Revised Corrective Action Plan Addendum

Gasoline Fueling Station – Royal Farms #64
7950 Pulaski Highway, Rosedale, Maryland 21237

MDE OCP Case No. 10-0339-BA
Facility ID No. 3975

AEC Project Number: 05-056RF064

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ADVANTAGE ENVIRONMENTAL CONSULTANTS, LLC

Revised Corrective Action Plan Addendum

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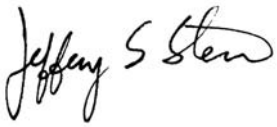

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1.0 INTRODUCTION

Advantage Environmental Consultants, LLC (AEC) has prepared this Revised Corrective Action Plan (CAP) Addendum for the Royal Farms Gasoline Fueling Station No. 64, located at 7950 Pulaski Highway in Rosedale, Maryland (i.e., the "Site"). This addendum is intended to satisfy certain requirements set forth in the *Settlement Agreement and Administrative Consent Order* entered into between The Maryland Department of the Environment (MDE) and Two Farms, Inc. t/a Royal Farms. The original CAP Addendum was completed on March 28, 2013. This revised CAP Addendum incorporates responses to comments from MDE correspondence dated May 29, 2013.

The purpose of the CAP Addendum will be to provide specific and measureable remedial goals for the site and propose deadlines in the form of completion dates, submission dates, and/or schedules for investigative and remedial work and reporting thereon.

2.0 SITE SPECIFIC REMEDIAL GOALS

Remedial activities will be considered complete when the remedial goals, defined below, are achieved.

2.1 Groundwater

Groundwater or Dissolved Phase Hydrocarbon (DPH) remediation is a site goal. The MDE Oil Control Program (OCP) *Maryland Environmental Assessment Technology for Leaking Underground Storage Tanks* (MEAT) guidance document revised February 2003 indicates that once it has been determined that DPH remediation is a site goal, DPH should be remediated based upon either the MDE Standards (Generic Numeric Cleanup Standards for Groundwater and Soil - Interim Final Guidance Update No. 2.1 - June 2008) or the achievement of the following three OCP specific objectives:

1. Prevent contamination migration
2. Remove all risks posed by the release
3. Demonstrate that an asymptotic trend in DPH contamination has been established

The remediation goals for DPH at this site have been developed and selected based on the achievement of the three OCP-specific objectives listed above. The following is a discussion of these objectives.

2.1.1 Prevention of Contaminant Migration

The remedial activities to date has resulted in the recovery of significant quantities of liquid phase hydrocarbons (LPH), DPH and adsorbed phase hydrocarbons (APH), which has caused a reduction of subsurface hydrocarbon source mass. This source reduction will be the main driver in preventing contaminant migration. In order to ascertain if the groundwater plume is expanding, stable or shrinking, historical groundwater quality monitoring data will be evaluated using the Mann-Kendall protocol. The evaluation will occur as part of the groundwater quality asymptotic trend analysis as discussed below.

2.1.2 Identification of Risks Posed by the Release

AEC evaluated potential impacts of exposure to petroleum hydrocarbons to a human receptor under a residential land use scenario for the off-site residences and a commercial land use scenario for the on-site property. The following presents the background used to evaluate potential impacts of exposure to a human receptor.

Various exposure pathways exist for a human receptor to contact chemicals of concern (COCs). The COCs for the site include benzene, toluene, ethylbenzene, and total xylenes (BTEX), and naphthalene. The most critical factors for exposure to COCs from petroleum hydrocarbon impact are listed below:

- Source for the COCs to be released to the environment (Underground Storage Tank [UST] or piping failure);
- Mechanism or medium for transport of COCs (air, groundwater and/or soil);
- Potential human exposure or contact with the contaminated medium (exposure
- point); and
- Human intake routes (ingestion, inhalation, or dermal contact).

There must be a complete pathway including a past or present release and a subsequent route of exposure for a human receptor. If one of the four elements listed above does not exist, then the exposure pathway is incomplete.

At this site, the primary source is from the UST equipment failure. Since groundwater is not used as a potable water source in the site vicinity, groundwater is not a mechanism or medium for transport of COCs for ingestion or dermal contact. Groundwater is a potential exposure source for COC vapor inhalation in off-site enclosed spaces. Based on indoor air quality testing of the on-site commercial structure and the off-site residences, COC vapor inhalation is not occurring. Subsurface soil was not deemed an exposure source because the release entered the tank field backfill and moved vertically downward to the groundwater table, which is in contact with the bottom of the UST backfill. As a result, any subsurface soil impact is associated with the hydrocarbon smear zone and is reflective of groundwater impact.

Based on the above discussion, AEC has developed off-site and on-site groundwater remedial goals. These goals are described as follows.

2.1.2.1 Off-Site Groundwater Remedial Goals

Indoor air quality sampling has been conducted at the 1207 Chesaco Avenue property on a quarterly basis since August 2010 and soil vapor samples were collected in March 2012. Indoor air quality sampling was conducted at the 1205 Chesaco Avenue property from August 2010 until October 2012. Groundwater samples are collected from both properties on a quarterly basis. Based on the data collected to date, vapor intrusion of petroleum hydrocarbons is not a risk to these off-site properties.

The off-site DPH remedial goal is to attain stable or declining trends in DPH concentrations, provided that evidence (i.e., groundwater, sump water, and indoor air quality data) continues to document the absence of vapor intrusion impact at off-site properties.

AEC is currently evaluating conflicting DPH data trends observed in groundwater samples collected from MW-22, MW-23 and MW-24. These data trends indicate increasing benzene concentrations in MW-23 and decreasing concentrations in MW-22 and MW-24. In particular, this is counter to the groundwater flow vector which is in line with MW-24. AEC is currently collecting additional seasonal data (summer low water table) to assist in the placement of the required monitoring well(s). A work plan for

delineation of subsurface conditions down gradient of MW-24 will be submitted to the MDE by August 19, 2013.

2.1.2.2 On-Site Groundwater Remedial Goals

The on-site remedial goals for groundwater will include the achievement of both asymptotic DPH concentrations in groundwater monitoring and recovery wells and asymptotic hydrocarbon recovery from the remediation system (both dissolved and vapor phase hydrocarbons [VPH]). Once asymptotic DPH and VPH concentrations are observed, a rebound evaluation will be performed as discussed below.

The current quarterly groundwater monitoring program will continue to be implemented. In addition, vapor samples will be collected from the system emission stack for laboratory analysis via EPA Analytical Method TO-15 on a monthly basis to track VPH recovery rates.

2.1.3 Asymptotic Level Evaluation

In order to statistically evaluate the DPH and VPH data for the purpose of determining the existence of a trend (i.e., COC concentrations are increasing, decreasing, or stable over time) the COC concentration data (i.e., groundwater quality, and water and vapor system influent quality) will be evaluated using the Mann-Kendall non-parametric statistical method. The Mann-Kendall procedure is applicable to evaluate the COC data since missing values are allowed and the data need not conform to any particular distribution. Also, the Mann-Kendall procedure can be used for data sets that include irregular sampling intervals, data below the detection limit, and trace or missing data. The method is used to test the null hypotheses of no trend against the alternative hypotheses of either a decreasing or increasing trend in a time-series data set. The outcome of the procedure depends on the ranking of individual data points and not the overall magnitude of the data points. This evaluation will be conducted on a quarterly basis and presented in the scheduled progress reports.

2.1.4 Rebound Evaluation

Once asymptotic VPH and DPH levels are achieved, AEC will submit a written request to the MDE for a trial dual phase EFR system shutdown in order to perform a rebound evaluation.

2.1.4.1 DPH Rebound Evaluation

The DPH evaluation will be performed on select representative wells, which will be sampled monthly for the first 6 months then quarterly for an additional 6 months. During the trial shutdown, the dual phase EFR system will remain at the site. The well selection will be made after consultation with the MDE. AEC proposes the use of the following techniques to analyze DPH rebound following the suspension of remediation activities at the site.

The rebound response in wells will be based on a normalization process. This process uses the mean of the initial pre-remediation COC concentration (C_0) data set for a particular well, which when divided into a rebound concentration C, results in a number between 0 and 1. Using the C/C_0 concentration ratio allows direct comparison of rebound response between monitoring locations with different initial concentrations. Thus, at time 0, C/C_0 is 1.00, at which time the remediation system was activated. The initial concentration C_0 can be calculated as the mean of the historical data collected prior to remediation startup.

Performing the normalization process on a particular well with C_0 as the mean of the pre-remediation contaminant concentrations and C as the post remediation COC concentration, the following three potential rebound responses are possible:

- Case A – Rapid Rebound Criterion, defined as the normalized COC concentration increasing to greater than or equal to 75 percent of the pre-remediation COC levels within the planned rebound test period;

- Case B – Gradual Rebound Criterion, defined as the normalized COC concentration increasing to greater than or equal to 25 percent but less than 75 percent of the pre-remediation COC levels within the planned rebound test period; and,

- Case C - Little-to-No Rebound Criterion, defined as the normalized COC concentration remaining less than 25 percent of the pre-remediation COC levels for the planned rebound test period.

The decision to restart the remediation system, allow additional time for further rebound evaluation, proceed into an in-situ chemical oxidation (ISCO), monitored natural attenuation or enhanced bioremediation polishing approach, or closure of the regulatory case will be based on the following criteria: If the mean normalized COC concentration from the representative wells is greater than 0.75 C_0 (Rapid Rebound Criterion-Case A) after a period of three months, then the rebound test will be terminated and remediation will be restarted. If the ongoing data evaluation shows that the Rapid Rebound Criterion is not met, then the rebound test will continue for three additional months (six months total). It is important to note that the observed rebound responses could vary from well to well, and more than one type of response could be observed at different wells. After completion of the rebound test the data will be evaluated to determine if the observed response meets the Gradual Rebound Criterion (Case B) or the Little-to-No Rebound Criterion (Case C). If the Gradual Rebound Criterion (25 to 75 percent rebound) is met, then the rebound test data will be evaluated to determine whether a system restart is needed or if it can remain in standby for an additional three month period of time. If the Little-to-No Rebound Criterion is met, then the system will remain in standby mode for an additional three month period of time so that COC trends can be verified.

If less than 25 percent of the pre-remediation contaminant levels are observed for the planned rebound test, as determined by an average taken from the select monitoring

wells for a period of 12 months, DPH remediation will be considered to be completed to the maximum extent possible.

2.1.4.2 VPH Rebound Evaluation

In order to establish baseline soil gas concentrations for the COCs, a sampling event will be performed within 20 days of MDE's approval of this Corrective Action Plan Addendum (CAPA). Once the asymptotic level evaluation is complete and shows consistent and prolonged COC system effluent concentration decay, the soil gas rebound evaluation sampling program will be initiated. The VPH rebound testing will occur in conjunction with the DPH rebound evaluation to determine if soil gas concentrations in the SVE field of influence have reached steady-state conditions. The system will be temporarily shut down and the rebound evaluation will be performed on select representative wells, which will be sampled every other month for the first 6 months then quarterly for an additional 6 months. The well selection will be made after consultation with the MDE.

The select recovery and monitoring wells will be used to determine soil gas concentrations. The procedure will entail sampling from existing groundwater monitoring and recovery wells with screened intervals extending across the water table. These can be used to draw a deep soil gas sample, provided that sufficient purging is performed prior to sample collection. A vacuum applied to wells of this nature will yield soil gas from the screened interval above the water level in the well, and can therefore be an alternative to soil gas probe installation. Soil gas sampling will be conducted at a vacuum that does not cause upwelling of the water level within the well to a height above the top of the well screen, causing soil gas flow to cease. Off-gassing of vapors from the standing water column within the lower part of the well screen will be negligible, provided that at least five casing volumes of soil gas are purged prior to sample collection, and the purging and sampling procedure is done expeditiously (i.e. over a period of less than an hour).

Prior to the collection of the soil gas samples, each vapor collection point will be purged of at least five volumes of air. A Pre-calibrated Buck Libra Model L-4 personal sampling pumps will be connected to each well. Field screening of vapor within the well will be performed periodically by attaching a PID to the well head. Once stable PID readings and at least five volumes of air have been purged, the soil gas sample collection will begin. Upon completion of the purge activities, a steel ball valve installed on each setup will be closed while the dedicated tubing will be connected to Vac-U-Tube with an attached 1-Liter tedlar bag. Vapor samples will then be submitted for laboratory analysis via EPA Analytical Method TO-15.

The COC rebound will be calculated after each sampling event for the select monitoring and recovery wells by comparing the rebound concentrations to the baseline concentrations. An order-of-magnitude increase in concentration will constitute significant rebound. If greater than an order-of-magnitude change occurs in the pre-and post-shutdown data sets then the system will be restarted for a period of 30 days.

During the 30 day interval the system will be operated to optimize recovery in the vadose and unsaturated zones in areas of recalcitrant impact. Once the 30 day restart period is over another set of soil vapor samples from select representative wells in the recalcitrant areas will be collected and rebound test will continue as scheduled. If less than an order-of-magnitude change of the pre-remediation contaminant levels is observed for the duration of the rebound test, as determined by an average taken from each select monitoring and recovery well for a period of 12 months, VPH remediation will be considered to be completed to the maximum extent possible.

2.2 Liquid Phase Hydrocarbon

Measureable LPH has not been detected in any of the on-site or off-site monitoring wells since August 7, 2012 (MW-6). As mentioned above, once asymptotic DPH and VPH levels are achieved, the dual phase EFR system operation will be suspended in order to perform a rebound evaluation. If LPH is not detected at greater than a sheen in any of the on-site or off-site monitoring wells for a period of 12 months following the suspension of system operation, LPH will be considered to be removed to the maximum extent possible. If LPH is detected at greater than a sheen, focused dual phase EFR will be conducted in that area.

2.3 Soil

Since soil impact resides in the smear zone and is more reflective of groundwater conditions as opposed to vadose zone soil conditions, the MDE Standards (Generic Numeric Cleanup Standards for Groundwater and Soil - Interim Final Guidance Update No. 2.1 - June 2008) may not be applicable. However, for the purposes of this CAP Addendum, AEC will utilize the MDE soil standards. The specific on-site and off-site Soil Cleanup Standards for each COC are summarized below:

Soil Cleanup Standards
Gasoline Fueling Station – Royal Farms # 64
7950 Pulaski Highway
Rosedale, Maryland

Sample Location	Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene
Off-Site (Residential*)	1.20E+04	6.30E+06	7.80E+06	1.60E+07	1.60E+06
On-Site (Non-Residential*)	5.20E+04	8.20E+07	1.20E+08	2.00E+08	2.00E+07

*MDE Soil Standards (Generic Numeric Cleanup Standards for Groundwater and Soil - Interim Final Guidance Update No. 2.1 - June 2008)
BTEX and Naphthalene standards in ug/kg

A subsurface investigation will be necessary to verify whether soil remediation goals have been met. A work plan detailing specific procedures for the subsurface

investigation will be submitted under separate cover when it has been determined that the groundwater has reached asymptotic levels.

2.4 Contingency Plans

In the event that proposed remedial goals cannot be achieved, a contingency plan will be activated. The plan will be based on site specific conditions and may include actions such as the use of ISCO, monitored natural attenuation or enhanced bioremediation as supplemental remediation technologies. The contingency plan will be developed in consultation with the MDE.

3.0 ESTIMATED REMEDIATION COMPLETION SCHEDULE

The following is the anticipated schedule for completion of the remediation effort at the site using the proposed approach:

Estimated Remediation Completion Schedule
Gasoline Fueling Station – Royal Farms # 64
7950 Pulaski Highway
Rosedale, Maryland

Activity	**Estimated Date of Completion**
Asymptotic Level/Achievement of Groundwater, LPH, VPH and Soil Remediation Goals Observed	December 2013
Begin Trial Shutdown and Start Rebound Evaluation	December 2013
Complete Rebound Evaluation	December 2014
Perform ISCO and or/ Enhanced Bioremediation Pilot Study (if necessary)	To be determined

Quarterly groundwater monitoring and system operation and maintenance will continue in accordance with current schedules. Schedules for additional investigative and remedial work and associated reporting will be updated or provided as necessary.