BEMIDJI CITY COUNCIL

Work Session Agenda

Monday, January 23, 2017

City Hall
Conference Room
5:30 p.m.

1. CALL TO ORDER / ROLL CALL

2. UPDATE ON CITY WATER SYSTEM

3. ADJOURNMENT

PLEASE NOTE: *All cellular telephones, pagers and BlackBerry devices to be switched to a non-audible function during Council and Committee meetings.*

COUNCIL AGENDA ITEM

Meeting Date: **January 23, 2017 Work Session**

Action Requested: **Water System Update**

Prepared By: **Craig Gray, City Engineer**

Reviewed By: **Nate Mathews, City Manager**

Background:

Acronyms used in this memo:

AFFF – Aqueous Film Forming Foams (firefighting foam)
PFCs – Perfluorochemicals – a family of manmade chemicals
MPCA – Minnesota Pollution Control Agency
MDH – Minnesota Department of Health
HI – Hazard Index – a measure of detected PFC concentrations
MGD – million gallons per day
gpm – gallons per minute

In 2008 the MPCA conducted a survey of fire departments around the state to identify possible locations where PFC-containing AFFF had been repeatedly used for training or firefighting purposes. MDH and MPCA staff reviewed this information and identified a number of locations where nearby water supply wells were potentially at risk. Bemidji was one of those locations.

In 2009, MDH sampled a number of municipal wells in Minnesota, including Bemidji. Low levels of PFCs were detected in our wells during this sampling, however the levels were below any amount that would cause any concern or health risk. (PFCs exist in the environment even in places where AFFF has not been used.) However because traces were found in the city wells during this 2009 sampling the MDH has continued with quarterly monitoring and testing of the city wells ever since.

A fact sheet on Aqueous Filming Foams and PFCs is attached.

City System

The city has five water supply wells that we use to provide water to the city residents. They are numbered 3, 4, 5, 6, and 7, and are shown on the attached map. In the winter our average usage is about 1 MGD. In the summer that increases to about 2.5 MGD. Each well can pump around 1000-1400 gpm and combined the five wells have a pumping capacity of about 4,000-4,500 gpm – each well is a little bit different. The city needs to pump about 2,500 gpm all day long to maintain the water supply system. We do that by running a variety of the wells at different gpm's.

Local PFC Monitoring Results

The MDH has established a Hazard Index of 1.0 for PFCs in drinking water. The HI is a calculation of the combined concentrations of the family of FPCs in the water. Staff from MDH will be at the meeting to discuss the HI criteria in more detail but the goal is to have HI concentrations below 1.0.

The attached colored spreadsheet shows the test results of the city's wells since February, 2015. The last set of sampling and testing was completed in December, 2016. The second to the last column on the spreadsheet is titled "New HI". This is the number that we want below 1.0. As you can see, wells 3, 5, 6 have always been below 1.0 and wells 4 and 7 are above 1.0.

Even though two of the city wells have a HI above 1.0 we have been able to provide a "blended" water supply that has always been below a HI of 1.0. Blending is the process by which we pump significantly more water (gpm) from wells 3,5,6 and blend it with smaller amounts of water from wells 4 and 7, creating a finished product with a HI less than 1.0. This process is the one that MDH has recommended the city use for the last few years while additionally monitoring on the PFCs was completed. This would also hopefully prevent the PFC's from migrating to private wells. So far no PFCs have been identified in any private wells.

We could just shut down wells 4 and 7 and pump only from wells 3, 5 and 6. The current thought by MDH is that would likely result in those wells drawing the PFCs into them which would just be creating a short term solution. An example would be how the HI at well 3 has increased over time. Based on its location it could be assumed that the PFC area is migrating toward well 3 as the pumping amounts from wells 4 and 7 are significantly reduced.

I hope to learn more from MDH at the meeting about this option as well. Right now MDH staff is thinking that perhaps the city should start to take a look at a long-term solution to the PFC issue. The first step in that process would be to hire a specialized water consultant. I hope to be talking to a couple of them at my CEAM meeting at the end of the week.

It is extremely important to note that the city has continued with the blending process and test results show that the finished water product supplied to the city's system is under a HI of 1.0.

City Well	UN	Date	PFBA	PFPeA	PFHxA	PFOA	PFBS	PFHxS	PFOS	EPA	New HI	New HI wo/PFHxS
3	462463	Feb-15	0	0	0	0	0	0.013	0	0.00	0.19	0.00
		May-15	0	0	0	0	0	0.016	0	0.00	0.23	0.00
		Sep-15	0	0	0	0	0	0.012	0	0.00	0.17	0.00
		Dec-15	0	0	0	0	0	0.02	0.009	0.13	0.41	0.13
		Feb-16	0	0	0	0	0	0.015	0	0.00	0.21	0.00
		Jun-16	0	0	0	0	0	0.028	0	0.00	0.40	0.00
		Dec-16	0	0	0	0	0	0.035	0.024	0.34	0.84	0.34
4	622716	Feb-15	0.017	0.015	0.038	0.025	0.039	0.22	0.16	2.64	5.79	2.65
		May-15	0	0	0.036	0.031	0.04	0.2	0.18	3.01	5.88	3.02
		Sep-15	0	0	0.033	0.012	0.034	0.24	0.17	2.60	6.03	2.60
		Dec-15	0.008	0	0.036	0.014	0.029	0.19	0.18	2.77	5.49	2.78
		Feb-16	0	0	0.039	0.019	0.03	0.2	0.18	2.84	5.70	2.85
		Jun-16	0	0	0.043	0.02	0.031	0.23	0.17	2.71	6.00	2.72
		Aug-16	0	0	0.054	0.024	0.045	0.42	0.3	4.63	10.64	4.64
		Dec-16	0	0	0.028	0.018	0.03	0.31	0.26	3.97	8.40	3.98
5	673449	Feb-15	0	0	0.0074	0	0	0.029	0	0.00	0.41	0.00
		May-15	0	0	0	0	0	0.025	0	0.00	0.36	0.00
		Feb-16	0	0	0	0	0	0.015	0	0.00	0.21	0.00
		Dec-16	0	0	0	0	0	0.023	0	0.00	0.33	0.00
6	673450	Feb-15	0	0	0.0066	0	0	0.0096	0	0.00	0.14	0.00
		May-15	0	0	0	0	0	0.008	0	0.00	0.11	0.00
		Feb-16	0	0	0	0	0	0.008	0	0.00	0.11	0.00
		Dec-16	0	0	0	0	0	0	0	0.00	0.00	0.00
7	709933	Feb-15	0	0	0.0071	0	0.0068	0.097	0.059	0.84	2.23	0.84
		May-15	0	0	0	0	0.01	0.11	0.064	0.91	2.49	0.92
		Sep-15	0	0	0	0	0	0.11	0.082	1.17	2.74	1.17
		Dec-15	0	0	0	0	0.016	0.11	0.088	1.26	2.83	1.26
		Feb-16	0	0	0	0	0.012	0.11	0.083	1.19	2.76	1.19
		Jun-16	0	0	0	0	0	0.036	0.041	0.59	1.10	0.59
		Aug-16	0	0	0	0	0	0.062	0.081	1.16	2.04	1.16
		Dec-16	0	0	0	0	0.011	0.078	0.13	1.86	2.97	1.86
Distr. System (MDH office)		Aug-16	0	0	0	0	0	0.029	0.037	0.53	0.94	0.53

Estimated, below Reporting Limit, but above Detection Limit

Estimated, below Detection Limit

Concentration exceeds drinking water critiera or HI exceeds 1

Hazard Index (HI) calculation: The HI is the sum of each detected PFC concentration divided by it's drinking water criteria - either HRL (PFBA, PFBS), EPA LHA (PFOS, PFOA), or interim guidance value (PFHxS) - so in ug/L (ppb) this would be: **HI = PFBA conc./7 + PFOA conc./0.07 + PFBS conc./7 + PFOS conc./0.07 + PFHxS conc./0.07**

This allows MDH to evaluate the relative contribution of each PFC (which have different toxicities) to the overall toxicity of the PFC mixture

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Minnesota Department of Health
(http://www.health.state.mn.us/index.html)

Class B Firefighting Foam - Municipal Well Investigative Sampling Results

Introduction

In February 2009, the Minnesota Department of Health (MDH) began sampling selected municipal water supplies for an expanded list of perfluorochemicals (PFCs) related to Class B firefighting foams. These systems were chosen based on the volume of reported use of Class B firefighting foams in training centers and the vulnerability of the wells.

Results Table

*indicates that the laboratory analysis was for List 555 (see below for more information)

City	Wells Results	Date Sampled	Public Health Action
Apple Valley	Trace amounts noted	2009	PFCs below health based exposure limits
Bemidji	Trace amounts noted	2009	PFCs below health based exposure limits
Brooklyn Center	No detection	2009	PFCs below health based exposure limits
Burnsville	Trace amounts noted	2009	PFCs below health based exposure limits
Cloquet	No detection	2009	PFCs below health based exposure limits
Cottage Grove*	Trace amounts noted	2009	PFCs below health based exposure limits
Goodview	No detection	2009	PFCs below health based exposure limits
Luverne	Trace amounts noted	2009	PFCs below health based exposure limits
North Mankato	No detection	2009	PFCs below health based exposure limits
North St. Paul*	No detection	2009	PFCs below health based exposure limits

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MDH Minnesota Department of Health
(http://www.health.state.mn.us/index.html)

Aqueous Film Forming Foams and PFCs

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What are the concerns associated with AFFF use?

When PFC-containing AFFF are repeatedly used in one location over a long period of time, the PFCs can move from the foam into soil and then into groundwater. The amount of PFCs that enter the groundwater depends on the type and amount of AFFF used, where it was used, the type of soil, and other factors. If private or public wells are located nearby, they could potentially be affected by PFCs from the place where AFFF was used.

This is more likely to occur near places where PFC-containing AFFF has been used repeatedly, such as a fire training areas, airports, refineries, and chemical plants. It is less likely to occur from the one-time use of AFFF to fight a fire, unless large volumes of AFFF are used. Although some portable fire extinguishers may use PFC-containing AFFF, one time use of such a small amount would be unlikely to pose a hazard to groundwater.

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What is being done to determine if AFFF use is causing contamination of drinking water?

In 2008, the MPCA conducted a survey of fire departments, airports, refineries, and other potential AFFF users around the state to identify locations where PFC-containing AFFF has been repeatedly used for training or firefighting purposes. MDH and MPCA staff reviewed this information and identified a number of locations where nearby water supply wells were potentially at risk.

In 2009, MDH sampled municipal wells in 17 communities and 16 noncommunity public wells (those that serve businesses, schools, churches, etc.) near the identified AFFF sites.

Low levels of some PFCs were detected in 7 municipal systems. No PFCs were detected in the other municipal wells or in any of the noncommunity public wells tested. A summary of the municipal well testing results are shown in the Class B Firefighting Foam - Municipal Well Investigative Sampling Results webpage (http://www.health.state.mn.us/divs/eh/hazardous/topics/pfcs/classbresults.html) .

In 2008-2011, MPCA tested the soil, surface water, groundwater, and sediments at and near 13 AFFF sites around the state. They detected high levels of PFCs at some of the sites, but in most cases the contamination did not affect a large area or pose a risk to humans or the environment (for more information on these investigations: (PFC) Containing Firefighting foams and their Use in Minnesota (http://www.pca.state.mn.us/index.php/view-document.html?gid=17922)). Three sites – Duluth Air National Guard Base, Bemidji Airport, and Western Area Fire Training Academy (WAFTA) - were identified where PFCs had spread far enough that MDH and MPCA decided to test nearby residential wells. The MPCA is continuing to investigate these sites and evaluating what additional actions may be needed.

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More information

2009 Perfluorochemicals & Firefighting Training Sites in Minnesota Slide Presentation (PPTX)
(http://www.health.state.mn.us/divs/eh/hazardous/topics/pfcs/2009_afff.pptx)

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Minnesota Department of Health
(http://www.health.state.mn.us/index.html)

Perfluorochemicals (PFCs) and Health

Also referred to as Perfluoroalkyl Substances (PFAS)

Perfluorochemicals (PFCs) are...

...a family of manmade chemicals that have been used for decades as an ingredient to make products that resist heat, oil, stains, grease and water and are extremely resistant to breakdown in the environment.

Common uses of PFCs include: 1) nonstick cookware, stain-resistant carpets and fabrics, 2) coatings on some food packaging (especially microwave popcorn bags and fast food wrappers), 3) as components of fire-fighting foam, and 4) many industrial applications.

PFCs commonly detected in Minnesota include:
perfluorooctane sulfonate (PFOS; C8F17SO3),
perfluorobutane sulfonate (PFBS; C4F9C03),
perfluorooctanoic acid (PFOA; C8F15O2H),
perfluorobutanoic acid (PFBA; C4F7O2H),
perfluoropentanoic acid (PFPeA; C5F9O2H), and
perfluorohexane sulfonate (PFHxS; C6F13SO3).

What do we know about PFCs in the environment?

- *In the environment:* Because PFCs are so stable, they may be found in soil, sediments, water or in other places. Studies indicate that some PFCs travel through soil and easily enter groundwater where they may move long distances. Some experts suggest that PFCs can also travel long distances in air, deposit on soil and leach into groundwater.

  For more information about where PFCs have been found in Minnesota, see the Minnesota Pollution Control Agency Web page: Perfluorochemicals (https://www.pca.state.mn.us/waste/perfluorochemicals-pfcs).

- *In wildlife:* PFCs have been found in the blood of many species of wildlife around the world, including fish, bald eagles and mink in the mid-western United States.
- *In fish:* PFOS is the PFC that accumulates to levels of concern in fish. Most fish have low levels of PFOS. However, the fish in some lakes have levels of PFOS that require restrictive fish consumption advice of only one meal of fish per month.

  For information on the Minnesota Department of Health (MDH) fish consumption guidelines, visit the Fish Consumption Guidance: Minnesota Fish: Benefits and Risks (http://www.health.state.mn.us/divs/eh/fish/faq.html). Information about PFCs in fish and site-specific meal advice are available.

- *In Minnesota lakes and rivers:* PFCs may be present in lakes and rivers at very low levels. MDH has determined that exposure to PFCs through swimming is not of concern. PFCs are poorly absorbed through skin and incidental ingestion of surface water while swimming will not result in a significant exposure. Also, because there is very little evaporation of PFCs from water into the air, breathing them in while swimming or bathing is not a health concern.

- *In people:* Studies show that nearly all people have some PFCs in their blood, regardless of age. The PFCs most commonly found in human blood are PFOS, PFOA, and PFHxS. People are exposed through food, water, dust or from using commercial products. Some PFCs stay in the human body for many years.

MDH conducted studies that measured PFCs in the blood of East Metro residents. For more information about the studies, see PFC Biomonitoring Projects.

(http://www.health.state.mn.us/divs/hpcd/tracking/biomonitoring/projects/emetro-landing.html)

Are PFCs harmful to people?

On May 19, 2016, the United States Environmental Protection Agency (EPA) released Drinking Water Health Advisories (HAs) for PFOA and PFOS. The HAs are based on noncancer and cancer health effects. The HAs were developed based on studies of PFOS and PFOA in laboratory animals, and they were informed by studies in humans. Studies in animals have found effects on the liver, development, and immune system responses. PFOA and PFOS were also associated with tumors in laboratory animals exposed long-term to high levels.

In humans, scientists are still studying whether PFCs cause health problems. Researchers have found links between PFCs and some human health outcomes. More work needs to be done to determine if PFCs cause health outcomes like cholesterol levels, birth weight, and immune system function or if they are due to other factors. Studies in PFC workers have not found consistent evidence that PFCs cause health problems.

EPA recommends that the HAs for PFOS and for PFOA apply to short periods of time (i.e., weeks to months) during pregnancy and breastfeeding, as well as over a lifetime of exposure. This recommendation reflects that PFOA and PFOS 1) stay in the human body for years and can increase with additional exposures and 2) can cross the placenta and are secreted in breastmilk.

MDH will continue to monitor the growing body of science about PFCs and adjust our health advice if needed.

What levels of PFCs are safe to drink?

MDH is responsible for ensuring safe drinking water for all Minnesotans. One way MDH does this is through regular testing of public water supplies for contaminants. MDH also works with the Minnesota Pollution Control Agency (MPCA) to investigate situations where groundwater contaminants may affect private wells.

Because PFCs are known to be in the environment in Minnesota, MDH has developed drinking water criteria, known as Health Risk Limits (HRLs) for PFOA, PFOS, PFBA, and PFBS. HRLs represent levels of chemicals in drinking water that MDH considers safe for people, including sensitive populations. For more information about HRLs, visit Health Risk Limits (for Groundwater (http://www.health.state.mn.us/divs/eh/risk/guidance/hrltype.html)).

The HRL values for these four PFCs are:
Developed in 2009,
Perfluorooctanoic Acid (PFOA) (http://www.health.state.mn.us/divs/eh/risk/guidance/gw/table.html#pfoa) :
0.3 micrograms per liter (µg/L) or 300 parts per trillion
Perfluorooctane Sulfonate (PFOS)
(http://www.health.state.mn.us/divs/eh/risk/guidance/gw/table.html#pfos) :
0.3 micrograms per liter (µg/L) or 300 parts per trillion
These HRL values are currently under review due to the May 19, 2016 release of EPA Drinking Water Health Advisories for PFOA and PFOS.

Developed in 2011,
Perfluorobutane sulfonate (PFBS)
(http://www.health.state.mn.us/divs/eh/risk/guidance/gw/table.html#pfbs) : 7 micrograms per liter (µg/L)
Perfluorobutyrate (PFBA) (http://www.health.state.mn.us/divs/eh/risk/guidance/gw/table.html#pfba) : 7 micrograms per liter (µg/L)

Due to limited toxicological research on the other PFCs for which MDH's Public Health Laboratory currently tests, there is not enough scientific information to develop HRLs. MDH continues to follow ongoing research activities on other PFCs of concern and may develop guidance if sufficient toxicological data becomes available. Levels of these other PFCs have been very low in area groundwater samples.

More information about Perfluoroalkyl Substances (PFAS) Research is available on the US EPA webpage Perfluorinated Chemical (PFC) Research (http://www.epa.gov/chemical-research/perfluorinated-chemical-pfc-research)

EPA Health Advisory for PFOA and PFOS – May 2016

The United States Environmental Protection Agency (EPA) set a lifetime drinking water Health Advisory (HA) for PFOA of 70 parts per trillion (ppt) and for PFOS of 70 ppt. These values are equal to 0.07 micrograms per liter (µg/L).

The EPA HAs for PFOA and PFOS are based on similar effects and are identical numbers. In drinking water where both PFOA and PFOS are found together, EPA recommends that the concentrations be added together. The HA for combined PFOS and PFOA is set at 0.07 micrograms per liter (µg/L). HAs are set to protect the population at large including sensitive individuals and are protective of both short-term as well as a lifetime of drinking water at these concentrations.

HAs serve as the informal technical guidance for unregulated drinking water contaminants to assist Federal, State and local officials, and managers of public or community water systems in protecting public health as needed. MDH is reviewing the EPA Drinking Water Health Advisories for PFOA and PFOS in order to determine the best action to protect the health of Minnesotans.

More information about the EPA Drinking Water Health Advisories for PFOA and PFOS can be found on the US EPA webpage Drinking Water Health Advisories for PFOA and PFOS (https://www.epa.gov/ground-water-and-drinking-water/drinking-water-health-advisories-pfoa-and-pfos) .

The Water Research Foundation (WRF) recently released findings of a study addressing methods for removing poly- and perfluoroalkyl substances (PFASs) from water and wastewater. The research report, "Treatment Mitigation Strategies for Poly- and Perfluorinated Chemicals" can be found on the Water Research Foundation Website (http://www.waterrf.org/Pages/Projects.aspx?PID=4322) .

How can I reduce my exposures to PFCs?

PFCs are found in people and animals all over the world. They are found in some food products and in the environment (air, water, soil, etc.). Completely stopping exposure to PFCs is unlikely. If you live near sources of PFC contamination, you can take steps to reduce your risk of exposure to PFCs.

- If your water contains PFCs, you can reduce exposure by using an alternative or treated water source for drinking, food preparation, cooking, brushing teeth, and any activity that might result in ingestion of water. It is safe to shower and bathe in PFC-contaminated water. Neither routine showering or bathing are a significant source of exposure. Studies have shown very limited absorption of PFCs through the skin.
  - There are different types of bottled water including purified water, spring water and others. Purified water is generally filtered using different methods including reverse osmosis and activated carbon. Spring water may also be filtered using activated carbon. While bottled water has not been tested for PFCs, both of these filtration methods have been shown to be effective at removing PFCs.
  - Filters containing activated carbon or reverse osmosis membranes have been shown to be effective at removing PFCs from water supplies. Other types of common water treatment systems, such as water softeners, are not likely to remove PFCs. Boiling water will not remove PFCs. MDH has information about water treatment devices on: "Home Water Treatment Units: Point of Use Devices (http://www.health.state.mn.us/divs/eh/water/factsheet/com/pou.html) ." Use a reliable installer to insure proper installation, operation and maintenance of the water filter system which will work best for your needs.
- People can reduce their exposure to PFCs in fish by following the MDH's Fish Consumption Guidance (http://www.health.state.mn.us/divs/eh/fish/index.html) . Fish are an excellent source of low-fat protein and most fish are healthy to eat. Special cleaning and cooking precautions used to reduce contaminants like polychlorinated biphenyls (PCBs) that concentrate in fat are not effective with PFOS.

Copy
Craig

MEMORANDUM

TO: Richard Sathers, Fire Chief and Harold VanLeeuwen, Airport Manager

FROM: John Chattin, City Manager

DATE: April 30, 2009

RE: Water Testing at the Airport

Attached is a fact sheet from the Minnesota Department of Health (MDH) regarding the use of Aqueous Film Forming Foams (AFFFs). Many of these firefighting foams contain Perfluorochemicals (PFCs) that could make their way into the groundwater, thereby causing contamination issues. The MDH has recently taken water samples from the city wells that are located near the airport. The test results showed trace amounts of PFCs but not at a level that causes any concern. However, quarterly monitoring and testing of the wells is being required and will be conducted by the MDH.

Effective immediately the airport and fire department should cease using or training with any fire fighting foam that contains PFCs.

Briefing:
Perfluorochemicals (PFCs) in Bemidji City Wells

Presented to Bemidji City Council
Jan. 23, 2017

Overview

- What are perfluorochemicals (PFCs)?
- How did they get into Bemidji's city wells?
- When were they detected?
- What are the current concentrations and trends?
- How does MDH evaluate mixtures of PFCs in drinking water?
- Next steps

What Are Perfluorochemicals (PFCs)?

- PFCs (also called poly- and perfluorinated alkyl substances, or PFAS) are a large class of chemicals used to make coatings that resist oil, water, and stains
- First developed in 1940s and used in a wide range of manufacturing processes and consumer products
- Very strong carbon-fluorine bond makes PFCs extremely persist in the environment and chemical structure makes them very soluble
- As a result, PFCs have become widely present in humans & wildlife globally

PFCs and Health

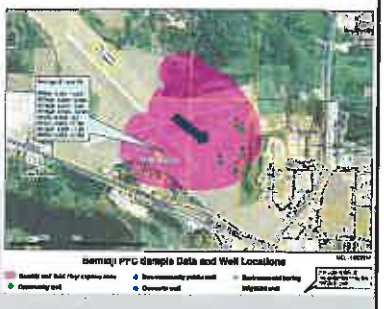
- **Animal studies:**
  - Developmental, liver, and immune system effects.
  - Long-term exposure to high levels of PFOA found to be associated with tumors (liver, prostate, thyroid)
- **Humans:**
  - Correlation studies suggest possible links between PFCs and some health outcomes
    - Altered cholesterol levels
    - Lowered birth weight
    - Immune system effects
  - More work needed to determine if PFCs are actually causing these effects
  - Studies of PFC workers have not found consistent evidence of health problems in adults

PFCs in Drinking Water - Guidance

- **MDH Health Risk Limits (HRL):**
  - **PFOA = 0.3 ppb**
  - **PFOS = 0.3 ppb**
  - **PFBA = 7 ppb**
  - **PFBS = 7 ppb**
  - PFHxS – insufficient studies to set an HRL, but long half-life and similar to PFOS, so MDH applies the PFOS value to PFHxS
- **EPA 2016 Health Advisories (HA):**
  - **PFOA = 0.07 ppb**
  - **PFOS = 0.07 ppb**
  - Additive if PFOA + PFOS > 0.07 ppb
  - Applies to short-term exposures during pregnancy and breastfeeding, as well as over a lifetime, to recognize that PFOA and PFOS
    - Accumulate in the body over time
    - Can cross the placenta and are secreted in breastmilk

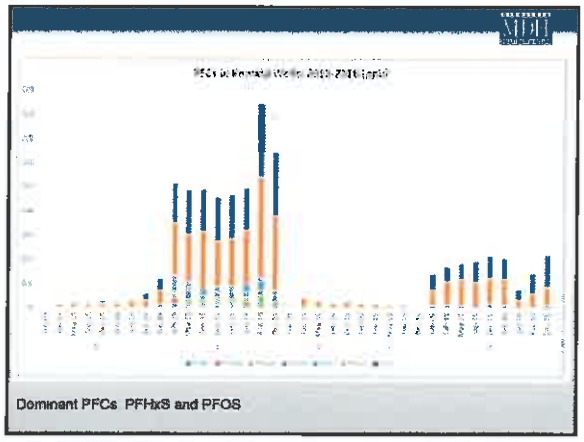
How Did PFCs Get Into Bemidji's City Wells?

- **Fire-training activities at the airport included use of PFC-bearing foams**
- **2009-2010: MPCA investigation detected PFCs in the soil and groundwater**
- **Groundwater flow is to the southeast and training area is within the capture zone of city wells**

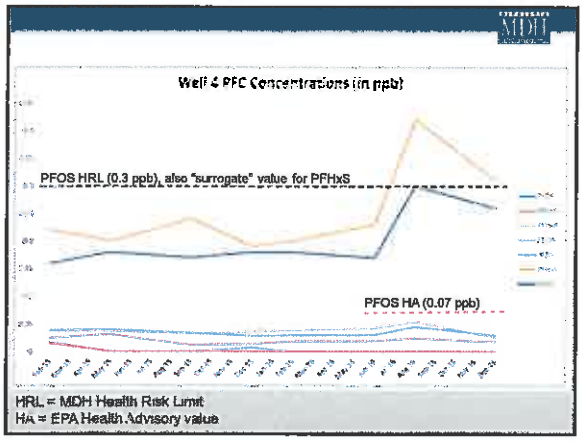


When Were PFCs Detected?

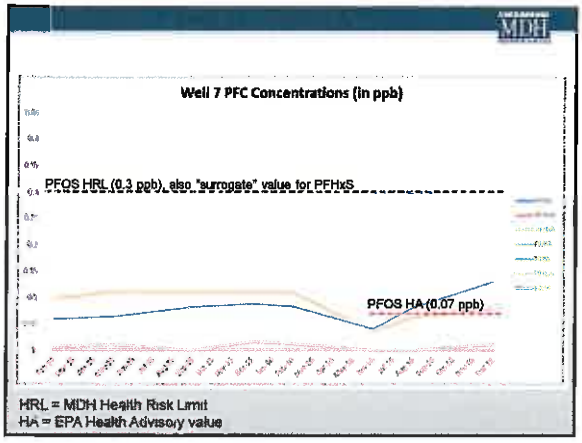
- **2009: MDH sampling detected trace levels well below Health Risk Limits (HRLs) at that time**
  - Well 4: 0.061 ppb PFHxS
  - Well 7: 0.063 ppb PFOS, 0.069 ppb PFHxS
  - HRLs: PFOS = 0.3 ppb; none established for PFHxS
- **2014: UCMR3 sampling (entry point)**
  - July: no detections
  - Nov: 0.13 ppb PFOS
- **2015-2016: MDH sampling**
  - Detected at least one PFC in all city wells (multiple PFCs in 3,4,7)
  - Below HRLs, even when combined concentrations evaluated
  - Wells 4 & 7 exceed EPA Health Advisory values issued in 2016



Dominant PFCs: PFHxS and PFOS



HRL = MDH Health Risk Limit
HA = EPA Health Advisory value

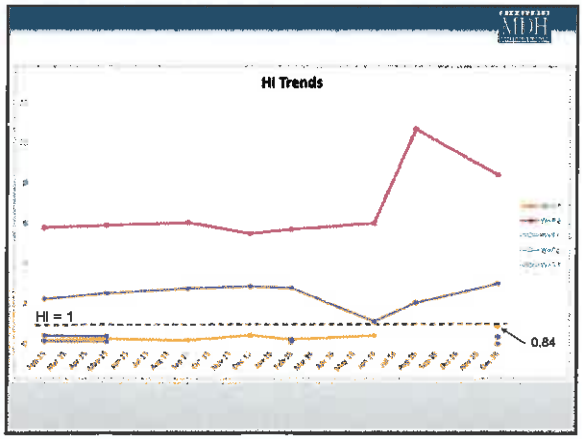


How Does MDH Evaluate PFC Mixtures?

- Additivity calculation done when chemicals affect same organ(s) by similar mechanism
- Provides a way to "add up" chemicals with different toxic "potency"
- Hazard Index (HI) Sum of each chemical divided by it's drinking water criteria

$$HI = \frac{PFBA_{[conc.]}}{7} + \frac{PFBS_{[conc.]}}{7} + \frac{PFOA_{[conc.]}}{0.07} + \frac{PFOS_{[conc.]}}{0.07} + \frac{PFHxS_{[conc.]}}{0.07}$$

- If HI > 1, considered same as a single PFC exceeding its drinking water criteria



Next Steps:

- **MPCA to investigate "new" training area and evaluate current conditions in previously investigated training area.**
- **Evaluate options, which may include:**
  - Blending to keep concentrations below a Hazard Index of 1
    - Distribution system sample in Aug 2016 had HI = 0.94
    - If concentrations increase, will be very difficult to stay under 1
  - Notify city water users if HI>1
    - Describe options for reducing exposure (boiled water, small filters, etc.)
  - Treatment
    - Granular Activated Carbon (GAC) – proven (Oakdale, MN)
    - Reverse-Osmosis – proven, but may be difficult to scale to municipal system
    - Ion Exchange Resin – proven, but not yet applied to municipal systems