ANALAYSIS OF BROWNFIELD CLEANUP ALTERNATIVES
Tanana Community Hall
Tanana, Alaska
January 18, 2019

1.0 INTRODUCTION

This analysis of Brownfield Cleanup Alternatives (ABCA) is intended for use as a screening tool to ensure and document that the appropriate type of cleanup is selected to address environmental contamination at the Tanana Community Hall property in Tanana, Alaska. Selection of the preferred remedial action should consider site characteristics, the surrounding environment, potential future uses and cleanup goals, as well as practical and economic feasibility.

2.0 SITE DESCRIPTION

The Tanana Community Hall site is comprised of a vacant lot at the intersection of First Avenue and Koyukuk street, Lot 7, Block 11, Section 17, Township 4 North Range 22 West, Fairbanks Meridian. The lot is owned by Tozitna, Ltd and is currently used as a parking lot and for outdoor community events.

The subject property has a complicated ownership history but appears to have been conveyed in 1985 under the Alaska Native Claims Settlement Act (ANCSA) to Tozitna, Ltd. (surface estate) and Doyon, Ltd. (subsurface estate). Adjoining properties to the west (Lot 1, Block 10), north (Lot 6, Block 11), and east (Lot 5, Block 11) are owned by the Tanana Tribal Council (TTC). The Alaska Railroad Corporation (ARC) owned Lot 7, Block 11 from at least 1954 until conveyance under ANCSA in 1985. The ARC operated the site as a fueling station for their river barge operation, which was reportedly contracted to Yutana Barge Lines from 1955 to 1975 (Yutana Barge Lines was later acquired by Crowley). A building was located on the site which housed two 2,500-barrel tanks, for storage of Bunker C used in the barges. Contamination was identified at the site by the City of Tanana in 2013 while digging a drainage ditch along the southern boundary of Lot 7, Block 11.

3.0 PREVIOUS INVESTIGATIONS

Following discovery of the soil contamination, The TTC submitted a successful Alaska Department of Environment Conservation (ADEC) Brownfields Assessment and Cleanup (DBAC) application. The issues that were addressed and work completed during previous investigations include the following:

1. ADEC contracted Shannon & Wilson, Inc. (S&W) to prepare a property assessment and cleanup plan (PACP) for the site (Shannon & Wilson, 2015). As part of the PACP, S&W performed historical research, records review, local interviews and a limited field investigation to delineate the extent of contamination. The PACP identified two

recognized environmental conditions: 1) the visible Bunker C contamination layer, and 2) leaks, drips and spills from vehicles.

2. A follow-up assessment further delineating soil contamination, evaluating groundwater impacts, and investigating remnant fuel transfer piping at the site was conducted by Ahtna Engineering Services, LLC (Ahtna) in 2016. The site assessment included the excavation of 14 shallow test pits and the installation of three temporary well points. Soil samples were submitted for analysis of site contaminants of potential concern (COPCs) including benzene, toluene, ethylbenzene, and xylenes (BTEX), diesel range organics (DRO), residual range organics (RRO), polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB) and Resource Conservation and Recovery Act (RCRA) metals. The temporary well points were advanced to groundwater (25 feet below ground surface) and groundwater samples were collected and analyzed for DRO, RRO, BTEX, and PAHs. To delineate the vertical extent of soil contamination, four test pits were excavated within the known area of Bunker C contamination. Additional test pits were excavated to delineate the horizontal extent of contamination, at three locations south of First Avenue, two locations west of Koyukuk Street, and five locations within Lots 7 and 8, Block 11. Bunker C fuel oil contamination was observed in the southern portion of the Lot 7, Block 11 property boundary in a distinct 2 to 6 in thick layer at approximately 0.5 to 1.5 ft bgs. Samples collected directly from the contaminated tar layer had DRO concentrations ranging from 12,400 to 99,500 milligrams per kilogram (mg/kg). Concentrations of RRO ranged from 31,400 to 70,700 mg/kg. No detections of PCBs or RCRA metals above background levels were detected. Groundwater was determined not to be impacted by Bunker C contamination with all analytes, except one, reported as not detected. DRO was detected in a duplicate groundwater sample at an estimated concentration of 0.190 milligrams per liter, below the ADEC groundwater cleanup level (GWCL).

3. In October 2018, Ahtna performed additional sampling and analysis to characterize Bunker C contamination, and suspected hydraulic oil contamination in the northwest corner of the property, for purposes of evaluating disposal options. Toxicity Characteristic Leaching Procedure (TCLP) and Synthetic Precipitation Leaching Procedure (SPLP) analyses were performed for site COPCs to assess leachability of contaminated soils, a requirement for potential landfill disposal. Nine test pits were excavated within the area of Bunker C contamination, and 13 test pits in the area of unknown hydrocarbon contamination. Significant amounts of Bunker C contaminated wood debris were observed in the eastern half of the contaminated area. Analytical soil samples were submitted for DRO, RRO, PAH, BTEX, with TCLP and SPLP preparation for select samples. Wood samples were analyzed for DRO and RRO. Concentrations of DRO and RRO in both contaminated soil and wood timbers exceeded the Solid Waste Disposal Criteria for soil outlined in 18 AAC 60.025. Soil TCLP and SPLP results for DRO exceeded the ADEC GWCLs in 18 AAC 75, and calculated total aromatic hydrocarbons (TAH) and total aqueous hydrocarbons (TAqH) values exceeded the Water Quality Standards in 18 AAC 70. The total volume of contaminated soil for removal was

estimated to be 830 loose cubic yards (CY) and the volume of suspected hydraulic oil contaminated soil was estimated at 105 loose CY, for a total disposal volume of 935 CY of contaminated soil. Bunker C coated timbers were estimated to have a volume of 68 CY.

A remaining data gap exists for the eastern extent of hydraulic oil contamination, however additional characterization is not recommended as the costs of additional investigation would likely outweigh any potential cost savings that could result from a tighter delineation. The cost range included with each alternative should encompass the range of potential volumes of hydraulic oil contaminated soil.

4.0 PROJECT GOALS

The Community Hall and the adjacent property (Lot 7) are considered historically and culturally significant, as they are a gathering spot for many community activities. According to the DBAC application, building a new hall and improving the adjacent parking lot is a community priority. The plans for the property also include a picnic area and cooking area.

5.0 APPLICABLE REGULATIONS AND CLEANUP STANDARDS

The cleanup will be overseen by the Brownfield Program staff within the ADEC Contaminated Sites Program (CSP). The ADEC CSP coordinates with the ADEC Solid Waste Program and the ADEC Air Quality Program to ensure protection of human health and the environment. The site is tracked under the ADEC contaminated site database as File Number 780.57.004 and Hazard ID: 26250.

Cleanup standards for the site are based on the Method Two soil cleanup levels (SCL) for the "Under 40 Inch Zone" from Tables B1 and B2 of 18 AAC 75.341; the SCLs are based on the migration to groundwater pathway. Additional regulations and cleanup standards pertaining to the potential disposal of contaminated soil include Solid Waste Disposal Criteria for soil outlined in 18 AAC 60.025 and Water Quality Standards outlined in 18 AAC 70.

6.0 REMEDIAL ALTERNATIVES

This section identifies the remedial alternatives that may be used to address the soil contamination present at the site. The "No Action Alternative" is used as the baseline against which other alternatives are evaluated. All alternatives will be evaluated with respect to all applicable State and Federal regulations including Chapter 75 of Title 18 of the Alaska Administrative Code (18 AAC 75).

The following broad categories of evaluation criteria were considered in assembling remediation alternatives at the site:

- Overall protectiveness to public health and welfare of the environment.
- Feasibility in achieving site redevelopment.

Rough order of magnitude cost estimates for each alternative (except no action) are presented below. Alternatives 1 through 4 assume the removal of contaminated soil and backfill with clean soil and gravel provided by the City of Tanana. The removal of contaminated soil from the site will effectively achieve site redevelopment goals and allow for unrestricted use. Alternative 5 involves isolating the contaminated soil in place and installing a cap over the contaminated soil area. This alternative may allow for limited site redevelopment, but would prevent unrestricted use of the area.

Following discussions with the City of Tanana, wood timbers separated during the removal action (RA) may be of beneficial use as fuel for their biomass energy program, significantly reducing transport and disposal cost of the estimated 68 CY of wood debris. Each alternative involving removal of soil (all except no action and Alternative 5) assumes wood debris will be segregated during the RA phase using a portable topsoil screener, then processed through the City's "Chomper" firewood processor, and used as fuel in the City's GARN® wood hydronic gasification boilers. The GARN® boilers achieve burn temperatures of 1900 degrees Fahrenheit, ensuring the wood and Bunker C residue will be fully combusted, thereby minimizing air emissions.

6.1 No Action

The "No Action Alternative" is included as a baseline against which the other alternatives are analyzed. This alternative does not address the contamination at the site. Given the current property use as a parking lot and gathering area for outdoor community events, this property would remain both a physical and environmental hazard. There is no cost associated with the no action alternative.

6.2 Disposal in Tanana City Landfill - Alternative #1

The "Disposal in Tanana City Landfill – Alternative #1" involves excavation of the bulk contaminated soil for disposal in a dedicated cell within the Tanana Landfill. This alternative assumes soil would be transferred directly into dump trucks and transferred to the Tanana Landfill, where the soil would be spread and capped with clean material. Under ADEC's solid waste management regulations, 18 AAC 60.025 allows for disposal of contaminated soil in a Class III municipal solid waste landfill if certain conditions are met, including a maximum volume of 500 CY and maximum allowable concentrations of petroleum hydrocarbons. However, DRO and RRO results exceed the maximum allowable concentrations from 18 AAC 60.025(b)(4) and the total volume of soil (estimated at 935 CY) exceeds the maximum volume. Additionally, soil TCLP and SPLP results for DRO exceeded the GWCL, and TAH and TAqH summations exceeded the Water Quality Standards outlined in 18 AAC 70. These leachability characteristics of the soil do not comply with the conditions and requirements in 18 ACC 60.025 (d) and (e). Therefore, local landfill disposal is not a feasible option.

Estimated cost for removal and disposal in the Tanana City Landfill are detailed below for comparison purposes.

Table 1: Disposal in Tanana City Landfill - Alternative #1 Cost Estimate

Item	Task 1 – Work Plan	Task 2 – Removal Action	Task - 3 Disposal, Tanana Landfill	Task 4 - Reporting
Professional Labor	$9,954	$11,368	$1,586	$5,500
Local Site Labor & Equipment	-	$15,810	$1,206	-
Backfill Material	-	$22,500	-	-
Tipping Fee	-	-	$103,785	-
Analytical Cost	-	$19,092		-
ODC	-	$10,282	$10,380	-
Task Totals	$9,954	$79,052	$116,957	$5,500
Project Total - Disposal in Tanana City Landfill				**$211,463**
Contingency: -30% / +50%				**$148,024 to $317,194**

6.3 Offsite Thermal Remediation – Alternative #2

The "Offsite Thermal Remediation" alternative includes excavation of the bulk contaminated soil then offsite transport and disposal via thermal desorption at Organic Incineration Technology, Inc. (OIT) in North Pole, Alaska. Thermal desorption treats contaminated soil by heating bulk soil in the presence of oxygen, effectively removing the contaminants from the soil and burning them. Significant cost savings could be achieved by transporting contaminated soil to OIT via ice road in the winter, as opposed to shipping via barge in summer. This assumes the ground at the site could be maintained in a thawed state using wood shavings or other suitable material for insulation, soil could be removed and directly loaded into 18 CY side dumps for transport to OIT, the ice bridge meets weight restrictions and commercial transport standards for unrestricted roads, and that loading operations could be overseen by a local qualified sampler. Cost and feasibility of this option would involve significant coordination with the City of Tanana, the TTC, the Alaska Department of Transportation & Public Facilities, and other entities. If offsite thermal remediation is selected as the preferred alternative, planning meetings should be held with all stakeholders to identify potential cost saving measures. Estimated costs associated with this option are presented below.

Table 2: Offsite Thermal Remediation – Alternative #2 Cost Estimate

Item	Task 1 – Work Plan	Task 2 – Removal Action	Task - 3 T&D, Offsite Thermal Desorption	Task 4 - Reporting
Professional Labor	$10,891	$15,988	$1,804	$5,500
Local Site Labor & Equipment		$25,072		
Materials		$22,500		
Transport			$190,000	
Treatment Cost			$146,944	
Analytical Cost		$19,092		
ODC		$7,160	$1,530	
Task Totals	$10,891	$$89,812	$340,278	$5,500
Project Total – Offsite Thermal Remediation				**$446,481**
Contingency: -30% / +50%				**$312,536 to $669,721**

If trucking via the ice road is not a feasible option, alternative removal and transport options may be evaluated, including transport via barge. Contaminated soil would be placed into 1 CY supersacks; increasing time and cost associated with the RA and T&D. Supersacks would be transported via barge to Nenana, then trucked to OIT for treatment. This option would result in an cost increase of roughly $300,000.

The offsite thermal remediation alternative is protective of public health and welfare of the environment. It has the advantage of being practically feasible and could be completed in a single season. The removal of contaminated soil from the site would achieve site redevelopment goals and allow for unrestricted use. It is proven technology and does not present ongoing risk of exposure during remediation. Disadvantages of this alternative include the high cost and large carbon footprint associated with transport and thermal remediation. Potential cost savings by segregating hydraulic oil contaminated soil for landfarming, and sending the Bunker C soil to OIT for thermal treatment would be offset by cost associated with landfarm construction and OM&M activities (see Alternative 3).

6.4 Landfarming – Alternative #3

The "Landfarming Alternative" includes excavation of bulk contaminated soil, and treatment via landfarming at a suitable local site. This alternative assumes a suitable local site could be identified by the community, and use of the site be provided at no cost to the project. Landfarming treats contaminated soil through a combination of physical and biological processes by spreading it in a thin layer (1 foot in depth), tilling regularly and augmenting it with fertilizer as needed. However, treatment effectiveness of Bunker C contaminated soil may be limited due to the recalcitrant nature of Bunker C. Bioavailability concerns could potentially be addressed by dilution and application of surfactants and/or oleophilic fertilizer. In order to increase the likelihood of bioremediation effectiveness, a bench-scale treatability study using site-specific conditions and soil is recommended. The treatability study would likely require a two-year time frame. A rough estimate of treatability study costs is included as Task 2.

This alternative assumes soil would be excavated and transferred directly into dump trucks and transferred to the local treatment site of approximately 24,500 square feet. Cost listed under Task 3 also include the RA reporting.

Cost associated with landfarm construction (including 20 mil liner, 6-inch sacrificial fill layer over the liner, and leachate treatment system), annual operations, maintenance, and monitoring (OM&M), and a final closure report are included as additional tasks. Annual OM&M activities include nutrient testing and fertilizer application, weekly tilling during a six-month season, and one progress sampling event. Total cost associated with the landfarming remedial alternative assumes a three-year operational schedule, followed by a closure assessment using incremental sampling methodology (ISM).

Table 3: Landfarming – Alternative #3 Cost Estimate

Item	Task 1 – Work Plan	Task 2 – Treatability Study	Task 3 – Removal Action & RA Report	Task 4 – Landfarm Construction	Task 5 – OM&M (1 year)	Task 6 – Closure Assessment
Professional Labor	$13,022	$24,728	$14,208	$3,750	$10,226	$15,744
Local Site Labor & Equipment			$15,810	$2,612	$16,900	
Materials			$22,500	$31,610	$240	
Analytical Cost		$12,000	$19,092		$1,860	$3,500
ODC		$1,595	$10,282	$4,823	$3,222	$2,222
Task Totals	$13,022	$38,323	$81,892	$42,795	$32,448	$21,466
Project Total – Landfarming (includes 3 years of OM&M)						**$294,843**
Contingency: -30% / +50%						**$206,390 to $442,265**

Assuming a suitable local treatment site could be identified, this alternative would immediately achieve reuse goals for the project site. The removal of contaminated soil from the site would allow for unrestricted use. Overall protectiveness of public health and the welfare of the environment would be contingent on the effectiveness of the landfarming treatment. This is why a treatability study is recommended.

6.5 Bioremediation– Alternative #4

The "Bioremediation Alternative" includes a combination of mycoremediation (fungi-based soil remediation) and phytoremediation (plant-based soil remediation) for a passive but carefully design and monitored bioremediation approach. White-rot fungi (e.g. oyster mushrooms) have been demonstrated to effectively degrade petroleum hydrocarbons, and may in fact be more effective at degrading heavy hydrocarbons than bacteria. White-rot fungi create enzymes for breaking down the long-chain lignin molecules of wood; these same enzymes can be effective at breaking down long-chain petroleum compounds present in Bunker C. However, due to the limited research and few applications of this approach in a sub-arctic climate, a bench-scale treatability study using site-specific conditions and soil is recommended. A rough estimate of treatability study costs is included as Task 2.

If deemed feasible, mycoremediation would be implemented first, by growing white-rot fungi on wood chips or sawdust, then mixing an adequate amount of this "spawn" with additional wood chips and contaminated soil in a lined containment area. Soil amendments would be added upon mixing as needed. Wood chips would be obtained locally. Following mycoremediation, the treatment plot would be planted with a suitable mix of non-invasive plant species determined to promote further biodegradation of hydrocarbons contaminants in the root-zone (a form of phytoremediation). Additional soil amendments would be added as needed and the plot irrigated to promote the establishment of a healthy plant cover. Phytoremediation progress would be monitored into the future.

The cost estimate includes an estimate for a treatability study, and assumes relocation of soil to a suitable local treatment site, a 20-mil bottom liner, initiation of mycoremediation/

phytoremediation treatment, and routine monitoring events. It also includes an estimate for final assessment and closure. Total project cost for the bioremediation alternative assumes 10 years for treatment, with approximately one OM&M event every three years. The treatability study would likely require a two-year time frame.

Table 4: Bioremediation– Alternative #4 Cost Estimate

Item	Task 1 – Work Plan	Task 2 – Treatability Study	Task 3 – Removal Action & RA Report	Task 4 – Biocell Construction	Task 5 – OM&M (1 year)	Task 6 – Closure Assessment
Professional Labor	$13,022	$47,768	$14,208	$4,462	$5,558	$15,744
Local Site Labor & Equipment			$15,810	$5,324		
Materials			$22,500	$31,080	$1,000	
Analytical Cost		$20,000	$19,092	$3,500	$1,860	$3,500
ODC		$2,331	$10,282	$5116	$754	$2,222
Task Totals	$13,022	$70,099	$81,892	$42,795	$32,448	$21,466
Project Total – Bioremediation (Assumes 10 years for treatment, 3 OM&Ms)						**$263,480**
Contingency: -30% / +50%						**$184,436 to $395,220**

Assuming a suitable local treatment site could be identified, this alternative would immediately achieve reuse goals for the project site. The removal of contaminated soil from the site will allow for unrestricted use. Overall protectiveness of public health and the welfare of the environment would be contingent on the effectiveness of the bioremediation treatment. This is why a treatability study is recommended.

6.6 Capping– Alternative #5

The capping remedial alternative involves placing an impermeable barrier (i.e., asphalt, concrete, or geomembrane layer), also called a “cap”, over the contaminated soil area. Caps do not degrade or remove contaminants; instead, they isolate them and keep them in place to avoid the spread of contamination. Capping primarily precludes direct contact by acting as a barrier between a receptor (i.e., humans and wildlife) and the contaminated soil below; it also prevents vertical contaminant migration by stopping rain and snowmelt from seeping through the contaminated layer.

Considering the proposed future re-use of the property as a parking lot or foundation for a new building, capping could be a potential alternative. The advantage of capping is that it is a relatively low-cost method that could achieve reuse goals for the site. Design of the cap would be instrumental in determining compatibility with reuse goals such as picnic areas or other green space. The disadvantage is that even appropriately designed and constructed caps only provide for a short term, limited control of exposure to contamination; no actual remediation takes place. Adequacy of post-closure funding and regulatory oversight may be limited, presenting further disadvantage.

Long-term monitoring and maintenance of the cap is required, as well as five-year reviews per EPA requirements. Funds for the maintenance of the cap are typically only assured for 30 years, and may not be adequate to replace the cap should significant deterioration take place. The ADEC may have limited means for committing brownfields funding for longer than 1 year. Institutional controls (i.e., deed restrictions) will be required. Even with deed restrictions that are intended to prevent future property owners/users from disrupting the integrity of the cap, there is little assurance that future problems due to site activities will not occur.

Community acceptance should be the driving factor to take into consideration, especially for this alternative. If deemed acceptable by the community, cost estimates should be prepared by an experienced engineer knowledgeable in arctic construction and design of structural cap types. Evaluation of cost would include engineering design and construction cost, long-term OM&M activities and repairs of the cap, required site visits and reporting obligations including protectiveness evaluations (EPA required five-year reviews).

7.0 PREFERRED REMEDIAL ALTERNATIVE

Remedial alternatives were evaluated based on protection of public health, safety, welfare of the environment and feasibility in achieving site reuse. All remedial alternatives considered, except no action and capping (Alternative 5), effectively remove the risk to public health and safety by moving contaminated soil offsite. These considered alternatives achieve the same level of site reusability. Alternative 5 may achieve site reuse under a fairly wide range or reuse scenarios but this alternative does not entirely remove the risk to public health and safety.

Include preferred remedial action summary following comment resolution period with ADEC and ABCA process.

8.0 REFERENCES

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