Alternative Water Solutions Program - Management Plan

Flint Hills Resources Alaska, LLC
North Pole, Alaska

Prepared for
Flint Hills Resources Alaska, LLC

October 2014

BARR

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List of Abbreviations and Acronyms

ADEC	Alaska Department of Environmental Conservation
ARCADIS	ARCADIS, US, Inc.
AWS	alternative water solutions
Barr	Barr Engineering Company
BGS	below ground surface
CC	construction coordinator
COC	contaminants of concern
FHRA	Flint Hills Resources Alaska, LLC
FNSB	Fairbanks North Star Borough
GAC	granular activated carbon
GFBR	Greater Fairbanks Board of Realtors
gpm	gallon per minute
IRMs	interim remediation measures
ITRC	the Interstate Technology & Regulatory Council
LOQ	limit of quantitation
mg/L	milligrams per liter
NPR	North Pole Refinery
PAN	parcel account number
PFD	Process Flow Diagram
POE	Point-of-Entry
ppb	parts per billion
ppm	parts per million
QA	quality assurance
QC	quality control
SAP	Sampling and Analysis Plan
SOP	standard operating procedure
SWI	Shannon & Wilson, Inc.
The City	The City of North Pole, Alaska
USEPA	United States Environmental Protection Agency
WQA	Water Quality Association
µg/L	micrograms per liter
°C	degrees Celsius
°F	degrees Fahrenheit

1.0 Introduction

This management plan provides a description of the options, procedures, and information related to the Alternative Water Solutions (AWS) program choices offered to affected residents and businesses of North Pole, Alaska, who have drinking-water wells impacted or at risk of being impacted by sulfolane. Barr Engineering Company (Barr) has prepared this plan on behalf of Flint Hills Resources Alaska, LLC (FHRA) for submittal to the Alaska Department of Environmental Conservation (ADEC). This plan, along with the appendices, presents information related to FHRA's actions to inform, track, install, operate and maintain the AWS choices offered to affected North Pole residents.

1.1 Background

Previous investigations conducted by FHRA have determined that a plume of dissolved-phase sulfolane exists in the groundwater downgradient of the North Pole Refinery (NPR) in North Pole, Alaska. Working closely with ADEC, FHRA has initiated a comprehensive response plan which includes delineation of the extent of the sulfolane plume and implementation of interim remediation measures (IRMs) with the goal of preventing sulfolane migration from the NPR facility. In addition to this response, and to ensure public safety, FHRA has been providing these AWS to the affected and potentially affected community. FHR has been providing bottled water only to any new properties with suflolane levels above non-detect.

1.2 Plan Organization

This plan includes the following sections:

- *Section 1 – Introduction*: Provides an overview and background of the project objectives.
- *Section 2 – Residential Well Identification, Monitoring, and Bottled Water Service:* Provides an overview of the search areas, past and future sampling plans, and procedures for sample collection.
- *Section 3 – Communications with Affected Property Owners*: Provides a description of the meetings and other communications with affected North Pole residents regarding AWS options.
- *Section 4 – Other AWS solutions*: Presents an outline of other solutions that have been offered in the past.
- *Section 5 – Operation and Maintenance of AWS Systems*: Summarizes the O&M of three AWS options and references appropriate O&M manuals.

- *Section 6 – Private Well Database:* Presents a description of work to complete a database to house information relevant to private wells within or near the sulfolane plume.
- *Section 7 – Reporting:* FHRA will prepare an annual report summarizing efforts to identify, install and maintain AWS options in the North Pole area.
- *Section 8 – Termination from AWS Program*

This document also contains extensive information regarding the POE treatment systems within AWS Mgmt. Plan - Appendix B (*Revised Point-of-Entry Treatment System Feasibility Study and Design Report*, Revised December 2013, prepared by Barr Engineering Co.). To enhance the usability of this document, below is the list of attachments that are included and support the AWS Mgmt. Plan - Appendix B.

- *Revised Point-of-Entry Treatment System Feasibility Study and Design Report*
  - Attachment A Laboratory Reports
  - Attachment B Residential Sampling and Analysis Plan
  - Attachment C Standard Operating Procedure for In-Home Pilot Testing
  - Attachment D Activated Carbon Scale-Up Calculations
  - Attachment E Operation and Maintenance Manual, Point-Of-Entry Treatment System for Sulfolane (blue tab)
    - Supplement A Equipment Specifications for the Point-Of-Entry Treatment System for Sulfolane
    - Supplement B Water Quality Association Certification (red tab)
    - Supplement C Standard Operating Procedures
    - Supplement D *Revised Updated Spent Carbon Management Plan*, December 2013, prepared by Arcadis US, Inc (yellow tab)
  - Attachment F Owner's Information Sheet
  - Attachment G *Point-of-Entry Sampling and Analysis Plan, Revision 1*, December 17 2013, prepared by Arcadis US, Inc. (clear tab)

Note: the hard copy of this report includes tabs to note the sections above. Additionally, colored tabs, as indicated above, are included to denote the beginning of key sections of the report. The electronic version of this document has been equipped with color-coded bookmarks.

2.0 Residential Well Identification, Monitoring, and Bottled Water Service

2.1 Initial Activities

The detection of sulfolane at the refinery's northern property boundary in October 2008 prompted a search for downgradient receptors even though the detected sulfolane was at concentrations below the clean-up levels in place at the time. FHRA requested Shannon & Wilson, Inc. (SWI) to conduct a drive-by search for private wells and a review of the City of North Pole utility maps. In August 2009, a residential well-search report was prepared which indicated most of the residences immediately north of the refinery had access to the City of North Pole Utilities public water-supply system. However, the report also noted several residences north of North Pole High School Boulevard did not have access to the public water-supply system and likely used private wells to obtain water.

2.1.1 Identified Search Areas

In November 2009, a door-to-door survey was conducted to acquire additional information regarding the presence of water wells at properties hydrologically downgradient of the NPR. The door-to-door survey started in Search Area 1 (Figure 1) and consisted of viewing permanent structures to determine if there were water-supply wells on the properties. Follow-up information about the water supply construction and use was requested at the locations identified as having water supply wells. If a drinking-water well was present on the property, permission to collect a groundwater sample for sulfolane analysis was requested. Based on the results of the door-to-door survey and sampling in Search Area 1, the well search and sampling work was expanded into other search areas in a phased manner, stepping out further from the refinery until sulfolane was not detected. Additional search areas were added when sulfolane was detected in private wells near the edge of the preceding search area(s), when sulfolane was detected in private and/or monitoring well samples downgradient of the existing boundaries, or when recommended by technical staff based on the plume characteristics and behavior. Survey efforts were expanded to include Search Areas 2, 3, 4, 5, and 6 in December 2009, February 2010, March 2010, April 2010, and October 2010, respectively. The well search areas are shown on Figure 1 and are described as follows:

> **Search Area 1:** Search Area 1 is defined as parcels north of the NPR, west of Old Richardson Highway, south of Perimeter Drive, and east of the Tanana River dike path. The search area did not include the North Pole wastewater plant or North Pole High School, as previous research determined water is provided to these facilities by the City of North Pole.

Search Area 2: Search Area 2 is defined as parcels north of Perimeter Drive, west of Finell Drive, south of the Richardson Highway, and east of Campton Street.

Search Area 3: Search Area 3 is defined as parcels between Badger Road and Richardson Highway, south of Lions Road, and east of Willeda Street.

Search Area 4: Search Area 4 is divided into three areas. Search Area 4a is defined as parcels north of the Richardson Highway, west of Willeda Street, south of Belle Avenue, and east of the Flood Control Drainage Channel C. Search Area 4b is defined as parcels along the southern boundary of Keeney Road, west of Campton Street, south of Richardson Highway, and east of Flood Control Drainage Channel C. Search Area 4c is defined as parcels west of South Santa Claus Lane, south of Richardson Highway, and east of Finell Drive and Old Richardson Highway.

Search Area 5: Search Area 5 is also divided into three areas. Search Area 5a is defined as parcels north of the Tanana River dike path, east of Jarred Drive, south of Richardson Highway, and west of Search Area 4b. Search Area 5b is defined as parcels north of Search Area 4a, east of Flood Control Drainage Channel C, south of Lions Road, and west of Willeda Street. Search Area 5c is defined as parcels north of Airway Drive, east of Badger Road, and south and west of Chena River Slough.

Search Area 6: Search Area 6 is divided into two areas. Search Area 6a is defined as parcels west of Flood Control Channel C and Woll Road, south of Ownby Road, east of Benn Lane, and north of the Richardson Highway.

The survey was expanded into additional search areas based on results of annual resampling in 2011 and 2012, and based on the results of a sample collected for the City of North Pole fire wells. Search Areas 7, 8, 9, and 10 were added in the fourth quarter of 2011, April 2012, September 2012, and March 2013, respectively. Search Area 11 was added following the annual review of the Buffer Zone, associated with the Alternative Water Solutions Program - 2013 Annual Report. The background and description of the additional search areas (Figure 1) are as follows:

Search Area 7: Following development of the sulfolane isotopic dilution analytical method in May 2011, private wells were resampled when the wells were located within and near the sulfolane-impacted area where sulfolane was not reported during the initial sampling event.

Based on results of the 2011 resampling event, Search Areas 7a and 7b were added during the fourth quarter of 2011.

Search Area 7 is divided into two areas. Search Area 7a is defined as parcels north of Search Areas 5b and 6b, east of Search Area 6a, parcels west of Bona Street on Bear Avenue and Julie Lane, parcels south of Repp Road on Christine Drive and Brock Road, parcels south of PAN 326615 on Badger Road and parcels located on the southern-most portion of Sunflower Loop. Search Area 7b is divided into two areas. The southern portion of Search Area 7b is defined as parcels east of Search Area 3, south of Search Area 5c, north of Hurst Road, and west of Chena Slough. The northern portion of Search Area 7b is defined as parcels east of Search Area 5c, south of Search Area 6b, and north of Airway Drive.

Search Area 8: Private wells within and near the sulfolane-impacted area (as defined by private well samples collected to date) where sulfolane has not previously been detected are resampled annually by FHRA or one of their representatives. A second resampling event began in April 2012. Search Area 8 was added in April 2012 based on a sulfolane detection at a private well in the southern portion of Search Area 7b.

Search Area 8 is defined as properties north of the Richardson Highway, east of Search Areas 3 and 7b, south of Airway Drive, and west of Flight Street and parcels on San Augustin Drive. Search Area 8 is outside the area supplied with North Pole City water, with the exception of businesses along Badger Road. Permanent structures within Search Area 8 that are outside the City water-supply are generally private-water wells.

Search Area 9: A sample collected on July 25, 2012 from a fire well located in the northern end of the North Pole Police Department building had detectable levels of sulfolane present. This well was resampled on September 13, 2012 and the results confirmed detection of sulfolane. Based on the detection in the fire well, Search Area 9 was added to the overall search area in September 2012.

Search Area 9 is defined as parcels south of Richardson Highway, east of Santa Claus Lane and Old Richardson Highway, north of East 7th Avenue, and west of Davis Boulevard. Search Area 9 is entirely within the North Pole City water-supply area.

Search Area 10: Sample results from the deep residential well on Horseshoe Way and MW-332-150 have shown higher levels of sulfolane than the shallow wells in the same area. The Buffer Zone was expanded into Search Area 10 to provide further protection in this area.

Search Area 10 is defined as selected parcels 2 to 3 properties wide along the eastern boundary of Search Area 7b from Airway Drive to Plack Road. This search area also includes sampling of selected deep wells beyond the border area that will provide additional understanding of deep groundwater in this area. Search Area 10 was added in June of 2013 and is depicted on Figure 1.

Search Area 11: During the second quarter of 2014, the overall search area was expanded to include Search Area 11 (Figure 1). The addition of Search Area 11 provides an increased area of buffer zone downgradient from the sulfolane-impacted aquifer. This addition was added following the 2013 detection in the groundwater sample collected from PW-1330 in Search Area 7a.

FHRA currently has 166 active offsite monitoring wells that have been installed to delineate the extent of the sulfolane plume with routine monitoring conducted to evaluate plume behavior. Data collected from monitoring wells is continuously reviewed and compared with data collected from private wells and POE treatment systems. Additional monitoring wells are installed as necessary to collect additional data to understand plume delineation and/or concentration trends in nearby private wells.

To ensure protection of residents, delivery of interim bottled water was immediately initiated for wells identified within the suspected area of the sulfolane plume. FHRA also extended the City of North Pole public water-supply system to include affected residents within the water service area. This work was completed in 2010 and provided a solution to 28 homes.

In the past, once a detection of sulfolane was confirmed, FHRA initiated the process of selecting an AWS with the homeowner.

ADEC is currently reviewing the sulfolane cleanup level. During the cleanup level review and until a sulfolane cleanup level for the site is established by DEC, FHRA will provide interim bottled water to any new properties with sulfolane detections, as discussed in Section 2.1.2. DEC anticipates that this cleanup level will be established by January 1, 2015.

2.1.2 Buffer Zone

The Buffer Zone consists of the properties located adjacent to or near properties with sulfolane detections, but have not had detections in their wells. Properties within the Buffer Zone may be at risk of sulfolane migrating into wells within a few years, so annual resampling is conducted on all Buffer Zone properties. Additionally, FHRA uses the data collected from the Buffer Zone to monitor the overall plume dynamics and to mitigate the exposure risk at the edges of the plume.

As a precautionary measure, properties located within the Buffer Zone are provided at the time they are identified to be within the Buffer Zone with interim bottled water for drinking and cooking purposes. In addition to quarterly sampling of monitoring wells located in these areas, wells at properties within the Buffer Zone are sampled on an annual basis to monitor for the presence of sulfolane. In the past, following the annual resampling, properties with new detections of sulfolane were offered a permanent AWS. During the cleanup level review and until a sulfolane cleanup level for the site is established by DEC, FHRA will provide interim bottled water to any new properties with sulfolane detections. DEC anticipates that this cleanup level will be established by January 1, 2015.

Additionally, based upon the annual sampling results, the extent and location of the Buffer Zone is reassessed and adjusted if necessary to assure adequate precautionary measures remain in place at the plume edges. Currently, the Buffer Zone is approximately two properties wide at the edge of the plume, with wider margins at the plume front boundary. Because the size and orientation of properties varies, and the likely movement of contamination at the plume edges is variable, the Buffer Zone is reviewed annually by project technical staff and recommended for changes to maintain protection in areas where the site data suggest contamination could possibly migrate within two to three years. The Buffer Zones as delineated in 2012 and 2013 are shown on Figures 2 and 3, respectively.

2.1.3 Interim Bottled Water

The owners of structures with private wells located within the plume area or the Buffer Zone, who are not on City water, are offered interim bottled water for drinking and cooking. The plume area definition is based on the furthest extent with detectable sulfolane concentrations. FHRA initially began offering bottled water to affected residences in October 2009 and continues this practice until a permanent AWS is selected or a sulfolane cleanup level is determined for the site. In cases where the residences within the plume area or in the Buffer Zone do not have detectable levels of sulfolane,

FHRA has chosen to provide interim bottled water to these properties to mitigate risks associated with the potential spatial variability or expansion of the sulfolane plume.

FHRA or its contractors gather contact information for each residence during initial sampling in the event that the new location requires bottled water service based on sampling results or changes to the Buffer Zone. If bottled water will be provided, the information is forwarded to the FHRA Groundwater Office personnel, who contact an ADEC-approved bottled water supplier with the name, phone number, and address of the new location needing bottled water service. The local bottled water supplier then calls the owners to set up delivery of the water cooler and sets up a weekly delivery schedule. The water cooler will have a sign on the exterior with the following language displayed: "This bottled water service is being provided by Flint Hills Resources Alaska, LLC (FHRA). The bottled water is intended for your drinking and cooking uses due to the potential presence of sulfolane in the groundwater. Please contact either the FHRA Groundwater Office at 907-488-0723 or the Alaska Department of Environmental Conservation at 907-451-2192 if you have any questions."

The water supplier has a weekly schedule for customers or, if property owners are in need of extra water, property owners are free to call the supplier directly and request additional water. Bottle delivery amounts vary per household depending on number of people served and their needs. Property owners have the choice of receiving either 3- or 5-gallon bottles and can also request easy-carry handles.

Currently, residences that are inside the plume area or Buffer Zone have either a long-term AWS, are on interim bottled water, or have been offered and have declined one of these options but to FHRA's knowledge most are using their own alternative source of water. To date, only one home owner has refused bottled water provided by FHRA, and has indicated to FHRA that they are using an alternative drinking water source. Where the property owners have not been able to be contacted, FHRA and contractor personnel have continued contact attempts, and have continued to visit the properties periodically to contact occupants or leave door hangers. The majority of non-contacted properties appear to be unoccupied. For a number of these properties, FHRA was able to verify connections to City water supply. Contacting property owners and providing AWS as needed remains an ongoing high-priority effort.

2.2 Annual Private Well Search and Sampling Plan

Each year since the private well search effort began in 2009, a program has been implemented to identify properties as being located within the affected plume and those properties have been sampled or resampled if previous sampling was nondetectable for sulfolane. This program will continue to be a focus as part of the ongoing effort to identify all affected properties and sample wells that may potentially be impacted by sulfolane. Experience has shown that the best time to conduct the sampling is during the spring and summer months due to the extreme cold conditions during the fall and winter and the nature of collecting samples.

Each annual effort starts with the identification of all properties to be sampled or resampled based on technical review of monitoring well and residential well data during the first quarter of the year. The sampling plan is then finalized and execution begins at the start of second quarter with a targeted timeline of completing the sampling by the end of the second quarter. Throughout the collection of these samples, FHRA Groundwater Office staff contact residences and property owners with the laboratory results and schedule a face-to-face meeting to discuss providing bottled water for those locations with any detectable level of sulfolane. Additionally, throughout the year, residential well sampling is conducted on a call-in basis for home sales within the plume and Buffer Zone or from requests by concerned residents outside of these areas.

As of October 13, 2014, groundwater samples have been collected from 666 private wells within the search areas; with many locations having been sampled several times as part of the annual resampling events. In addition, 185 water samples were collected from private wells outside the search areas at locations near the defined search areas (e.g., sharing a driveway) or where FHRA was contacted by a landowner, resident, or a real estate agent with requests for testing.

During each annual sampling event, locations with new detections of sulfolane will be listed in the annual report as discussed in Section 7.0 of this report. FHR will continue to perform the annual sampling event until the sulfolane cleanup level has been determined for the site.

2.2.1 Annual Private Well Survey Plan

Each year, FHRA or one of its representatives will attempt to collect water samples from private well locations within the plume and Buffer Zone, that have not previously had a detection, as delineated by private well sulfolane results to date. POE systems are also sampled periodically as the systems are maintained.

FHRA and its contractor (SWI) have maintained a list of locations where private wells have not been sampled or where homeowners have not responded to requests to be contacted. These locations are given priority during each annual sampling event, and SWI will continue to visit these locations to attempt to collect water samples where private wells are observed.

2.3 Well Sampling Procedure

Purging and sampling techniques vary based on well configuration, system design, and date of sampling. The variability is considered to be reasonable as the wells being sampled are generally in active use. Prior to sampling, each well is purged. Generally, wells sampled at the beginning of the project were purged for 10 to 20 minutes into a sink or through a garden hose to the ground surface. Purging was accomplished by allowing water to run until temperature and water parameters (pH, conductivity) stabilized. Currently, purging is accomplished by allowing water to run until temperature and water parameters (pH, conductivity) stabilized in accordance with the *Revised Sampling and Analysis Plan* (Arcadis, 2013). Purge water is generally discharged into on-site septic systems via the sink, except where purging occurs from an outside spigot or open well, in which case purge water is discharged to the ground surface.

Following well purging, samples are collected directly from the sampling pump, or water-well system piping prior to any water-treatment system. Samples are collected into laboratory-prepared sample containers and placed in a cooler to be kept cold (4°C). The collected samples are then hand-delivered to the SGS North America, Inc. (SGS) sample-receiving office in Fairbanks for analysis of sulfolane. Samples are analyzed using ADEC-approved EPA Method 1625B with isotope dilution and, where applicable, reported at estimated concentrations between the detection limit and limit of quantitation (LOQ).

Following reporting by SGS, FHRA representatives conduct data validation of the analytical laboratory reports. The results are submitted to FHRA following data validation. Environmental Standards, Inc. (ESI), an independent, third-party consulting firm that specializes in environmental chemistry and data management, reviews detailed (Level IV) sulfolane analytical data for approximately ten percent (10%) of the private well samples. This detailed review is conducted to confirm the analytical method and to identify any potential systemic errors. The results of the detailed review are reported to the ADEC quarterly.

2.4 Ongoing Affected Property Search

Properties Within the City Water Service Area

New construction within the City limits requires a building permit from the City. The City Code states that any building within 200 feet of a City Utility must connect to that utility, which means that the property owners are not allowed to cross-connect a well on the property with the City's system even with a backflow preventer. The City is aware of the groundwater issues and directs builders and homeowners to contact FHRA if the City cannot answer the resident's questions.

Properties Outside the City Water Service Area

The following are means of ensuring that the property owners in the affected area have been advised of the AWS program as property transfers occur and new residents move onto properties with the potential of sulfolane detections in the groundwater.

1. FHRA has become an affiliate member of the Greater Fairbanks Board of Realtors (GFBR) which will further open lines of communications with Borough realtors. This organization includes realtors, title companies, lenders, insurance brokers and agents, builders and property developers, engineers, and local building product suppliers.

2. FHRA will present the AWS program and project updates to the GFBR during the first quarter of each year subject to approval and schedule availability of the GFBR.

3. An email will be sent to all GFBR members with the annual presentation information. The email will include a link to the FHRA groundwater website.

4. During the first quarter of each year, FHRA will utilize the Fairbanks North Star Borough GIS website to identify any property transactions and potential new owners within the sulfolane-impacted area. FHRA will contact any new owners.

5. During the third quarter of each year, FHRA and its contractors will conduct a lot by lot drive through the affected area in an effort to identify any new construction or developments that have not been informed of the AWS program. Additionally, throughout the year FHRA's contractors who are driving the streets of affected neighborhoods servicing the AWS equipment are watching for and notifying FHRA of any new construction or recently occupied property they observe. Any changes or updates regarding property transfers, new construction or developments will be

updated in the Private Well Database as discussed in Section 6.0 of this report and discussed in the annual report.

6. During the second and third quarter of each year, FHRA and its contractors conduct an annual well sampling of affected properties throughout the plume that have not been previously sampled. During this event, any new construction or developments and previously vacant properties that are now occupied will be contacted and informed of the AWS program if needed.

7. The annual communication newsletter sent to affected property owners with an AWS and property owners within the Buffer Zone will be a means of communicating the AWS program and project updates (as described in Section 3.0). The newsletter will provide a reminder of disclosure obligations associated with a property transfer. A copy of the newsletter will be provided with the annual report.

3.0 Communications with Affected Property Owners

All members of the public can access the FHRA's Groundwater Office to learn about the sulfolane plume and AWS options available for residents on private well water within the sulfolane plume. Homeowners with wells having a positive detection for sulfolane are contacted by a FHRA representative to schedule a meeting to discuss the water option currently available to the homeowner. FHRA also notifies owners by phone when nondetectable results have been received for their wells, and sends them the results of the testing.

Additionally, FHRA will distribute an annual direct communication newsletter to affected property owners with an AWS and property owners within the Buffer Zone. The communication newsletter will share basic information about the plume, planned sampling efforts, alternative water system information, contact information for both the Groundwater office and also ADEC, and other pertinent information. An informational reminder regarding disclosure obligations associated with property transfers will also be included in the newsletter. Additionally, the newsletter will provide instructions to homeowners on how they can request information on their specific AWS system operation and performance (i.e., water usage, sampling results). The newsletter will be sent annually during the first quarter via mail (or email if requested by the recipient).

In the past, the following options were offered by FHRA:

- An in home water treatment system that uses the existing well water and treats for sulfolane before water is distributed throughout the residence (POE treatment system);
- A bulk water tank option where water would be delivered by a water delivery company from another site to the tank and that water would be distributed throughout the residence; or
- A bulk water tank and associated infrastructure, but the owner retained the responsibility to provide the actual replacement water.

The first two options are no longer provided because of the sulfolane cleanup level review and pending cleanup level decision. The third solution is no longer being provided, after protectiveness concerns were raised by ADEC. FHRA contacted the property owners who previously selected this option and requested the owner accept an amended solution from FHRA whereby FHRA committed to supply and deliver potable water for the bulk tank.

If the property owner declines FHRA's offer to provide bottled water, FHRA will notify the owner that at ADEC's specific direction they will be providing the property owner's available contact information to the ADEC project manager. FHRA will notify ADEC as soon as FHRA has knowledge of the property owner decision to decline the service.

As of October 13, 2014, FHRA has provided 344 long-term AWS systems at 320 properties as listed below:

- 166 POE systems which have treated more than 15 million gallons with, based on POE system validation data, no detections of sulfolane in the effluent water supplied to the home
- 117 bulk water tanks
- 33 long-term bottled water options
- 48 garden tanks

In addition to the long-term solutions provided above, FHRA is providing interim bottled water to 246 residences that are either affected properties inside the plume that have not selected a long-term Alternative Water Supply, not had a detection of sulfolane, or are located within the Buffer Zone of the plume. A map showing the AWS's installed to data is included as Figure 4.

3.1 FHRA Groundwater Office Information

The FHRA Groundwater Office is located next to the post office in the City of North Pole at 201 South Santa Claus Lane. The centrally-located office offers easy access for affected homeowners as well as the general public. The office is open Monday through Thursday, 8:00 a.m. to 5:00 p.m. and Friday, 8:00 a.m. to 4:00 p.m. Office personnel are also available for after-hours meetings by appointment.

The office displays large maps of the affected area showing sulfolane detections, AWS systems installed, and the locations of monitoring well nests in the area. Informative posters of other sulfolane-related projects completed in North Pole are also displayed. Office personnel can also offer the homeowners a link to the ADEC website for additional information on the sulfolane issue, as well as printed copies of ADEC's literature on the sulfolane project.

The FHRA Groundwater Office also has an out-building with a typical POE treatment system installed for display purposes.

Currently, the office staff includes a Project Manager and an Administrative Assistant. The FHRA Groundwater Office is overseen and supported by the NPR Alaska Terminal manager and technical staff. The FHRA Groundwater Office staff is available at the office to answer questions in person or

by phone. Efforts are made to help members of the public feel comfortable asking questions and discussing issues of concern.

3.2 Interim Alternative Water Options Meeting

A homeowner meeting is requested after a home has been tested and if the sampling results indicate a positive detection for sulfolane. The meeting is held to inform the owners of the results, to answer questions, and to provide a hard copy of the analytical report. In the instance that the analytical results indicate nondetectable sulfolane, the owners are informed of the results and offered a copy of the report. If no sulfolane is detected and the homeowner is located within the plume footprint or Buffer Zone, they are also informed that FHRA would like to include them in annual resampling events.

Homeowner meetings are scheduled with two representatives from FHRA and preferably all owners of the property. The time and date is selected based on the availability and convenience of the homeowner, with the exception of weekends. Meetings have been held as early as 7:00 a.m. and as late as 8:00 p.m. and typically take 45 minutes to an hour.

FHRA representatives provide the homeowner with the following information:

- analytical testing results,
- an overview of the interim bottled water solution,
- a contact list for various FHRA representatives, and
- an informational sheet with the web addresses for the ADEC website for the North Pole Sulfolane project and the Water Quality Association.

The meeting with the homeowner also includes a discussion on the interim bottled water service that will be provided. The homeowner is advised that the interim service includes bottled water delivery, consisting of 3- or 5-gallon bottles of water, for drinking and cooking, delivered to the residence on a weekly basis. It's explained that the water service also includes a water cooler to dispense the water and that the cooler includes a sign on the exterior with the following language displayed: "This bottled water service is being provided by Flint Hills Resources Alaska, LLC (FHRA). The bottled water is intended for your drinking and cooking uses due to the potential presence of sulfolane in the groundwater. Please contact either the FHRA Groundwater Office at 907-488-0723 or the Alaska Department of Environmental Conservation at 907-451-2192 if you have any questions." There is no limit to the number of bottles a homeowner can request. The homeowners work directly with a supplier to schedule deliveries, and invoices are sent directly to FHRA.

Affected residents without City water connections also have the option of an above-ground water tank specifically for gardening/greenhouse purposes. This tank is set outside, above ground, and is designed for summer use only. The tank is a 1,000 gallon capacity tank that FHRA commits to filling twice each summer. A small portable inline pump, hose and sprayer are provided to be used with the garden tank option.

3.3 Commercial Properties

If an affected well is identified as serving a commercial property during initial contact with the property owner, FHRA modifies the normal procedure for the selected AWS option to address additional requirements. The additional requirements are set by the ADEC Drinking Water Program based upon a review of water use at the commercial property. These modifications could include, but are not limited to: (1) a modified agreement addressing specific requirements; (2) a review with the owner of their Public Water System (PWS) information; and (3) working with the owner to incorporate the new system into existing PWS records. In some instances, where owners have no PWS in place, FHRA has assisted them in working with ADEC in the initial approval processes. Provisions are made so FHRA will cover the cost of required testing for sulfolane; however, the owner is still responsible for other regularly required water tests.

4.0 Other Active Alternative Water Solutions

4.1 Point of Entry Treatment System

In the past, FHRA provided a POE treatment system to properties that chose this option. The POE treatment system was typically installed within the house where the existing water utilities are located. The POE treatment system treats water as it enters the house, with exception to outdoor water spigots. Two POE treatment system options, Simplex and Duplex, were offered based upon anticipated water usage and the level of sulfolane in the water. The Simplex POE treatment system consists of a single granular activated carbon (GAC) vessel followed by a redundant GAC vessel (Figure 5). A Duplex POE treatment system consists of two primary GAC vessels installed in series followed by a redundant GAC vessel (Figure 6).

The POE utilizes two large size canister filters that remove the sand and sediment that may come up from the well. Next, the water passes through a softener with a detached brine tank. This step removes the minerals and hardness from the water. The water then flows through a UV filter to remove naturally occurring bacteria. After the UV filter, the water passes through a series of tanks that are filled with coconut shell GAC. At this step, sulfolane is removed from the water, and the treated water passes through a final UV filter before entering the plumbing system of the home. The POE treatment system includes two other components which are described to the homeowner: a water meter that transmits a remote signal to allow tracking of the water usage to schedule routine maintenance, and a series of sampling ports that will allow sampling of the raw water and treated water each time service is performed on the system. AWS Mgmt. Plan - Appendix B provides specifics on the design, selection, operation and maintenance of the POE treatment system. Arctic Home Living of Fairbanks has been contracted by FHRA to provide maintenance of the POE treatment systems.

FHRA provides a summary of a typical service visit to the homeowner. Each visit will be scheduled by a representative from Arctic Home Living and may include any or all of the following tasks:

- replace the filter cartridge in the canister filters;
- fill the brine tank with salt;
- check and service the water softener;
- remove the primary GAC tank and replace with a new tank with fresh GAC;
- remove and replace the redundant GAC vessel every 12 -24 months (may not be completed at each visit);
- replace the bulbs in the UV filters (annually, so may not be completed at each visit); and

- collect samples from the raw water port, between the GAC vessels, and the post treatment port and submit to an ADEC approved laboratory for analysis.
- if the post treatment system detects sulfolane, any of the above steps may be undertaken and the water will be resampled.
- If detections of sulfolane are found, the GAC vessel(s) will be changed and notification will be given to ADEC and the property owners of the detection. Once the GAC vessel(s) is changed out, the water will be resampled.

4.2 Bulk Water Tank

In the past, if a bulk tank was chosen by the property owner, a suitable location for installation was identified. The tank offered was a 2,000 gallon low profile tank. FHRA buried the tank to provide extra protection against freezing in the winter, unless the property owner refused to allow or if conditions prevent the subgrade installation. The location of the tank was determined at a pre-construction meeting with the contractors and the homeowner taking into account the existing locations of the homes septic, fuel tank, well, driveways and parking areas.

As part of the bulk water option, FHRA agreed to provide, without cost to the homeowner, 60 gallons of water per person in the home, per day, on an annual basis. If the homeowner uses less water than this allowance during the year, a credit is provided to the homeowner's account to buffer future uses exceeding the allowance. To date, this allowance has been adequate to meet homeowner needs.

Following location selection, excavation commenced. A schematic of the bulk tank option and associated components is shown on Figure 7. The bulk tank, which is coated with 4 inches of spray foam, was set and the excavation was backfilled with pea gravel to eliminate settling. Two inches of foam board and 2-feet of fill were placed on top of the tank to provide protection from winter temperatures. The final grade of the ground surface was performed to ensure proper drainage and applies grass seed and mulch (hydro seed) to the disturbed soil as final stabilization of the excavation area.

A minimum amount of heat trace was used on the water supply line leading from the bulk water tank to the house and on the vent tube for the tank. The water supply line and vent tube were also foamed and buried to protect from freezing. To have minimal effect on the homeowner's electrical bill, the heat trace used is self-limiting and controlled by a programmable 24 hour timer. It can also be switched on for continuous winter use if needed, and off in the summer. No regular maintenance is required of the insulation and heating system; however, malfunctions may occur over time and the homeowner is instructed to report them to FHRA.

Following installation, the bulk tank was filled with water, performance testing conducted, and samples for E. Coli and total coliform collected and sent to a laboratory for analysis. If the laboratory sampling indicated positive results, the bulk tank and home piping were chlorinated, and re-sampled. The chlorination process involved adding chlorine to the bulk tank, agitating, running the chlorinated water through all faucets, allowing the tank and piping to soak for 12-hours (without use), collection and off-site disposal of chlorinated water, and rinsing the system. Confirmation samples for E. Coli and total coliform were collected after the chlorination process, prior to allowing use of the bulk water tank. Once negative results were received from the laboratory, the system was put into service, and interim bottle water delivery service was terminated.

4.3 Garden Tank

An optional above-ground 1,000-gallon garden tank can be selected by residents for watering vegetable gardens. The garden tank is set outside on a level gravel pad, includes a small transfer pump set in a water-proof box, and is designed for summer use only. A 50-foot hose and hand spray nozzle are provided for homeowner convenience.

Water is supplied twice per growing season at FHRA's cost and not to exceed 2,000 gallons. Water is supplied by a local water vendor, currently Pioneer Wells, with water sourced from the untreated Fox Spring well.

5.0 Operation and Maintenance of AWS Systems

5.1 Interim Bottled Water Deliveries and Removal Process

The interim bottled water delivery, as discussed in Section 2.1.3, is intended to be a short-term solution until the sulfolane cleanup level has been established for the site. In the past, interim bottled water delivery was also used as a short-term solution until the homeowner selected their final AWS option. If the long-term bottled water option is selected as the permanent AWS, no changes occur to the interim bottled water delivery for the homeowner.

5.2 POE Treatment System Operation and Maintenance

POE treatment system operation and maintenance activities are completed by FHRA contractors, currently Arctic Home Living. These activities include regular change out of the GAC vessels, water use monitoring, water softener maintenance and salt replenishment, UV bulb replacement, regular water sampling to confirm sulfolane removal, and various other checks and system operation validations. Concurrent with submittal of this plan, FHRA has prepared a *Revised Point-of-Entry Treatment System Feasibility Study and Design Report* which includes a detailed operation and maintenance plan for the POE treatment systems and is included as AWS Mgmt. Plan - Appendix B.

5.3 Bulk Water Tank

Water deliveries for bulk tanks are currently provided by local suppliers hired by FHRA. Currently these local suppliers include Pioneer Wells, Inc. (Pioneer Wells) or H20 2 U, LLC (Water Wagon). Pioneer Wells sources their water from a well in Fairbanks and runs the water through a water softener system prior to delivery to affected properties. Water Wagon sources treated water from College Utilities in Fairbanks. Both vendors are registered with the ADEC.

Both vendors set up delivery schedules with the homeowners based on water use to avoid unexpected outages.

As noted in Section 3.0, a fourth AWS option was previously offered where FHRA provided and installed the bulk water tank and associated infrastructure, but the owner retained the responsibility to provide the actual replacement water. This option is no longer being provided as an option to affected property owners, and FHRA is in the process of contacting the property owners who previously selected this option and is requesting the owner accept an amended solution from FHRA whereby FHRA will commit to supply and deliver potable water for the bulk tank.

5.4 Transfer of Ownership of Property with an AWS

As stated in the AWS agreement with each property owner, if the home is sold, the agreement and AWS system transfers to the new owner. Section 2.4 of this report outlines the process FHRA has implemented to monitor for property transactions. FHRA has asked each property owner to provide this new contact information at the time of sale so that the change can be made in FHRA's database. FHRA stresses that this will allow the same commitments of service to continue without interruption for the new property owner. FHRA has also expressed to realtors, property seller and buyers that the Groundwater Office staff are available to assist with answering questions and providing information regarding the AWS systems and the overall project.

5.5 Trouble Call Procedures

5.5.1 POE Treatment System

Trouble call information and procedures for POE treatment systems are provided to the homeowner at the completion of the installation during the system operation review (Homeowners Information Sheet is included in AWS Mgmt. Plan – Appendix B). These informational sheets are attached to the equipment or posted nearby on the wall. Included on the information sheet is a 24-hour phone number that is responded to immediately. To date, few trouble calls have been received. Typically, service technicians are able to respond to the home within a few hours or the next morning if the call was made during the night

5.5.2 Bulk Tank

Property owners who have selected the bulk water tank system are provided with a small magnetic sign that states FHRA's installation contractor name, Rolling Stone Inc. and a 24-hour trouble call hotline. These are typically placed on the pressure tank as a reference for the homeowner. Homeowners are asked to contact the installation contractor directly if a problem occurs. Depending on the nature of the problem, the installation contractor will determine if the problem can be fixed over the phone or if a representative needs to be sent out. If a representative is called out, they will determine the cause of problem and call the appropriate trade contractor (i.e., plumbing, electrical, water delivery).

5.5.3 Bottled Water Delivery

Currently bottled water delivery is provided by Spring Alaska. Spring Alaska contacts residents weekly to confirm the number of bottles required in advance of delivery. This allows residences receiving this service to manage delivery to their individual needs from week to week. FHRA Groundwater Office staff keeps additional bottles of water and dispensers available for emergency

calls that the vendor may not be able to respond to in a timely manner. FHRA's general contractor Rolling Stone Inc., also responds to any after-hours trouble calls.

6.0 Private Well Database

FHRA completed construction of a database to house information relevant to private wells within or near the sulfolane plume. The database incorporates historical data gathered from the beginning of this project and will be the primary storage location for information as the project progresses. This database will continue to assist the groundwater staff as they track items such as, but not limited to:

- Owner and contact information
- Agreements
- AWS options
- Interim bottled water service
- Sampling Results
- AWS operation and maintenance schedules

The database became fully operational in the fourth quarter of 2013 and FHRA will continue to enhance and update the database, as necessary to manage the AWS program.

7.0 Reporting

By March 1st of each year, FHRA will prepare an annual summary report for submittal to ADEC to document identification, installation, and maintenance of AWS in the North Pole area. The report will include the following elements:

- A summary of the type and number of AWS's installed in the North Pole area.
- Historical sulfolane data collected at each well location, including raw water and treated water sampling for each POE system, and the volume of water treated through each POE system. This information will be similar to the data summary of the finished water results that were provided to ADEC via email on July 11, 2013, and to the raw water results that have been previously provided to ADEC in quarterly monitoring reports in 2013. This data will be utilized to verify that the POE systems are properly treating the groundwater and performing as designed. The data is also relied upon to assure the proper operation and maintenance of the system is performed. If problems with the systems are identified, they will be addressed as necessary, and documented as noted below.
- A summary of the GAC usage volume from the POE systems.
- A description of the source and delivery schedule for bottled and bulk water supplies, including garden tanks.
- A summary of commercial greenhouses within the plume limits with an AWS and a discussion of water supply and usage, as available.
- A summary of major complaints, problems or issues encountered with the AWS during the calendar year.
- A summary of the sample results for the prior year for the City of North Pole's supply wells if made available to FHRA.
- A discussion of any significant updates or changes to the AWS program.

The annual summary report will also include a map depicting the current extent of the dissolved-phase sulfolane plume based on results from private well and AWS system sampling, and the AWS in place throughout the plume area.

An annual newsletter will be prepared by FHRA, as described in Section 3.0 and provided to each affected property owners with an AWS and property owners within the Buffer Zone. This newsletter will provide instructions to homeowners on how they can request information on their AWS system

operation and performance (i.e., water usage, sampling results). A copy of the newsletter will be provided in the annual summary report to DEC.

8.0 Termination from AWS Program

When a final determination of the cleanup level for the site is made by ADEC, this plan will be revised to incorporate the final sulfolane cleanup level. Factors to be considered in transition when the final sulfolane cleanup level is issued may include: data trends, location and other relevant property information.

The program may be modified or terminated as appropriate in the event a public water system becomes available to serve the affected properties or another program is substituted following resolution of pending litigation among the potentially responsible parties.

9.0 References

ARCADIS, 2013. Revised Sampling and Analysis Plan, Revision #5, North Pole Refinery, Flint Hills Resources Alaska, LLC, March 2013.