



Sulfolane Investigation Update

A publication from the Alaska Department of Environmental Conservation to inform the North Pole community of developments related to sulfolane contamination from the North Pole Refinery

August 2015

NTP begins new studies on sulfolane

This spring the National Toxicology Program (NTP) began new studies on sulfolane, a solvent that has impacted the drinking water supplies north-northwest of the North Pole Refinery in North Pole, Alaska. Previous toxicology studies on sulfolane are limited, and important questions remain about sulfolane's health effects. The NTP studies will address these questions. Of particular concern to DEC is the lack of information on the effects of long-term exposure to this chemical.

The NTP is a federal program that evaluates environmental contaminants of public health concern. The program elected to study sulfolane at DEC's request. A two-year study initiated May 2015 will evaluate the effects of long-term exposure.

"This key piece of information has yet to be adequately addressed by the scientific community studying sulfolane. We need this information to make a
(Continued, see NTP, back page)

Sulfolane cleanup level status

At present, no cleanup level for sulfolane is in effect. While Flint Hills has proposed a cleanup level of 362 parts per billion, DEC's current stance is to wait to set a cleanup level for sulfolane until more data are available from the new NTP studies, in order to best protect people from exposure (see article above). When

a cleanup level is established, Flint Hills may discontinue providing alternative water supplies for people whose groundwater contamination is below that set level. Long-term studies are particularly important because sulfolane contamination may potentially impact residents living within the plume area for their entire lives.

Until a cleanup level is set, DEC will ensure residents with detectable levels of sulfolane will be provided alternative drinking water.

DEC will also ensure that impacts on construction projects are minimized. State, local and industry parties continue discussions on the possibility of a piped water system to the affected properties. Results of a cost engineering study for a piped water supply to affected properties are due this fall.

The U.S. Environmental Protection Agency (EPA) concurs that the NTP studies on sulfolane will provide valuable information. Mr. Richard Albright, Director of EPA's Region 10 Office of

(Continued, see DEC continues, page 2)

No cleanup level - What does it mean?

Will Flint Hills stop providing water or maintaining water systems?

No. Until a cleanup level is set, DEC's approval of Flint Hills' Onsite Cleanup Plan requires the company to provide alternative drinking water to residents with detectable levels of sulfolane.

Would setting a cleanup level change the water service I get from Flint Hills?

It might. When a cleanup level is established, Flint Hills may discontinue providing alternative water supplies to people whose groundwater contamination is below that set level.

Does cleanup activity continue at the refinery?

Yes. DEC continues to require cleanup activity on the refinery. Flint Hills has improved the refinery's groundwater treatment systems to address DEC's requirement to stop migration off the refinery property of sulfolane above 15 parts per billion, although some migration continues at the present time. This summer Flint Hills plans to remove several areas of soil with the highest levels of sulfolane from the refinery property.

Have the health recommendations changed?

No. Current health recommendations remain in effect (see www.dec.alaska.gov/spar/csp/sites/north-pole-refinery/health.htm). Since 2012, The Alaska Department of Health and Social Services has recommended that people with detectable levels of sulfolane in their water should continue to use the provided alternative source of water for drinking and cooking where the water is consumed. This has not changed.

North Pole Open House on Sulfolane

Tuesday, August 18th
4:30 – 7:00 p.m.

North Pole Branch Library
656 NPHS Blvd.


Meet with staff overseeing the investigation and remediation of the sulfolane groundwater plume in North Pole. The event is designed to update the community on the project and answer questions. Staff from the City of North Pole and the Fairbanks North Star Borough will also be there.

For more information,
call DEC at (907) 451-2192

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Environmental Cleanup, stated, “Given the uncertainty that exists regarding the toxicity values associated with sulfolane, and the high number of residents who potentially face direct exposure to the chemical in their drinking water, EPA strongly encourages DEC to wait until the NTP study is completed before setting a sulfolane cleanup level for groundwater.”

One of a number of factors used in calculating a cleanup level is a reference dose. At DEC’s request, an independent, expert peer review of the available reference doses for sulfolane was conducted in Fairbanks by the non-profit organization Toxicology Excellence for Risk Assessment (TERA).


The TERA report was released in December 2014. Although the report says that the value proposed by Flint Hills most closely aligns with the panel’s conclusions, the experts identified a number of uncertainties about the toxicity of sulfolane. These uncertainties include lack of reliable studies on the health effects of long-term exposure. TERA panelists noted that the NTP research will address the data gaps in the effects of long-term exposure to the chemical. 

Cleanup proceeds at refinery, plume monitoring continues

In October 2014, DEC approved an Onsite Cleanup Plan to address contamination on the North Pole Refinery property. Sulfolane that has migrated beyond the refinery boundary is not addressed in the Onsite Cleanup Plan.

The actions included in the Onsite Cleanup Plan are designed to protect workers and reduce migration of sulfolane off the refinery property. Under this plan, Flint Hills intends to remove some contaminated soil from some accessible areas of the refinery this summer. A groundwater pump-and-treat system collects contaminated groundwater and removes the contamination before discharging the water to the gravel pits. This pump-and-treat system was ex-

panded under the 2014 Onsite Cleanup Plan to capture all groundwater containing sulfolane above 15 parts per billion.

Flint Hills continues to monitor the extensive plume of sulfolane-contaminated groundwater extending beyond the refinery property to the north-northwest. (See map at right.) The two mile wide, three and a half mile long plume is present both above and below permafrost. Above permafrost, the sulfolane boundaries are reasonably well understood, but there is little information about the extent of the plume below permafrost. There are no monitoring wells below permafrost, so the only information on this part of the contamination comes from sampling private wells. 

“EPA strongly encourages DEC to wait until the NTP study is completed before setting a sulfolane cleanup level for groundwater.”

- Richard Albright, Director of EPA’s Region 10 Office of Environmental Cleanup.

A brief history

The 2009 discovery of sulfolane in drinking water wells near the North Pole Refinery led to an extensive groundwater investigation. Flint Hills Resources Alaska, owner of the refinery, responded quickly by providing affected residents with alternate drinking water.

Sulfolane is an emerging contaminant, and the possible effects of long-term exposure to this chemical through drinking water are not fully understood. The groundwater plume is approximately two miles wide, three and a half miles long and over 300 feet deep, making it the largest in the state, with many private properties impacted. Currently approximately 1,500 people living within or just beyond the sulfolane plume receive alternate drinking water supplies.

Health and toxicity

When sulfolane was first discovered in drinking water wells, DEC asked the Alaska Department of Health and Social Services (DHSS) as well as the Agency for Toxic Substances and Disease Registry (ATSDR) for assistance in establishing a safe drinking water level. As a result, both agencies conducted health consultations, and DHSS continues to provide health recommendations for people in the affected area.

Expert guidance

Experts in the areas of human health, site characterization, toxicology, chemistry, and engineering design have been working on the sulfolane plume since its discovery. In March of 2010, DEC’s Contaminated Sites Program created a Technical Project Team to provide comprehensive and coordinated oversight for the sulfolane release investigation. The team consisted of

technical representatives from DEC, DHSS, the U.S. Environmental Protection Agency, Flint Hills, and Williams, Inc. Each contributed experts in relevant fields, and the team was coordinated by a professional facilitator.

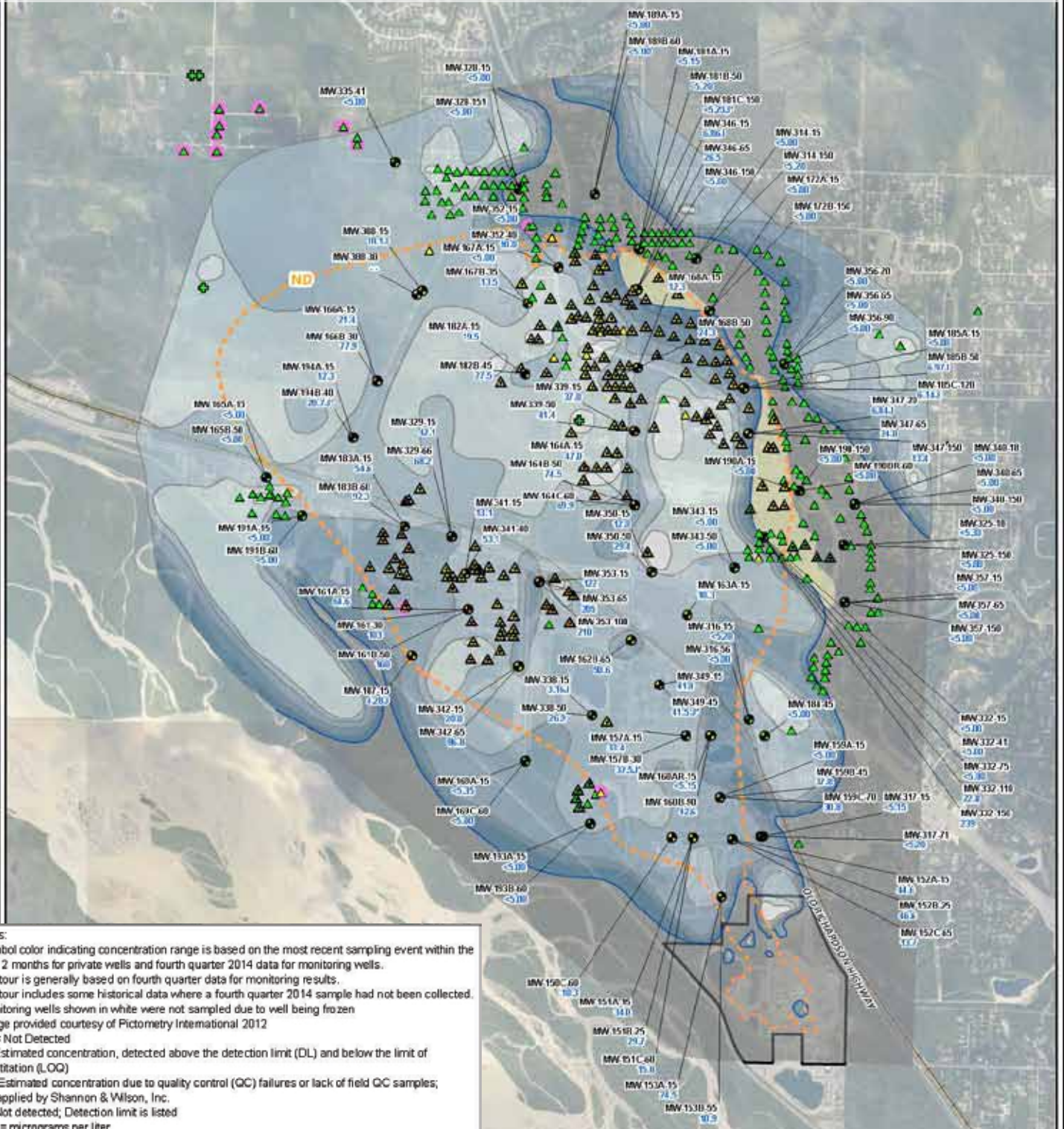
In March 2014, the State filed a lawsuit against the current and former owners of the North Pole Refinery. Due to these legal developments, regular communications are now occurring through the attorneys for the parties. DEC, however, continues oversight of the site investigation and cleanup.

Rigorous site investigation

Between 2010 and 2013, Flint Hills conducted an extensive investigation of the contamination both on and off the refinery property. Over 500 monitoring wells have been installed and over 1,000 soil samples and 7,000 groundwater samples have been collected. *(Continued, see **Brief History**, back page)*

Aerial map of sulfolane groundwater plume

This map shows the approximate extent of sulfolane groundwater contamination - outlined in the yellow dashed line (blue areas represent permafrost). Results are based on monitoring through the last quarter of 2014. A larger version of this map and others will be available at the Open House that DEC is hosting, Aug. 18th, North Pole Library, 4:30-7 p.m.



Notes:
 -Symbol color indicating concentration range is based on the most recent sampling event within the last 12 months for private wells and fourth quarter 2014 data for monitoring wells.
 -Contour is generally based on fourth quarter data for monitoring results.
 -Contour includes some historical data where a fourth quarter 2014 sample had not been collected.
 -Monitoring wells shown in white were not sampled due to well being frozen
 -Image provided courtesy of Pictometry International 2012
 ND = Not Detected
 J = Estimated concentration, detected above the detection limit (DL) and below the limit of quantitation (LOQ)
 J* = Estimated concentration due to quality control (QC) failures or lack of field QC samples; flag applied by Shannon & Wilson, Inc.
 <math>< </math> = Not detected; Detection limit is listed
 $\mu\text{g/L}$ = micrograms per liter

Legend

- Monitoring Well
- Point-of-entry treatment system sample collected
- Private Well
- Initial Result from Fourth Quarter 2014
- Permafrost Boring
- Suprapermafrost and Subpermafrost Mixing Zone
- FHRA Property Boundary
- Not sampled due to well being frozen or obstructed

Private Well Sulfolane Results

- Not Detected
- 2.5 - 100 $\mu\text{g/L}$
- 100 - 1,000 $\mu\text{g/L}$

Monitoring Well Sulfolane Results

- Not Detected
- 3.17 - 100 $\mu\text{g/L}$
- 100 - 1,000 $\mu\text{g/L}$

Depth to Permafrost in feet

- <math>< 10</math>
- 10 - 30
- 30 - 60
- 60 - 90
- 90 - 120
- 120 - 150
- > 150

Approximate Sulfolane Isoleth
 Regardless of Depth in $\mu\text{g/L}$

SCALE IN FEET
 0 2,500 5,000

FLINT HILLS RESOURCES ALASKA, LLC
 NORTH POLE REFINERY, NORTH POLE, ALASKA
**FOURTH QUARTER 2014 OFFSITE
 GROUNDWATER MONITORING REPORT**

**APPROXIMATE EXTENT OF SULFOLANE IMPACTS IN
 OFFSITE MONITORING WELLS AND PRIVATE WELLS**

FIGURE
4-5

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sound decision when setting a cleanup level for the contaminant,” DEC’s Director of the Division of Spill Prevention and Response, Kristin Ryan, has stated.

“Our first and most important consideration is protection of human health. These studies, now underway, will provide information critical to setting a cleanup level that protects the hundreds of adults and children whose drinking water is impacted by the sulfolane contamination,” Ryan said.

Flint Hills Resources Alaska, owner of the North Pole Refinery, currently provides alternative drinking water to an estimated 1,500 people residing in the impacted area. While the NTP studies progress, the company is obligated to continue to provide drinking water. DEC will continue to work with Flint Hills to clean up contamination on the refinery property and track migration of the expanding area impacted by sulfolane. The NTP research is summarized at right.



Brief history, *Continued from Page 2*

samples collected to date. Over 850 private wells have been sampled. Unprecedented laboratory methods were developed to detect sulfolane in water, soil and plants.

On the refinery property, groundwater treatment systems have been expanded and improved to reduce sulfolane migration off the refinery property. Petroleum contamination has been contained within the refinery property boundaries.

Collaborative effort

DEC has worked with experts from state and federal agencies, industry, the University of Alaska Fairbanks and other universities to investigate how sulfolane travels in the environment, how it may be treated and removed, and the potential health impacts of exposure to the chemical. DEC nominated sulfolane for additional toxicity studies through the National Toxicology Program to address health effects questions. Those studies are currently underway to provide critical new information needed to set a cleanup level.



**Status of
National Toxicology Program
studies on sulfolane**



- 1. 28-day Toxicity Study – Nearing Completion.**
Mice, rats and guinea pigs were given a range of doses of sulfolane. Goals of this study were 1) to determine if any of the animal species studied are more sensitive to sulfolane toxicity than the other species, and 2) to identify appropriate dosing levels for longer duration studies.
- 2. ADME Study - Ongoing**
Studies measure the absorption, distribution, metabolism, and excretion (ADME) of a chemical in male and female mice and rats. ADME studies help understand how a chemical moves around within the body, including whether there are any differences between sexes or rodent species.
- 3. Subchronic Toxicity Study - Currently Underway, Began Spring 2015**
Mice and rats from the 2-year study will be assessed after 3 months of exposure. The study will look at effects including markers of development in the rats. In a separate study, the immune system of rats and mice exposed to sulfolane for 3 months will be evaluated.
- 4. Chronic Toxicity Study – Currently Underway, Began Spring 2015**
Rats and mice will be given sulfolane in their drinking water for two years, consistent with how people would most likely come in contact with sulfolane. The purpose of this study is to determine the effects of long-term exposure to sulfolane, including any potential carcinogenic effects. The NTP will do a limited assessment of pregnancy outcomes in rats.

More information available on the web:

DEC’s NTP fact sheet at
www.dec.alaska.gov/spar/csp/sites/north-pole-refinery/health.htm

The NTP’s website on sulfolane at
www.ntp.niehs.nih.gov/results/areas/sulfolane/research.html

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