Sulfolane Investigation Update

Provided by the Technical Project Team to inform the North Pole community on recent developments in the investigation and remediation of soil and groundwater contamination related to the North Pole refinery.

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NTP Accepts Sulfolane, Initiates Toxicity Studies

Design of toxicity studies to evaluate the health effects of exposure to sulfolane is now underway after the chemical compound was officially accepted into the National Toxicology Program (NTP).

Final approval came shortly after the NTP Board of Scientific Counselors' endorsement of the sulfolane nomination in December. Funding for the initial studies has already been secured, and the first phase of studies is planned within the year.

The move is welcome news for the State of Alaska's Technical Project Team which had championed sulfolane's nomination since late 2011.

According to Dr. Scott Masten, director of NTP's Office of Nomination and Selection, the toxicology studies will first evaluate comparative species sensitivity

Dr. Chad Blystone, NTP toxicologist (photo courtesy of Steve McCaw)

to sulfolane using experimental animals, followed by studies to evaluate developmental and immune effects. The final phase of the research program will be a two-year exposure study to evaluate toxicity after long-term exposure to sulfolane in drinking water.

Dr. Chad Blystone, an NTP toxicologist and sulfolane project leader, has completed the initial study design that will be provided to a laboratory to conduct the research, scheduled to begin this year. The work is being conducted in partnership with the National Institute for Occupational Safety and Health.

The NTP is a federal interagency effort of the National Institutes of Health, the Centers for Disease Control and Prevention, and the Food and Drug Administration, to safeguard public health by conducting cutting-edge toxicity research on new chemicals. The Board of Scientific Counselors is a federally chartered advisory committee whose members are university and industry experts appointed by the Secretary of the U.S. Department of Health and Human Services.

DHSS Fact Sheet Offers Garden Watering Guidance

The Alaska Department of Health and Social Services has published a fact sheet for North Pole gardeners concerned about using well water containing sulfolane to grow edible fruits and vegetables. It outlines information and recommendations gleaned from a 2010 study where the Technical Project Team (TPT) tested a variety of edible plants from seven local gardens for sulfolane content.

The fact sheet is available by selecting the Documents link on the TPT's sulfolane contamination website at:

http://dec.alaska.gov/spar/csp/sites/north-pole-refinery/

The tests showed edible plants can take up sulfolane with water. The levels of sulfolane found in plants depended on the type of plant (e.g., lettuce versus beet) and the part of the plant (e.g., leaf versus root) tested. Overall, the levels of sulfolane in all 56 samples were below a level considered to be a health concern. Most samples — 35 — were non-detect for sulfolane, meaning they were below a level the laboratory could measure. Of the plants tested, the study found leafy parts of plants had higher levels, suggesting sulfolane tends to concentrate there rather than the root, stem, fruit or flower.

The project was very limited in scope, however, so these results should not be used to draw general conclusions for all North Pole gardens or future growing seasons. Consequently, the TPT recommends North Pole gardeners in the plume area use an alternative water source for growing fruits and vegetables until more information is known.

Last year, Flint Hills Resources (FHR) sampled surface soil from two residential gardens downgradient of the refinery. Sulfolane was not detected in either of the garden surface soil samples. Results from these two samples, though limited, suggest that sulfolane does not remain in surface soils after irrigation with sulfolane-contaminated water. This is consistent with the chemical properties of sulfolane, which suggest it does not readily adhere to soil particles.

FHR provides bulk tanks for storing clean gardening water to homeowners with a positive detection of sulfolane in their wells who live within the city limits but have no access to the City of North Pole water main system, and to those who live outside the city limits. Residents on the city's water main system are encouraged to use city water for gardening.

Residents can still use wells with positive sulfolane detections for other non-potable water activities such as watering grass and flowers, and washing vehicles.

For questions or concerns about gardening, please contact the FHR Groundwater Office at (907) 488-0723.

From the PM's Desk

I've spoken with many of you on the phone or in person at public meetings and always appreciate the chance to talk to you and hear your concerns first-hand. While I don't live within the impacted area, I've lived in Fairbanks for nearly 20 years and take this project personally.

For more than two years now, the Technical Project Team (TPT) has been working hard to answer your questions regarding sulfolane and I'm pleased to report what I feel is the best news we've received on this project to date — the National Toxicity Program (NTP) has announced it is moving forward with new studies on sulfolane toxicity. The news is recognition that, on a national level, this is a serious issue. It gives me hope that in the next few years, better scientific information about the chemical will be available to all of us.

In addition to the important news regarding the NTP, the Environmental Protection Agency's Provisional Peer Reviewed Toxicity Value (PPRTV), which we have anticipated for the past year, has finally been set. The TPT will continue its discussions on the PPRTV and will report in the next newsletter on the role this value will play in developing the State of Alaska's anticipated cleanup level for sulfolane.

We've worked cooperatively within the TPT to evaluate new ways to cleanup sulfolane in groundwater. These cooperative efforts, combined with the research being conducted by world-class arctic researchers from the University of Alaska Fairbanks and our work with other state and federal agencies, make me feel optimistic we'll have a solid cleanup plan finalized by the end of this year, ready for implementation in 2013.

I hope you continue to read the newsletters, visit our website, call me or other project contacts, and do your own research to get the information you need to make good decisions on protecting your family and home. In the meantime, the TPT will be working as hard and as fast as possible to oversee and clean up the contamination.

Please contact me if you have any questions. I hope to see you at our next community Open House scheduled for Tuesday, May 1, from 5:30-7:30 p.m. at the North Pole Plaza Mall.

Sincerely,
Ann Farris
TPT Project Manager

FHR Contributes to Project's Progress

Flint Hills Resources (FHR), its consultants and contractors continue to collect data and respond to both on- and off-site components of the project. To date, more than 600 residential well samples have been collected and tested for sulfolane, producing 289 positive detections outside the North Pole city water main system. Long-term solutions have been provided to 238 of these locations, and FHR continues to meet and discuss options with the remaining homeowners. Homeowners in and near the plume boundary area have been provided bottled water delivery services. Starting in May, homes within the search area that have previously had no detection of sulfolane in their well will be contacted for resampling.

Currently, 159 monitoring wells are in place; 73 off-site in and around the affected area and 86 on-site at the refinery. These wells continue to be monitored on a quarterly basis. New monitoring wells to be installed in summer 2012 include 44 more off-site wells and 20 more on-site wells. Data recovered from the monitoring wells are crucial in helping the Technical Project Team (TPT) determine long-term behavior of the plume.

Under the direction of the Alaska Department of Environmental Conservation and the TPT, FHR continues work to determine the most appropriate methods to address sulfolane impacts, including piloting several different technologies that may prove useful in certain applications. One such technology is the Granulated Activated Carbon (GAC) unit that went online in November. The GAC unit pumps and treats approximately 500,000 gallons of contaminated water per day from the refinery. It removes sulfolane from the groundwater, then discharges the treated water to an onsite gravel pit. Well replacements and improvements planned for 2012 should further improve the functionality of the GAC system.

(L-R), Ann Farris (DEC), Tim Arnold and Brain Gould (FHR), Brian Angerman (BARR Engineering), and Jonathan Flomerfelt (ARCADIS) with the air sparger pilot system, one of several new technologies being tested at the FHR North Pole Refinery. (Flint Hills photo)

Source Control Key to Preventing Contamination

Identifying and eliminating the source of discharge is critical to preventing further contamination. To help ensure a fuller understanding of source control measures undertaken by the Alaska Department of Environmental Conservation (DEC) and Flint Hills Resources (FHR), the following summary is provided.

Background

Flint Hills refinery receives North Slope crude oil via the Alaska oil pipeline and refines it into regular and unleaded gasoline, diesel fuel, Jet A-50, asphalt, and naptha. Refined product is then redistributed via railcar and tanker truck.

The site also hosts storage facilities for these products. Other chemicals and additives used in the refining process are also stored on site, including the industrial solvent sulfolane.

Regulatory Authority

DEC is the state agency charged with guardianship of the public's health and safety from ill effects caused by hazardous substances entering the air, land and water. State statutes give DEC authority to regulate FHR's crude oil-related operations, including:

1. Ensuring spill prevention measures are in place and adequate for above ground storage tanks and other facility infrastructure;
2. Ensuring regulated facilities have an emergency response program for immediate actions to address a spill; and
3. Ensuring discharges of oil and other hazardous substances are reported, cleaned up and removed from the environment.

Item 3 above directs DEC's lead role in the sulfolane contamination cleanup.

It is important to note DEC does not have authority to regulate sulfolane use since it is not federally or state regulated until released. At that time, DEC becomes involved as the agency charged with regulating disposal or release of any chemical into the environment.

Origin of Contamination

The refinery began using sulfolane in 1985. In October 2009, FHR identified sulfolane in drinking water wells north of refinery property. Additional testing delineated the large underground contamination plume.

A leaking sump beneath the sulfolane extraction unit and a compromised wastewater lagoon (Lagoon B in the southwest area of refinery property) are considered the primary sources of sulfolane releases into the environment. There was also a release documented in the waste storage area west of Lagoon B, and it is likely some sulfolane transferred to groundwater via spilled petroleum products.

Source Control

Since 2009, aggressive source control has taken place. These efforts consisted primarily of improvements (identifying leak points and stopping them) and associated procedural changes:

- FHR, at the behest of DEC, has undertaken an exhaustive records search looking for all possible sources of contamination (not just sulfolane, but all other chemicals used at the refinery).
- FHR has conducted extensive integrity testing on its underground piping and sumps. In 2009-2010, all 42 sumps were tested; four failed and corrective action was taken immediately.
- Lagoon B was taken out of service in 2005; only Lagoons A and C are still in use. The liner for biological treatment (wastewater) Lagoon C was replaced by FHR in 2010. The new liner is double-layer, with the top being bright yellow and the bottom dark. The color contrast allows for better detection of any liner tears. Lagoon A's liner was determined to be in adequate condition.
- FHR is removing existing sulfolane and fuel contamination in the groundwater on the refinery (see inset and article on Page 2). FHR is also evaluating other treatment alternatives and will be required to implement all determined to be feasible.
- Additional data are gathered during ongoing site characterization, groundwater monitoring, etc., to monitor the cleanup process, but also to enable early detection of any new release.
- Increased DEC inspection frequency.
- Frequent meetings between FHR and DEC assess current and planned operations to ensure adequate preventative measures are in place.

NAPL Recovery

In 2011, a total of 3,603 gallons of NAPL (non-aqueous-phase liquid or "floating product") was recovered from North Pole groundwater.

The NAPL, mixed with water, was recovered through nine recovery wells. The mixture is routed through a treatment system that separates the NAPL from the water, then removes dissolved-phase hydrocarbons and sulfolane using a gallery pond, air stripper and activated carbon filtration.

The NAPL recovery rate increased significantly in three wells last summer after their screens were cleaned. Three recovery wells are slated for replacement this year, which will further improve recovery.

- All spills, including small volumes and releases to containment areas are reported to DEC whose spill response expert inspects the site and mitigation.
- Increased DEC spill response oversight, including a large-scale, unannounced spill drill. FHR personnel responded by ramping up an emergency management team and bringing in their contracted spill response company, complete with equipment and personnel to the refinery for a mock spill situation.

Looking Ahead

DEC has given FHR the goal of zero contaminant migration offsite. FHR has responded with the aggressive source control efforts described above, comprehensive site investigation, and an updated groundwater cleanup approach. The latter two efforts are still ongoing, but a final cleanup plan is expected by the end of this year incorporating all the research conducted by the Technical Project Team.

While it is impossible to foresee the future or completely eliminate all risk of release of sulfolane or other hazardous substances to the environment, DEC and FHR are committed to taking cooperative actions to reduce the risk of additional releases as well as aggressively cleaning up existing contamination.

TPT Subgroups Status Report

Chemistry

Ensuring high-quality data is used to characterize the sulfolane contamination at the site is a top priority of the Chemistry Subgroup. The Chemistry Subgroup continues to refine the methods used to analyze for sulfolane in soil, water and plant material to ensure the methods can continue to accurately and consistently detect sulfolane under a number of scenarios and are standardized across laboratories. Recently, chemists conducted a rigorous review of the laboratory data on sulfolane in groundwater and soil. This entailed a detailed review of a number of quality assurance and quality control indicators. No significant issues were identified during the review. Based on this, the Chemistry Subgroup reduced the laboratory reporting requirements for sulfolane samples from the site. The Chemistry Subgroup will continue to check a percentage of the data to make sure the highest level of data continues to be reported.

Toxicology

The Toxicology Subgroup has worked continually with the Environmental Protection Agency and the National Toxicology Program in their assessments and will continue to support future work (see previous articles). The Draft Final Human Health Risk Assessment for the site, incorporating the Provisional Peer-Reviewed Toxicology Value for sulfolane, was submitted to DEC April 9; a detailed review is now underway.

Site Characterization and Remediation

Site data are complex and often warrant evaluation from a variety of experts before interpretations can be agreed on. The subgroup provides a forum to exchange ideas, discuss data, identify data gaps, and explore methods for gaining a better understanding of site dynamics. It has been very active since January; 10 subgroup meetings were held in the past three months. The work has resulted in a more robust understanding of the site and helped focus the field efforts on critical data gaps.

The subgroup has also helped facilitate DEC approval of some key additional investigative work without requiring formal work plan approval. This accelerated data collection and moved the site through the site characterization process faster.

Key topics addressed through the subgroup include:

- Analysis of drinking water and monitoring well data to ascertain conditions in sub-permafrost (below the frozen zone) groundwater, in order to develop the most efficient means to assess water in this zone. This information is needed to determine the scope of remedial efforts that may be required for sub-permafrost water.
- Selection of wells in which to place pressure transducers so that a better understanding of vertical and horizontal groundwater gradients can be gleaned. This understanding will be vital during evaluation of remedial alternatives. The number of transducers deployed at the site has approximately tripled as a result of this effort.
- The groundwater model has been presented to technical reviewers and discussed at length. Observations regarding limitations, boundary conditions, and data gaps identified have improved both the model and the overall site characterization effort by identifying areas that warrant further evaluation.
- Transect locations and well construction details discussed and agreed on.
- Plans to further evaluate permafrost incidence were presented and approved.
- Arsenic data were presented and discussed. The exchange resulted in an agreed methodology to use the data to assess cumulative risk without diverting focus of the work from sulfolane.
- Optimized review of the air sparging pilot test, tracer test, and results of biological degradation studies.
- Presentation of feasibility study concepts to aid development of the study.

The subgroup will continue to meet in the coming months with the overall goals of facilitating site characterization efforts, developing consensus, and ultimately optimizing development of a robust feasibility study which will identify the best remedial alternative for the site.

Drinking Water

New public drinking water wells began operation in January 2011. Final operational approval has been requested by the City of North Pole, and the engineering plans are being reviewed by DEC Drinking Water Program engineers. Final operational approval for the project is expected to be granted soon.

The new wells were sampled each month during 2011 with no sulfolane detected in any sample. Consequently, sampling frequency was reduced to quarterly for 2012. DEC has received the sample for the first quarter of 2012, and results for both wells were below the detection limit.

The Church at North Pole is a federally-regulated public water system in the plume area that elected to install the point-of-entry treatment system provided by Flint Hills Resources. DEC's Drinking Water Program engineers have reviewed the plan set, and construction approval was granted. A request for final approval to operate has been received by DEC and is scheduled for review.

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