CLEAN WATER/CLEAN AIR BOND ACT
ENVIRONMENTAL RESTORATION PROJECT

PILOT SCALE TREATABILITY WORK PLAN

for the

MATT PETROLEUM SITE
Leland Avenue
City of Utica, Oneida County, New York
DEC Site No. B00192-6

Prepared for:

CITY OF UTICA
1 Kennedy Plaza
Utica, New York 13502

Prepared by:

PLUMLEY ENGINEERING

8232 Loop Road
Baldwinsville, New York 13027
(315) 638-8587
Project No. 2003118

June 2006

TABLE OF CONTENTS

ATTACHMENTS

1.0 INTRODUCTION

This pilot test work plan presents a scope to define field scale factors governing soil excavation, and ex-situ soil treatment bioremediation at the former Matt Petroleum Site in Utica, New York. A bench scale study determined that bioremediation for this soil is feasible under controlled laboratory conditions (i.e. constant temperature, continuous aeration, optimum soil moisture, uniform nutrient loading). This pilot scale study will implement the bench scale treatability study findings at full-scale site conditions. The goal of this study is to assess the field variables that control the ability to meet standards, criteria and guidance values (SCGs), the length of time required for soil treatment, and treatment variables for large volumes of soil.

2.0 BACKGROUND

The complex soil and groundwater contamination patterns measured across the Matt Petroleum Site are consistent with a theory of multiple releases over a period of six decades. These releases include young light fraction non-aqueous phase liquid (LNAPL) releases, typified by the presence of Benzene-Toluene-Ethylbenzene-Xylene (BTEX) and Methyl-Tertiary-Butyl Ether (MTBE) plumes; long chain aliphatic hydrocarbons typical of old degraded petroleum, typified by the numerous tentatively identified compounds (TICs) and elevated concentrations of 1,2,4-trimethylbenzene and 1,3,5-triemethylbenzene in soil and groundwater samples across the site; and heavier petroleum residuals, typified by petroleum aromatic hydrocarbons (PAHs), as shown in the semi-volatile organic compounds (SVOCs) found at the site. However, it should be noted that the PAHs, especially the four and higher ring PAHs, are not present in significant quantities at this site. This profile is likely to have resulted from releases at concurrent and/or different times of all or nearly all of the petroleum products handled at the site during its long history as a bulk petroleum terminal.

In the winter of 2006 a bench scale test was performed to assess the ability of site soils to meet SCGs. The bench test results are summarized below.

- Bench testing was performed to determine if site soils responded to either biodegradation or chemical oxidation.
- Bench study results indicated site soils can be either bio-remediated or chemically oxidized.
- Bio-remediation is approximately half the cost of chemical oxidation.
- Pilot testing is designed to confirm the best approach for soil cell treatment.

The overall site remedy will likely include the following techniques:

- Excavation and landfill disposal of grossly impacted soils and clean fill replacement;
- Groundwater skimming and treatment in the open excavation; and
- ex-situ Area of Concern soil treatment employing aeration, biodegradation, and soil mixing with Allu bucket processing.

2.0 PILOT SCALE WORK SCOPE

The bench scale test verified that petroleum hydrocarbon degrading bacteria are present in site soils and estimated that up to twelve months of active bioremediation might be required to meet the SCGs. This is without any Allu bucket soil processing. Final remedial design will be based on results of both the bench and pilot study results. Currently, preliminary remedial design includes landfill disposal for most of the zone of gross contamination (ZGC) and Allu bucket processing (potentially plus bio-treatment) of the AOC soils over several summer seasons.

Scale-up of study results to full scale remedial design will be based on both the bench and pilot scale treatment studies. Ultimately, it is believed the site remedy lies within an approach that utilizes multiple treatment technologies and at present the options are Allu bucket alone, Allu bucket plus bio-treatment, and soil disposal (either for recalcitrant soils or soils so heavily impacted when excavated they are designated for direct disposal). It is anticipated that soil treated in this pilot study will be stockpiled onsite and be available for immediate backfill in the ZGC when soils are excavated.

This study includes soils screening with a photo-ionization detector and both visual and olfactory observations of soil conditions along with analytical soil testing for STARs SVOCs plus 20 TICs by EPA Method 8270, heterotrophic plate counts, and STARS VOCs plus 10 TICs by EPA Method 8260 for soil at the test conclusion. It is noted that VOC analyses are required to demonstrate SCG compliance if soils are to be available for backfill into the ground.

This pilot study is designed to reduce uncertainty for the full remediation design to reduce overall cost. Ex-situ soil mixing is a critical element of the proposed remedial alternative based on the soil grain size and soil heterogeneity observed across the site. The soil mixing technology identified is an Allu bucket to mix and aerate soils above ground. The Allu is a large clamshell bucket with a spiked roller in the center to aerate and homogenize the soil.

3.1 OBJECTIVES

Specific objectives of the pilot study are to:

- determine the timing (amount of soil turning) and whether for the Allu bucket processing alone will meet SCGs;
- test whether added bacteria can shorten treatment time or provide added treatment where Allu alone falls short of the SCGs;
- determine if soil covering is necessary to promote biological degradation (adds heat, retains moisture);
- assess atmospheric particulate generation from the Allu handling and uncovered soil piles;
- field test the effects of nutrient additions to soil microbe population density;
- visually assess the scope of oil skimming and groundwater treatment necessary for the full scale remedial design;
- Nutrient (N-P-K) and food (dextrose) loading rate and frequency, soil moisture and temperature maintenance, and biological response to these factors;
- Assessment of oxygen levels sustained in the soils from the Allu processing;
- Soil pile configuration, cell sizing, and moisture control;
- evaluate odor issues and vapor monitoring; and

- gather data sufficient to scale the pilot operation to full scale treatment.

In addition this action is intended to generate treated soil meeting the SCGs that will be stockpiled for immediate backfill for the full-scale remediation.

3.2 EVALUATION AND SELECTION OF SOIL CONTRACTOR

Two upstate New York contractors own and operate equipment proven effective in treating ex-situ soil to provide aeration levels shown effective at successfully remediating petroleum affected soils. This equipment is an Allu bucket attached to a standard excavator. After excavation and drainage of groundwater, if needed, soil screening and crushing is done with an accessory attachment to remove boulders, wood chunks and bricks while crushing small stones, brick and soil chunks. The soil is then placed into working cells that can be aerated through the Allu bucket processing. Quotes have been obtained from both contractors to provide services to excavate, screen, and process soil with an Allu bucket for up to 42 calendar days (30 working days, Monday through Friday).

3.3 PILOT STUDY DESIGN

The pilot study will be implemented under the following design limitations. Figure 1 is a schematic showing the design parameters for the six soil piles is attached to this report. Figure 2 is a site location map indicating the location of proposed soil excavation and treatment areas.

- A volume of excavated soil selected according to a daily Allu processing rate of 1,000 – 1,300 cubic yards (1,500 - 2,000 tons) per day. This rate applies to post soil screening, which decreases soil density to approximately 1.5 tons per cubic yard.
- The bench treatability study recommendation to sustain biological activity was to turn the soil three times weekly to maintain adequate soil oxygen levels for microbial respiration. Contractor quotes were requested to identify the excavated soil volume that could be turned a minimum of three times weekly. Based on those quotes, a maximum of 4000 tons of soil is to be excavated. Applying a density of 1.785 tons

per cubic yard (compacted soil) equates to an excavation volume of 2,240 cubic yards. Therefore, a volume of 1,000 cubic yards will be excavated from the ZGC and 1,000 cubic yards from the AOC.

- A suitably sized area for staging and turning soil will be prepared by scraping off near surface soils (estimated at 6 to 24 inches) from an area large enough to contain two times the soil volume to a height 12 feet plus a suitable separation distance.
- 2,000 cubic yards of site soils will be excavated from the AOC and Zone of Gross Contamination (ZGC) to test the degree of treatment attained from biological and soil turning processes. Figure 2 shows the proposed excavation locations. This figure indicates 1000 cubic yards will be excavated from the Area of Concern (AOC) at a location near SB-75 (down gradient of the former AST-6). 1,000 cubic yards of grossly contaminated soils will also be excavated from the ZGC the vicinity of SB-19 (centered approximately 100 south of the loading dock).
- Excavated soil will be allowed to drain, then will be screened to remove boulders and breakup soil chunks. This soil will then be placed in four similarly sized soil piles: two piles of AOC soil and two piles of ZGC soil.
- One AOC and one ZGC soil pile will receive water, nutrients, and be covered with black poly sheeting when not being actively processed with the Allu bucket.
- A small soil volume from each location may be taken to perform bucket studies of enhanced bio-remediation that receive the water, nutrients and, also the addition of commercially available microbes to assess soil response under field conditions.
- Pre-, mid- (as warranted by visual, olfactory, and PID screening), and post processing soil samples for SVOC, total heterotrophic plate counts, and total petroleum hydrocarbons will be collected as detailed in Section 3.5.

3.4 SOIL TREATMENT LOCATION

It is proposed to stage and treat soils adjacent to their point of excavation. These soils will be staged directly on the ground surface after unimpacted surface soils (if any) have been scraped

and stockpiled. See Figure 2.

3.5 SOIL SAMPLING AND HANDLING PROCEDURES

Soil samples will be collected at the pilot test beginning, during, and at the test conclusion to document treatment time required and effectiveness of the treatment processes tested. Samples will be collected and analyzed for semi volatile organic compounds (SVOCs), heterotrophic plate count (from bio-cells only), and, at the study conclusion, for volatile organic compounds (VOCs) from all cells. The DEC soil clean-up goals (SCGs) contain clean-up goals for specific petroleum compounds, the sum of VOCs and SVOCs included in the laboratory analyses (indicated as STARs + 10/20 TICs), and odor. A heterotrophic plate count is a measure of the density of bacteria in the soil. The bench scale test demonstrated that the site soils contain between 10^2 to 10^4 colonies per gram of soil. However, effective bioremediation occurs at bacteria densities of 10^5 to 10^6 and higher. Therefore, heterotrophic plate counts will be performed to measure the bacteria density in the four covered soil piles to indicate if bioremediation plays a significant role in reducing petroleum contamination during the pilot test and also to demonstrate if an increase in bacteria density occurs during the pilot test. Increasing plate counts toward the end of the pilot test may be reason to allow longer treatment time in the full-scale remediation to benefit from the reduced contaminant concentrations that bio-degradation can provide, if needed to meet SCGs.

Plumley Engineering personnel shall provide oversight and collect field samples in accordance with the field collection procedures outlined below.

a. Initial soil samples shall be collected from each soil cell at the test beginning. Sampling will include two grab and three composite samples for analysis of SVOCs + 20 TICs by EPA Method 8270. In addition five composite soil samples for analysis of the heterotrophic plate counts will be collected from each of the two covered soil piles.

b. After the first two-week interval, SVOC soil sample collection will be based on field indicators of VOC/SVOC/odor reduction. SVOC soil samples will be collected from

each of the four soil piles **if** field indicators of staining, odor, and photo-ionization detector screening indicate a significant drop in VOCs/SVOCs has occurred. If these criteria are **not** met two weeks into the pilot study, no samples will be collected at that time. However, sampling will subsequently be performed at two-week intervals thereafter, regardless of field indicators. This will generate analytical data to assess progress of the pilot study and for use in the full-scale remedial design. Soil sampling will include the collection of two grab and three composite samples for analysis of SVOCs by EPA Method 8270. In addition, five composite soil samples for analysis of the heterotrophic plate counts will be collected **at two week intervals** from each of the two covered soil piles throughout the pilot study. These samples will track biological population growth, as these piles will be managed to encourage biological growth.

c. At the test conclusion the following soil samples shall be collected from each of the four soil piles and submitted to the laboratory for analysis: two grab and five composite samples for analysis of STARS + 20 TICs SVOCs by EPA Method 8270; five grab and two composite samples for analysis of STARs VOCs + 10 TICs by EPA Method 8260; and five composite soil samples for analysis of the heterotrophic plate counts. [The VOC/SVOC soil sampling is in general accordance with the DEC Spill Technology and Remediation Series (STARS) # 1 memo to document whether the soils meet the SCGs and can be placed back into the ground.]

d. Clean protective gloves must be worn at all times during the collection of soil samples. No touching of the internal containers or cap shall occur. Soil samples may be analyzed for microbial content, and the potential for the introduction of foreign biological material into the sample container by the sampler must be minimized during sampling.

e. Each sample shall be collected in duplicate and the jars labeled with a sample number, date and time of collection, site name, and the initials of the collector. The number and type of sampling jars, as well as any preservative, will be as indicated by the laboratory.

f. All filled sample containers shall be placed into a thermally insulated container with

a heat sink (typically ice) after sample collection.

g. A field log, including the sample identification number, time of collection, PID readings, and any additional information deemed relevant to sample collection, shall be recorded by the sample collector.

h. All samples will be shipped priority overnight to the laboratory with chain of custody documentation.

4.0 COST

The cost to implement this pilot study is approximately $40 per ton of soil treated or $160,000.

5.0 REPORTING OF PILOT SCALE TEST RESULTS

5.1 SUMMARY OF BENCH SCALE RESULTS

A summary of the pilot scale test results will be included in the Remedial Alternatives Report. These results will be used in the remedial design phase and will provide information to specify costs including equipment, supplies, manpower, and timing to complete the final site remediation.