

October 25, 2016

Mr. Mark Detterman  
Senior Hazardous Materials Specialist, PG, CEG  
Alameda County Environmental Health  
1131 Harbor Bay Parkway  
Alameda, CA 94502

**RECEIVED**

By Alameda County Environmental Health 1:21 pm, Dec 15, 2016

Re: Alameda County Letter dated December 7, 2015  
Request for Corrective Action Plan Addendum  
2103 San Pablo Ave  
Oakland, CA 94608  
Fuel Leak Case No. RO000074  
Geotracker Global ID T0600100666

Dear Mr. Detterman:

Green Star Environmental, (Green Star) on behalf of Greyhound Lines, Inc., (Greyhound) has reviewed the above referenced letter from the Alameda County Environmental Health (ACEH) Department. In the letter, the ACEH requested that additional information be submitted as an addendum to support a Feasibility Study (FS) and Corrective Action Plan (CAP) to remediate elevated concentrations of petroleum hydrocarbons at the above referenced address (Site). In January and February of this year, Green Star tried to clarify the ACEH request, however, as a response has not been received, this letter is to provide the requested addendum.

In the FS/CAP, surfactant enhanced In-Situ Chemical Oxidation (ISCO) via the injection of a blend of surfactants and oxidizing reagents was identified as the most effective remediation treatment. In the letter, the ACEH has expressed concern over the ability of existing and proposed monitoring wells at the Site to control the migration of potentially mobilized elevated concentrations of dissolved hydrocarbons and/or phase separated hydrocarbons (PSH) and recommended that pilot testing be performed at the Site. Additionally, the letter requested estimated costs for each remediation technology assessed and reiterated the need to collect additional shallow soil samples from the Site to obtain closure under the Low Threat Closure Policy (LTCP).

In order to address the ACEH's concerns, the following letter will serve as an addendum to the FS/CAP dated October 9, 2015. In this addendum, Green Star is proposing an aquifer pumping test, an injection pilot test, and additional soil sampling at the Site. Additionally, Green Star will provide general costs estimated for each remediation technology identified in the FS/CAP.

## **BACKGROUND**

The Site has been developed as a bus terminal since 1929. Six, out-of-service underground storage tanks (USTs) were removed from the Site in April 1990. The USTs were reportedly out of use for at least two decades prior to their removal. Subsurface investigations between 1989 and 1997 indicated that petroleum hydrocarbon impacts, including phase-separated hydrocarbons (PSH), were present in soils and groundwater at the Site. The groundwater gradient at the Site has historically been a radial pattern near the former tank area with flow to

the west-southwest and to the northwest.

Between October 20 and 22, 2010, Green Star advanced twelve additional soil borings at the Site in order to further evaluate subsurface conditions in the area of the former USTs. To document current groundwater conditions, Green Star began conducting groundwater monitoring events in September 2008 and most recently in August 2016 using the network of 13 wells at the Site.

In March 1991, approximately 714 tons of stockpiled, tankhold-related soils were removed from the Site and treated via solidification/stabilization processes at Gibson Oil Refinery in Bakersfield, California. It was reported by a previous consultant that soils treated by Gibson were typically utilized as road base material. This indicates that the excavated tankpit was backfilled with imported fill and not the existing, contaminated stockpiles.

A groundwater remediation system was operated from 1992 to 1997 to recover phase-separated hydrocarbons (PSH) and dissolved-phase impacts in groundwater utilizing total-fluid recovery pumps in four, four-inch diameter wells (ES-1, ES-5, BC-1 and ES-2). The recovered fluids were treated with an oil/water separator and activated carbon absorption columns prior to the permitted discharge to the sanitary sewer. Data indicate that the system was effective as PSH greater than 0.1-foot has not been detected since 1995.

### **Proposed Aquifer Pumping Test**

The ACEH has expressed concerns about the ability of existing groundwater monitoring wells and newly proposed monitoring wells at the Site to adequately capture and remove potentially liberated PSH and dissolved phase contaminants during remediation activities and to mitigate the potential for migration of contaminants off the Site. Therefore, Green Star is proposing an aquifer pumping test to evaluate the subsurface groundwater system at the Site.

Prior to the aquifer pumping test, the two monitoring points proposed in the FS/CAP, MP-1 and MP-2, as well as four of the proposed permanent injection points will be installed at the Site. The proposed monitoring points MP-1 and MP-2 will be installed as 4-inch diameter wells in order to provide the most accurate representation of the subsurface aquifer as well as to increase the pumping capacity of each monitoring point in the event they must be used as extraction or mitigation wells during remediation activities. One well (either MP-1 or MP-2) will be selected as the pumping well. The Site's existing groundwater monitoring wells and the four new permanent injection points selected for installation will serve as observation points within the radius of the pumping well. The aquifer pumping test will be designed to determine the wells ability to recover fluids by measuring parameters such as well yield, radius of influence, hydraulic conductivity, specific capacity, transmissivity, storativity, and well efficiency. Green Star will record monitoring well fluid levels during and after the test from the various wells and the total volume of recovered liquids.

The pumping test will be conducted for period of up to 12 hours at an anticipated pumping rate of approximately two gallons per minute. Therefore, over a 12-hour period, a total of approximately 1,440 gallons of fluids will be removed and require disposal.

Water removed during the pilot test will be stored in either a tank or one or more vacuum transport trucks. The fluids will be transported and disposed of off-site at a Greyhound approved permitted facility.



Data obtained as part of the pumping test as well as any field observations of PSH if any will be submitted to the ACEH under a separate letter following conclusion of the aquifer pumping test.

### **Proposed Injection Pilot Test**

As per ACEH recommendation, Green Star would like to propose a small scale injection pilot test of <1,000 gallons of injection fluid at the Site. The injection pilot test would serve to evaluate the effectiveness of the injection in a small localized area while minimizing the potential risk for off-site contaminant migration. The injection fluid will be administered via the four permanent injections points selected for installation during the aquifer pumping test.

The Injection will be conducted at low pressures and flow rates and will be designed to determine the capacity of the formation at the Site to accept the injection fluid and if mobilization of PSH is observed. The newly installed monitoring points, MP-1 and MP-2, as well as existing adjacent monitoring wells across the Site will serve as observation points during the injection pilot test. Each observation point will be periodically gauged for water level and the presence of PSH. Additionally, a field sample from each monitoring point will be field screened for pH and ORP. The pH and ORP data will be recorded and used to help determine a radius of influence of injection.

If PSH is observed in any observation point during the injection pilot test, injection in the area will stop immediately and the PSH will be removed by pumping fluid from the affected well until such time PSH is no longer observed. The PSH and fluids extracted will be stored in either a tank or one or more vacuum transport trucks. The fluids will be transported and disposed of at a Greyhound approved permitted facility.

Please note that PSH has not been observed at the site since 1995, therefore, it is not expected to be observed during the pilot test. However, the contingencies listed will be followed in order to control potential PSH that in theory could be mobilized from the vadose zone. As such, direct observation of potential PSH will be used to determine if extraction of injection fluids from the ground is warranted.

### **Proposed Additional Soil Sampling**

The ACEH has reiterated in their letter dated December 7, 2015 that in order to obtain closure at the Site under the LTCP criteria for Vapor Intrusion and Direct Contact to Outdoor Air, additional soil samples would need to be obtained from the Site. Therefore, Green Star will use the opportunity of drilling and installation of MP-1, MP-2, and the permanent injections point to gather additional soil data from the Site in the 0-5 and 5-10 feet below ground surface range. The soil samples will be collected and analyzed to allow a comparison to Low Threat Closure Policy (LTCP) criteria for the Vapor Intrusion and the Direct Contact and Outdoor Air criterions. Additional soil samples will be collected from deeper intervals in MP-1 and MP-2 to validate vertical and lateral delineation of soil impacts. Since a drill rig will be necessary to install MP-1, MP-2, and the permanent injection points, Green Star will also use this opportunity to collect the shallow soil samples from the areas of previous and current dispensers as proposed in the FS/CAP.

### **Cost Evaluation of Remediation Technologies**

The ACEH has requested that a cost evaluation be presented for the remediation technologies evaluated for the Site as part of the FS/ CAP. Green Star evaluated excavation, combination pump and treat and soil vapor extraction, and surfactant enhanced ISCO as possible remediation methods for the Site. The following are general costs estimated for each remediation technology identified in the FS/CAP. However, please note that final costs cannot



be determined until such time the pilot testing is completed. The estimates provided in this addendum are therefore based on Green Star's past experiences working with the same or similar remediation technologies at various other sites.

**Option 1 – Excavation:** The first remediation method evaluated was excavation of the impacted soils at the Site. However, as previously discussed in the FS/CAP, due to the Site being an active bus terminal, the proximity of the presumed secondary source material in the former tank pit to the terminal building and traffic lanes of Castro Street, and the depth of the petroleum hydrocarbon impacted soil (10 feet bgs to water table), excavation of the secondary source material is not deemed feasible. Therefore, no additional cost analysis has been completed for this remediation option.

**Option 2 – Pump & Treat with Soil Vapor Extraction.** Green Star also evaluated a combination pump-and-treat and vapor extraction system to remediate the Site. As discussed in the FS/CAP, pump-and-treat systems are most effective for the treatment and reduction of PSH present on groundwater and have far more limited effectiveness in treating dissolved phase groundwater impacts because they ultimately do not directly address the source of the contamination. Additionally, soil vapor extraction (SVE) as a treatment for soil contaminants would also be limited in its effectiveness. Typically, residual petroleum impacts are difficult to treat since older impact plumes often include the heavier constituents of petroleum hydrocarbons and are not easily volatilized or naturally attenuated. This can result in longer remediation timeframes (5-10 years or more) for remediation to achieve the identified clean up goals for the Site. Continuous groundwater monitoring would inevitably have to be done in this time period, as well as post remediation monitoring until closure is achieved. While possible to remediate the Site by this combination of methods, due to the inherent lack of efficiency, the extended time needed to remediate the site, the necessity of long term operating and maintenance costs associated with such a system, and the need for continuous groundwater monitoring for the remediation period, costs associated with this remediation method are high. Given a realistic 7-year remediation period, Green Star would estimate the costs of this remediation method to be approximately \$750,000.00. A more detailed breakdown of the cost estimate is provided on the attached Table 1.

**Option 3 –Surfactant Enhanced In Situ Chemical Oxidation.** Green Star ultimately evaluated and recommended surfactant enhanced ISCO treatment of the secondary source material consisting of petroleum hydrocarbon impacted soils remaining within the former tankpit. As discussed in the FS/CAP, Green Star has previous experience successfully remediating similar sites via this remediation method primarily due to its ability to achieve direct destruction of the source contaminants. This results in greatly reduced remediation treatment times to achieve cleanup goals under the SWRCB LCTP and would greatly reduce the remaining natural attenuation time of observable impacts to meet SFRWQCB Basin Plan ESLs for commercial/industrial sites versus the previous remediation method discussed. The reduced remediation treatment time also reduces the number of groundwater monitoring events necessary both during and following remediation treatment. Therefore, the reduced treatment and monitoring time period makes surfactant enhanced ISCO the most cost effective option to remediate the Site. Green Star estimates that remediation via surfactant enhanced ISCO can be achieved within two years at an estimated cost of \$372,000.00. A more detailed breakdown of the cost estimate is provided on the attached Table 1.



**Summary**

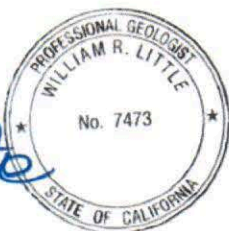
The proposed aquifer pumping test, injection pilot test, and additional soil sampling outlined in this FS/CAP Addendum will provide Green Star and the ACEH with the necessary additional data to determine the feasibility of the CAP and remediation of the site. Should you have any questions or comments regarding this FS/CAP Addendum, please do not hesitate to call one of the undersigned at (214) 222-8752.

Sincerely,

**GREEN STAR ENVIRONMENTAL**



Terrance Harriman  
Project Manager

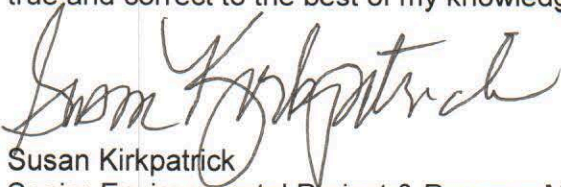


William R. Little  
Senior Project Geologist  
California Professional Geologist No. 7473



Leonard Albright  
Principal

I declare, under penalty of perjury, that the information and/or recommendations contained in the above Feasibility Study/Corrective Action Plan Addendum letter dated October 25, 2016 are true and correct to the best of my knowledge.



Susan Kirkpatrick  
Senior Environmental Project & Program Manager  
FirstGroup America, Inc.  
600 Vine Street  
Cincinnati, OH 45202

Attachment – Table 1 - Cost Evaluation Summary

cc: Susan Kirkpatrick, Sr. Environmental Project & Program Manager, FirstGroup America



**Table 1 - Cost Evaluation Summary**

Greyhound Lines, Inc.  
2103 San Pablo Avenue  
Oakland, CA

**Option 1 - Excavation**

Item	Description/Requirement	Excavation		
		Scope	Duration	Cost
1	Design/Bidding/Contracting	This option was deemed to be not feasible due to safety issues and the need to shut the facility down, address utilities in the excavation area, and shoring of the excavation by Castro Street and the building. Therefore, no further cost evaluation was conducted.	NA	NA
2	Shoring Design - Building and Street			
3	Utility Issues			
4	Permitting			
5	Excavation/Backfilling			
6	Post Remediation Sampling/Monitoring			
<b>TOTALS</b>			<b>NA</b>	<b>NA</b>

**Option 2 - Pump & Treat with Soil Vapor Extraction**

Item	Description/Requirement	Pump & Treat with Soil Vapor Extraction		
		Scope	Duration	Cost
1	CAP Design/Equipment Bidding	Design system and spec equip.	3 months	\$ 10,000.00
2	Pilot Testing	P&T and SVE	3 months	\$ 30,000.00
3	Permitting - Discharge and Emissions	Permitting applicable agency	6 months	\$ 10,000.00
4	Equipment Procurement	Bid and Procure Equipment		\$ 125,000.00
5	System Installation	Install trenches, piping, equipment	1 Month	\$ 95,000.00
6	Operations and Maintenance	Maintain and sample system	5 Years (estimated)	\$ 250,000.00
7	Groundwater Monitoring/Remediation	Sample semi annually		\$ 130,000.00
8	System Decommissioning	Removed equipment/piping	1 Month	\$ 40,000.00
9	Post Remediation Monitoring	1 Year Quarterly monitoring	1 year	\$ 40,000.00
10	Well Plugging & Abandonment		1 Month	\$ 20,000.00
<b>TOTALS</b>			<b>7 Years +/-</b>	<b>\$ 750,000.00</b>

**Option 3 - Surfactant Enhanced ISCO**

Item	Description/Requirement	Surfactant Enhanced ISCO		
		Scope	Duration	Cost
1	Pilot Testing	As proposed in this addendum	3 months	\$ 50,000.00
2	Permitting	Injection Permit	3 months	\$ 8,000.00
3	Implementation of ISCO	Injection Points/Field implementation	3-6 months	\$ 250,000.00
4	Shallow Soil Sampling/Vapor Intrusion	Soil sampling by dispensers	Included	\$ 12,000.00
5	Post Remediation Monitoring	Quarterly for 1 year	1 Year	\$ 40,000.00
6	Well Plugging & Abandonment		2 Months	\$ 20,000.00
<b>TOTALS</b>			<b>2 Years +/-</b>	<b>\$ 380,000.00</b>