



June 2011

## Flint Hills' North Pole Refinery Contaminated Site

### Frequently Asked Questions

#### Health Questions

##### **Have any studies been devoted to the effects of sulfolane on human development?**

There have been two animal studies that have looked at the developmental or reproductive effects of sulfolane. These effects were noted only when very high levels of sulfolane were administered in the animals' drinking water. The federal Agency for Toxic Substances and Disease Registry's (ATSDR's) drinking water action levels are based on health effects found in test animals at much lower concentrations of sulfolane. The ATSDR action level is protective of the developmental and reproductive impacts described in these studies.

In addition, the Alaska Department of Health and Social Services (DHSS) has reviewed the rates of cancer and birth defects in the North Pole area and did not find any unusually high rates of either. This information is based on statistical analysis of reported cases of cancer and birth defects from the State of Alaska Cancer Registry and Birth Defects Registry.

Until we have a more complete picture of the toxic effects of sulfolane, however, the Alaska Department of Environmental Conservation (DEC) has ordered the interruption of all human exposure routes to sulfolane-impacted water, and DHSS has recommended that residents continue to use their alternative source of water for drinking and growing garden produce.

##### **How do you apply the results of studies on animals to humans?**

It is critical that these action levels are protective of human health. Tests on the toxic effects of chemicals, such as beauty products and household cleaners, are often studies on animals. Animal tests are conducted in a controlled environment where the smallest change or effect can be identified. Based on years of animal research, we also know how some animals react to different conditions relative to how a person would react.

There is still some uncertainty when translating the results from studies conducted in animals to potential impacts in people. The ATSDR action level for sulfolane is based on a dose (amount) shown to have no impacts in laboratory animals. That dose is then reduced by a factor of 10 (10 times smaller) to account for the uncertainty in extrapolating from animal research to potential impacts in humans. Other uncertainty factors are also applied, resulting in a dose much smaller (1,000 times smaller) than the dose found to have no health effects in the laboratory studies. The U.S. Environmental Protection Agency (EPA), ATSDR and other health agencies all use animal studies combined with uncertainty factors when human studies are not available, which is the case with the majority of the chemicals in use in U.S. at this time. The process for using data from animal studies is well-established and has conservative guidelines.

### **What is the detection limit for analysis of sulfolane in water?**

The detection limit for sulfolane in water is now 5 parts per billion (ppb) for all laboratories. In January 2011, DEC issued minimum requirements for the analysis of sulfolane that included a 5 ppb detection limit. These requirements were developed by DEC's Technical Project Team's (TPT's) chemistry subgroup, a team of high-caliber chemists from around the country. Prior to this, the detection limit was more commonly around 10 ppb, and did vary between laboratories and sample batches. With the refined analytical procedures, sulfolane is now being consistently detected at a lower concentration.

### **Does “not detected” or ND mean there is no sulfolane present?**

Not necessarily. Not detected (or ND) sample results mean sulfolane was not found at or above the detection limit. Results reported as ND mean either the water is sulfolane-free (no sulfolane present) or sulfolane is present, but at levels too small to detect.

### **How is the ATSDR “action level” different from a DEC “cleanup level”?**

The ATSDR action level is very protective of public health and reflects a 1,000-fold uncertainty factor to account for what we don't know about sulfolane toxicity. DEC will take this information into account, as well as additional toxicity information, site characterization information and cleanup alternatives, when developing final cleanup levels. The interim site cleanup level is currently set at 25 ppb. Once sufficient data is collected and the evaluation is complete, DEC will set a final cleanup level that is protective of both current and future uses of the area. This means the level could go lower, or it may go higher. We hope to have sufficient data to set a final cleanup level by early 2012.

### **Is it safe to shower using sulfolane-impacted water?**

Yes. Using sulfolane-impacted water to shower and bathe does not pose a health risk. Studies have shown that sulfolane is not readily absorbed through skin due to its low permeability (it's less able to go through the skin). In other words, human skin prevents sulfolane from reaching the bloodstream. Also, sulfolane has low volatility, which means that it does not readily go from a liquid to a gas (vapor) that people could breathe in while bathing or showering. It is important to point out that this answer is based primarily on the physical and chemical properties of sulfolane, which are better understood than the toxicity. Since sulfolane does not easily transfer from water through skin or into air, very little of the chemical enters the body while showering, unlike when the water is directly ingested. Thus, the uncertainty around the toxicity of sulfolane does not weigh as heavily in determining the safety of showering with sulfolane-impacted water.

### **What about gardening?**

The results of the 2010 summer garden sampling project of 23 different plants from seven North Pole gardens showed that sulfolane can end up in different parts of plants, especially in the leaves. **The highest levels were found in beet leaves and lettuce, but none of the concentrations found in 2010 exceeded the DHSS Division of Public Health's recommended levels.** Fifty-six samples were collected from various parts of the 23 different plants; 21 had detections of sulfolane. The concern, though, is that the sulfolane concentrations in fruits and vegetables will vary based on a number of factors, such as the percentage of rain water versus impacted water used to irrigate, type of soil, and concentration of sulfolane in the well water. Also, this information is based on a limited number of gardens from only one growing season. So, until the investigation is complete and additional data evaluated, DHSS recommends using a clean, alternative water source for growing fruits and vegetables.

### **Are you going to conduct a larger greenhouse study?**

At this time we do not know if we will conduct a larger greenhouse study. This is something the TPT has been considering since last summer. We have spoken to the University of Alaska Fairbanks (UAF) and private labs, but unfortunately we need research on sulfolane in several different areas and we are trying to determine where the efforts are best focused. There needs to be more research on the toxicity of sulfolane and on cleanup alternatives. This has been the focus through this past winter and why we have held off on a greenhouse study. We are continuing to work with UAF, the federal agencies and all the TPT members to prioritize the technical issues that need attention and address them in the most appropriate way. Updates will continue to come from this team as decisions are made.

## **The Site Investigation**

### **What is the current status of the site investigation?**

There has been a lot of work completed since sulfolane was found in drinking water wells. However, there is still a lot of work to do. At the end of May, Flint Hills submitted a summary of all investigation work to date. DEC's TPT, composed of experts from all relevant disciplines, will critically review all components of this document. Information gathered to date will be used to develop the final cleanup plan, which we hope will be completed by early 2012.

### **How long will the TPT, DEC and Flint Hills Refinery (FHR) be involved in this investigation and how long will the process take?**

The TPT, DEC and responsible parties will be involved in the investigation and cleanup until the groundwater meets cleanup levels for unrestricted use. This investigation and cleanup is required by state law. The current timeline is to finish the initial investigation stage this summer and evaluate viable cleanup alternatives, then draft the final cleanup plan over the winter and, in 2012, begin implementation of that plan. The interim measures that are already in place (such as an alternative water supply to homeowners and a remediation system on the refinery site) and the groundwater monitoring will continue while this final plan is being developed. Also, further research studies and collection of more data will likely still be needed through this time. However, the goals by summer 2012 are:

- Have data to document that there is no more contamination moving off the refinery property,
- Understand the full extent of the sulfolane contamination offsite and the fate and transport (if it's moving and how is it being changed in the environment) of that contamination, and
- Have enforceable controls on the alternative water supplies to be certain they are maintained.

At this time, we don't know how long it will take to restore the groundwater because we don't yet know the biological degradation rates for sulfolane in our climate or the effectiveness of the treatment systems that are in place. This is the first time anyone has had to deal with a sulfolane plume like this and it's the largest groundwater plume that we know of in Alaska. The TPT is dedicated to dealing with the issue and Flint Hills has been responsive to working hard to come into compliance with all the State's requirements.

### **Is surface water being tested? If so, what are the results?**

Flint Hills has tested the surface water of both a gravel pit on the refinery property and the slough that runs parallel to Badger Road and neither had a detection of sulfolane.

**How long will sulfolane stay in my well, and will the concentration of sulfolane in my well increase over time? How is the plume behaving? How long has this water been in my well before we found out about it?**

The analysis of the information we have to date indicates the plume is not growing. However, there is only data north of the refinery's property line for a little over a year so we cannot say with certainty that the situation will not change. There will be ongoing monitoring for many years. The sources for sulfolane have been identified on the refinery, there is a more robust inspection process in place to prevent leaks, and an interim treatment system is in place. These efforts should prevent additional contamination from entering the groundwater and, therefore, the concentrations should decrease with time. As mentioned earlier, the investigation is not complete yet, but these are the indications from the available data at this time.

Currently we do not know how long sulfolane will be in the groundwater or how long it has been there. Groundwater modeling that is underway right now will help us understand those issues better. Preliminary results from the modeling were received by DEC on May 31, 2011, and the TPT is critically reviewing this work.

Until the investigation is complete, DEC has ordered the interruption of all human exposure routes to sulfolane-impacted water, and DHSS has recommended that residents continue to use their alternative source of water for drinking and growing garden produce.

**How often are the monitoring wells being tested?**

Monitoring wells will be tested for chemical concentrations on a quarterly basis, and more frequently if determined necessary by the TPT. New wells will be sampled roughly six consecutive months before they switch to the quarterly testing schedule.

**Can you explain the details of the remediation system?**

The current remediation system consists of a series of wells on the FHR property that pump contaminated groundwater from the subsurface to an above-ground treatment system that includes an air stripper to remove petroleum constituents and a charcoal filter system to remove sulfolane. Besides treating the pumped groundwater, the system aims to maintain hydraulic control over the groundwater beneath the refinery. That means preventing any more contaminated groundwater from moving offsite by maintaining sufficiently consistent pumping rates in each "recovery" (pumping) well. FHR has added an additional recovery well to the refinery's network in order to completely capture all the impacted groundwater on site. That well will be brought online in June.

The TPT will evaluate the effectiveness of the system and determine if additional treatment systems are required. Other cleanup alternatives may be needed to supplement this "pump and treat" system.

**Do you account for the seasonal fluctuations in groundwater during your testing and monitoring efforts?**

Seasonal fluctuations in groundwater are currently being monitored with water level loggers on 28 key monitoring wells. Level loggers are instruments that are placed in monitoring wells to take continuous incremental measurements of groundwater elevations over a period of time. Data is recorded electronically and can be downloaded directly from the level loggers to evaluate the changing groundwater flow through the seasons.

## Property Values

### **Do you plan to evaluate the possibility that owners of homes with wells located in the plume area have suffered a loss of property value?**

The TPT is focused on the sulfolane investigation and cleanup efforts of the affected area in North Pole. Questions about property values should be directed to the Fairbanks North Star Borough's Assessor's Office.

Property owners are invited to discuss any issues and share information with the Assessor's Office staff. Property owners may call the office at (907) 459-1428, or contact:

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(907) 459-1466  
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Prepared by the  
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**Contaminated Sites Program**

Updates, site summaries, project documents, and past, present and future actions for the sulfolane investigation at the Flint Hills Refinery in North Pole can be found at the DEC North Pole sulfolane Web site:  
<http://dec.alaska.gov/spar/csp/sites/north-pole-refinery/>.

The Contaminated Sites Program protects human health and the environment by managing the cleanup of contaminated soil and groundwater in Alaska. For more information, please visit <http://dec.alaska.gov/spar/csp/index.htm> or contact our staff in the Contaminated Site Program closest to you:

Juneau: (907) 465-5390 / Anchorage: (907) 269-7503  
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