AquAeTer optimizing environmental resources | water, air, earth
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October 19, 2007

Dorene Bolze
Harpeth River Watershed Association
P.O. Box 1127
1164 Columbia Avenue
Franklin, TN 37065

RE: Comments on Egyptian Lacquer Manufacturing Company's Corrective Action Plan

Dear Ms. Bolze:

AquAeTer attended the public hearing concerning the corrective action plan (CAP) for Egyptian Lacquer Manufacturing Company (ELMCO) on October 10, 2007. We have a few comments that we believe should be addressed before the Tennessee Department of Environment and Conservation (TDEC) accepts the CAP. There are several fundamental issues that have not been addressed by the CAP and by the information presented at the Public Hearing. There are also several key regulatory issues that seem to be totally ignored by this CAP and its validity, if accepted by TDEC, violate federal and state laws dealing with Resource Conservation and Recovery Act (RCRA), the Clean Water Act, and both state and federal guidance on preparing a CAP and accepting a Monitored Natural Attenuation as a remedy for this site. The continued degradation of the Harpeth River also jeopardizes the ability of three wastewater treatment facilities that use the Harpeth River for assimilative capacity. It is also clear that citizen lawsuits will result if no further work is required on this site by TDEC. From our perspective of having worked on many similar sites, this is one of the most contaminated sites and one that is having a negative impact on the environment.

SPECIFIC POINTS

1. The United States Environmental Protection Agency's guidance for Monitored Natural Attenuation requires the following:
   a. Source removal;
   b. Determination of plume extent;
   c. Determination of aquifer characteristics including hydraulic conductivities, storage coefficients, and travel time to receptors (in this case, Daniel Drive residents, Liberty Creek, BGA Lower Campus, and the Harpeth River ;
   d. Definition of impact of contaminants not removed;
   e. Time required for natural attenuation to assimilate or remove the contaminants; and

f. The costs of other remedial options to demonstrate that Monitored Natural Attenuation is the preferred alternative.

2. Given the time required for karst hydrogeologic systems to naturally wash contaminants out of the numerous storage locations in the fractured rock, it is anticipated that this contaminant source without further remediation will continue to degrade the Harpeth River for at least the next 20 years.
3. Based on TriAD's analysis that the karst is several feet below Liberty Creek, the BGA Lower Campus site is most likely impacted by the plume during summer months when Liberty Creek dries up and groundwater elevations are below the bed of Liberty Creek. This has an impact on the property values of this campus if for some reason BGA decides to move this campus in the future.
4. There are still RCRA listed hazardous wastes, waste acetone is designated U002 (Commercial chemical products that become waste) and waste toluene is designated as U220, being discharged through point source locations on Liberty Creek and the Harpeth River for which there is no National Pollutant Discharge Elimination System (NPDES) Permit(s). These products are designated as wastes because they have contaminated the soil, groundwater, and U.S. navigable waterways. This is in direct violation of 40 CFR 122 and 125 (NPDES), 40 CFR 261 (hazardous waste listings), and 40 CFR 446 (effluent guidelines limits for paint formulating point source category) which prohibits discharge of wastewaters generated from paint formulating point source categories from discharge to surface streams or to a Publically Owned Treatment Works (POTW). This could also be construed to be in violation with the oil spill pollution and prevention regulations, 40 CFR 112;
5. These point source discharges have been and continue to cause further degradation of the water quality of the Harpeth River, an impaired stream, in direct violation of 40 CFR 131.12 antidegradation and the Rules of the TDEC, Chapter 1200-4-3-.06;
6. The solvents entering the Harpeth River through Liberty Creek and from point source locations on the Harpeth River itself are causing a significant degradation of the water quality of the Harpeth River in violation of 40 CFR 131;
7. The facility is currently in violation of the Federal Clean Water Act, sections 301, 302, 303, 304, 307, and 402. The State and the facility are open to citizen suits under Section 505 of the Clean Water Act.
8. This degradation causes an impairment to the dissolved oxygen resources of the Harpeth River upstream from the City of Franklin POTW effluent discharge to the Harpeth. Under 40 CFR 131.12 and under the TMDL 40 CFR 130.7, the Franklin POTW cannot discharge to an impaired stream that is not meeting water quality standards, in this case, the DO standard, if the NPDES discharge causes further degradation of the stream downstream from this discharge. The Franklin POTW has been documented to cause further impairment of the Harpeth River DO water quality standard downstream from the POTW effluent discharge. Under both Federal and state law, Franklin's ability to discharge to the Harpeth River during several months of the year is in jeopardy.
9. There are two other NPDES dischargers on the Harpeth River, Lynwood Utilities and Cartwright Creek Utilities that also have been violating the Clean Water Act due to the Harpeth River not meeting water quality standards upstream from these

discharges and further impairment of the River DO resources is documented downstream from these discharges.

10. There are alternatives that potentially could be used to substantially remediate this site that could be implemented for less than what has been spent on the investigations to date and these are required to be investigated before any Monitored Natural Attenuation is allowed.
11. Finally, leaving this site unremediated with free product and a documented past and continued degradation of the environment receiving this contamination for some undetermined indefinite time period, the Harpeth River, sets a precedent that TDEC should seriously ponder for its legal and regulatory impact on future remediation activities in the state.

Product Loss

TriAD stated that no estimate had been made nor could be made about the volume of product released. The following provides an engineering estimate of the range of product loss, based upon the following assumptions:

- The pipes began leaking within 1 and 10 years following installation in 1978;
- The leakage rate was 1 milliliter per minute; and
- There were 10 tanks.

This gives a range of 26,000 to 38,000 gallons of product released. The flow rate of 1 mL/min is considered very conservative, given the extent of corrosion to the piping and the amount of head (pressure) exerted on the pipe above the known leaks. Other potential leaking sections of the pipe have not been fully addressed. If pipe elbows at the tank farm were not wrapped, then there is no reason to believe that the pipe elbows at the building were wrapped either. Additionally, this does not take into account the increased rate of release when the pipe was under pressure while the pump was running. Given the extent of the plume frontage along Liberty Creek and the Harpeth River, if we assume that 1 to 4 gallons (1 mL/min from 10 tanks is 3.8 gallons of RCRA hazardous wastes seeping into the ground each day for the last 20 years) of RCRA hazardous wastes have been released daily for the last 20 years, then about 7,300 to 29,200 gallons of hazardous wastes have been discharged to the Harpeth River over the last 2 decades. Since free toluene and groundwater containing acetone is still seeping into the Harpeth River, it is assumed that there is still a significant inventory of product in the plume area, most likely on the order of 10,000 to 30,000 gallons of RCRA hazardous wastes.

Remedial Alternatives

Unsaturated Zone. The unsaturated zone is the soil that is above the water table. TriAD identified an area around the tank farm that was contaminated. They then utilized a product, Bioxx, to treat the contamination in the unsaturated zone. There has been no follow-up sampling to confirm its effectiveness. This should be determined immediately.

An alternative to the method already employed that is much cheaper and is very effective for volatile organics is the installation of a soil vapor extraction (SVE) system. This system basically provides a vent to allow the volatile organic compounds (VOCs) to volatilize from the

soil to a collection point where the volatile organics can be removed through a catalytic oxidation unit or through carbon canisters. An SVE system may be active or passive. A passive system does not utilize any mechanical equipment to increase the suction pressure on the wells. An active system does utilize a pump or other mechanical means to increase the suction on the well, thus potentially drawing more VOCs from the soil.

PROS of a SVE System:

- Can be relatively cheap to install, depending upon site characteristics;
- A passive system can be very cheap to maintain and operate, although it would be more difficult to utilize controls to capture air emissions;
- An active system can potentially can help to remove free product from ground water, if the well is screened through the soil/water interface by reducing the vapor pressure in the well, thus allowing more volatilization of the VOCs; and
- An active system should be routed through a control device to minimize the emissions to the atmosphere.
- Neither type of SVE system requires the zone to be saturated in order for it to work. (Biological systems require at least some degree of saturation in the soil in order to grow. Chemical systems only work so long as the chemicals remain in the unsaturated zone. Once they have passed through the zone, they can no longer be expected to treat the unsaturated zone.)

CONS of a SVE System:

- Soil type plays a large role in determining the number of wells required.
- A passive system requires more wells, since the area of influence around each well is solely dependent upon atmospheric pressure, which increases the installation costs.

Saturated Zone. First and foremost, any free product should be removed from the groundwater. It is by far the easiest and cheapest way to treat contamination. Doing nothing is not a method of treatment and so cannot be compared to remedial alternatives. Any recovered product can be sent to the onsite distillation units for recovery or can be sent to a recycle center for uses such as a fuel.

As for the dissolved phase, there are two ways to go about treating the saturated zone, either by removing and treating (ex situ) or by treating in place (in situ). We would recommend in situ treatment.

One of the reasons TriAD gave for not being able to perform ex situ treatment is that they could not discharge the water to the City of Franklin's Publicly Owned Treatment Works (POTW), which legally, Franklin cannot accept this waste for treatment as specified in 40 CFR 446. ELMCO could potentially treat this water and re-inject the clean water to provide a clean groundwater to move the contamination towards the collection wells. This would have to be permitted by TDEC, but it has been done at numerous sites across the country.

If ex-situ treatment is used, after the groundwater is removed it must be treated. The following alternatives, which may or may not be done on-site, could be used:

- Distillation – This method basically relies on heating the recovered groundwater to separate the volatile constituents from the water. This treatment technology would be costly to operate and may not work to separate all of the acetone from the water;
- Air sparging – This method may work to remove soluble toluene and some of the acetone, but again would not likely remove all of the acetone. Emissions would also need to be captured and put through a control device;
- Chemical oxidation (peroxide) – This method should theoretically be able to achieve treatment of both toluene and acetone. A bench-scale test or a pilot-scale test would show the efficiency of this method and provide an estimation for the costs. This method is patented and costs for use may be prohibitive;
- Adsorption onto carbon or other media – This method should theoretically be able to treat both acetone and toluene. This method could be easily tested to determine the efficiency of the carbon. Alternatively, carbon could be used as a polishing step of another treatment method, thus reducing the amount of carbon needed; and
- Biological treatment – This method is suited to treat both toluene and acetone if set up properly. It can be a cost effective method for dealing with the contaminated groundwater, but the water would have to be reinjected or evaporated (no discharge alternative).

Of these alternatives, a biological treatment system would probably be the most effective. The system would probably need an equalization tank, a reactor tank, and other peripheral equipment. If free-product is not being removed separately, an oil/water separator would need to be in-line before the biological treatment. This method is most likely costly due to equipment and operational expenditures.

In Situ Treatment. In situ treatment means that treatment takes place in the ground. This is accomplished by making conditions favorable to micro-organisms that can consume these contaminants. The treatment system should employ a treatment curtain at a designated location to treat the contaminants that are migrating. On-site, it usually involves injection wells that are installed to allow injection of the treatment just upgradient of the contaminant plume and within the plume itself. This allows the treatment to fully encompass the affected area. Biological treatment walls could be placed next to the creek and the River to affect treatment of the groundwater entering the River. The existing trench along Liberty Creek would provide a very effective injection point; however, we would not recommend leaving this trench open (regardless of its future use) since this trench is evidently resulting in a direct air exposure pathway to the neighbors along Daniel Drive.

A few of the in-situ bioremediation alternatives include:

- Bio-stimulation. These injections are made to stimulate the growth of micro-organisms present in the soil and groundwater to breakdown the contamination. Acetone and toluene are two of the most readily degradable volatile organic constituents to biologically treat. In fact, toluene is used in some methods as the biostimulant in groundwater remediation projects. The contaminants contained in the ELMCO plume can be used as a food source by the micro-organisms. The

injection usually includes an oxygen source, a minor amount of food source to ensure a healthy population, and nutrients depending on the characteristics of the soil. One advantage of the use of bacteria is that the bacteria will follow the food, meaning that an effective treatment curtain will continue to work downgradient from the injection site. Both acetone and toluene are rapidly degraded using in-situ techniques.

- One alternative that has merit would be to use the unchlorinated effluent from the Franklin POTW as a continuous injection fluid with the addition of nutrients and an oxygen source, such as, peroxide, at low levels to bring the groundwater DO up to around 8 to 10 mg/L. The bacteria require about 1 mg/L to aerobically decay the food source (Eckenfelder 2007) (Oxidation occurs around 100 to 200 mg/L O_2). A vacuum truck per week of treated effluent for about 1 year would more than likely go a long way in reducing the contaminated plume. Laboratory treatability tests could easily confirm this technique. Obviously, TDEC would have to hold harmless the City of Franklin for the use of this valuable bacterial seed material. We have demonstrated that acclimated treated effluent is an effective biostimulant in a groundwater, even to complex ringed constituents, such as, benzo(a)pyrene (half-life of about 30 days).
- AquAeTer has developed a patented bio-stimulation process for the treatment of contaminated groundwater. The AquAeTer method has been used in Tennessee and several other states. The injection is typically measured in a few mL per day rather that the thousands of gallons used by TriAD on the unsaturated zone with unknown effects.
- Other companies also offer bio-stimulation methods, but these typically involve truckloads of chemicals on a routine basis. These would have to be costed individually to determine their economic validity.
- Chemical oxidation. These injections usually include a peroxide, such as hydrogen peroxide (chemical grade), and a reagent, such as Fenton's reagent, to activate the peroxide. This is a patented process as well. The effectiveness of this injection is entirely limited to the area in which the chemical and its reagent spread. It may or may not follow the food source, depending upon the groundwater transport. With effective injection well points, this method can be effective in destroying the majority of the contaminants, but may not be able to get into every crack and crevice within the bedrock. Again this may not be economically viable and would include with dealing with another hazardous material (hydrogen peroxide at concentrations greater than 8% by weight are considered hazardous).

Any of the above methods could work on the site. Each method has advantages and disadvantages, and the costs associated with doing them can also range in price. Some methods are not very costly at all, while others, such as distillation, could be extremely costly. There are, however, relatively low cost methods, when compared with the costs already expended, to effectively reduce the contamination in the groundwater plume area. Having participated in toxic tort trials, TDEC and ELMCO could certainly expect the costs of a toxic tort lawsuit(s) to be about $1,000,000 per week. Although we doubt that ELMCO has this type of resource, the State of Tennessee does. It appears that some further treatment would save all parties concerned a great deal of time, money and grief in the long run.

TDEC should carefully weigh a decision to allow Monitored Natural Attenuation of this site. We see no merit in TDEC accepting this remedy when the downside will potentially cost the state a substantial amount of investment in defending its position before both the USEPA and private citizens. Given that numerous federal and state laws are being violated, it appears that granting of this CAP will probably lead to far greater costs than taking further remediation steps, such as, in situ treatment with one of the more economical but highly effective in-situ techniques.

Air Emissions

Although not related to the CAP, the lack of an Air Permit if needed would represent another violation of federal and state laws. TriAD, the consultant working for ELMCO, mentioned that the tanks were vented to the atmosphere. Since all of the volatile constituents contained in the tank potentially would have significant loss rates from the tanks and when used in the process, it would seem that this facility would need an air permit. We have reviewed the EPA's records of air permits for the Franklin area. ELMCO does not seem to have an air permit. ELMCO should file for an air permit in order to be in compliance with the state and federal Clean Air Act Amendments of 1990. An emission estimate will need to be made to determine if the facility meets the definition of a Major Source (greater than 10 tons per year of a single Hazardous Air Pollutant (HAP) or greater than 25 tons per year of total HAPs), a Minor Source, or a Synthetic Minor Source.

We would like to note that all numbers given in this document are hypothetical estimates based on similar sites that we have studied. TriAD is in the best position to make these estimates since they have spent about $750,000 to collect the data that can be used to make engineering estimates of the required information to support Monitored Natural Attenuation. If you should have questions or comments concerning these comments, please contact Mike Corn or myself at (615) 373-8532 or by e-mail at jmcorn@aquaeter.com or mcorn@aquaeter.com.

Sincerely,
AquAeTer, Inc.

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