Aqua Science Engineers, Inc. 208 West El Pintado, Suite C, Danville, CA 94526
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September 13, 2006

Mr. Jerry Wickham
Alameda County Health Care Services Agency
1131 Harbor Bay Parkway
Alameda, CA 94502-6577

SUBJECT: RESPONSE TO COMMENTS
Albany Hill Mini Mart
800 San Pablo Avenue
Albany, California

Dear Mr. Wickham:

In the July 27, 2006 letter from your office, you agreed that vapor extraction was not suitable for the site but expressed concern that the proposed ozone sparging system may not effectively treat the mass of soil contamination in the source areas. This is because there appears to be a significant mass of contamination in the vadose zone above the water table. Your letter then goes on to request a calculation of the mass of contaminants that will not be treated in the source area using an ozone treatment system.

However, it is very difficult to calculate the mass of contamination in the impacted soil for a number of reasons. The most important reason is that there is very limited analytical data in the vadose zone on-site. Due to the site being so small with an uncertainty in the line locations, most of the borings are located in the perimeter of the site. In the borings located on-site, most of the soil samples analyzed were collected from the capillary zone, with little data above 10-feet bgs. Equally important, most of the soil samples that are located on-site contained relatively low concentrations of hydrocarbons in soil. For example, the on-site borings consisted of MW-1, MW-2, MW-3, SB-3, SB-4, BH-R, and BH-S. In these borings, the highest respective TPH-G concentration detected were 1.8 ppm, ND, ND, 61 ppm, 160 ppm, 1.7 ppm and 8.2 ppm. Since the RWQCB environmental screening level (ESL) for TPH-G is either 100 ppm or 400 ppm (depending on whether groundwater is considered a drinking water source), no more than one on-site soil sample contained a TPH-G concentration that exceeded an ESL. In soil samples collected from the perimeter of the site, TPH-G concentrations were 180 ppm, 240 ppm, 400 ppm, 210 ppm, 170 ppm, 45 ppm and 87 ppm in borings BH-A, BH-B, BH-C, BH-F, BH-G, BH-H, and BH-U, respectively. These concentrations are likely more representative of hydrocarbon concentrations in soil in the vadose zone beneath the site. The average concentration in these perimeter soil samples was 190 ppm.

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The following is a rough estimate of the mass of TPH-G in the vadose zone at the site. Due to the volume of USTs and clean fill in areas of former USTs, this calculation is estimated to be biased high.

Area of impacted soil in the vadose zone:

50 feet x 50 feet x 10 feet deep = 25,000 cubic feet of soil

25,000 cubic feet of soil x 111 lbs/cubic feet = 2,775,000 lbs of soil or 1,261,364 kg of soil (2.2 lbs/kg)

Average TPH-G concentration:

190 mg/kg or 0.190 grams/kg

Mass of TPH-G in soil:

1,261,364 kg of soil x 0.190 grams of hydrocarbons/ kg of soil = 239,659 grams of hydrocarbons

239,659 grams / 454 grams/lb = 528 lbs of hydrocarbons

528 lbs of hydrocarbons / 6.5 lbs per gallon of gasoline = 81 gallons of gasoline

TOTAL TPH-G IN THE VADOSE ZONE IS ESTIMATED 528 LBS OR 81 GALLONS OF GASOLINE

In addition, although ozone sparging is designed to treat groundwater and saturated soil beneath the site, the ozone sparging test did show helium being detected in the adjacent vapor extraction wells. This shows that even though the vapor extraction test showed no influence in surrounding wells, some flow of ozone in the vadose zone may be possible and any movement of ozone through the vadose zone will result in remediation of soil, although the extent of remediation can not be calculated.

It is ASE's opinion that ozone sparging will be the most effective means of remediation at the site. The only other form of remediation that would be more effective for remediation of soils in the vadose zone would be overexcavation, which is not feasible at an active gas station. Although some other form of chemical oxidation (such as injection of Fenton's Reagent or RegenOx) may also provide some form of remediation in the vadose zone, it is unlikely that liquids would distribute in the tight clayey soils in the vadose zone better than ozone as a gas, even if the gas is injected in soils beneath the vadose zone.

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Should you have any questions, please feel free to call me at (925) 820-9391.

Respectfully submitted,

AQUA SCIENCE ENGINEERS, INC.

Robert E. Kitay, RG, REA
Senior Geologist

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