FEASIBILITY EVALUATION

OF

ALTERNATIVE GREEN REMEDIATION APPLICATIONS

Stamping - Grand Rapids

March 2010

INTRODUCTION

Toxicological & Environmental Associates, Inc. (TEA) reviewed the Motors Liquidation Company (MLC) site portfolio to determine if there are candidates for Alternative Green Remedial approaches, either solely or in combination with other remedies previously identified for those sites. Alternative Green Remedial approaches were defined in a memorandum submitted on October 2, 2009, entitled "Site Selection Criteria for the Identification of Candidate Sites for Alternative Green Remediation" and included, but were not limited to, phytoremediation, source area reduction of dense non-aqueous phase liquid (DNAPL), and various in-situ technologies. Eight sites from the MLC portfolio were identified for conceptual development. These eight sites included:

1. Former Delco Chassis Plant (Livonia)
2. Willow Run Company Vehicle Operations
3. GMPT Bay City
4. Danville Central Foundry
5. Stamping - Grand Rapids
6. Buick City
7. Former GM Delco Plant 5 (Kokomo)
8. Delphi - Moraine

In addition to these sites, GMPT Massena (New York), Buick City and others were targeted for feasibility evaluation of an emerging polychlorinated biphenyl (PCB) abatement technology for paints, soils, sediment, sludge, and light non-aqueous phase liquid (LNAPL) treatment for oils containing PCBs.

TEA prepared "Conceptual Design and Preliminary Cost" reports for these sites which were uploaded to the IDEA database in October 2009. Based on subsequent discussions among the remedial and planning team members, TEA evaluated these sites in further detail to assess the practical feasibility of incorporating alternative green technologies into remedial plans for those specific sites. Assessments of potential cost impacts were also evaluated during the current assignment.

The limited information and data available for TEA's "Conceptual Design and Preliminary Cost" reports were expanded to generate this document. The feasibility evaluations presented herein are based solely on data available on the IDEA database and telephone discussions with site project managers.

The objectives of this submittal are to evaluate practical, logistical, technical, regulatory, and financial issues related to these sites in which alternative green remedies may be considered within the course of proposed remediation schemes. Considered during the evaluations were implementability, effectiveness, cost, and green sustainable principles and practices. Estimates of capital costs, O&M costs, and monitoring costs were refined for the alternative green remedies proposed for each site. The results of the evaluation are presented succinctly using the following general outline:

I. Problem Statement
   - compounds/contaminants
   - media
   - saturated/unsaturated zones
   - landfill, etc.

II. Site Characteristics
   - Hydrogeology
     a. depth to groundwater
     b. groundwater flow direction
     c. hydraulic conductivity, groundwater velocity, etc.
   - Extent of contaminant plume
   - Potential receptors

III. Proposed Alternative Green Remedy
   - Purpose and objectives
   - Description of alternative green remedial technology
   - Sustainability
   - Analysis of Green and Sustainable Remediation
   - Monitoring program
   - Term of operation
   - Advantages and disadvantages

IV. Regulatory Outlook
   - Existing order
   - Regulatory agency
   - Potential obstacles

V. Green and Sustainable Remediation (GSR) Comparison

VI. Costs

- Capital/O&M/Monitoring
- Assumptions
- Potential savings

VII. Conclusions

Estimated costs for the proposed alternative green remedies proposed in this submittal were refined based on all information and data gathered by TEA to date. At this time, costs are not necessarily intended to modify overall remediation estimates necessary for these sites. These estimates are mostly intended for consideration during future planning and design of site remediation as proven, implementable, sustainable, and effective cost-saving measures.

Grand Rapids, Michigan, Stamping Plant
MLC# 1198

I. Problem Statement

The primary environmental concern at the Grand Rapids, Michigan Stamping Plant is due to a TCE release from a former degreaser that has impacted on-site soil, as well as on-site and off-site groundwater. There are no known private wells in the impacted off-site groundwater area, and all known receptors are on municipally-supplied water. There are no vapor intrusion issues, and the plume is well characterized and monitoring continues on a semi-annual basis. At a bulk unloading area, there is a small area of metals and petroleum compound contamination that will require further investigation. There is also LNAPL in one monitoring well on-site. In addition, there are areas of concern (AOCs) that have not been identified or assessed (e.g., pits and trenches associated with manufacturing).

- Compounds/contaminants – TCE, metals, polynuclear aromatic hydrocarbons (PAHs);
- Media – groundwater and soils;
- Saturated/unsaturated – the upper aquifer area is unsaturated. The depth to water is up to approximately 20 feet; and
- This is currently an active manufacturing operation which is expected to cease operations at the end of this year.

II. Site Characteristics

- Depth to water – depth to water varies throughout the site. The IDEA database information indicates the depth to water within the site ranges from a few feet to as much as 20 feet.
- Size – site/plume/etc. – the TCE plume has been well characterized. Additional studies are planned for a bulk unloading area at the site, as well as other AOCs.
- Flow velocity/hydrologic conductivity –the groundwater flow rate is highly influenced by local topography and surface water drainage ways. The overburden at the site is a sand and/or clay surficial layer containing varying amounts of sand and gravel, underlain by interbedded layers of silt and clay materials. Groundwater discharges to Cole Drain.

- Receptors – With the municipally operated system available for off-site potable water, and the potential for establishment of deed restrictions and an ordinance prohibiting the use of groundwater for drinking water purposes, there are no significant receptors.

III. Proposed Alternative Green Remedy

Purpose and Objectives

The area to the south of 36th Street and the manufacturing building would be utilized for an *ENGINEERED_PHYTOREMEDIATION*SM system. This area is approximately 1,250 ft long x 125 ft wide, or 3.6 acres. A density of just under 100 trees per acre can be accomplished given the space constraints. This would provide a total of approximately 360 tree systems. The parking lot on the south side of 36th Street would be demolished, and it is assumed that the asphalt material could be stockpiled on site.

At this site, *ENGINEERED_PHYTOREMEDIATION*SM would act in two ways to promote contaminant reduction: (1) enhanced in-situ biodegradation of contaminants due to conditions in and near the root zone; and (2) plant uptake and consumption of contaminated groundwater. These two mechanisms promote remediation of residual chemical concentrations in soil macropores and micropores.

Description of Technology

Phytoremediation is defined as the use of green plants (including grasses, forbs, and woody species) to remove, contain, or render harmless environmental contaminants such as heavy metals, organic compounds, and radioactive compounds in soil or water. In this case, phytoremediation would be the engineered use of green plants (including primarily willows and poplars) to remove organic compounds in, and contain the flow of groundwater at the Grand Rapids Stamping facility. The trees would be planted at a density of 100 trees per acre.

Description of Monitoring Program

The monitoring program would be the regulatory requirements of the Michigan Department of Environmental Quality (MDEQ) groundwater monitoring requirements, which includes semi-annual groundwater monitoring of the site. The monitoring of the phytoremediation system would include semi-annual tree assessments to ensure healthy tree growth.

Term of Operation

Trees begin using water during the initial growing season. The phytoremediation system would operate in perpetuity.

Advantages and Disadvantages

Advantages

The principal advantage of the phytoremediation system is its simplicity and low operation and maintenance costs. Once the tree growth is established, there is very little to do to maintain the system. Advantages associated with phytoremediation systems include the following:

- Reduced long-term cost of ownership due to:
  a. No external energy inputs required during operation;
  b. No operation requirements;
  c. Low maintenance requirements;
- Pumping capacity is spread out over many natural pumping units;
- Effectiveness of technology has been demonstrated at many environmental sites under various conditions by numerous regulatory agencies;
- Utilizes standard groundwater monitoring programs; and
- Eliminates monitoring of permitted discharges.

Disadvantages

- The cover area can be so great that the property cannot be used for anything else until remediation is successful;
- Extreme depths to groundwater, steep topography and subsurface debris can be practical limitations to the technology; and
- Average of three year lag time until full hydraulic effects of trees likely to be observed.

At Grand Rapids, the groundwater depths are 20 feet or less and topography is not so great across the site to be a limiting factor.

IV. Regulatory Outlook

The existing requirements are for standard semi-annual groundwater monitoring. Other areas require additional studies, but there is insufficient information at this time to determine possible remedies for those areas.

Agency – Michigan Department of Environmental Quality (MDEQ).

Potential obstacles – No known potential obstacles.

V. GSR Comparison

At this point, the previous treatment system has been shut down and the path forward is monitoring of groundwater only. Until such time as other areas are investigated and a remedy selection process identifies future remediation efforts that may be required, no GSR comparison is possible.

VI. Costs

Capital Costs

For the non-engineered method, a unit price of $100 – 150 per tree is assumed. For 360 trees (based on 100 trees per acre and a 3.6-acre area), the cost of planting would be $36,000 to $54,000.

The estimate for the *ENGINEERED_PHYTOREMEDIATION*^{SM} system is based on the planting of 360 trees using the methods described above. Costs include the caisson rig drilling for the boreholes, oversight costs, the sleeve and aeration tube materials, backfill material, 10-foot target depth for trees, and the associated labor to install the trees in the proper manner. Experience with these types of systems and this order of magnitude indicates a unit cost of approximately $560 per tree. The tree installation estimate would be about $201,600. Actual costs would be based on the final design considerations. The parking lot demolition would be 50,000 ft^3 or 1,850 yd^3. Demolition would be approximately $10/$yd^3$ for a total of $18,500. Total capital costs, excluding management, are about $220,100. Actual costs would be based on the final design considerations.

For either method, there would be additional project management costs of approximately 10%. Therefore, the non-engineered method would cost about $39,600 to $59,400. The *ENGINEERED_PHYTOREMEDIATION*℠ system would cost about $242,110.

Potential Savings

Monitoring costs could be reduced depending on the efficacy of the phytoremediation system.

VII. Conclusions

1. No cost changes or changes in scope of proposed work can be justified at this time.

2. An engineered phytoremediation system may be utilized to intercept a TCE plume and provide hydraulic control to eliminate the off-site migration of the plume. TCE concentrations are not high enough to justify the use of EZVI as an amendment. There is no active remediation of the plume being conducted. The previous systems have been shut down. Monitoring costs could be reduced depending on the efficacy of the phytoremediation system. Space constraints exist due to the potential for reuse of the buildings on the property. Additional investigations for potential new AOCs are still required. This could expand the nature of remedy selection in the future.