Final Meeting Minutes
Restoration Advisory Board (RAB) Meeting
Former Galena Forward Operating Location (FOL), Alaska
Galena, Alaska
26 October 2022

Time/Place: Larsen Charlie Community Hall, Galena, Alaska at 7:00 pm

Attendees:

Fourteen (14) people attended the RAB meeting including representatives from the Air Force Civil Engineer Center (AFCEC), the Alaska Department of Environmental Conservation (ADEC), Louden Tribal Council, community members, and Air Force remediation contractors. The following is a list of those attending the meeting.

Christiana Hewitt, AFCEC
Joe Reyna, AFCEC
Ed Heyse, Parsons
Brian Blicker, Parsons
John Jones, EA Engineering
Win Westervelt, Jacobs
Jordan Couture, Jacobs
Ellie Cook, FPM
Jamie McKellar, ADEC
Tim Bodony, Community member, RAB Co-chair
Brooke Sanderson, Louden Tribal Council
Ranch Burgett, Community Member
Ron Burgett, Community Member
Larry Hausman, Community Member

Agenda: See **Attachment 1**

Introduction:

Christiana Hewitt (AFCEC) opened the RAB meeting by thanking everyone for attending. Attendees were asked to identify themselves and their affiliation. Christiana Hewitt began the meeting with an update on the BECOS contract.

BRAC Environmental Construction and Optimization Services (BECOS) Contract

Work in 2022 included soil management at the Galena landfarm. Operation of the remedial systems will be transferred to the BECOS contractor in the summer of 2023.

Presentation

Remedial Process Optimization (RPO) Evaluation Contracts

Ed Heyse and Win Westervelt gave a presentation (**Attachment 2**) with an update on the RPO contracts. Thirteen (13) of 32 sites were closed under the previous Performance-Based Remediation (PBR) contract and 19 sites remain open. RPO evaluations are being conducted at 18 sites with a remedy in place. The objective of the RPO effort is to evaluate and optimize remediation systems and monitoring programs to ensure they are efficient and effective at meeting remediation goals.

The location of the RPO sites is shown on Slide 4 in **Attachment 2**.

Activities to date include the following:

- Annual groundwater performance monitoring and RPO groundwater monitoring in 2020, 2021, and 2022.
- Soil sampling at select sites in 2021 and 2022.
- April/May 2022 – The operating systems were shut down for annual soil vapor monitoring to track cleanup progress.
- September/October 2022 – Bioventing and soil vapor extraction (SVE) started up at 10 sites and vertical and horizontal air sparging systems started up at 2 sites.

Operating systems will be maintained by Parsons and Jacobs through April 2023.

The RPO study included an evaluation of monitoring techniques for diesel-range organics (DRO). DRO is expected to drive time to achieve cleanup goals at several sites. The evaluation showed that DRO in groundwater is heavily weathered, which means that natural conditions and engineered remediation systems are biodegrading DRO.

The RPO study also investigated the presence of manganese in groundwater. Manganese is a naturally occurring element in soil, but changes in subsurface chemistry cause by the release of fuels in the environment can enhance dissolution of manganese. Manganese was evaluated because ADEC established a cleanup level in 2018. The study showed that manganese concentrations in groundwater are within the range of natural background and the established land use control boundaries are protective. Tim Bodony asked what risks are associated with manganese. Ed replied that we would get back to him. The Agency for Toxic Substances and Disease Registry (ATSDR) ToxFAQ sheet for manganese is attached (**Attachment 5**). (After the meeting, John Jones discussed some of the risks with Ed and Tim based on an internet search.)

Recommendations for optimizing SVE, bioventing, and air sparging systems will be proposed in a forthcoming RPO Report. Several systems can be shut down because they have met performance objectives.

A pilot study was conducted at Site SS005 to treat low-level concentrations of 1,2-dichloroethane (a lead-scavenging additive to gasoline) in groundwater. Monitoring will continue to determine the effectiveness of the enhanced bioremediation approach.

Supplemental site characterization was conducted at Sites SS018 and CST011 Area 1 to determine the extent of fuel contamination remaining under paved areas. Sample results indicate about 280 cubic yards of fuel-contaminated soil remain at Site SS018 and 30 cubic yards of fuel-contaminated soil remain at CST011 Area 1 (under pavement at both sites).

The period of performance for the RPO contracts has been extended to June 2023 for Jacobs and September 2023 for EA/Parsons to complete the 2022 annual performance monitoring reports. Tim Bodony asked what USAF's contracting plan was after 2023. Christiana responded that the USAF is working on another contracting mechanism (AE2023) and had alternative contract vehicles at their disposal including the US Army Corps of Engineers (USACE) contracts and the BECOS contract. Christiana stated that work will continue at the subject sites.

Tar Sites Investigation at Sites SS107 and SS108

Win Westervelt presented a summary of the investigation conducted in August 2022 for two tar sites at the former Galena FOL. Sites SS107 and SS108 are areas within and north of the airfield where asphalt tar and tar barrels were dispersed during a flood in 1945 when the runway was under construction. Jacobs installed 27 soil borings and 7 monitoring wells. Samples are being analyzed and a report is due to ADEC in Spring 2023.

Larry Hausmann asked if groundwater was present in wells that there only installed to 16 feet at Site SS107. Win replied that yes, groundwater was present in these wells and that the surface of the permafrost to the north was at same elevation as groundwater.

Tim Bodony asked if implementing a smoldering or stabilization remedy was feasible because during presentation it was stated that implementing either of these remedies would be a huge undertaking. Win responded that these remedies (if determined to be effective) were implementable but it remained to be seen if they are warranted or if they would be effective (pending treatability studies).

Tim Bodony mentioned that community may have concerns with air quality issues that could be associated with in situ smoldering approach. Win responded that the off gas will be analyzed as part of the smoldering treatability study.

Presentation

Remedial Investigation (RI) for PFAS Compounds at the Former Galena Forward Operating Location, Alaska

Ed Heyse presented an Air Force project for a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) RI for two Air Force sites at the Former Galena FOL (**Attachment 3**). The objective of the RI is to determine the nature and extent of per- and polyfluoroalkyl substances (PFAS) contamination in the environment and to evaluate the risk that PFAS pose to human health and ecological receptors.

Ed presented some background information on PFAS, including what PFAS are, why they are of interest at now, the human health and ecological risks, and how PFAS were used at the former Galena FOL. To date, the Air Force has completed a Preliminary Assessment (records search), and a Site Inspection (to determine if PFAS is present). The third study, a Remedial Investigation, is underway.

The two PFAS sites at Galena are Site CG109 (Aqueous Film Forming Foam [AFFF] Release Areas) in the "Triangle" area (shown on **Attachment 3** Slide 9) and Site FT001 (former Fire Protection Training Area) at the east end of the airfield (shown on Slide 10). The source areas for Site CG109 include the former Fire Station, Building 1556 Fire Station, and the Vehicle Maintenance Facility (now the ADOT building). The sanitary sewer system outfall to the west is also being evaluated.

Two field mobilizations were conducted during the 2022 field season. The spring 2022 activities included:

- An initial round of groundwater sampling in May 2022 to bound the extent of PFAS in groundwater (approximately 73 monitoring wells).
- Surface Soil and Sediment Sampling
    - 5 surface soil samples at Site FT001
    - 15 surface soil samples in Airfield Drainage Features
    - 15 surface soil samples in Triangle Area Drainage Features
    - 10 sediment samples near Sanitary Sewer Outfall

The summer 2022 activities included:

- Installed and sampled 6 new monitoring wells.
- A second round of groundwater sampling in August/September 2022 to confirm the extent of PFAS in groundwater.
- Sample approximately 35 soil borings to delineate extent of PFAS in subsurface soil.

- Surface soil and sediment soil sampling step out locations as needed.
- Surface water sampling in drainage ditches and sewer outfall.
- Sampling for ecological risk.

Ed showed a series of maps illustrating the sample locations (shown on **Attachment 3**, Slides 13-18). The sampling locations were selected to determine if there is surface soil contamination outside of the immediate fire training pit.

Field work for the PFAS RI will be completed in September 2022. The data will be evaluated over the winter and an RI report will be submitted for ADEC review in April 2023. In addition to evaluating the extent of PFAS in soil and groundwater, the RI report will include baseline human health and screening level ecological risk assessments. Some additional monitoring wells and supplemental sampling are anticipated for Spring 2023.

Larry Hausmann asked if any private wells have been impacted. Ed responded that wells in Old Town have been sampled and PFAS concentrations were below 2016 EPA Lifetime Health Advisories.

Win asked if there were any studies of PFAS in the Yukon River up and down stream of Galena. Ed responded that there were no such studies that we were aware of. There was discussion that given the magnitude of flow in the Yukon, dilution of discharged groundwater would be so great that PFAS would be undetectable in surface water. Ed stated that the impact to downgradient receptors including the Yukon would be evaluated in the RI.

Additional information on Air Force remediation at Galena can be obtained from the Galena Administrative Record (https://ar.afcec-cloud.af.mil/), and questions submitted to Air Force Installation and Mission Support Central (AFIMSC) Public Affairs office (afimsc.pa.workflow@us.af.mil). Comments can also be provided directly to Christiana Hewitt at christiana.hewitt.1@us.af.mil.

Closing Remarks

Jamie McKellar clarified that her role at ADEC was to review the Galena documents and noted that the contractors are the ones that do the hard work. Jamie noted that this is a community process; the community members live here every day and we value your feedback. If you or your neighbors have concerns, please reach out to ADEC or the Air Force.

Christiana Hewitt thanked the Galena community for attending and contributing to the meeting, and to contact her or Public Affairs if they have any questions. Christiana asked if there were any additional questions (there were none) and closed the RAB meeting.

Attachments:

1. Final RAB Meeting Agenda
2. Presentation: Remedial Process Optimization (RPO) at the Former Galena Forward Operating Location (FOL), Alaska
3. Presentation: Tar Sites Investigation at the Former Galena Forward Operating Location (FOL), Alaska
4. Presentation: Remedial Investigation (RI) for PFAS Compounds at the Former Galena Forward Operating Location, Alaska
5. ATSDR ToxFAQs Fact Sheet for Manganese

Attachment 1
RAB Meeting Agenda

Final

Galena RAB Meeting Agenda

October 26, 2022
7:00 pm – 8:30 pm AKT
Charlie Larsen Hall
Galena, Alaska

Welcome **Christiana Hewitt, AFCEC**

- Introductions

Overview of Environmental Restoration

- BRAC Environmental Construction and Optimization Services (BECOS) Contract (Christiana Hewitt, AFCEC)
  - Activities for 2022 Field Season
- Remedial Process Optimization Evaluation (RPO) Contracts (Ed Heyse, Parsons and Win Westervelt, Jacobs)
  - Summary of 2022 Field Season
  - Status of RPO Evaluation
- Tar Sites Investigation (Win Westervelt, Jacobs)
  - Summary of 2022 Field Season
- Remedial Investigation for Per- and Polyfluoroalkyl Substances (PFAS) (Ed Heyse, Parsons)
  - Overview of PFAS Use and Risk
  - Sampling Activities for 2022 Field Season
  - Reporting Schedule

Remarks from ADEC **Jamie McKellar, ADEC**

Remarks from ADOT **Sam Myers, ADOT**

Questions from the Public **Christiana Hewitt (Facilitator)**

Schedule for Next RAB and Closing Remarks **Christiana Hewitt**

For more information about the Galena Environmental Cleanup Program, please contact the AFCEC Public Affairs hotline at 1-866-725-7617 or via email at afimsc.pa.workflow@us.af.mil

Attachment 2

Remedial Process Optimization (RPO) at the Former Galena Forward Operating Location (FOL), Alaska

Air Force Civil Engineer Center

Remedial Process Optimization (RPO) at the Former Galena Forward Operating Location (FOL), Alaska

Restoration Advisory Board (RAB) Meeting
26 October 2022

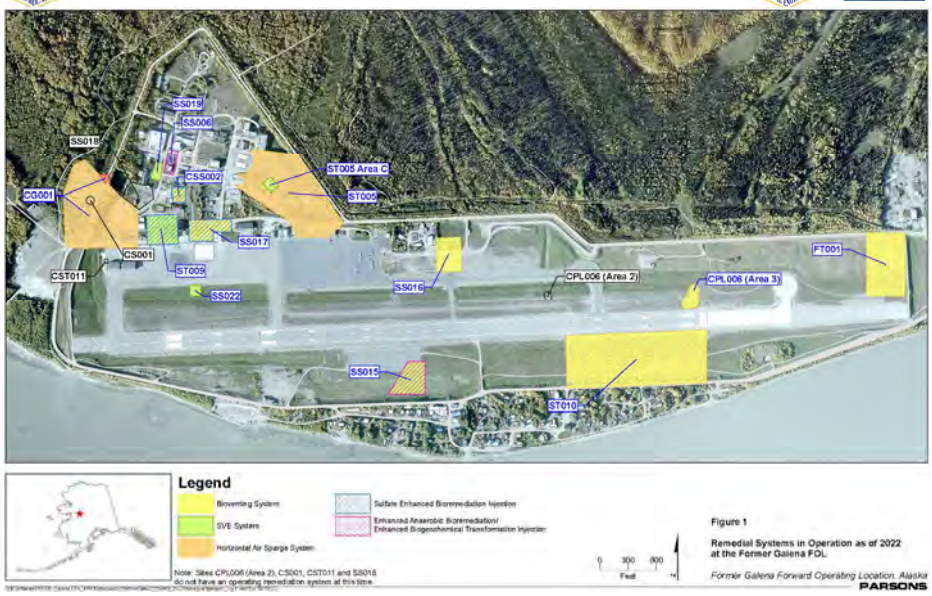
Former Galena FOL Remedial Process Optimization (RPO)

- **Jacobs and Parsons (through EA Engineering) - Separate Contracts**
- **13 of 32 sites have been closed under the Performance-Based Remediation (PBR) contract and 19 sites remain open**
- **RPO evaluations are being conducted at 18 sites with a remedy in place**
- **Objective is to evaluate and optimize operating systems and monitoring programs**
- **Jacobs and Parsons will maintain operating systems through April 2023**

Activities to Date

- Annual groundwater performance monitoring and RPO groundwater monitoring in 2020, 2021, and 2022
- Soil sampling at select sites in 2021 and 2022
- April/May 2022 – The operating systems were shut down for annual soil vapor monitoring to track cleanup progress
- September/October 2022 – Bioventing and soil vapor extraction (SVE) started up at 10 sites and vertical and horizontal air sparging systems started up at 2 sites
- Operating systems will be maintained by Parsons and Jacobs through April 2023

Remedial Systems in Operation



Summary of RPO Activities

- Evaluate methods for measuring diesel-range organics (DRO) in groundwater
  - DRO takes longest time to clean up
  - Evaluate alternative methods to measure concentrations (submersible pump, passive diffusion bags, and HydraSleeve)
  - Tests show DRO is heavily weathered (biodegrading)
  - Data will help decide how much longer to continue active treatment
- Evaluate dissolved manganese in groundwater
  - DEC established new cleanup levels in 2018
  - Manganese concentrations in groundwater are within background range
  - Current Land Use Control boundaries do not need to be extended
- Evaluate and optimize bioventing, SVE, and air sparge systems
  - Systems at Sites TU001, CST014, SS005, CSS002, SS016 and FT001 meet performance goals and proposed to discontinue operation
  - Groundwater monitoring will continue until site closure requirements are met

Summary of RPO Activities

- Pilot Test at Site SS005
  - Injected vegetable oil and iron to stimulate breakdown of 1,2-dichloroethane (an additive in leaded gasoline) in groundwater
  - Monitoring ongoing to determine effectiveness
- Supplemental Site Characterization at Sites SS018 and CST011 Area 1 to determine actions needed to complete remediation
  - SS018 (storage area east of sewage lagoons): ~ 280 cubic yards of petroleum contaminated soil remains east and south of 2019 excavation (including under concrete pad)
  - CST011 Area 1 (northwest corner of former Combat Alert Cell hangar): ~ 30 cubic yards of petroleum-contaminated soil remains beneath the pavement
- Period of Performance for the Jacobs contract extends to June 2023 and for the EA/Parsons contract to September 2023 to complete the 2022 annual performance monitoring reports

Communications

- **Semi-annual RAB Meetings (April/October) to continue**
- **Anyone interested in becoming a member of the RAB should contact Christiana Hewitt**
- **Air Force maintains Administrative Record for Final Documents at:**

  https://ar.afcec-cloud.af.mil/

Questions?

Air Force Installation and Mission Support Central (AFIMSC) Public Affairs

AFIMSC/Public Affairs
2261 Hughes Ave., Suite 155
JBSA Lackland, TX 78236-9853
Toll Free (866) 725-7617
afimsc.pa.workflow@us.af.mil


AIR FORCE CIVIL ENGINEER CENTER

Attachment 3

Tar Sites Investigation at the Former Galena Forward Operating Location, Alaska

Air Force Civil Engineer Center

Tar Sites Investigation at the Former Galena Forward Operating Location (FOL), Alaska

Restoration Advisory Board (RAB) Meeting
26 October 2022

1

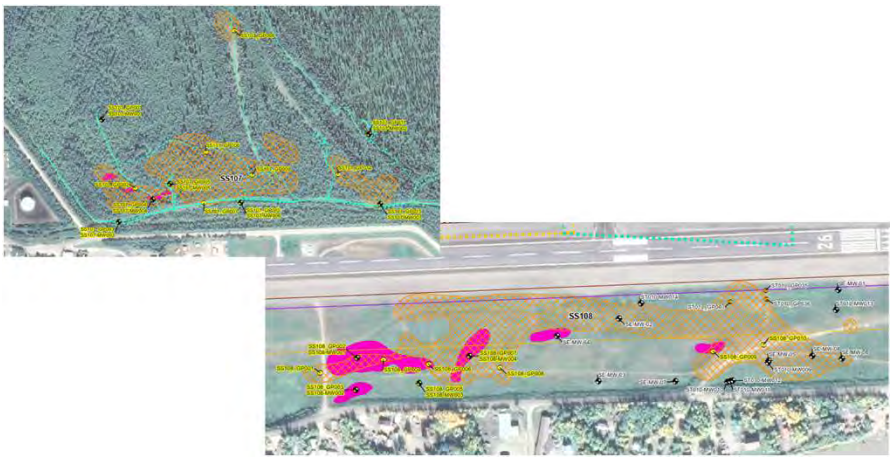
Tar Sites Investigation at Sites SS107 and SS108

- **CH2M (Jacobs) is under contract for site characterization of areas north of dike road (Site SS107) and in the airfield south of the runway (Site SS108) where asphalt tar and tar barrels were dispersed during a flood in 1945.**

2

Activities to Date

- During August 2022, 27 soil borings and 7 monitoring wells were installed and sampled to evaluate if contaminants have leached from the tar into the underlying soil and groundwater.



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Activities to Date

- **Observations:**
  - Permafrost was encountered at approximately 6 feet deep in most of the wooded area of Site SS107.
  - The tar appeared to be more like small discrete patches than continuous large areas.

4

Treatability Studies

- **Samples of the tar and soil were also collected for two treatability studies:**
  - **STARx by Savron testing laboratory (Geosyntec Consultants) for evaluating treatment of excavated tar/soil by smoldering.**
  - **In-situ Solidification/Stabilization will be evaluated by Jacobs for reducing leachability of petroleum constituents by mixing with cement.**

Site SS107 soil and tar samples

Site SS108 soil and tar samples

Next Steps

- **Soil and groundwater samples are currently being analyzed by the laboratories.**
- **Results of the site characterization sampling and treatability study evaluations will be submitted in a report in Spring 2023.**
- **The investigation results will be used to determine if cleanup needs to be performed under ADEC Contaminated Sites or Solid Waste regulations or if the tar does not cause human health or environmental risks.**

Communications

- **Semi-annual RAB Meetings (April/October) to continue**
- **Anyone interested in becoming a member of the RAB should contact Christiana Hewitt**
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Attachment 4

Remedial Investigation (RI) for PFAS Compounds at the Former Galena Forward Operating Location, Alaska

Air Force Civil Engineer Center

Remedial Investigation (RI) for PFAS Compounds at the Former Galena Forward Operating Location, Alaska

Restoration Advisory Board (RAB) Meeting
26 October 2022

Former Galena FOL PFAS RI Contract

- EA Prime Contractor and Teaming Partner Parsons
- Period of Performance through September 2023
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Remedial Investigation (RI) for two Air Force Sites (CG109 and FT001) at the Former Galena Forward Operating Location (FOL), Alaska
- Determine nature and extent of per- and polyfluoroalkyl substances (PFAS) in the environment, and evaluate risk that PFAS pose to human health and ecological receptors

What are PFAS Compounds?

- PFAS are fluorinated chemicals (9,000+) used in industry and commercially since the 1940's
  - Nonstick cookware
  - Some food wrappers
  - Stain resistant fabrics, carpet, clothing (e.g., Gore-Tex)
  - Personal care products (shampoo, dental floss) and cosmetics (nail polish, eye makeup)
  - Aqueous Film Forming Foam (AFFF) used by the Air Force beginning in the early 1970s to fight fires

- Health and environmental impacts of PFAS began to be recognized in 1990's and 2000's
- Persistence and mobility of some PFAS, combined with decades of widespread use, resulted in their presence in the environment at trace levels across the globe

Why all the attention on PFAS now?

- Analytical methods to detect low levels of PFAS in the environment were not available until the early 2010s
- Recent toxicological studies raised concerns regarding bioaccumulative nature and potential health concerns of some PFAS chemicals
- Regulatory limits:
  - EPA drinking water advisories for two PFAS (PFOS and PFOA) established in 2016
  - Alaska DEC clean up levels for PFOS and PFOA established in 2016
  - EPA risk levels established and used by DoD to support remedial investigation and risk assessment

What Human Health Risks do PFAS Cause?

- **Human Risks (from Interstate Technology & Regulatory Council [ITRC] Fact Sheet No. 1)**
  - **Liver effects (serum enzymes/bilirubin/cholesterol)**
  - **Immunological effects (decreased vaccination response, asthma)**
  - **Developmental effects (birth weight)**
  - **Endocrine effects (thyroid disease)**
  - **Reproductive effects (decreased fertility)**
  - **Cardiovascular effects (pregnancy induced hypertension)**
  - **Cancer* (testicular, kidney)**

* PFOA only

What Ecological Risks do PFAS Cause?

- **Animal Risks (from ITRC Fact Sheet No. 1)**
  - **Liver effects**
  - **Immunological effects**
  - **Developmental effects**
  - **Endocrine effects (thyroid)**
  - **Reproductive effects**
  - **Hematological (blood) effects**
  - **Neurobehavioral effects**
  - **Tumors (liver, testicular*, pancreatic*)**

*** PFOA only**

How was PFAS used at Galena?

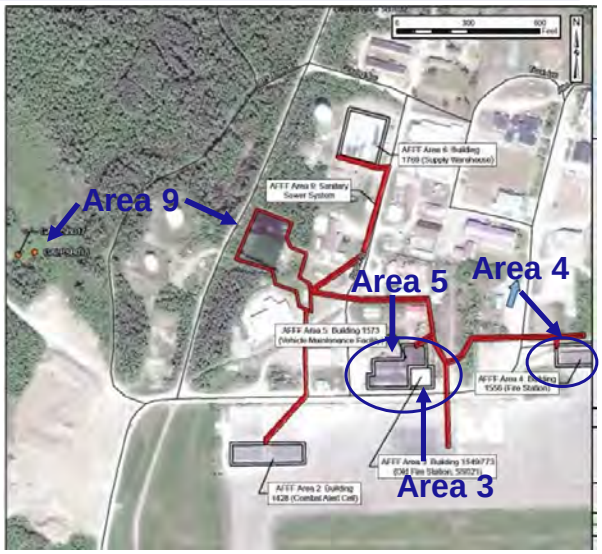
- Air Force used AFFF for fire-fighting
- Potential release areas identified, including:
  - Fire-fighter training area at east end of the runway
  - AFFF used to fight fire at crash site on runway in 2003
  - AFFF stored at old and new Fire Stations
  - AFFF fire suppression system in Vehicle Maintenance Facility
  - Runoff discharged to sewage treatment system
- Deep drinking water wells in Galena Triangle Area and in New Town have been tested

PFAS Investigations at Galena

- Preliminary Assessment (records search) completed in 2016
- Site Inspection (sampling to determine if PFAS is present) completed 2018 - 2020
- Remedial Investigation (determines nature and extent and evaluates risk) – begun in 2022 and on-going

Site CG109
Primary Source Areas

- Old Fire Station
- Building 1556 Fire Station
- Vehicle Maintenance Facility
- Sanitary Sewer System



Site FT001 Source Area

- Site FT001 has an Interim Record of Decision for Constituents of Concern (COCs) other than PFAS compounds
- Alaska Department of Environmental Conservation (DEC) includes Site FT001 in Site CG109

PFAS RI Field Mobilizations

Spring 2022

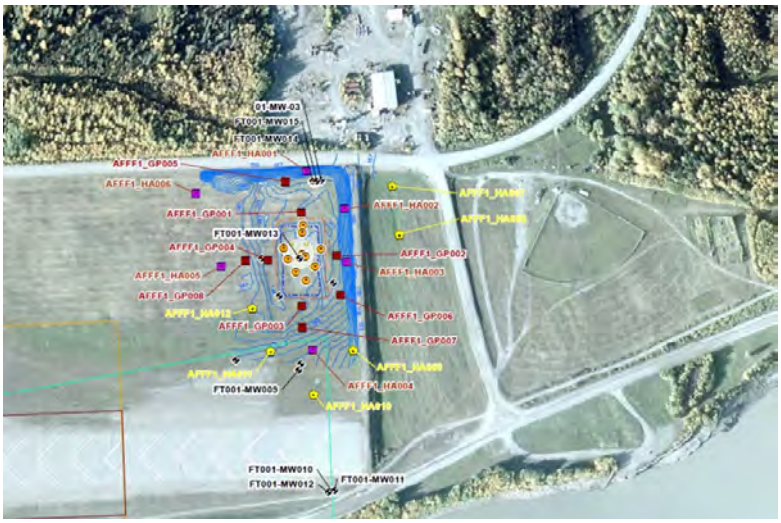
- Initial round of groundwater sampling in May 2022 to bound the extent of PFAS in groundwater (approximately 73 monitoring wells)
- Surface Soil and Sediment Sampling
  - 5 Surface Soil Samples at Site FT001
  - 15 Surface Soil Samples in Airfield Drainage Features
  - 15 Surface Soil Samples in Triangle Area Drainage Features
  - 10 Sediment Samples near Sanitary Sewer Outfall - Aqueous Film Forming Foam (AFFF) Area 9

PFAS RI Field Mobilizations

Summer 2022

- Installed six new monitoring wells based on spring 2022 sampling event
- Second round of groundwater sampling in August/ September 2022 to confirm the extent of PFAS in groundwater
- Sampled approximately 35 soil borings to delineate extent of PFAS in soil
- Surface Soil and Sediment Soil Sampling – Step out locations based on spring sample results
- Surface Water Sampling
- Ecological Risk Sampling

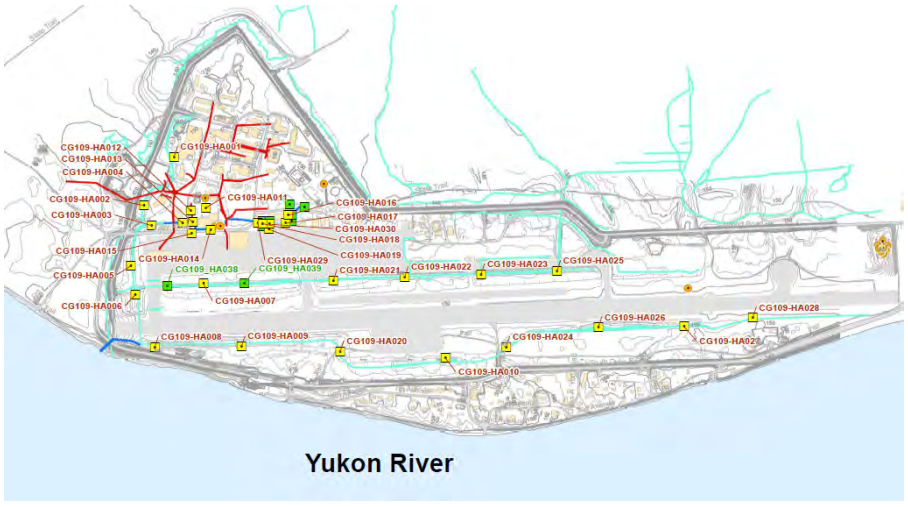
Soil Sampling FT001



Groundwater Sampling FT001

Soil Sampling CG109

Surface Soil Sampling in Drainage Ditches CG109 and Airfield



Groundwater Sampling CG109

Surface Water and Sediment Sampling CG109

PFAS RI Evaluation

- 2022 field work completed in September
- RI Report for submittal to DEC in April 2023
- RI Report includes Baseline Human Health and Screening Level Ecological Risk Assessments
- Supplemental RI field work may be performed in early summer of 2023

Questions?

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Attachment 5

ASTDR ToxFAQs Fact Sheet for Manganese

Manganese - ToxFAQs™

CAS # 7439-96-5

This fact sheet answers the most frequently asked health questions (FAQs) about manganese. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Manganese is a trace element and eating a small amount from food or water is needed to stay healthy. Exposure to excess levels of manganese may occur from breathing air, particularly where manganese is used in manufacturing, and from drinking water and eating food. At high levels, it can cause damage to the brain. Manganese has been found in at least 869 of the 1,669 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is manganese?

Manganese is a naturally occurring metal that is found in many types of rocks. Pure manganese is silver-colored, but does not occur naturally. It combines with other substances such as oxygen, sulfur, or chlorine. Manganese occurs naturally in most foods and may be added to some foods.

Manganese is used principally in steel production to improve hardness, stiffness, and strength. It may also be used as an additive in gasoline to improve the octane rating of the gas.

What happens to manganese when it enters the environment?

- Manganese can be released to the air, soil, and water from the manufacture, use, and disposal of manganese-based products.
- Manganese cannot break down in the environment. It can only change its form or become attached to or separated from particles.
- In water, manganese tends to attach to particles in the water or settle into the sediment.
- The chemical state of manganese and the type of soil determine how fast it moves through the soil and how much is retained in the soil.
- The manganese-containing gasoline additive may degrade in the environment quickly when exposed to sunlight, releasing manganese.

How might I be exposed to manganese?

- The primary way you can be exposed to manganese is by eating food or manganese-containing nutritional supplements. Vegetarians, who consume foods rich in manganese such as grains, beans and nuts, as well as heavy tea drinkers, may have a higher intake of manganese than the average person.
- Certain occupations like welding or working in a factory where steel is made may increase your chances of being exposed to high levels of manganese.
- Manganese is routinely contained in groundwater, drinking water, and soil at low levels. Drinking water containing manganese or swimming or bathing in water containing manganese may expose you to low levels of this chemical.

How can manganese affect my health?

Manganese is an essential nutrient, and eating a small amount of it each day is important to stay healthy.

The most common health problems in workers exposed to high levels of manganese involve the nervous system. These health effects include behavioral changes and other nervous system effects, which include movements that may become slow and clumsy. This combination of symptoms when sufficiently severe is referred to as "manganism". Other less severe nervous system effects such as slowed hand movements have been observed in some workers exposed to lower concentrations in the work place.

Manganese

CAS # 7439-96-5

Exposure to high levels of manganese in air can cause lung irritation and reproductive effects.

Nervous system and reproductive effects have been observed in animals after high oral doses of manganese.

How likely is manganese to cause cancer?

The EPA concluded that existing scientific information cannot determine whether or not excess manganese can cause cancer.

How can manganese affect children?

Studies in children have suggested that extremely high levels of manganese exposure may produce undesirable effects on brain development, including changes in behavior and decreases in the ability to learn and remember. We do not know for certain that these changes were caused by manganese alone. We do not know if these changes are temporary or permanent. We do not know whether children are more sensitive than adults to the effects of manganese, but there is some indication from experiments in laboratory animals that they may be.

Studies of manganese workers have not found increases in birth defects or low birth weight in their offspring. No birth defects were observed in animals exposed to manganese.

How can families reduce the risk of exposure to manganese?

- Children are not likely to be exposed to harmful amounts of manganese in the diet. However, higher-than-usual amounts of manganese may be absorbed if their diet is low in iron. It is important to provide your child with a well-balanced diet.
- Workers exposed to high levels of airborne manganese in certain occupational settings may accumulate manganese dust on their work clothes. Manganese-contaminated work clothing should be removed before getting into your car or entering your home to help reduce the exposure hazard for yourself and your family.

Is there a medical test to determine whether I've been exposed to manganese?

Several tests are available to measure manganese in blood, urine, hair, or feces. Because manganese is normally present in our body, some is always found in tissues or fluids.

Because excess manganese is usually removed from the body within a few days, past exposures are difficult to measure with common laboratory tests.

Has the federal government made recommendations to protect human health?

The EPA has determined that exposure to manganese in drinking water at concentrations of 1 mg/L for up to 10 days is not expected to cause any adverse effects in a child.

The EPA has established that lifetime exposure to 0.3 mg/L manganese is not expected to cause any adverse effects.

The Food and Drug Administration (FDA) has determined that the manganese concentration in bottled drinking water should not exceed 0.05 mg/L.

The Occupational Health and Safety Administration (OSHA) has established a ceiling limit (concentration that should not be exceeded at any time during exposure) of 5 mg/m^3 for manganese in workplace air.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2012. Toxicological Profile for Manganese. Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636.

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.