferred groundwater flow direction in the area of the Richfield fire foam training area is to the east.

Site Reconnaissance – Richfield Fire Foam Training Area
Site reconnaissance of the Richfield fire foam training area was conducted on March 26, 2009. Delta representative Nancy Rodning and MPCA Project Manager Nile Fellows were accompanied by the Richfield Fire Chief. The Richfield Fire Chief related that it has been approximately ten years since the Richfield Fire Department has trained with Class B AFF at the training location and that they now utilize training foam for training exercises. The Fire Chief and other department members he consulted recalled that foam had been discharged in training exercises in two locations behind (north of) the Richfield Ice Arena. The main area where the Fire Chief recalled most foam training occurred is situated directly north of the ice arena building; a second area where foam training occurred fewer times is located on a slight hill to the northwest of the ice arena building. Both areas are grass-covered. The department did not utilize a burn pan or live fire in training; they sprayed the foam directly on the ground. Spent foam was allowed to dissipate on the ground over time. Delta recorded GPS locations of the corners of the two training areas using a hand-held GPS unit with an accuracy of approximately 15 feet. Photographs and a mapped figure (Fire Training Area, Richfield Ice Arena) of the training areas are included in Appendix K.

The surface grade would result in stormwater runoff from both training areas down a driveway to the east, toward Legion Lake. It appeared that water runoff would settle into a low area at the east end of the driveway before reaching the lake.
The Richfield municipal well building number 4 is located approximately 325 feet to the north and northwest of the training areas. Nearby water wells identified via a search of the MDH CWI (shown on Figure 1) included a commercial well at the west-adjoining American Legion facility, and a second municipal well located approximately one-third mile southeast of the fire foam training area. Other private wells are scattered in the neighborhood around the training area. Nearby wells are described further on the Site Summary included in the April 2009 Report.

The Richfield Fire Chief recalled two car fires within the last few years at which the Richfield Fire Department responded with Class B foam: approximately five gallons of foam concentrate was used on a car fire near the intersection of 76th Street and Nicollet Avenue; and approximately twenty to twenty-five gallons of foam concentrate were used on a car fire near the intersection of Highway 62 and 2nd or 3rd Avenue South. Both of these locations are located at least one-half mile to the northwest of the fire foam training area.

Locations for soil borings in the fire foam training areas were discussed during the site reconnaissance.

Sample Collection – Richfield Fire Foam Training Area

On May 7, 2009, three soil borings were advanced within or downslope of the Richfield fire training areas. Soil boring locations are shown on the Fire Training Area, Richfield Ice Arena figure. Soil borings were advanced by Thein Well Company using push probe drilling technology, under the oversight of Delta personnel. Soil samples were collected continuously and logged onto soil boring logs. Soil boring logs detailing soil descriptions, groundwater depths, boring depths, and the GPS locations of the borings are included in Appendix K.

Borings B-1 and B-2 were advanced in the main fire foam training area directly north of the Richfield Ice Arena, to a depth of 16 feet below grade surface (bgs). Soils encountered in B-1 consisted of topsoil over medium- to coarse-grained sand to a depth of 7 feet bgs, over a two-foot sandy clay layer, over silty sand grading to sand. Soils in B-2 were comprised of topsoil over sandy clay to a depth of 7.5 feet bgs, over silty sand grading to silt to a depth of 13.75 feet bgs, over fine- to medium-grained sand to the bottom of the boring at 16 feet. Groundwater was encountered in both borings at an approximate depth of 13 to 13.5 feet bgs. No staining or foul or unusual odors were noted in the soils. Temporary wells with five-foot screens were set to the bottom of the borings for the collection of groundwater samples.

Boring B-3 was advanced at the east end of the driveway downslope of the fire foam training areas, in a low spot where it appeared storm water runoff from the training area would collect. Boring B-3 was advanced to a depth of 12 feet bgs. Soils encountered in B-3 consisted of four feet of fill over silty sands...
and silt to a depth of 8 feet bgs, over medium-grained sand to the boring terminus. Groundwater was encountered at a depth of 9 feet bgs. No staining or foul or unusual odors were noted in the soils. A temporary well with a five-foot screen was set to the bottom of the boring for the collection of a groundwater sample.

Upon completion of groundwater sampling at each boring, the boring was routed and sealed in accordance with applicable MDH requirements.

Due to presence of buried gas and water lines extending through the smaller fire foam training area to the northwest of the ice arena building, no soil borings were advanced in this area.

Soil and groundwater samples were collected for laboratory analysis as described in Section 1.3 (Task 3) of the main body of the report.

**Sampling Results – Richfield Fire Foam Training Area**

Laboratory analysis detected PFC compound concentrations in soil and groundwater samples collected from the Richfield fire foam training area as listed in the tables below. All soil and groundwater sample analytical results, including non-detect results, are summarized in Table 1, **Soil Analytical Results, PFCs and TOC**, and Table 2, **Groundwater Analytical Results, PFCs**, of this report. A copy of the laboratory report with the chain-of-custody record is included in Appendix K.

<p>| Soil Sample PFC Detections – Richfield Fire Department Fire Foam Training Area |
|---------------------------------|---------------------------------|-------------------|
| Soil Boring | Sample Depth | Compound Concentration |
| B-1 0-4 | feet | 0.226 ng/g PFPeA |
| | | 0.191 ng/g PFHxA |
| | | 0.433 ng/g PFHpA |
| | | 1.36 ng/g PFOA |
| | | 1.44 ng/g PFNA |
| | | 0.095 ng/g PFDA |
| | | 1.26 ng/g PFHxS |
| | | 104 ng/g PFOS |
| | | 0.21 ng/g PFOSA |
| B-1 4-8 | feet | 0.322 ng/g PFBA |
| | | 1.43 ng/g PFPeA |
| | | 0.905 ng/g PFHxA |</p>
<table>
<thead>
<tr>
<th>Soil Boring</th>
<th>Sample Depth</th>
<th>Compound Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-2 0-4</td>
<td>feet</td>
<td>0.592 ng/g PFHpA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.11 ng/g PFOA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.89 ng/g PFNA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.44 ng/g PFHxS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>102 ng/g PFOS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.464 ng/g PFBA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.33 ng/g PFPeA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.07 ng/g PFHxA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.85 ng/g PFHpA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.32 ng/g PFOA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.03 ng/g PFNA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.306 ng/g PFDA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13 ng/g PFHxS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>401 ng/g PFOS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.47 ng/g PFOSA</td>
</tr>
<tr>
<td>B-2 4-8</td>
<td>feet</td>
<td>1.04 ng/g PFBA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.52 ng/g PFPeA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.7 ng/g PFHxA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.28 ng/g PFHpA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.02 ng/g PFOA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.83 ng/g PFNA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>32.2 ng/g PFHxS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>666 ng/g PFOS</td>
</tr>
<tr>
<td>B-3 0-4</td>
<td>feet</td>
<td>0.314 ng/g PFHxA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.309 ng/g PFHpA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.49 ng/g PFOA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21.9 ng/g PFHxS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>56.4 ng/g PFOS</td>
</tr>
<tr>
<td>B-3 4-8</td>
<td>feet</td>
<td>0.173 ng/g PFBA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.439 ng/g PFPeA</td>
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<td></td>
<td></td>
<td>1.02 ng/g PFHxA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.283 ng/g PFHpA</td>
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</tbody>
</table>
Soil Sample PFC Detections – Richfield Fire Department Fire Foam Training Area

<table>
<thead>
<tr>
<th>Soil Boring</th>
<th>Sample Depth</th>
<th>Compound Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0.336 ng/g PFOA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.57 ng/g PFBS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.35 ng/g PFHxS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9.33 ng/g PFOS</td>
</tr>
</tbody>
</table>

ng/g = nanograms per gram, which is equivalent to parts per billion (ppb).

The MPCA Tier 1 Residential and Tier 2 Recreational SRVs for PFOS and PFOA are 2,000 ng/g and 4,000 ng/g, respectively. The Tier 2 Industrial SRVs for PFOS and PFOA are 12,000 ng/g and 23,000 ng/g. None of the detected soil concentrations in the Richfield soil samples met or exceeded any of the MPCA SRVs.

Groundwater Sample PFC Detections – Richfield Fire Department Fire Foam Training Area

<table>
<thead>
<tr>
<th>Soil Boring</th>
<th>Compound Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-1</td>
<td>1070 ng/L PFBA</td>
</tr>
<tr>
<td></td>
<td>3470 ng/L PFPeA</td>
</tr>
<tr>
<td></td>
<td>3500 ng/L PFHxA</td>
</tr>
<tr>
<td></td>
<td>819 ng/L PFHpA</td>
</tr>
<tr>
<td></td>
<td>50.3 ng/L PFOA</td>
</tr>
<tr>
<td></td>
<td>737 ng/L PFBS</td>
</tr>
<tr>
<td></td>
<td>76.2 ng/L PFHxS</td>
</tr>
</tbody>
</table>

B-2

|         | 1240 ng/L PFBA         |
|         | 4890 ng/L PFPeA        |
|         | 4170 ng/L PFHxA        |
|         | 1920 ng/L PFHpA        |
|         | 1330 ng/L PFOA         |

B-3

|         | 201 ng/L PFBA          |
|         | 331 ng/L PFPeA         |
|         | 888 ng/L PFHxA         |
|         | 217 ng/L PFHpA         |
|         | 458 ng/L PFOA          |
|         | 293 ng/L PFBS          |
Groundwater Sample PFC Detections – Richfield Fire Department Fire Foam Training Area

<table>
<thead>
<tr>
<th>Soil Boring</th>
<th>Compound Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>689 ng/L PFHxS</td>
</tr>
</tbody>
</table>

ng/L = nanograms per liter, which is equivalent to parts per trillion (ppt).

The MDH HRL for both PFOS and PFOA in drinking water is 3,000 ng/L. The MDH HBV for PFBA for acute, one day exposure is 8,000 ng/L; the HBV for short-term, subchronic and chronic exposures is 7,000 ng/L. The PFOA concentrations in two of the groundwater samples exceeded the PFOA HRL: 1,330 ng/L PFOA was detected in the groundwater sample collected from B-2, and 458 ng/L PFOA was detected in the B-3 groundwater sample. PFOA was detected in the B-1 groundwater sample but at a concentration below the HRL.

None of the groundwater sample concentrations collected at the Richfield fire foam training area met or exceeded the HRL for PFOS or the HBV for PFBA.

Discussion and Conclusion – Richfield Fire Foam Training Area

Based on information provided by the Richfield Fire Chief, the last fire foam training at the Richfield fire foam training area occurred approximately ten years ago, and 3M-brand AFFF was used. PF C compounds were detected in all of the soil and groundwater samples collected from three borings. Barring another source of PFCs in the soils behind the Richfield Ice Arena at the Richfield fire foam training area, it appears that the discharge of fire foam at the site resulted in the release of PFCs to the soil and groundwater and that the PFCs have remained in the soils for approximately ten years.

In analyzing PFC concentrations in soils and sample depths, Delta makes the following observations:

- The concentrations of the shorter chain perfluorocarboxylic acids (PFBA, PFPeA, PFHxA, PFHpA) were lower in shallow soil samples than deeper soil samples (see Graph A, Richfield Soil Samples, Soil Depth vs. PFC Compound Concentration included in Appendix K).
- The shorter chain perfluorocarboxylic acids (PFBA, PFPeA, PFHxA, PFHpA, and PFOA) were detected more often than the longer chain compounds (PFNA, PFDA, PFUnA and PFDaOa), and the longer chain compounds were only detected in the shallow soil samples. The trend is apparent in Graph A.
- The shorter four carbon chain PFBS was only detected in one soil sample, while the six and eight-chain PFHxS and PFOA were detected in all of the samples. The eight-chain PFOA was detected at concentrations at least 2.5 times higher than the six-chain PFHxS.
- No trends are apparent between PFC compound concentrations and TOC concentrations. As expected, TOC concentrations are higher in the shallower soil samples.
- Generally, the boring exhibiting the highest concentrations of perfluorocarboxylic acids in soil samples also exhibited the highest perfluorocarboxylic acid groundwater concentrations.
1. Does your Department currently or has your Department historically used Class A or Class B foams for firefighting operations?
   - Yes - Proceed to Question 2
   - No - Sign the back of this form and return to Delta Consultants

2. How often is Class B or Class A foam used in response to fire calls?
   - 25-50% of fires
   - 75-100% of fires

3. Does the Department have a compressed air foam system (CAFS) with a built-in tank on its engine(s)?
   - Yes
   - No

4. How often is foam used in training exercises?
   - Never
   - Weekly
   - Monthly
   - Quarterly
   - Semi-Annually
   - Annually
   - Bi-Annually
   - Other (please specify): Every couple - every other shift.

5. How much foam is used per training event?
   - Less than 5 gallons
   - 5 gallons
   - 5 to 10 gallons
   - More than 10 gallons (please specify): 50-100 gal per event.

6. In training, where does the spent foam go?
   - Storm Sewer
   - Sanitary Sewer
   - On-Site Septic
   - Ground

7. Where does/did the training take place? Please include address, intersection or other specific location information for current and past training areas.
   - Ice arena - Richfield, 630 E. 60th St.

OVER
8. What type(s) and brand(s) of foam are or were used now and in the past by the Department, both for fire response and in training (if applicable)? Please check all that apply.

<table>
<thead>
<tr>
<th>Type of Foam</th>
<th>Brand of Foam</th>
<th>Used in Training?</th>
<th>Amount Used Annually</th>
<th>Currently Used?</th>
<th>Historically Used?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class B Aqueous Film-Forming Foam (AFFF)</td>
<td>Ansul</td>
<td>Yes</td>
<td>1020</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Class B Alcohol-Resistant (AR)-AFFF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Protein</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Fluoroprotein (FP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Film-Forming Fluoroprotein (FFFP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B AR-FFFP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class A-B Hi Expansion Foam</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class A Training Foam</td>
<td>Silv-Ey</td>
<td>Yes</td>
<td>50 gal</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>Natle</td>
<td></td>
<td></td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

Thank you for your time and cooperation. Please contact Nancy Rodning at Delta Consultants (651-697-5152 or nrodnin@deltanv.com) or Jim Stockinger at the Minnesota Pollution Control Agency (651-297-8666 or jim.stockinger@state.mn.us) if you have any questions regarding this questionnaire.

Please return this questionnaire to Delta Consultants by June 6, 2008 in the enclosed stamped, self-addressed envelope.

Questionnaire completed by: Fire Chief Brad Suehm

Name and Title: F.D.

Fire Department: 10-12-24-13-9502

Date: 9-9-08

E-Mail Address: Xnogen
Minnesota Pollution Control Agency

ACCESS AGREEMENT BETWEEN
THE MINNESOTA POLLUTION CONTROL AGENCY
AND CITY OF RICHLAND

The Minnesota Pollution Control Agency (MPCA) is investigating firefighting training sites where Class B foams have been or are being utilized. The site reconnaissance and investigation will be conducted at the following firefighting training site owned by the City of Richfield and utilized by the Richfield Fire Department:

City Property located at 636 E. 66th Street, near the ice arena

The Property Owner hereby consents and authorizes the MPCA, its employees, agents and contractors, to enter this property for the purpose of performing reasonable and necessary investigations in response to the use of Class B firefighting foams that may or may not contain perfluorocarbons (PFCs). The MPCA is authorized to take these actions under Minn. Stat. § 115C.03, subd. 7 (2002).

The MPCA will notify the Property Owner at least 48 hours before entering the property. Work will be conducted during regular business hours (8:00 a.m. to 5:00 p.m.) unless the MPCA receives permission to and arrangements are made to conduct work during different hours. The MPCA will conduct its activities so as to minimize interference with the use of the property. If any portion of the property must be disturbed as a result of the MPCA's activities, the MPCA will restore the property as close to its original condition as is reasonably possible under the circumstances. The Property Owner will take reasonable precautions to ensure that the equipment of the MPCA and its contractors on the property is not damaged, and that the work being conducted by the MPCA, its employees, agents and contractors is not disrupted.

The MPCA will obtain all necessary permits for installation of soil borings and temporary monitoring wells, if such wells are installed. Upon completion of sampling, the MPCA will seal the borings and monitoring wells in accordance with state law. Results of all testing conducted on the property will be provided to the Property Owner.

The MPCA shall be liable for injury to or loss of property, or personal injury or death, caused by an act or omission of any employee of the state in the performance of the work described above, under the circumstances where the state, if a private person, would be liable to the claimant, in accordance with Minn. Stat. § 3.736.

MINNESOTA POLLUTION CONTROL AGENCY

[Signature]
Signature

[Title]
Title

[Date]
Date

City of Richfield

[Signature]
City Manager

[Title]
Title

[Date]
Date
Richfield Ice Arena
Richfield Fire Department Fire Foam Training Area
March 26 and May 7, 2009

Photograph 1
The main fire foam training area is at left, in the grassy area left (north) of the driveway. View facing east, toward Legion Lake.

Photograph 2
Soil boring B-1 was advanced near the southwest corner of the main fire foam training area. View facing southwest.
Richfield Ice Arena
Richfield Fire Department Fire Foam Training Area
March 26 and May 7, 2009

Photograph 3
Soil boring B-2 was located east of B-1. View facing south toward the ice arena building.

Photograph 4
Soil boring B-3 was advanced east (downslope) of B-1 and B-2, in a low area at the east end of the driveway.
**ENVIRONMENTAL BORING LOG**

**BORING ID:** B-1  
**TOTAL DEPTH:** 16'

### PROJECT INFORMATION
- Project: PFC's in Fire Fighting Foam
- Site Location: Richfield, MN
- Job No.: 19382DEL03
- Logged By: Curt McKay
- Weather: Sunny
- Date Completed: 5/7/09
- Water Level During Drilling: 13'

### DRILLING INFORMATION
- Drilling Co.: Thein Well
- Drill Crew Chief: Curt McKay
- Rig Type: Truck-Mounted Geoprobe
- Method of Drilling: Direct Push Probe
- Soil Sampling Method: 4’ samplers with liners
- Surface Elevation (feet): NA
- Field Screening Instrument: None

### DEPTH | LITHOLOGY | DESCRIPTION | USCS | LAB SAMP. | PID ppm
---|---|---|---|---|---
0 | (0.00, 4.00) TOPSOIL: Grass and topsoil. Top 5 ft hand augered. | PT | NA | Composite Sample from 0’ - 4’.
5 | (4.00, 7.00) SAND: Brown medium to coarse sand, moist. | SW | | Composite Sample from 4’ - 8’.
7 | (7.00, 9.00) SANDY CLAY: Dark brown sandy clay, moist. | CL | | |
9 | (9.00, 11.00) SILTY SAND: Brown silty sand, moist. | SM | | |
11 | (11.00, 11.90) SILTY SAND: Dark brown silty sand, slightly moist. | SM | | Water Sample from 11’ - 16’.
12 | (11.90, 12.00) SILT: Black silt, moist. | ML | | |
13 | (12.00, 13.00) SAND: Black/gray medium sand, moist. | SW | | |
16 | (13.00, 16.00) SAND: Gray medium sand, wet. | SW | | |

**Comments:** E.O.B. at 16’.

**Boring Location:** 44 53.157’ N / 93 15.930’ W
**ENVIRONMENTAL BORING LOG**

**BORING ID:** B-2  
**TOTAL DEPTH:** 16'

### PROJECT INFORMATION
- **Project:** PFC's in Fire Fighting Foam  
- **Site Location:** Richfield, MN  
- **Job No.:** 19382DEL03  
- **Logged By:** Curt McKay  
- **Weather:** Sunny  
- **Date Began:** 5/7/09  
- **Date Completed:**  
  - Water Level During Drilling: 13.75'

### DRILLING INFORMATION
- **Drilling Co.:** Thein Well  
- **Drill Crew Chief:**  
- **Rig Type:** Truck-Mounted Geoprobe  
- **Method of Drilling:** Direct Push Probe  
- **Soil Sampling Method:** 4' samplers with liners  
- **Surface Elevation (feet):** NA  
- **Field Screening Instrument:** None  

### DEPTH LITHOLOGY DESCRIPTION

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>LITHOLOGY</th>
<th>DESCRIPTION</th>
<th>USCS</th>
<th>LAB SAMP.</th>
<th>PID ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>(0.00, 4.00) TOPSOIL: Grass and topsoil. Top 5 ft hand augered.</td>
<td>PT</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>(4.00, 7.50) SANDY CLAY: Red/brown medium sand and clay, moist.</td>
<td>CL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>(7.50, 8.00) SILTY SAND: Black/gray silty sand, moist.</td>
<td>SM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(8.00, 9.00) SANDY SILT: Gray sandy silt, moist</td>
<td>SM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(9.00, 10.00) SILT: Brown silt, moist.</td>
<td>ML</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(10.00, 13.75) SILT: Black silt, moist.</td>
<td>ML</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>150</td>
<td>(13.75, 16.00) SAND: Gray medium-fine sand, wet to very moist.</td>
<td>SW</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Comments:** E.O.B. at 16'.

**Boring Location:** 44 53.157' N / 93 15.917' W
**ENVIRONMENTAL BORING LOG**

**BORING ID:** B-3  
**TOTAL DEPTH:** 12'

### PROJECT INFORMATION

- **Project:** PFC's in Fire Fighting Foam  
- **Site Location:** Richfield, MN  
- **Job No.:** 19382DEL03  
- **Logged By:** Curt McKay  
- **Weather:** Sunny  
- **Date Completed:** 5/7/09  
- **Water Level During Drilling:** 9'

### DRILLING INFORMATION

- **Drilling Co.:** Thein Well  
- **Drill Crew Chief:**  
- **Rig Type:** Truck-Mounted Geoprobe  
- **Method of Drilling:** Direct Push Probe  
- **Soil Sampling Method:** 4' samplers with liners  
- **Surface Elevation (feet):** NA  
- **Field Screening Instrument:** None

#### DEPTH | LITHOLOGY | DESCRIPTION | USCS | LAB SAMP. |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>(0.00, 1.00) TOPSOIL: Top 5 ft hand augered.</td>
<td>PT</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>(1.00, 4.00) FILL: Light brown sand and gravel fill.</td>
<td>GW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>(4.00, 4.50) SILTY SAND: Dark gray silty sand, moist.</td>
<td>SM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>(4.50, 7.00) SILT: Black silt, moist.</td>
<td>ML</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>(7.00, 8.00) SILTY SAND: Black/gray silty sand, moist.</td>
<td>SM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>(8.00, 9.00) SAND: Dark gray medium sand, moist.</td>
<td>SW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>(9.00, 12.00) SAND: Gray medium sand, wet, limited recovery.</td>
<td>SW</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Comments:** E.O.B. at 12'.

**Boring Location:** 44 53.151' N / 93 15.889' W
APPENDIX L

Rochester Fire Department Discussion and Supporting Documents
Background and Access – Rochester Fire Foam Training Area
The Rochester Fire Department Deputy Fire Chief submitted a completed firefighting foam use questionnaire to Delta in April 2008, indicating the department’s use of 3M-brand AFFF for annual training. A copy of the questionnaire returned by the Rochester Fire Department is included in Appendix L. Follow-up conversations with the Rochester Deputy Fire Chief revealed that the training location address listed on the questionnaire was where Class A foam is used in training; the department trains with Class B AFFF at the Olmsted County Fairgrounds in Rochester.

The Rochester Deputy Fire Chief related that the fire department trained in the past with Class B AFFF in a parking lot located adjacent northeast of the fairground grandstand. The location of the fire foam training area is shown on Figure 1, Fire Foam Training Area Location, Rochester, included in Appendix L. The fairground property is owned by Olmsted County. An access agreement was signed by the Olmsted County Administrator and the MPCA, allowing access for a site reconnaissance and sampling at the fire foam training area. A copy of the access agreement is included in Appendix L.

As presented in Delta’s April 2009 report, the inferred groundwater flow direction in the area of the fire foam training area is to the north-northwest.

Site Reconnaissance – Rochester Fire Foam Training Area
Site reconnaissance of the Rochester fire foam training area was conducted on April 29, 2009. Delta representative Nancy Rodning and MPCA Project Manager Nile Fellows were accompanied by the Rochester Deputy Fire Chief, the Olmsted County Park Superintendent, and the Fairgrounds Supervisor. The Deputy Fire Chief showed Delta where fire foam training took place in a gravel parking lot northeast of the grandstand, near the intersection of South Broadway and 14th Street SE. He indicated that the Rochester Fire Department stopped training with Class B foam about seven or eight years ago, and that five gallons or less of foam concentrate was used per annual training event. The Fairgrounds Supervisor stated that the parking lot where the foam training occurred was historically an unpaved grassy area, and that it was converted to a gravel parking lot approximately ten years ago. The fire foam training area is relatively flat, with no obvious surface runoff direction. Photographs of the training area are included in Appendix L.

Delta recorded GPS locations of the fire training area using a hand-held GPS unit with an accuracy of approximately 15 feet. The training area is shown on the figure Rochester Fire Department Fire Foam Training Area, which is included in Appendix L.
The Rochester Deputy Fire Chief could not recall any large fires where a significant amount of Class B foam would have been used in the fire response, except for a fire in a hangar at the Rochester Airport that occurred sometime within the last ten years.

The Fairgrounds Supervisor pointed out the location of an on-site water supply well located approximately 900 feet northeast of the fire foam training area. The well water is used for filling fish ponds. No other water wells were observed during the site reconnaissance.

A map of municipal well locations provided by the MDH shows Rochester Well #19 located approximately 1/3-mile southeast of the fairgrounds, in an inferred upgradient groundwater flow direction. Rochester Well #11 is the nearest downgradient well, located approximately 3/4-mile to the northwest and a cross the Zumbro River. Nearby water wells identified via a search of the MDH CWI are shown on Figure 1, Fire Foam Training Area Location, Rochester and are described in the Site Summary included in Delta’s April 2009 Report.

Locations for soil borings in the fire foam training area were discussed during the site reconnaissance.

**Sample Collection – Rochester Fire Foam Training Area**

On May 28, 2009, two soil borings were advanced within the fire foam training area at the Olmsted County Fairgrounds. Soil boring locations are shown on the figure Rochester Fire Department Fire Foam Training Area included in Appendix L. Soil borings were advanced by West Central Environmental Consultants using push probe drilling technology, under the oversight of Delta personnel. Soil samples were collected continuously and logged onto soil boring logs. Soil boring logs detailing soil descriptions, boring depths, and the GPS locations of the borings are included in Appendix L.

Borings B-1 and B-2 were advanced to depths of 15 feet and 14.75 feet below grade surface (bg s), respectively. Soils encountered in both borings consisted of fill over a two-foot layer of black silt, underlain by sand with minor gravel to the bottom of the borings, where sandstone bedrock was encountered. Wet sand was encountered in B-1 from 14.5 to 15 feet bgs, however, an insufficient volume of water was recoverable for sampling. Groundwater was not encountered in B-2. Both borings were sealed in accordance with applicable MDH requirements.

Soil samples were collected and submitted for laboratory analysis as described in Section 1.3 (Task 3) of the main body of the report.
Sampling Results – Rochester Fire Foam Training Area

Analytical results were not available from Axys Analytical Services LTD at the time of this report. Analytical results will be presented in a forthcoming report.
Wellhead Protection Area

Wellhead Protection Area

Rochester Soldiers Field Park

Associated Milk Producers, Inc.

SITE

ROCHESTER

FIRE FOAM TRAINING AREA LOCATION
OLMSTED COUNTY FAIRGROUND
ROCHESTER, MINNESOTA

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<tbody>
<tr>
<td>5/12/09</td>
<td>Rochester-1</td>
<td>DELTA</td>
</tr>
</tbody>
</table>
1. Does your Department currently or has your Department historically used Class A or Class B foams for firefighting operations?
   
   X Yes - Proceed to Question 2
   
   ____ No - Sign the back of this form and return to Delta Consultants

2. How often is Class B or Class A foam used in response to fire calls?
   
   X 0-25% of fires
   
   ____ 25-50% of fires
   
   ____ 75-100% of fires

3. Does the Department have a compressed air foam system (CAFS) with a built-in tank on its engine(s)?
   
   ____ Yes
   
   X No

4. How often is foam used in training exercises?
   
   ____ Weekly
   
   ____ Monthly
   
   ____ Quarterly
   
   ____ Semi-Annually
   
   X Annually
   
   ____ Bi-Annually
   
   ____ Other (please specify): ____________________________

5. How much foam is used per training event?
   
   ____ Less than 5 gallons
   
   ____ 5 gallons
   
   ____ 5 to 10 gallons
   
   ____ More than 10 gallons (please specify): ____________________________

6. In training, where does the spent foam go?
   
   ____ Storm Sewer
   
   ____ Sanitary Sewer
   
   ____ On-Site Septic
   
   X Ground
   
   ____ Other (please describe): ____________________________

7. Where does/did the training take place? Please include address, intersection or other specific location information for current and past training areas.
   
   2021 41 St NN Rochester MN

   ____________________________

   ____________________________

   We currently use a product called FireHog which is an unscented fire retardant in place of foam. We have foam in stock but use it less often than we did 5 yrs ago.
8. What type(s) and brand(s) of foam are or were used now and in the past by the Department, both for fire response and in training (if applicable)? Please check all that apply.

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<th>Type of Foam</th>
<th>Brand of Foam</th>
<th>Used in Training? Yes or No</th>
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<td>Class B Alcohol-Resistant (AR)-AFFF</td>
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<td>Class B Protein</td>
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<td>Class B Fluoroprotein (FP)</td>
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<td>Class B Film-Forming Fluoroprotein (FFFP)</td>
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<td>Class B AR-FFFPE</td>
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<tr>
<td>Class A-B Hi Expansion Foam</td>
<td>3M</td>
<td>Yes</td>
<td>5</td>
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<tr>
<td>Class A</td>
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<td>Training Foam</td>
<td>3M</td>
<td>Yes</td>
<td>5</td>
<td></td>
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<tr>
<td>Other</td>
<td>3M</td>
<td>Yes</td>
<td>25</td>
<td></td>
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</table>

Thank you for your time and cooperation. Please contact Nancy Rodning at Delta Consultants (651-697-5152 or nrodnig@deltakenv.com) or Jim Stockinger at the Minnesota Pollution Control Agency (651-297-8666 or jim.stockinger@state.mn.us) if you have any questions regarding this questionnaire.

Please return this questionnaire to Delta Consultants by May 9, 2009 in the enclosed stamped, self-addressed envelope.

Questionnaire completed by:

[Signature]

Deputy Chief

Rochester F.D.

Fire Department: 507 328 2813

Date: 4/30/08

Phone Number: 507 328 2813

E-Mail Address: dslavin@rochester.mn.gov
ACCESS AGREEMENT BETWEEN
THE MINNESOTA POLLUTION CONTROL AGENCY
AND OLMSTED COUNTY

The Minnesota Pollution Control Agency (MPCA) is investigating firefighting training sites where Class B foams have been or are being utilized. The site reconnaissance and investigation will be conducted at the following site owned and operated by Olmsted County where firefighting training with Class B foams conducted by the Rochester Fire Department occurs:

Olmsted County Fairgrounds (aka Graham Park)
Trunk Highway 63
Rochester, Minnesota

The Property Owner hereby consents and authorizes the MPCA, its employees, agents and contractors, to enter this property for the purpose of performing reasonable and necessary investigations in response to the use of Class B firefighting foams that may or may not contain perfluorocarbons (PFCs). The MPCA is authorized to take these actions under Minn. Stat. §§ 115B.17, subd. 4 and 115.04, subd. 3.

The MPCA will notify the Property Owner at least 14 days before entering the property. Work by the Contractor shall not occur on any of the dates listed in the attached documents “Fairgrounds Events 2009” without prior written approval from the Property Owner. Work will be conducted during regular business hours (8:00 a.m. to 5:00 p.m.) unless the MPCA receives permission to and arrangements are made to conduct work during different hours. The MPCA’s work shall be confined to the area within Graham Park where training with Class B firefighting foam has been conducted by the Rochester Fire Department, as shown on the attached map. The MPCA will conduct its activities so as to minimize interference with the use of the property. If any portion of the property is disturbed as a result of the MPCA’s sampling activities, the MPCA will restore the property as close to its original condition as is reasonably possible under the circumstances by no later than November 1, 2009. The Property Owner will take reasonable precautions to ensure that the equipment of the MPCA and its contractors on the property is not damaged, and that the work being conducted by the MPCA, its employees, agents and contractors is not disrupted. However, the ultimate responsibility to insure that the MPCA and its Contractor’s equipment does not become damaged remains the obligation of the MPCA and/or the Contractor.

Prior to the commencement of any work on the site in question, the MPCA and its Contractor shall be obligated to contact Gopher One in advance in order to locate any utilities running through or under the site to help insure that utilities are not unintentionally damaged during the course of the work on the site. The MPCA will obtain all necessary permits for installation of soil borings and temporary monitoring wells, if such wells are installed. Upon completion of soil and/or groundwater sampling, the MPCA will seal the borings and monitoring wells in accordance with state law. Results of all testing conducted on the property will be provided to the Property Owner.

The MPCA shall be liable for injury to or damage to property, or personal injury or death, caused by an act or omission of any employee of the state in the performance of the work described above, under the circumstances where the state, if a private person, would be liable to the claimant, in accordance with Minn. Stat. § 3.736. The MPCA shall cause its contractor who carries out the work to provide the Property Owner with certificates of insurance showing commercial general liability insurance and professional liability insurance coverage of not less than $1M per occurrence and $2M aggregate. The certificate of insurance shall indicate or be accompanied by an endorsement which indicates that Olmsted County has been named as an additional insured under the contractor’s commercial general liability coverage.
MINNESOTA POLLUTION CONTROL AGENCY

Signature

Supervisor / Sympel Unit 1

Title

5/18/09

Date

Olmsted County

Richard Devlin
County Administrator

5/5/09

Date
CERTIFICATE OF LIABILITY INSURANCE

PRODUCER
877-945-7378
Willis of Minnesota, Inc.
26 Century Blvd.
P.O. Box 305191
Nashville, TN 37230-5191

INSURED
Delta Environmental Consultants, Inc.
DBA Delta Consultants
5910 Rice Creek Parkway, Ste 100
Shoreview, MN 55126

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW.

INSURERS AFFORDING COVERAGE
INSURER B: American International Specialty Lines
INSURER C:
INSURER D:
INSURER E:

NAIC# 19410-001

COVERAGES
THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. AGGREGATE LIMITS SHOWN MAY HAVE BEEN REDUCED BY PRIOR CLAIMS.

INSR ADNOS LTR INSR RC
INSERD LTR INSERD RC

A X GENERAL LIABILITY
X COMMERCIAL GENERAL LIABILITY
X CLAIMS MADE X OCCUR
X XCU included

GENL AGGREGATE LIMIT APPLIES PER:
POLICY X PRO X LOC

AUTOMOBILE LIABILITY
ANY AUTO
ALL OWNED AUTOS
SCHEDULED AUTOS
HIRED AUTOS
NON-OWNED AUTOS

GARAGE LIABILITY
ANY AUTO

EXCESS UMBRELLA LIABILITY
OCUR CLAIMS MADE

DEDUCTIBLE $ RETENTION $300,000

WORKERS COMPENSATION AND EMPLOYERS’ LIABILITY
ANY PROPRIETOR/Partner/EXECUTIVE OFFICER/OWNER/EXCLUDED? (Mandatory in NH)
Y N
If yes, describe under SPECIAL PROVISIONS below

B OTHER
Professional Liability
COPS2675431

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES / EXCLUSIONS ADDED BY ENDORSEMENT / SPECIAL PROVISIONS
Re: Delta’s site access on behalf of the MFCA at the Olmsted County Fairgrounds (aka Graham Park) on Truck Highway 61 in Rochester, MN - Project 19382DELO3, Phase 0002B.

It is agreed that Olmsted County is included as an Additional Insured as respects to General Liability when required by written contract, agreement or permit.

CERTIFICATE HOLDER
Olmsted County
Attn: Richard Devlin, County Administrator
Government Center
151 4th Street SE
Rochester, MN 55904-3710

CANCELLATION
SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING INSURER WILL ENDEAVOR TO MAIL 30 DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER REFERRED TO THE LEFT, BUT FAILURE TO DO SO SHALL IMPOSE NO OBLIGATION OR LIABILITY OF ANY KIND UPON THE INSURER, ITS AGENTS OR REPRESENTATIVES.

AUTHORIZED REPRESENTATIVE

ACORD 25 (2009/01) Coll:2700995 Tp:1928417 Cert:1255581 © 1988-2009 ACORD CORPORATION. All rights reserved
The ACORD name and logo are registered marks of ACORD.
IMPORTANT

If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

DISCLAIMER

This Certificate of Insurance does not constitute a contract between the issuing insurer(s), authorized representative or producer, and the certificate holder, nor does it affirmatively or negatively amend, extend or alter the coverage afforded by the policies listed thereon.
Photograph 1
Fire foam was sprayed on the gravel parking lot located northeast of the Fairgrounds grandstand. View facing south.

Photograph 2
Soil borings B-1 in the background and B-2 in the foreground.
## ENVIRONMENTAL BORING LOG

**BORING ID:** B-1  
**TOTAL DEPTH:** 15'

### PROJECT INFORMATION
- **Project:** PFC's in Fire Fighting Foam  
- **Site Location:** Rochester, MN  
- **Job No.:** 19382DEL03  
- **Logged By:** Curt McKay  
- **Weather:** NA  
- **Date Completed:** 5/28/09

  - Water Level During Drilling: 14.5'

### DRILLING INFORMATION
- **Drilling Co.:** West Central Environmental Consultants  
- **Drill Crew Chief:** NA  
- **Rig Type:** Geoprobe  
- **Method of Drilling:** Direct Push Probe  
- **Soil Sampling Method:** 5' samplers with liners  
- **Surface Elevation (feet):** NA  
- **Field Screening Instrument:** None

<table>
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<tr>
<th>DEPTH</th>
<th>LITHOLOGY</th>
<th>DESCRIPTION</th>
<th>USCS</th>
<th>LAB SAMP.</th>
<th>PID ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>(0.00, 1.00) GRAVEL: Fill. Top 5' hand augered.</td>
<td>GP</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>(1.00, 3.00) SILT: Black, moist.</td>
<td>SM</td>
<td>Composite Sample from 0'-4'.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Becoming more moist at 6' bgs.</td>
<td>SP</td>
<td>Composite Sample from 4'-8'.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>(8.00, 12.00) SAND AND GRAVEL: Brown, medium to coarse sand, gravel &lt; 1&quot;, slightly moist.</td>
<td>SP &amp; GP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>(12.00, 13.50) SAND: Brown, medium grain, moist.</td>
<td>SP</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>(13.50, 14.50) SAND AND GRAVEL: Dark brown, medium to coarse sand, gravel &lt; 1&quot;, slightly moist.</td>
<td>SP &amp; GP</td>
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<td></td>
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<tr>
<td></td>
<td>(14.50, 14.75) SAND AND GRAVEL: Light brown, fine grain, wet.</td>
<td>SP &amp; GP</td>
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<td>(14.75, 15.00) SAND AND GRAVEL: Brown, medium sand, gravel &lt;1/2&quot;, wet.</td>
<td>SP &amp; GP</td>
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<td></td>
<td></td>
</tr>
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</table>

Comments: E.O.B. at 15' due to refusal. Insufficient water volume for sampling.

Boring Location: 44 00.159' N / 92 27.799' W

Page 1 of 1
## ENVIRONMENTAL BORING LOG

### BORING ID: B-2
### TOTAL DEPTH: 14.75’

### PROJECT INFORMATION

- **Project:** PFC’s in Fire Fighting Foam
- **Site Location:** Rochester, MN
- **Job No.:** 19382DEL03
- **Logged By:** Curt McKay
- **Weather:** NA
- **Date Completed:** 5/28/09

### DRILLING INFORMATION

- **Drilling Co.:** West Central Environmental Consultants
- **Drill Crew Chief:** NA
- **Rig Type:** Geoprobe
- **Method of Drilling:** Direct Push Probe
- **Soil Sampling Method:** 5’ samplers with liners
- **Surface Elevation (feet):** NA
- **Field Screening Instrument:** None

### DEPTH | LITHOLOGY | DESCRIPTION | USCS | LAB SAMP. | PID ppm
---|---|---|---|---|---
0 | (0.00, 1.00) GRAVEL: Fill. Top 5ft hand augered. | GP | NA | |
1 | (1.00, 3.00) SILT: Black, moist. | SM | Composite Sample from 0’ - 4’. | |
2 | (3.00, 14.75) SAND: Brown, medium grain, moist. | SP | Composite Sample from 4’ - 8’. | |
3 | @ 13.75’ light brown, fine grain, dry. | | | |
4 | @ 14.75’ bedrock/sandstone, dry. | | | |

**Comments:** E.O.B. at 14.75’ due to refusal.

**Boring Location:** 44 00.165’ N / 92 27.792’ W
APPENDIX M

Flint Hills Pine Bend Refinery Discussion and Supporting Documents
Background and Access – FHR Pine Bend Refinery Fire Foam Training Area

The Deputy Fire Chief at the Flint Hills Resources (FHR) Pine Bend Refinery returned a completed firefighting foam use questionnaire to Delta in June 2008, indicating the use of Class B AR-AFFF in fire foam training by the fire department at the refinery. The questionnaire indicated that five to ten gallons of Ansul-brand Thunderstorm AR-AFFF is used for each of the 20 to 25 fire foam training exercises performed annually from April through November per year, with up to 300 gallons of foam concentrate used annually for training. The fire foam training is conducted at the fire training grounds near the southwest corner of the refinery. Spent foam is collected into a lined holding area from which it is pumped out and disposed through an on-site waste water treatment plant (WWTP). A copy of the questionnaire is included in Appendix M.

The questionnaire also indicates that 3M-brand foam is used for fire response but not for training. In a follow-up conversation with the FHR Deputy Fire Chief, he stated that 3M-brand AR-AFFF was historically used in training, but the fire department switched to Thunderstorm foam in 2005.

The fire training grounds are located near the southwest corner of the refinery, as shown on Figure 1, Fire Foam Training Area Location, Flint Hills Pine Bend Refinery, included in Appendix M.

An access agreement between FHR and the MPCA was not executed at the time of this report. A site reconnaissance was performed at the FHR Pine Bend Refinery in Rosemont without an executed access agreement, as discussed below.

As presented in Delta’s April 2009 report, the inferred groundwater flow direction at the Flint Hills refinery is to the east-northeast.

Site Reconnaissance – FHR Pine Bend Refinery Fire Foam Training Area

Site reconnaissance of the fire foam training area at the FHR Pine Bend Refinery was conducted on March 11, 2009. Delta representative Nancy Rodning and MPCA Project Manager Nile Fellows met with the FHR Pine Bend Refinery’s Deputy Fire Chief, the Regulatory Affairs Manager, the Water Compliance Engineer, and the Compliance System Owner. A copy of the meeting notes is included in Appendix M.

According to FHR personnel, the Pine Bend Refinery fire department trains with foam at a concrete-paved fire training area at the southwest portion of the facility. The fire training area was first constructed with asphalt pavement in approximately 1995 and was later re-paved with concrete. Training with foam was not conducted on-site prior to construction of the training pad. Run-off from the training pad drains to a high-density polyethylene (HDPE)-lined retention pond. The pond is pumped out as needed and the
contents are trucked and disposed through the on-site WWTP. According to FHR personnel, any spent foam used on a live fire at the refinery would go to the on-site storm sewer system, which is routed through the on-site WWTP. Photographs of the fire training area are included in Appendix M.

Delta recorded GPS locations of the corners of the fire training area using a hand-held GPS unit with an accuracy of approximately 15 feet. The training area is shown on the figure Fire Foam Training Area, Flint Hills Pine Bend Refinery, which is included in Appendix M.

As presented in Delta’s April 2009 Report, FHR personnel related that land adjacent to the west and north of the fire training area is being used for ‘land-farming’ soil impacted with RCRA-regulated waste. Soils beneath the HDPE-lined retention pond were tested for benzene associated with the RCRA waste a few years ago; no benzene was detected in the soil samples, indicating that the HDPE-lined retention pond was not leaking at that time.

According to FHR personnel, WWTP influent and effluent samples were collected by the MPCA in 2007 and 2008 and analyzed for PFCs. The MPCA provided a table summary of sampling analytical results, a copy of which is included in Appendix M. Low levels of several PFC compounds were detected in samples collected both years in both influent and effluent samples; detected concentrations of PFOS, PFOA and PFBA compound concentrations were below MDH Health Risk Limits (HRLs) and Health-Based Values (HBVs) for drinking water.

As reported in Delta’s April 2009 Report, FHR personnel collected groundwater samples on February 16, 2009, from three existing monitoring wells on-site for PFC analyses: MW-1 is located approximately 500 feet west (upgradient) of the fire training area and is completed to a depth of 50 feet below grade surface (bgs); MW-3 is located approximately 400 feet northeast (downgradient) of the fire training area and is 90 feet deep; and, MW-111 is located approximately 1,700 feet east of the fire training area and is 85 feet deep. The depth to groundwater is approximately 50 feet, with a flow direction to the east-northeast. Exogen Laboratory in Pennsylvania was used for laboratory analysis of the groundwater samples. A table of laboratory results supplied by FHR personnel is included in Appendix M. The groundwater sample collected from MW-3 exhibited the highest concentrations of PFCs as compared to the other two wells, and one PFC compound concentration in the MW-3 sample, 0.489 parts-per-billion (ppb) PFOS, exceeded the MDH HRL for PFOS of 0.3 ppb. Low levels of PFOA, PFBA, and PFHxS were detected in the upgradient groundwater sample collected from MW-1.

No potential community water supply systems such as those typically associated with rest stops, trailer parks, etc., were observed within 1/4-mile of the training areas. Nearby water wells identified via a search
of the MDH CWI are shown on Figure 1, Fire Foam Training Area Location, Flint Hills Pine Bend Refinery and are described on the Site Summary included in the April 2009 Report.

Sample Collection – FHR Pine Bend Refinery Former Fire Foam Training Area
Since groundwater sampling around the fire foam training area was recently conducted by FHR, it was decided to delay sampling at the Pine Bend Refinery at this time. Pending PFC sampling results from other fire foam training areas sampled as part of this investigation, groundwater sampling from existing wells, or soil and groundwater sampling from temporary wells at the Pine Bend Refinery may be considered if results from other sites indicate the use of Class B firefighting foams may be resulting in the release of PFCs to the environment.

Recommendations – FHR Pine Bend Refinery Former Fire Foam Training Area
Based on the findings of groundwater sampling at other fire foam training areas being conducted as part of this (and future) scopes of work, additional groundwater sampling at the Pine Bend Refinery may be considered.
LEGEND:

- Well Locations

FIGURE 1
FIRE FOAM TRAINING AREA LOCATION
FLINT HILLS PINE BEND REFINERY
ROSEMOUNT, MINNESOTA

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<td>6/8/09</td>
<td></td>
<td>Rosemount-1</td>
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Fire Foam Training Area
Flint Hills Pine Bend Refinery
Rosemount, MN
QUESTIONNAIRE
Firefighting Foam Use in Fire Training

1. Does your Department use Class A and/or Class B firefighting foams for firefighting operations?
   _____ Class A only  _____ Class B only  _____ Both Class A and Class B

2. How often is Class B or Class A foam used in response to fire calls?
   _____ 0-25% of fires  _____ 25-50% of fires  _____ 75-100% of fires

3. What type of foam does your Department use for training exercises operations?
   _____ Class A only  _____ Class B only  _____ Both Class A and Class B
   _____ Training foam  _____ No foam is used in training (If none, please skip to Question 8)

4. How often is foam used in training exercises?
   _____ Weekly  _____ Monthly  _____ Quarterly
   _____ Semi-Annually  _____ Annually  _____ Bi-Annually
   _____ Other (please specify): Approximately 20 – 25 times during the training season from April through November. This includes mutual aid fire training and training for St Paul and Minneapolis Trainees.

5. How much foam is used per training event?
   _____ Less than 5 gallons  _____ 5 gallons  _____ 5 to 10 gallons
   _____ More than 10 gallons (please specify):

6. Where does/did the training take place? Please include address, intersection or other specific location information for current and past training areas.
   1255 Clayton Blvd. Junction Hwys 52 & 55. At the fire training grounds in the SW corner of the Refinery.
   _______________________________________________________________________

   In training, where does the spent foam go?
   _____ Storm Sewer  _____ Sanitary Sewer  _____ On-Site Septic  _____ Ground
   _____ Other (please describe): To a lined holding area from which it is pumped to a sump, then to our Waste Water Treatment Facility.

7. In fire responses at the refinery, where does the spent foam go?
   _____ Storm Sewer  _____ Sanitary Sewer  _____ On-Site Septic  _____ Ground
   _____ Other (please describe): Depending on the location of the fire/spill, some goes to the Waste Water Treatment Facility and other may go to soil.

XInogen
5910 Rice Creek Parkway Suite 100 St. Paul, MN 55126 USA
Phone: 651.639.9449 / 800.477.7411 Fax: 651.639.9473 www.deltaenv.com
8. What type(s) and brand(s) of foam are or were used now and in the past by the Department, both for fire response and in training (if applicable)? Please check all that apply.

<table>
<thead>
<tr>
<th>Type of Foam</th>
<th>Brand of Foam</th>
<th>Used in Training?</th>
<th>Amount Used</th>
<th>Current Use or Historic Use?</th>
</tr>
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<td>Class B Aqueous Film-Forming Foam (AFFF)</td>
<td>3M FC 600F</td>
<td>Yes</td>
<td>Response</td>
<td>Current for all</td>
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<td></td>
<td>3M FC 602</td>
<td>No</td>
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<td></td>
<td>3M ATC 3X3</td>
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<tr>
<td>Class B Fluoroprotein (FP)</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Class B Film-Forming Fluoroprotein (FFFP)</td>
<td>Used many years ago.</td>
<td>Yes</td>
<td>Not Sure</td>
<td>Historic</td>
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<tr>
<td>Class B AR-FFFP</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Class A-BHi Expansion Foam</td>
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<td>Training Foam</td>
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<td></td>
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</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Thank you for your time and cooperation. Please contact Nancy Rodning at Delta Consultants (651-697-5152 or nrodnng@deltalenv.com) or Jim Stockinger at the Minnesota Pollution Control Agency (651-297-8666 or jim.stockinger@state.mn.us) if you have any questions regarding this questionnaire.

*Please return this questionnaire to Delta Consultants by May 9, 2008.*

Questionnaire completed by:
Pete D. Herpst
Deputy Fire Chief
Name and Title
Flint Hills Resources, Pine Bend Refinery Fire Department
Fire Department

651-437-0643
Phone Number

6/2/08
Date

pete.herpst@fhr.com
E-Mail Address
Meeting Notes for Meeting at Flint Hills Refinery-Pine Bend  
March 11, 2009  
Re: Site reconnaissance of fire training area and perfluorocarbons (PFCs) in firefighting foam

Meeting Attendees:  Rebecca Kenow, Regulatory Affairs Manager, Flint Hills Refinery (FHR); Peter Herpst, Deputy Fire Chief, FHR; Scott Baker, Water Compliance Engineer, Environmental, FHR; Mike Falk, Compliance System Owner, Waste and Water Programs, FHR; Nile Fellows, Project Manager, Remediation Division, Superfund Section, Minnesota Pollution Control Agency; John Estes, Project Manager, Delta Consultants; Nancy Rodning, Project Scientist, Delta Consultants.

Mr. Fellows presented select information from Perfluorocarbon (PFC)-Containing Firefighting Foams and Their Use in Firefighting Training in Minnesota, dated June 30, 2008, and the Addendum to this report dated October 22, 2008, prepared by Delta Consultants (Delta). The reports are available on the MPCA’s website at www.pca.state.mn.us/cleanup/pfc/index.html#pfcfoam.

In April 2008 Delta, on behalf of the MPCA, mailed questionnaires to fire departments across the State. FHR Deputy Fire Chief Herpst indicated on the questionnaire that the department trains on-site approximately 20 to 25 times per year from April through November with Class B foams and up to 300 gallons of foam are used annually. In a follow-up telephone conversation with Delta, Deputy Fire Chief Herpst related that the department formerly used foam manufactured by 3M in training, but switched to Williams Thunderstorm foam in 2005. Approximately 50,000 gallons of 3M foam remains at the refinery but is not used in training. The surfactants in Class B foams made by 3M through 2002 were made using an electro-chem ical fluorination (ECF) process, which may break down to PFOS, PFOA and other PFCs in the environment. The surfactants in other Class B foams, including Ansul foam, are made using a telomerization process, which may break down to PFOA, telomere sulfonates, and other PFCs. At this time the MPCA does not know if the use of firefighting foams in training have resulted in the release of PFCs to the environment, thus the MPCA would like to collect soil, groundwater and surface water samples at fire training areas where Class B fire foams are used repeatedly in order to make that determination.

Deputy Fire Chief Herpst related that the fire training area utilized by FHR-Pine Bend was paved with asphalt in the early to mid-1990s. The fire department first started using Class B aqueous film-forming foam (AFFF) for training in 1994. Prior to 1994 the department used protein foam. The fire training area was later paved with concrete. The training area was constructed so that overflow is captured by a HDPE (high density polyethylene)-lined retention pond. The pond is vacuum pumped as needed into vac trucks and the water brought to the on-site wastewater treatment plant (WWTP). Deputy Fire Chief Herpst stated that very little foam typically runs over the edge of the pavement during training.

Mr. Falk explained that past testing for benzene associated with RCRA-regulated waste found that the HDPE-lined pond had not leaked.

Mr. Falk and Mr. Baker explained the operation of the WWTP and that most of the surfaces beneath the production areas are paved and these areas drain to the on-site storm water sewer system which is routed to the WWTP. Testing of WWTP influent and effluent in 2007 and 2008 detected low levels (up
to 0.3 ppb) of several PFC compounds, including PFOS and PFBA, but not PFOA. Mr. Baker provided a copy of the PFC effluent sampling results for 2007 and 2008 (attached).

Mr. Baker indicated the locations and depths of three groundwater monitoring wells in the vicinity of the fire training area: MW-1 is located west (upgradient) of the fire training area and is 50 feet deep; MW-3 is located northeast (or roughly downgradient) of the fire training area and is 90 feet deep; and, MW-111 is located to the east and is 85 feet deep. FHR recently sampled these wells for PFCs and found low levels (up to 0.7 ppb) of several PFC compounds in all three wells. Mr. Baker supplied the MPCA and Delta with a copy of the laboratory report. Past well data has shown a groundwater flow direction toward the east-northeast.

Deputy Fire Chief Herpst and Mr. Baker accompanied Mr. Fellows and Delta personnel on a driving tour of the fire training area. Delta mapped the training area location using GPS and photographed the area. The photographs are attached at the end of these meeting notes. GPS coordinates for the four corners of the concrete-paved fire training area are as follows:

- NE Corner: N44° 45.474, W93° 02.810
- NW Corner: N44° 45.475 W93° 02.865
- SE Corner: N44° 45.448 W93° 02.812
- SW Corner: N44° 45.457 W93° 02.866

The MPCA will consult with Delta to determine if soil, groundwater or surface water sampling around the fire training area is warranted. The MPCA or Delta will communicate sampling plans to Ms. Kenow. If sampling efforts are put forth, Ms. Kenow would like in writing an explanation of the purpose of the investigation and under whose authority the investigation will be conducted, and a written work plan attached to an access agreement.

Mr. Fellows and Delta personnel left the refinery at 3:30 PM.
Photograph 1
Concrete-paved training area and HDP-lined retention pond, view from the northwest corner facing east.

Photograph 2
View of the training area and pond from the northwest corner facing southwest.
Flint Hills Resources WWTP Perfluorochemical Assessment

<table>
<thead>
<tr>
<th></th>
<th>Influent [ng/L (ppt)]</th>
<th>Effluent [ng/L (ppt)]</th>
<th>Sludge [ng/g (ppb)]</th>
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<td>&lt; 2.59</td>
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<tr>
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<td>&lt; 2.59</td>
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<= below detection limit; value listed is detection limit
*= estimated value based on QA review
-= no data available
NQ = not quantifiable
2007 – grab samples collected 5/2/07
2008 – grab samples collected 3/25/08

Marathon Petroleum WWTP Perfluorochemical Assessment

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<th></th>
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<td>% moisture</td>
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</table>

<= below detection limit; value listed is detection limit
*= estimated value based on QA review
-= no data available
2007 – grab samples collected 5/18/07
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<td>ND</td>
<td>ND</td>
</tr>
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</table>

Note: All concentrations listed are in ng/mL, or ppb.  
HBV: Health Based Value  
HRL: Health Risk Limit  
SW Standard: Surface Water Standard

MW1: Monitoring well located upgradient of refinery. (depth = 50')  
MW1*: Laboratory duplicate of MW1.  
MW3: Monitoring well located downgradient of fire training grounds, NNW of Tank 7. (depth = 90')  
MW111: Monitoring well located sidegradient of fire training grounds, South of Tank 6. (depth = 85')
APPENDIX N
Marathon Refinery Discussion and Supporting Documents
Background and Access – Marathon Refinery Fire Foam Training Area

The Fire Chief at the Marathon Refinery in St. Paul Park returned a completed firefighting foam use questionnaire to Delta in May 2008, indicating the use of Thunderstorm Class B A-R-AFFF in fire foam training by the fire department at the refinery. The questionnaire indicated that 50 to 100 gallons of AR-AFFF is used per semi-annual training event, with up to 250 gallons of foam concentrate used annually for training. The fire foam training is conducted at the fire training grounds near the southwest corner of the refinery. Spent foam goes to an on-site waste water treatment plant (WWTP). A copy of the questionnaire is included in Appendix N. In a follow-up conversation with the Marathon Fire Chief, he stated that 3 M-brand AR-AFFF was historically used in training, but the fire department switched to Thunderstorm foam in approximately 2000.

The fire training area is located near the southwest corner of the refinery, as shown on Figure 1, Fire Foam Training Area Location, Marathon Refinery, included in Appendix N. An access agreement was signed by the Minnesota Refining Division Manager of Marathon Petroleum Company LLC and the MPCA, allowing access for sampling of existing groundwater monitoring wells at the Marathon Refinery. A copy of the access agreement with an accompanying scope of work is included in Appendix N.

As presented in Delta’s April 2009 report, the inferred groundwater flow direction at the Marathon Refinery is to the west. The groundwater flow direction was confirmed by the Marathon Refinery Environmental Coordinator during the site reconnaissance.

Site Reconnaissance – Marathon Refinery Fire Foam Training Area

Site reconnaissance of the fire foam training area at the Marathon Refinery was conducted on March 17, 2009. Delta representatives John Estes and Nancy Rodning were accompanied by the Marathon Refinery Fire Chief and the Marathon Environmental Coordinator.

As presented in Delta’s April 2009 Report, the Marathon Refinery fire department trains with foam at a concrete-paved fire training area in the southwest portion of the facility. The concrete pad at the training area is slightly raised above grade with 2- to 4-inch high concrete curbing around the perimeter. The pad is surrounded by ten to twenty feet of river rock pebbles. Pooled or collected liquids on the training pad drain to an on-site storm sewer system, which is routed to an on-site WWTP. According to the Fire Chief, the outflow storm sewer valves at the training pad are closed temporarily, until the foam breaks down or condenses, so that the foam does not create a foaming issue at the WWTP. The training area was built in 1995; prior to 1995 training was conducted off-site. The Fire Chief confirmed the departments’ current use of Ansul-brand Thunderstorm AR-AFFF since 2000, and stated that the department historically used AR-AFFF manufactured by 3 M for training from 1995 through approximately 2000. Photographs of the fire
training area are included in Appendix N. Delta recorded GPS locations of the corners of the fire training area using a hand-held GPS unit with an accuracy of approximately 15 feet. The training area is shown on the figure Fire Foam Training Area, Marathon Refinery, which is included in Appendix N.

As reported in Delta’s April 2009 Report, the Marathon Fire Chief recalled two fires in the past where large amounts of Ansul Thunderstorm AR-AFFF were used. Approximately 6,500 gallons of foam were used on a fire at Tank 120 in July 2004, and approximately 2,000 gallons of foam were used in December 2007 on a fire at Tank 82. Tank 120, along with eight other tanks, is surrounded by an earthen berm. Fire Chief Crisp indicated that the spent foam was contained within the bermed area and allowed to break down; water from within the bermed area was pumped out. Under the oversight of the MPCA, the soil from within the bermed area was excavated due to petroleum impacts; confirmation soil samples were collected from the excavated area and results reported to the MPCA. Tank 120 is located approximately 1,300 feet northeast of the fire training area.

According to the Marathon Environmental Coordinator, WWTP influent and effluent samples were collected by the MPCA and analyzed for PFCs in 2007. The MPCA provided a table summary of sampling analytical results, a copy of which is included in Appendix N. Low levels of several PFC compounds were detected in samples in both influent and effluent samples; detected concentrations of PFOS, PFOA and PFBA compound concentrations were below MDH HRLs and HBVs for drinking water.

There are several groundwater monitoring and recovery wells in the area of the fire training pad. A map illustrating well locations provided by the Marathon Environmental Coordinator is included in Appendix N. The wells have not been sampled for PFCs by Marathon Petroleum Company.

Groundwater studies associated with former 3M dumpsites and PFC contaminants have been conducted by the MDH in southern Washington County, including St. Paul Park. The Marathon Refinery is in an area where PFBA has been detected in the regional groundwater at concentrations of 1.0 ppb or greater.

No potential community water supply systems such as those typically associated with rest stops, trailer parks, etc., were observed within 1/4-mile of the training areas. Nearby water wells identified via a search of the MDH CWI are shown on Figure 1, Fire Foam Training Area Location, Marathon Refinery and are described on the Site Summary included in the April 2009 Report.
Sample Collection – Marathon Refinery Fire Foam Training Area

The access agreement was executed between Marathon Petroleum Company LLC and the MPCA on June 8, 2009. Due to the upcoming end of the 2009 fiscal year for the State of Minnesota, there was insufficient time to complete groundwater sampling at the Marathon Refinery as part of this scope of work.
1. Does your Department use Class A and/or Class B firefighting foams for firefighting operations?
   - Class A only
   - Class B only
   - Both Class A and Class B

2. How often is Class B or Class A foam used in response to fire calls?
   - 0-25% of fires
   - 25-50% of fires
   - 75-100% of fires

3. What type of foam does your Department use for training exercises operations?
   - Class A only
   - Class B only
   - Both Class A and Class B
   - Training foam
   - No foam is used in training (If none, please skip to Question 8)

4. How often is foam used in training exercises?
   - Weekly
   - Semi-Annually
   - Other (please specify):
   - Monthly
   - Annually
   - Bi-Annually

5. How much foam is used per training event?
   - Less than 5 gallons
   - More than 10 gallons (please specify): 50-100 gal.
   - 5 gallons
   - 5 to 10 gallons

6. Where does/did the training take place? Please include address, intersection or other specific location information for current and past training areas.
   - MARATHON PETROLEUM REFINERY FIRE TRAINING GRANOS
   - 301 ST. PAUL PARK RD., ST. PAUL PARK MN.

7. In training, where does the spent foam go?
   - Storm Sewer
   - Sanitary Sewer
   - On-Site Septic
   - Ground
   - Other (please describe):

8. In fire responses at the refinery, where does the spent foam go?
   - Storm Sewer
   - Sanitary Sewer
   - On-Site Septic
   - Ground
   - Other (please describe):

Xinogen
5910 Rice Creek Parkway Suite 100 St. Paul, MN 55126 USA
Phone: 651.639.9449 / 800.477.7411 Fax: 651.639.9473 www.deltaenv.com
9. What type(s) and brand(s) of foam are or were used now and in the past by the Department, both for fire response and in training (if applicable)? Please check all that apply.

<table>
<thead>
<tr>
<th>Type of Foam</th>
<th>Brand of Foam</th>
<th>Used in Training? Yes or No</th>
<th>Amount Used Annually</th>
<th>Current Use or Historic Use?</th>
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<td>Class B Fluoroprotein (FP)</td>
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</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Thank you for your time and cooperation. Please contact Nancy Rodning at Delta Consultants (651-697-5152 or nrodnig@deltaenv.com) or Jim Stockinger at the Minnesota Pollution Control Agency (651-297-8666 or jim.stockinger@state.mn.us) if you have any questions regarding this questionnaire.

Please return this questionnaire to Delta Consultants by May 9, 2008.

Questionnaire completed by:

STEVE CRISP  FIRE CHIEF

Name and Title

MARATHON PETROLEUM CORP.

Fire Department

651-458-6461  5-2-08

Phone Number  Date

E-Mail Address

MARATHON@dol.com

DELTA

QUESTONNAIRE

Firefighting Foam Use in Fire Training
Nancy Rodning

From: Crisp, Steven L. [slcrisp@marathonoil.com]
Sent: Wednesday, June 04, 2008 8:23 AM
To: Nancy Rodning
Subject: RE: Questions re. firefighting foams

---Original Message---

From: Nancy Rodning
Sent: Tuesday, June 03, 2008 3:33 PM
To: 'slcrisp@marathonpetroleum.com'
Subject: Questions re. firefighting foams

Good afternoon Mr. Crisp:

Delta Consultants is working with the Minnesota Pollution Control Agency on conducting research into the use of firefighting foams in Minnesota. Mr. Jim Stockinger at the MPCA gave me your contact information. Delta is gathering information from fire departments and training schools across the State so the MPCA can better understand how much, what kind, and where firefighting foam is being used in Minnesota.

Attached is an explanatory letter from the MPCA and a questionnaire regarding foam use at the refinery. It is Delta's understanding that the Flint Hills Refinery has their own fire department, and that fire training with foam is conducted at the refinery. Would you please complete the attached questionnaire and return it to me by Friday, June 6th?

I appreciate any information you can provide. If you have any questions, please call me at 651-697-5152. You can return the questionnaire to me via email or regular mail at my address below.

Thank you.

Nancy Rodning
ACCESS AGREEMENT BETWEEN
THE MINNESOTA POLLUTION CONTROL AGENCY
AND MARATHON PETROLEUM COMPANY LLC

The Minnesota Pollution Control Agency (MPCA) is investigating firefighting training sites where Class B foams have been or are being utilized. The investigation will be conducted at the following site (Property) owned and operated by Marathon Petroleum Company LLC (Owner) where firefighting training with Class B foams occurs:

Marathon Petroleum Company LLC Refinery
Fire training grounds
301 St. Paul Park Road
St. Paul Park, Minnesota

The Property Owner hereby consents and authorizes the MPCA, its employees, agents and contractors, to enter this Property for the purpose of performing reasonable and necessary investigations in response to the use of Class B firefighting foams that may or may not contain perfluorocarbons (PFCs). The MPCA is authorized to take these actions under Minn. Stat. §§ 115B.17, subd. 4 and 115.04, subd. 3.

The MPCA will notify the Property Owner at least 48 hours before entering the Property. Work will be conducted during regular business hours (8:00 a.m. to 5:00 p.m.) unless the MPCA receives permission to and arrangements are made to conduct work during different hours. The MPCA will conduct its activities so as to avoid interference with the use of the Property. If any portion of the Property must be disturbed as a result of the MPCA's activities, the MPCA will restore the Property to as close to its original condition as is reasonably possible under the circumstances. The Property Owner will take reasonable precautions regarding its own conduct and the conduct of its employees, agents and contractors on the Property to avoid damage to the equipment of the MPCA and its contractors, and to avoid disrupting the work being conducted by the MPCA, its employees, agents and contractors.

A Scope of Work to collect groundwater samples from select existing wells for analysis of PFCs is attached. All work will be performed as outlined in the attached Scope of Work. A copy of all laboratory reports for all groundwater samples collected at the Property will be provided to the Property Owner.

The MPCA shall be liable for injury to or damage to property, or personal injury or death, caused by an act or omission of any employee of the state in the performance of the work described above, under the circumstances where the state, if a private person, would be liable to the claimant, in accordance with Minn. Stat. § 3.736. The MPCA shall cause its contractor who carries out the work to provide the Property Owner with certificates of insurance showing commercial general liability insurance and professional liability insurance coverage of not less than $1M per occurrence and $2M aggregate. The certificate of insurance shall indicate or be accompanied by an endorsement which indicates that Marathon Petroleum Company LLC has been named as an additional insured under the contractor's commercial general liability coverage.

**MINNESOTA POLLUTION CONTROL AGENCY**

Signature
D. Wirth
Title
Supervisor, Sulfur Unit 1
Date
6/8/09

**Marathon Petroleum Company LLC**

Signature
P. Bunts
Title
MN Refining Division Manager
Date
5/19/09
SCOPe OF WORK: Sampling of Existing Wells

SITE: Marathon Petroleum Company LLC (Marathon) Refinery
301 St. Paul Park Road
St. Paul Park, MN

Delta Consultants (Delta), as a contractor for the Minnesota Pollution Control Agency (MPCA), proposes to conduct the scope of work detailed below at the above-referenced site (Site). The proposed work is being conducted as part of the MPCA’s PFCs in Firefighting Foam project.

Marathon provided Delta with a well location map and well logs for selected wells. Review of the well logs indicates that all of the wells, except for SP-11 and perhaps EBH-1, are completed into the Prairie du Chien limestone formation. Generally, 1 to 9 feet of soil is present above the limestone, and the depth to groundwater ranges from 24 to 38 feet below grade. The presumed groundwater flow direction is to the west, toward the Mississippi River.

1. Based on review of well logs and well location maps provided by Marathon, groundwater samples will be collected from the following existing Site wells. The wells were chosen for sampling based on their location relative to the fire training area.

   - MW-W156, located adjacent east (upgradient) of the fire training area.
   - MW-W173, located near the southwest corner of the fire training area. Delta understands that this well had 0.15 feet of LNAPL when sampled on 3/29/09. If LNAPL is found to be present at the time of well sampling, a groundwater sample will not be collected from this well.
   - EBH-1, located in the fire training area (this structure may or may not be a groundwater monitoring well, no well log was available for EBH-1).
   - SP-11, a sand point well located approximately 300 feet west (downgradient) of the fire training area. A well log was not available for SP-11.
   - MW-172, located approximately 400 feet west of the fire training area.
   - MW-W101, located just south-southwest of Tank 120, where firefighting foam was released on a fire in 2004.
   - MW-912, located upgradient of the fire training area and Tank 120, near the east (upgradient) refinery property boundary. The sample collected from this well will serve as a “background” sample representative of base-line conditions.

   It is assumed that these wells do not contain light non-aqueous phase liquid (LNAPL); this information will be verified with Marathon prior to sampling.

2. The depths to water will be measured at each well prior to sampling. Each will be checked for LNAPL with a free-phase product indicator prior to sampling. Wells with LNAPL will not be sampled.

3. Groundwater samples will be manually collected using dedicated, disposable bailers. Groundwater samples will be placed directly into laboratory-supplied jars and handled under standard chain-of-custody controls. If any development/stabilization water is generated from any sampled well, Delta will containerize it, and will work with Marathon to discharge any and all such water to the MCES sewer.

4. It is Delta’s understanding that Marathon may request “split samples” for submittal to their own laboratory. Delta will provided Marathon with groundwater from the same bailer, and will fill Marathon-supplied sample jars if requested, as directed by Marathon personnel.

5. Groundwater samples will be submitted to a State-contracted laboratory, either Axys Laboratories or MPI Research, Inc., for analysis of perfluorocarbons (PFCs) only. The following PFC compounds will be included on the list of analytes:

   - Perfluorobutanoic acid (PFBA)
   - Perfluorobutane Sulfonate (PFBS)
- Perfluoropentanoic acid (PFPeA)
- Perfluorohexanoic acid (PFHxA)
- Perfluoroheptanoic acid (PFHpA)
- Perfluorohexane Sulfonate (PFHxS)
- Perfluorooctanoic acid (PFOA)
- Perfluorooctane Sulfonate (PFOS)

- Perfluorooctane Sulfonamide (PFOSA)
- Perfluorononanoic acid (PFNA)
- Perfluorodecanoic acid (PFDA)
- Perfluoroundecanoic acid (PFUDA)
- Perfluorododecanoic acid (PFDoDA)

6. While at the Marathon Petroleum Refinery, Delta will follow all rules, safety-related and otherwise, as set forth by Marathon. Delta will also conduct all site work in conformance with their own site-specific health and safety plan.

7. A copy of the laboratory analytical report will be provided to Marathon upon receipt.
Named Insured: Delta Environmental Con
Insured City: Shoreview
## Certificate of Liability Insurance

**Producer:** Willie of Minnesota, Inc.
26 Century Blvd.
P. O. Box 305191
Nashville, TN 37220-5191

**INSURED:** Delta Environmental Consultants, Inc.
DEA Delta Consultants
5910 Rice Creek Parkway, Ste 100
Shoreview, MN 55126

**Certifying Parties:**
- Insurer: Commerce and Industry Insurance Company 19410-001
- Insurer: American International Specialty Lines Inc 26883-002
- Insurer: [Missing Insurer]
- Insurer: [Missing Insurer]

### Coverages

The policies of insurance listed below have been issued to the insured named above for the policy period indicated. Notwithstanding any requirement, term or condition of any contract or other document with respect to which this certificate may be issued or may pertain, the insurance afforded by the policies described herein is subject to all the terms, exclusions and conditions of such policies. Aggregate limits shown may have been reduced by paid claims.

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**Description of Operations/Locations/Vehicles/Exclusions Added by Endorsement/Special Provisions**

Marathon Petroleum Company LLC is named as Additional Insured on the General Liability policy as required by the access agreement between MPCA and Marathon regarding Delta's site access at Marathon Petroleum Company LLC Refinery, Fire Training Grounds 301 St. Paul Park Road, St. Paul Park, MN - Delta PN 19382DEL04, Phase 0003H.

**Certificate Holder**

Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, MN 55155

**Cancelation**

Should any of the above described policies be cancelled before the expiration date thereof, the issuing insurer will endeavor to mail 30 days written notice of cancellation to the certificate holder named to the left, but failure to do so shall not impose any obligation or liability of any kind upon the insurer, its agents or representatives.
IMPORTANT

If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

DISCLAIMER

This Certificate of Insurance does not constitute a contract between the issuing insurer(s), authorized representative or producer, and the certificate holder, nor does it affirmatively or negatively amend, extend or alter the coverage afforded by the policies listed thereon.
Photograph 1
Fire training area concrete pad and structures, view from the northwest corner facing southeast.

Photograph 2
View of the training area from the southeast corner facing west.
### Flint Hills Resources WWTP Perfluorochemical Assessment

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<= below detection limit; value listed is detection limit
* = estimated value based on QA review
- = no data available
NQ = not quantifiable
2007 – grab samples collected 5/2/07
2008 – grab samples collected 3/25/08

### Marathon Petroleum WWTP Perfluorochemical Assessment

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<= below detection limit; value listed is detection limit
* = estimated value based on QA review
- = no data available
2007 – grab samples collected 5/18/07
APPENDIX O

MSP Airport Discussion and Supporting Documents
Background and Access – MSP Airport Fire Foam Training Areas

The Manager of Environmental Affairs for the Metropolitan Airports Commission (MAC) returned a completed firefighting foam use questionnaire to Delta in May 2008, indicating the use of Class B AFFF in quarterly fire foam training by the fire department at the Minneapolis-St. Paul International (MSP) Airport. The questionnaire indicated that Ansul-brand AFFF is currently used in fire foam training exercises at the deicing pads and a remote ramp at the Humphrey terminal and that the spent foam is collected and discarded off-site by a licensed contractor. A copy of the questionnaire is included in Appendix O.

Follow-up conversations with MAC revealed that the fire department historically trained at MSP Airport with 3M-brand foam and that the use of foam during on-site training exercises has been discontinued. Other reliever airports within MAC’s oversight, including the St. Paul Downtown Airport, the Airlake Airport in Lakeville, the Anoka County Airport in Blaine, the Flying Cloud Airport in Eden Prairie, and the Crystal and Lake Elmo Airports receive fire protection from the surrounding community fire departments.

The locations of the current and past fire foam training areas utilized by the MSP Airport fire department are shown on Figure 1, Fire Foam Training Area Location, MSP Airport, included in Appendix O. An access agreement was signed by the MAC Deputy Executive Director of Planning and Environment and the MPCA, allowing access for a site reconnaissance and sampling at the MSP Airport. A copy of the access agreement is included in Appendix O.

As presented in Delta’s April 2009 report, the groundwater flow direction at the MSP Airport was inferred to be to the southeast. The groundwater flow direction was confirmed by MAC personnel during the site reconnaissance.

Site Reconnaissance – MSP Airport Fire Foam Training Areas

Site reconnaissance of the fire foam training areas at the MSP Airport was conducted on April 27, 2009. Delta representative Nancy Rodning and MPCA Project Manager Nile Fellows met with the MAC Manager of Environmental Affairs, the MSP Airport Fire Chief, and a representative of the MAC Environment Department. The Fire Chief related that the fire department now uses only water in training exercises at the airport and that any foam training is done at the fire training facility in Duluth, Minnesota.

MAC personnel confirmed that since 2001 until recently, on limited occasion, fire foam training with Ansul-brand AFFF occurred at contained deicing locations at the MSP Airport. During the fire foam training exercises, spent foam and water was contained, collected, and disposed off-site by a licensed contractor/service provider.
From 1983 through 2001, fire foam training with 3M-brand AFFF was conducted in live fire exercises east of Cargo Road near the present location of the glycol management facility. The foam and water mixture would drain to a holding pond located directly west of the training area. Limited information was available regarding foam training practices at the airport prior to 1983. Foam training prior to 1983 took place at an area located northeast of the current FedEx facility. The Fire Chief was uncertain as to what type of structure, if any, may have been present at this location for training purposes. Both the pre- and post-1983 former fire foam training areas were re-worked and excavated to some extent during construction associated with the addition of a new airport runway in 2001. Photographs of the pre-1983 and post-1983 former fire foam training areas are included in Appendix O.

Delta recorded GPS locations of the corners of the former fire foam training areas using a hand-held GPS unit with an accuracy of approximately 15 feet. The training areas are shown on the figure MSP Former Fire Foam Training Areas, which is included in Appendix O.

The MSP Airport Fire Chief could recall no large fires where significant quantities of firefighting foam were used in fire response at MSP Airport.

No potential community water supply systems such as those typically associated with rest stops, trailer parks, etc., were observed within 1/4-mile of the training areas. Nearby water wells identified via a search of the MDH CWI are shown on Figure 1, Fire Foam Training Area Location, MSP Airport and are described on the Site Summary included in the April 2009 Report.

Locations for soil borings in the fire foam training areas were discussed during the site reconnaissance.

**Sample Collection – MSP Airport Former Fire Foam Training Areas**

Due to the height of the push probe drill tower, an Airspace Evaluation Application was submitted to MAC prior to initiation of sample collection work. The Airspace Evaluation was approved; a copy of the approved application is included in Appendix O.

On May 29, 2009, four soil borings were advanced at MSP Airport, two within each of the two former fire foam training areas. Soil boring locations are shown on the MSP Former Fire Foam Training Areas figure. Soil borings were advanced by Thein Well Company using push probe drilling technology, under the oversight of Delta personnel and accompanied by MAC Environmental Department personnel. MAC’s environmental consultant was also present to collect duplicate samples. Since both former fire training areas were excavated to some extent as part of the runway construction project in 2001, soils within the
former training areas were not sampled. Soil boring logs detailing groundwater depths, boring depths, and the GPS locations of the borings are included in Appendix O.

Borings B-1 and B-2 were located within the post-1983 former fire training area, and borings B-3 and B-4 were located within the pre-1983 training area. Prior to advancing borings B-1 and B-2, the water level in a nearby groundwater monitoring well was checked by MAC’s environmental consultant and found to be approximately 21 feet below grade surface (bgs). Borings B-1 and B-2 were advanced by “blind drilling” to a depth of 25 feet bgs, with no soil samples collected. Screens were set from 21 to 25 feet bgs for groundwater sampling, and groundwater samples were collected. No groundwater monitoring wells are situated near the pre-1983 training area, so boring B-3 was also “blind drilled” to a depth of 25 feet bgs. Water was measured at a depth of 23.5 feet. A screen was set from 21 to 25 feet bgs in B-3, and a groundwater sample was collected. To ensure adequate water for sample collection, boring B-4 was drilled “blind” to a depth of 27 feet bgs. A groundwater sample was collected from B-4 with a screen set from 23 to 27 feet bgs. Upon completion of groundwater sampling at each boring, the boring was grouted and sealed in accordance with applicable MDH requirements.

Groundwater samples were submitted for laboratory analysis as described in Section 1.3 (Task 3) of the main body of the report.

**Soil Sampling Results – MSP Airport Former Fire Foam Training Areas**

Analytical results were not available from Axys Analytical Services LTD at the time of this report. Analytical results will be presented in a forthcoming report.
MSP Airport Former Fire Foam Training Areas
Minneapolis - St. Paul Airport
Minneapolis, MN

Legend
- Foam Training Area
- Boring Location

0 75 150 300 450 600 Feet

Pre 1983 Training Area
Post 1983 Training Area
QUESTIONNAIRE
Firefighting Foam Use in Fire Training

1. Does your Department use Class A and/or Class B firefighting foams for firefighting operations?
   ______ Class A only    ______ Class B only    ______ Both Class A and Class B

2. How often is Class B or Class A foam used in response to fire calls?
   ______ 0-25% of fires    ______ 25-50% of fires    ______ 75-100% of fires

3. What type of foam does your Department use for training exercises operations?
   ______ Class A only    ______ Class B only    ______ Both Class A and Class B
   ______ Training foam    ______ No foam is used in training (If none, please skip to Question 8)

4. How often is foam used in training exercises?
   ______ Weekly    ______ Semi-Annually    ______ Monthly    ______ Annually
   ______ Bi-Annually    ______ Quarterly    ______ Other (please specify):

5. How much foam is used per training event?
   ______ Less than 5 gallons    ______ 5 gallons    ______ 5 to 10 gallons
   ______ More than 10 gallons (please specify):

6. In training, where does the spent foam go?
   ______ Storm Sewer    ______ Sanitary Sewer    ______ On-Site Septic    ______ Ground
   ______ Other (please describe):

   Training has been conducted on plugged a concrete area which is then pumped out, removed from site, discharged to sanitary sewer system off site by a licensed contractor.

7. Where does/did the training take place? Please include address, intersection or other specific location information for current and past training areas.

   On airport. Training conducted on concrete areas; Humphrey remote ramp or a deice pad with covered or plugged drains.
## QUESTIONNAIRE

**Firefighting Foam Use in Fire Training**

What type(s) and brand(s) of foam are or were used now and in the past by the Department, both for fire response and in training (if applicable)? Please check all that apply.

<table>
<thead>
<tr>
<th>Type of Foam</th>
<th>Brand of Foam</th>
<th>Used in Training?</th>
<th>Amount Used Annually</th>
<th>Current Use or Historic Use?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class B Aqueous Film-Forming Foam (AFFF)</td>
<td>Ansol 3%</td>
<td>Yes</td>
<td>200-250 gallons</td>
<td>Both</td>
</tr>
<tr>
<td>Class B Alcohol-Resistant (AR)-AFFF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Protein</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Historic (1960s/1970s) - Military</td>
</tr>
<tr>
<td>Class B Fluoroprotein (FP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B Film-Forming Fluoroprotein (FFF)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class B AR-FFFFP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class A-B Hi Expansion Foam</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class A</td>
<td>1% Lorcon</td>
<td>No</td>
<td>5 gallons</td>
<td>current</td>
</tr>
<tr>
<td>Training Foam</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Thank you for your time and cooperation. Please contact Nancy Rodning at Delta Consultants (651-697-5152 or nr rodning@deltaenv.com) or Jim Stockinger at the Minnesota Pollution Control Agency (651-297-8666 or jim.stockinger@state.mn.us) if you have any questions regarding this questionnaire.

**Please return this questionnaire to Delta Consultants by May 9, 2008.**

Questionnaire completed by:

Toni J. Howell  MAC Manager/Environmental Affairs

Metropolitan Airports Commission Fire Department (at MSP)

Fire Department

612-726-8100  02 May 08

Phone Number  Date

E-Mail Address  toni.howell@mspmac.org

Xinogen
Ms. Rodning - Please find attached the completed firefighting foam questionnaire from the MAC/MSP Fire Department. Per your inquiry, the Reliever airports do not have their own fire departments but instead receive fire protection from the surrounding communities (listed below).

Saint Paul Downtown Airport
Airlake
Anoka County
Flying Cloud
Crystal
Lake Elmo

City Of Saint Paul Fire Department
City of Lakeville Fire Department
Blaine Spring Lake Park Mounds View Fire Department
Eden Prairie Fire Department
West Metro Fire
Lake Elmo Fire Department

Please call or email if you have questions regarding this submittal or if I can be of further assistance in your efforts.

Toni J. Howell
Manager, Environmental Affairs
Metropolitan Airports Commission
phone: 612-726-5336

Please consider reducing environmental impacts by not printing this email.

This message, including attachments, is for the designated recipient only and may contain privileged or confidential information. Any other use of this email is prohibited. If you have received this in error, please notify the sender immediately and delete the original email.

Thank you.

---

Good morning Ms. Howell,

As we discussed last week, Delta Consultants is working with the Minnesota Pollution Control Agency on research into the use of firefighting foams in Minnesota. We’ve sent out questionnaires to municipal fire departments and training schools across the State to find out where and how much foams are being used. Attached is the questionnaire and a cover letter from the MPCA. I appreciate you and Chief Burke taking the time to complete the questionnaire.

I have not send questionnaires to the MAC reliever airports assuming that any fire training would be handled out of the MSP airport. If this is not so and it would be appropriate for me to send questionnaires to the reliever airport fire departments, please let me know. Otherwise I assume the MSP fire department is responsible for foam training with all of the MAC airport fire departments?

Please call me with any questions you may have about the questionnaire or this research.

Thank you.

Nancy Rodning
Project Geologist
DELTA CONSULTANTS
5910 Rice Creek Parkway, Suite 100
Shoreview, MN 55126
nrodning@deltaenv.com

5/14/2008
Ms. Rodning - Yes, 3M foam was used at the airport in the past. Use of the 3M product was discontinued in the 2000-2001 timeframe. We now use Ansul 3%. Please call if I can be of further assistance.

Toni J. Howell
Manager, Environmental Affairs
Metropolitan Airports Commission
phone: 612-726-5336

---

From: Nancy Rodning [mailto:nrodnig@deltaenv.com]
Sent: Monday, June 09, 2008 2:16 PM
To: thowell@mspmac.org
Subject: Firefighting foam questionnaire

Good afternoon Ms. Howell,

I am just finishing the Firefighting Foam Use in Minnesota report for the Minnesota Pollution Control Agency, and I have one more question for you-- Do you know if foam made by 3M was ever used at the airport?

Thank you.

Nancy Rodning
Project Geologist
DELTA CONSULTANTS
5910 Rice Creek Parkway, Suite 100
Shoreview, MN 55126
nrodnig@deltaenv.com
(651)697-5152 direct
(800)477-7411 toll free
(651)639-9473 fax
www.deltaenv.com

Member of Inogen
www.inogenet.com

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MINNESOTA POLLUTION CONTROL AGENCY

ACCESS AGREEMENT BETWEEN
THE MINNESOTA POLLUTION CONTROL AGENCY
AND THE METROPOLITAN AIRPORTS COMMISSION

The Minnesota Pollution Control Agency (MPCA) is investigating firefighting training sites where Class B foams have been or are being utilized. The site reconnaissance and investigation will be conducted at the following site owned and operated by the Metropolitan Airports Commission (MAC) where firefighting training with Class B foams occurred:

Minneapolis-St. Paul International Airport
Minneapolis, Minnesota

MAC hereby consents and authorizes the MPCA, its employees, agents and contractors (collectively, hereafter the “MPCA”), to enter the MSP Airport to conduct soil and groundwater sampling at the specific locations depicted in Attachment A in response to the use of Class B firefighting foams that may or may not contain perfluorocarbons (PFCs). The MPCA is authorized to take these actions under Minn. Stat. § 115C.03, subd. 7 (2002).

The MPCA will notify MAC at least 48 hours in advance and must be escorted throughout the time of being on the property. Work will be conducted during regular business hours (8:00 a.m. to 5:00 p.m.) unless the MPCA receives permission to and arrangements are made to conduct work during different hours. The MPCA will conduct its activities so as to minimize interference with the use of the property. If any portion of the property must be disturbed as a result of the MPCA’s activities, the MPCA will restore the property as close to its original condition as is reasonably possible under the circumstances. MAC agrees to take reasonable precautions to ensure that the equipment of the MPCA and its contractors on the property is not damaged, and that the work being conducted by the MPCA, its employees, agents and contractors is not disrupted. MAC reserves the right to have MAC personnel or its representatives be present during the soil and groundwater sampling activities.

The MPCA will obtain all necessary permits for installation of soil borings and temporary monitoring wells, if such wells are installed. Upon completion of sampling, the MPCA will seal the borings and monitoring wells in accordance with state law. Results of all testing conducted on the property will be provided to MAC. All waste material generated during the soil and groundwater sampling activities shall be promptly and properly disposed off-site by the MPCA, and the removal and proper disposal thereof shall be the responsibility of the MPCA.

The MPCA shall be liable for injury to or loss of property, or personal injury or death, caused by an act or omission of any employee of the state in the performance of the work described above, under the circumstances where the state, if a private person, would be liable to the claimant, in accordance with Minn. Stat. § 3.736.

MAC’s consent to this access does not constitute an admission of liability of any kind by the MAC regarding the use of firefighting foam or the presence of PFCs. This Access Agreement shall automatically terminate at the time the borings and monitoring wells have been sealed in accordance with state law.

Minnesota Pollution Control Agency

Signature: [Signature]
Title: Supervisor - Surface Water
Date: 5/13/09

Metropolitan Airports Commission

Signature: [Signature]
Title: Deputy Executive Director, Planning and Environment
Date: 5-8-2009
Photograph 1
Soil boring B-1 was advanced near the northwest corner of the post-1983 former fire foam training area. Photo view facing northwest. Cargo Road is visible in the background at left.

Photograph 2
Soil boring B-2 was advanced near the southeast corner of the post-1983 former fire foam training area.
Photograph 3
Soil boring B-3 was located within the western portion of the pre-1983 former fire foam training area. View facing north.

Photograph 4
Soil boring B-4 was advanced near the south-central portion of the pre-1983 former fire foam training area. View facing southeast.
AIRSPACE EVALUATION APPLICATION
METROPOLITAN AIRPORTS COMMISSION
6040-28th AVENUE SOUTH
MINNEAPOLIS, MN 55450-2799
612-467-0425(ph)  612-713-7440(fx)
OFFICE USE ONLY
PERMIT NUMBER:
PROJECT NUMBER:

DATE: 05-08-09
MAC NUMBER: NA

SITE ADDRESS: open grass areas, no address association

PROJECT VALUATION/BID AWARD AMOUNT $: NA

MAC PROJ. MANAGER NAME: Mark Wacek PHONE NUMBER: 612-725-6428

APPLICANT IS: x CONTRACTOR □ ARCHITECT □ ENGINEER □ OTHER

PROPERTY OWNER/TENANT NAME
NAME: MAG

ADDRESS:

CITY: ST ZIP CODE:

CONTACT PERSON: Mark Wacek PHONE NUMBER: 612-725-6428 or 612-919-8562 FAX NUMBER:

CONTRACTOR NAME
NAME: Thein Well Company Inc.

ADDRESS: P.O. Box 778

CITY: Spicer ST MN ZIP CODE 56288

CONTACT PERSON: Margaret Haugen PHONE NUMBER 320-796-2111 FAX NUMBER: 320-796-2114

ARCHITECT/ENGINEER NAME
NAME: Delta Consultants

ADDRESS: 5910 Rice Creek Pkwy, Suite 100

CITY: Shoreview ST MN ZIP CODE 55126

CONTACT PERSON: Nancy Rodning PHONE NUMBER 651-697-5152 FAX NUMBER: 651-639-9473

REGISTRATION NUMBER

CLASS OF WORK (CHECK ONE ONLY) □ NEW □ ADDITION □ ALTERATION/REMODEL □ MAINTENANCE/REPAIR/REPLACE

TYPE OF STRUCTURE CHECK ONE ONLY

□ OFFICES, BANKS, PROFESSIONAL
□ STORES, RESTAURANTS, WAREHOUSE
□ HOTELS, MOTELS
□ PARKING GARAGE
□ OTHER NON HOUSEKEEPING SHELTER
□ INDUSTRIAL BUILDINGS

□ PUBLIC WORKS/UTILITIES BUILDING
□ CHURCHES/RELIGIOUS BUILDINGS
□ HOSPITAL AND INSTITUTIONAL BUILDINGS
□ SERVICE STATIONS/REPAIR GARAGE
□ RECREATIONAL, AMUSEMENT
PLEASE COMPLETE OTHER SIDE

DESCRIPTION OF WORK: INCLUDING AIRPORT COORDINATES, ELEVATIONS FOR ALL EQUIPMENT AND STRUCTURES ACCOMPANIED WITH DRAWINGS. Advance four soil borings to an estimated depth of 30 feet, at two locations: 1) southwest of FedEx facility (south of service road), 2) grass area west of South ALEC, east of cargo road. Geo-probe boom up to exceed elevation of eleven feet above ground level.

REQUESTED DATE AND TIME OF WORK: One day during the week of May 25, 2009

I HEREBY APPLY FOR AN AIRSPACE EVALUATION AND I ACKNOWLEDGE THAT THE INFORMATION ABOVE IS COMPLETE AND ACCURATE; THAT THE WORK WILL BE IN CONFORMANCE WITH THE ORDINANCE AND CODES OF THE METROPOLITAN AIRPORTS COMMISSION AND WITH THE MINNESOTA BUILDING CODES; THAT THE WORK WILL BE IN ACCORDANCE WITH THE APPROVED PLAN IN THE CASE OF ALL WORK WHICH REQUIRES REVIEW AND APPROVAL OF PLANS.

Nancy Rockwell

APPLICANT'S SIGNATURE

DATE

OFFICE USE ONLY

CONDITIONS OF ISSUANCE: Provide checkered flag on top of boom. Contact Airside Operations prior to booming up and down (612-726-5111). Provide Air Ops with the contact name and number of the person with direct control of the crane.

OK for daytime work with no runway or taxiway closures. Envir. Dept. will escort.

AIRSPACE EVALUATION APPROVED BY: Albert Ogle DATE: 5/14/09
**ENVIRONMENTAL BORING LOG**

**BORING ID:** B-1  
**TOTAL DEPTH:** 25'

### PROJECT INFORMATION

- **Project:** PFC's in Fire Fighting Foam  
- **Site Location:** MSP Airport, MN  
- **Job No.:** 19382DEL04  
- **Logged By:** Curt McKay  
- **Weather:** NA  
- **Date Completed:** 5/29/09  
- **Water Level During Drilling:** 21'

### DRILLING INFORMATION

- **Drilling Co.:** Thein Well  
- **Drill Crew Chief:** NA  
- **Rig Type:** Geoprobe  
- **Method of Drilling:** Direct Push Probe  
- **Soil Sampling Method:** 4' samplers with liners  
- **Surface Elevation (feet):** NA  
- **Field Screening Instrument:** None

### DEPTH | LITHOLOGY | DESCRIPTION

<table>
<thead>
<tr>
<th>Depth</th>
<th>Lithology</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>(0.00, 1.00)</td>
<td>TOPSOIL: Grass.</td>
</tr>
<tr>
<td>(1.00, 25.00)</td>
<td>NO RECOVERY: Blind drill/push to water at 25' bgs.</td>
<td></td>
</tr>
<tr>
<td>No Soil Sampling.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Set screen at 21' - 25' bgs.

**Water Sample from 21' to 25'.**

**Comments:** E.O.B. at 25'.

**Boring Location:** 44 52.717' N / 93 14.125' W
<table>
<thead>
<tr>
<th>DEPTH</th>
<th>LITHOLOGY</th>
<th>DESCRIPTION</th>
<th>USCS</th>
<th>LAB SAMP.</th>
<th>PID ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>(0.00, 1.00)</td>
<td>TOPSOIL: Grass.</td>
<td>PT</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.00, 25.00)</td>
<td>NO RECOVERY: Blind drill/push to water at 25' bgs.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>No Soil Sampling.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Set screen at 21' - 25' bgs.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Water Sample from 21' to 25'</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments: E.O.B. at 25'.

Boring Location: 44 52.715' N / 93 14.111 W
**ENVIRONMENTAL BORING LOG**

**BORING ID:** B-3

**TOTAL DEPTH:** 25'

---

**PROJECT INFORMATION**

- **Project:** PFC's in Fire Fighting Foam
- **Site Location:** MSP Airport, MN
- **Job No.:** 19382DEL04
- **Logged By:** Curt McKay
- **Weather:** NA
- **Date Completed:** 5/29/09
- **Water Level During Drilling:** 23.5'

---

**DRILLING INFORMATION**

- **Drilling Co.:** Thein Well
- **Drill Crew Chief:** NA
- **Rig Type:** Geoprobe
- **Method of Drilling:** Direct Push Probe
- **Soil Sampling Method:** 4' samplers with liners
- **Surface Elevation (feet):** NA
- **Field Screening Instrument:** None

---

**DEPTH**

<table>
<thead>
<tr>
<th>DEPTH</th>
<th>LITHOLOGY</th>
<th>DESCRIPTION</th>
<th>USCS</th>
<th>LAB SAMP.</th>
<th>PID ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>TOPSOIL: Grass.</td>
<td>(0.00, 1.00) TOPSOIL: Grass.</td>
<td>PT</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1.00, 25.00) NO RECOVERY: Blind drill/push to water at 25' bgs.</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>No Soil Sampling.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
<td>E.O.B. at 25'.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Set screen at 21’ - 25’ bgs.**

**Water Sample from 21’ to 25’**

---

Comments: E.O.B. at 25'.

Boring Location: 44 53.023' N / 93 13.878 W
ENVIRONMENTAL BORING LOG
BORING ID: B-4
TOTAL DEPTH: 27'

PROJECT INFORMATION

Project: PFC's in Fire Fighting Foam
Site Location: MSP Airport, MN
Job No.: 19382DEL04
Logged By: Curt McKay
Weather: NA
Date Completed: 5/29/09
  Water Level During Drilling: 23.5'

DEEP INFO

DEPTH LITHOLOGY DESCRIPTION USCS LAB SAMP. PID ppm

0 (0.00, 1.00) TOPSOIL: Grass.

5 (1.00, 27.00) NO RECOVERY: Blind drill/push to water at 27' bgs.

No Soil Sampling.

Set screen at 23' - 27' bgs.

27' Water Sample from 23' to 27'

Comments: E.O.B. at 27'.

Boring Location: 44 53.011' N / 93 13.879 W
APPENDIX P

South Central College Discussion and Supporting Documents
Background and Access – South Central College Fire Foam Training Area

In May 2008 the Fire and Rescue Program Manager at South Central College in North Mankato returned a completed questionnaire form indicating the use of a variety of foam brands and types in training exercises, including AFF F, AR-AFF F, Class A foam, and training foam. A copy of the questionnaire returned by South Central College is included in Appendix M. In follow-up correspondence with the Fire and Rescue Program Manager, he indicated that approximately 10% of the fire foam training takes place at the college, while the rest occurs off campus as foam demonstrations at various municipal fire department locations.

Delta attempted to execute an access agreement between South Central College and the MPCA. The access agreement would have allowed the MPCA and Delta as their contractor to conduct a reconnaissance of the fire training areas and to collect soil and groundwater and surface water samples at the training areas, if applicable. An access agreement between South Central College and the MPCA was not executed, however, a site reconnaissance was conducted with verbal approval by both parties.

Site Reconnaissance – South Central College Fire Foam Training Area

A site reconnaissance of the fire foam training area at South Central College in North Mankato was conducted on April 15, 2009. Delta representative Linda Opperman was accompanied by the South Central College Fire and Rescue Program Manager. The Program Manager was interviewed to verify the types and amounts of Class B foam used in training and training practices. The Fire and Rescue Program Manager indicated that the firefighting program has been offered at the college for at least twenty years, and that the majority of training or demonstrations with foam is conducted off-campus at various municipal department locations. The college training program services more than one hundred municipal fire departments in thirteen counties in south-central Minnesota. The Fire and Rescue Program Manager stated that, while some Class B foam may have been used during off-campus training, only Class A foam and training foam have been used in training exercises conducted at the college campus. He reviewed purchasing records for the last ten years and found that the college has not purchased Class B foam during that time. Training with Class A foam occurs at two areas on campus: at a mobile home “burn building” situated on asphalt pavement located at the northeast corner of the campus and in an asphalt-paved parking lot west of Building E near the northwest corner of the campus. The Fire and Rescue Program Manager related that the Mankato Fire Department utilizes the burn building approximately twice per year, and that if they use foam in their training exercises it would be Class A foam.

Based on information gathered during the site reconnaissance that indicates Class B foam is not currently nor was historically used in training exercises at the South Central College campus in North Mankato, the campus fire foam training areas are not considered a source of PFCs at this time. Therefore, GIS maps of
the training areas were not created, and soil or groundwater sampling was not conducted at the South Central College Campus as part of this scope of work.
1. Does or has the school’s firefighting training program include(d) practice with Class A or Class B foams, either now or in the past?
   - Yes - Please proceed to Question 2
   - No - Please sign the back of this form and return to Delta Consultants

2. How often does the school train with Class A or Class B foam?
   - Weekly
   - Monthly
   - Quarterly
   - Semi-Annually
   - Annually
   - Bi-Annually
   - Other (please specify):

3. How much foam is used per training event?
   - Less than 5 gallons
   - 5 gallons
   - 5 to 10 gallons
   - More than 10 gallons (please specify):

4. Where does the spent foam go?
   - Storm Sewer
   - Sanitary Sewer
   - On-Site Septic
   - Ground
   - Containment system for off-site disposal
   - Other (please describe):

5. Where does/did the training take place? Please include address, intersection or other specific location information for current and past training areas.
   - I have no way of telling you this information.

6. Do other fire departments utilize your facility for their training with foam?
   - Yes
   - No
   - If yes, do the other fire departments bring their own foam?
     - Yes
     - No
   - If yes, approximately how much foam is discharged annually by other departments at your facility?
     - Less than 5 gallons
     - 5-25 gallons
     - 25 to 50 gallons
     - More than 50 gallons (please specify):
7. What type(s) and brand(s) of foam are currently or were historically used for training by the school? Please check all that apply.

<table>
<thead>
<tr>
<th>Type of Foam</th>
<th>Brand of Foam</th>
<th>Amount Used Annually</th>
<th>Current Use or Historic Use?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class B Aqueous Film-Forming Foam (AFFF)</td>
<td>All</td>
<td>5 gal plus</td>
<td>yes</td>
</tr>
<tr>
<td>Class B Alcohol-Resistant (AR)-AFFF</td>
<td>All</td>
<td>5 gal plus</td>
<td>yes</td>
</tr>
<tr>
<td>Class B Protein</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Class B Fluoroprotein (FP)</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Class B Film-Forming Fluoroprotein (FFF)</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Class B AR-FFF</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Class A-B Hi Expansion Foam</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Class A</td>
<td>All</td>
<td>10 plus</td>
<td>yes</td>
</tr>
<tr>
<td>Training Foam</td>
<td>Silver</td>
<td>10 plus</td>
<td>yes</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Thank you for your time and cooperation. Please contact Nancy Rodning at Delta Consultants (651-697-5152) or nrodnig@deltacnm.com, or Jim Stockinger at the Minnesota Pollution Control Agency (651-297-8666) or jim.stockinger@state.mn.us if you have any questions regarding this questionnaire.

Please return this form by May 9, 2008, to Nancy Rodning, Delta Consultants: nrodnig@deltacnm.com

Questionnaire completed by:

Tim Zehnder First Responder Program Manager
South Central College

School Name
507-389-7329 office
507-381-1390 Cell

Phone Number
Date
Tim Zehnder@southcentral.edu

E-Mail Address

Xinogen
5910 Rice Creek Parkway Suite 100 St. Paul, MN 55126 USA
Phone: 651.639.9449 / 800.477.7411 Fax: 651.639.9473 www.deltaenv.com
Nancy Rodning

From: Tim Zehnder [tim.zehnder@southcentral.edu]  
Sent: Tuesday, May 20, 2008 9:30 AM  
To: Nancy Rodning  
Subject: RE: Firefighting Foam Questionnaire

The training takes place at the school and were ever the depts. request it, at their station or in a empty lot, etc

Thank You
Tim Zehnder
Program Manager
South Central College
507-389-7329 Office
507-381-1390 Cell
tim.zehnder@southcentral.edu

"343 NEVER FORGET"

9/15/08 1:25 PM
what broad "all"? whatever
what has on hands, whatever
is cheeped.

From: Nancy Rodning [mailto:nrodnning@deltaenv.com]  
Sent: Monday, May 19, 2008 5:11 PM  
To: Tim Zehnder  
Subject: Firefighting Foam Questionnaire

Hello Mr. Zehnder,

Thank you for returning the Delta/MPCA firefighting foam questionnaire. Can you please give me some clarification as to where the training takes place? Do you train with foam at the school? or does the foam training take place at various local fire departments?

Thank you, any additional information would be helpful.

Nancy Rodning
Project Geologist
DELTA CONSULTANTS
5910 Rice Creek Parkway, Suite 100
Shoreview, MN 55126
nrodnning@deltaenv.com
(651)697-5152 direct
(800)477-7411 toll free
(651)639-9473 fax
www.deltaenv.com

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www.inogenet.com

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Utility Clearance

Prior to any drilling or sample collection, underground utilities were identified and marked via public utility meets and private utility locates.

Special PFC Sampling Consideration

Since PFCs are also in numerous everyday items, the following special precautions must be taken at the site: no use of Teflon (i.e., Teflon tubing, Teflon tape, Teflon plumbing paste); no Tyvek clothing can be worn; clothing treated with stain- or rain-resistant coatings must be avoided or have gone through several washings; no Post-It Notes on site; no fast food wrappers or disposable cups on site during sampling, and hands must be washed after handling such items; no microwave popcorn on site; and no use of chemical (blue) ice packs.

Utility Clearance and Soil Sample Collection via Hand Auger

In order to help ensure that buried utilities in the upper five feet of the soil profile are not encountered during drilling, the top five feet of the borings were cleared via hand augers equipped with a stainless steel bucket head. The auger was hand-turned to a depth of five feet below grade surface (bgs).

Soil collected in the bucket head from the surface to four feet bgs was composited in a large polyethylene or stainless steel bowl. After mixing, soil was placed into sample jars provided by the laboratory for laboratory analysis. Disposable nitrile gloves were worn when handling the soil and were changed between each sample. Excess soil was disposed by thin-spreading on site.

Hand auger equipment and auxiliary sample compositing equipment was decontaminated before use and between each boring by washing in Alconox or a similar detergent and rinsing with clean tap water. On-site well water, if available, was not used for washing or rinsing purposes. Wash and rinse water was disposed by thin-spreading on site.

Push Probe Soil Sample Collection

Soil borings were advanced using a truck-mounted, hydraulically-powered Geoprobe® push probe machine that utilizes static force and percussion to advance small (2- to 3-inch diameter) sampling tools into the subsurface face for collecting soil core samples. Sampling depth was attained by driving a tile probe with a tip to a specified sampling depth. Soil samples deeper than 5 feet bgs were collected continuously for this project, except at the MSP Airport where no soil samples were collected. The tile probe was withdrawn and a 4-foot or 5-foot long, 2- to 3-inch outer diameter stainless steel sampling spoon lined with an acetate liner was inserted into the bore hole. The stainless steel sampling spoon was driven four or five feet past the bottom of the boring for collection of a soil core sample. The sampling spoon was withdrawn, and the acetate
liner removed from the steel sampling spoon. The acetate liner with soil sample intact was provided to an on-site Delta representative. Liners were opened by Delta personnel. Disposable nitrile gloves were worn when handling soils and acetate liners. Separate gloves were used for each discrete soil sample.

Tile probes and stainless steel sampling spoons were decontaminated between each discrete sample by washing in Alconox or a similar detergent and rinsing with clean tap water. On-site well water, if available, was not used for washing or rinsing purposes. Wash and rinse water was disposed by thin-spreading on site. Separate acetate liners are used for each discrete soil sample.

No Teflon tubing or liners were used in sample collection.

**Soil Classification**

Soil samples were classified using the Unified Soil Classification system. Soil descriptions and depths were recorded on a soil boring log. Visual and olfactory evidence of contamination was also noted on the soil boring log.

**Soil Sample Collection for Laboratory Analysis**

Composite soil samples were collected for laboratory analysis of PFCs and TOC from two intervals: from the surface to four feet below grade and from four feet to eight feet below grade. Soil samples were placed into laboratory-supplied jars. Soil jars were labeled and stored on regular ice (no chemical ice) in a cooler pending shipment to the laboratory.

A chain-of-custody record was kept for all laboratory samples. The chain-of-custody record included project number, sample ID number, sampling point location, date and time of sample, sample type, number of containers, analyses required, sampler signature, and other information required by the laboratory.

**Soil Headspace Analysis**

Based on a literature search, no field instruments are currently available for field screening soils for PFCs. Correspondence with Dr. Jennifer Field of Oregon State University, who has conducted field research into analytical methodologies for PFCs in soil and groundwater at fire foam training sites, confirmed that she is not aware of any field detectors for PFCs in soil. Therefore, soils could not be field screened for the presence of PFCs.

**Groundwater Sample Collection Via Push Probe**

The depth to groundwater was determined by observation of wet soil in the soil core samples, and by direct measure with a groundwater interface probe as necessary. Upon drilling into the water table, an assembled screen point sampler with a 4- or 5-foot screen encased in a perforated stainless steel sleeve was driven into the boring to a depth where approximately 6 inches to 1 foot of the screen was situated above the water table, and the remainder of the screen was below the water table. While the screen point sampler was being driven, O-ring connections placed at critical locations on the assembly kept the sampler sealed. When the desired sampling depth was reached, the
sampler was pulled up about 2 feet, which disengages the expendable drive point and creates an open bore hole from which to sample. The inner screen core was then pushed out into the bore hole and water was allowed to enter the sampler. Groundwater samples were collected by inserting disposable, non-Teflon, polyethylene tubing through the center of the drill rods and into the screen. The groundwater was either drawn via a sampling pump or hand-checked through tubing into laboratory-supplied sample jars. Laboratory jars were labeled and stored on ice pending shipment to the laboratory.

Tile probes and stainless steel screen point sampler were decontaminated between each use using an Alconox (or similar detergent) solution and water rinse. New polyethylene tubing was used for each groundwater sample. Teflon or Teflon-lined tubing was not used for sampling.

**Soil Boring Closure**

Soil borings were abandoned in accordance with Minnesota Department of Health regulations by filling the bore hole with bentonite, to approximately 2 inches from the surface grade. Then, cement or asphalt patches completed the top 2 inches of the bore hole, as needed.

**Sample Shipment**

Soil and groundwater samples were stored on ice in a secure refrigerator at Delta over the weekend pending shipment to the laboratory. On Monday morning soil and groundwater samples were securely packed in a cooler with ice, chain-of-custody records and other required documentation for shipping to Axys laboratory in Canada included in the cooler. There was one exception: the chain-of-custody records for samples collected at the Harmony and Burnsville fire training areas were inadvertently not shipped with the samples. Delta immediately faxed a copy of the chain-of-custody to the laboratory and sent the original chain-of-custody via FedEx to the laboratory separately.
APPENDIX R

Laboratory Reports
PERFLUORINATED ORGANIC ANALYSIS

SOLID SAMPLES

AXYS METHOD: MLA-041

PROJECT: FIRE FIGHTING FOAM SAMPLING AT HARMONY AND BURNSVILLE

WORK ORDER #: 34494368

Contract: 4095
Data Package Identification: DPWG29023
Analysis WG28682

9 June 2009
PERFLUORINATED ORGANIC ANALYSIS

SOLID SAMPLES

AXYS METHOD: MLA-041

PROJECT: FIRE FIGHTING FOAM SAMPLING AT HARMONY AND BURNSVILLE

WORK ORDER #: 34494368

Contract: 4095
Data Package Identification: DPWG29023
Analysis WG28682

Prepared for:
Minnesota Pollution Control Agency

Prepared by:
AXYS Analytical Services Ltd.
2045 Mills Rd
Sidney, British Columbia V8L 5X2
CANADA

Contact: Angie Whetung
Project Manager

9 June 2009
MINNESOTA POLLUTION CONTROL AGENCY
SOLID SAMPLES
PERFLUORINATED ORGANICS ANALYSIS
AXYS METHOD: MLA-041
4095: L12606-1 to -12

PROJECT: Fire fighting Foam Sampling at Harmony and Burnsville
WORK ORDER #: 34494368

9 June 2009

NARRATIVE

This narrative describes the analysis of twelve solid samples for the determination of perfluorinated organic compounds using high performance liquid chromatography/tandem mass spectrometry (HPLC/MS-MS).

SAMPLE RECEIPT, STORAGE AND DESCRIPTION

The samples were received on the 28th of April 2009. Samples were logged in following the client's instructions. Details of sample conditions upon receipt are provided on the Sample Receiving Record form included in the sample documentation section of this data package. Prior to sample preparation and analysis, the samples were stored at -20 °C in a freezer.

SAMPLE PREPARATION AND ANALYSIS

The samples were pretreated following AXYS SOP and analyzed in analysis batch named PFCWG28682. The composition of the batch is shown on the Cover pages and the Batch List forms included in this data package.

Sample preparation, instrumental analysis and analyte quantification procedures were in accordance with AXYS Method MLA-041: Analytical Procedure for the Analysis of Perfluorinated Organic Compounds in Solid Samples by LC-MS/MS.

Accurately weighed sample was spiked with isotopically labeled quantification standards and extracted in acetic acid and basic methanol. The extract was cleaned up using SPE cartridges and carbon. After spiked with labeled recovery (internal) standards, the extract was analyzed using liquid chromatography/mass spectrometry (LC-MS/MS). Analyte concentrations were determined by isotope dilution/internal standard method, comparing the area of the quantification ion to that of the ¹³C-labelled standard and correcting for response factors. Linear quantification equations with 1/X² weighting fit were determined from a multi-point calibration series prepared alongside with the sample.

Sample Harmony B-3 SL 0-4' (AXYS ID L12606-5) was used as the matrix for MS/MSD testing samples. The MS/MSD samples were assigned AXYS ID WG28682-103/104.

The reporting limit (RL) was defined as the concentration equivalent to the lowest calibration standard analyzed or the sample specific detection limits, whichever was greater.

REPORTING CONVENTIONS

The AXYS contract number assigned for internal tracking was 4095. The samples were assigned a unique laboratory identifier of the form L12606-1 to -12. All data reports reference this unique AXYS ID plus the
client's sample identifier. To assist with locating data, a table correlating AXYS ID with the client sample number is included in this data package.

Any extra work required and performed after the initial instrumental analysis of the sample's extract is given an extra "test suffix" code. The single letter code per extra work performed is added to the AXYS sample ID as a suffix, and is combined with any other applicable test suffix codes. The extra work codes used to report data in this package include:

\[ Y1 \] = instrumental analysis performed on another portion of the sample extract.

The following laboratory qualifier flags are used in this data package:

\[ N \] = authentic recovery is not within method/contract control limits
\[ U \] = identifies a compound that was not detected.
\[ V \] = surrogate recovery is not within method/contract control limits.

Results are reported in concentration units of nanograms per gram (ng/g) on a dry weight basis. Concentration and detection limits are provided to three significant figures. Analysis results for each sample are provided on Analysis Report form 1A/2.

**QA/QC NOTE**

The samples and QC samples analyzed in one analysis batch were carried intact through the entire analytical process. The sample data were reviewed and evaluated in relation to the batch QC samples.

- Sample analyte concentrations are not blank corrected.
- By virtue of the isotope dilution/internal standard quantification procedures, data are recovery corrected for possible losses during extraction and cleanup.
- All linearity, CAL/VER, OPR and labeled compound recovery specifications were met with the following exceptions:

In the initial calibrations (Form 3A and 3C), the highest-level calibration standard (CS7) was excluded for PFOSA as it showed non-linearity. Percent recoveries for this compound in all the other points in the initial calibrations met the method criteria, data are not considered affected by the variance. The highest-level calibration standard (CS7) was excluded for 13C2-PFDoA (Form 3B and 3D) as the percent recovery for the compound was biased high. However, a minimum of 6 calibration standard points were used to calculate response factor (RF) for quantification of 13C2-PFDoA. As multi-point calibrations were used, sample data are deemed not to be significantly affected.

Percent recoveries of analytes PFBS in the OPR (AXYS ID WG28682-102) were above the client method upper limit of 130% and the analyte has been flagged with an 'N' on the report form. Since the analyte was not detected in the samples data are not considered affected by this variance.

The percent recovery for the surrogate 13C2-PFDoA in samples Harmony B-3 SL 4-8' and Harmony B-4 SL 4-8' (AXYS ID: L12606-6 and L12606-8, respectively) was below method specifications and the surrogate has been flagged with a 'V' on report forms. Since the isotope dilution quantification method produces data that are recovery corrected, slight variance of the surrogate recovery from the method specifications is deemed not to have affected the data.
ANALYTICAL DISCUSSION

As the initial analysis data did not meet all the method criteria, a new portion of extract was transferred to a new microvial followed by an instrument re-analysis for all samples and QC samples. The re-analysis data are reported (indicated by the suffix ‘Y1’ on the AXYS IDs).

DATA PACKAGE

This data package is assigned a unique identifier, DPWG29023, shown on the cover page of the data package. Included in the data package after this narrative are the following documents:

- Method summary
- Sample ‘Cover Page’ and ‘Correlation Table’
- Sample receiving documentation
- Sample data reports
- Laboratory QC data reports
- Instrumental QC data reports (organized by analysis date)

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, except for the conditions detailed above. In addition, I certify, that to the best of my knowledge and belief, the data as reported are true and accurate. The following signature, on behalf of AXYS Analytical Services Ltd, authorizes the release of the data contained in this data package.

Signed: Bryan Alonzo, B.Sc. QA/QC Chemist

Date Signed: 09 Jan 09
Summary of AXYS Method MLA-041:

Analytical Procedure for the Analysis of Perfluorinated Organic Compounds in Solid Samples by LC-MS/MS

This method, MLA-041, describes the analysis of perfluorinated organic compounds (PFC) in solid samples (sediment, soil). Typical detection limits are in the range of 0.1 – 0.2 ng/g for a 5 g sample.

EXTRACTION AND CLEANUP

Sample size may be up to 5 g (dry weight). After addition of surrogate standards the sample is extracted by shaking one time with dilute acetic acid solution and then two times with methanolic ammonium hydroxide solution, each time collecting the supernatants. The supernatants are combined and treated with ultra pure carbon powder. The resulting solution is diluted with water and cleaned up by solid phase extraction (SPE) using disposable cartridges containing a weak anion exchange sorbent. The eluate is spiked with recovery standards and analyzed by LC-MS/MS. Calibration solutions are processed through the same SPE cleanup procedure.

QUALITY ASSURANCE / QUALITY CONTROL

All samples are analyzed in batches. The composition of a batch is detailed on a batch sheet. Each batch has the following composition:

- Batch Size - Each batch consists of test samples and additional QC samples.
- Blanks – 5% of the samples within a batch are procedural blanks.
- Duplicates – 5% of the samples within a batch are analyzed in duplicate.
- Reference Samples - 5% of the samples within a batch are spiked reference samples.
- Spiked Samples – 5% of the samples within a batch are spiked with an aliquot of native standard.

QC Specification Table for PFC in Solids by LC-MS/MS:

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Procedural Blank Level ng/sample</th>
<th>Acceptable Matrix Spike % Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfluorobutanoate (PFBA)</td>
<td>&lt;0.25</td>
<td>70-130</td>
</tr>
<tr>
<td>Perfluoropentanoate (PFPeA)</td>
<td>&lt;0.25</td>
<td>60-130</td>
</tr>
<tr>
<td>Perfluorohexanoate (PFHxA)</td>
<td>&lt;0.25</td>
<td>70-130</td>
</tr>
<tr>
<td>Perfluoroheptanoate (PFHpA)</td>
<td>&lt;0.25</td>
<td>70-130</td>
</tr>
<tr>
<td>Perfluoroctanoate (PFOA)</td>
<td>&lt;0.25</td>
<td>70-130</td>
</tr>
<tr>
<td>Perfluorononanoate (PFNA)</td>
<td>&lt;0.25</td>
<td>70-130</td>
</tr>
<tr>
<td>Perfluorodecanoate (PFDA)</td>
<td>&lt;0.25</td>
<td>70-130</td>
</tr>
<tr>
<td>Perfluoroundecanoate (PFUnA)</td>
<td>&lt;0.25</td>
<td>40-130</td>
</tr>
<tr>
<td>Perfluorododecanoate (PFDoA)</td>
<td>&lt;0.25</td>
<td>70-130</td>
</tr>
</tbody>
</table>
AXYS Analytical Services Ltd.

| Perfluorobutanesulfonate (PFBS) | <0.25 | 60-130 |
| Perfluorohexanesulfonate (PFHxS) | <0.25 | 60-130 |
| Perfluoroctanesulfonate (PFOS) | <0.25 | 70-130 |
| Perfluorooctane sulfonamide (PFOSA) | <0.25 | 60-130 |

SURROGATE STANDARD RECOVERIES: % RECOVERY RANGES

<table>
<thead>
<tr>
<th>Surrogate Standard</th>
<th>% Recovery Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>13C4-Perfluorobutyric acid (13C4-PFBA)</td>
<td>20% - 150%</td>
</tr>
<tr>
<td>13C2-Perfluorocaproic acid (13C2-PFHxA)</td>
<td>40% - 150%</td>
</tr>
<tr>
<td>13C2-Perfluorooctanoic acid (13C2-PFOA)</td>
<td>40% - 150%</td>
</tr>
<tr>
<td>13C5-Perfluorononanoic acid (13C5-PFNA)</td>
<td>40% - 150%</td>
</tr>
<tr>
<td>13C2-Perfluorodecanoic acid (13C2-PFDA)</td>
<td>40% - 150%</td>
</tr>
<tr>
<td>13C2-Perfluorododecanoic acid (13C2-PFDoA)</td>
<td>40% - 150%</td>
</tr>
<tr>
<td>13C4-Perfluorooctane sulfonate (13C4-PFOS)</td>
<td>40% - 150%</td>
</tr>
</tbody>
</table>

1 Lower surrogate recoveries may be reported for individual samples where dilution analysis or spiked sample results demonstrate acceptable accuracy.

<table>
<thead>
<tr>
<th>QC Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instrument Sensitivity</td>
<td>Daily, S:N ≥ 3:1 for all analytes for lowest calibration standard</td>
</tr>
<tr>
<td>Initial Calibration</td>
<td>Daily, (1/x²) weighed linear regression. Calculated concentrations must be within 30% of actual concentration.</td>
</tr>
<tr>
<td>Continuing Calibration Verification</td>
<td>Every 20 samples, determined concentrations must be within 30% of actual concentrations</td>
</tr>
<tr>
<td>Instrumental Carryover And Instrument Background</td>
<td>Every Initial Calibration, Cal/Ver, or SPM: &lt;0.3% carryover and area response of analytes in instrument blank &lt;800 judged following two previous methanol blank injections</td>
</tr>
</tbody>
</table>

ANALYSIS BY LC-MS/MS

Analysis of sample extracts for perfluorinated organics by HPLC-MS/MS is performed on a high performance liquid chromatograph coupled to a triple quadrupole mass spectrometer. The MS is run at unit mass resolution in the Multiple Reaction Monitoring (MRM) mode.

Instrument specifications:

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Waters 2690 or Waters 2795 HPLC, Micromass Quattro Ultima MS/MS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LC Column</td>
<td>Waters Xtera C18MS Reverse Phase C18, 10.0 cm, 2.1 mm i.d., 3.5 µm particle size (or equivalent)</td>
</tr>
<tr>
<td>Ionization</td>
<td>Negative Ion Electrospray</td>
</tr>
<tr>
<td>Acquisition</td>
<td>MRM mode, unit resolution</td>
</tr>
<tr>
<td>Injection Volume</td>
<td>15 µL</td>
</tr>
</tbody>
</table>
AXYS Analytical Services Ltd.

LC-MS/MS Operating Conditions:

<table>
<thead>
<tr>
<th>LC Gradient Program</th>
<th>LC Flow Rate Program</th>
<th>Gradient Curve</th>
<th>General LC Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (min)</td>
<td>Flow mixture</td>
<td>(mL/min)</td>
<td>Column Temp (°C)</td>
</tr>
<tr>
<td>0.0</td>
<td>15% solvent A 85% solvent B</td>
<td>0.15</td>
<td>1</td>
</tr>
<tr>
<td>1.0</td>
<td>15% solvent A 85% solvent B</td>
<td>0.15</td>
<td>1</td>
</tr>
<tr>
<td>5.0</td>
<td>70% solvent A 30% solvent B</td>
<td>0.20</td>
<td>4</td>
</tr>
<tr>
<td>8.5</td>
<td>100% solvent A</td>
<td>0.20</td>
<td>4</td>
</tr>
<tr>
<td>11</td>
<td>100% solvent A</td>
<td>0.20</td>
<td>4</td>
</tr>
<tr>
<td>11.3-14.5</td>
<td>15% solvent A 85% solvent B</td>
<td>0.20</td>
<td>2</td>
</tr>
</tbody>
</table>

1 Eluent A = 90% CH₃CN (aqueous), Eluent B = 12.1 mM NH₄OAc in 0.1% AcOH (aqueous)

Initial calibration of the LC-MS/MS instrument is performed by the analysis of six or more calibration solutions. A mid-level calibration standard is analyzed to verify the initial calibration after every 20th sample (including QC samples) injected at a minimum. All calibration solutions go through the same SPE extraction/cleanup procedure as the samples.

A typical instrument analysis sequence is as follows:
1-2 Instrument Blanks
6 Initial Calibration Standards
1-2 Instrument Blanks

Samples are run in the following order:
Spiked Reference Sample
Instrument Blank
Procedural Blank
Samples
Calibration Verification Standard (after 20 samples)
Samples
Calibration Verification Standard (after 20 samples)
…continued cycle
ANALYTE IDENTIFICATION

Positive identification of target PFC, surrogate standard and recovery standards require:

- \( \geq 3:1 \) S:N for parent ion to daughter ion transition.

- Compound retention time falls within 0.4 minutes of the predicted retention times from the mean determined from the Initial Calibration. Natives with labelled surrogate standards must elute within 0.1 minutes of the associated labelled surrogates.

QUANTIFICATION AND DATA REPORTING PROCEDURES

Target compounds are quantified using the internal standard method, comparing the area of the quantification ion to that of the \(^{13}\)C-labelled standard and correcting for response factors. Linear quantification equations are determined from a multi-point calibration series with \( 1/X^2 \) weighting fit and expressed as below:

\[
Y = \text{slope} \times X + \text{intercept}
\]

Where: \( Y = \text{response ratio} = \left( \frac{\text{area of Target}}{\text{area of Surr}} \right) \times \text{weight of Surr (ng)} \), and

\( X = \text{weight of target (ng)} \)

The slope and intercept are used to convert raw peak areas in sample chromatograms to final concentrations as follows:

\[
\text{Sample Conc.} = \left( \frac{\text{area of Target}}{\text{area of Surr}} \times \text{weight of Surr (ng) - intercept} \right) \times \left( \frac{1}{\text{slope}} \right) \times \left( \frac{1}{\text{sample size (g)}} \right)
\]

where Surr is the surrogate standard

The recovery of the surrogate standard is calculated (by internal standard quantification against the recovery standard using an average RRF) and monitored as an indication of overall data quality. Final target concentrations are recovery corrected by this method of quantification.

The lower reporting limit is defined as the concentration equivalent to the lowest calibration standard analyzed.
## Analytes, Ions, and Quantification References:

<table>
<thead>
<tr>
<th>Target Analyte</th>
<th>Typical Retention Time (minutes)</th>
<th>Parent Ion Mass</th>
<th>Daughter Ion Mass</th>
<th>Quantified Against</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfluorobutanoate (PFBA)</td>
<td>5.0</td>
<td>213</td>
<td>169</td>
<td>(^{13})C(_4)-PFBA</td>
</tr>
<tr>
<td>Perfluoropentanoate (PFPeA)</td>
<td>5.8</td>
<td>263</td>
<td>219</td>
<td>(^{13})C(_2)-PFHxA</td>
</tr>
<tr>
<td>Perfluorohexanoate (PFHxA)</td>
<td>6.2</td>
<td>313</td>
<td>269</td>
<td>(^{13})C(_2)-PFHxA</td>
</tr>
<tr>
<td>Perfluoroheptanoate (PFHpA)</td>
<td>6.6</td>
<td>363</td>
<td>319</td>
<td>(^{13})C(_2)-PFHxA</td>
</tr>
<tr>
<td>Perfluorooctanoate (PFOA)</td>
<td>7.0</td>
<td>413</td>
<td>369 / 219</td>
<td>(^{13})C(_2)-PFOA</td>
</tr>
<tr>
<td>Perfluorononanoate (PFNA)</td>
<td>7.4</td>
<td>463</td>
<td>419</td>
<td>(^{13})C(_5)-PFNA</td>
</tr>
<tr>
<td>Perfluorodecanoate (PFDA)</td>
<td>7.9</td>
<td>513</td>
<td>469</td>
<td>(^{13})C(_2)-PFDA</td>
</tr>
<tr>
<td>Perfluoroundecanoate (PFUnA)</td>
<td>8.5</td>
<td>563</td>
<td>519</td>
<td>(^{13})C(_2)-PFDA</td>
</tr>
<tr>
<td>Perfluorododecanoate (PFDoA)</td>
<td>9.0</td>
<td>613</td>
<td>569</td>
<td>(^{13})C(_2)-PFDoA</td>
</tr>
<tr>
<td>Perfluorobutane sulfonate (PFBS)</td>
<td>6.3</td>
<td>299</td>
<td>80 / 99(^1)</td>
<td>(^{13})C(_4)-PFDoA</td>
</tr>
<tr>
<td>Perfluorohexane sulphonate (PFHxS)</td>
<td>7.2</td>
<td>399</td>
<td>80 / 99(^1)</td>
<td>(^{13})C(_4)-PFOS</td>
</tr>
<tr>
<td>Perfluoroctane sulfonate (PFOS)</td>
<td>8.2</td>
<td>499</td>
<td>80 / 99(^1)</td>
<td>(^{13})C(_4)-PFOS</td>
</tr>
<tr>
<td>Perfluoroctane sulfonamide (PFOSA)</td>
<td>9.9</td>
<td>498</td>
<td>78</td>
<td>(^{13})C(_4)-PFOS</td>
</tr>
</tbody>
</table>

### Surrogate Standard

<table>
<thead>
<tr>
<th>Surrogate Standard</th>
<th>Typical Retention Time (minutes)</th>
<th>Parent Ion Mass</th>
<th>Daughter Ion Mass</th>
<th>Quantified Against</th>
</tr>
</thead>
<tbody>
<tr>
<td>(^{13})C(_4)-Perfluorobutanoic acid ((^{13})C(_4)-PFBA)</td>
<td>5.0</td>
<td>217</td>
<td>172</td>
<td>(^{13})C(_2)-FOUEA</td>
</tr>
<tr>
<td>(^{13})C(_2)-Perfluorohexanoic acid ((^{13})C(_2)-PFHxA)</td>
<td>6.2</td>
<td>315</td>
<td>270</td>
<td>(^{13})C(_2)-FOUEA</td>
</tr>
<tr>
<td>(^{13})C(_2)-Perfluorooctanoic acid ((^{13})C(_2)-PFOA)</td>
<td>7.0</td>
<td>415</td>
<td>370</td>
<td>(^{13})C(_4)-PFOA</td>
</tr>
<tr>
<td>(^{13})C(_5)-Perfluorononanoic acid ((^{13})C(_5)-PFNA)</td>
<td>7.4</td>
<td>470</td>
<td>423</td>
<td>(^{13})C(_2)-FOUEA</td>
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<tr>
<td>(^{13})C(_2)-Perfluorodecanoic acid ((^{13})C(_2)-PFDA)</td>
<td>7.9</td>
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<td>(^{13})C(_4)-Perfluoroctanesulfonate ((^{13})C(_4)-PFOS)</td>
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<td>503</td>
<td>80 / 99(^1)</td>
<td>(^{13})C(_2)-FOUEA</td>
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### Recovery Standard

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<th>Recovery Standard</th>
<th>Typical Retention Time (minutes)</th>
<th>Parent Ion Mass</th>
<th>Daughter Ion Mass</th>
<th>Quantified Against</th>
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<tr>
<td>(^{13})C(_2)-2H-Perfluoro-2-decenoic acid ((^{13})C(_2)-FOUEA)</td>
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<td>(^{13})C(_4)-Perfluoroctanoic acid ((^{13})C(_4)-PFOA)</td>
<td>6.9</td>
<td>417</td>
<td>372</td>
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\(^1\) Quantification is based on the m/z 80 daughter, m/z 99 may be used as alternate if necessary to avoid interference.
# PERFLUORINATED ORGANIC ANALYSIS

## COVER PAGE AND CORRELATION TABLE

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<th>Client Sample No.</th>
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<td>OPR</td>
<td>WG28682-102</td>
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<tr>
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<td>WG28682-103</td>
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<tr>
<td>MATRIX SPIKE DUPLICATE</td>
<td>WG28682-104</td>
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<td>L12606-12</td>
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</table>
## CHAIN OF CUSTODY

**AXYS CLIENT #:** 4095

### REPORT TO:
- **Company:** Delta MPCA
- **Address:** 5410 Rice Creek Pkwy 520 La Foyle Ave. St. Paul, MN 55155
- **Contact:** Nancy Rodney Nile Fellows
- **Phone:** 651.639.9449 9707
- **FAX:** 651-296-9707 4757
- **E-mail:** Nile.Fellows@state.mn.us

### INVOICE TO:
- **Company:** Same
- **Address:**
- **Contact:**
- **Phone:**
- **FAX:**
- **E-mail:**

### Project Name/Number:
- **19382-DEL**

### Client Sample Identification

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<tr>
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<th>Matrix</th>
<th>Sampling Date</th>
<th>Sampling Time</th>
<th>Container Type/No.</th>
<th>AXYS Lab Sample ID (Lab use only)</th>
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<tr>
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<td>Soil</td>
<td>4/23/19</td>
<td>9:06</td>
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<tr>
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<tr>
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<td>1L</td>
<td>L12607-1 x</td>
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<td>12:05</td>
<td>250 mL</td>
<td>L12606-5 (242) x</td>
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</table>

### Relinquished by (Signature)
- **Date:** 4/27/19, **Time:** 9:00 AM

### Received by (Signature)
- **Date:** 28 Apr 09, **Time:** 11:00

### Remarks
- **Temp °C**
- **Custody Seal #**
- **Seal Intact:** Y / N
- **Sample Tags:** Y / N
# CHAIN OF CUSTODY

**AXYS CLIENT #:** 4095

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<th>REPORT TO:</th>
<th>INVOICE TO:</th>
<th>ANALYSIS REQUESTED</th>
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<tr>
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<td></td>
</tr>
<tr>
<td>9418 Rice Creek Pkwy 520 Lafayette</td>
<td>1400 Road N.</td>
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</tr>
<tr>
<td>Shoreview, MN 55126</td>
<td>Shreveport, LA 71108</td>
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<tr>
<td><strong>Contact</strong></td>
<td>Contact</td>
<td></td>
</tr>
<tr>
<td>Nancy Robinson Nile Fellows</td>
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</tr>
<tr>
<td><strong>Phone</strong></td>
<td>Phone</td>
<td></td>
</tr>
<tr>
<td>651.639.4444</td>
<td>651-296-9707</td>
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<tr>
<td><strong>FAX</strong></td>
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<tr>
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<tr>
<td><strong>E-mail</strong></td>
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</tr>
<tr>
<td><a href="mailto:nile.fellows@state.mn.us">nile.fellows@state.mn.us</a></td>
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**Project Name/Number:** Fire Foam Sampling - Burnsville / 344936

**Sample’s Name:** Curt McKay

**Signature:** Curt McKay

<table>
<thead>
<tr>
<th>Client Sample Identification</th>
<th>Matrix</th>
<th>Sampling Date</th>
<th>Sampling Time</th>
<th>Container Type/No.</th>
<th>AXYS Lab Sample ID (Lab use only)</th>
<th>Remarks</th>
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<tbody>
<tr>
<td>Burnsville B-1 SL 0-4'</td>
<td>Soil</td>
<td>4/21/9</td>
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<tr>
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**Relinquished by (Signature):** Curt McKay

**Date:** 4/27/19  **Time:** 9:00AM

**Received by (Signature):** M. Magan

**Date:** 4/28/19  **Time:** 11:00AM

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<table>
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<th>Seal Intact</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Y / N</td>
<td>Y / N</td>
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</table>
Expanded Service
International Air Waybill

Not all services and options are available to all destinations.

From
Date: 04/27/09
Sender's Name: Curt McKay
Phone: 651.741.3806
Company: Delta
Address: 3110 Rice Creek Pkwy
City: Shoreview
Province: MN
Postal Code: 55126

To
Recipient's Name: ARYS ANALYTICAL SERVICES
Company: ARYS ANALYTICAL SERVICES
Address: 2045 Mills Rd
City: Sidney
State: BC
Postal Code: 20150

Shipment Information
Total Packages: 34
Total Weight: 34
Commodity Description: 2X1L HDPE Bottles, container, CCL
Harmonized Code: 3829.20
Country of Manufacture: none
Value for Customs Purposes: none

Express Package Service
Packages up to 150 lbs./68 kg
FedEx International Priority
FedEx International First
FedEx International Economy
FedEx International EconomySmart
FedEx International Priority

Freight Service
Packages over 150 lbs./68 kg
FedEx International Priority

Broker Selection
International Broker Select

Payment
Bill of Lading Charges:
Recipient: ARYS ANALYTICAL SERVICES

Required Signature
This Air Waybill constitutes your agreement to the Conditions of Contract on the back of this form. Tendering a complete Air Waybill, including all signed forms, is essential to the orderly operation of the Air Waybill system. This Air Waybill is subject to the airway bill condition of delivery in good order and condition as defined in the Conditions of Contract.

#131 2585 5K360 15073 114
FedEx Tracking Number: 8625 6665 2940 0426

Page 12 of 62
AXYS Analytical Services Ltd
SAMPLE RECEIVING RECORD

Waybill:   Yes  No
Date Shipped:  27-APR-09
Waybill #:  86256652940
AXYS Client & Contract #:  4095-Minnesota Pollution Control
Date /Time Received:  28-APR-09 11:00
Project Number:  
Receipt No:  WB7347

Received By:  MMASLIN
Log in by:  MMASLIN
Signature:  MMASLIN

Axys Sample ID's:  L12506-1 to 12  L12507-1 to 2
Matrix Type:  2 water, 18 seds
Condition of Shipping Container:  Intact
Temperature upon Receipt:  3 Celsius
lots of wet ice present

Custody Seals:  
Shipping Containers Yes  No  Intact Yes  No  Seal Numbers Yes  No
Samples Yes  No  Intact Yes  No  Seal Numbers Yes  No

Chain of Custody or Documents:
Sample ID's Yes  No
Collection Location Yes  No
Date & Time Collection Yes  No
Collector's Name Yes  No

Tracking Report /Packing List:  Yes  No
Sample Tag Numbers Yes  No
Sample Type Yes  /No
Preservative Added Yes  No
Preservation Requested Yes  No

Sample Tags  Yes  No
Sample Labels  Yes  No

Sample Labels Cross Referenced to COC Yes  No
Information Agrees Yes  No
Sample Tags Cross Referenced to Sample Labels  Yes  /No
Information Agrees Yes  /No
Sample Tags Cross Referenced to COC  Yes  /No
Information Agrees Yes  /No

Comments:
All samples logged in as per COC with site name at beginning.

Action Taken:
Contacted P.M.
See client email regarding Client ID log in protocol  W28AP9
Use COC provided = Site name + sample ID
<table>
<thead>
<tr>
<th>Axys ID versus Client Sample Identification</th>
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<th>PR</th>
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<tbody>
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<tr>
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<td>1:</td>
<td>250 mL plastic</td>
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## AXYS Analytical Services Ltd.

### Login Chain of Custody Report (In01)

**May. 01, 2009**

**Login Number:** L12606  
**Account:** 4095  
Minnesota Pollution Control  
**Project:** NILE FELLOWS

---

### Axys ID versus Client Sample Identification

<table>
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<th>Axys ID</th>
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- **Solid**: 2: MOISTURE
- **Solid**: 5: MOISTURE
- **Solid**: HOMOGENIZATION
- **Solid**: PERFLUORO ORG (LC)
- **Solid**: PFC PRESCREEN (LC)
- **EDDataDeliv**: PFC EDD
- **Package**: PFOS DATA PKG
- **ANY**: SAMPLE RECEIPT

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<table>
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- **Solid**: 2: MOISTURE
- **Solid**: 5: MOISTURE
- **Solid**: HOMOGENIZATION
- **Solid**: PERFLUORO ORG (LC)
- **Solid**: PFC PRESCREEN (LC)
- **EDDataDeliv**: PFC EDD
- **Package**: PFOS DATA PKG
- **ANY**: PFC MS
- **ANY**: PFC MSD
- **ANY**: SAMPLE RECEIPT

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<table>
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- **Solid**: 2: MOISTURE
- **Solid**: 5: MOISTURE
- **Solid**: HOMOGENIZATION
- **Solid**: PERFLUORO ORG (LC)
- **Solid**: PFC PRESCREEN (LC)
- **EDDataDeliv**: PFC EDD
- **Package**: PFOS DATA PKG
- **ANY**: SAMPLE RECEIPT

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AXYS Analytical Services Ltd.
Login Chain of Custody Report (In01)
May 01, 2009
12:20 PM

Login Number: L12606
Account: 4095 Minnesota Pollution Control
Project: NILE FELLOWS

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<td>23-APR-09 13:35</td>
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<td>ANY</td>
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L12606-8

Harmony B-4 SL 4-8'                         |          |     |    |
23-APR-09 13:50                              |          |     |    |
Solid                                      |          |     |    |
2:MOISTURE                                  |          |     | USD|
Solid                                      |          |     |    |
5:MOISTURE                                  |          |     | USD|
Solid                                      |          |     |    |
HOMOGENIZATION                              |          |     | USD|
Solid                                      |          |     |    |
PERFLUORO ORG (LC)                          |          |     | USD|
Solid                                      |          |     |    |
PFC PRESCREEN (LC)                          |          |     | USD|
EDataDeliv                                  |          |     |    |
PFC EDD                                    |          |     | USD|
D.Package                                  |          |     |    |
PFOS DATA PKG                              |          |     | USD|
ANY                                        |          | 1  | 250 mL plastic | USD|

L12606-9

Burnsville B-1 SL 0-4'                       |          |     |    |
24-APR-09 08:50                              |          |     |    |
Solid                                      |          |     |    |
2:MOISTURE                                  |          |     | USD|
Solid                                      |          |     |    |
5:MOISTURE                                  |          |     | USD|
Solid                                      |          |     |    |
HOMOGENIZATION                              |          |     | USD|
Solid                                      |          |     |    |
PERFLUORO ORG (LC)                          |          |     | USD|
Solid                                      |          |     |    |
PFC PRESCREEN (LC)                          |          |     | USD|
EDataDeliv                                  |          |     |    |
PFC EDD                                    |          |     | USD|
D.Package                                  |          |     |    |
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<td>Solid</td>
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<td>Solid</td>
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<td>PFC EDD</td>
<td>:</td>
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<td>D.Packaging</td>
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| L12606-11                                |          | 28-APR-09 |    |
| Burnsville B-2 SL 0-4"                    |          | Permit #: P-2009-01078 |    |
| 24-APR-09 11:35                           |          | Project #: NILE FELLOWS |    |
| Solid                                    | 2:MOISTURE | : | USD |
| Solid                                    | 5:MOISTURE | : | USD |
| Solid                                    | HOMOGENIZATION | : | USD |
| Solid                                    | PERFLUORO ORG (LC) | : | USD |
| Solid                                    | PFC PRESCREEN (LC) | : | USD |
| EDataDeliv                               | PFC EDD | : | USD |
| D.Packaging                              | PFOS DATA PKG | : | USD |
| ANY                                      | SAMPLE RECEIPT | 1 : 250 mL plastic | USD |

<p>| L12606-12                                |          | 28-APR-09 |    |
| Burnsville B-2 SL 4-8&quot;                    |          | Permit #: P-2009-01078 |    |
| 24-APR-09 11:45                           |          | Project #: NILE FELLOWS |    |
| Solid                                    | 2:MOISTURE | : | USD |
| Solid                                    | 5:MOISTURE | : | USD |
| Solid                                    | HOMOGENIZATION | : | USD |
| Solid                                    | PERFLUORO ORG (LC) | : | USD |
| Solid                                    | PFC PRESCREEN (LC) | : | USD |
| EDataDeliv                               | PFC EDD | : | USD |
| D.Packaging                              | PFOS DATA PKG | : | USD |
| ANY                                      | SAMPLE RECEIPT | 1 : 250 mL plastic | USD |</p>
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<tr>
<td>ANY</td>
<td>SAMPLE RECEIPT</td>
<td>1 : 1 L plastic</td>
<td>USD</td>
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</table>

| L12607-2      |          | 28-APR-09 |    |
| Harmony B-2 GW |          |     |    |
| Storage: wic-2, floor | |     |    |
| 23-APR-09 10:50 |          |     |    |
| Project #: NILE FELLOWS | |     |    |
| EDataDeliv  | PFC EDD  | :   | USD |
| D.Package    | PFOS DATA PKG | : | USD |
| Aqueous      | PFC (V3)  | :   | USD |
| Aqueous      | PFC PRESCREEN (LC) | : | USD |
| ANY          | SAMPLE RECEIPT | 1 : 1 L plastic | USD |
Angelica Whetung

Subject: FW: Drill schedule for fire training sites.

-----Original Message-----
From: Angelica Whetung
Sent: Tuesday, April 28, 2009 3:18 PM
To: 'Fellows, Nile'; Nancy Rodning
Subject: RE: Drill schedule for fire training sites.

Hi Nile,

The sample bottles have SL incorporated into the name but do not appear on the COC. We have used the COC with the protocol as previously discussed.

Cheers,
Angie

-----Original Message-----
From: Fellows, Nile [mailto:Nile.Fellows@state.mn.us]
Sent: Tuesday, April 28, 2009 1:12 PM
To: Angelica Whetung; Nancy Rodning
Subject: RE: Drill schedule for fire training sites.

That is fine with me. I will confirm with Delta for future samples.

-----Original Message-----
From: Angelica Whetung [mailto:awhetung@axys.com]
Sent: Tuesday, April 28, 2009 3:03 PM
To: Nancy Rodning; Fellows, Nile
Subject: RE: Drill schedule for fire training sites.

Nile, we will proceed with this protocol for logging in your samples into our system. Please confirm.

Thanks Nancy.

-----Original Message-----
From: Nancy Rodning [mailto:nrodnng@deltaenv.com]
Sent: Tuesday, April 28, 2009 12:59 PM
To: Angelica Whetung; Fellows, Nile
Subject: RE: Drill schedule for fire training sites.

Actually, I did instruct the sampler to include the city name in the sample ID. We'll be sure to include that next time.

-----Original Message-----
From: Angelica Whetung [mailto:awhetung@axys.com]
Sent: Tuesday, April 28, 2009 2:59 PM
To: Nancy Rodning; Fellows, Nile
Cc: Curt McKay
Subject: RE: Drill schedule for fire training sites.

Nancy, thank you for sending these.

Nile: Please advise, in order to differentiate between Client IDs, I would recommend using the Site name + Sample ID. I can see that similar naming for depths have been sampled from each site. Would this be feasible nomenclature for your samples going forward to use Site name + sample ID for the client IDs in our system? For example: Burnsville B-1,0-4 ft.
Please let me know if this is feasible.

Thanks,
Angie

-----Original Message-----
From: Nancy Rodning [mailto:nrodnign@deltaenv.com]
Sent: Tuesday, April 28, 2009 12:48 PM
To: Angelica Whetung
Cc: Fellows, Nile; Curt McKay
Subject: RE: Drill schedule for fire training sites.

Angie, here are the chains of custody for the PFC samples from the Harmony and Burnsville sites. As soon as I can I will email you the original COCs and then send them via FedEx.

Again, my apologies and thank you for your understanding.

Nancy

-----Original Message-----
From: Angelica Whetung [mailto:aawhetung@axys.com]
Sent: Tuesday, April 28, 2009 2:15 PM
To: Nancy Rodning
Subject: RE: Drill schedule for fire training sites.

Hi Nancy,

Please find the chain of custody word document to fill out for these samples. I have attached instructions as well for your records. Please let me know if you have any questions.

Cheers,
Angie

-----Original Message-----
From: Nancy Rodning [mailto:nrodnign@deltaenv.com]
Sent: Tuesday, April 28, 2009 11:52 AM
To: Angelica Whetung
Subject: RE: Drill schedule for fire training sites.

I am terribly sorry! Curt, the guy who did the field work, has been doing this for 10+ years, I am so surprised. He is in the field today, I just left him a message to call me. I looked on his desk, but didn't see the paperwork. I'll get back to you as soon as I can.

Nancy

-----Original Message-----
From: Angelica Whetung [mailto:aawhetung@axys.com]
Sent: Tuesday, April 28, 2009 1:38 PM
To: Nancy Rodning
Cc: Nile.Fellows@state.mn.us
Subject: RE: Drill schedule for fire training sites.
Importance: High

Hi Nancy,

Can you please send us a Chain of Custody document via e-mail or fax? We received the coolers of samples today with no COC documentation.
Thank you,
Angie

-----Original Message-----
From: Angelica Whetung
Sent: Tuesday, April 28, 2009 9:52 AM
To: 'Nancy Rodning'
Subject: RE: Drill schedule for fire training sites.

Hi Nancy, thank you.

Please remind them when they do ship samples to e-mail me with the FedEx waybill #s when they ship samples. It helps us track the shipments and work with FedEx when there are delays in order to get the samples safely to AXYS.

Thanks,
Angie

Angelica Whetung, BSc., CEP
Project Manager
AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, BC V8L 5X2
Tel (250) 655-5800
Direct Tel (250) 655-5836

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-----Original Message-----
From: Nancy Rodning [mailto:nrodnig@deltapen.com]
Sent: Tuesday, April 28, 2009 9:43 AM
To: Angelica Whetung
Subject: RE: Drill schedule for fire training sites.

Angie, I sent your request on to Curt McKay, our field tech who shipped the samples. But I believe he is in the field today. I'll see what I can do to get you those tracking #s today.

Nancy

-----Original Message-----
From: Angelica Whetung [mailto:awhetung@axys.com]
Sent: Tuesday, April 28, 2009 11:35 AM
To: Nancy Rodning
Subject: RE: Drill schedule for fire training sites.

Hi Nancy,

Can you please let me know the FedEx numbers for the shipments so I can track them? Did you send these yesterday?

Thanks,
Angie
Hi Nancy and Nile,

I will change the documentation for the samples to include SL and GW in the sample IDs and resend Nile the sample Acknowledgements.

Thank you,
Angie

-----Original Message-----
From: Nancy Rodning [mailto:nrodnings@deltaenv.com]
Sent: Thursday, April 30, 2009 12:38 PM
To: Angelica Whetung
Cc: Fellows, Nile
Subject: COCs for Burnsville and Harmony

Hello Angelica,

Attached are scanned copies of the original COCs for the PFC soil and groundwater samples collected at the Burnsville and Harmony sites. We will overnight via FedEx the originals to your attention.

Nancy Rodning
Project Geologist
DELTA CONSULTANTS
5910 Rice Creek Parkway, Suite 100
Shoreview, MN 55125
nrodnings@deltaenv.com
(651)697-5152 direct
(800)477-7411 toll free
(651)639-9473 fax
www.deltaenv.com

Member of Inogen
www.inogen.org

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AXYS METHOD MLA-041 Rev 07

PERFLUORINATED ORGANICS ANALYSIS REPORT

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

For Axys Internal Use Only [ XSL Template: FC-Form1A.xsl; Created: 08-Jun-2009 13:18:24; Application: XMLTransformer-1.9.24; Report Filename: PFC_FC_LC_PFOA_L12606-1_Form1A_FC9G_182S30_SJ1018511.html; Workgroup: WG28682; Design ID: 312 ]

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.

COMPOUND LAB FLAG ¹ CONC. FOUND DETECTION LIMIT RETENTION TIME

PFBA U 0.0955
PFPeA U 0.0955
PFHxA U 0.0955
PFHpA U 0.0955
PFOA U 0.0955
PFNA U 0.0955
PFDA U 0.0955
PFUnA U 0.0955
PFDoA U 0.0955
PFBS U 0.191
PFHxS U 0.191
PFOS U 0.191
PFOSA U 0.0955

¹ Where applicable, custom lab flags have been used on this report; U = not detected.

 Approved by: Bryan Alonzo QA/QC Chemist
**AXYS METHOD MLA-041 Rev 07**

**PERFLUORINATED ORGANICS ANALYSIS REPORT**

**AXYS ANALYTICAL SERVICES**

2045 MILLS RD., SIDNEY, B.C., CANADA

V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Contract No.:** 4095  
**Lab Sample I.D.:** L12606-1 Y1

**Matrix:** SOLID  
**Sample Size:** 5.24 g (dry)

**Sample Receipt Date:** 28-Apr-2009  
**Initial Calibration Date:** 14-May-2009

**Extraction Date:** 06-May-2009  
**Instrument ID:** LC MS/MS

**Analysis Date:** 15-May-2009  
**Column ID:** C18

**Extract Volume (uL):** 4000  
**Sample Data Filename:** FC9G_182S: 30

**Injection Volume (uL):** 15  
**Blank Data Filename:** FC9G_182S: 28

**Dilution Factor:** N/A  
**Cal. Ver. Data Filename:** FC9G_182S: 20

**Concentration Units:** ng absolute  
**% Moisture:** 17.3

### LABELED COMPOUND

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(1) Where applicable, custom lab flags have been used on this report.

(2) R(%) = percent recovery.

Approved by: __________ Bryan Alonzo __________ QA/QC Chemist
AXYS METHOD MLA-041 Rev 07

PERFLUORINATED ORGANICS ANALYSIS REPORT

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 4095

Matrix: SOLID

Sample Receipt Date: 28-Apr-2009

Extraction Date: 06-May-2009

Analysis Date: 15-May-2009

Extract Volume (uL): 4000

Injection Volume (uL): 15

Dilution Factor: N/A

Concentration Units: ng/g (dry weight basis)

Sample Collection: 23-Apr-2009

Form 1A

PERFLUORINATED ORGANICS ANALYSIS REPORT

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 4095

Matrix: SOLID

Sample Receipt Date: 28-Apr-2009

Extraction Date: 06-May-2009

Analysis Date: 15-May-2009

Extract Volume (uL): 4000

Injection Volume (uL): 15

Dilution Factor: N/A

Concentration Units: ng/g (dry weight basis)

Sample Collection: 23-Apr-2009

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.

COMPOUND LAB FLAG 1 CONC. FOUND DETECTION LIMIT RETENTION TIME

PFBA U 0.101
PFPeA U 0.101
PFHxA U 0.101
PFHpA U 0.101
PFOA U 0.101
PFNA U 0.101
PFDA U 0.101
PFUnA U 0.101
PFDoA U 0.101
PFBS U 0.201
PFHxS U 0.201
PFOS U 0.201
PFOSA U 0.101

(1) Where applicable, custom lab flags have been used on this report; U = not detected.

Approved by: _______Bryan Alonzo_______ QA/QC Chemist

For Axys Internal Use Only [ XSL Template: FC-Form1A.xsl; Created: 08-Jun-2009 13:18:24; Application: XMLTransformer-1.9.24; Report Filename: PFC_FC_LC_PFOA_L12606-2_Form1A_FC9G_182S31_SJ1018512.html; Workgroup: WG28682; Design ID: 312 ]
### AXYS METHOD MLA-041 Rev 07

**PERFLUORINATED ORGANICS ANALYSIS REPORT**

**AXYS ANALYTICAL SERVICES**

2045 MILLS RD., SIDNEY, B.C., CANADA

V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Project No.**

FFFI AT BURNSVILLE AND HARMONY

**Lab Sample I.D.:**

L12606-2 Y1

**Sample No.:**

Harmony B-1 SL 4-8'

**Sample Collection:**

23-Apr-2009 09:20

**Form 2**

**Sample Receipt Date:**

28-Apr-2009

**Initial Calibration Date:**

14-May-2009

**Extraction Date:**

06-May-2009

**Instrument ID:**

LC MS/MS

**Analysis Date:**

15-May-2009 Time: 13:16:54

**Column ID:**

C18

**Extract Volume (uL):**

4000

**Sample Data Filename:**

FC9G_182 S: 31

**Injection Volume (uL):**

15

**Blank Data Filename:**

FC9G_182 S: 28

**Dilution Factor:**

N/A

**Cal. Ver. Data Filename:**

FC9G_182 S: 20

**Concentration Units:**

ng absolute

**% Moisture:**

20.1

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---

(1) Where applicable, custom lab flags have been used on this report.
(2) \( R(\%) = \text{percent recovery} \)

Approved by: __________ Bryan Alonzo _________ QA/QC Chemist

Contact: analytical@axys.com

---

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### AXYS METHOD MLA-041 Rev 07

**PERFLUORINATED ORGANICS ANALYSIS REPORT**

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Contract No.:** 4095

**Matrix:** SOLID

**Sample Receipt Date:** 28-Apr-2009

**Extraction Date:** 06-May-2009

**Analysis Date:** 15-May-2009 **Time:** 13:35:32

**Extract Volume (uL):** 4000

**Injection Volume (uL):** 15

**Dilution Factor:** N/A

**Concentration Units:** ng/g (dry weight basis)

**% Moisture:** 18.2

---

### COMPOUND LAB FLAG ¹ CONC. FOUND DETECTION LIMIT RETENTION TIME

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<th>RETENTION TIME</th>
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(¹) Where applicable, custom lab flags have been used on this report; U = not detected.

**Approved by:** Bryan Alonzo QA/QC Chemist

---

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**LABELED COMPOUND** | **LAB FLAG**¹ | **SPIKE CONC.** | **CONC. FOUND** | **R(%)**² | **RETENTION TIME**
--- | --- | --- | --- | --- | ---
13C4-PFBA | 12.0 | 8.64 | 72.0 | 5:19
13C2-PFHxA | 12.0 | 9.44 | 78.6 | 6:26
13C2-PFOA | 36.0 | 26.2 | 72.7 | 7:11
13C5-PFNA | 12.0 | 8.46 | 70.5 | 7:38
13C2-PFDA | 12.0 | 6.75 | 56.2 | 8:08
13C2-PFDoA | 12.0 | 5.81 | 48.4 | 9:17
13C4-PFOS (80) | 18.0 | 11.3 | 62.6 | 8:24

¹ Where applicable, custom lab flags have been used on this report.
² R(%) = percent recovery.

Approved by: Bryan Alonzo QA/QC Chemist
### AXYS METHOD MLA-041 Rev 07

**Form 1A**

**PERFLUORINATED ORGANICS ANALYSIS REPORT**

**CLIENT SAMPLE NO.**
Harmony B-2 SL 4-8
Sample Collection: 23-Apr-2009 10:30

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Contract No.:** 4095

**Matrix:** SOLID

**Sample Receipt Date:** 28-Apr-2009

**Extraction Date:** 06-May-2009

**Analysis Date:** 15-May-2009

**Extract Volume (uL):** 4000

**Injection Volume (uL):** 15

**Dilution Factor:** N/A

**Concentration Units:** ng/g (dry weight basis)

**% Moisture:** 22.0

---

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1) Where applicable, custom lab flags have been used on this report; U = not detected.

Approved by: Bryan Alonzo QA/QC Chemist
## AXYS METHOD MLA-041 Rev 07

### AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Contract No.:** 4095

**Matrix:** SOLID

**Sample Receipt Date:** 28-Apr-2009

**Sample Collection:** 23-Apr-2009 10:30

**Initial Calibration Date:** 14-May-2009

**Extraction Date:** 06-May-2009

**Analysis Date:** 15-May-2009

**Time:** 13:54:11

**Extract Volume (uL):** 4000

**Injection Volume (uL):** 15

**Dilution Factor:** N/A

**Concentration Units:** ng absolute

**% Moisture:** 22.0

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1. Where applicable, custom lab flags have been used on this report.
2. R(%) = percent recovery.

Approved by: __________ Bryan Alonzo __________ QA/QC Chemist

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AXYS METHOD MLA-041 Rev 07

PERFLUORINATED ORGANICS ANALYSIS REPORT

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 4095

Project No.:

Lab Sample I.D.:

Sample No.: Harmony B-3 SL 0-4'

Sample Collection: 23-Apr-2009 12:05

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Contact: analytical@axys.com

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(1) Where applicable, custom lab flags have been used on this report; U = not detected.

Approved by: Bryan Alonzo QA/QC Chemist

Page 1 of 1 (WG28682 - PFC_FC_LC_PFOA_L12606-5_Form1A_FC9G_182S45_SJ1018526.html)
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(1) Where applicable, custom lab flags have been used on this report.
(2) R(%) = percent recovery.

Approved by: Bryan Alonzo QA/QC Chemist
## PERFLUORINATED ORGANICS ANALYSIS REPORT

### AXYS METHOD MLA-041 Rev 07

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Contract No.:** 4095

**Matrix:** SOLID

**Sample Receipt Date:** 28-Apr-2009

**Extraction Date:** 06-May-2009

**Analysis Date:** 15-May-2009

**Extract Volume (uL):** 4000

**Injection Volume (uL):** 15

**Dilution Factor:** N/A

**Concentration Units:** ng/g (dry weight basis)

**% Moisture:** 20.2

### Sample Information

**CLIENT SAMPLE NO.**
Harmony B-3 SL 4-8'

**Sample Collection:**
23-Apr-2009 12:20

**Lab Sample I.D.:** L12606-6 Y1

**Initial Calibration Date:** 14-May-2009

**Instrument ID:** LC MS/MS

**Column ID:** C18

**Sample Data Filename:** FC9G_182 S: 34

**Blank Data Filename:** FC9G_182 S: 28

**Cal. Ver. Data Filename:** FC9G_182 S: 20

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(1) Where applicable, custom lab flags have been used on this report; U = not detected.

Approved by: Bryan Alonzo QA/QC Chemist
Where applicable, custom lab flags have been used on this report; V = surrogate recovery is not within method/contract control limits.

R(%) = percent recovery.

Approved by: Bryan Alonzo QA/QC Chemist

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AXYS METHOD MLA-041 Rev 07

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 4095

Matrix: SOLID

Sample Receipt Date: 28-Apr-2009

Extraction Date: 06-May-2009

Analysis Date: 15-May-2009

Sample Data Filename: FC9G_182 S: 35

Injection Volume (uL): 15

Blank Data Filename: FC9G_182 S: 28

Dilution Factor: N/A


Concentration Units: ng/g (dry weight basis)

% Moisture: 17.9

**COMPOUND** | **LAB FLAG** | **CONC. FOUND** | **DETECTION LIMIT** | **RETENTION TIME**
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PFPeA | 0.253 | 0.0989 | 6:03 |
PFHxA | 0.133 | 0.0989 | 6:26 |
PFHpA | 0.150 | 0.0989 | 6:47 |
PFOA | U | 0.0989 |  |
PFNA | U | 0.0989 |  |
PFDA | U | 0.0989 |  |
PFUnA | U | 0.0989 |  |
PFDoA | U | 0.0989 |  |
PFBS | U | 0.198 |  |
PFHxS | U | 0.198 |  |
PFOS | U | 0.198 |  |
PFOSA | U | 0.0989 |  |

Where applicable, custom lab flags have been used on this report; U = not detected.

Approved by: Bryan Alonzo QA/QC Chemist

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For Axys Internal Use Only [ XSL Template: FC-Form1A.xsl; Created: 08-Jun-2009 13:18:24; Application: XMLTransformer-1.9.24; Report Filename: PFC_FC_LC_PFOA_L12606-7_Form1A_FC9G_182S35_SJ1018516.html; Workgroup: WG28682; Design ID: 312 ]

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.
Where applicable, custom lab flags have been used on this report.

R(%) = percent recovery.

Approved by: ___________ Bryan Alonzo ___________ QA/QC Chemist

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.

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<th>CONC. FOUND</th>
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<td>13C5-PFNA</td>
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<td>13C2-PFDA</td>
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<td>6.73</td>
<td>56.1</td>
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<td>13C2-PFDoA</td>
<td>12.0</td>
<td>5.68</td>
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<tr>
<td>13C4-PFOS (80)</td>
<td>18.0</td>
<td>12.8</td>
<td>70.9</td>
<td>8:24</td>
<td></td>
</tr>
</tbody>
</table>

(1) Where applicable, custom lab flags have been used on this report.
(2) R(%) = percent recovery.
These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.
**PERFLUORINATED ORGANICS ANALYSIS REPORT**

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Project No.**

**Lab Sample I.D.:**

**CLIENT SAMPLE NO.**
Harmony B-4 SL 4-8’

**Sample Collection:** 23-Apr-2009 13:50

**Contract No.:** 4095

**Matrix:** SOLID

**Sample Receipt Date:** 28-Apr-2009

**Extraction Date:** 06-May-2009

**Analysis Date:** 15-May-2009

**Extract Volume (uL):** 4000

**Injection Volume (uL):** 15

**Dilution Factor:** N/A

**Concentration Units:** ng absolute

**% Moisture:** 20.9

**Sample Data Filename:** FC9G_182 S: 36

**Blank Data Filename:** FC9G_182 S: 28

**Cal. Ver. Data Filename:** FC9G_182 S: 20

**LABELED COMPOUND** | **LAB FLAG** | **SPIKE CONC.** | **CONC. FOUND** | **R(%)** | **RETENTION TIME**
--- | --- | --- | --- | --- | ---
13C4-PFBA | V | 12.0 | 8.96 | 74.7 | 5:19
13C2-PFHxA | 12.0 | 9.78 | 81.5 | 6:26
13C2-PFOA | 36.0 | 27.5 | 76.5 | 7:11
13C5-PFNA | 12.0 | 8.17 | 68.1 | 7:38
13C2-PFDA | 12.0 | 7.50 | 62.5 | 8:08
13C2-PFDoA | V | 12.0 | 3.78 | 31.5 | 9:17
13C4-PFOS (80) | 18.0 | 11.8 | 65.3 | 8:24

(1) Where applicable, custom lab flags have been used on this report; V = surrogate recovery is not within method/contract control limits.
(2) R(%) = percent recovery.

Approved by: Bryan Alonzo QA/QC Chemist

For Axys Internal Use Only [ XSL Template: FC-Form2.xsl; Created: 08-Jun-2009 13:18:24; Application: XMLTransformer-1.9.24; Report Filename: PFC_FC_LC_PFOA_L12606-8_Form2_FC9G_182S36_SJ1018517.html; Workgroup: WG28682; Design ID: 312 ]

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.
# AXYS METHOD MLA-041 Rev 07

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**AXYS ANALYTICAL SERVICES**

**PERFLUORINATED ORGANICS ANALYSIS REPORT**

**Form 1A**

**Project No.**

**FFFI AT BURNSVILLE AND HARMONY**

**Lab Sample I.D.:**

**L12606-9 Y1**

**CLIENT SAMPLE NO.**

Burnsville B-1 SL 0-4'

**Sample Collection:**

24-Apr-2009 08:50

**Approved by:** Bryan Alonzo

[QA/QC Chemist]

**Contract No.:** 4095

**Matrix:** SOLID

**Sample Receipt Date:** 28-Apr-2009

**Initial Calibration Date:** 14-May-2009

**Extraction Date:** 06-May-2009

**Instrument ID:** LC MS/MS

**Analysis Date:** 15-May-2009 Time: 17:05:01

**Column ID:** C18

**Extract Volume (uL):** 4000

**Sample Data Filename:** FC9G_182 S: 43

**Injection Volume (uL):** 15

**Blank Data Filename:** FC9G_182 S: 28

**Dilution Factor:** N/A

**Cal. Ver. Data Filename:** FC9G_182 S: 20

**Concentration Units:** ng/g (dry weight basis)

**% Moisture:** 9.41

---

**COMPUND**

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<td>PFBA</td>
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<td>1.73</td>
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<td>U</td>
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<td></td>
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(1) Where applicable, custom lab flags have been used on this report; U = not detected.

---

Approved by: Bryan Alonzo [QA/QC Chemist]

---

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These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.
**LABELED COMPOUND** | **LAB FLAG** | **SPIKE CONC.** | **CONC. FOUND** | **R(%)** | **RETENTION TIME**
---|---|---|---|---|---
13C4-PFBA | 1 | 12.0 | 12.5 | 104 | 5:22
13C2-PFHxA | 2 | 12.0 | 13.4 | 112 | 6:27
13C2-PFOA | 3 | 36.0 | 29.0 | 80.5 | 7:14
13C5-PFNA | 4 | 12.0 | 12.5 | 104 | 7:38
13C2-PFDA | 5 | 12.0 | 10.8 | 90.4 | 8:08
13C2-PFDoA | 6 | 12.0 | 11.0 | 91.9 | 9:17
13C4-PFOS (80) | 7 | 18.0 | 16.0 | 89.1 | 8:24

(1) Where applicable, custom lab flags have been used on this report.
(2) R(%) = percent recovery.

Approved by: __________ Bryan Alonzo __________ QA/QC Chemist
**COMPOUND** | **LAB FLAG** | **CONC. FOUND** | **DETECTION LIMIT** | **RETENTION TIME**
--- | --- | --- | --- | ---
PFBA | 0.132 | 0.0956 | 5:19 |
PFPeA | 1.54 | 0.0956 | 6:03 |
PFHxA | 1.77 | 0.0956 | 6:28 |
PFHpA | 8.46 | 0.0956 | 6:51 |
PFOA | 14.8 | 0.0956 | 7:14 |
PFNA | U | 0.0956 | |
PFDA | U | 0.0956 | |
PFUnA | U | 0.0956 | |
PFDoA | U | 0.0956 | |
PFBS | U | 0.191 | |
PFHxS | 11.0 | 0.191 | 7:26 |
PFOA | 1.62 | 0.191 | 8:15 |
PFOSA | U | 0.0956 | |

(1) Where applicable, custom lab flags have been used on this report; U = not detected.

Approved by: Bryan Alonzo, QA/QC Chemist
## AXYS METHOD MLA-041 Rev 07

### AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Project No. | FFFI AT BURNSVILLE AND HARMONY
Lab Sample I.D. | L12606-10 Y1

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<td>06-May-2009</td>
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<td>Analysis Date</td>
<td>15-May-2009 Time: 16:26:49</td>
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<td>FC9G_182 S: 41</td>
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<td>Injection Volume (µL)</td>
<td>15</td>
<td>Blank Data Filename</td>
<td>FC9G_182 S: 28</td>
</tr>
<tr>
<td>Dilution Factor</td>
<td>N/A</td>
<td>Cal. Ver. Data Filename</td>
<td>FC9G_182 S: 20</td>
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### LABELED COMPOUND

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<th>CONC. FOUND</th>
<th>R(%)</th>
<th>RETENTION TIME</th>
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</thead>
<tbody>
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<td>13C4-PFBA</td>
<td>12.0</td>
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<td>13C2-PFHxA</td>
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<td>76.1</td>
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<tr>
<td>13C5-PFNA</td>
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<tr>
<td>13C2-PFDoA</td>
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<tr>
<td>13C4-PFOS (80)</td>
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<td>13.0</td>
<td>72.4</td>
<td>8:27</td>
<td></td>
</tr>
</tbody>
</table>

(1) Where applicable, custom lab flags have been used on this report.
(2) R(%) = percent recovery.

Approved by: Bryan Alonzo QA/QC Chemist

For Axys Internal Use Only [ XSL Template: FC-Form2.xsl; Created: 08-Jun-2009 13:18:24; Application: XMLTransformer-1.9.24; Report Filename: PFC_FC_LC_PFOA_L12606-10_Form2_FC9G_182S41_SJ1018522.html; Workgroup: WG28682; Design ID: 312 ]

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.
**COMPOND** | **LAB FLAG**<sup>1</sup> | **CONC. FOUND** | **DETECTION LIMIT** | **RETENTION TIME**
--- | --- | --- | --- | ---
PFBA | 0.796 | 0.0992 | 5.20 |
PFPeA | 3.08 | 0.0992 | 6.03 |
PFHxA | 1.69 | 0.0992 | 6.27 |
PFHpA | 1.05 | 0.0992 | 6.47 |
PFOA | 5.78 | 0.0992 | 7.14 |
PFNA | 7.92 | 0.0992 | 7.38 |
PFDA | U | 0.0992 |
PFUnA | U | 0.0992 |
PFDoA | U | 0.0992 |
PFBS | U | 0.198 |
PFHxS | U | 0.198 |
PFOS | 2.80 | 0.198 | 8.15 |
PFOSA | U | 0.0992 |

<sup>1</sup> Where applicable, custom lab flags have been used on this report; U = not detected.

Approved by: Bryan Alonzo QA/QC Chemist
### PERFLUORINATED ORGANICS ANALYSIS REPORT

**AXYS ANALYTICAL SERVICES**  
2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

<table>
<thead>
<tr>
<th>LABELED COMPOUND</th>
<th>LAB FLAG</th>
<th>SPIKE CONC.</th>
<th>CONC. FOUND</th>
<th>R(%)</th>
<th>RETENTION TIME</th>
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<td>13C2-PFHxA</td>
<td>12.0</td>
<td>9.80</td>
<td>81.7</td>
<td>6:26</td>
<td></td>
</tr>
<tr>
<td>13C2-PFOA</td>
<td>36.0</td>
<td>30.8</td>
<td>85.5</td>
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<tr>
<td>13C5-PFNA</td>
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<td>8.81</td>
<td>73.4</td>
<td>7:38</td>
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<tr>
<td>13C2-PFDA</td>
<td>12.0</td>
<td>7.85</td>
<td>65.4</td>
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<td></td>
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<tr>
<td>13C2-PfDoA</td>
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<td>7.98</td>
<td>66.5</td>
<td>9:17</td>
<td></td>
</tr>
<tr>
<td>13C4-PFOS (80)</td>
<td>18.0</td>
<td>13.0</td>
<td>72.3</td>
<td>8:27</td>
<td></td>
</tr>
</tbody>
</table>

1. Where applicable, custom lab flags have been used on this report.  
2. R(%) = percent recovery.

Approved by: __________ Bryan Alonzo __________ QA/QC Chemist

---

For Axys Internal Use Only [ XSL Template: FC-Form2.xsl; Created: 08-Jun-2009 13:18:24; Application: XMLTransformer-1.9.24; Report Filename: PFC_FC_LC_PFOA_L12606-11_Form2_FC9G_182S39_SJ1018520.html; Workgroup: WG28682; Design ID: 312 ]

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AXYS METHOD MLA-041 Rev 07

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Form 1A
PERFLUORINATED ORGANICS ANALYSIS REPORT

Axys Analytical Services
2045 Mills Rd., Sidney, B.C., Canada
V8L 5X2
Tel (250) 655-5800
Fax (250) 655-5811

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 4095
Laboratory I.D.: L12606-12 Y1
Sample Receipt Date: 28-Apr-2009
Sample Collection: 24-Apr-2009 11:45

Matrix: SOLID
Sample Size: 5.08 g (dry)
Initial Calibration Date: 14-May-2009

Extraction Date: 06-May-2009
Instrument ID: LC MS/MS

Analysis Date: 15-May-2009
Column ID: C18

Extract Volume (uL): 4000
Sample Data Filename: FC9G_182 S: 37

Injection Volume (uL): 15
Blank Data Filename: FC9G_182 S: 28

Dilution Factor: N/A

Concentration Units: ng/g (dry weight basis)
% Moisture: 16.5

**COMPOUND** | **LAB FLAG** ¹ | **CONC. FOUND** | **DETECTION LIMIT** | **RETENTION TIME**
--- | --- | --- | --- | ---
PFBA | 1.83 | 0.0985 | 5.20 |
PFPeA | 4.81 | 0.0985 | 6.02 |
PFHxA | 3.97 | 0.0985 | 6.27 |
PFHpA | 4.14 | 0.0985 | 6.47 |
PFOA | 0.355 | 0.0985 | 7.11 |
PFNA | U | 0.0985 | |
PFDA | U | 0.0985 | |
PFUnA | U | 0.0985 | |
PFDoA | U | 0.0985 | |
PFBS | U | 0.197 | |
PFHxS | 1.20 | 0.197 | 7.23 |
PFOS | U | 0.197 | |
PFOSA | U | 0.0985 | |

(1) Where applicable, custom lab flags have been used on this report; U = not detected.

Approved by: Bryan Alonzo QA/QC Chemist

For Axys Internal Use Only | XSL Template: FC-Form1A.xsl; Created: 08-Jun-2009 13:18:24; Application: XMLTransformer-1.9.24; Report Filename: PFC_FC_LC_PFOA_L12606-12/Form1A_FC9G_182S37_SJ1018518.html; Workgroup: WG28682; Design ID: 312

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.
AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

AXYS METHOD MLA-041 Rev 07

PERFLUORINATED ORGANICS ANALYSIS REPORT

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 4095

Sample Collection: 24-Apr-2009 11:45

Form 2

PERFLUORINATED ORGANICS ANALYSIS REPORT

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Project No.: FFFI AT BURNSVILLE AND HARMONY

Lab Sample I.D.: L12606-12 Y1

Sample Receipt Date: 28-Apr-2009

Initial Calibration Date: 14-May-2009

Extraction Date: 06-May-2009

Instrument ID: LC MS/MS

Analysis Date: 15-May-2009 Time: 15:10:31

Column ID: C18

Extract Volume (uL): 4000

Sample Data Filename: FC9G_182 S: 37

Injection Volume (uL): 15

Blank Data Filename: FC9G_182 S: 28

Dilution Factor: N/A


Concentration Units: ng absolute

% Moisture: 16.5

LABELED COMPOUND | LAB FLAG | SPIKE CONC. | CONC. FOUND | R(%) 2 | RETENTION TIME
---|---|---|---|---|---
13C4-PFBA | 1 | 12.0 | 8.56 | 71.3 | 5:20
13C2-PFHxA | 12.0 | 9.81 | 81.8 | 6:26
13C2-PFOA | 36.0 | 26.9 | 74.8 | 7:11
13C5-PFNA | 12.0 | 8.24 | 68.7 | 7:35
13C2-PFDA | 12.0 | 7.78 | 64.8 | 8:05
13C2-PFDoA | 12.0 | 7.42 | 61.8 | 9:17
13C4-PFOS (80) | 18.0 | 12.7 | 70.3 | 8:24

(1) Where applicable, custom lab flags have been used on this report.
(2) R(%) = percent recovery.

Approved by: Bryan Alonzo QA/QC Chemist

For Axys Internal Use Only [ XSL Template: FC-Form2.xsl; Created: 08-Jun-2009 13:18:24; Application: XMLTransformer-1.9.24;
Report Filename: PFC_FC_LC_PFOA_L12606-12_Form2.FC9G_182S37_SJ1018518.html; Workgroup: WG28682; Design ID: 312 ]

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.
**AXYS METHOD MLA-041 Rev 07**

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Contract No.:** 4095

**Form 1A**

**PERFLUORINATED ORGANICS ANALYSIS REPORT**

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Project No.:** N/A

**Lab Sample I.D.:** WG28682-101 Y1

**Matrix:** AQUEOUS

**Sample Size:** 5.00 g

**Sample Receipt Date:** N/A

**Initial Calibration Date:** 14-May-2009

**Extraction Date:** 06-May-2009

**Instrument Calibration Date:** LC MS/MS

**Analysis Date:** 15-May-2009 **Time:** 12:18:17

**Column ID:** C18

**Extract Volume (uL):** 4000

**Sample Data Filename:** FC9G_182 S: 28

**Injection Volume (uL):** 15

**Blank Data Filename:** FC9G_182 S: 28

**Dilution Factor:** N/A

**Cal. Ver. Data Filename:** FC9G_182 S: 20

**Concentration Units:** ng/g

**COMPOUND**

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<tr>
<th>COMPOND</th>
<th>LAB FLAG</th>
<th>CONC. FOUND</th>
<th>DETECTION LIMIT</th>
<th>RETENTION TIME</th>
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<td>PFBA</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>PFPeA</td>
<td>U</td>
<td>0.100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PFHxA</td>
<td>U</td>
<td>0.100</td>
<td></td>
<td></td>
</tr>
<tr>
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</table>

(1) Where applicable, custom lab flags have been used on this report; U = not detected.

**Approved by:** Bryan Alonzo QA/QC Chemist
Where applicable, custom lab flags have been used on this report.

R(%) = percent recovery.

Approved by: Bryan Alonzo QA/QC Chemist
AXYS METHOD MLA-041 Rev 07

PERFLUORINATED ORGANICS ONGOING PRECISION AND RECOVERY (OPR)

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 4095
Lab Sample I.D.: WG28682-102 Y1i
Matrix: SOLID
Initial Calibration Date: 14-May-2009
Extraction Date: 06-May-2009
Instrument ID: LC MS/MS
Analysis Date: 15-May-2009 Time: 10:42:28
Column ID: C18
Extract Volume (uL): 4000
OPR Data Filename: FC9G_182 S: 23
Injection Volume (uL): 15
Blank Data Filename: FC9G_182 S: 28
Dilution Factor: N/A

ALL CONCENTRATIONS REPORTED ON THIS FORM ARE CONCENTRATIONS IN EXTRACT, BASED ON A 1 mL EXTRACT VOLUME.

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<th>COMPOUND</th>
<th>LAB FLAG</th>
<th>SPIKE CONC. (ng/mL)</th>
<th>CONC. FOUND (ng/mL)</th>
<th>% RECOVERY</th>
<th>RETENTION TIME</th>
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<td>10:00</td>
</tr>
</tbody>
</table>

(1) Where applicable, custom lab flags have been used on this report; N = authentic recovery is not within method/contract control limits.

Approved by: ________ Bryan Alonzo ________ QA/QC Chemist

Contact: analytical@axys.com
AXYS METHOD MLA-041 Rev 07  

PERFLUORINATED ORGANICS ONGOING PRECISION AND RECOVERY (OPR)

 AXYS ANALYTICAL SERVICES  
 2045 MILLS RD., SIDNEY, B.C., CANADA  
 V8L 0Z2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 4095  
Lab Sample I.D.: WG28682-102 Y1i

Matrix: SOLID  
Initial Calibration Date: 14-May-2009

Extraction Date: 06-May-2009  
Instrument ID: LC MS/MS

Analysis Date: 15-May-2009 Time: 10:42:28  
Column ID: C18

Extract Volume (uL): 4000  
OPR Data Filename: FC9G_182 S: 23

Injection Volume (uL): 15  
Blank Data Filename: FC9G_182 S: 28

Dilution Factor: N/A  

ALL CONCENTRATIONS REPORTED ON THIS FORM ARE CONCENTRATIONS IN EXTRACT, BASED ON A 1 mL EXTRACT VOLUME.

<table>
<thead>
<tr>
<th>LABELED COMPOUND</th>
<th>LAB FLAG</th>
<th>SPIKE CONC. (ng/mL)</th>
<th>CONC. FOUND (ng/mL)</th>
<th>% RECOVERY</th>
<th>RETENTION TIME</th>
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<td>66.3</td>
<td>8:24</td>
</tr>
</tbody>
</table>

(1) Where applicable, custom lab flags have been used on this report.

Approved by: __________Bryan Alonzo_________ QA/QC Chemist

Contact: analytical@axys.com
AXYS METHOD MLA-041 Rev 07

PERFLUORINATED ORGANICS MATRIX SPIKE (MS)

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Project No.:
Lab Sample I.D.:

Harmony B-3 SL 0-4’ (MS)
WG28682-103 Y1 (MS)

Contract No.: 4095
Matrix: SOLID
Sample Size: 5.28 g (dry)

Extraction Date: 06-May-2009
Initial Calibration Date: 14-May-2009

Analysis Date: 15-May-2009 Time: 18:03:31
Instrument ID: LC MS/MS

Extract Volume (µL): 4000
GC Column ID: C18

Injection Volume (µL): 15
MS Data Filename: FC9G_182 S: 46

Dilution Factor: N/A
Blank Data Filename: FC9G_182 S: 28

ALL CONCENTRATIONS REPORTED ON THIS FORM ARE CONCENTRATIONS ON SAMPLE SIZE BASIS

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<tr>
<th>COMPOUND</th>
<th>LAB FLAG ¹</th>
<th>ION ABUND. RATIO</th>
<th>SPIKE CONC (ng/g)</th>
<th>SAMPLE LAB FLAG ¹</th>
<th>SAMPLE CONC (ng/g)</th>
<th>CONC. FOUND (ng/g)</th>
<th>MS R% ²</th>
<th>REL % DIFF</th>
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<td>125</td>
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<td>U</td>
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<td>4.04</td>
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(1) Where applicable, custom lab flags have been used on this report; U = not detected.
(2) R% = percent recovery.

Approved by: Bryan Alonzo QA/QC Chemist
AXYS METHOD MLA-041 Rev 07

PERFLUORINATED ORGANICS ANALYSIS REPORT

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 4095

Matrix: SOLID
Sample Receipt Date: 28-Apr-2009

Sample Collection: 23-Apr-2009 12:05

Sample Data Filename: FC9G_182 S: 46
Injection Volume (µL): 15
Blank Data Filename: FC9G_182 S: 28

Initial Calibration Date: 14-May-2009
Column ID: C18

Instrument ID: LC MS/MS

Analysis Date: 15-May-2009 Time: 18:03:31


Extraction Date: 06-May-2009

Sample Size: 5.28 g (dry)

Extract Volume (µL): 4000

Concentration Units: ng absolute

Dilution Factor: N/A
% Moisture: 18.9

LABELED COMPOUND | LAB FLAG 1 | SPIKE CONC. | CONC. FOUND | R(%) 2 | RETENTION TIME
13C4-PFBA | 12.0 | 8.89 | 74.1 | 5:22
13C2-PFHxA | 12.0 | 7.91 | 65.9 | 6:26
13C2-PFOA | 36.0 | 26.6 | 73.8 | 7:14
13C5-PFNA | 12.0 | 7.99 | 66.6 | 7:38
13C2-PFDA | 12.0 | 7.07 | 58.9 | 8:08
13C2-PFDoA | 12.0 | 7.21 | 60.1 | 9:17
13C4-PFOS (80) | 18.0 | 11.0 | 61.4 | 8:24

(1) Where applicable, custom lab flags have been used on this report.
(2) R(%) = percent recovery.

Approved by: Bryan Alonzo QA/QC Chemist

Contact: analytical@axys.com
### PERFLUORINATED ORGANICS MATRIX SPIKE DUPLICATE (MSD) ANALYSIS REPORT

**AXYS ANALYTICAL SERVICES**  
2045 MILL RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811  

**Contr. No.:** 4095  
**Lab Sample I.D.:**  
**Matrix:** SOLID  
**Sample Size:** 5.20 g (dry)  
**Extraction Date:** 06-May-2009  
**Initial Calibration Date:** 14-May-2009  
**Analysis Date:** 15-May-2009 **Time:** 18:23:06  
**Instrument ID:** LC MS/MS  
**GC Column ID:** C18  
**MSD Data Filename:** FC9G_182 S: 47  
**Blank Data Filename:** FC9G_182 S: 28  
**Cal. Ver. Data Filename:** FC9G_182 S: 20

**ALL CONCENTRATIONS REPORTED ON THIS FORM ARE CONCENTRATIONS ON SAMPLE SIZE BASIS**

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<th>SPIKE CONC. (ng/g)</th>
<th>SAMPLE LAB FLAG</th>
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<th>CONC. FOUND (ng/g)</th>
<th>MSD R%</th>
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<td>4.04</td>
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(1) Where applicable, custom lab flags have been used on this report; U = not detected.  
(2) R% = percent recovery.

Approved by: Bryan Alonzo QA/QC Chemist

---

For Axys Internal Use Only [ XSL Template: MS.xsl; Created: 08-Jun-2009 13:18:46; Application: XMLTransformer 1.9.24;  
Report Filename: MS_FC_LC_PFOA-MS-MSD_WG28682-104_L12606-5_Form8E.html; Workgroup: WG28682; Design ID: 312 ]

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.
**AXYS METHOD MLA-041 Rev 07**

**PERFLUORINATED ORGANICS ANALYSIS REPORT**

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Project No.**
FFI AT BURNSVILLE AND HARMONY

**Sample Collection:**
23-Apr-2009

**Contract No.:**
4095

**Lab Sample I.D.:**
WG28682-104 Y1 (MSD)

**Matrix:**
SOLID

**Sample Receipt Date:**
28-Apr-2009

**Initial Calibration Date:**
14-May-2009

**Extraction Date:**
06-May-2009

**Instrument ID:**
LC MS/MS

**Analysis Date:**
15-May-2009

**Time:**
18:23:06

**Column ID:**
C18

**Extract Volume (uL):**
4000

**Sample Data Filename:**
FC9G_182 S: 47

**Injection Volume (uL):**
15

**Blank Data Filename:**
FC9G_182 S: 28

**Dilution Factor:**
N/A

**Cal. Ver. Data Filename:**
FC9G_182 S: 20

**Concentration Units:**
ng absolute

**% Moisture:**
19.9

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<th>LABELED COMPOUNDS</th>
<th>LAB FLAG 1</th>
<th>SPIKE CONC.</th>
<th>CONC. FOUND</th>
<th>R(%) 2</th>
<th>RETENTION TIME</th>
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<tr>
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<td>8:24</td>
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</tbody>
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(1) Where applicable, custom lab flags have been used on this report.

(2) R(%) = percent recovery.

Approved by: Bryan Alonzo
QA/QC Chemist

For Axys Internal Use Only [ XSL Template: FC-Form2.xsl; Created: 08-Jun-2009 13:18:24; Application: XMLTransformer-1.9.24; Report Filename: PFC_FC_LC_PFOA_WG28682-104_Form2_FC9G_182S47_SJ1018528.html; Workgroup: WG28682; Design ID: 312 ]

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.
## PERFLUORINATED ORGANICS INITIAL CALIBRATION PERCENT RECOVERIES

**AXYS ANALYTICAL SERVICES**  
2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811  
**Initial Calibration Date:** 14-May-2009  
**Instrument ID:** LC MS/MS  
**LC Column ID:** C18

### PERCENT RECOVERY (%)

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(1) Where applicable, custom lab flags have been used on this report.

Approved by: Bryan Alonzo QA/QC Chemist

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**AXYS METHOD MLA-041 Rev 07**  

**AXYS ANALYTICAL SERVICES**  
2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

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Approved by: Bryan Alonzo QA/QC Chemist
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(1) Where applicable, custom lab flags have been used on this report.

Approved by: __________ Bryan Alonzo __________ QA/QC Chemist
# Perfluorinated Organics Initial Calibration Retention Times

**AXYS Analytical Services**  
2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811  

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<sup>1</sup> Where applicable, custom lab flags have been used on this report.

Approved by: ___________Bryan Alonzo_________ QA/QC Chemist

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### Perfluorinated Organics Calibration Verification

**AXYS METHOD MLA-041 Rev 07**  
**Form 4A**

**AXYS ANALYTICAL SERVICES**  
2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 0G2 TEL (250) 655-5800 FAX (250) 655-5811

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(1) Where applicable, custom lab flags have been used on this report.

Approved by: __________Bryan Alonzo_________ QA/QC Chemist
**AXYS METHOD MLA-041 Rev 07**

**PERFLUORINATED ORGANICS CALIBRATION VERIFICATION**

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

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Instrument ID: LC MS/MS  
Analysis Date: 15-May-2009

LC Column ID: C18  
Analysis Time: 19:59:46

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<td>8:24</td>
<td>40.0</td>
<td>43.3</td>
<td>108</td>
</tr>
<tr>
<td>PFOSA</td>
<td></td>
<td>10:01</td>
<td>19.0</td>
<td>20.4</td>
<td>107</td>
</tr>
</tbody>
</table>

(1) Where applicable, custom lab flags have been used on this report.

Approved by: Bryan Alonzo QA/QC Chemist
AXYS METHOD MLA-041 Rev 07

PERFLUORINATED ORGANICS CALIBRATION VERIFICATION

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5Z2 TEL (250) 655-5800 FAX (250) 655-5811

<table>
<thead>
<tr>
<th>LABELED COMPOUND</th>
<th>LAB FLAG ¹</th>
<th>RETENTION TIME</th>
<th>EXPECTED CONC.</th>
<th>CONC. FOUND</th>
<th>RECOVERY (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13C4-PFBA</td>
<td></td>
<td>5:22</td>
<td>12.0</td>
<td>10.5</td>
<td>87.4</td>
</tr>
<tr>
<td>13C2-PFHxA</td>
<td></td>
<td>6:26</td>
<td>12.0</td>
<td>10.7</td>
<td>88.9</td>
</tr>
<tr>
<td>13C2-PFOA</td>
<td></td>
<td>7:11</td>
<td>36.0</td>
<td>31.7</td>
<td>88.0</td>
</tr>
<tr>
<td>13C5-PFNA</td>
<td></td>
<td>7:38</td>
<td>12.0</td>
<td>10.0</td>
<td>83.7</td>
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<tr>
<td>13C2-PFDA</td>
<td></td>
<td>8:08</td>
<td>12.0</td>
<td>9.58</td>
<td>79.8</td>
</tr>
<tr>
<td>13C2-PFDoA</td>
<td></td>
<td>9:18</td>
<td>12.0</td>
<td>9.01</td>
<td>75.1</td>
</tr>
<tr>
<td>13C4-PFOS (80)</td>
<td></td>
<td>8:24</td>
<td>18.0</td>
<td>14.5</td>
<td>80.5</td>
</tr>
</tbody>
</table>

(1) Where applicable, custom lab flags have been used on this report.

Approved by: Bryan Alonzo QA/QC Chemist

For Axys Internal Use Only [ XSL Template: FC-Forms4B.xsl; Created: 08-Jun-2009 13:18:24; Application: XMLTransformer-1.9.24; Report Filename: PFOA_FC_LC_FC9G_182S52__Form4B_SJ1018532.html; Workgroup: WG28682; Design ID: 312 ]
PERFLUORINATED ORGANIC ANALYSIS

AQUEOUS SAMPLES

AXYS METHOD: MLA-060

PROJECT: FIRE FIGHTING FOAM SAMPLING AT HARMONY AND BURNSVILLE

WORK ORDER #: 34494368

Contract: 4095
Data Package Identification: DPWG29021
Analysis WG28652

9 June 2009
PERFLUORINATED ORGANIC ANALYSIS

AQUEOUS SAMPLES

AXYS METHOD: MLA-060

PROJECT: FIRE FIGHTING FOAM SAMPLING AT HARMONY AND BURNSVILLE

WORK ORDER #: 34494368

Contract: 4095
Data Package Identification: DPWG29021
Analysis WG28652

Prepared for:
Minnesota Pollution Control Agency

Prepared by:
AXYS Analytical Services Ltd.
2045 Mills Rd
Sidney, British Columbia V8L 5X2
CANADA

Contact: Angie Whetung
Project Manager

9 June 2009
MINNESOTA POLLUTION CONTROL AGENCY
AQUEOUS SAMPLES

PERFLUORINATED ORGANIC ANALYSIS
AXYS METHOD: MLA-060

Project: Fire fighting Foam Sampling at Harmony and Burnsville
Work Order #: 34494368

4095: L12607-1 to -2
9 June 2009

NARRATIVE

This narrative describes the analysis of two aqueous samples for the determination of perfluorinated organic compounds using high performance liquid chromatography/tandem mass spectrometry (HPLC/MS-MS).

SAMPLE RECEIPT AND STORAGE

The samples were received on the 28th of April 2009. Samples were logged in following the client's instructions. Details of sample conditions upon receipt are provided on the Sample Receiving Record forms included in the sample documentation section of this data package. The samples were stored at 4°C prior to extraction and analysis.

SAMPLE EXTRACTION AND ANALYSIS

The samples were analyzed in one analysis batch named PFCWG28652. Composition of the batch is shown on the Cover pages and the Batch List forms included in this data package.

Sample extraction, instrumental analysis and analyte quantification procedures were in accordance with AXYS Method MLA-060: Analytical Procedure for the Analysis of Perfluorinated Organic Compounds in Aqueous Samples by LC-MS/MS.

The samples were filtered and accurately weighed. After spiked with $^{13}$C-labelled quantification standards, the samples were extracted and cleaned up using SPE cartridges. The resulted extracts were instrumentally analyzed using liquid chromatography/mass spectrometry (LC-MS/MS). Analyte concentrations were determined by isotope dilution/internal standard quantification, comparing the area response of the quantification ion to that of the $^{13}$C-labelled standards and correcting for response factors. Quadratic quantification equations with 1/X weighting fit were determined from a multi-point calibration series prepared alongside the samples.

The sample from another MPCA project was used as matrix for MS/MSD testing to meet the contract requirement. The MS/MSD was assigned AXYS IDs WG28652-103/-104.

The reporting limit (RL) was defined as the concentration equivalent to the lowest calibration standard or the sample specific detection limit, whichever was greater.

REPORTING CONVENTIONS

The AXYS contract number assigned for internal tracking was 4095. Samples were assigned a unique laboratory identifier of the form L12607-XX, where X = numeral. All data reports reference these unique
AXYS IDs plus the client’s sample identifier. To assist with locating data, a table correlating AXYS ID with the client sample number is included in this data package.

The following laboratory qualifier flags were used in this data package:

  U = identifies a compound that was not detected.

Results are reported in concentration units of nanograms per liter (ng/L). Concentration and detection limits are provided to three significant figures. Analysis results for each sample are provided on Analysis Report form 1A and form 2.

QA/QC NOTE

Samples and QC samples analyzed in one analysis batch were carried intact through the entire analytical process. The sample data were reviewed and evaluated in relation to the batch QC samples.

  • Sample analyte concentrations are not blank corrected.
  • By virtue of the isotope dilution/internal standard quantification procedures, data are recovery corrected for possible losses during extraction and cleanup.
  • All linearity, CAL/VER, OPR and labeled compound recovery specifications were met with the following exceptions:

The highest-level calibration standard CS7 (Form 3B and 3D) in the initial calibration was excluded for $^{13}$C$_2$-PFDoA as the percent recovery was biased high. However, a minimum of 6 calibration standard points were used to construct the regression equations for quantification of target analytes or calculate response factor (RF) for quantification of labeled surrogates. As multi-point calibrations were used, sample data are deemed not to be significantly affected.

Relative Percent Difference (RPD) value (20.6%) for analyte PFDA was observed to be slightly above the contract limit of 20% between the sample MS and duplicate MS (AXYS ID: WG28652-103 and -104, respectively). Other method QC indicators showed that the method was under control, data are not considered affected by this variance.

ANALYTICAL DISCUSSION

No analytical difficulty was encountered in the analysis of the samples in this data package.

DATA PACKAGE

This data package is assigned a unique identifier, DPWG29021, shown on the cover page of the data package. Included in the data package after this narrative are the following documents:

  • Method summary
  • Sample ‘Cover Page’ and ‘Correlation Table’
  • Sample receiving documentation
  • Sample data reports (in order of AXYS Sample ID)
  • Laboratory QC data reports
Instrumental QC data reports (organized by analysis date)

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, except for the conditions detailed above. In addition, I certify, that to the best of my knowledge and belief, the data as reported are true and accurate. The following signature, on behalf of AXYS Analytical Services Ltd, authorizes the release of the data contained in this data package.

Signed: Bryan Alonzo, B.Sc, QA/QC Chemist

Date Signed: 09-Jan-09
Method MLA-060 describes the analysis of perfluorinated organic compounds (PFC) in aqueous samples. Typical quantification limits are in the range of 1 - 2 ng/L for a 0.5 L sample size.

**EXTRACTION AND CLEANUP**

Sample size may be up to 1000 mL. Samples are stored in HDPE (high density polyethylene) containers. Samples are filtered, adjusted to pH 7, spiked with surrogate standards and extracted by solid phase extraction (SPE) using weak anion exchange cartridges. Wash and elution procedures are chosen to meet various analysis requirements. The eluates are spiked with recovery standards and analyzed by HPLC-MS/MS. Calibration solutions are processed through SPE in the same way as the samples.

**QUALITY ASSURANCE / QUALITY CONTROL**

All samples are analyzed in batches. The composition of a batch is detailed on a batch sheet. Each batch has the following composition:

- **Batch Size** - Each batch consists of test samples and additional QC samples.
- **Blanks** – 5% of the samples within a batch are procedural blanks.
- **Duplicates** – 5% of the samples within a batch are analyzed in duplicate, provided there is sufficient sample.
- **Matrix Spike/Matrix Spike Duplicate** analyzed upon client request.
- **OPR (Spiked Reference Sample)** – 5% of the samples within a batch are spiked reference samples.

**QC Specification: Procedural Blank Levels and OPR Recoveries**

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Procedural Blank Level ng/sample</th>
<th>OPR Recovery Range (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfluorobutanoate</td>
<td>&lt;0.25</td>
<td>80 – 120 ^1</td>
</tr>
<tr>
<td>Perfluoropentanoate</td>
<td>&lt;0.25</td>
<td>80 – 120 ^1</td>
</tr>
<tr>
<td>Perfluorohexanoate</td>
<td>&lt;0.25</td>
<td>80 – 120 ^1</td>
</tr>
<tr>
<td>Perfluoroheptanoate</td>
<td>&lt;0.25</td>
<td>80 – 120 ^1</td>
</tr>
<tr>
<td>Compound</td>
<td>LLOQ or LOQ (μg/L)</td>
<td>LLOQ or LOQ (ppb)</td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td>--------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Perfluorooctanoate (PFOA)</td>
<td>&lt;0.25</td>
<td>80 – 120</td>
</tr>
<tr>
<td>Perfluorononanoate (PFNA)</td>
<td>&lt;0.25</td>
<td>80 – 120</td>
</tr>
<tr>
<td>Perfluorodecanoate (PFDA)</td>
<td>&lt;0.25</td>
<td>80 – 120</td>
</tr>
<tr>
<td>Perfluoroundecanoate (PFUnA)</td>
<td>&lt;0.25</td>
<td>80 – 120</td>
</tr>
<tr>
<td>Perfluorododecanoate (PFDoA)</td>
<td>&lt;0.25</td>
<td>80 – 120</td>
</tr>
<tr>
<td>Perfluorobutanesulfonate (PFBS)</td>
<td>&lt;0.25</td>
<td>70 - 130</td>
</tr>
<tr>
<td>Perfluorohexanesulfonate (PFHxS)</td>
<td>&lt;0.25</td>
<td>70 – 130</td>
</tr>
<tr>
<td>Perfluorooctanesulfonate (PFOS)</td>
<td>&lt;0.25</td>
<td>70 – 130</td>
</tr>
<tr>
<td>Perfluorooctane sulfonamide (PFOSA)</td>
<td>&lt;0.25</td>
<td>70 – 130</td>
</tr>
</tbody>
</table>

1. Additional criteria – recovery for 2 compounds may be 75-125% and for one compound 70-130%
2. For results reported to higher reporting limits, the blank acceptance limit is equal to the reporting limit. Higher blank may be accepted where sample concentrations exceed blank levels by >x10.

**QC Specification: Surrogate Standard Recoveries (Calibration Solutions and Samples)**

<table>
<thead>
<tr>
<th>Surrogate Standard</th>
<th>Recovery Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>$^{13}$C4-Heptafluorobutyric acid ($^{13}$C4-PFBA)</td>
<td>20 - 150%</td>
</tr>
<tr>
<td>$^{13}$C2-Perfluorocaproic acid ($^{13}$C2-PFHxA)</td>
<td>40 - 150%</td>
</tr>
<tr>
<td>$^{13}$C2-Perfluoroctanoic acid ($^{13}$C2-PFOA)</td>
<td>40 - 150%</td>
</tr>
<tr>
<td>$^{13}$C5-Heptadecafluorononanoic acid ($^{13}$C5-PFNA)</td>
<td>40 - 150%</td>
</tr>
<tr>
<td>$^{13}$C2-Perfluorodecanoic acid ($^{13}$C2-PFDA)</td>
<td>40 - 150%</td>
</tr>
<tr>
<td>$^{13}$C2-Perfluoro-n-(1,2)decanoic acid ($^{13}$C2-PFDoA)</td>
<td>40 - 150%</td>
</tr>
<tr>
<td>$^{13}$C4-Perfluorooctanesulfonate ($^{13}$C4-PFOS)</td>
<td>40 - 150%</td>
</tr>
<tr>
<td>d7-N-Me-Perfluoro-1-octanesulfonamidoethanol (d7-MeFOSE)</td>
<td>40 - 150%</td>
</tr>
</tbody>
</table>

2. Lower recoveries may be accepted based on application and professional judgment

**QC Specification Table: Other Parameters**

<table>
<thead>
<tr>
<th>QC Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Calibration (native compounds)</td>
<td>Run initially, and as required to maintain calibration verification and instrument sensitivity. (1/x) weighted quadratic, exclude origin. Calculated conc. 75-125 % of actual (lowest cal may be 70-130%), R^2 &gt; 0.990</td>
</tr>
<tr>
<td>Continuing Calibration Verification (native compounds)</td>
<td>Run every 20 samples or more frequently, quantify against I-CAL. Calculated conc. 70-130% actual for a maximum of three compounds with the remainder 80 –120 % of actual</td>
</tr>
<tr>
<td>Instrumental Carryover and Instrument Background</td>
<td>Every Initial Calibration, Cal/Ver, or SPM: &lt; 0.3 % carryover and area response of analytes in instrument blank &lt; 800 judged following two previous methanol blank injections.</td>
</tr>
<tr>
<td>Duplicate Samples or MS/MSD</td>
<td>If conc. &gt; 5 times R.L., RPD &lt; 40%</td>
</tr>
<tr>
<td></td>
<td>If conc. &lt; 5 times R.L., difference between pairs &lt; R.L.</td>
</tr>
</tbody>
</table>
ANALYSIS BY LC-MS/MS

Analysis of sample extracts for perfluorinated organics by HPLC-MS/MS is performed on a high performance liquid chromatograph coupled to a triple quadrupole mass spectrometer. The MS is run at unit mass resolution in the Multiple Reaction Monitoring (MRM) mode.

Instrument specifications:

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Waters 2690 or Waters 2795 HPLC, Micromass Quattro Ultima MS/MS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LC Column</td>
<td>Waters Xtera C18MS Reverse Phase C18, 10.0 cm, 2.1 mm i.d., 3.5 µm particle size (or equivalent)</td>
</tr>
<tr>
<td>Ionization</td>
<td>Negative Ion Electrospray</td>
</tr>
<tr>
<td>Acquisition</td>
<td>MRM mode, unit resolution</td>
</tr>
<tr>
<td>Injection Volume</td>
<td>15 µL</td>
</tr>
</tbody>
</table>

LC-MS/MS Operating Conditions:

<table>
<thead>
<tr>
<th>LC Gradient Program</th>
<th>General LC Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (min)</td>
<td>Flow mixture(^1)</td>
</tr>
<tr>
<td>0.0</td>
<td>15% solvent A 85% solvent B</td>
</tr>
<tr>
<td>1.0</td>
<td>15% solvent A 85% solvent B</td>
</tr>
<tr>
<td>5.0</td>
<td>70% solvent A 30% solvent B</td>
</tr>
<tr>
<td>8.5</td>
<td>100% solvent A</td>
</tr>
<tr>
<td>11</td>
<td>100% solvent A</td>
</tr>
<tr>
<td>11.3 - 14.5</td>
<td>15% solvent A 85% solvent B</td>
</tr>
</tbody>
</table>

\(^1\) Eluent A = 90% CH₃CN (aqueous), Eluent B = 12.1 mM NH₄OAc in 0.1% AcOH (aqueous)

Initial calibration of the LC-MS/MS instrument is performed by the analysis of six or more calibration solutions. A mid-level calibration standard is analyzed to verify the initial calibration after every 20th sample (including QC samples) injected at a minimum. All calibration solutions go through the same SPE extraction/cleanup procedures as the samples.
**ANALYTE IDENTIFICATION**

Positive identification of target PFC, surrogate standard and recovery standards require:

- > 3:1 S:N for parent ion to daughter ion transition.
- Compound retention time falls within 0.4 minutes of the predicted retention times from the mean determined from the Initial Calibration. Natives with labelled surrogate standards must elute within 0.1 minutes of the associated labelled surrogates. Typical retention times are shown in Table 9.

**QUANTIFICATION AND DATA REPORTING PROCEDURES**

Target compounds are quantified using the internal standard method, comparing the area of the quantification ion to that of the $^{13}$C-labelled standard and correcting for response factors.

Quadratic calibration equations are determined from a multi-point calibration series with 1/X weighing fit as described by the following general equation:

$$ Y = a + bX + cX^2 $$

( general quadratic equation)

Where  

- $Y = (\text{area target}/\text{area surr}) \times \text{weight surr}$
- $X = \text{weight target}$
- $a,b,c$ are empirical constants

Concentrations in samples are determined as:

$$ \text{Sample Conc} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2c \times \text{sample size}} \left( a - \left( \frac{\text{area of target}}{\text{area of surr}} \times \text{weight surr} \right) \right) $$

The recovery of the surrogate standard is calculated (by internal standard quantification against the recovery standard using an average RRF) and monitored as an indication of overall data quality. Final target concentrations are recovery corrected by this method of quantification.

Sample Specific Detection Limits (SDL) are determined by converting the area equivalent of 3.0 times the estimated chromatographic noise height to a concentration in the same manner that target peak responses are converted to final concentrations. The SDL accounts for any effect of matrix on the detection system and for recovery achieved through the analytical work-up.

Results are reported to the greater of the SDL or the concentration equivalent to the lowest calibration standard analyzed.
Table 9. Analytes, Ions and Quantification References

<table>
<thead>
<tr>
<th>Target Analyte</th>
<th>Typical Retention Time (minutes)</th>
<th>Parent Ion Mass</th>
<th>Daughter Ion Mass</th>
<th>Quantified Against</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target Analytes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perfluorobutanoate (PFBA)</td>
<td>5.0</td>
<td>213</td>
<td>169</td>
<td>$^{13}\text{C}_4$-PFBA</td>
</tr>
<tr>
<td>Perfluoropentanoate (PFPeA)</td>
<td>5.8</td>
<td>263</td>
<td>219</td>
<td>$^{13}\text{C}_2$-PFHxA</td>
</tr>
<tr>
<td>Perfluorohexanoate (PFHxA)</td>
<td>6.2</td>
<td>313</td>
<td>269</td>
<td>$^{13}\text{C}_2$-PFHxA</td>
</tr>
<tr>
<td>Perfluoroheptanoate (PFHpA)</td>
<td>6.6</td>
<td>363</td>
<td>319</td>
<td>$^{13}\text{C}_2$-PFHxA</td>
</tr>
<tr>
<td>Perfluorooctanoate (PFOA)</td>
<td>7.0</td>
<td>413</td>
<td>369 / 219</td>
<td>$^{13}\text{C}_2$-PFOA</td>
</tr>
<tr>
<td>Perfluororononanoate (PFNA)</td>
<td>7.4</td>
<td>463</td>
<td>419</td>
<td>$^{13}\text{C}_5$-PFNA</td>
</tr>
<tr>
<td>Perfluorodecanoate (PFDA)</td>
<td>7.9</td>
<td>513</td>
<td>469</td>
<td>$^{13}\text{C}_2$-PFDA</td>
</tr>
<tr>
<td>Perfluoroundecanoate (PFUnA)</td>
<td>8.5</td>
<td>563</td>
<td>519</td>
<td>$^{13}\text{C}_2$-PFDA</td>
</tr>
<tr>
<td>Perfluorododecanoate (PFDoA)</td>
<td>9.0</td>
<td>613</td>
<td>569</td>
<td>$^{13}\text{C}_2$-PFDoA</td>
</tr>
<tr>
<td>Perfluorobutanesulfonate (PFBS)</td>
<td>6.3</td>
<td>299</td>
<td>80 / 99</td>
<td>$^{13}\text{C}_4$-PFOS</td>
</tr>
<tr>
<td>Perfluorohexanesulfonate (PFHxS)</td>
<td>7.2</td>
<td>399</td>
<td>80 / 99</td>
<td>$^{13}\text{C}_4$-PFOS</td>
</tr>
<tr>
<td>Perfluoroctane sulfonate (PFOS)</td>
<td>8.2</td>
<td>499</td>
<td>80 / 99</td>
<td>$^{13}\text{C}_4$-PFOS</td>
</tr>
<tr>
<td>Perfluoroctane sulfonamide (PFOSA)</td>
<td>9.9</td>
<td>498</td>
<td>78</td>
<td>$^{13}\text{C}_4$-PFOS</td>
</tr>
<tr>
<td><strong>Surrogate Standard</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$^{13}\text{C}_4$-Heptafluorobutyric acid ($^{13}\text{C}_4$-PFBA)</td>
<td>5.0</td>
<td>217</td>
<td>172</td>
<td>$^{13}\text{C}_2$-FOUEA</td>
</tr>
<tr>
<td>$^{13}\text{C}_2$-Perfluorocaproic acid ($^{13}\text{C}_2$-PFHxA)</td>
<td>6.2</td>
<td>315</td>
<td>270</td>
<td>$^{13}\text{C}_2$-FOUEA</td>
</tr>
<tr>
<td>$^{13}\text{C}_2$-Perfluorooctanoic acid ($^{13}\text{C}_2$-PFOA)</td>
<td>7.0</td>
<td>415</td>
<td>370</td>
<td>$^{13}\text{C}_4$-PFOA</td>
</tr>
<tr>
<td>$^{13}\text{C}_2$-Heptadecafluorononanoic acid ($^{13}\text{C}_9$-PFNA)</td>
<td>7.4</td>
<td>470</td>
<td>423</td>
<td>$^{13}\text{C}_2$-FOUEA</td>
</tr>
<tr>
<td>$^{13}\text{C}_2$-Perfluorodecanoic acid ($^{13}\text{C}_2$-PFDA)</td>
<td>7.9</td>
<td>515</td>
<td>470</td>
<td>$^{13}\text{C}_2$-FOUEA</td>
</tr>
<tr>
<td>$^{13}\text{C}_2$-Perfluoro-n-(1,2)decanoic acid ($^{13}\text{C}_2$-PFDoA)</td>
<td>9.0</td>
<td>615</td>
<td>570</td>
<td>$^{13}\text{C}_2$-FOUEA</td>
</tr>
<tr>
<td>$^{13}\text{C}_4$-Perfluoroctanesulfonate ($^{13}\text{C}_4$-PFOS)</td>
<td>8.2</td>
<td>503</td>
<td>80 / 99</td>
<td>$^{13}\text{C}_2$-FOUEA</td>
</tr>
<tr>
<td>d7-N-Me-Perfluoro-1-octanesulfonamidoethanol (d7-Me-FOSE)</td>
<td>~10.6</td>
<td>623</td>
<td>59</td>
<td>$^{13}\text{C}_2$-FOUEA</td>
</tr>
<tr>
<td><strong>Recovery Standard</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$^{13}\text{C}_2$-2H-Perfluoro-2-decenoic acid ($^{13}\text{C}_2$-FOUEA)</td>
<td>7.3</td>
<td>459</td>
<td>394</td>
<td>-</td>
</tr>
<tr>
<td>$^{13}\text{C}_2$-Perfluorooctanoic acid ($^{13}\text{C}_4$-PFOA)</td>
<td>6.9</td>
<td>417</td>
<td>372</td>
<td>-</td>
</tr>
</tbody>
</table>

1 Quantification is based on m/z 80 daughter, m/z 99 may be used as alternate if necessary to avoid interference.

2 PFOSA quantified against d7-Me-FOSE if collected in separate fraction.
<table>
<thead>
<tr>
<th>Lab Name: AXYS Analytical Services Ltd.</th>
<th>Project Manager: Angie Whetung</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Name: FIRE FIGHTING FOAM SAMPLING AT HARMONY AND BURNSVILLE</td>
<td>Contract No: 4095</td>
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<tr>
<td>Work Order #: 34494368</td>
<td>AXYS Method: MLA-060</td>
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<td>Data Package Identification: DPWG29021</td>
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<table>
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<tr>
<th>Client Sample No.</th>
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<tbody>
<tr>
<td>LAB BLANK</td>
<td>WG28652-101</td>
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<tr>
<td>OPR</td>
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<tr>
<td>MATRIX SPIKE</td>
<td>WG28652-103</td>
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<tr>
<td>MATRIX SPIKE DUPLICATE</td>
<td>WG28652-104</td>
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<tr>
<td>Harmony B-1 GW</td>
<td>L12607-1</td>
</tr>
<tr>
<td>Harmony B-2 GW</td>
<td>L12607-2</td>
</tr>
</tbody>
</table>
# Chain of Custody

**Company:** Delta MPCA  
**Address:** 2410 Rice Creek Pkwy 520 La Fayette Rd Suite #26  
**City:** St. Paul, MN  
**Phone:** 651.296.9707  
**Fax:** 651.296.9707  
**E-mail:** nile.fellows@state.mn.us  
**Project Name/Number:** 19382-DEL

## Client Sample Identification

<table>
<thead>
<tr>
<th>Matrix</th>
<th>Sampling Date</th>
<th>Sampling Time</th>
<th>Container Type/No.</th>
<th>AXYS Lab Sample ID (Lab use only)</th>
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<tbody>
<tr>
<td>Harmony B-1 SL 4-4'</td>
<td>4/23/9</td>
<td>9:06</td>
<td>250 mL</td>
<td>L2606-1</td>
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<tr>
<td>Harmony B-1 SL 4-8'</td>
<td>4/23/9</td>
<td>9:06</td>
<td>250 mL</td>
<td>L2606-1</td>
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<tr>
<td>Harmony B-2 SL 0-4'</td>
<td>4/13/9</td>
<td>10:15</td>
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<tr>
<td>Harmony B-2 SL 4-8'</td>
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<tr>
<td>Harmony B-3 SL 0-4'</td>
<td>4/13/9</td>
<td>12:05</td>
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<tr>
<td>Harmony B-3 SL 4-8'</td>
<td>4/13/9</td>
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<tr>
<td>Harmony B-4 SL 0-4'</td>
<td>4/13/9</td>
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<td>Harmony B-4 SL 4-8'</td>
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## Requisitioned by (Signature):  
**Date:** 4/27/9  
**Time:** 9:00 AM

## Received by (Signature):  
**Date:** 28 Apr 09  
**Time:** 11:00

## Remarks

- **Temp °C:**  
- **Custody Seal #:**  
- **Seal Intact:** Y / N  
- **Sample Tags:** Y / N
### Chain of Custody

**AXYS CLIENT #: 4095**

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<tr>
<th>REPORT TO:</th>
<th>INVOICE TO:</th>
<th>ANALYSIS REQUESTED</th>
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<tbody>
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<tr>
<td><strong>Phone</strong></td>
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<tr>
<td><strong>E-mail</strong></td>
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<td><strong>Contact</strong></td>
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<table>
<thead>
<tr>
<th>Project Name/Number:</th>
<th>Sampler’s Name</th>
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<tbody>
<tr>
<td>Fire Foam Sampling - Burnsville</td>
<td>Curt McKay</td>
<td>Curt McKay</td>
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<table>
<thead>
<tr>
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<th>Sampling Time</th>
<th>Container</th>
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<tr>
<td>Burnsville B-1 SL 0-4'</td>
<td>Soil</td>
<td>4/24/19</td>
<td>8:50</td>
<td>250 mL</td>
<td>L2606 - 9</td>
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<td>Burnsville B-1 SL 4-8'</td>
<td>I</td>
<td>4/24/19</td>
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<td>I</td>
<td>-10</td>
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<tr>
<td>Burnsville B-2 SL 0-4'</td>
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<tbody>
<tr>
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<tr>
<td>M. Magli</td>
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<tbody>
<tr>
<td></td>
<td>Y / N</td>
<td>Y / N</td>
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</tbody>
</table>

**Contact:** analytical@axys.com
FedEx International Air Waybill

Not all services and options are available to all destinations.

From
Date 04/27/09
Sender's Name CURT MCKAY Phone 661.241.3900
Company DELTA
Address 9410 Rice Creek Pkwy
City Shoreview
Province MN CANADA Postal Code 55112

To
Recipient's Name Phone 605.556.00
Company ARYS ANALYTICAL SERVICES
Address
City SIOUX FALLS
State SD
Country USA
ZIP Postal Code 57068

Shipment Information
Total Packages 34
Total Weight 13.0 lbs.

Commodity Description
2X1L HDPE Bottle, Contain. Concentrator
12X250mL HDPE Bottle, Contain. EDC

Country of Manufacture none
Value for Customs Declaration none

Payment
Bill transportation charges to

Signature

Required Signature

Amount Due

Authorized FedEx Agent

Tracking Number

512 04/27/09

Recipient's Signature

Recipient's Company

Date 04/27/09

Shipper's Signature

Date 04/27/09

Recipient's Company

Date 04/27/09

Shipper's Signature

Date 04/27/09
**AXYS Analytical Services Ltd**  
**SAMPLE RECEIVING RECORD**

<table>
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<td>28-APR-09 11:00</td>
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<tr>
<td>AXYS Client &amp; Contract #</td>
<td>4095-Minnesota Pollution Control</td>
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<td>MMASLIN</td>
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<td>Signature</td>
<td>MMASLIN</td>
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<td>Axys Sample ID's</td>
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<tr>
<td>Matrix Type</td>
<td>2 water, 13 seds</td>
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<td>Condition of Shipping Container:</td>
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<td>lots of wet ice present</td>
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<td>Yes/No</td>
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<td>Sample Tag Numbers</td>
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<td>Sample Type</td>
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<td>Preservative Added</td>
<td>Yes/No</td>
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<td>Preservation Requested</td>
<td>Yes/No</td>
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<tr>
<td>Comments:</td>
<td>All samples logged in as per coc with site name at beginning.</td>
</tr>
<tr>
<td>Action Taken:</td>
<td>Contacted P.M.</td>
</tr>
<tr>
<td></td>
<td>see client email regarding client ID login protocol. W28AP09</td>
</tr>
<tr>
<td></td>
<td>use coc provided as site name + sample id</td>
</tr>
</tbody>
</table>

Contact: analytical@axys.com
<table>
<thead>
<tr>
<th>Axys ID versus Client Sample Identification</th>
<th>Received</th>
<th>Due</th>
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<tbody>
<tr>
<td>L12606-1</td>
<td>28-APR-09</td>
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<tr>
<td>Harmony B-1 SL 0-4'</td>
<td>Storage: wif-4, floor</td>
<td>Permit #: P-2009-01078</td>
<td></td>
</tr>
<tr>
<td>23-APR-09 09:05</td>
<td>Project #: NILE FELLOWS</td>
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<tr>
<td>Solid</td>
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<tr>
<td>EDataDeliv</td>
<td>PFC EDD</td>
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<tr>
<td>D.Package</td>
<td>PFOS DATA PKG</td>
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<tr>
<td>ANY</td>
<td>SAMPLE RECEIPT</td>
<td>1 : 250 mL plastic</td>
<td>USD</td>
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</table>

| L12606-2                                   | 28-APR-09|     |     |
| Harmony B-1 SL 4-8'                         | Storage: wif-4, floor | Permit #: P-2009-01078 |
| 23-APR-09 09:20                            | Project #: NILE FELLOWS |
| Solid                                      | 2:MOISTURE | : | USD |
| Solid                                      | 5:MOISTURE | : | USD |
| Solid                                      | HOMOGENIZATION | : | USD |
| Solid                                      | PERFLUORO ORG (LC) | : | USD |
| Solid                                      | PFC PRESCREEN (LC) | : | USD |
| EDataDeliv                                 | PFC EDD | : | USD |
| D.Package                                  | PFOS DATA PKG | : | USD |
| ANY                                        | SAMPLE RECEIPT | 1 : 250 mL plastic | USD |

<p>| L12606-3                                   | 28-APR-09|     |     |
| Harmony B-2 SL 0-4'                         | Storage: wif-4, floor | Permit #: P-2009-01078 |
| 23-APR-09 10:15                            | Project #: NILE FELLOWS |
| Solid                                      | 2:MOISTURE | : | USD |
| Solid                                      | 5:MOISTURE | : | USD |
| Solid                                      | HOMOGENIZATION | : | USD |
| Solid                                      | PERFLUORO ORG (LC) | : | USD |
| Solid                                      | PFC PRESCREEN (LC) | : | USD |
| EDataDeliv                                 | PFC EDD | : | USD |
| D.Package                                  | PFOS DATA PKG | : | USD |
| ANY                                        | SAMPLE RECEIPT | 1 : 250 mL plastic | USD |</p>
<table>
<thead>
<tr>
<th>Axys ID versus Client Sample Identification</th>
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<tr>
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<tr>
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Storage: wif-4, floor
Project #: NILE FELLOWS

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|               | Solid 5:MOISTURE              |          | USD  |    |
|               | Solid HOMOGENIZATION          |          | USD  |    |
|               | Solid PERFLUORO ORG (LC)      |          | USD  |    |
|               | Solid PFC PRESCREEN (LC)      |          | USD  |    |
|               | EDataDeliv PFC EDD            |          | USD  |    |
|               | D.Package PFOS DATA PKG       |          | USD  |    |
|               | ANY SAMPLE RECEIPT            |          | USD  |    |

Storage: wif-4, floor
Project #: NILE FELLOWS

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|               | Solid HOMOGENIZATION          |          | USD  |    |
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|               | Solid PFC PRESCREEN (LC)      |          | USD  |    |
|               | EDataDeliv PFC EDD            |          | USD  |    |
|               | D.Package PFOS DATA PKG       |          | USD  |    |
|               | ANY SAMPLE RECEIPT            |          | USD  |    |

Storage: wif-4, floor
Project #: NILE FELLOWS
### AXYS Analytical Services Ltd.

**Login Chain of Custody Report (L001)**  
**May, 01, 2009**  
**11:59 AM**

**Login Number:**  L12607  
**Account:** 4095  
**Project:** NILE FELLOWS

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<td>USD</td>
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| L12607-2     |                            |          | 28-APR-09 |    |
| Harmony B-2 GW|                            |          |       |    |
| 23-APR-09 10:50|                            | Project #: NILE FELLOWS |    |
| EDataDeliv   | PFC EDD                    |          | USD |    |
| D.Package    | PFOS DATA PKG              |          | USD |    |
| Aqueous      | PFC (V3)                   |          | USD |    |
| Aqueous      | PFC PRESCREEN (LC)         |          | USD |    |
| ANY          | SAMPLE RECEIPT             | 1        | 1 L plastic | USD |

---

*for scanning only*
Hi Nile,

The sample bottles have SL incorporated into the name but do not appear on the COC. We have used the COC with the protocol as previously discussed.

Cheers,
Angie

That is fine with me. I will confirm with Delta for future samples.

Nile, we will proceed with this protocol for logging in your samples into our system. Please confirm.

Thanks Nancy.

Nile: Please advise, in order to differentiate between Client IDs, I would recommend using the Site name + Sample ID. I can see that similar naming for depths have been sampled from each site. Would this be feasible nomenclature for your samples going forward to use Site name + sample ID for the client IDs in our system? For example: Burnsville B-1,0-4 ft.
Please let me know if this is feasible.

Thanks, 
Angie

-----Original Message-----
From: Nancy Rodning [mailto:nrodnig@deltaenv.com]
Sent: Tuesday, April 28, 2009 12:48 PM
To: Angelica Whetung
Cc: Fellows, Nile; Curt McKay
Subject: RE: Drill schedule for fire training sites.

Angie, here are the chains of custody for the PFC samples from the Harmony and Burnsville sites. As soon as I can I will email you the original COCs and then send them via FedEx.

Again, my apologies and thank you for your understanding.

Nancy

From: Angelica Whetung [mailto:aWhetung@axys.com]
Sent: Tuesday, April 28, 2009 2:15 PM
To: Nancy Rodning
Subject: RE: Drill schedule for fire training sites.

Hi Nancy,

Please find the chain of custody word document to fill out for these samples. I have attached instructions as well for your records. Please let me know if you have any questions.

Cheers,
Angie

-----Original Message-----
From: Nancy Rodning [mailto:nrodnig@deltaenv.com]
Sent: Tuesday, April 28, 2009 11:52 AM
To: Angelica Whetung
Subject: RE: Drill schedule for fire training sites.

I am terribly sorry! Curt, the guy who did the field work, has been doing this for 10+ years, I am so surprised. He is in the field today, I just left him a message to call me. I looked on his desk, but didn't see the paperwork. I'll get back to you as soon as I can.

Nancy

From: Angelica Whetung [mailto:aWhetung@axys.com]
Sent: Tuesday, April 28, 2009 1:38 PM
To: Nancy Rodning
Cc: Nile.Fellows@state.mn.us
Subject: RE: Drill schedule for fire training sites.
Importance: High

Hi Nancy,

Can you please send us a Chain of Custody document via e-mail or fax? We received the coolers of samples today with no COC documentation.
Thank you,
Angie

-----Original Message-----
From: Angelica Whetung
Sent: Tuesday, April 28, 2009 9:52 AM
To: 'Nancy Rodning'
Subject: RE: Drill schedule for fire training sites.

Hi Nancy, thank you.

Please remind them when they do ship samples to e-mail me with the FedEx waybill #s when they ship samples. It helps us track the shipments and work with FedEx when there are delays in order to get the samples safely to AXYS.

Thanks,
Angie

Angelica Whetung, BSc., CEP
Project Manager
AXYS Analytical Services Ltd.
2045 Mills Road West
Sidney, BC V8L 5X2
Tel (250) 655-5800
Direct Tel (250) 655-5836

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If you have received this email in error please notify us immediately, by return email, and delete this email.

-----Original Message-----
From: Nancy Rodning [mailto:nrodney@deltaenv.com]
Sent: Tuesday, April 28, 2009 9:43 AM
To: Angelica Whetung
Subject: RE: Drill schedule for fire training sites.

Angie, I sent your request on to Curt McKay, our field tech who shipped the samples. But I believe he is in the field today. I'll see what I can do to get you those tracking #s today.

Nancy

-----Original Message-----
From: Angelica Whetung [mailto:a Whetung@axys.com]
Sent: Tuesday, April 28, 2009 11:35 AM
To: Nancy Rodning
Subject: RE: Drill schedule for fire training sites.

Hi Nancy,

Can you please let me know the FedEx numbers for the shipments so I can track them? Did you send these yesterday?

Thanks,
Angie

28/04/2009
Hi Nancy and Nile,

I will change the documentation for the samples to include SL and GW in the sample IDs and resend Nile the sample Acknowledgements.

Thank you,
Angie

-----Original Message-----
From: Nancy Rodning [mailto:nrodnig@deltaenv.com]
Sent: Thursday, April 30, 2009 12:38 PM
To: Angelica Whetung
Cc: Fellows, Nile
Subject: COCs for Burnsville and Harmony

Hello Angelica,

Attached are scanned copies of the original COCs for the PFC soil and groundwater samples collected at the Burnsville and Harmony sites. We will overnight via FedEx the originals to your attention.

Nancy Rodning
Project Geologist
DELTA CONSULTANTS
5910 Rice Creek Parkway, Suite 100
Shoreview, MN 55126
nrodnig@deltaenv.com
(651)697-5152 direct
(800)477-7411 toll free
(651)639-9473 fax
www.deltaenv.com

Member of Inogen
www.inogenlf.com

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AXYS METHOD MLA-060 Rev 07

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 4095

Matrix: AQUEOUS
Sample Collection: 23-Apr-2009 10:00

Sample Receipt Date: 28-Apr-2009
Initial Calibration Date: 07-May-2009
Extraction Date: 01-May-2009
Analysis Date: 08-May-2009

Extract Volume (uL): 4000
Injection Volume (uL): 15

Concentration Units: ng/L

Lab Sample I.D.: L12607-1

Sample Data Filename: FC9G_168 S: 31
Blank Data Filename: FC9G_168 S: 25
Cal. Ver. Data Filename: FC9G_168 S: 17

Column ID: C18

COMPOUND LAB FLAG 1 CONC. FOUND DETECTION LIMIT RETENTION TIME

PFBA 7.30 2.49 5:20
PFPeA 3.27 2.49 6:05
PFHxA 2.67 2.49 6:26
PFHpA U 2.49
PFOA 7.00 2.49 7:11
PFNA U 2.49
PFDA U 2.49
PFUnA U 2.49
PFDoA U 2.49
PFBS U 4.98
PFHxS U 4.98
PFOS 8.33 4.98 8:15
PFOSA U 2.49

(1) Where applicable, custom lab flags have been used on this report; U = not detected.

Approved by: __________ Bryan Alonzo_________ QA/QC Chemist

For Axys Internal Use Only [ XSL Template: FC-Form1A.xsl; Created: 08-Jun-2009 09:15:35; Application: XMLTransformer-1.9.24; Report Filename: PFC_FC_LC_PFOA_L12607-1_Form1A_FC9G_168S31_SJ1018000.html; Workgroup: WG28652; Design ID: 312 ]

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.
Where applicable, custom lab flags have been used on this report.

R(%) = percent recovery.

Approved by: Bryan Alonzo QA/QC Chemist

For Axys Internal Use Only [ XSL Template: FC-Form2.xsl; Created: 08-Jun-2009 09:15:35; Application: XMLTransformer-1.9.24; Report Filename: PFC_FC_LC_PFOA_L12607-1_Form2_FC9G_168S31_SJ1018000.html; Workgroup: WG28652; Design ID: 312 ]

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.
**AXYS METHOD MLA-060 Rev 07**

**PERFLUORINATED ORGANICS ANALYSIS REPORT**

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Contract No.:** 4095  
**Lab Sample I.D.:** L12607-2

**Matrix:** AQUEOUS  
**Sample Size:** 0.508 L

**Sample Receipt Date:** 28-Apr-2009  
**Initial Calibration Date:** 07-May-2009

**Extraction Date:** 01-May-2009  
**Instrument ID:** LC MS/MS

**Analysis Date:** 08-May-2009  
**Column ID:** C18

**Extract Volume (uL):** 4000  
**Sample Data Filename:** FC9G_168 S: 32

**Injection Volume (uL):** 15  
**Blank Data Filename:** FC9G_168 S: 25

**Concentration Units:** ng/L

**COMPONENT**  
**LAB FLAG**  
**CONC. FOUND**  
**DETECTION LIMIT**  
**RETENTION TIME**

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(1) Where applicable, custom lab flags have been used on this report; U = not detected.

Approved by: Bryan Alonzo QA/QC Chemist
### LABELED COMPOUND ANALYSIS

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(1) Where applicable, custom lab flags have been used on this report.
(2) R(%) = percent recovery.

Approved by: __________ Bryan Alonzo __________ QA/QC Chemist
### PERFLUORINATED ORGANICS ANALYSIS REPORT

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Contract No.:** 4095  
**Lab Blank**  
**Sample Collection:** N/A

**Matrix:** AQUEOUS  
**Sample Size:** 0.500 L

**Sample Receipt Date:** N/A  
**Initial Calibration Date:** 07-May-2009

**Extraction Date:** 01-May-2009  
**Instrument Calibration:** LC MS/MS

**Analysis Date:** 08-May-2009 **Time:** 04:08:45  
**Column ID:** C18

**Extract Volume (uL):** 4000  
**Sample Data Filename:** FC9G_168 S: 25

**Injection Volume (uL):** 15  
**Blank Data Filename:** FC9G_168 S: 25

**Dilution Factor:** N/A  
**Cal. Ver. Data Filename:** FC9G_168 S: 17

**Concentration Units:** ng/L

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(1) Where applicable, custom lab flags have been used on this report; U = not detected.

**Approved by:** Bryan Alonzo QA/QC Chemist

---


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**Labeled Compound** | **Lab Flag** | **Spike Conc.** | **Conc. Found** | **R(%)** | **Retention Time**
--- | --- | --- | --- | --- | ---
13C4-PFBA | 1 | 12.0 | 13.2 | 110 | 5.19
13C2-PFHxA | 2 | 12.0 | 13.6 | 114 | 6.26
13C2-PFOA | 3 | 36.0 | 34.5 | 95.8 | 7.11
13C5-PFNA | 4 | 12.0 | 12.6 | 105 | 7.35
13C2-PFDA | 5 | 12.0 | 12.1 | 101 | 8.05
13C2-PFDoA | 6 | 12.0 | 13.6 | 114 | 9.16
13C4-PFOS (80) | 7 | 18.0 | 22.8 | 127 | 8.24

(1) Where applicable, custom lab flags have been used on this report.
(2) R(%) = percent recovery.

Approved by: __________ Bryan Alonzo __________ QA/QC Chemist

For Axys Internal Use Only [ XSL Template: FC-Form2.xsl; Created: 08-Jun-2009 09:15:35; Application: XMLTransformer-1.9.24; Report Filename: PFC_FC_LC_PFOA_WG28652-101_Form2_FC9G_168S25_SJ1017986.html; Workgroup: WG28652; Design ID: 312 ]

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### AXYS METHOD MLA-060 Rev 07

**PERFLUORINATED ORGANICS ONGOING PRECISION AND RECOVERY (OPR)**

**AXYS ANALYTICAL SERVICES**

2045 MILLS RD., SIDNEY, B.C., CANADA

V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Contract No.:** 4095  
**Lab Sample I.D.:** WG28652-102

**Matrix:** AQUEOUS  
**Initial Calibration Date:** 07-May-2009

**Extraction Date:** 01-May-2009  
**Instrument ID:** LC MS/MS

**Analysis Date:** 08-May-2009 Time: 02:13:14  
**Column ID:** C18

**Extract Volume (uL):** 4000  
**OPR Data Filename:** FC9G_168 S: 19

**Injection Volume (uL):** 15  
**Blank Data Filename:** FC9G_168 S: 25

**Dilution Factor:** N/A  
**Cal. Ver. Data Filename:** FC9G_168 S: 17

*ALL CONCENTRATIONS REPORTED ON THIS FORM ARE CONCENTRATIONS IN EXTRACT, BASED ON A 1 mL EXTRACT VOLUME.*

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<th>CONC. FOUND (ng/mL)</th>
<th>% RECOVERY</th>
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(1) Where applicable, custom lab flags have been used on this report.

**Approved by:** Bryan Alonzo  
**QA/QC Chemist**


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PERFLUORINATED ORGANICS ONGOING PRECISION AND RECOVERY (OPR)

ALL CONCENTRATIONS REPORTED ON THIS FORM ARE CONCENTRATIONS IN EXTRACT, BASED ON A 1 mL EXTRACT VOLUME.

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(1) Where applicable, custom lab flags have been used on this report.

Approved by: ____________Bryan Alonzo__________ QA/QC Chemist

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AXYS METHOD MLA-060 Rev 07

AXYS ANALYTICAL SERVICES
2045 MILL RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5809 FAX (250) 655-5811

Contact: analytical@axys.com

Form 8C
PERFLUORINATED ORGANICS MATRIX SPIKE (MS)
ANALYSIS REPORT

Project No. 

Lab Sample I.D.: WG28652-103 (MS)

Sample Size: 0.510 L

Initial Calibration Date: 07-May-2009

Instrument ID: LC MS/MS

GC Column ID: C18

MS Data Filename: FC9G_168 S: 35

Blank Data Filename: FC9G_168 S: 25

Cal. Ver. Data Filename: FC9G_168 S: 17

ALL CONCENTRATIONS REPORTED ON THIS FORM ARE CONCENTRATIONS ON SAMPLE SIZE BASIS

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<th>SAMPLE LAB FLAG ¹</th>
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<th>CONC. FOUND (ng/L)</th>
<th>MS R% ²</th>
<th>REL % DIFF</th>
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</tbody>
</table>

(1) Where applicable, custom lab flags have been used on this report; U = not detected.
(2) R% = percent recovery.

Approved by: Bryan Alonzo QA/QC Chemist

For Axys Internal Use Only [XSL Template: MS.xsl; Created: 08-Jun-2009 09:15:56; Application: XMLTransformer-1.9.24; Report Filename: MS.FC.LC.PFOA-MS-MSD.WG28652-103 2022 Form8C.html; Workgroup: WG28652; Design ID: 312 ]

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AXYS METHOD MLA-069 Rev 07

PERFLUORINATED ORGANICS ANALYSIS REPORT

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL. (250) 655-6900 FAX (250) 655-5811

Contract No.: 4095

Matrix: AQUEOUS
Sample Receipt Date: 23-Apr-2009
Extraction Date: 01-May-2009
Analysis Date: 08-May-2009 Time: 07:20:33

Lab Sample I.D.: WG28652-103 (MS)
Sample Size: 0.510 L
Initial Calibration Date: 07-May-2009
Instrument ID: LC MS/MS
Column ID: C18

Extract Volume (uL): 4000
Injection Volume (uL): 15

Sample Data Filename: FC9G_168 S: 35
Blank Data Filename: FC9G_168 S: 25
Cal. Ver. Data Filename: FC9G_168 S: 17

Concentration Units: ng absolute

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(1) Where applicable, custom lab flags have been used on this report.
(2) % R(%) = percent recovery.

Approved by: Bryan Alonzo QA/QC Chemist

For Axys Internal Use Only [ XSL Template: FC-Form2.xsl: Created; 09-Jun-2009 09:19:35; Application: XMLTransformer-1.0.24, Report Filename: PFC_FC_LC_PFOA_WG28652-103_Form2_FC9G_168S35_SI1018004.html; Workgroup: WG28652; Design ID: 312 ]

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.
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(1) Where applicable, custom lab flags have been used on this report; U = not detected.
(2) R% = percent recovery.

Approved by: Bryan Alonzo OA/QC Chemist
AXYS METHOD MLA-060 Rev 07

PERFLUORINATED ORGANICS ANALYSIS REPORT

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-6900 FAX (250) 655-5811

Contract No.: 4095
Matrix: AQUEOUS
Sample Receipt Date: 28-Apr-2009
Extraction Date: 01-May-2009
Analysis Date: 08-May-2009 Time: 07:40:00

Lab Sample I.D.:
Sample Size: 0.501 L
Initial Calibration Date: 07-May-2009
Instrument ID: LC MS/MS
Column ID: C18

Extract Volume (μL): 4000
Sample Data Filename: FC9G_168 S: 36
Injection Volume (μL): 15
Blank Data Filename: FC9G_168 S: 25

Concentration Units: ng absolute
Cal. Ver. Data Filename: FC9G_168 S: 17

Concentration Units: ng absolute

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</tbody>
</table>

(1) Where applicable, custom lab flags have been used on this report.
(2) R(%) = percent recovery.

Approved by: Bryan Alonzo QA/QC Chemist
## AXYS METHOD MLA-060 Rev 07

### Form 3A

**PERFLUORINATED ORGANICS INITIAL CALIBRATION PERCENT RECOVERIES**

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(1) Where applicable, custom lab flags have been used on this report.

Approved by: Bryan Alonzo QA/QC Chemist

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### AXYS METHOD MLA-060 Rev 07

**AXYS ANALYTICAL SERVICES**  
2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811  

**Initial Calibration Date:** 07-May-2009  
**Instrument ID:** LC MS/MS  
**LC Column ID:** C18

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#### PERCENT RECOVERIES (%)

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(1) Where applicable, custom lab flags have been used on this report.

Approved by: __________ Bryan Alonzo __________ QA/QC Chemist

---

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Report Filename: PFOA_FC_LC_07-May-2009_FC9G__Form3B_GS32041.html; Workgroup: WG28652; Design ID: 312 ]
## PERFLUORINATED ORGANICS INITIAL CALIBRATION RETENTION TIMES

**AXYS ANALYTICAL SERVICES**  
2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811  

**Initial Calibration Date:** 07-May-2009  

**Instrument ID:** LC MS/MS  
**LC Column ID:** C18  
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(1) Where applicable, custom lab flags have been used on this report.

Approved by: Bryan Alonzo QA/QC Chemist
**AXYS METHOD MLA-060 Rev 07**

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date: 07-May-2009

Instrument ID: LC MS/MS

LC Column ID: C18

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(1) Where applicable, custom lab flags have been used on this report.

Approved by: __________ Bryan Alonzo __________ QA/QC Chemist

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Page 1 of 1 (WG28652 - PFOA_FC_LC_07-May-2009_FC9G__Form3D_GS32041.html)
## AXYS METHOD MLA-060 Rev 07

### FORM 4A

**PERFLUORINATED ORGANICS CALIBRATION VERIFICATION**

**AXYS ANALYTICAL SERVICES**  
2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 0G2 TEL (250) 655-5800 FAX (250) 655-5811

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**Initial Calibration Date:** 07-May-2009  
**VER Data Filename:** FC9G_168 S: 17  
**LC Column ID:** C18

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1) Where applicable, custom lab flags have been used on this report.

Approved by: __________ Bryan Alonzo __________ QA/QC Chemist
## LABELED COMPOUND LAB FLAG  RETENTION TIME  EXPECTED CONC.  CONC. FOUND  RECOVERY (%)

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(1) Where applicable, custom lab flags have been used on this report.

Approved by: Bryan Alonzo QA/QC Chemist
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<tr>
<th>COMPOUND</th>
<th>LAB FLAG</th>
<th>RETENTION TIME</th>
<th>EXPECTED CONC.</th>
<th>CONC. FOUND</th>
<th>RECOVERY (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PFBA</td>
<td>5:19</td>
<td>20.0</td>
<td>19.5</td>
<td>97.5</td>
<td></td>
</tr>
<tr>
<td>PFPeA</td>
<td>6:02</td>
<td>20.0</td>
<td>19.5</td>
<td>97.4</td>
<td></td>
</tr>
<tr>
<td>PFHxA</td>
<td>6:26</td>
<td>20.0</td>
<td>19.1</td>
<td>95.4</td>
<td></td>
</tr>
<tr>
<td>PFHpA</td>
<td>6:47</td>
<td>20.0</td>
<td>18.3</td>
<td>91.5</td>
<td></td>
</tr>
<tr>
<td>PFOA</td>
<td>7:11</td>
<td>20.0</td>
<td>17.9</td>
<td>89.6</td>
<td></td>
</tr>
<tr>
<td>PFNA</td>
<td>7:38</td>
<td>20.0</td>
<td>21.0</td>
<td>105</td>
<td></td>
</tr>
<tr>
<td>PFDA</td>
<td>8:05</td>
<td>20.0</td>
<td>18.3</td>
<td>91.3</td>
<td></td>
</tr>
<tr>
<td>PFUnA</td>
<td>8:40</td>
<td>20.0</td>
<td>19.0</td>
<td>95.0</td>
<td></td>
</tr>
<tr>
<td>PFDoA</td>
<td>9:18</td>
<td>20.0</td>
<td>19.7</td>
<td>98.3</td>
<td></td>
</tr>
<tr>
<td>PFBS</td>
<td>6:32</td>
<td>40.0</td>
<td>37.6</td>
<td>94.1</td>
<td></td>
</tr>
<tr>
<td>PFHxS</td>
<td>7:23</td>
<td>40.0</td>
<td>33.8</td>
<td>84.5</td>
<td></td>
</tr>
<tr>
<td>PFOS</td>
<td>8:24</td>
<td>40.0</td>
<td>35.2</td>
<td>88.0</td>
<td></td>
</tr>
<tr>
<td>PFOSA</td>
<td>10:03</td>
<td>20.0</td>
<td>18.3</td>
<td>91.7</td>
<td></td>
</tr>
</tbody>
</table>

(1) Where applicable, custom lab flags have been used on this report.

Approved by: Bryan Alonzo QA/QC Chemist
**PERFLUORINATED ORGANICS CALIBRATION VERIFICATION**

**AXYS METHOD MLA-060 Rev 07**

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5Z2 TEL (250) 655-5800 FAX (250) 655-5811

<table>
<thead>
<tr>
<th>Labeled Compound</th>
<th>LAB FLAG</th>
<th>Retention Time</th>
<th>Expected Conc.</th>
<th>Conc. Found</th>
<th>Recovery (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13C4-PFBA</td>
<td></td>
<td>5:19</td>
<td>12.0</td>
<td>13.8</td>
<td>115</td>
</tr>
<tr>
<td>13C2-PFHxA</td>
<td></td>
<td>6:26</td>
<td>12.0</td>
<td>13.7</td>
<td>114</td>
</tr>
<tr>
<td>13C2-PFOA</td>
<td></td>
<td>7:11</td>
<td>36.0</td>
<td>36.2</td>
<td>101</td>
</tr>
<tr>
<td>13C5-PFNA</td>
<td></td>
<td>7:38</td>
<td>12.0</td>
<td>12.9</td>
<td>108</td>
</tr>
<tr>
<td>13C2-PFDA</td>
<td></td>
<td>8:08</td>
<td>12.0</td>
<td>12.3</td>
<td>102</td>
</tr>
<tr>
<td>13C2-PFDoA</td>
<td></td>
<td>9:17</td>
<td>12.0</td>
<td>12.4</td>
<td>103</td>
</tr>
<tr>
<td>13C4-PFOS (80)</td>
<td></td>
<td>8:24</td>
<td>18.0</td>
<td>26.9</td>
<td>150</td>
</tr>
</tbody>
</table>

(1) Where applicable, custom lab flags have been used on this report.

Approved by: Bryan Alonzo QA/QC Chemist

For Axys Internal Use Only [ XSL Template: FC-Forms4B.xsl; Created: 08-Jun-2009 09:15:35; Application: XMLTransformer-1.9.24; Report Filename: PFOA_FC_LC_FC9G_168S41__Form4B_SJ1018008.html; Workgroup: WG28652; Design ID: 312 ]
PERFLUORINATED ORGANIC ANALYSIS

SOLID SAMPLES

AXYS METHOD: MLA-041

PROJECT: FFFI SAMPLING AT RICHFIELD, NORTH ST. PAUL AND GOODVIEW

WORK ORDER #: 34499770

Contract: 4095
Data Package Identification: DPWG29177
Analysis WG28781

22 June 2009
PERFLUORINATED ORGANIC
ANALYSIS

SOLID SAMPLES

AXYS METHOD: MLA-041

PROJECT: FFFI SAMPLING AT RICHFIELD, NORTH
ST. PAUL AND GOODVIEW

WORK ORDER #: 34499770

Contract: 4095
Data Package Identification: DPWG29177
Analysis WG28781

Prepared for:
Minnesota Pollution Control Agency

Prepared by:
AXYS Analytical Services Ltd.
2045 Mills Rd
Sidney, British Columbia V8L 5X2
CANADA

Contact: Angie Whetung
Project Manager

22 June 2009
MINNESOTA POLLUTION CONTROL AGENCY
SOLID SAMPLES

PERFLUORINATED ORGANIC ANALYSIS
AXYS METHOD: MLA-041

Project: FFFI Sampling at Richfield, North St. Paul and Goodview
Work Order #: 34399770

22 June 2009

NARRATIVE

This narrative describes the analysis of eleven solid samples for the determination of perfluorinated organic compounds using high performance liquid chromatography/tandem mass spectrometry (HPLC/MS-MS).

SAMPLE RECEIPT AND STORAGE

The samples were received on the 12th of May 2009. Details of sample conditions upon receipt are provided on the Sample Receiving Record forms included in the sample documentation section of this data package. The temperature of the samples upon receipt was 5 °C, exceeding the requirement of 4 °C. This is judged not to significantly impact the data accuracy and the analysis was allowed to proceed. The samples were stored at 4°C prior to extraction and analysis.

SAMPLE EXTRACTION AND ANALYSIS

The samples were analyzed in one analysis batch named WG28781. Composition of the batch is shown on the Cover pages included in this data package.

Sample preparation, instrumental analysis and analyte quantification procedures were in accordance with AXYS Method MLA-041: Analytical Procedure for the Analysis of Perfluorinated Organic Compounds in Solid Samples by LC-MS/MS.

Accurately weighed sample was spiked with isotopically labeled quantification standards and extracted in acetic acid and basic methanol. The extract was cleaned up using SPE cartridges and carbon. After spiked with labeled recovery (internal) standards, the extract was analyzed using liquid chromatography/mass spectrometry (LC-MS/MS). Analyte concentrations were determined by isotope dilution/external standard method, comparing the area of the quantification ion to that of the 13C-labelled standard and correcting for response factors. Linear quantification equations with 1/X² weighting fit were determined from a multi-point calibration series prepared alongside with the sample.

Sample Richfield B-2 4-8' (AXYS ID: L12669-9) was used as the matrix for MS/MSD testing samples. The MS/MSD samples were assigned AXYS IDs WG28781-103/104.

The reporting limit (RL) was defined as the concentration equivalent to the lowest calibration standard analyzed or the sample specific detection limits, whichever was greater.

REPORTING CONVENTIONS

The AXYS contract number assigned for internal tracking was 4095. Samples were assigned a unique laboratory identifier of the form L12669-X, where X = numeral. All data reports reference these unique AXYS IDs plus the client’s sample identifier. To assist with locating data, a table correlating AXYS ID with the client sample number is included in this data package.

The following laboratory qualifier flags were used in this data package:

U = identifies a compound that was not detected.
V = surrogate recovery is not within method control limits
Results are reported in concentration units of nanograms per gram (ng/g) on a dry weight basis. Concentration and detection limits are provided to three significant figures. Analysis results for each sample are provided on Analysis Report form 1A/2.

QA/QC NOTE

Samples and QC samples analyzed in one analysis batch were carried intact through the entire analytical process. The sample data were reviewed and evaluated in relation to the batch QC samples.

- Sample analyte concentrations are not blank corrected.
- By virtue of the isotope dilution/internal standard quantification procedures, data are recovery corrected for possible losses during extraction and cleanup.
- All linearity, CAL/VER, OPR, duplicate and labeled compound recovery specifications were met with the following exceptions:

The highest-level calibration standard CS7 (Form 3B and 3D) in the initial calibration was excluded for $^{13}$C$_2$-PFDoA. Given that a minimum of 6 calibration standard points were used to determine the mean response factor (RF) for quantification of labeled surrogates, data would not be affected.

The highest-level calibration standard CS7 (Form 3A and 3C) in the initial calibration was excluded for PFDoA and PFOSA due to non-linearity. However, a minimum of 6 calibration standard points were used to construct the regression equations for quantification of target analytes. As multi-point calibrations were used, sample data are deemed not to be significantly affected.

The percent recovery of $^{13}$C$_2$-PFDoA surrogate was below method specifications in the OPR (AXYS ID: WG28781-102), and this surrogate has been flagged with a 'V'. Native targets spiked into the OPR that are quantified using $^{13}$C$_2$-PFDoA surrogate were recovered within method specifications and data are not considered affected by this variance.

The percent recovery of $^{13}$C$_2$-PFDoA surrogate in NoSTPaul B-1 SL 4-8', NoSTPaul B-2 SL 4-8', Richfield B-1 0-4' and the Laboratory Blank (AXYS IDs: L12669-2, -4, -6 and WG28781-101, respectively) did not meet the method criteria; this compound is flagged with a 'V'. As the isotope dilution method of quantification produces data that are recovery corrected, the slight variances from the method acceptance criteria are deemed not to affect the quantification of these analytes. Percent surrogate recoveries are used as general method performance indicator only.

ANALYTICAL DISCUSSION

No analytical difficulties experienced in WG28781.

DATA PACKAGE

This data package is assigned a unique identifier, DPWG29177, shown on the cover page of the data package. Included in the data package after this narrative are the following documents:

- Method summary
- Sample ‘Cover Page’ and ‘Correlation Table’
- Sample receiving documentation
- Sample data reports (in order of AXYS Sample ID)
- Laboratory QC data reports
- Instrumental QC data reports (organized by analysis date)
I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, except for the conditions detailed above. In addition, I certify, that to the best of my knowledge and belief, the data as reported are true and accurate. The following signature, on behalf of AXYS Analytical Services Ltd, authorizes the release of the data contained in this data package.

Signed: Jason MacKenzie, B.Sc., Product Development Chemist

Date Signed: 22nd of June, 2009
Summary of AXYS Method MLA-041:

Analytical Procedure for the Analysis of Perfluorinated Organic Compounds in Solid Samples by LC-MS/MS

This method, MLA-041, describes the analysis of perfluorinated organic compounds (PFC) in solid samples (sediment, soil). Typical detection limits are in the range of 0.1 – 0.2 ng/g for a 5 g sample.

EXTRACTION AND CLEANUP

Sample size may be up to 5 g (dry weight). After addition of surrogate standards the sample is extracted by shaking one time with dilute acetic acid solution and then two times with methanolic ammonium hydroxide solution, each time collecting the supernatants. The supernatants are combined and treated with ultra pure carbon powder. The resulting solution is diluted with water and cleaned up by solid phase extraction (SPE) using disposable cartridges containing a weak anion exchange sorbent. The eluate is spiked with recovery standards and analyzed by LC-MS/MS. Calibration solutions are processed through the same SPE cleanup procedure.

QUALITY ASSURANCE / QUALITY CONTROL

All samples are analyzed in batches. The composition of a batch is detailed on a batch sheet. Each batch has the following composition:

- Batch Size - Each batch consists of test samples and additional QC samples.
- Blanks – 5% of the samples within a batch are procedural blanks.
- Duplicates – 5% of the samples within a batch are analyzed in duplicate.
- Reference Samples - 5% of the samples within a batch are spiked reference samples.
- Spiked Samples – 5% of the samples within a batch are spiked with an aliquot of native standard.

QC Specification Table for PFC in Solids by LC-MS/MS:

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Procedural Blank Level ng/sample</th>
<th>Acceptable Matrix Spike % Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfluorobutanoate (PFBA)</td>
<td>&lt;0.25</td>
<td>70-130</td>
</tr>
<tr>
<td>Perfluoropentanoate (PFPeA)</td>
<td>&lt;0.25</td>
<td>60-130</td>
</tr>
<tr>
<td>Perfluorohexanoate (PFHxA)</td>
<td>&lt;0.25</td>
<td>70-130</td>
</tr>
<tr>
<td>Perfluoroheptanoate (PFHpA)</td>
<td>&lt;0.25</td>
<td>70-130</td>
</tr>
<tr>
<td>Perfluorooctanoate (PFOA)</td>
<td>&lt;0.25</td>
<td>70-130</td>
</tr>
<tr>
<td>Perfluorononanoate (PFNA)</td>
<td>&lt;0.25</td>
<td>70-130</td>
</tr>
<tr>
<td>Perfluorodecanoate (PFDA)</td>
<td>&lt;0.25</td>
<td>70-130</td>
</tr>
<tr>
<td>Perfluoroundecanoate (PFUnA)</td>
<td>&lt;0.25</td>
<td>40-130</td>
</tr>
<tr>
<td>Perfluorododecanoate (PFDoA)</td>
<td>&lt;0.25</td>
<td>70-130</td>
</tr>
</tbody>
</table>
Perfluorobutanesulfonate (PFBS)  <0.25  60-130
Perfluorohexanesulfonate (PFHxS)  <0.25  60-130
Perfluoroctanesulfonate (PFOS)  <0.25  70-130
Perfluoroctane sulfonamide (PFOSA)  <0.25  60-130

SURROGATE STANDARD RECOVERIES:  % RECOVERY RANGES

| 13C4- Perfluorobutyric acid  (13C4-PFBA)  20% - 150% |
| 13C2- Perfluorocaproic acid  (13C2-PFHxA)  40% - 150% |
| 13C2- Perfluorooctanoic acid  (13C2-PFOA)  40% - 150% |
| 13C5- Perfluorononanoic acid  (13C5-PFNA)  40% - 150% |
| 13C2- Perfluorodecanoic acid  (13C2-PFDA)  40% - 150% |
| 13C2- Perfluorododecanoic acid  (13C2-PFDoA)  40% - 150% |
| 13C4- Perfluorooctane sulfonate  (13C4-PFOS)  40% - 150% |

1 Lower surrogate recoveries may be reported for individual samples where dilution analysis or spiked sample results demonstrate acceptable accuracy.

<table>
<thead>
<tr>
<th>QC Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instrument Sensitivity</td>
<td>Daily, S:N ≥ 3:1 for all analytes for lowest calibration standard</td>
</tr>
<tr>
<td>Initial Calibration</td>
<td>Daily, (1/x^2) weighed linear regression. Calculated concentrations must be within 30% of actual concentration.</td>
</tr>
<tr>
<td>Continuing Calibration Verification</td>
<td>Every 20 samples, determined concentrations must be within 30% of actual concentrations</td>
</tr>
<tr>
<td>Instrumental Carryover And Instrument Background</td>
<td>Every Initial Calibration, Cal/Ver, or SPM: &lt;0.3 % carryover and area response of analytes in instrument blank &lt;800 judged following two previous methanol blank injections</td>
</tr>
</tbody>
</table>

ANALYSIS BY LC-MS/MS

Analysis of sample extracts for perfluorinated organics by HPLC-MS/MS is performed on a high performance liquid chromatograph coupled to a triple quadrupole mass spectrometer. The MS is run at unit mass resolution in the Multiple Reaction Monitoring (MRM) mode.

Instrument specifications:

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Waters 2690 or Waters 2795 HPLC, Micromass Quattro Ultima MS/MS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LC Column</td>
<td>Waters Xtera C18MS Reverse Phase C18, 10.0 cm, 2.1 mm i.d., 3.5 µm particle size (or equivalent)</td>
</tr>
<tr>
<td>Ionization</td>
<td>Negative Ion Electrospray</td>
</tr>
<tr>
<td>Acquisition</td>
<td>MRM mode, unit resolution</td>
</tr>
<tr>
<td>Injection Volume</td>
<td>15 µL</td>
</tr>
</tbody>
</table>
LC-MS/MS Operating Conditions:

<table>
<thead>
<tr>
<th>LC Gradient Program</th>
<th>LC Flow Rate Program</th>
<th>Gradient Curve</th>
<th>General LC Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (min)</td>
<td>Flow mixture</td>
<td>(mL/min)</td>
<td>Column Temp (°C)</td>
</tr>
<tr>
<td>0.0</td>
<td>15% solvent A</td>
<td>0.15</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>85% solvent B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>15% solvent A</td>
<td>0.15</td>
<td>Max Pressure (bar)</td>
</tr>
<tr>
<td></td>
<td>85% solvent B</td>
<td>1</td>
<td>300</td>
</tr>
<tr>
<td>5.0</td>
<td>70% solvent A</td>
<td>0.20</td>
<td>Source Temp (°C)</td>
</tr>
<tr>
<td></td>
<td>30% solvent B</td>
<td>4</td>
<td>120</td>
</tr>
<tr>
<td>8.5</td>
<td>100% solvent A</td>
<td>0.20</td>
<td>Desolvation Temp (°C)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>300</td>
</tr>
<tr>
<td>11</td>
<td>100% solvent A</td>
<td>0.20</td>
<td>Capillary Voltage (kV)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>2.75</td>
</tr>
<tr>
<td>11.3-14.5</td>
<td>15% solvent A</td>
<td>0.20</td>
<td>Gases (L/hr)</td>
</tr>
<tr>
<td></td>
<td>85% solvent B</td>
<td>2</td>
<td>~70 cone</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>~300 desolvation</td>
</tr>
</tbody>
</table>

1 Eluent A = 90% CH₃CN (aqueous), Eluent B = 12.1 mM NH₄OAc in 0.1% AcOH (aqueous)

Initial calibration of the LC-MS/MS instrument is performed by the analysis of six or more calibration solutions. A mid-level calibration standard is analyzed to verify the initial calibration after every 20th sample (including QC samples) injected at a minimum. All calibration solutions go through the same SPE extraction/cleanup procedure as the samples.

A typical instrument analysis sequence is as follows:
1-2 Instrument Blanks
6 Initial Calibration Standards
1-2 Instrument Blanks

Samples are run in the following order:
Spiked Reference Sample
Instrument Blank
Procedural Blank
Samples
Calibration Verification Standard (after 20 samples)
Samples
Calibration Verification Standard (after 20 samples)
… continued cycle
ANALYTE IDENTIFICATION

Positive identification of target PFC, surrogate standard and recovery standards require:

- $\geq 3:1$ S:N for parent ion to daughter ion transition.

- Compound retention time falls within 0.4 minutes of the predicted retention times from the mean determined from the Initial Calibration. Natives with labelled surrogate standards must elute within 0.1 minutes of the associated labelled surrogates.

QUANTIFICATION AND DATA REPORTING PROCEDURES

Target compounds are quantified using the internal standard method, comparing the area of the quantification ion to that of the $^{13}$C-labelled standard and correcting for response factors. Linear quantification equations are determined from a multi-point calibration series with $1/X^2$ weighting fit and expressed as below:

\[ Y = \text{slope} \times X + \text{intercept} \]

Where: \[ Y = \text{response ratio} = \left( \frac{\text{area of Target}}{\text{area of Surr}} \right) \times \text{weight of Surr (ng)} \]

\[ X = \text{weight of target (ng)} \]

The slope and intercept are used to convert raw peak areas in sample chromatograms to final concentrations as follows:

\[
\text{Sample Conc.} = \left( \frac{\text{area of Target}}{\text{area of Surr}} \times \text{weight of Surr (ng)} - \text{intercept} \right) \times \left( \frac{1}{\text{slope}} \right) \times \left( \frac{1}{\text{sample size (g)}} \right)
\]

where Surr is the surrogate standard

The recovery of the surrogate standard is calculated (by internal standard quantification against the recovery standard using an average RRF) and monitored as an indication of overall data quality. Final target concentrations are recovery corrected by this method of quantification.

The lower reporting limit is defined as the concentration equivalent to the lowest calibration standard analyzed.
### Analytes, Ions, and Quantification References:

<table>
<thead>
<tr>
<th>Target Analyte</th>
<th>Typical Retention Time (minutes)</th>
<th>Parent Ion Mass</th>
<th>Daughter Ion Mass</th>
<th>Quantified Against</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfluorobutanoate (PFBA)</td>
<td>5.0</td>
<td>213</td>
<td>169</td>
<td>$^{13}$C$_4$-PFBA</td>
</tr>
<tr>
<td>Perfluoropentanoate (PFPeA)</td>
<td>5.8</td>
<td>263</td>
<td>219</td>
<td>$^{13}$C$_2$-PFHxA</td>
</tr>
<tr>
<td>Perfluorohexanoate (PFHxA)</td>
<td>6.2</td>
<td>313</td>
<td>269</td>
<td>$^{13}$C$_2$-PFHxA</td>
</tr>
<tr>
<td>Perfluorohexanoate (PFHpA)</td>
<td>6.6</td>
<td>363</td>
<td>319</td>
<td>$^{13}$C$_2$-PFHxA</td>
</tr>
<tr>
<td>Perfluorooctanoate (PFOA)</td>
<td>7.0</td>
<td>413</td>
<td>369 / 219</td>
<td>$^{13}$C$_2$-PFOA</td>
</tr>
<tr>
<td>Perfluorononanoate (PFNA)</td>
<td>7.4</td>
<td>463</td>
<td>419</td>
<td>$^{13}$C$_5$-PFNA</td>
</tr>
<tr>
<td>Perfluorodecanoate (PFDA)</td>
<td>7.9</td>
<td>513</td>
<td>469</td>
<td>$^{13}$C$_2$-PFDA</td>
</tr>
<tr>
<td>Perfluoroundecanoate (PFUnA)</td>
<td>8.5</td>
<td>563</td>
<td>519</td>
<td>$^{13}$C$_2$-PFDA</td>
</tr>
<tr>
<td>Perfluorododecanoate (PFDoA)</td>
<td>9.0</td>
<td>613</td>
<td>569</td>
<td>$^{13}$C$_2$-PFDoA</td>
</tr>
<tr>
<td>Perfluorobutane sulfonate (PFBS)</td>
<td>6.3</td>
<td>299</td>
<td>80 / 99</td>
<td>$^{13}$C$_4$-PFDoA</td>
</tr>
<tr>
<td>Perfluorohexane sulphonate (PFHxS)</td>
<td>7.2</td>
<td>399</td>
<td>80 / 99</td>
<td>$^{13}$C$_4$-PFOS</td>
</tr>
<tr>
<td>Perfluorooctane sulfonate (PFOS)</td>
<td>8.2</td>
<td>499</td>
<td>80 / 99</td>
<td>$^{13}$C$_4$-PFOS</td>
</tr>
<tr>
<td>Perfluorooctane sulfonamide (PFOSA)</td>
<td>9.9</td>
<td>498</td>
<td>78</td>
<td>$^{13}$C$_4$-PFOS</td>
</tr>
</tbody>
</table>

### Surrogate Standard

<table>
<thead>
<tr>
<th>Surrogate Standard</th>
<th>Typical Retention Time (minutes)</th>
<th>Parent Ion Mass</th>
<th>Daughter Ion Mass</th>
<th>Quantified Against</th>
</tr>
</thead>
<tbody>
<tr>
<td>$^{13}$C$_4$-Perfluorobutanoic acid ($^{13}$C$_4$-PFBA)</td>
<td>5.0</td>
<td>217</td>
<td>172</td>
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<tr>
<td>$^{13}$C$_2$-Perfluorohexanoic acid ($^{13}$C$_2$-PFHxA)</td>
<td>6.2</td>
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<td>$^{13}$C$_5$-Perfluorononanoic acid ($^{13}$C$_5$-PFNA)</td>
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<td>$^{13}$C$_2$-Perfluorodecanoic acid ($^{13}$C$_2$-PFDA)</td>
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<td>$^{13}$C$_2$-Perfluorododecanoic acid ($^{13}$C$_2$-PFDoA)</td>
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<td>$^{13}$C$_4$-Perfluoroctanesulfonate ($^{13}$C$_4$-PFOS)</td>
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<td>80 / 99</td>
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### Recovery Standard

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<tr>
<th>Recovery Standard</th>
<th>Typical Retention Time (minutes)</th>
<th>Parent Ion Mass</th>
<th>Daughter Ion Mass</th>
<th>Quantified Against</th>
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<tbody>
<tr>
<td>$^{13}$C$_2$-2H-Perfluoro-2-decenoic acid ($^{13}$C$_2$-FOUEA)</td>
<td>7.3</td>
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<td>$^{13}$C$_4$-Perfluorooctanoic acid ($^{13}$C$_4$-PFOA)</td>
<td>6.9</td>
<td>417</td>
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</table>

$^1$ Quantification is based on the m/z 80 daughter, m/z 99 may be used as alternate if necessary to avoid interference.
<table>
<thead>
<tr>
<th>Client Sample No.</th>
<th>Lab Sample ID</th>
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<tbody>
<tr>
<td>LAB BLANK</td>
<td>WG28781-101</td>
</tr>
<tr>
<td>OPR</td>
<td>WG28781-102</td>
</tr>
<tr>
<td>MATRIX SPIKE</td>
<td>WG28781-103</td>
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<tr>
<td>MATRIX SPIKE DUPLICATE</td>
<td>WG28781-104</td>
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<tr>
<td>NoStPaul B-1 SL 0-4'</td>
<td>L12669-1</td>
</tr>
<tr>
<td>NoStPaul B-1 SL 4-8'</td>
<td>L12669-2</td>
</tr>
<tr>
<td>NoStPaul B-2 SL 0-4'</td>
<td>L12669-3</td>
</tr>
<tr>
<td>NoStPaul B-2 SL 4-8'</td>
<td>L12669-4</td>
</tr>
<tr>
<td>NoStPaul B-3 SL 0-2'</td>
<td>L12669-5</td>
</tr>
<tr>
<td>Richfield B-1 0-4'</td>
<td>L12669-6</td>
</tr>
<tr>
<td>Richfield B-1 4-8'</td>
<td>L12669-7</td>
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<tr>
<td>Richfield B-2 0-4'</td>
<td>L12669-8</td>
</tr>
<tr>
<td>Richfield B-2 4-8'</td>
<td>L12669-9</td>
</tr>
<tr>
<td>Richfield B-3 0-4'</td>
<td>L12669-10</td>
</tr>
<tr>
<td>Richfield B-3 4-8'</td>
<td>L12669-11</td>
</tr>
</tbody>
</table>

*Contact: analytical@axys.com*
# CHAIN OF CUSTODY

**AXYS CLIENT #: 4095**

## REPORT TO:
- **Company**: MPCA
- **Address**: 520 Lafayette Rd N, St. Paul, MN 55155
- **Contact**: Nile Fellows
- **Phone**: 651-757-2352
- **E-mail**: nile.fellows@state.mn.us

## INVOICE TO:
- **Company**: SAME
- **Address**: 
- **Contact**: 
- **Phone**: 
- **FAX**: 
- **E-mail**: 

## ANALYSIS REQUESTED

<table>
<thead>
<tr>
<th>Project Name/Number:</th>
<th>Sampler’s Name: Curt McCoy</th>
<th>Signature:</th>
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<table>
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<th>Matrix</th>
<th>Sampling Date</th>
<th>Sampling Time</th>
<th>Container Type/No.</th>
<th>AXYS Lab Sample ID (Lab use only)</th>
<th>PFL</th>
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<tbody>
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<td>North St. Paul</td>
<td>Soil</td>
<td>5/6/09</td>
<td>9:05</td>
<td>1/12/669 -1</td>
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<tr>
<td>North St. Paul B-1 SC 0'-4'</td>
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<td></td>
<td>9:15</td>
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<td>10:50</td>
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<td>-8</td>
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<td>11:50</td>
<td>-11</td>
<td>✗</td>
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## Relinquished by (Signature)
- **Date**: 5/7/09
- **Time**: 13:00

## Received by (Signature)
- **Date**: 12 May 09
- **Time**: 10:40

<table>
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<td>Richfield B-2 4'-8' lab/tn soil</td>
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<table>
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<tr>
<th>Courier</th>
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<table>
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<th>Custody Seal #</th>
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</table>

<table>
<thead>
<tr>
<th>Seal Intact</th>
<th>Y / N</th>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Sample Tags</th>
<th>Y / N</th>
</tr>
</thead>
</table>
**Expanded Service International Air Waybill**

**Not all services and options are available to all destinations.**

1. **From**
   - Name: [Name]
   - Company: [Company]
   - Address: [Address]
   - City: [City]
   - Province: [Province]
   - Postal Code: [Postal Code]

2. **To**
   - Name: [Recipient's Name]
   - Company: AXYS ANALYTICAL SERVICES
   - Address: [Address]
   - City: [City]
   - Province: [Province]
   - Postal Code: [Postal Code]

3. **Shipment Information**
   - Total Packages: [Total Packages]
   - Total Weight: [Total Weight]
   - Description of Commodity: [Description of Commodity]
   - Harmonized Code: [Harmonized Code]
   - Country of Manufacture: [Country of Manufacture]
   - Value for Customs: [Value for Customs]

4. **Payment**
   - Bill transportation charges to: [Payment Method]
   - Sender's Acct No: [Sender's Acct No]
   - Recipient's Acct No: [Recipient's Acct No]
   - Third Party: [Third Party]
   - Credit Card: [Credit Card]
   - Cash/Check: [Cash/Check]

5. **Required Signature**
   - Signature: [Signature]
   - Date: [Date]

---

**Packages up to 150 lb / 68 kg**

1. FedEx International Priority
   - Available to select less than 3.0 kg.
   - Higher rates apply.

5. **Express Freight Service**
   - Packages over 150 lb / 68 kg
   - FedEx International Priority Freight

7. **Special Handling**
   - HOLD at FedEx Location
   - SATURDAY Delivery
   - Additional handling fees apply
   - Dangerous Goods

---

**Canada Export Declaration (USEA)**

- Manual USEA cleared
- USEA filed electronically
- USEA Summary Reporting

**Origin Station ID**

- FCMKK

**Destination Station ID**

- CAAYJA

**URSA Routing**

- [Routing Number]
AXYS Analytical Services Ltd
SAMPLE RECEIVING RECORD

Waybill#: 862566653383
Date/Time Received: 12-MAY-09

AXYS Client & Contract #: 4095-Minnesota Pollution Control
Project Number: WB7402

Received By: MGIERDEN
Log in by: MGIERDEN
Signature: [signature]

Waybill #: 12-May-09
Date Shipped: 07-MAY-09

Axys Sample ID's: L12009-1 to 11

Matrix Type: 11 solids
Condition of Shipping Container: Ice packs partially thawed, samples did not arrive frozen

Temperature upon Receipt: 5 C Celcius

Custody Seals: Shipping Containers Intact
Sample Intact

Seal Numbers Intact

Yes / No

Tracking Report / Packing List: Yes
Sample Tag Numbers: Yes
Sample Type: Yes
Preservative Added: Yes
Preservation Requested: Yes

Chain of Custody or Documents:
Sample ID's: Yes
Collection Location: Yes
Date & Time Collection: Yes
Collector's Name: Yes

Sample Tags: Yes
Sample Labels: Yes
Sample Labels Cross Referenced to COC: Yes
Sample Tags Cross Referenced to Sample Labels: Yes
Sample Tags Cross Referenced to COC: Yes

Comments:

Action Taken: Confirmed with shipper that samples were shipped on 11-May-09, not 13-May-09.
<table>
<thead>
<tr>
<th>Axys ID versus</th>
<th>Received</th>
<th>Due</th>
<th>PR</th>
</tr>
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<tbody>
<tr>
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<tr>
<td>L12669-1</td>
<td>Storage: WIF-4, 1B</td>
<td>Permit #: P-2009-01078</td>
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</tr>
<tr>
<td>NoStPaul B-1 SL 0-4&quot;</td>
<td>06-MAY-09</td>
<td>Project #: NILE FELLOWS</td>
<td></td>
</tr>
<tr>
<td>Comments: c-tube portion consumed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solid 2:MOISTURE</td>
<td>USD</td>
<td></td>
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<tr>
<td>Solid 5:MOISTURE</td>
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<tr>
<td>Solid HOMOGENIZATION</td>
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</tr>
<tr>
<td>Solid PERFLUORO ORG (LC)</td>
<td>USD</td>
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</tr>
<tr>
<td>Solid PFC PRESCREEN (LC)</td>
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<td>EDataDeliv PFC EDD</td>
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<tr>
<td>D.Pack PFOS DATA PKG</td>
<td>USD</td>
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<td></td>
</tr>
<tr>
<td>ANY SAMPLE RECEIPT 1: 500 mL glass</td>
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<td>L12669-2</td>
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<tr>
<td>NoStPaul B-1 SL 4-8&quot;</td>
<td>06-MAY-09</td>
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<tr>
<td>Comments: c-tube portion consumed</td>
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<tr>
<td>Solid 2:MOISTURE</td>
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<td>Solid 5:MOISTURE</td>
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<td>Solid HOMOGENIZATION</td>
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<tr>
<td>Solid PERFLUORO ORG (LC)</td>
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<tr>
<td>Solid PFC PRESCREEN (LC)</td>
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<tr>
<td>EDataDeliv PFC EDD</td>
<td>USD</td>
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<tr>
<td>D.Pack PFOS DATA PKG</td>
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<tr>
<td>ANY SAMPLE RECEIPT 1: 500 mL glass</td>
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<tr>
<td>L12669-3</td>
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<td>Permit #: P-2009-01078</td>
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<tr>
<td>NoStPaul B-2 SL 0-4&quot;</td>
<td>06-MAY-09</td>
<td>Project #: NILE FELLOWS</td>
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<tr>
<td>Comments: c-tube portion consumed</td>
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<tr>
<td>Solid 2:MOISTURE</td>
<td>USD</td>
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<tr>
<td>Solid 5:MOISTURE</td>
<td>USD</td>
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</tr>
<tr>
<td>Solid HOMOGENIZATION</td>
<td>USD</td>
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<td></td>
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<tr>
<td>Solid PERFLUORO ORG (LC)</td>
<td>USD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solid PFC PRESCREEN (LC)</td>
<td>USD</td>
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<tr>
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<tr>
<td>D.Pack PFOS DATA PKG</td>
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<tr>
<td>ANY SAMPLE RECEIPT 1: 500 mL glass</td>
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</table>
## AXYS Analytical Services Ltd.

**Login Chain of Custody Report (in01)**  
May 19, 2009  
08:18 AM

**Login Number:** L12669  
**Account:** 4095  
**Project:** NILE FELLOWS  
**Page: 2 of 4**

### Axys ID versus Client Sample Identification

<table>
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<th>Axys ID</th>
<th>Client Sample Identification</th>
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<th>Due</th>
<th>PR</th>
</tr>
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</table>
| L12669-4 | NoStPaul B-2 SL 4-8'  
06-MAY-09 10:05  
Storage: WIF-4, 1B  
Permit #: P-2009-01078  
Project #: NILE FELLOWS | 12-MAY-09 | | |
| | Comments: c-tube portion consumed  
Solid | USD | | |
| | 2:MOISTURE | : | | |
| | 5:MOISTURE | : | | |
| | HOMOGENIZATION | : | | |
| | PERFLUORO ORG (LC) | : | | |
| | PFC PRESCREEN (LC) | : | | |
| | EDataDeliv PFC EDD | : | | |
| | D,Package PFOS DATA PKG | : | | |
| | ANY SAMPLE RECEIPT | 1 | 500 mL glass | USD |
| L12669-5 | NoStPaul B-3 SL 0-2'  
06-MAY-09 10:50  
Storage: WIF-4, 1B  
Permit #: P-2009-01078  
Project #: NILE FELLOWS | 12-MAY-09 | | |
| | Comments: c-tube portion consumed  
Solid | USD | | |
| | 2:MOISTURE | : | | |
| | 5:MOISTURE | : | | |
| | HOMOGENIZATION | : | | |
| | PERFLUORO ORG (LC) | : | | |
| | PFC PRESCREEN (LC) | : | | |
| | EDataDeliv PFC EDD | : | | |
| | D,Package PFOS DATA PKG | : | | |
| | ANY SAMPLE RECEIPT | 1 | 500 mL glass | USD |
| L12669-6 | Richfield B-1 0-4'  
07-MAY-09 10:45  
Storage: WIF-4, 1B  
Permit #: P-2009-01078  
Project #: NILE FELLOWS | 12-MAY-09 | | |
| | Comments: c-tube portion consumed  
Solid | USD | | |
| | 2:MOISTURE | : | | |
| | 5:MOISTURE | : | | |
| | HOMOGENIZATION | : | | |
| | PERFLUORO ORG (LC) | : | | |
| | PFC PRESCREEN (LC) | : | | |
| | EDataDeliv PFC EDD | : | | |
| | D,Package PFOS DATA PKG | : | | |
| | ANY SAMPLE RECEIPT | 1 | 250 mL plastic | USD |
# AXYS Analytical Services Ltd.

## Login Chain of Custody Report (In01)

**May 19, 2009**

**Login Number:** L12669  
**Account:** 4095. Minnesota Pollution Control  
**Project:** NILE FELLOWS

<table>
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<tbody>
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<tr>
<td>Richfield B-1 4-8'</td>
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<td></td>
</tr>
<tr>
<td>07-MAY-09 10:50</td>
<td></td>
<td></td>
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<tr>
<td>Comments: c-tube portion consumed</td>
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</tr>
<tr>
<td>Solid 2:MOISTURE</td>
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<td>Solid 5:MOISTURE</td>
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<tr>
<td>Solid PERFLUORO ORG (LC)</td>
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<td>Solid PFC PRESCREEN (LC)</td>
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| L12669-8                                   | 12-MAY-09- |     |    |
| Richfield B-2 0-4'                         |          |     |    |
| 07-MAY-09 11:20                            |          |     |    |
| Comments: c-tube portion consumed          |          |     |    |
| Solid 2:MOISTURE                           |          | USD |    |
| Solid 5:MOISTURE                           |          | USD |    |
| Solid HOMOGENIZATION                       |          | USD |    |
| Solid PERFLUORO ORG (LC)                   |          | USD |    |
| Solid PFC PRESCREEN (LC)                   |          | USD |    |
| EDataDeliv PFC EDD                         |          | USD |    |
| D.Package PFOS DATA PKG                    |          | USD |    |
| ANY SAMPLE RECEIPT                         | 250 mL plastic | USD |

<p>| L12669-9                                   | 12-MAY-09- |     |    |
| Richfield B-2 4-8'                         |          |     |    |
| 07-MAY-09 11:25                            |          |     |    |
| Comments: c-tube portion consumed          |          |     |    |
| Solid 2:MOISTURE                           |          | USD |    |
| Solid 5:MOISTURE                           |          | USD |    |
| Solid HOMOGENIZATION                       |          | USD |    |
| Solid PERFLUORO ORG (LC)                   |          | USD |    |
| Solid PFC PRESCREEN (LC)                   |          | USD |    |
| EDataDeliv PFC EDD                         |          | USD |    |
| D.Package PFOS DATA PKG                    |          | USD |    |
| ANY PFC MS                                 |          | USD |    |
| ANY PFC MSD                                |          | USD |    |
| ANY SAMPLE RECEIPT                         | 250 mL plastic | USD |</p>
<table>
<thead>
<tr>
<th>Axys ID versus</th>
<th>Received</th>
<th>Due</th>
<th>PR</th>
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<tr>
<td>Richfield B-3</td>
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<tr>
<td>07-MAY-09 11:50</td>
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<tr>
<td>Comments: c-tube portion consumed</td>
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<tr>
<td>Solid 2:MOISTURE</td>
<td>:</td>
<td>USD</td>
<td></td>
</tr>
<tr>
<td>Solid 5:MOISTURE</td>
<td>:</td>
<td>USD</td>
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</tr>
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<td>Solid HOMOGENIZATION</td>
<td>:</td>
<td>USD</td>
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</tr>
<tr>
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<tr>
<td>Solid PFC PRESCREEN (LC)</td>
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</tr>
<tr>
<td>EDataDeliv PFC EDD</td>
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<td>USD</td>
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</tr>
<tr>
<td>D,Package PFOS DATA PKG</td>
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| L12669-11     |          |     |    |
| Richfield B-3 | 4-8'     |     |    |
| 07-MAY-09 11:55 |          |     |    |
| Comments: c-tube portion consumed |
| Solid 2:MOISTURE | : | USD |
| Solid 5:MOISTURE | : | USD |
| Solid HOMOGENIZATION | : | USD |
| Solid PERFLUORO ORG (LC) | : | USD |
| Solid PFC PRESCREEN (LC) | : | USD |
| EDataDeliv PFC EDD | : | USD |
| D,Package PFOS DATA PKG | : | USD |
| ANY SAMPLE RECEIPT | 1 : 250 mL plastic | USD |
**AXYS METHOD MLA-041 Rev 07**

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**PERFLUORINATED ORGANICS ANALYSIS REPORT**

**Project No.**

**Lab Sample I.D.:**

**CLIENT SAMPLE NO.**
NoStPaul B-1 SL 0-4'

**Sample Collection:**
06-May-2009 09:30

**Approved by:**
Jason MacKenzie
QA/QC Chemist

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**CONTRACT NO.:**
4095

**MATRIX:**
SOLID

**SAMPLE RECEIPT DATE:**
12-May-2009

**INITIAL CALIBRATION DATE:**
22-May-2009

**EXTRACTION DATE:**
19-May-2009

**INSTRUMENT ID:**
LC MS/MS

**ANALYSIS DATE:**
22-May-2009 Time: 13:56:31

**COLUMN ID:**
C18

**EXTRACT VOLUME (uL):**
4000

**SAMPLE DATA FILENAME:**
FC9G_193 S: 28

**INJECTION VOLUME (uL):**
15

**BLANK DATA FILENAME:**
FC9G_193 S: 26

**DILUTION FACTOR:**
N/A

**CAL. VER. DATA FILENAME:**
FC9G_193 S: 17

**CONCENTRATION UNITS:**
ng/g (dry weight basis)

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<th>CONC. FOUND</th>
<th>DETECTION LIMIT</th>
<th>RETENTION TIME</th>
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<tr>
<td>PFPeA</td>
<td>U</td>
<td>0.0926</td>
<td></td>
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<tr>
<td>PFHxA</td>
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<td>0.0926</td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
</tr>
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<td>PFOA</td>
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<td>0.0926</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PFNA</td>
<td>U</td>
<td>0.0926</td>
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<td>PFUnA</td>
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(1) Where applicable, custom lab flags have been used on this report; U = not detected.

Approved by: ___________Jason MacKenzie__________ QA/QC Chemist

For Axys Internal Use Only [ XSL Template: FC-Form1A.xsl; Created: 16-Jun-2009 11:23:11; Application: XMLTransformer-1.9.24;
Report Filename: PFC_FC_LC_PFOA_L12669-1_Form1A_FC9G_193S28_SJ1021174.html; Workgroup: WG28781; Design ID: 312 ]

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.
**AXYS METHOD MLA-041 Rev 07**

**PERFLUORINATED ORGANICS ANALYSIS REPORT**

---

**AXYS ANALYTICAL SERVICES**

2045 MILLS RD., SIDNEY, B.C., CANADA

V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

---

**Project No.**

FFFI RICHL FIELD, N. ST. PAUL AND GOODVIEW

**Lab Sample I.D.:**

L12669-1

---

**Contract No.:**

4095

**Matrix:**

SOLID

**Sample Receipt Date:**

12-May-2009

**Initial Calibration Date:**

22-May-2009

---

**Extraction Date:**

19-May-2009

**Instrument ID:**

LC MS/MS

---

**Analysis Date:**

22-May-2009 **Time:** 13:56:31

**Column ID:**

C18

---

**Extract Volume (uL):**

4000

**Sample Data Filename:**

FC9G_193 S: 28

---

**Injection Volume (uL):**

15

**Blank Data Filename:**

FC9G_193 S: 26

---

**Dilution Factor:**

N/A

**Cal. Ver. Data Filename:**

FC9G_193 S: 17

---

**Concentration Units:**

ng absolute

**% Moisture:**

11.8

---

### LABELED COMPOUND

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<th>LAB FLAG</th>
<th>SPIKE CONC.</th>
<th>CONC. FOUND</th>
<th>R(%)</th>
<th>RETENTION TIME</th>
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<tbody>
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<td>13C4-PFBA</td>
<td>12.0</td>
<td>9.46</td>
<td>78.8</td>
<td>5:20</td>
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<tr>
<td>13C2-PFHxA</td>
<td>12.0</td>
<td>11.8</td>
<td>98.3</td>
<td>6:26</td>
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<tr>
<td>13C2-PFOA</td>
<td>36.0</td>
<td>30.8</td>
<td>85.6</td>
<td>7:14</td>
</tr>
<tr>
<td>13C5-PFNA</td>
<td>12.0</td>
<td>10.0</td>
<td>83.7</td>
<td>7:38</td>
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<tr>
<td>13C2-PFDA</td>
<td>12.0</td>
<td>7.69</td>
<td>64.1</td>
<td>8:08</td>
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<td>13C2-PFD0A</td>
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<td>5.39</td>
<td>44.9</td>
<td>9:17</td>
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<tr>
<td>13C4-PFOS (80)</td>
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<td>11.5</td>
<td>63.6</td>
<td>8:27</td>
</tr>
</tbody>
</table>

---

(1) Where applicable, custom lab flags have been used on this report.

(2) R(%) = percent recovery.

Approved by: __________Jason MacKenzie__________ QA/QC Chemist

---

Contact: analytical@axys.com

---

For Axys Internal Use Only [ XSL Template: FC-Form2.xsl; Created: 16-Jun-2009 11:23:11; Application: XMLTransformer-1.9.24; Report Filename: PFC_FC_LC_PFOA_L12669-1_Form2_FC9G_193S28_SJ1021174.html; Workgroup: WG28781; Design ID: 312 ]

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**AXYS METHOD MLA-041 Rev 07**

**PERFLUORINATED ORGANICS ANALYSIS REPORT**

**AXYS ANALYTICAL SERVICES**

2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Project No.**

FFFI RICHFIELD, N. ST. PAUL AND GOODVIEW

**Lab Sample I.D.:**

L12669-2

---

**CLIENT SAMPLE NO.**

NoStPaul B-1 SL 4-8'

**Sample Collection:**

06-May-2009 09:15

**Form 1A**

**PERFLUORINATED ORGANICS ANALYSIS REPORT**

**AXYS ANALYTICAL SERVICES**

2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Contract No.:**

4095

**Matrix:**

SOLID

**Sample Size:**

5.01 g (dry)

**Sample Receipt Date:**

12-May-2009

**Initial Calibration Date:**

22-May-2009

**Extraction Date:**

19-May-2009

**Instrument ID:**

LC MS/MS

**Analysis Date:**

22-May-2009 **Time:** 14:15:09

**Column ID:**

C18

**Extract Volume (uL):**

4000

**Sample Data Filename:**

FC9G_193 S: 29

**Injection Volume (uL):**

15

**Blank Data Filename:**

FC9G_193 S: 26

**Dilution Factor:**

N/A

**Cal. Ver. Data Filename:**

FC9G_193 S: 17

**Concentration Units:**

ng/g (dry weight basis)

**% Moisture:**

13.2

---

**COMPOUND**

**LAB FLAG**

**1**

**CONC. FOUND**

**DETECTION LIMIT**

**RETENTION TIME**

PFBA  
U  
0.0998

PFPeA  
U  
0.0998

PFHxA  
U  
0.0998

PFHpA  
U  
0.0998

PFOA  
U  
0.0998

PFNA  
U  
0.0998

PFDA  
U  
0.0998

PFUnA  
U  
0.0998

PFDoA  
U  
0.0998

PFBS  
U  
0.200

PFHxS  
U  
0.200

PFOS  
U  
0.200

PFOSA  
U  
0.0998

---

(1) Where applicable, custom lab flags have been used on this report; U = not detected.

Approved by: ________Jason MacKenzie_________ QA/QC Chemist

For Axys Internal Use Only | XSL Template: FC-Form1A.xsl; Created: 16-Jun-2009 11:23:11; Application: XMLTransformer-1.9.24;
Report Filename: PFC_FC_LC_PFOA_L12669-2_Form1A_FC9G_193S29_SJ1021175.html; Workgroup: WG28781; Design ID: 312

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.
**AXYS METHOD MLA-041 Rev 07**

**AXYS ANALYTICAL SERVICES**

2045 MILLS RD., SIDNEY, B.C., CANADA

V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Form 2**

**PERFLUORINATED ORGANICS ANALYSIS REPORT**

**Project No.**

FFFI RICHLFIELD, N. ST. PAUL AND GOODVIEW

**Lab Sample I.D.:**

L12669-2

**Contract No.:**

4095

**Matrix:**

SOLID

**Sample Receipt Date:**

12-May-2009

**Initial Calibration Date:**

22-May-2009

**Extraction Date:**

19-May-2009

**Instrument ID:**

LC MS/MS

**Analysis Date:**

22-May-2009

**Time:**

14:15:09

**Column ID:**

C18

**Extract Volume (uL):**

4000

**Sample Data Filename:**

FC9G_193 S: 29

**Injection Volume (uL):**

15

**Blank Data Filename:**

FC9G_193 S: 26

**Dilution Factor:**

N/A

**Cal. Ver. Data Filename:**

FC9G_193 S: 17

**Concentration Units:**

ng absolute

**% Moisture:**

13.2

**LABELED COMPOUND**

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<th>LAB FLAG</th>
<th>SPIKE CONC.</th>
<th>CONC. FOUND</th>
<th>R(%)</th>
<th>RETENTION TIME</th>
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<td>13C4-PFBA</td>
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<td>13C2-PFHxA</td>
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<tr>
<td>13C2-PFOA</td>
<td>36.0</td>
<td>29.2</td>
<td>81.2</td>
<td>7:14</td>
</tr>
<tr>
<td>13C5-PFNA</td>
<td>12.0</td>
<td>10.5</td>
<td>87.3</td>
<td>7:38</td>
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<tr>
<td>13C2-PFDA</td>
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<td>69.4</td>
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(1) Where applicable, custom lab flags have been used on this report; V = surrogate recovery is not within method/contract control limits.

(2) R(%) = percent recovery.

Approved by: __________Jason MacKenzie__________ QA/QC Chemist

For Axys Internal Use Only [ XSL Template: FC-Form2.xsl; Created: 16-Jun-2009 11:23:11; Application: XMLTransformer-1.9.24; Report Filename: PFC_FC_LC_PFOA_L12669-2_Form2_FC9G_193S29_SJ1021175.html; Workgroup: WG28781; Design ID: 312 ]

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**FORM 1A**

**AXYS ANALYTICAL SERVICES**

2045 MILLS RD., SIDNEY, B.C., CANADA

V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Project No.:** FFFI RICHFIELD, N. ST. PAUL AND GOODVIEW

**Lab Sample I.D.:** L12669-3

**Sample No.:** NoStPaul B-2 SL 0-4'

**Sample Collection:** 06-May-2009 09:55

**Sample Receipt Date:** 12-May-2009

**Initial Calibration Date:** 22-May-2009

**Extraction Date:** 19-May-2009

**Analysis Date:** 22-May-2009

**Time:** 14:33:39

**Instrument ID:** LC MS/MS

**Column ID:** C18

**Extract Volume (uL):** 4000

**Sample Data Filename:** FC9G_193 S: 30

**Injection Volume (uL):** 15

**Blank Data Filename:** FC9G_193 S: 26

**Dilution Factor:** N/A

**Cal. Ver. Data Filename:** FC9G_193 S: 17

**Sample Size:** 5.24 g (dry)

**% Moisture:** 11.4

**CONCENTRATION UNITS:** ng/g (dry weight basis)

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<tr>
<td>PFPeA</td>
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<td>0.0954</td>
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<td>PFHxA</td>
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<td>0.0954</td>
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(1) Where applicable, custom lab flags have been used on this report; U = not detected.

Approved by: ___________ Jason MacKenzie _________ QA/QC Chemist

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For Axys Internal Use Only [ XSL Template: FC-Form1A.xsl; Created: 16-Jun-2009 11:23:11; Application: XMLTransformer-1.9.24; Report Filename: PFC_FC_LC_PFOA_L12669-3_Form1A_FC9G_193S30_SJ1021176.html; Workgroup: WG28781; Design ID: 312 ]

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.
### AXYS METHOD MLA-041 Rev 07

**PERFLUORINATED ORGANICS ANALYSIS REPORT**

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

<table>
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<th>Lab Sample I.D.</th>
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<tbody>
<tr>
<td>FFFI RICHHIELD, N. ST. PAUL AND GOODVIEW</td>
<td>L12669-3</td>
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#### Contract No.:
4095

#### Matrix:
SOLID

#### Sample Receipt Date:
12-May-2009

#### Initial Calibration Date:
22-May-2009

#### Extraction Date:
19-May-2009

#### Instrument ID:
LC MS/MS

#### Analysis Date:
22-May-2009 Time: 14:33:39

#### Column ID:
C18

#### Extract Volume (uL):
4000

#### Sample Data Filename:
FC9G_193 S: 30

#### Injection Volume (uL):
15

#### Blank Data Filename:
FC9G_193 S: 26

#### Dilution Factor:
N/A

#### Cal. Ver. Data Filename:
FC9G_193 S: 17

#### Concentration Units:
ng absolute

#### % Moisture:
11.4

### LABELED COMPOUND

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<th>CONC. FOUND</th>
<th>R(%)</th>
<th>RETENTION TIME</th>
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<tr>
<td>13C2-PFOA</td>
<td>36.0</td>
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<td>81.2</td>
<td>7:14</td>
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<tr>
<td>13C5-PFNA</td>
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(1) Where applicable, custom lab flags have been used on this report.

(2) R(%) = percent recovery.

Approved by: __________ Jason MacKenzie ________ QA/QC Chemist
AXYS METHOD MLA-041 Rev 07

PERFLUORINATED ORGANICS ANALYSIS REPORT

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Sample Collection:
06-May-2009 10:05

Analysis Date:
22-May-2009

Form 1A

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</thead>
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<td>0.0978</td>
<td></td>
<td></td>
</tr>
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(1) Where applicable, custom lab flags have been used on this report; U = not detected.

Approved by: __________Jason MacKenzie_________ QA/QC Chemist

For Axys Internal Use Only [ XSL Template: FC-Form1A.xsl; Created: 16-Jun-2009 11:23:11; Application: XMLTransformer-1.9.24; Report Filename: PFC_FC_LC_PFOA_L12669-4_Form1A_FC9G_193S31_SJ1021177.html; Workgroup: WG28781; Design ID: 312 ]

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.
Where applicable, custom lab flags have been used on this report; V = surrogate recovery is not within method/contract control limits.

R(%) = percent recovery.

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</tbody>
</table>

(1) Where applicable, custom lab flags have been used on this report; V = surrogate recovery is not within method/contract control limits.  
(2) R(%) = percent recovery.

Approved by: ___________Jason MacKenzie___________ QA/QC Chemist
**PERFLUORINATED ORGANICS ANALYSIS REPORT**

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Project No.**
FFI RICHFIELD, N. ST. PAUL AND GOODVIEW

**Lab Sample I.D.:**
L12669-5

**Sample Data Filename:**
FC9G_193 S: 32

**Blank Data Filename:**
FC9G_193 S: 26

**Cal. Ver. Data Filename:**
FC9G_193 S: 17

**COMPOUND** | **LAB FLAG** | **CONC. FOUND** | **DETECTION LIMIT** | **RETENTION TIME**
---|---|---|---|---
PFBA | U | 0.0972 |
PPFeA | U | 0.0972 |
PFHxA | U | 0.0972 |
PFHpA | U | 0.0972 |
PFOA | 0.107 | 0.0972 | 7:11 |
PFNA | U | 0.0972 |
PFDA | U | 0.0972 |
PFUnA | U | 0.0972 |
PFDoA | U | 0.0972 |
PBFS | U | 0.194 |
PFHxS | U | 0.194 |
PFOA | 0.623 | 0.194 | 8:27 |
PFOA | U | 0.0972 |

(1) Where applicable, custom lab flags have been used on this report; U = not detected.

Approved by: __________Jason MacKenzie_________ QA/QC Chemist

For Axys Internal Use Only [ XSL Template: FC-Form1A.xsl; Created: 16-Jun-2009 11:23:11; Application: XMLTransformer-1.9.24; Report Filename: PFC_FC_LC_PFOA_L12669-5_Form1A_FC9G_193S32_SJ1021178.html; Workgroup: WG28781; Design ID: 312 ]

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.

Contact: analytical@axys.com
**Labeled Compound**

<table>
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<th>Lab Flag</th>
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<th>Conc. Found</th>
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<td>8:24</td>
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</table>

(1) Where applicable, custom lab flags have been used on this report.
(2) R(%) = percent recovery.

Approved by: ________Jason MacKenzie_________ QA/QC Chemist
AXYS METHOD MLA-041 Rev 07

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 4095

Matrix: SOLID
Sample Receipt Date: 12-May-2009
Sample Collection: 07-May-2009 10:45

Sample Size: 5.37 g (dry)
Initial Calibration Date: 22-May-2009

Extraction Date: 19-May-2009
Instrument ID: LC MS/MS

Analysis Date: 22-May-2009 Time: 15:30:32
Column ID: C18

Extract Volume (uL): 4000
Sample Data Filename: FC9G_193 S: 33

Injection Volume (uL): 15
Blank Data Filename: FC9G_193 S: 26

Dilution Factor: N/A
Cal. Ver. Data Filename: FC9G_193 S: 17

Concentration Units: ng/g (dry weight basis)
% Moisture: 6.66

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<th>RETENTION TIME</th>
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Approved by: __________Jason MacKenzie_________ QA/QC Chemist

For Axys Internal Use Only | XSL Template: FC-Form1A.xsl; Created: 16-Jun-2009 11:23:11; Application: XMLTransformer-1.9.24;
Report Filename: PFC_FC_LC_PFOA_L12669-6_Form1A_FC9G_193S33_SJ1021179.html; Workgroup: WG28781; Design ID: 312 J

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### AXYS METHOD MLA-041 Rev 07

**PERFLUORINATED ORGANICS ANALYSIS REPORT**

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Project No.**

**Richfield B-1 0-4**

**Sample Collection:**

07-May-2009 10:45

**Form 2**

**AXYS ANALYTICAL SERVICES**

**2045 MILLS RD., SIDNEY, B.C., CANADA**

**V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811**

**Contract No.:**

4095

**Lab Sample I.D.:**

L12669-6

**Matrix:**

SOLID

**Sample Receipt Date:**

12-May-2009

**Initial Calibration Date:**

22-May-2009

**Extraction Date:**

19-May-2009

**Instrument Calibration Date:**

22-May-2009

**Analysis Date:**

22-May-2009 Time: 15:30:32

**Column ID:**

C18

**Extract Volume (uL):**

4000

**Sample Data Filename:**

FC9G_193 S: 33

**Injection Volume (uL):**

15

**Blank Data Filename:**

FC9G_193 S: 26

**Dilution Factor:**

N/A

**Cal. Ver. Data Filename:**

FC9G_193 S: 17

**Concentration Units:**

ng absolute

**% Moisture:**

6.66

### LABELED COMPOUND

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(1) Where applicable, custom lab flags have been used on this report; V = surrogate recovery is not within method/contract control limits.

(2) R(%) = percent recovery.

Approved by: __________Jason MacKenzie__________ QA/QC Chemist

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### Perfluorinated Organics Analysis Report

**AXYS METHOD MLA-041 Rev 07**

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Project No.**

**Lab Sample I.D.:**

**Matrix:** SOLID

**Sample Receipt Date:** 12-May-2009

**Initial Calibration Date:** 22-May-2009

**Extraction Date:** 19-May-2009

**Instrument ID:** LC MS/MS

**Analysis Date:** 22-May-2009

**Time:** 15:49:59

**Column ID:** C18

**Extract Volume (uL):** 4000

**Sample Data Filename:** FC9G_193 S: 34

**Injection Volume (uL):** 15

**Blank Data Filename:** FC9G_193 S: 26

**Dilution Factor:** N/A

**Cal. Ver. Data Filename:** FC9G_193 S: 17

**Concentration Units:** ng/g (dry weight basis)

**% Moisture:** 11.0

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(1) Where applicable, custom lab flags have been used on this report; U = not detected.

Approved by: __________Jason MacKenzie_________ QA/QC Chemist
AXYS METHOD MLA-041 Rev 07
PERFLUORINATED ORGANICS ANALYSIS REPORT

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 4095
Matrix: SOLID
Sample Receipt Date: 12-May-2009
Sample Collection: 07-May-2009 10:50
Initial Calibration Date: 22-May-2009

Lab Sample I.D.: L12669-7
Sample Size: 5.17 g (dry)
Instrument ID: LC MS/MS

Project No. FFFI RICHFIELD, N. ST. PAUL AND GOODVIEW
Analysis Date: 22-May-2009 Time: 15:49:59
Column ID: C18

Extract Volume (uL): 4000
Sample Data Filename: FC9G_193 S: 34
Injection Volume (uL): 15
Blank Data Filename: FC9G_193 S: 26

Sample Size: 5.17 g (dry)
Initial Calibration Date: 22-May-2009
Instrument ID: LC MS/MS

Dilution Factor: N/A
Cal. Ver. Data Filename: FC9G_193 S: 17

Concentration Units: ng absolute
% Moisture: 11.0

LABELED COMPOUND LAB FLAG 1 SPIKE CONC. CONC. FOUND R(%) 2 RETENTION TIME

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<th>Flag</th>
<th>Spike Conc.</th>
<th>Concentration Found</th>
<th>% Recovery</th>
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<td>8:24</td>
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1 Where applicable, custom lab flags have been used on this report.
2 R(%) = percent recovery.

Approved by: ___________ Jason MacKenzie ___________ QA/QC Chemist
### PERFLUORINATED ORGANICS ANALYSIS REPORT

**AXYS METHOD MLA-041 Rev 07**

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Contract No.**: 4095  
**Lab Sample I.D.**:  
**Project No.**: FFFI RICHFIELD, N. ST. PAUL AND GOODVIEW  
**Sample Collection**: 07-May-2009 11:20

**Matrix**: SOLID  
**Sample Receipt Date**: 12-May-2009  
**Initial Calibration Date**: 22-May-2009

**Sample Size**: 2.68 g (dry)  
**Instrument ID**: LC MS/MS  
**Column ID**: C18  
**Extraction Date**: 19-May-2009  
**Analysis Date**: 22-May-2009 Time: 16:47:31

**Sample Data Filename**: FC9G_193 S: 37  
**Blank Data Filename**: FC9G_193 S: 26  
**Cal. Ver. Data Filename**: FC9G_193 S: 17

**Sample Data Filename**: FC9G_193 S: 37  
**Blank Data Filename**: FC9G_193 S: 26  
**Cal. Ver. Data Filename**: FC9G_193 S: 17

**Concentration Units**: ng/g (dry weight basis)  
**% Moisture**: 10.9

### COMPOUND

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(1) Where applicable, custom lab flags have been used on this report; U = not detected.

Approved by: __________Jason MacKenzie_________ QA/QC Chemist
AXYS METHOD MLA-041 Rev 07

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

PERFLUORINATED ORGANICS ANALYSIS REPORT

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Project No. FFFI RICHFIELD, N. ST. PAUL AND GOODVIEW

Contract No.: 4095

Lab Sample I.D.: L12669-8

Matrix: SOLID

Sample Receipt Date: 12-May-2009

Initial Calibration Date: 22-May-2009

Extraction Date: 19-May-2009

Instrument Calibration Date: LC MS/MS

Analysis Date: 22-May-2009

Column ID: C18

Extract Volume (uL): 4000

Sample Data Filename: FC9G_193 S: 37

Injection Volume (uL): 15

Blank Data Filename: FC9G_193 S: 26

Dilution Factor: N/A

Cal. Ver. Data Filename: FC9G_193 S: 17

Concentration Units: ng absolute

% Moisture: 10.9

LABELED COMPOUND LAB FLAG 1 SPIKE CONC. CONC. FOUND R(%) 2 RETENTION TIME

13C4-PFBA 12.0 10.7 88.8 5:22
13C2-PFHxA 12.0 12.5 104 6:27
13C2-PFOA 36.0 29.9 83.2 7:14
13C5-PFNA 12.0 12.6 105 7:38
13C2-PFDA 12.0 9.25 77.1 8:08
13C2-PFDoA 12.0 7.61 63.4 9:18
13C4-PFOS (80) 18.0 12.2 67.9 8:24

(1) Where applicable, custom lab flags have been used on this report.
(2) R(%) = percent recovery.

Approved by: _________ Jason MacKenzie _________ QA/QC Chemist

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Report Filename: PFC_FC_LC_PFOA_L12669-8_Form2_FC9G_193S37_SJ1021183.html; Workgroup: WG28781; Design ID: 312 ]

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AXYS METHOD MLA-041 Rev 07

PERFLUORINATED ORGANICS ANALYSIS REPORT

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 4095

Matrix: SOLID

Sample Receipt Date: 12-May-2009

Extraction Date: 19-May-2009

Analysis Date: 22-May-2009

Extract Volume (uL): 4000

Injection Volume (uL): 15

Concentration Units: ng/g (dry weight basis)

% Moisture: 19.0

COMPOUND LAB FLAG 1 CONC. FOUND DETECTION LIMIT RETENTION TIME

PFBA 1.04 0.379 5:20

PFPeA 4.52 0.379 6:05

PFHxA 4.70 0.379 6:27

PFHpA 3.28 0.379 6:47

PFDA 5.02 0.379 7:14

PFNA 4.83 0.379 7:38

PFDA U 0.379

PFUnA U 0.379

PFDoA U 0.379

PFBS U 0.757

PFHxS 32.2 0.757 7:26

PFOS 666 0.983 8:15

PFOSA U 0.379

(1) Where applicable, custom lab flags have been used on this report; U = not detected.

Approved by: ________Jason MacKenzie_______ QA/QC Chemist

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Report Filename: PFC_FC_LC_PFOA_L12669-9_Form1A_FC9G_193S39_SJ1021185.html; Workgroup: WG28781; Design ID: 312

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**AXYS METHOD MLA-041 Rev 07**

**PERFLUORINATED ORGANICS ANALYSIS REPORT**

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**PROJECT NO.**

**Lab Sample I.D.:**

**Matrix:**

**Sample Receipt Date:**

**Extraction Date:**

**Analysis Date:**

**Extract Volume (uL):**

**Injection Volume (uL):**

**Dilution Factor:**

**Concentration Units:**

**% Moisture:**

**LABELED COMPOUND**

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<th>Spike Conc.</th>
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<td>77.3</td>
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</table>

(1) Where applicable, custom lab flags have been used on this report.
(2) R(%) = percent recovery.

Approved by: __________Jason MacKenzie__________ QA/QC Chemist
**AXYS METHOD MLA-041 Rev 07**

**PERFLUORINATED ORGANICS ANALYSIS REPORT**

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Contract No.**: 4095  
**Matrix**: SOLID

**Sample Receipt Date**: 12-May-2009  
**Initial Calibration Date**: 22-May-2009

**Extraction Date**: 19-May-2009  
**Instrument ID**: LC MS/MS

**Analysis Date**: 22-May-2009 **Time**: 16:09:26  
**Column ID**: C18

**Extract Volume (uL)**: 4000  
**Sample Data Filename**: FC9G_193S:35

**Injection Volume (uL)**: 15  
**Blank Data Filename**: FC9G_193S:26

**Dilution Factor**: N/A  
**Cal. Ver. Data Filename**: FC9G_193S:17

**Concentration Units**: ng/g (dry weight basis)  
**% Moisture**: 20.3

### COMPOUND

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<th>LAB FLAG ¹</th>
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<th>DETECTION LIMIT</th>
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(1) Where applicable, custom lab flags have been used on this report; U = not detected.

Approved by: __________Jason MacKenzie_________ QA/QC Chemist

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Report Filename: PFC_FC_LC_PFOA_L12669-10_Form1A_FC9G_193S35_SJ1021181.html; Workgroup: WG28781; Design ID: 312 ]

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<table>
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<tr>
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<th>SPIKE CONC.</th>
<th>CONC. FOUND</th>
<th>R(%)</th>
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</table>

(1) Where applicable, custom lab flags have been used on this report.
(2) R(%) = percent recovery.

Approved by: ____________ Jason MacKenzie ____________ QA/QC Chemist
### PERFLUORINATED ORGANICS ANALYSIS REPORT

**AXYS METHOD MLA-041 Rev 07**

**AXYS ANALYTICAL SERVICES**

2045 MILLS RD., SIDNEY, B.C., CANADA

V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Contract No.:** 4095

**Project No.:**

**Lab Sample I.D.:**

**Matrix:** SOLID

**Sample Receipt Date:** 12-May-2009

**Initial Calibration Date:** 22-May-2009

**Extraction Date:** 19-May-2009

**Instrument ID:** LC MS/MS

**Analysis Date:** 22-May-2009

**Time:** 16:28:53

**Column ID:** C18

**Extract Volume (uL):** 4000

**Sample Data Filename:** FC9G_193 S: 36

**Injection Volume (uL):** 15

**Blank Data Filename:** FC9G_193 S: 26

**Dilution Factor:** N/A

**Cal. Ver. Data Filename:** FC9G_193 S: 17

**Concentration Units:** ng/g (dry weight basis)

**% Moisture:** 35.3

### COMPOUND LAB FLAG 1 CONC. FOUND DETECTION LIMIT RETENTION TIME

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(1) Where applicable, custom lab flags have been used on this report; U = not detected.

Approved by: ___________Jason MacKenzie__________ QA/QC Chemist

---

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### AXYS METHOD MLA-041 Rev 07

**PERFLUORINATED ORGANICS ANALYSIS REPORT**

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Contract No.:** 4095  
**Lab Sample I.D.:** L12669-11

**Matrix:** SOLID  
**Sample Size:** 4.82 g (dry)

**Sample Receipt Date:** 12-May-2009  
**Initial Calibration Date:** 22-May-2009

**Extraction Date:** 19-May-2009  
**Instrument ID:** LC MS/MS

**Analysis Date:** 22-May-2009  
**Column ID:** C18

**Time:** 16:28:53  
**Sample Data Filename:** FC9G_193S:36

**Injection Volume (uL):** 15  
**Blank Data Filename:** FC9G_193S:26

**Dilution Factor:** N/A  
**Cal. Ver. Data Filename:** FC9G_193S:17

**Concentration Units:** ng absolute  
**% Moisture:** 35.3

#### LABELED COMPOUND | LAB FLAG | SPIKE CONC. | CONC. FOUND | R(%) | RETENTION TIME
--- | --- | --- | --- | --- | ---
13C4-PFBA | 1 | 12.0 | 8.51 | 71.0 | 5:20
13C2-PFHxA | 12.0 | 10.1 | 84.0 | 6:26
13C2-PFOA | 36.0 | 30.0 | 83.3 | 7:14
13C5-PFNA | 12.0 | 9.53 | 79.4 | 7:38
13C2-PFDA | 12.0 | 7.98 | 66.5 | 8:08
13C2-PfDoA | 12.0 | 7.24 | 60.3 | 9:18
13C4-PFOS (80) | 18.0 | 12.1 | 67.3 | 8:27

---

(1) Where applicable, custom lab flags have been used on this report.
(2) R(%) = percent recovery.

---

Approved by: ___________ Jason MacKenzie ________ QA/QC Chemist

---

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Report Filename: PFC_FC_LC_PFOA_L12669-11_Form2_FC9G_193S36_SJ1021182.html; Workgroup: WG28781; Design ID: 312 ]

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### AXYS METHOD MLA-041 Rev 07

#### AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

---

#### LABORATORY REPORT

**PERFLUORINATED ORGANICS ANALYSIS REPORT**

<table>
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<th>RETENTION TIME</th>
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1. Where applicable, custom lab flags have been used on this report; U = not detected.

---

**Approved by:** __________ Jason MacKenzie _________ QA/QC Chemist

---

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<th>CONC. FOUND</th>
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<th>RETENTION TIME</th>
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</tr>
</tbody>
</table>

(1) Where applicable, custom lab flags have been used on this report; V = surrogate recovery is not within method/contract control limits.
(2) R(%) = percent recovery.

Approved by: __________Jason MacKenzie__________ QA/QC Chemist
AXYS METHOD MLA-041 Rev 07

PERFLUORINATED ORGANICS ONGOING PRECISION AND RECOVERY (OPR)

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 4095
Lab Sample I.D.: WG28781-102

Matrix: SOLID
Initial Calibration Date: 22-May-2009

Extraction Date: 19-May-2009
Instrument ID: LC MS/MS

Analysis Date: 22-May-2009 Time: 11:22:28
Column ID: C18

Extract Volume (uL): 4000
OPR Data Filename: FC9G_193 S: 20

Injection Volume (uL): 15
Blank Data Filename: FC9G_193 S: 26

Dilution Factor: N/A
Cal. Ver. Data Filename: FC9G_193 S: 17

ALL CONCENTRATIONS REPORTED ON THIS FORM ARE CONCENTRATIONS IN EXTRACT, BASED ON A 1 mL EXTRACT VOLUME.

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<tr>
<th>COMPOUND</th>
<th>LAB FLAG 1</th>
<th>SPIKE CONC. (ng/mL)</th>
<th>CONC. FOUND (ng/mL)</th>
<th>% RECOVERY</th>
<th>RETENTION TIME</th>
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<td>7:38</td>
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</table>

(1) Where applicable, custom lab flags have been used on this report.

Approved by: Jason MacKenzie QA/QC Chemist

For Axys Internal Use Only | XSL Template: FC-Form8A.xsl; Created: 16-Jun-2009 11:23:11; Application: XMLTransformer-1.9.24; Report Filename: PFC_FC_LC_PFOA_WG28781-102_Form8A_SJ1021160.html; Workgroup: WG28781; Design ID: 312}

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.
### Ongoing Precision and Recovery (OPR)

**AXYS METHOD MLA-041 Rev 07**

**AXYS ANALYTICAL SERVICES**

2045 MILLS RD., SIDNEY, B.C., CANADA

V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Contract No.:** 4095  
**Lab Sample I.D.:** WG28781-102

**Matrix:** SOLID  
**Initial Calibration Date:** 22-May-2009

**Extraction Date:** 19-May-2009  
**Instrument ID:** LC MS/MS

**Analysis Date:** 22-May-2009  
**Column ID:** C18

**Extract Volume (uL):** 4000  
**OPR Data Filename:** FC9G_193 S: 20

**Injection Volume (uL):** 15  
**Blank Data Filename:** FC9G_193 S: 26

**Dilution Factor:** N/A  
**Cal. Ver. Data Filename:** FC9G_193 S: 17

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**ALL CONCENTRATIONS REPORTED ON THIS FORM ARE CONCENTRATIONS IN EXTRACT, BASED ON A 1 mL EXTRACT VOLUME.**

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<th>LABELED COMPOUND</th>
<th>LAB FLAG ¹</th>
<th>SPIKE CONC. (ng/mL)</th>
<th>CONC. FOUND (ng/mL)</th>
<th>% RECOVERY</th>
<th>RETENTION TIME</th>
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<td>11.7</td>
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<td>8:27</td>
</tr>
</tbody>
</table>

¹ Where applicable, custom lab flags have been used on this report; V = surrogate recovery is not within method/contract control limits.

Approved by: Jason MacKenzie  
QA/QC Chemist

---

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### AXYS METHOD MLA-041 Rev 07

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**PROJECT No.**

**Lab Sample I.D.:**

**Matrix:** SOLID

**Sample Size:** 1.28 g (dry)

**Extraction Date:** 19-May-2009

**Initial Calibration Date:** 22-May-2009

**Analysis Date:** 22-May-2009 **Time:** 17:45:05

**Instrument ID:** LC MS/MS

**GC Column ID:** C18

**Injection Volume (uL):** 15

**Blank Data Filename:** FC9G_193 S: 26

**Cal. Ver. Data Filename:** FC9G_193 S: 17

### All Concentrations Reported on this Form Are Concentrations on Sample Size Basis

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<th>ION ABUND. RATIO</th>
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<th>CONC. FOUND (ng/g)</th>
<th>MS R% ²</th>
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<td>15.6</td>
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<td></td>
<td></td>
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</tbody>
</table>

(1) Where applicable, custom lab flags have been used on this report; U = not detected.

(2) R% = percent recovery.

Approved by: __________Jason MacKenzie__________ QA/QC Chemist

For Axys Internal Use Only [ XSL Template: MS.xsl; Created: 16-Jun-2009 11:23:32; Application: XMLTransformer 1.9.24; Report Filename: MS_FC_LC_PFOA-MS-MSD_WG28781-103_L12669-9_Form8C.html; Workgroup: WG28781; Design ID: 312 ]

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.
**AXYS METHOD MLA-041 Rev 07**

**PERFLUORINATED ORGANICS ANALYSIS REPORT**

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Contract No.:** 4095

**Project No.:** FFFI RICHFIELD, N. ST. PAUL AND GOODVIEW

**Lab Sample I.D.:** WG28781-103 (MS)

**Matrix:** SOLID

**Sample Receipt Date:** 12-May-2009

**Sample Size:** 1.28 g (dry)

**Initial Calibration Date:** 22-May-2009

**Instrument ID:** LC MS/MS

**Analysis Date:** 22-May-2009 Time: 17:45:05

**Column ID:** C18

**Extract Volume (uL):** 4000

**Sample Data Filename:** FC9G_193 S: 40

**Injection Volume (uL):** 15

**Blank Data Filename:** FC9G_193 S: 26

**Dilution Factor:** N/A

**Cal. Ver. Data Filename:** FC9G_193 S: 17

**Concentration Units:** ng absolute

**% Moisture:** 20.6

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<th>CONC. FOUND</th>
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</tr>
<tr>
<td>13C2-PFOA</td>
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<td>31.1</td>
<td>86.4</td>
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<tr>
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</tbody>
</table>

(1) Where applicable, custom lab flags have been used on this report.
(2) R(%) = percent recovery.

Approved by: __________Jason MacKenzie_________ QA/QC Chemist

For Axys Internal Use Only [ XSL Template: FC-Form2.xsl; Created: 16-Jun-2009 11:23:11; Application: XMLTransformer-1.9.24; Report Filename: PFC_FC_LC_PFOA_WG28781-103_Form2_FC9G_193S40_SJ1021186.html; Workgroup: WG28781; Design ID: 312 ]

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### AXYS METHOD MLA-041 Rev 07

#### FORM 8E

**PERFLUORINATED ORGANICS MATRIX SPIKE DUPLICATE (MSD)**

**ANALYSIS REPORT**

**AXYS ANALYTICAL SERVICES**

2045 MILLS RD., SIDNEY, B.C., CANADA

V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Contract No.:** 4095

**Matrix:** SOLID

**Sample Size:** 1.34 g (dry)

**Extraction Date:** 19-May-2009

**Initial Calibration Date:** 22-May-2009

**Analysis Date:** 22-May-2009

**Instrument ID:** LC MS/MS

**GC Column ID:** C18

**Extract Volume (µL):** 4000

**Injection Volume (µL):** 15

**Blank Data Filename:** FC9G_193 S: 26

**Cal. Ver. Data Filename:** FC9G_193 S: 17

**Sample Collection:** 07-May-2009 11:25

**Form 8E**

**PERFLUORINATED ORGANICS MATRIX SPIKE DUPLICATE (MSD)**

**ANALYSIS REPORT**

**AXYS ANALYTICAL SERVICES**

2045 MILLS RD., SIDNEY, B.C., CANADA

V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Project No.:** FFFI RICHFIELD, N. ST. PAUL AND GOODVIEW

**Lab Sample I.D.:** WG28781-104 (MSD)

**Sample Collection:** 07-May-2009 11:25

---------- QA/QC Chemist

For Axys Internal Use Only [ XSL Template: MS.xsl; Created: 16-Jun-2009 11:23:32; Application: XMLTransformer 1.9.24; Report Filename: MS_FC_LC_PFOA-MS-MSD_WG28781-104_L12669-9_Form8E.html; Workgroup: WG28781; Design ID: 312 ]

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.

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### ALL CONCENTRATIONS REPORTED ON THIS FORM ARE CONCENTRATIONS ON SAMPLE SIZE BASIS

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<th>SPIKE CONC (ng/g)</th>
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<th>CONC. FOUND (ng/g)</th>
<th>MSD R%</th>
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</table>

(1) Where applicable, custom lab flags have been used on this report; U = not detected.

(2) R% = percent recovery.

Approved by: __________Jason MacKenzie_________ QA/QC Chemist
### AXYS METHOD MLA-041 Rev 07

**PERFLUORINATED ORGANICS ANALYSIS REPORT**

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Project No.:** 4095  
**Lab Sample I.D.:**  

**Matrix:** SOLID  
**Sample Size:** 1.34 g (dry)

**Sample Receipt Date:** 12-May-2009  
**Initial Calibration Date:** 22-May-2009

**Extraction Date:** 19-May-2009  
**Instrument ID:** LC MS/MS

**Analysis Date:** 22-May-2009 Time: 18:04:31  
**Column ID:** C18

**Extract Volume (uL):** 4000  
**Sample Data Filename:** FC9G_193 S: 41

**Injection Volume (uL):** 15  
**Blank Data Filename:** FC9G_193 S: 26

**Dilution Factor:** N/A  
**Cal. Ver. Data Filename:** FC9G_193 S: 17

**Concentration Units:** ng absolute  
**% Moisture:** 19.2

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(1) Where applicable, custom lab flags have been used on this report.  
(2) R(%) = percent recovery.

Approved by: __________Jason MacKenzie__________ QA/QC Chemist

---

For Axys Internal Use Only [ XSL Template: FC-Form2.xsl; Created: 16-Jun-2009 11:23:11; Application: XMLTransformer-1.9.24;  
Report Filename: PFC_FC_LC_PFOA_WG28781-104_Form2_FC9G_193S41_SJ1021187.html; Workgroup: WG28781; Design ID: 312 ]

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.
AXYS METHOD MLA-041 Rev 07

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date: 22-May-2009

Instrument ID: LC MS/MS

LC Column ID: C18

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CS1 Data Filename: FC9G_193 S: 5
CS2 Data Filename: FC9G_193 S: 6
CS3 Data Filename: FC9G_193 S: 7
CS4 Data Filename: FC9G_193 S: 8
CS5 Data Filename: FC9G_193 S: 9
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(1) Where applicable, custom lab flags have been used on this report.

Approved by: ___________Jason MacKenzie_________ QA/QC Chemist

Contact: analytical@axys.com
## PERFLUORINATED ORGANICS INITIAL CALIBRATION PERCENT RECOVERIES

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Initial Calibration Date:** 22-May-2009

**Instrument ID:** LC MS/MS

**LC Column ID:** C18

**CS0 Data Filename:** FC9G_193 S: 4

**CS1 Data Filename:** FC9G_193 S: 5

**CS2 Data Filename:** FC9G_193 S: 6

**CS3 Data Filename:** FC9G_193 S: 7

**CS4 Data Filename:** FC9G_193 S: 8

**CS5 Data Filename:** FC9G_193 S: 9

**CS6 Data Filename:** FC9G_193 S: 10

**CS7 Data Filename:** FC9G_193 S: 11

**CS8 Data Filename:** N/A

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(1) Where applicable, custom lab flags have been used on this report.

Approved by: Jason MacKenzie QA/QC Chemist
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(1) Where applicable, custom lab flags have been used on this report.

Approved by: __________Jason MacKenzie__________ QA/QC Chemist
**AXYS METHOD MLA-041 Rev 07**

**PERFLUORINATED ORGANICS INITIAL CALIBRATION RETENTION TIMES**

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Initial Calibration Date:** 22-May-2009

**Instrument ID:** LC MS/MS

**LC Column ID:** C18

**CS0 Data Filename:** FC9G_193 S: 4

**CS1 Data Filename:** FC9G_193 S: 5

**CS2 Data Filename:** FC9G_193 S: 6

**CS3 Data Filename:** FC9G_193 S: 7

**CS4 Data Filename:** FC9G_193 S: 8

**CS5 Data Filename:** FC9G_193 S: 9

**CS6 Data Filename:** FC9G_193 S: 10

**CS7 Data Filename:** FC9G_193 S: 11

**CS8 Data Filename:** N/A

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(1) Where applicable, custom lab flags have been used on this report.

Approved by: __________Jason MacKenzie__________ QA/QC Chemist

For Axys Internal Use Only [ XSL Template: FC-Form3D.xsl; Created: 16-Jun-2009 11:23:11; Application: XMLTransformer-1.9.24; Report Filename: PFOA_FC_HC_22-May-2009_FC9G__Form3D_GS32270.html; Workgroup: WG28781; Design ID: 312 ]
**AXYS METHOD MLA-041 Rev 07**

**PERFLUORINATED ORGANICS CALIBRATION VERIFICATION**

**AXYS ANALYTICAL SERVICES**

2045 MILLS RD., SIDNEY, B.C., CANADA

V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

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(1) Where applicable, custom lab flags have been used on this report.

Approved by: ____________Jason MacKenzie__________ QA/QC Chemist

For Axys Internal Use Only [ XSL Template: FC-Form4A.xsl; Created: 16-Jun-2009 11:23:11; Application: XMLTransformer-1.9.24; Report Filename: PFOA_FC_LC_FC9G_193S17__Form4A_SJ1021155.html; Workgroup: WG28781; Design ID: 312 ]
**LABELED COMPOUND** | **LAB FLAG** | **RETENTION TIME** | **EXPECTED CONC.** | **CONC. FOUND** | **RECOVERY (%)**
--- | --- | --- | --- | --- | ---
13C4-PFBA | 1 | 5:19 | 12.0 | 11.8 | 98.2
13C2-PFHxA | 1 | 6:27 | 12.0 | 11.8 | 98.7
13C2-PFOA | 1 | 7:14 | 36.0 | 32.5 | 90.4
13C5-PFNA | 1 | 7:38 | 12.0 | 12.1 | 101
13C2-PFDA | 1 | 8:08 | 12.0 | 9.85 | 82.1
13C2-PFDoA | 1 | 9:18 | 12.0 | 8.54 | 71.2
13C4-PFOS (80) | 1 | 8:24 | 18.0 | 17.0 | 94.7

(1) Where applicable, custom lab flags have been used on this report.

Approved by: ___________Jason MacKenzie_________ QA/QC Chemist

For Axys Internal Use Only [ XSL Template: FC-Form4B.xsl; Created: 16-Jun-2009 11:23:11; Application: XMLTransformer-1.9.24; Report Filename: PFOA_FC_LC_FC9G_193S17__Form4B_SJ1021155.html; Workgroup: WG28781; Design ID: 312 ]
<table>
<thead>
<tr>
<th>COMPOUND</th>
<th>LAB FLAG</th>
<th>RETENTION TIME</th>
<th>EXPECTED CONC.</th>
<th>CONC. FOUND</th>
<th>RECOVERY (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PFBA</td>
<td>1</td>
<td>5:19</td>
<td>20.0</td>
<td>25.8</td>
<td>129</td>
</tr>
<tr>
<td>PFPeA</td>
<td>1</td>
<td>6:02</td>
<td>20.0</td>
<td>17.7</td>
<td>88.5</td>
</tr>
<tr>
<td>PFHxA</td>
<td>1</td>
<td>6:26</td>
<td>20.0</td>
<td>20.0</td>
<td>100</td>
</tr>
<tr>
<td>PFHpA</td>
<td>1</td>
<td>6:47</td>
<td>20.0</td>
<td>18.5</td>
<td>92.5</td>
</tr>
<tr>
<td>PFOA</td>
<td>1</td>
<td>7:14</td>
<td>20.0</td>
<td>19.3</td>
<td>96.6</td>
</tr>
<tr>
<td>PFNA</td>
<td>1</td>
<td>7:38</td>
<td>20.0</td>
<td>18.2</td>
<td>90.8</td>
</tr>
<tr>
<td>PFDA</td>
<td>1</td>
<td>8:11</td>
<td>20.0</td>
<td>21.9</td>
<td>109</td>
</tr>
<tr>
<td>PFUnA</td>
<td>1</td>
<td>8:45</td>
<td>20.0</td>
<td>18.7</td>
<td>93.5</td>
</tr>
<tr>
<td>PFDoA</td>
<td>1</td>
<td>9:21</td>
<td>20.0</td>
<td>23.5</td>
<td>117</td>
</tr>
<tr>
<td>PFBS</td>
<td>1</td>
<td>6:35</td>
<td>40.0</td>
<td>34.5</td>
<td>86.2</td>
</tr>
<tr>
<td>PFHxS</td>
<td>1</td>
<td>7:26</td>
<td>40.0</td>
<td>30.1</td>
<td>75.3</td>
</tr>
<tr>
<td>PFOS</td>
<td>1</td>
<td>8:27</td>
<td>40.0</td>
<td>32.3</td>
<td>80.7</td>
</tr>
<tr>
<td>PFOSA</td>
<td>1</td>
<td>10:04</td>
<td>20.0</td>
<td>18.1</td>
<td>90.5</td>
</tr>
</tbody>
</table>

(1) Where applicable, custom lab flags have been used on this report.

Approved by: __________ Jason MacKenzie __________ QA/QC Chemist
AXYS METHOD MLA-041 Rev 07

PERFLUORINATED ORGANICS CALIBRATION VERIFICATION

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date: 22-May-2009
VER Data Filename: FC9G_193 S: 45

Instrument ID: LC MS/MS
Analysis Date: 22-May-2009

LC Column ID: C18
Analysis Time: 19:22:36

LABELED COMPOUND   LAB FLAG 1   RETENTION TIME   EXPECTED CONC.   CONC. FOUND   RECOVERY (%)

| 13C4-PFBA   | 5:18          | 12.0           | 9.37           | 78.1  
| 13C2-PFHxA  | 6:27          | 12.0           | 13.0           | 108   
| 13C2-PFOA   | 7:14          | 36.0           | 32.7           | 90.8  
| 13C5-PFNA   | 7:38          | 12.0           | 12.4           | 103   
| 13C2-PFDA   | 8:11          | 12.0           | 9.87           | 82.3  
| 13C2-PFDoA  | 9:20          | 12.0           | 8.26           | 68.9  
| 13C4-PFOS (80) | 8:27        | 18.0           | 17.9           | 99.4  

(1) Where applicable, custom lab flags have been used on this report.

Approved by: __________Jason MacKenzie_________ QA/QC Chemist

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PERFLUORINATED ORGANIC ANALYSIS

AQUEOUS SAMPLES

AXYS METHOD: MLA-060

PROJECT: FIRE FIGHTING FOAM SAMPLING AT RICHFIELD, NORTH ST. PAUL AND GOODVIEW

WORK ORDER #: 34499770

Contract: 4095
Data Package Identification: DPWG29083
Analysis WG28780

12 June 2009
PERFLUORINATED ORGANIC ANALYSIS

AQUEOUS SAMPLES

AXYS METHOD: MLA-060

PROJECT: FIRE FIGHTING FOAM SAMPLING AT RICHFIELD, NORTH ST. PAUL AND GOODVIEW

WORK ORDER #: 34499770

Contract: 4095
Data Package Identification: DPWG29083
Analysis WG28780

Prepared for:
Minnesota Pollution Control Agency

Prepared by:
AXYS Analytical Services Ltd.
2045 Mills Rd
Sidney, British Columbia V8L 5X2
CANADA

Contact: Angie Whetung
Project Manager

12 June 2009
MINNESOTA POLLUTION CONTROL AGENCY
AQUEOUS SAMPLES

PERFLUORINATED ORGANIC ANALYSIS
AXYS METHOD: MLA-060

Project: FFFI Richfield, N. St. Paul and Goodview
Work Order #: 34499770

4095: L12672-1 to -5
12 June 2009

NARRATIVE

This narrative describes the analysis of five aqueous samples for the determination of perfluorinated organic compounds using high performance liquid chromatography/tandem mass spectrometry (HPLC/MS-MS).

SAMPLE RECEIPT AND STORAGE

The samples were received on the 12th of May 2009. Samples were logged in following the client’s instructions. Details of sample conditions upon receipt are provided on the Sample Receiving Record forms included in the sample documentation section of this data package. The samples were stored at 4°C prior to extraction and analysis.

SAMPLE EXTRACTION AND ANALYSIS

The samples were analyzed in one analysis batch named PFCWG28780. Composition of the batch is shown on the Cover pages and the Batch List forms included in this data package.

Sample extraction, instrumental analysis and analyte quantification procedures were in accordance with AXYS Method MLA-060: Analytical Procedure for the Analysis of Perfluorinated Organic Compounds in Aqueous Samples by LC-MS/MS.

The samples were filtered and accurately weighed. After spiked with ¹³C-labelled quantification standards, the samples were extracted and cleaned up using SPE cartridges. The resulted extracts were instrumentally analyzed using liquid chromatography/mass spectrometry (LC-MS/MS). Analyte concentrations were determined by isotope dilution/internal standard quantification, comparing the area response of the quantification ion to that of the ¹³C-labelled standards and correcting for response factors. Quadratic quantification equations with 1X weighting fit were determined from a multi-point calibration series prepared alongside the samples.

Sample NoStPaul B-1 GW (AXYS ID: L12672-1) was used as the matrix for MS/MSD testing. The MS/MSD was assigned AXYS IDs WG28780-103/-104.

The reporting limit (RL) was defined as the concentration equivalent to the lowest calibration standard or the sample specific detection limit, whichever was greater.

REPORTING CONVENTIONS

The AXYS contract number assigned for internal tracking was 4095. Samples were assigned a unique laboratory identifier of the form L12672-XX, where X = numeral. All data reports reference these unique
AXYS IDs plus the client's sample identifier. To assist with locating data, a table correlating AXYS ID with the client sample number is included in this data package.

Any extra work required and performed after the initial instrumental analysis of the sample's extract is given an extra "test suffix" code. The single letter code per extra work performed is added to the AXYS sample ID as a suffix, and is combined with any other applicable test suffix codes. The extra work codes used to report data in this package include:

- i = instrumental re-analysis performed on the sample extract
- (A) = parent sample for a duplicate pair

The following laboratory qualifier flags were used in this data package:

- U = identifies a compound that was not detected.

Results are reported in concentration units of nanograms per liter (ng/L). Concentration and detection limits are provided to three significant figures. Analysis results for each sample are provided on Analysis Report form 1A and form 2.

**QA/QC NOTE**

Samples and QC samples analyzed in one analysis batch were carried intact through the entire analytical process. The sample data were reviewed and evaluated in relation to the batch QC samples.

- Sample analyte concentrations are not blank corrected.
- By virtue of the isotope dilution/ internal standard quantification procedures, data are recovery corrected for possible losses during extraction and cleanup.
- All linearity, CALVER, OPR and labeled compound recovery specifications were met with the following exceptions:

The highest-level calibration standard CS7 (Form 3A and 3C) in the initial calibration was excluded for PFDoA due to non-linearity. However, a minimum of 6 calibration standard points were used to construct the regression equations for quantification of target analytes or calculate response factor (RF) for quantification of labeled surrogates. As multi-point calibrations were used, sample data are deemed not to be significantly affected.

Relative Percent Difference (RPD) for the analyte PFNA (23.6%) in the sample MS and MSD (AXYS ID: WG28780-103 and -104, respectively) was observed to be slightly above the client method limit of 20%, but met AXYS method criteria. Data are not considered affected by this variance.

**ANALYTICAL DISCUSSION**

The extracts for the QC samples (Lab Blank and OPR) were routinely re-analyzed for a second time on instrument for confirmative purposes; re-analysis data for the OPR (AXYS ID: WG28780-102) are reported (indicated by the suffix 'i' on AXYS ID).

**DATA PACKAGE**
This data package is assigned a unique identifier, DPWG29083, shown on the cover page of the data package. Included in the data package after this narrative are the following documents:

- Method summary
- Sample ‘Cover Page’ and ‘Correlation Table’
- Sample receiving documentation
- Sample data reports (in order of AXYS Sample ID)
- Laboratory QC data reports
- Instrumental QC data reports (organized by analysis date)

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, except for the conditions detailed above. In addition, I certify, that to the best of my knowledge and belief, the data as reported are true and accurate. The following signature, on behalf of AXYS Analytical Services Ltd, authorizes the release of the data contained in this data package.

Signed: Bryan Alonzo, B.Sc. QA/QC Chemist

12-Jan-09

Date Signed
AXYS Analytical Services Ltd.

Analytical Procedure for the Analysis of Perfluorinated Organic Compounds in Aqueous Samples by LC-MS/MS

Method MLA-060 describes the analysis of perfluorinated organic compounds (PFC) in aqueous samples. Typical quantification limits are in the range of 1 - 2 ng/L for a 0.5 L sample size.

EXTRACTION AND CLEANUP

Sample size may be up to 1000 mL. Samples are stored in HDPE (high density polyethylene) containers. Samples are filtered, adjusted to pH 7, spiked with surrogate standards and extracted by solid phase extraction (SPE) using weak anion exchange cartridges. Wash and elution procedures are chosen to meet various analysis requirements. The eluates are spiked with recovery standards and analyzed by HPLC-MS/MS. Calibration solutions are processed through SPE in the same way as the samples.

QUALITY ASSURANCE / QUALITY CONTROL

All samples are analyzed in batches. The composition of a batch is detailed on a batch sheet. Each batch has the following composition:

- Batch Size - Each batch consists of test samples and additional QC samples.
- Blanks – 5% of the samples within a batch are procedural blanks.
- Duplicates – 5% of the samples within a batch are analyzed in duplicate, provided there is sufficient sample.
- Matrix Spike/Matrix Spike Duplicate analyzed upon client request.
- OPR (Spiked Reference Sample) – 5% of the samples within a batch are spiked reference samples.

QC Specification: Procedural Blank Levels and OPR Recoveries

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Procedural Blank Level ng/sample</th>
<th>OPR Recovery Range (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfluorobutanoate</td>
<td>&lt;0.25</td>
<td>80 – 120</td>
</tr>
<tr>
<td>Perfluoropentanoate</td>
<td>&lt;0.25</td>
<td>80 – 120</td>
</tr>
<tr>
<td>Perfluorohexanoate</td>
<td>&lt;0.25</td>
<td>80 – 120</td>
</tr>
<tr>
<td>Perfluoroheptanoate</td>
<td>&lt;0.25</td>
<td>80 – 120</td>
</tr>
<tr>
<td>Substance</td>
<td>Recovery</td>
<td>Range</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>----------</td>
<td>-----------</td>
</tr>
<tr>
<td>Perfluorooctanoate (PFOA)</td>
<td>&lt;0.25</td>
<td>80 – 120</td>
</tr>
<tr>
<td>Perfluorononanoate (PFNA)</td>
<td>&lt;0.25</td>
<td>80 – 120</td>
</tr>
<tr>
<td>Perfluorodecanoate (PFDA)</td>
<td>&lt;0.25</td>
<td>80 – 120</td>
</tr>
<tr>
<td>Perfluoroundecanoate (PFUnA)</td>
<td>&lt;0.25</td>
<td>80 – 120</td>
</tr>
<tr>
<td>Perfluorododecanoate (PFDoA)</td>
<td>&lt;0.25</td>
<td>80 – 120</td>
</tr>
<tr>
<td>Perfluorobutanesulfonate (PFBS)</td>
<td>&lt;0.25</td>
<td>70 - 130</td>
</tr>
<tr>
<td>Perfluorohexanesulfonate (PFHxS)</td>
<td>&lt;0.25</td>
<td>70 – 130</td>
</tr>
<tr>
<td>Perfluoroctanesulfonate (PFOS)</td>
<td>&lt;0.25</td>
<td>70 – 130</td>
</tr>
<tr>
<td>Perfluorooctanesulfonamide (PFOSA)</td>
<td>&lt;0.25</td>
<td>70 – 130</td>
</tr>
</tbody>
</table>

1. Additional criteria– recovery for 2 compounds may be 75-125% and for one compound 70-130%
2. For results reported to higher reporting limits, the blank acceptance limit is equal to the reporting limit. Higher blank may be accepted where sample concentrations exceed blank levels by >x10.

**QC Specification: Surrogate Standard Recoveries (Calibration Solutions and Samples)**

<table>
<thead>
<tr>
<th>Surrogate Standard</th>
<th>Recovery Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>$^{13}$C$_4$-Heptafluorobutyric acid ($^{13}$C$_4$-PFBA)</td>
<td>20 - 150%</td>
</tr>
<tr>
<td>$^{13}$C$_2$-Perfluorocaproic acid ($^{13}$C$_2$-PFHxA)</td>
<td>40 - 150%</td>
</tr>
<tr>
<td>$^{13}$C$_2$-Perfluorooctanoic acid ($^{13}$C$_2$-PFOA)</td>
<td>40 - 150%</td>
</tr>
<tr>
<td>$^{13}$C$_5$-Heptadecafluorononoic acid ($^{13}$C$_5$-PFNA)</td>
<td>40 - 150%</td>
</tr>
<tr>
<td>$^{13}$C$_2$-Perfluorodecanoic acid ($^{13}$C$_2$-PFDA)</td>
<td>40 - 150%</td>
</tr>
<tr>
<td>$^{13}$C$_2$-Perfluoro-o-(1,2)decanoic acid ($^{13}$C$_2$-PFDoA)</td>
<td>40 - 150%</td>
</tr>
<tr>
<td>$^{13}$C$_4$-Perfluorooctanesulfonate ($^{13}$C$_4$-PFOS)</td>
<td>40 - 150%</td>
</tr>
<tr>
<td>d7-N-Me-Perfluoro-1-octanesulfonamidoethanol (d7-MeFOSE)</td>
<td>40 - 150%</td>
</tr>
</tbody>
</table>

2. Lower recoveries may be accepted based on application and professional judgment.

**QC Specification Table: Other Parameters**

<table>
<thead>
<tr>
<th>QC Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Calibration (native compounds)</td>
<td>Run initially, and as required to maintain calibration verification and instrument sensitivity. (1/x) weighted quadratic, exclude origin. Calculated conc. 75-125 % of actual (lowest cal may be 70-130%), $R^2 &gt; 0.990$</td>
</tr>
<tr>
<td>Continuing Calibration Verification (native compounds)</td>
<td>Run every 20 samples or more frequently, quantify against I-CAL. Calculated conc. 70-130% actual for a maximum of three compounds with the remainder 80 –120 % of actual</td>
</tr>
<tr>
<td>Instrumental Carryover and Instrument Background</td>
<td>Every Initial Calibration, Cal/Ver, or SPM: &lt; 0.3 % carryover and area response of analytes in instrument blank &lt; 800 judged following two previous methanol blank injections.</td>
</tr>
<tr>
<td>Duplicate Samples or MS/MSD</td>
<td>If conc. &gt; 5 times R.L., RPD &lt; 40%</td>
</tr>
<tr>
<td></td>
<td>If conc. &lt; 5 times R.L., difference between pairs &lt; R.L.</td>
</tr>
</tbody>
</table>
ANALYSIS BY LC-MS/MS

Analysis of sample extracts for perfluorinated organics by HPLC-MS/MS is performed on a high performance liquid chromatograph coupled to a triple quadrupole mass spectrometer. The MS is run at unit mass resolution in the Multiple Reaction Monitoring (MRM) mode.

Instrument specifications:

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Waters 2690 or Waters 2795 HPLC, Micromass Quattro Ultima MS/MS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LC Column</td>
<td>Waters Xtera C18MS Reverse Phase C18, 10.0 cm, 2.1 mm i.d., 3.5 µm particle size (or equivalent)</td>
</tr>
<tr>
<td>Ionization</td>
<td>Negative Ion Electrospray</td>
</tr>
<tr>
<td>Acquisition</td>
<td>MRM mode, unit resolution</td>
</tr>
<tr>
<td>Injection Volume</td>
<td>15 µL</td>
</tr>
</tbody>
</table>

LC-MS/MS Operating Conditions:

<table>
<thead>
<tr>
<th>LC Gradient Program</th>
<th>General LC Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (min)</td>
<td>Flow mixture¹</td>
</tr>
<tr>
<td>0.0</td>
<td>15% solvent A 85% solvent B</td>
</tr>
<tr>
<td>1.0</td>
<td>15% solvent A 85% solvent B</td>
</tr>
<tr>
<td>5.0</td>
<td>70% solvent A 30% solvent B</td>
</tr>
<tr>
<td>8.5</td>
<td>100% solvent A</td>
</tr>
<tr>
<td>11</td>
<td>100% solvent A</td>
</tr>
<tr>
<td>11.3 - 14.5</td>
<td>15% solvent A 85% solvent B</td>
</tr>
</tbody>
</table>

¹ Eluent A = 90% CH₃CN (aqueous), Eluent B = 12.1 mM NH₄OAc in 0.1% AcOH (aqueous)

Initial calibration of the LC-MS/MS instrument is performed by the analysis of six or more calibration solutions. A mid-level calibration standard is analyzed to verify the initial calibration after every 20th sample (including QC samples) injected at a minimum. All calibration solutions go through the same SPE extraction/cleanup procedures as the samples.
ANALYTE IDENTIFICATION

Positive identification of target PFC, surrogate standard and recovery standards require:

- > 3:1 S:N for parent ion to daughter ion transition.
- Compound retention time falls within 0.4 minutes of the predicted retention times from the mean determined from the Initial Calibration. Natives with labelled surrogate standards must elute within 0.1 minutes of the associated labelled surrogates. Typical retention times are shown in Table 9.

QUANTIFICATION AND DATA REPORTING PROCEDURES

Target compounds are quantified using the internal standard method, comparing the area of the quantification ion to that of the $^{13}$C-labelled standard and correcting for response factors.

Quadratic calibration equations are determined from a multi-point calibration series with $1/X$ weighing fit as described by the following general equation:

$$Y = a + bX + cX^2$$  \hspace{1cm} \text{(general quadratic equation)}

Where

- $Y = (\text{area target/area surr}) \times \text{weight surr}$
- $X = \text{weight target}$
- $a, b, c$ are empirical constants

Concentrations in samples are determined as:

$$
\text{Sample Conc} = \frac{-b \pm \sqrt{b^2 - 4c \left(a - \left(\frac{\text{area of target}}{\text{area of sur}}\right) \times \text{weight sur}\right)}}{2c \times \text{sample size}}
$$

The recovery of the surrogate standard is calculated \text{(by internal standard quantification against the recovery standard using an average RRF)} and monitored as an indication of overall data quality. Final target concentrations are recovery corrected by this method of quantification.

Sample Specific Detection Limits (SDL) are determined by converting the area equivalent of 3.0 times the estimated chromatographic noise height to a concentration in the same manner that target peak responses are converted to final concentrations. The SDL accounts for any effect of matrix on the detection system and for recovery achieved through the analytical work-up.

Results are reported to the greater of the SDL or the concentration equivalent to the lowest calibration standard analyzed.
Table 9. Analytes, Ions and Quantification References

<table>
<thead>
<tr>
<th>Target Analyte</th>
<th>Typical Retention Time (minutes)</th>
<th>Parent Ion Mass</th>
<th>Daughter Ion Mass</th>
<th>Quantified Against</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfluorobutanoate (PFBA)</td>
<td>5.0</td>
<td>213</td>
<td>169</td>
<td>$^{13}$C$_4$-PFBA</td>
</tr>
<tr>
<td>Perfluoropentanoate (PFPeA)</td>
<td>5.8</td>
<td>263</td>
<td>219</td>
<td>$^{13}$C$_2$-PFHxA</td>
</tr>
<tr>
<td>Perfluorohexanoate (PFHxA)</td>
<td>6.2</td>
<td>313</td>
<td>269</td>
<td>$^{13}$C$_2$-PFHxA</td>
</tr>
<tr>
<td>Perfluoroheptanoate (PFHpA)</td>
<td>6.6</td>
<td>363</td>
<td>319</td>
<td>$^{13}$C$_2$-PFHxA</td>
</tr>
<tr>
<td>Perfluorooctanoate (PFOA)</td>
<td>7.0</td>
<td>413</td>
<td>369 / 219</td>
<td>$^{13}$C$_2$-PFOA</td>
</tr>
<tr>
<td>Perfluorononanoate (PFNA)</td>
<td>7.4</td>
<td>463</td>
<td>419</td>
<td>$^{13}$C$_5$-PFNA</td>
</tr>
<tr>
<td>Perfluorodecanoate (PFDA)</td>
<td>7.9</td>
<td>513</td>
<td>469</td>
<td>$^{13}$C$_2$-PFDA</td>
</tr>
<tr>
<td>Perfluoroundecanoate (PFUnA)</td>
<td>8.5</td>
<td>563</td>
<td>519</td>
<td>$^{13}$C$_2$-PFDA</td>
</tr>
<tr>
<td>Perfluorododecanoate (PFDoA)</td>
<td>9.0</td>
<td>613</td>
<td>569</td>
<td>$^{13}$C$_2$-PFDoA</td>
</tr>
<tr>
<td>Perfluorobutanesulfonate (PFBS)</td>
<td>6.3</td>
<td>299</td>
<td>80 / 99</td>
<td>$^{13}$C$_4$-PFOS</td>
</tr>
<tr>
<td>Perfluorohexanesulfonate (PFHxS)</td>
<td>7.2</td>
<td>399</td>
<td>80 / 99</td>
<td>$^{13}$C$_4$-PFOS</td>
</tr>
<tr>
<td>Perfluorooctane sulfonate (PFOS)</td>
<td>8.2</td>
<td>499</td>
<td>80 / 99</td>
<td>$^{13}$C$_4$-PFOS</td>
</tr>
<tr>
<td>Perfluorooctane sulfonamide (PFOSA)</td>
<td>9.9</td>
<td>498</td>
<td>78</td>
<td>$^{13}$C$_4$-PFOS</td>
</tr>
</tbody>
</table>

Surrogate Standard

<table>
<thead>
<tr>
<th></th>
<th>Typical Retention Time (minutes)</th>
<th>Parent Ion Mass</th>
<th>Daughter Ion Mass</th>
<th>Quantified Against</th>
</tr>
</thead>
<tbody>
<tr>
<td>$^{13}$C$_4$-Heptafluorobutyric acid ($^{13}$C$_4$-PFBA)</td>
<td>5.0</td>
<td>217</td>
<td>172</td>
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<tr>
<td>$^{13}$C$_2$-Perfluorocaproic acid ($^{13}$C$_2$-PFHxA)</td>
<td>6.2</td>
<td>315</td>
<td>270</td>
<td>$^{13}$C$_2$-FOUEA</td>
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<tr>
<td>$^{13}$C$_2$-Perfluoroctanoic acid ($^{13}$C$_2$-PFOA)</td>
<td>7.0</td>
<td>415</td>
<td>370</td>
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<tr>
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<td>7.4</td>
<td>470</td>
<td>423</td>
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<tr>
<td>$^{13}$C$_2$-Perfluorodecanoic acid ($^{13}$C$_2$-PFDA)</td>
<td>7.9</td>
<td>515</td>
<td>470</td>
<td>$^{13}$C$_2$-FOUEA</td>
</tr>
<tr>
<td>$^{13}$C$_2$-Perfluorooctanoic acid ($^{13}$C$_2$-PFDoA)</td>
<td>9.0</td>
<td>615</td>
<td>570</td>
<td>$^{13}$C$_2$-FOUEA</td>
</tr>
<tr>
<td>$^{13}$C$_4$-Perfluorooctanesulfonate ($^{13}$C$_4$-PFOS)</td>
<td>8.2</td>
<td>503</td>
<td>80 / 99</td>
<td>$^{13}$C$_2$-FOUEA</td>
</tr>
<tr>
<td>d7-N-Me-Perfluoro-1-octanesulfonamidoethanol (d7-Me-FOSE)</td>
<td>~10.6</td>
<td>623</td>
<td>59</td>
<td>$^{13}$C$_2$-FOUEA</td>
</tr>
</tbody>
</table>

Recovery Standard

<table>
<thead>
<tr>
<th></th>
<th>Typical Retention Time (minutes)</th>
<th>Parent Ion Mass</th>
<th>Daughter Ion Mass</th>
<th>Quantified Against</th>
</tr>
</thead>
<tbody>
<tr>
<td>$^{13}$C$_2$-2H-Perfluoro-2-decenoic acid ($^{13}$C$_2$-FOUEA)</td>
<td>7.3</td>
<td>459</td>
<td>394</td>
<td>-</td>
</tr>
<tr>
<td>$^{13}$C$_4$-Perfluoroctanoic acid ($^{13}$C$_4$-PFOA)</td>
<td>6.9</td>
<td>417</td>
<td>372</td>
<td>-</td>
</tr>
</tbody>
</table>

1 Quantification is based on m/z 80 daughter, m/z 99 may be used as alternate if necessary to avoid interference.
2 PFOSA quantified against d7-Me-FOSE if collected in separate fraction.
<table>
<thead>
<tr>
<th>Client Sample No.</th>
<th>Lab Sample ID</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>LAB BLANK</td>
<td>WG28780-101</td>
<td></td>
</tr>
<tr>
<td>OPR</td>
<td>WG28780-102</td>
<td></td>
</tr>
<tr>
<td>MATRIX SPIKE</td>
<td>WG28780-103</td>
<td></td>
</tr>
<tr>
<td>MATRIX SPIKE DUPLICATE</td>
<td>WG28780-104</td>
<td></td>
</tr>
<tr>
<td>NoStPaul B-1 GW</td>
<td>L12672-1</td>
<td></td>
</tr>
<tr>
<td>NoStPaul B-2 GW</td>
<td>L12672-2</td>
<td></td>
</tr>
<tr>
<td>Richfield B-1 GW</td>
<td>L12672-3</td>
<td></td>
</tr>
<tr>
<td>Richfield B-2 GW</td>
<td>L12672-4</td>
<td></td>
</tr>
<tr>
<td>Richfield B-3 GW</td>
<td>L12672-5</td>
<td></td>
</tr>
</tbody>
</table>
**CHAIN OF CUSTODY**

**AXYS CLIENT #:** 4095

<table>
<thead>
<tr>
<th>REPORT TO:</th>
<th>INVOICE TO:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company: MPCA</td>
<td>Company: SAME</td>
</tr>
<tr>
<td>Address: 520 Lafayette Rd N St. Paul, MN 55155</td>
<td>Address:</td>
</tr>
<tr>
<td>Contact: Nile Fellows</td>
<td>Contact:</td>
</tr>
<tr>
<td>Phone: 651 757-2352</td>
<td>Phone:</td>
</tr>
<tr>
<td>FAX:</td>
<td>FAX:</td>
</tr>
<tr>
<td>E-mail: <a href="mailto:nile.fellows@state.mn.us">nile.fellows@state.mn.us</a></td>
<td>E-mail:</td>
</tr>
</tbody>
</table>

**Project Name/Number:** North St. Paul | Richfield

<table>
<thead>
<tr>
<th>Client Sample Identification</th>
<th>Matrix</th>
<th>Sampling Date</th>
<th>Sampling Time</th>
<th>Container Type/No.</th>
<th>AXYS Lab Sample ID (Lab use only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>North St. Paul B-1 GW</td>
<td>GW</td>
<td>5/16/19</td>
<td>9:30</td>
<td>1L</td>
<td>12672-1</td>
</tr>
<tr>
<td>North St. Paul B-1 GW</td>
<td>ML</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North St. Paul B-2 GW</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Richfield B-1 GW</td>
<td>GW</td>
<td>5/17/19</td>
<td>11:00</td>
<td>1L</td>
<td>24612-3</td>
</tr>
<tr>
<td>Richfield B-2 GW</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Richfield B-3 GW</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Reinforced by (Signature):** Curt McKay

**Date:** 5/17/19 **Time:** 13:00

**Received by (Signature):**

**Date:** 6/12/07 **Time:** 10:40

**Remarks**

**Temp °C**

**Custody Seal #:**

**Seal Intact:** Y/N

**Sample Tags:** Y/N

**Cooler**
**Expanded Service International Air Waybill**

**1** From

Date 05/11/09

**2** Your Internal Reference

**3** To

Recipient’s Name

Company AXYS ANALYTICAL SERVICES

Address

City SIDNEY

Country CA

ZIP VA1 VXP

**4** Shipment Information

Total Packages 40

Commodity Description

<table>
<thead>
<tr>
<th>Description</th>
<th>Harmonized Code</th>
<th>Country of Manufacture</th>
<th>Value for Customs</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 X 1 LAINE E800 CONTAINER</td>
<td>383.00</td>
<td>USA</td>
<td>30.00</td>
</tr>
</tbody>
</table>

**5a** Express Package Service

FedEx International Priority

FedEx International First

FedEx International Economy

**5b** Express Freight Service

Packages up to 80 lb / 36 kg

Packages over 80 lb / 36 kg

**6** Packaging

FedEx Envelope

FedEx Pak

FedEx Box

FedEx Tube

Other:Cool Temp.

**7** Special Handling

HOLD at FedEx Location

SUNDAY Delivery

**8** Broker Selection

International Broker Selection

**9a** Payment

Bill transportation charges to

Send FedEx A/C No. or Credit Card Data below:

1) Send A/C No. in Section 1 above.

2) Recipient.

3) Third Party

4) Credit Card

5) Cash/Cheque

**9b** Payment

Bill Consignee charges to:

Send FedEx A/C No. below:

1) Send A/C No. in Section 1 above.

2) Recipient

3) Third Party

4) Cash/Cheque

**10** Required Signature

Use of this Air Waybill constitutes your agreement to the Conditions of Contract on the back of this Air Waybill. Certain international treaties, including the Warsaw Convention, may apply to this shipment and limit our liability for damage, loss, or delay, as described in the Conditions of Contract.

Recipient’s Signature

Date 12 May 09 10:40

FedEx Tracking Number 8626 6665 3394 0426
**AXYS Analytical Services Ltd**

**SAMPLE RECEIVING RECORD**

**Waybill #:** 862566653394  
**Date Shipped:** 11-MAY-09  
**Waybill #:** 862566653394  
**Date /Time Received:** 12-MAY-09 14:25

**AXYS Client & Contract #** 4095-Minnesota Pollution Control  
**Project Number:**  
**Receipt No:** WB7407

**Received By:** MGIERDEN  
**Log in by:** MGIERDEN  
**Signature:**

**Axys Sample ID's:** L12672-1 405

**Matrix Type:** 6 Water  
**Condition of Shipping Container:** Ice packs still frozen  
**Temperature upon Receipt:** 3 Celsius

**Custody Seals:**  
**Shipping Containers Yes/No** Intact Yes/No  
**Samples Yes/No** Intact Yes/No  
**Seal Numbers Yes/No**

**Chain of Custody or Documents:**  
**Sample ID's ** Yes/No  
**Collection Location** Yes/No  
**Date & Time Collection** Yes/No

**Tracking Report /Packing List:** Yes/No  
**Sample Tag Numbers** Yes/No  
**Sample Type** Yes/No  
**Preservative Added** Yes/No  
**Preservation Requested** Yes/No

**Sample Tags** Yes/No  
**Sample Labels** Yes/No

**Sample Labels Cross Referenced to COC** Yes/No  
**Sample Tags Cross Referenced to Sample Labels** Yes/No  
**Sample Tags Cross Referenced to COC** Yes/No  
**Information Agrees** Yes/No

**Comments:**  
Two bottles received for one sample. (NoT-Form B-1 602) was each listed out separately on the client COC. This sample has only been logged in once.

**Action Taken:**

---

**Page 12 of 40**
## AXYS Analytical Services Ltd.

**Login Chain of Custody Report (In01)**  
May 13, 2009  
11:09 AM

**Login Number:** L12672  
**Account:** 4095  |  Minnesota Pollution Control  
**Project:** NILE FELLOWS

<table>
<thead>
<tr>
<th>Axys ID versus Client Sample Identification</th>
<th>Received</th>
<th>Due</th>
<th>PR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>L12672-1</strong></td>
<td></td>
<td>12-MAY-09</td>
<td></td>
</tr>
<tr>
<td>NoStPaul B-1 GW</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>06-MAY-09 09:30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EDataDeliv</td>
<td>PFC EDD</td>
<td></td>
<td>USD</td>
</tr>
<tr>
<td>D.Package</td>
<td>PFOS DATA PKG</td>
<td></td>
<td>USD</td>
</tr>
<tr>
<td>Aqueous</td>
<td>PFC (V3)</td>
<td></td>
<td>USD</td>
</tr>
<tr>
<td>Aqueous</td>
<td>PFC PRESCREEN (LC)</td>
<td></td>
<td>USD</td>
</tr>
<tr>
<td>ANY</td>
<td>PFC MS</td>
<td></td>
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<td>ANY</td>
<td>PFC MSD</td>
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</tr>
<tr>
<td>ANY</td>
<td>SAMPLE RECEIPT</td>
<td>2</td>
<td>1 L plastic</td>
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</tbody>
</table>

| **L12672-2** | | 12-MAY-09 | |
| NoStPaul B-2 GW | | | |
| 06-MAY-09 10:20 | | | |
| EDataDeliv | PFC EDD | | USD |
| D.Package | PFOS DATA PKG | | USD |
| Aqueous | PFC (V3) | | USD |
| Aqueous | PFC PRESCREEN (LC) | | USD |
| ANY | SAMPLE RECEIPT | | USD |

| **L12672-3** | | 12-MAY-09 | |
| Richfield B-1 GW | | | |
| 07-MAY-09 11:00 | | | |
| EDataDeliv | PFC EDD | | USD |
| D.Package | PFOS DATA PKG | | USD |
| Aqueous | PFC (V3) | | USD |
| Aqueous | PFC PRESCREEN (LC) | | USD |
| ANY | SAMPLE RECEIPT | 1 | 1 L plastic | USD |

| **L12672-4** | | 12-MAY-09 | |
| Richfield B-2 GW | | | |
| 07-MAY-09 11:35 | | | |
| EDataDeliv | PFC EDD | | USD |
| D.Package | PFOS DATA PKG | | USD |
| Aqueous | PFC (V3) | | USD |
| Aqueous | PFC PRESCREEN (LC) | | USD |
| ANY | SAMPLE RECEIPT | 1 | 1 L plastic | USD |
AXYS Analytical Services Ltd.
Login Chain of Custody Report (In01)
May. 13, 2009
11:09 AM

Login Number: L12672
Account: 4095  Minnesota Pollution Control
Project: NILE FELLOWS

<table>
<thead>
<tr>
<th>Axys ID versus Client Sample Identification</th>
<th>Received</th>
<th>Due</th>
<th>PR</th>
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</thead>
<tbody>
<tr>
<td>L12672-5</td>
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<td>12-MAY-09</td>
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<tr>
<td>Storage: WIC-2, 1A</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Richfield B-3 GW</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07-MAY-09 12:10</td>
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<tr>
<td>Project #: NILE FELLOWS</td>
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</tr>
<tr>
<td>EDataDeliv PFC EDD</td>
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<td></td>
<td>USD</td>
</tr>
<tr>
<td>D.Package PFOS DATA PKG</td>
<td></td>
<td></td>
<td>USD</td>
</tr>
<tr>
<td>Aqueous PFC (V3)</td>
<td></td>
<td></td>
<td>USD</td>
</tr>
<tr>
<td>Aqueous PFC PRESCREEN (LC)</td>
<td></td>
<td></td>
<td>USD</td>
</tr>
<tr>
<td>ANY SAMPLE RECEIPT</td>
<td>1</td>
<td></td>
<td>USD</td>
</tr>
<tr>
<td></td>
<td>: 1 L plastic</td>
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</table>
**AXYS METHOD MLA-060 Rev 07**  
**AXYS ANALYTICAL SERVICES**  
2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811  

<table>
<thead>
<tr>
<th>COMPOUND</th>
<th>LAB FLAG</th>
<th>CONC. FOUND</th>
<th>DETECTION LIMIT</th>
<th>RETENTION TIME</th>
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<tbody>
<tr>
<td>PFBA</td>
<td></td>
<td>137</td>
<td>3.49</td>
<td>5:20</td>
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<td>PFPeA</td>
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<td>13.3</td>
<td>3.49</td>
<td>6:03</td>
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<td>PFHxA</td>
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<td>13.2</td>
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<td>6:27</td>
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<tr>
<td>PFHpA</td>
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<td>8.83</td>
<td>3.49</td>
<td>6:47</td>
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<td>PFOA</td>
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<td>13.8</td>
<td>3.49</td>
<td>7:14</td>
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<tr>
<td>PFNA</td>
<td>U</td>
<td></td>
<td>3.49</td>
<td></td>
</tr>
<tr>
<td>PFDA</td>
<td>U</td>
<td></td>
<td>3.49</td>
<td></td>
</tr>
<tr>
<td>PFUnA</td>
<td>U</td>
<td></td>
<td>3.49</td>
<td></td>
</tr>
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<td>PFDoA</td>
<td>U</td>
<td></td>
<td>3.49</td>
<td></td>
</tr>
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<td>PFBS</td>
<td>U</td>
<td></td>
<td>6.99</td>
<td></td>
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<td>PFHxS</td>
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<td>14.1</td>
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<td></td>
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<tr>
<td>PFOSA</td>
<td>U</td>
<td></td>
<td>3.49</td>
<td></td>
</tr>
</tbody>
</table>

(1) Where applicable, custom lab flags have been used on this report; U = not detected.

Approved by: Bryan Alonzo QA/QC Chemist

For Axys Internal Use Only | XSL Template: FC-Form1A.xsl; Created: 11-Jun-2009 13:38:43; Application: XMLTransformer-1.9.24;
Report Filename: PFC_FC_LC_PFOA_L12672-1_Form1A_FC9G_188S39_SJ1020088.html; Workgroup: WG28780; Design ID: 312 J

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.
AXYS METHOD MLA-060 Rev 07

PERFLUORINATED ORGANICS ANALYSIS REPORT

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Project No.:

Form 2

Lab Sample I.D.:

NoStPaul B-1 GW

Sample Collection:

06-May-2009 09:30

FFFI RICHFIELD, N. ST. PAUL AND GOODVIEW

Contract No.:

L12672-1 (A)

Lab Sample I.D.:

Sample Receipt Date:

0.358 L

12-May-2009

Initial Calibration Date:

19-May-2009

Instrument Calibration Date:

LC MS/MS

Extraction Date:

15-May-2009

Column ID:

Analysis Date:

C18

20-May-2009 Time: 02:21:37

Extract Volume (uL):

Sample Data Filename:

4000

FC9G_188 S: 39

Injection Volume (uL):

Blank Data Filename:

15

FC9G_188 S: 25

Dilution Factor:

Cal. Ver. Data Filename:

N/A

FC9G_188 S: 17

Concentration Units:

ng absolute

LABELED COMPOUND LAB FLAG 1 SPIKE CONC. CONC. FOUND R(%) 2 RETENTION TIME

<table>
<thead>
<tr>
<th>COMPOUND</th>
<th>FLAG 1</th>
<th>SPIKE</th>
<th>CONC. FOUND</th>
<th>R(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13C4-PFBA</td>
<td>12.0</td>
<td>7.86</td>
<td>65.5</td>
<td>5:19</td>
</tr>
<tr>
<td>13C2-PFHxA</td>
<td>12.0</td>
<td>9.54</td>
<td>79.5</td>
<td>6:27</td>
</tr>
<tr>
<td>13C2-PFOA</td>
<td>36.0</td>
<td>35.7</td>
<td>99.1</td>
<td>7:14</td>
</tr>
<tr>
<td>13C5-PFNA</td>
<td>12.0</td>
<td>11.2</td>
<td>93.0</td>
<td>7:38</td>
</tr>
<tr>
<td>13C2-PFDA</td>
<td>12.0</td>
<td>9.74</td>
<td>81.1</td>
<td>8:11</td>
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<tr>
<td>13C2-PFDoA</td>
<td>12.0</td>
<td>6.67</td>
<td>55.6</td>
<td>9:21</td>
</tr>
<tr>
<td>13C4-PFOS (80)</td>
<td>18.0</td>
<td>15.6</td>
<td>86.6</td>
<td>8:27</td>
</tr>
</tbody>
</table>

(1) Where applicable, custom lab flags have been used on this report.
(2) R(%) = percent recovery.

Approved by: Bryan Alonzo QA/QC Chemist

For Axys Internal Use Only [ XSL Template: FC-Form2.xsl; Created: 11-Jun-2009 13:38:43; Application: XMLTransformer-1.9.24; Report Filename: PFC_FC_LC_PFOA_L12672-1_Form2_FC9G_188S39_SJ1020088.html; Workgroup: WG28780; Design ID: 312 ]

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**AXYS METHOD MLA-060 Rev 07**

**PERFLUORINATED ORGANICS ANALYSIS REPORT**

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Contract No.:** 4095

**Matrix:** AQUEOUS

**Sample Receipt Date:** 12-May-2009

**Extraction Date:** 15-May-2009

**Analysis Date:** 20-May-2009

**Extract Volume (uL):** 4000

**Injection Volume (uL):** 15

**Dilution Factor:** N/A

**Concentration Units:** ng/L

**PFBA**
- **Lab Flag:** U
- **Conc. Found:** 145
- **Detection Limit:** 2.50
- **Retention Time:** 5:22

**PFPeA**
- **Lab Flag:** U
- **Conc. Found:** 15.5
- **Detection Limit:** 2.50
- **Retention Time:** 6:03

**PFHxA**
- **Lab Flag:** U
- **Conc. Found:** 14.1
- **Detection Limit:** 2.50
- **Retention Time:** 6:28

**PFHpA**
- **Lab Flag:** U
- **Conc. Found:** 8.22
- **Detection Limit:** 2.50
- **Retention Time:** 6:51

**PFOA**
- **Lab Flag:** U
- **Conc. Found:** 13.2
- **Detection Limit:** 2.50
- **Retention Time:** 7:14

**PFNA**
- **Lab Flag:** U
- **Conc. Found:** 2.50

**PFDA**
- **Lab Flag:** U
- **Conc. Found:** 2.50

**PFUnA**
- **Lab Flag:** U
- **Conc. Found:** 2.50

**PFDoA**
- **Lab Flag:** U
- **Conc. Found:** 2.50

**PFBS**
- **Lab Flag:** U
- **Conc. Found:** 5.01

**PFHxS**
- **Lab Flag:** U
- **Conc. Found:** 14.8
- **Detection Limit:** 5.01
- **Retention Time:** 7:26

**PFOS**
- **Lab Flag:** U
- **Conc. Found:** 5.01

**PFOSA**
- **Lab Flag:** U
- **Conc. Found:** 2.50

(1) Where applicable, custom lab flags have been used on this report; U = not detected.

Approved by: Bryan Alonzo QA/QC Chemist
**LABELED COMPOUND** | LAB FLAG | SPIKE CONC. | CONC. FOUND | R(%) | RETENTION TIME  
---|---|---|---|---|---
13C4-PFBA | | 12.0 | 6.17 | 51.4 | 5:20  
13C2-PFHxA | | 12.0 | 8.47 | 70.6 | 6:27  
13C2-PFOA | | 36.0 | 31.4 | 87.1 | 7:14  
13C5-PFNA | | 12.0 | 9.95 | 82.9 | 7:41  
13C2-PFDA | | 9.30 | 9.30 | 77.5 | 8:15  
13C2-PFDoA | | 12.0 | 5.55 | 46.3 | 9:25  
13C4-PFOS (80) | | 18.0 | 14.1 | 78.5 | 8:34

(1) Where applicable, custom lab flags have been used on this report.  
(2) R(%) = percent recovery.

Approved by: ___________ Bryan Alonzo ___________ QA/QC Chemist
AXYS METHOD MLA-060 Rev 07

PERFLUORINATED ORGANICS ANALYSIS REPORT

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Project No. L12672-3

Form 1A

CLIENT SAMPLE NO.
Richfield B-1 GW
Sample Collection: 07-May-2009 11:00

AXYS ANALYTICAL SERVICES

Richfield B-1 GW
Sample Collection: 07-May-2009 11:00

COMPOUND LAB FLAG ¹ CONC. FOUND DETECTION LIMIT RETENTION TIME

PFBA 1070 18.8 5:20
PFPeA 3470 18.8 6:02
PFHxA 3500 18.8 6:27
PFHpA 819 18.8 6:51
PFOA 50.3 18.8 7:11

PFNA U 18.8
PFDA U 18.8
PFUnA U 18.8
PFDoA U 18.8
PFBS 737 37.7 6:35
PFHxS 76.2 37.7 7:23
PFOS U 37.7
PFOSA U 18.8

¹ Where applicable, custom lab flags have been used on this report; U = not detected.

Approved by: ________ Bryan Alonzo ________ QA/QC Chemist

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Report Filename: PFC_FC_LC_PFOA_L12672-3_Form1A_FC9G_188S34_SJ1020084.html; Workgroup: WG28780; Design ID: 312 ]

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**LABELED COMPOUND** | **LAB FLAG** | **SPIKE CONC.** | **CONC. FOUND** | **R(%)** | **RETENTION TIME**
--- | --- | --- | --- | --- | ---
13C4-PFBA | 12.0 | 11.2 | 93.0 | 5:22
13C2-PFHxA | 12.0 | 11.0 | 91.4 | 6:26
13C2-PFOA | 36.0 | 31.2 | 86.7 | 7:14
13C5-PFNA | 12.0 | 13.4 | 112 | 7:41
13C2-PFDA | 12.0 | 11.8 | 98.1 | 8:11
13C2-PFDoA | 12.0 | 8.56 | 71.3 | 9:25
13C4-PFOS (80) | 18.0 | 19.1 | 106 | 8:31

(1) Where applicable, custom lab flags have been used on this report.
(2) R(%) = percent recovery.

Approved by: Bryan Alonzo QA/QC Chemist

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AXYS METHOD MLA-060 Rev 07

PERFLUORINATED ORGANICS ANALYSIS REPORT

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 4095

Matrix: AQUEOUS

Sample Receipt Date: 12-May-2009

Extraction Date: 15-May-2009

Analysis Date: 20-May-2009 Time: 01:24:03

Extract Volume (uL): 4000

Injection Volume (uL): 15

CONCENTRATION UNITS: ng/L

COMPOUND

PFBA
PFPeA
PFHxA
PFHpA
PFOA
PFNA
PFDA
PFUnA
PFDoA
PBFS
PFHxS
PFOS
PFOSA

PFBA
PFPeA
PFHxA
PFHpA
PFOA
PFNA
PFDA
PFUnA
PFDoA
PBFS
PFHxS
PFOS
PFOSA

1240
4890
4170
1920
1330

U
U
U
U
U

91.4
91.4
91.4
91.4
91.4

5.19
6.02
6.27
6.47
7.14

(1) Where applicable, custom lab flags have been used on this report; U = not detected.

Approved by: Bryan Alonzo QA/QC Chemist

For Axys Internal Use Only | XSL Template: FC-Form1A.xsl; Created: 13-Jun-2009 13:38:43; Application: XMLTransformer-1.9.24; Report Filename: PFC_FC_LC_PFOA_L12672-4_Form1A_FC9G_188S36_SJ1020086.html; Workgroup: WG28780; Design ID: 312

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### AXYS METHOD MLA-060 Rev 07

**PERFLUORINATED ORGANICS ANALYSIS REPORT**

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Contract No.:** 4095  
**Lab Sample I.D.:** L12672-4

**Matrix:** AQUEOUS  
**Sample Size:** 0.0137 L

**Sample Receipt Date:** 12-May-2009  
**Initial Calibration Date:** 19-May-2009

**Extraction Date:** 15-May-2009  
**Instrument ID:** LC MS/MS

**Analysis Date:** 20-May-2009  
**Column ID:** C18

**Extract Volume (uL):** 4000  
**Sample Data Filename:** FC9G_188S:36

**Injection Volume (uL):** 15  
**Blank Data Filename:** FC9G_188S:25

**Dilution Factor:** N/A  
**Cal. Ver. Data Filename:** FC9G_188S:17

**Concentration Units:** ng absolute

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<th>SPIKE CONC.</th>
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<th>R(%)</th>
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(1) Where applicable, custom lab flags have been used on this report.
(2) R(%) = percent recovery.

Approved by: Bryan Alonzo, QA/QC Chemist

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### AXYS METHOD MLA-060 Rev 07

## PERFLUORINATED ORGANICS ANALYSIS REPORT

**AXYS ANALYTICAL SERVICES**

2045 MILLS RD., SIDNEY, B.C., CANADA

V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Contract No.:** 4095

**Matrix:** AQUEOUS

**Sample Receipt Date:** 12-May-2009

**Sample Collection:** 07-May-2009 12:10

**Initial Calibration Date:** 19-May-2009

**Extraction Date:** 15-May-2009

**Analysis Date:** 20-May-2009 **Time:** 01:05:24

**Extract Volume (uL):** 4000

**Injection Volume (uL):** 15

**Sample Data Filename:** FC9G_188 S: 35

**Blank Data Filename:** FC9G_188 S: 25

**Cal. Ver. Data Filename:** FC9G_188 S: 17

**Lab Sample I.D.:** L12672-5

**Sample Size:** 0.0187 L

**Project No.:** FFFI RICHFIELD, N. ST. PAUL AND GOODVIEW

**Sample Collection:** 07-May-2009 12:10

### COMPOUND

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(1) Where applicable, custom lab flags have been used on this report; U = not detected.

Approved by: ________ Bryan Alonzo ________ QA/QC Chemist

---

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Where applicable, custom lab flags have been used on this report.

R(%) = percent recovery.

Approved by: Bryan Alonzo QA/QC Chemist

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### AXYS METHOD MLA-060 Rev 07

#### AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

<table>
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#### PERFLUORINATED ORGANICS ANALYSIS REPORT

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(1) Where applicable, custom lab flags have been used on this report; U = not detected.

Approved by: Bryan Alonzo QA/QC Chemist

---

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### AXYS METHOD MLA-060 Rev 07

#### PERFLUORINATED ORGANICS ANALYSIS REPORT

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Project No. N/A

Lab Sample I.D.: WG28780-101

Sample Collection: N/A

**Matrix:** AQUEOUS

**Sample Receipt Date:** N/A

**Initial Calibration Date:** 19-May-2009

**Sample Size:** 0.500 L

**Instrument Calibration Date:** 19-May-2009

**Column ID:** C18

**Sample Data Filename:** FC9G_188 S: 25

**Cal. Ver. Data Filename:** FC9G_188 S: 17

**Extract Volume (uL):** 4000

**Blank Data Filename:** FC9G_188 S: 25

**Injection Volume (uL):** 15

**Concentration Units:** ng absolute

---

**LABELED COMPOUND** | **LAB FLAG** 1 | **SPIKE CONC.** | **CONC. FOUND** | **R(%)** 2 | **RETENTION TIME**
--- | --- | --- | --- | --- | ---
13C4-PFBA | | 12.0 | 13.4 | 112 | 5.23
13C2-PFHA | | 12.0 | 12.9 | 108 | 6.26
13C2-PFOA | | 36.0 | 37.2 | 103 | 7.14
13C5-PFNA | | 12.0 | 12.2 | 102 | 7.38
13C2-PFDA | | 12.0 | 11.0 | 92.0 | 8.11
13C2-PFDoA | | 12.0 | 11.1 | 92.5 | 9.21
13C4-PFOS (80) | | 18.0 | 19.4 | 108 | 8.31

1. Where applicable, custom lab flags have been used on this report.
2. $R(\%) = \text{percent recovery}$.

Approved by: Bryan Alonzo QA/QC Chemist

---

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**AXYS METHOD MLA-060 Rev 07**  
**PERFLUORINATED ORGANICS ONGOING PRECISION AND RECOVERY (OPR)**

**AXYS ANALYTICAL SERVICES**  
2045 MILLS RD., SIDNEY, B.C., CANADA  
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 4095

Matrix: AQUEOUS

**Laboratory Sample I.D.**: WG28780-102 i

**Initial Calibration Date**: 19-May-2009

**Extraction Date**: 15-May-2009

**Analysis Date**: 19-May-2009 **Time**: 20:18:12

**Extract Volume (uL)**: 4000

**Injection Volume (uL)**: 15

**Instrument ID**: LC MS/MS

**Column ID**: C18

**OPR Data Filename**: FC9G_188 S: 20

**Blank Data Filename**: FC9G_188 S: 25

**Cal. Ver. Data Filename**: FC9G_188 S: 17

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**ALL CONCENTRATIONS REPORTED ON THIS FORM ARE CONCENTRATIONS IN EXTRACT, BASED ON A 1 mL EXTRACT VOLUME.**

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<th>LAB FLAG ¹</th>
<th>SPIKE CONC. (ng/mL)</th>
<th>CONC. FOUND (ng/mL)</th>
<th>% RECOVERY</th>
<th>RETENTION TIME</th>
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(1) Where applicable, custom lab flags have been used on this report.

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Approved by: Bryan Alonzo QA/QC Chemist

---

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Where applicable, custom lab flags have been used on this report.

Approved by: __________ Bryan Alonzo __________ QA/QC Chemist

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### Labeled Compound
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<th>RETENTION TIME</th>
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(1) Where applicable, custom lab flags have been used on this report.

---

AXYS METHOD MLA-060 Rev 07

PERFLUORINATED ORGANICS ONGOING PRECISION AND RECOVERY (OPR)

AXYS ANALYTICAL SERVICES

2045 MILLS RD., SIDNEY, B.C., CANADA

V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Contract No.: 4095

Matrix: AQUEOUS

Initial Calibration Date: 19-May-2009

Instrument ID: LC MS/MS

Analysis Date: 19-May-2009 Time: 20:18:12

Column ID: C18

Extract Volume (uL): 4000

OPR Data Filename: FC9G_188 S: 20

Injection Volume (uL): 15

Blank Data Filename: FC9G_188 S: 25

Dilution Factor: N/A

Cal. Ver. Data Filename: FC9G_188 S: 17

---

ALL CONCENTRATIONS REPORTED ON THIS FORM ARE CONCENTRATIONS IN EXTRACT, BASED ON A 1 mL EXTRACT VOLUME.

---

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.
### Analysis Report

**AXYS METHOD MLA-060 Rev 07**

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Project No.**

**CLIENT SAMPLE NO.**

**Form 8C**

**PERFLUORINATED ORGANICS MATRIX SPIKE (MS)**

**ANALYSIS REPORT**

**Sample Collection:**

**06-May-2009 09:30**

**For Axys Internal Use Only**

---

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

**Contract No.:** 4095

**Lab Sample I.D.:** WG28780-103 (MS)

**Matrix:** AQUEOUS

**Sample Size:** 0.384 L

**Extraction Date:** 15-May-2009

**Initial Calibration Date:** 19-May-2009

**Analysis Date:** 20-May-2009 **Time:** 02:41:12

**Instrument ID:** LC MS/MS

**Extract Volume (uL):** 4000

**GC Column ID:** C18

**Injection Volume (uL):** 15

**MS Data Filename:** FC9G_188 S: 40

**Blank Data Filename:** FC9G_188 S: 25

**Cal. Ver. Data Filename:** FC9G_188 S: 17

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**ALL CONCENTRATIONS REPORTED ON THIS FORM ARE CONCENTRATIONS ON SAMPLE SIZE BASIS**

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(1) Where applicable, custom lab flags have been used on this report; U = not detected.

(2) R% = percent recovery.

Approved by: Bryan Alonzo

QA/QC Chemist

---

For Axys Internal Use Only [ XSL Template: MS.xsl; Created: 11-Jun-2009 13:39:04; Application: XMLTransformer-1.9.24; Report Filename: MS_FC_LC_PFOA-MS-MSD_WG28780-103_L12672-1_Form8C.html; Workgroup: WG28780; Design ID: 312 ]

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.
**LABELED COMPOUND** | **LAB FLAG** | **SPIKE CONC.** | **CONC. FOUND** | **R(%)** | **RETENTION TIME**
---|---|---|---|---|---
13C4-PFBA | 12.0 | 7.58 | 63.2 | 5:20
13C2-PFHxA | 12.0 | 9.05 | 75.4 | 6:27
13C2-PFOA | 36.0 | 28.7 | 79.8 | 7:14
13C5-PFNA | 12.0 | 9.79 | 81.6 | 7:38
13C2-PFDA | 12.0 | 9.85 | 82.1 | 8:08
13C2-PFDoA | 12.0 | 7.13 | 59.4 | 9:20
13C4-PFOS (80) | 18.0 | 15.6 | 86.6 | 8:27

(1) Where applicable, custom lab flags have been used on this report.
(2) R(%) = percent recovery.

Approved by: ___________Bryan Alonzo_________ QA/QC Chemist

For Axys Internal Use Only [ XSL Template: FC-Form2.xsl; Created: 11-Jun-2009 13:38:43; Application: XMLTransformer-1.9.24;
Report Filename: PFC_FC_LC_PFOA_WG28780-103_Form2_FC9G_188S40_SJ1020089.html; Workgroup: WG28780; Design ID: 312 ]

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.
Where applicable, custom lab flags have been used on this report; U = not detected.

R% = percent recovery.

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(1) Where applicable, custom lab flags have been used on this report; U = not detected.
(2) R% = percent recovery.

Approved by: Bryan Alonzo QA/QC Chemist
AXYS METHOD MLA-060 Rev 07

PERFLUORINATED ORGANICS ANALYSIS REPORT

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Project No.: FFFI RICHFIELD, N. ST. PAUL AND GOODVIEW
Lab Sample I.D.: WG28780-104 (MSD)

Contract No.: 4095
Matrix: AQUEOUS
Sample Receipt Date: 12-May-2009
Sample Size: 0.382 L

Initial Calibration Date: 19-May-2009
Instrument Calibration Date: LC MS/MS

Analysis Date: 20-May-2009 Time: 03:00:39
Column ID: C18

Extract Volume (µL): 4000
Sample Data Filename: FC9G_188 S: 41

Injection Volume (µL): 15
Blank Data Filename: FC9G_188 S: 25

Dilution Factor: N/A
Cal. Ver. Data Filename: FC9G_188 S: 17

Concentration Units: ng absolute

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(1) Where applicable, custom lab flags have been used on this report.
(2) R(%) = percent recovery.

Approved by: Bryan Alonzo QA/QC Chemist

For Axys Internal Use Only [ XSL Template: FC-Form2.xsl; Created: 11-Jun-2009 13:38:43; Application: XMLTransformer-1.9.24; Report Filename: PFC_FC_LC_PFOA_WG28780-104_Form2_FC9G_188S41_SJ1020090.html; Workgroup: WG28780; Design ID: 312]

These pages are part of a larger report that may contain information necessary for full data evaluation. Results reported relate only to the sample tested. Results are compliant with NELAP where specific accreditation is held.
AXYS METHOD MLA-060 Rev 07

PERFLUORINATED ORGANICS INITIAL CALIBRATION PERCENT RECOVERIES

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date: 19-May-2009

Instrument ID: LC MS/MS

LC Column ID: C18

CS0 Data Filename: N/A

CS1 Data Filename: FC9G_188 S: 5

CS2 Data Filename: FC9G_188 S: 6

CS3 Data Filename: FC9G_188 S: 7

CS4 Data Filename: FC9G_188 S: 8

CS5 Data Filename: FC9G_188 S: 9

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CS8 Data Filename: N/A

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(1) Where applicable, custom lab flags have been used on this report.

Approved by: Bryan Alonzo QA/QC Chemist

For Axys Internal Use Only [ XSL Template: FC-Form3A.xsl; Created: 11-Jun-2009 13:38:43; Application: XMLTransformer-1.9.24; Report Filename: PFOA_FC_LC_19-May-2009_FC9G__Form3A_GS32195.html; Workgroup: WG28780; Design ID: 312 ]
PERFLUORINATED ORGANICS INITIAL CALIBRATION PERCENT RECOVERIES

## AXYS METHOD MLA-060 Rev 07

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5800 FAX (250) 655-5811

*Initial Calibration Date: 19-May-2009*

**Instrument ID: LC MS/MS**

**LC Column ID: C18**

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(1) Where applicable, custom lab flags have been used on this report.

Approved by: Bryan Alonzo QA/QC Chemist

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(1) Where applicable, custom lab flags have been used on this report.

Approved by: __________ Bryan Alonzo_________ QA/QC Chemist
**AXYS METHOD MLA-060 Rev 07**

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5X2 TEL (250) 655-5900 FAX (250) 655-5811

Initial Calibration Date: 19-May-2009

**Instrument ID:** LC MS/MS

**LC Column ID:** C18

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**PERFLUORINATED ORGANICS INITIAL CALIBRATION RETENTION TIMES**

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RT

1. Where applicable, custom lab flags have been used on this report.

Approved by: __________ Bryan Alonzo _______ QA/QC Chemist

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For Axys Internal Use Only [ XSL Template: FC-Form3D.xsl; Created: 11-Jun-2009 13:38:43; Application: XMLTransformer-1.9.24; Report Filename: PFOA_FC_LC_19-May-2009_FC9G__Form3D_GS32195.html; Workgroup: WG28780; Design ID: 312 ]
AXYS METHOD MLA-060 Rev 07

PERFLUORINATED ORGANICS CALIBRATION VERIFICATION

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5Z2 TEL (250) 655-5800 FAX (250) 655-5811

Initial Calibration Date: 19-May-2009
VER Data Filename: FC9G_188 S: 17

Instrument ID: LC MS/MS
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LC Column ID: C18
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(1) Where applicable, custom lab flags have been used on this report.

Approved by: __________ Bryan Alonzo __________ QA/QC Chemist

Contact: analytical@axys.com
**AXYS METHOD MLA-060 Rev 07**

**PERFLUORINATED ORGANICS CALIBRATION VERIFICATION**

**AXYS ANALYTICAL SERVICES**
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 0Z2 TEL (250) 655-5800 FAX (250) 655-5811

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Approved by: __________Bryan Alonzo_________ QA/QC Chemist

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**AXYS METHOD MLA-060 Rev 07**

PERFLUORINATED ORGANICS CALIBRATION VERIFICATION

AXYS ANALYTICAL SERVICES
2045 MILLS RD., SIDNEY, B.C., CANADA
V8L 5Z2 TEL (250) 655-5800 FAX (250) 655-5811

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(1) Where applicable, custom lab flags have been used on this report.

Approved by: __________ Bryan Alonzo __________ QA/QC Chemist
**LABELED COMPOUND** | **LAB FLAG ¹** | **RETENTION TIME** | **EXPECTED CONC.** | **CONC. FOUND** | **RECOVERY (%)**
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13C2-PFDoA | | 8:08 | 12.0 | 11.4 | 95.2
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13C4-PFOS (80) | | 8:27 | 18.0 | 17.1 | 95.0

(1) Where applicable, custom lab flags have been used on this report.

Approved by: Bryan Alonzo QA/QC Chemist
APPENDIX S

GIS Map Layer of Fire Foam Training Area Polygons and Boring Point Locations (Electronic File)