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TECHNICAL MEMORANDUM

DATE: March 31, 2016

TO: Mr. Nnamdi Madakor, Washington State Department of Ecology

CC: Mr. Change Moon, North City Texaco
Mr. Gary East, Attorney at Law
Mr. Rosendo Valenzuela, Seattle Gourmet Coffee

FROM: Ms. Tena Seeds, P.E.

RE: Focused Feasibility Study Amendment
Aloha Texaco (North City Texaco)
17563 15th Avenue NE, Shoreline, Washington
Colony Claim No. 019600001753C

This Technical Memorandum will serve as an amendment to the *Focused Feasibility Study* (FFS) dated January 28, 2016 for the Aloha Texaco site at 17563 15th Avenue NE in Shoreline, Washington (Site). The results of the FFS indicate that Alternative 1, which consists of implementing institutional controls and maintaining the existing cap, is the preferred remedial action for the Site.

In a letter dated February 7, 2016, the Washington State Department of Ecology (Ecology) provided comments to the FFS indicating that the cost allocated for Alternative 1 should include periodic vapor intrusion (VI) monitoring at the Site as part of the containment remedy, and that all of the alternatives should be re-evaluated and the FFS resubmitted. In response to Ecology's comments, this FFS amendment presents revised information pertaining to Alternative 1 in lieu of submitting a fully revised FFS report. The information provided herein includes the following:

- A revised description for Alternative 1 (FFS Section 9.2.1);
- A revised Remedial Alternatives Cost Summary table (FFS Section 10.8);
- A revised Disproportionate Cost Analysis (FFS Section 10.9); and
- A revised Order-of-Magnitude Cost Estimate for Alternative 1 (FFS Table 7).

It is EPI's opinion that the inclusion of periodic VI monitoring does not affect the scoring of Alternative 1. Therefore, it is not necessary to re-evaluate the alternatives or revise Table 6 of the FFS at this time (Remedial Alternatives Evaluation).

Alternative 1 (Revised) – Institutional Controls, Maintain Cap, and Periodic VI Monitoring

This remedial alternative consists of implementing an Environmental Covenant (EC) for the Site and maintaining the existing surface cap (asphalt and concrete). The protective concrete and asphalt pavement will continue to isolate the residual soil contaminants from human contact while total petroleum hydrocarbon concentrations continue to exceed the Site-specific cleanup level (CUL). The impacted soil would remain in place beneath the existing cap, while an EC would restrict certain specific uses of the Site, such as redevelopment for residential purposes, and would include an inspection and maintenance plan for the cap to prevent direct contact exposures to Site workers.

This alternative, and presumably the EC, would also include provisions for periodic VI monitoring while the cap is maintained. This would be necessary for verifying that concentrations of petroleum-related compounds in sub-slab vapors and indoor air do not deviate from background concentrations while the Site continues to operate as an active gas station.

It is assumed that periodic VI monitoring would be performed on an annual basis and would include collection and analysis of sub-slab vapor samples from the previously-installed vapor monitoring ports in the building's floor, collection and analysis of an indoor air sample from within the station building, and collection and analysis of an ambient air sample from outside the building. All samples would be collected into Summa canisters over a period of 8 hours and analyzed by the laboratory for air-phase petroleum hydrocarbons (APH) and volatile organic compounds (VOCs). The data would be evaluated to determine if vapor intrusion has occurred and also to assess whether concentrations of naphthalene and other compounds are present in indoor air above the remediation levels (RELs).

Should the VI monitoring indicate that sub-slab vapors pose a potential threat to indoor air quality, appropriate action will be taken to mitigate the threat. Such action(s) would be identified in a Contingency Plan as part of the *Corrective Action Plan* (CAP) for the Site. It should be noted that, regardless of the VI pathway, indoor air quality within the gas station building will likely continue to be affected by ambient conditions as long as fueling operations continue on the property.

The EC will apply to both parcels that contain soil contaminant concentrations above the Site-specific CUL. This includes the Aloha Texaco gas station property and the North City Plaza property to the south. The Environmental Covenant would also include deed notifications to inform future property owners of the presence of soil contaminants. It is assumed that implementation of this remedial alternative would also include preparation and submittal of a *Cleanup Action Report*.

If implemented, this remedy may need to be altered in the future if redevelopment of one or both of the affected properties were desired.

Remedial Alternatives Cost Summary (Revised)

The order-of-magnitude remediation costs estimated for Alternative 1 have been revised to include periodic VI monitoring at the Site. Previously estimated order-of-magnitude costs for Alternative 1, without periodic VI monitoring, totaled approximately $81,000. The revised estimated costs, which assume 10 annual VI monitoring events and associated data evaluation and reporting, total approximately $134,000. A discount rate of 7 percent was used to adjust the 10-year total of estimated VI monitoring costs to a net present value. A detailed analysis of these costs is provided in the revised Table 7, which is attached to this memorandum.

The following table presents a summary of the estimated order-of-magnitude costs for each of the remedial alternatives evaluated in the FFS. These costs are for comparison purposes only and actual implementation costs will vary from those provided below. These estimated costs incorporate a variety of necessary assumptions and the validity of those assumptions cannot be fully known at this time.

Remedial Alternative	Order-of-Magnitude Remediation Cost Estimate[a]
1. Institutional Controls, Maintain Cap, and Periodic VI Monitoring	$ 134,000
2. Focused Soil Removal	$ 323,000
3. Full Soil Removal	$ 885,000
4. Soil Vapor Extraction	$ 344,000

[a]Estimates include net present value (7 percent discount rate) of recurring and future costs.

As indicated in the above table, the revised total estimated cost for Alternative 1 is still lower than the estimated costs for all of the other remedial alternatives.

Disproportionate Cost Analysis (Revised)

As discussed in Section 10 of the FFS and in accordance with the Model Toxics Control Act (MTCA), each alternative was evaluated relative to the following criteria and subcriteria specified in WAC 173-340-360(3)(f) and WAC 173-340-360(4):

- Protectiveness;
- Permanence;
- Effectiveness over the long term;
- Management of short-term risks;
- Technical and administrative implementability;
- Consideration of public concerns;
- Restoration time frame;
- Consideration of public concerns; and
- Cost.

Each alternative was assigned a score for each evaluation criterion, with a score of 10 representing the highest overall perceived benefit and a score of 1 representing the lowest overall perceived benefit. Those scores were presented in Table 6 of the FFS.

Under WAC 173-340-360(3)(e), a cleanup action shall not be considered practicable "*if the incremental cost of the alternative over that of a lower cost alternative exceeds the incremental degree of benefits achieved by the alternative over that of the other lower cost alternative*". The determination of practicability is made using an analysis of benefit versus cost. The disproportionate cost analysis (DCA) can be performed quantitatively using the judged scoring of the non-cost criteria as the net benefit.

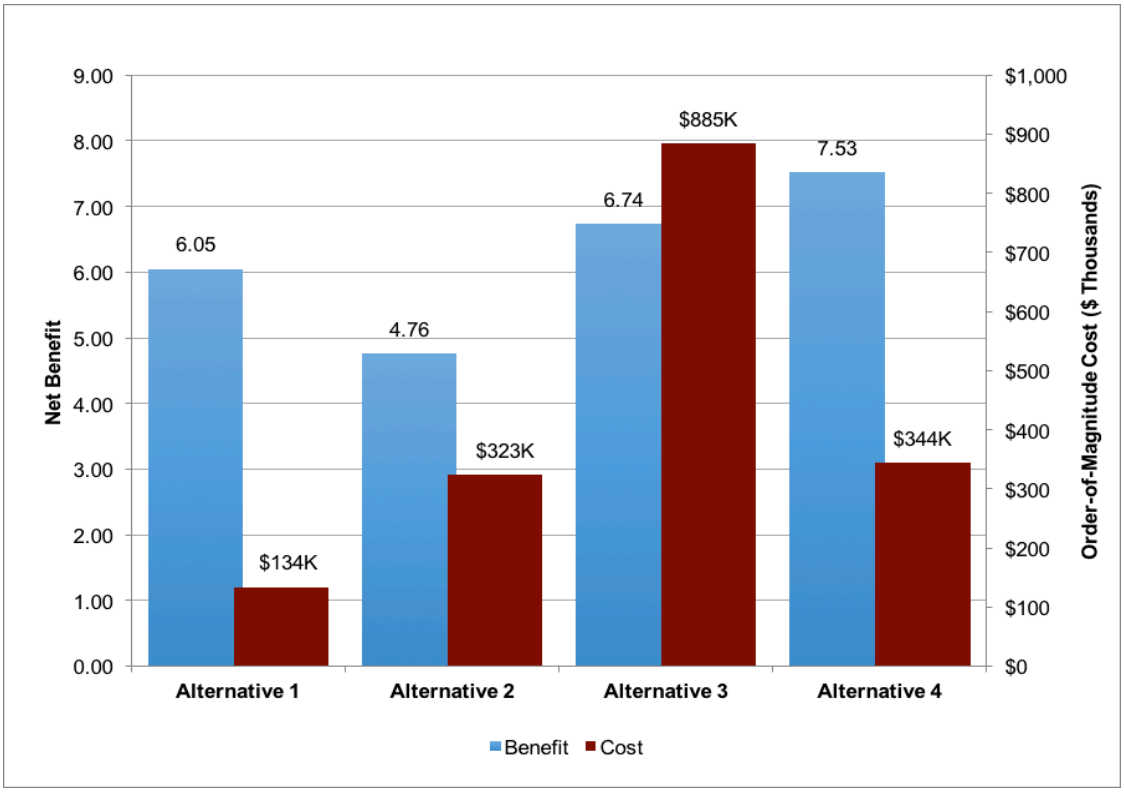
The raw scores that were assigned in Table 6 are summarized below and are weighted for each criterion according to weighting factors established by Ecology. The sum of the individual weighted scores for each alternative represents a value of the overall benefit of the alternative.

Remedial Alternatives Scoring Summary

Criteria *(Weighting Factor)*	**Alternative 1**		**Alternative 2**		**Alternative 3**		**Alternative 4**	
	Rank	**Value**	**Rank**	**Value**	**Rank**	**Value**	**Rank**	**Value**
Protectiveness *(0.3)*	4.8	1.44	7.0	2.10	10	3.00	7.8	2.34
Permanence *(0.2)*	4.7	0.94	5.3	1.06	7.3	1.46	7.3	1.46
Long-Term Effectiveness *(0.2)*	5.0	1.00	4.5	0.90	8.3	1.66	8.3	1.66
Short-Term Risk *(0.1)*	10.0	1.00	2.5	0.25	1.5	0.15	7.5	0.75
Implementability *(0.1)*	9.7	0.97	3.5	0.35	3.7	0.37	7.2	0.72
Public Concerns *(0.1)*	7.0	0.70	1.0	0.10	1.0	0.10	6.0	0.60
BENEFIT VALUE	6.05		4.76		6.74		7.53	

The chart below presents the DCA using the estimated order-of-magnitude costs and quantitative net benefit values.

Cost-to-Benefit Analysis



Conclusion and Recommendation

Based upon the FFS and as amended herein, Alternative 1 still appears to best meet the MTCA criteria for selection of a remedial action. This approach complies with applicable regulations, is protective of human health and the environment, is reasonably practicable, and can be readily implemented at the Site to effectively prevent exposures to residual soil contaminants. Based on the revised DCA, Alternative 1 still provides the best cost-to-benefit ratio of the available alternatives.

Alternative 4 (implementation of SVE to actively treat impacted soil) has the highest perceived benefit of all the alternatives, but its cost would be more than 2.5 times that of Alternative 1. The cost to implement Alternative 2 would be similar to that of Alternative 4, but its perceived benefit is lowest of the alternatives and would likely be the most complex to implement. Alternative 3 has the second highest perceived benefit, but its high cost to implement significantly outweighs any incremental increase in benefit that it provides. Overall, the lower cost-to-benefit ratio of Alternative 1, which is at least 2 to 6 times lower than the cost-to-benefit ratios of the other alternatives, makes it the most preferred remedial option for addressing residual contaminants at the Site.

Attachments

Table 7 – Revised Order-of-Magnitude Cost Estimate, Alternative 1

Table 7
Revised Order-of-Magnitude Cost Estimate
Alternative 1 - Institutional Controls, Maintain Cap, and Periodic VI Monitoirng
Aloha Texaco (North City Texaco)
17563 15th Avenue NE, Shoreline, WA

Task	Component	Units	Basis	Unit Cost	Subtotal	Professional Labor	Component Subtotal	Task Subtotal
Implement Institutional Controls								
	Implement Environmental Covenant with Cap Inspection & Maintenance Plan	1	LS			$ 10,000	$ 10,000	
	Interactions with Agencies and Property Owners	1	LS			$ 1,500	$ 1,500	
	Cleanup Action Report	1	LS			$ 13,000	$ 13,000	
	Administrative Maintenance	1	LS			$ 1,000	$ 1,000	***$ 25,500***
Maintain Surface Cap								
	Surface Cap Inspections (10 years)							
	Quarterly Site Visits (per year)	4	visits	$ 250	$ 1,000	$ 2,000	$ 3,000	
	Annual Monitoring/Inspection Subtotal						$ 3,000	
	Net Present Value (10 years, 7% discount)[a]						*$ 21,100*	
	Asphalt Maintenance							
	Asphalt Sealcoat (Years 1, 5, and 10)	3,200	SF	$ 0.50	$ 1,600	$ 2,000	$ 3,600	
	Net Present Value (years 1, 5 & 10, 7% discount)[a]						*$ 8,000*	
	Concrete Maintenance							
	Concrete Replacement (Year 5)	3,500	SF	$ 10	$ 35,000	$ 2,000	$ 37,000	
	Net Present Value (year 5, 7% discount)[a]						*$ 26,400*	***$ 55,500***
Periodic Vapor Intrusion Monitoring								
	Annual Vapor Sampling (10 years)							
	Vapor Sampling Event	1	event	$ 3,800	$ 3,800		$ 3,800	
	Vapor Analytical Cost	1	event	$ 1,600	$ 1,600		$ 1,600	
	Data Evaluation & Reporting	1	year	$ 2,200	$ 2,200		$ 2,200	
	Annual Vapor Intrusion Monitoring Subtotal						$ 7,600	
	Net Present Value (10 years, 7% discount)[a]						*$ 53,400*	***$ 53,400***
PROJECT TOTAL								**$ 134,000**

Notes:

LS Lump sum
SF Square feet

a Net Present Value based on Annual or Multi-Year Discount Factors published in *Guide to Developing and Documenting Cost Estimates During the Feasibility Study* (USACE/USEPA, July 2000).

- Annual Discount Factor at 7% = 1÷1.07t, where t = year that future cost is incurred.
- Multi-Year Discount Factor at 7% = [1.07n-1]÷[0.7(1.07)n], where n = number of years that future costs are incurred.