



## Minnesota Pollution Control Agency

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# Perfluorochemicals

## Past, present and future actions

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**T**his Minnesota Pollution Control Agency (MPCA) fact sheet provides a brief history, an overview of current actions and a look ahead to planned activities related to perfluorochemicals (PFCs) in Minnesota.

### What are PFCs?

PFCs are a family of proprietary 3M chemicals that have been used for decades to make products that resist heat, oil, stains, grease and water. In the past, PFCs were not regulated. Common uses include nonstick cookware; stain-resistant carpets and fabrics; components of fire-fighting foam; industrial applications; coatings for packaging, such as milk cartons; cosmetic additives; and other personal products.

Chemicals in the PFC family found in the environment in Minnesota are perfluorooctane sulfate (PFOS), perfluorooctanic acid (PFOA), and perfluorobutanoic acid (PFBA). Their chemical structures make them extremely resistant to breakdown in the environment. PFOS and PFOA bioaccumulate in humans and animals. Less is known about PFBA.

### What is the PFC connection to Minnesota?

The 3M chemicals that contain PFCs were produced in Minnesota at the 3M Chemolite facility in Cottage Grove. Historically, 3M disposed of this production waste on-site at the Chemolite facility in Cottage Grove as well as the 3M Oakdale disposal site, 3M Woodbury site, and the Washington County Landfill. The MPCA has also been looking at other sites that may have accepted 3M production

waste containing PFOS, PFOA and other PFCs.

It is important to note that a number of consumer products that used Scotchguard™ (produced by 3M) or that use Teflon® (produced by Dupont) may contain various PFCs. In 2002, 3M stopped using PFOS and PFOA in Scotchguard™ products. The company announced this phase out in 2000.

There are still other PFCs generated by 3M. The U.S. Environmental Protection Agency (EPA) is conducting testing to ensure that current PFC generation does not pose a risk.

### What's the concern?

Although PFCs have been used for decades, there are few studies of health effects in people. In animal studies, high concentrations of PFOA, PFOS and PFBA have been shown to adversely affect the liver and other organs. High concentrations of PFOA over a long period may also cause cancer in animals, but the relevance of these health effects to humans is still unclear. Developmental effects have been seen in the offspring of rodents exposed to PFOS and PFOA while pregnant.

Studies of 3M workers exposed to PFOS and PFOA during manufacturing show no apparent impact on their health. Some studies of PFCs in the general population are currently under way.

The National Science Advisory Board's PFOA Review Panel reviewed the issue and a majority of the panel recommended to the EPA that PFOA be classified as a

“likely” carcinogen. However, EPA is reviewing information that questions the relevance of some of the tumor data. The Review Panel advised EPA to sponsor an independent review of the tumor data.

## **Actions taken**

The MPCA has taken the following actions related to PFC production waste contamination:

- Evaluation and investigation of closed dumps and landfills that accepted PFC production waste
- Private drinking well sampling
- Municipal drinking well sampling
- Evaluation of active landfills that may have accepted production waste containing PFOS or PFOA
- Sediment sampling in the Mississippi River; sampling of 3M outfalls at the Mississippi River from the 3M Chemolite facility; sampling of effluent from the metro wastewater plant; and fish tissue sampling
- Review and oversight of 3M monitoring and work plans for sites that are in the state Superfund or Voluntary Investigation and Cleanup (VIC) programs
- Recommended EPA investigation of PFOA
- Developing water quality criteria for surface water discharge of PFOS and PFOA
- Sampling shallow monitoring wells and surface water for an expanded list of PFCs
- Collected fish from the Mississippi and ST. Croix rivers and Lake Calhoun for PFC analysis

This list of actions is further detailed below.

## **Closed landfill sampling and monitoring**

The MPCA’s Closed Landfill Program (CLP) started sampling for PFOS and PFOA at the Washington County Landfill in the spring of 2004, after learning of past 3M disposal of PFC production wastes at the site. This sampling expanded to residential wells near the landfill. This sampling in Lake Elmo is referenced in the next section of this fact sheet. The CLP sampling led to additional work that included Mississippi River sediment sampling; water sampling; fish sampling; and closed and active landfill leachate (liquid waste from precipitation and decay at landfills) sampling.

The CLP completed a test at the Washington County Landfill for treatment of ground water contaminated

with PFOS, PFOA and PFBA. These compounds are removed by a class of chemicals called anionic resins. The CLP is looking at the design and costs of building and operating an on-site, resin-based ground water treatment system.

## **Private well sampling**

The CLP, in coordination with the Minnesota Department of Health (MDH), sampled 385 private residential wells in southwestern Lake Elmo and seven residential wells in Oakdale. So far, 149 residential wells in Lake Elmo and one residential well in Oakdale have PFCs in excess of the well advisory guidelines set by the MDH. Residents whose water exceeds the well advisory guidelines are receiving bottled water until a granular-activated carbon (GAC) filter system can be installed or city water is connected to their home.

Fifty-nine residential wells have PFC levels below the well advisory guidelines. These wells are routinely monitored by the MPCA and MDH. The extent of PFOS and PFOA contamination has been well defined based on the well sampling. Well sampling continues to determine the full extent of PFBA in the ground water.

The city of Lake Elmo has reached an agreement with 3M that includes the expansion of the municipal water system to provide city water to 214 homes with private wells in Lake Elmo. Lake Elmo and state agencies are exploring options for a long-term solution for homes outside the area of the currently planned water system expansion.

MDH sampling of residential wells in Woodbury in 2005 did not detect PFOA or PFOS, however more recent sampling in January 2007 detected PFBA in these residential wells.

## **Municipal well sampling**

After PFCs were detected in some private wells, the MPCA in consultation with 3M and the MDH sampled municipal wells in Oakdale and other neighboring municipalities. Based on sampling, PFOS and PFOA were not detected in neighboring municipalities that include Cottage Grove, Woodbury and Hastings.

The city of Oakdale had levels of PFOS and PFOA generally below the health guidelines set by the MDH. However, in March 2006, the MDH laboratories were able to expand the list of PFCs for which they could test. Staff re-sampled the Oakdale municipal wells since that time and detected PFOS, PFOA, PFBA, and perfluorohexanoic acid or PFHxA (which is also in the

PFC family). To ensure that PFCs consistently remain well below the health guidelines, 3M designed and constructed a GAC filter system to treat the water from Municipal Well #5 and Municipal Well #9. These wells, which had the highest PFC levels, will be able to supply the majority of water to the Oakdale system. While the city of Oakdale will operate the plant, 3M will cover the operating costs.

In January 2007, MDH sampled or re-sampled municipal wells in Cottage Grove, Woodbury, Hastings, St. Paul Park, Newport and South St. Paul. While PFOA and PFOS were not detected in these municipal wells, PFBA was detected.

### Active landfill evaluation for PFCs

In 2006, the MPCA developed a strategy to screen open solid waste facilities in Minnesota for the presence of PFCs. As part of this strategy, the MPCA looked at various landfill types that did not receive production waste from the 3M Chemolite Grove facility. The agency is screening results to assess the impacts associated with PFC contamination generated from residential, commercial and industrial products in the waste stream.

Historically, PFCs were detected in landfill gas condensate at Pine Bend Landfill and Onyx Landfill. Therefore, MPCA staff collected landfill gas samples at these facilities to study potential PFC impacts in the gas.

Staff collected samples from six municipal solid waste landfills, two combustor ash landfills and three industrial-demolition landfills. All landfills identified in the screening effort were constructed with synthetic liners designed to prevent landfill leachate and gas condensate from migrating outside the landfill boundary into ground water. The sampling plan allowed for the collection of landfill leachate samples at each facility. Staff also collected landfill gas condensate samples from three facilities with active-gas extraction systems. The results of the screening effort indicated low levels of PFCs in the leachate and gas condensate samples from sampled landfills, however PFCs were not found in the landfill gas samples themselves.

The results of the screening effort suggest that PFCs are likely components in leachate and gas condensate in municipal solid waste landfills, industrial-demolition landfills, and combustor ash landfills in Minnesota. Likely landfill sources for these chemicals are PFC-containing commercial products, residential products,

and industrial products introduced into the Minnesota waste stream.

In the past 15 years of solid waste management, lined landfills in Minnesota have proven to be effective barriers in preventing leachate and condensate from impacting the ground water and the environment at landfills. The MPCA is proposing additional work at Minnesota solid waste facilities to evaluate the effectiveness of the liners with respect to PFCs and will also determine the impact of PFCs at unlined demolition landfills.

### Sediment and water-related sampling

MPCA staff collected sediment cores and river water samples upstream and downstream of the 3M discharge to the Mississippi River from the Cottage Grove facility. PFC contaminant levels between 10 and 99 parts per billion were found in river core sediments. This may be significant, but the aquatic and ecological effects are not yet known.

The MDH revised its Fish Consumption Advisory to include guidelines for eating fish from Pool 2 of the Mississippi River (the section of the river between the Ford Dam and Hastings) that may contain PFOS. PFOS has been measured in the edible tissues of bluegill sunfish and smallmouth bass at levels of health concern for people who eat these fish too often.

The MDH recommends that people who eat bluegill sunfish from Pool 2 of the Mississippi limit their consumption to one meal per week. Previously, the consumption recommendation for bluegill sunfish was unlimited. The DNR has special regulations requiring that smallmouth bass be immediately released after they are caught from Pool 2. Since this recommendation should prevent people from eating smallmouth bass, the MDH only revised the bluegill sunfish advice. Although channel catfish fillets and white bass also had low levels of PFCs, following the existing fish consumption advice based on mercury and/or polychlorinated biphenyls (PCBs) will also protect people from exposure to PFCs.

In the winter of 2006, staff analyzed 21 fish from Pool 2 and 21 fish from Lake Pepin. No additional advisories were issued based on this sampling.

During the summer and fall of 2006, staff collected for testing an additional 94 fish from Mississippi River Pools 3, 4, 5 and 5a, the St. Croix River, and Lake Calhoun. Results are expected in early 2007.

The MPCA also collected surface and ground water samples from statewide locations. With these samples, they conducted a preliminary evaluation of 13 different PFCs found in Minnesota yet not associated with known point sources of contamination.

- Regarding surface water sampling: In November and December 2006, staff collected water from five lakes. The lakes were selected from a database used in mercury studies, and had no known source of PFCs. Staff found that all 13 PFCs were below detectable limits. The MPCA will evaluate more surface water samples from around the state in 2007.
- Regarding ground water sampling: Staff sampled 17 shallow monitoring wells (nine located in the Twin Cities Metro Area and eight in Greater Minnesota) for PFCs during November and December 2006. Again, each sample location had no known source of PFC contamination. Preliminary results indicate that seven of the Twin Cities metro area sample locations have PFBA concentrations between 0.04 and 0.92 parts per billion. All of these PFBA concentrations are below MDH's well advisory guideline. The MPCA will conduct further investigation in 2007 to better understand the observed PFBA occurrences.

## Oversight of 3M Superfund & VIC sites

The MPCA continues its review and oversight of current and future work plans or actions related to PFC contamination from the 3M Superfund and Voluntary Investigation and Cleanup (VIC) sites including 3M Chemolite (Superfund site in Cottage Grove), 3M Woodbury (VIC site), and 3M Oakdale (Superfund).

A final comprehensive report from 3M Chemolite was submitted in April 2006. Based on the results submitted, the MPCA required 3M to continue its evaluation to determine the extent of PFC contamination at the site (primarily in the Mississippi). The investigation was conducted in fall 2006 and a report is planned for submittal to the MPCA in April 2007. It will include an evaluation of additional cleanup actions that may be necessary at the 3M Chemolite facility. 3M did submit a proposed response action plan for on-site disposal areas at the facility in December 2006. The MPCA is currently evaluating these plans, but anticipates these actions will be implemented in 2007.

3M will continue to monitor PFC contamination in wells at the 3M Woodbury site. In December 2005, the MDH sampled residential wells near the 3M Chemolite and

Woodbury sites and did not detect PFOA and PFOS in any of the samples. In January 2007, MDH sampled 13 residential wells around the 3M Woodbury Site and found PFBA levels between .2 and 2.6 parts per billion. Based on these test results, the MPCA has requested 3M to:

- evaluate the barrier system's ability to capture all PFCs,
- install sentinel monitoring wells between the disposal area and nearby residences,
- reassess PFC waste remaining on the site,
- determine if the pumpout pipeline is leaking, and
- monitor nearby residential and sentinel wells.

3M submitted an investigation report for the 3M Oakdale site in September 2006. Additional site evaluations were conducted in November 2006 and will be used to help determine the full extent of PFC contamination from the site. This will include an evaluation of additional cleanup actions that may be necessary. These plans are expected to be submitted to the MPCA in April 2007.

The MPCA sampled ground water at the PCI Superfund site in Shakopee and the Pig's Eye Landfill Superfund site in St. Paul and detected PFOA, PFOS and PFBA. The MPCA is evaluating the data to determine the appropriate actions. These sites were sampled based on information provided by 3M that PFC-containing production waste could have been sent to these locations.

Samples were also collected at the Isanti-Solvent Superfund site. 3M used this site for disposal of solvent wastes. PFCs were not detected in the ground-water samples collected. The MPCA continues to assess other possible disposal sites, including fire training locations, where PFC-containing materials may have been used.



## EPA investigation of PFOS and PFOA

In the late 1990s, the EPA received information indicating that PFOS was widespread in the blood of the general population and presented concerns for persistence, bioaccumulation and toxicity. Following discussions between the EPA and 3M, 3M halted production of PFOS. PFOS findings led to EPA review of similar chemicals including PFOA, beginning in 2000.

EPA is working with industry and others to obtain additional monitoring information about PFOA, including its incineration or loss over time from products that may contain this chemical. A draft risk assessment about PFOA was released in January 2005 for scientific peer review. EPA will use this new information as it revises the assessment. MPCA staff and managers met with the EPA regarding PFC activities in late November 2005. MPCA will continue to share information regarding PFCs with EPA.

EPA is also conducting a “microcosm” study of the possible breakdown of PFOS and PFOA in soil. The two-year study began in March 2006 and is ongoing.

## Future activities

Since PFCs are used in a number of household, commercial and industrial products that are ultimately disposed of at solid waste facilities and landfills throughout Minnesota, staff anticipates doing additional sampling at the solid waste facilities evaluated as part of the 2006 screening effort. This will include ground-water sampling in down gradient monitoring wells. Landfill gas will be re-evaluated to confirm the initial results generated in the 2006 effort. The sampling effort will be expanded to a subset of demolition landfills which do not have synthetic liners. Sampling at these facilities will be focused on ground-water sampling in monitoring wells to evaluate the potential for PFC contamination in ground water down gradient from these facilities. This sampling is expected to take place in 2007.

Budgeted projects which include investigation for PFCs include:

- \$115,000 for additional fish tissue sampling in the Mississippi River and other locations.
- \$20,000 for additional sampling to better understand the presence of PFCs in ambient ground water (for example, sampling in areas not associated with a disposal site).
- \$200,000 for a consultant contract to accelerate development of criteria for PFOS and PFOA that would apply to wastewater effluent discharge to surface waters of the state.
- \$154,500 for active landfill evaluation of PFCs.
- \$150,000 for the evaluation of PFCs at wastewater treatment plants.

These projects are expected to be completed in 2007.

## For more information

If you have questions or would like more information about PFCs or information related to this fact sheet, go to the MPCA or MDH Web sites. Other Web links include EPA, the city of Lake Elmo and the city of Oakdale:

[www.pca.state.mn.us/hot/pfc.html](http://www.pca.state.mn.us/hot/pfc.html)

[www.pca.state.mn.us/publications/reports/clp-washington.pdf](http://www.pca.state.mn.us/publications/reports/clp-washington.pdf)

[www.health.state.mn.us/divs/eh/hazardous/topics/pfcshealth.html](http://www.health.state.mn.us/divs/eh/hazardous/topics/pfcshealth.html)

[www.lakeelmo.org/](http://www.lakeelmo.org/)

[www.ci.oakdale.mn.us/](http://www.ci.oakdale.mn.us/)

[www.epa.gov/opptintr/pfoa/index.htm](http://www.epa.gov/opptintr/pfoa/index.htm)