WORK PLAN

GROUNDWATER SAMPLING
&
OFF-SITE SOIL VAPOR INTRUSION EVALUATION

For

MERRICK CLEANERS (a.k.a MINUTE MAN CLEANERS)
5640 Merrick Road, East Massapequa, New York
NYSDEC SITE #1-30-065

August 2011

Prepared for:

Merrick Cleaners, Inc.
213 Rivendale Court
Melville, NY 11747

Prepared by:

CA RICH CONSULTANTS, INC.
17 Dupont Street
Plainview, NY 11803-1614

August 19, 2011

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF ENVIRONMENTAL REMEDIATION
Remedial Bureau A, Section B
625 Broadway, 11th Floor Cell 083
Albany, New York 12207-2942

Attention: Cyn Whitfield, P.E.
Environmental Engineer

Re: WORK PLAN: Groundwater Sampling & Off-site Soil Vapor Intrusion Evaluation

Merrick Cleaners Site Code No. 1-30-065
5640 Merrick Road, East Massapequa, NY
Agreement Index # W1-0866-00-03

Dear Ms. Whitfield:

As requested, CA RICH Consultants, Inc. (CA RICH) is pleased to provide you with this Work Plan for groundwater sampling and an off-site soil vapor intrusion evaluation in connection with Merrick Cleaners (aka: Minute Man Cleaners) in East Massapequa (Site). A Site Location Map is presented in Figure 1. We have included the following items in this Work Plan:

- Collection of groundwater samples from the five existing groundwater monitoring wells associated with the Site;

- A soil vapor intrusion evaluation at the private residences 9 and 11 Carmen Boulevard and 16 River Street. The evaluation will include the installation and sampling of one sub-slab soil vapor monitoring point and collection of one indoor air sample with an ambient outdoor air sample collected concurrent with the sub-slab sampling at each residence; and

- Reporting.

1.0 Site Background and Purpose

Based upon the information provided to CA RICH, the operation of the Merrick Cleaners Site had impacted soil and groundwater with the dry cleaning chemical perchloroethylene (PCE), and its degradation byproducts. Remedial measures at the Site conducted by EEA, Inc. dating back to the 1990's included the removal of bottom soils from on-site leaching pools, installation and operation of Air Sparge/Soil Vapor Extraction (AS/SVE) system and the possible application HRC® to enhance the biological degradation of chlorinated hydrocarbons in groundwater (Ref. 1).

Additional information is provided in the Record of Decision (ROD).

Record of Decision – Minuteman Cleaners Site Number 1-30-065, East Massapequa, Nassau County, New York — March 1999

The purpose of this Work Plan is to obtain a current round of groundwater quality samples from the existing monitoring well network and to determine if soil vapor has intruded, or has the potential to intrude, into residences located immediately downgradient from the Site.

2.0 Field Activities Plan

2.1 Groundwater Monitoring Wells

Groundwater samples will be collected from existing each of the five existing water table monitoring wells. On-site monitoring wells designated MW-1, MW-2 and MW-3 were recently inspected and appear to be functioning and are 4-inches in diameter. The off-site wells, designated MW-4 and MW-5, were also inspected and appear to be functioning and are 2-inches in diameter. One off-site monitoring well, designated MW-6, could not be located and it appears that this well may have been paved over by third parties. A Site Plan illustrating the location of each groundwater monitoring well is presented in Figure 2.

2.2 Groundwater Monitoring Well Sampling

Static water levels will be collected from each well to determine present-day depth to groundwater and to calculate groundwater purge volumes. An electrically operated submersible pump will then be lowered into the well. The pump will be connected to dedicated polyethylene tubing. The well with then be purged of a minimum of three well casing volumes to obtain a representative sample of groundwater.

Since the wells have not been sampled since January of 2003, purging until appropriate groundwater quality parameters have stabilized is important. The parameters and stabilization indicators are pH (+/- 0.1 standard units), conductivity (+/- 3% mS/cm), ORP (+/- 10 mV), D.O. (+/- 10% mg/L), turbidity (+/- 10% NTUs), and temperature (in degrees Celsius). All purge water will be contained in DOT-approved 55-gallon drums temporarily stored at the Site pending waste characterization sample results for proper disposal.

All samples will be collected directly from the pump discharge tubing into laboratory issued VOA vials and stored in an ice-filled cooler until delivery to an ELAP-approved laboratory. Laboratory analysis will include VOCs using USEPA Method 8260 with NYSDEC ASP Category B deliverables. Additional field and laboratory QA/QC protocol is included in the attached Quality Assurance Project Plan (Appendix A).

2.3 Off-site Soil Vapor Intrusion Evaluation

Three private residences have been selected for the soil vapor intrusion evaluation, which include residences at 9 and 11 Carmen Boulevard and 16 River Street (see Figure 2). Letters will be sent via U.S. certified mail to each of the properties listed above requesting permission to perform sub-slab soil vapor testing and indoor air sampling inside each residence. A property access agreement will be included with each request letter. If permission is not granted, CA RICH will confer with NYSDEC about the NYSDEC helping in obtaining access to these residences. Should permission be granted by the property owner, a temporary sub-slab soil vapor sampling point will be installed in the basement, or the lowest floor level in the residence. The sub-slab vapor points will be installed in accordance with the New York State Department of Health (NYSDOH) “Guidance for Evaluating Soil Vapor Intrusion in the State of New York” dated October 2006 (Ref. 2). Indoor ambient air samples will be also be collected in the interior of each residence.

Using the NYSDOH guidelines as a reference, a pre-sampling inspection of each residence will be performed to determine the best locations for sub-slab and indoor air sampling. The inspection will focus on recording items such as: the construction of the building; cracks in the floors and walls of the basements; building mechanical & ventilation systems; petroleum product storage areas; garages; and recent renovations that may have involved paints, finishes, carpeting, caulking or adhesives. The pre-sampling building inspection will also include an inventory of any chemicals used or stored in the residences that may contain volatile organic solvents.

The approximate volume stored, estimated usage and product constituents will be recorded. The actual location of all of the sampling points will be determined in the field upon receipt of the executed access agreement and with consultation with NYSDEC/NYSDOH representatives.

2.4 Soil Vapor Point Installation and Sampling

The soil vapor points will be installed by drilling a 1/2-inch diameter hole through the concrete surface using a manually operated hammer-drill equipped with a carbide bit. The hole will be advanced down through the concrete to approximately 2-3 inches below the floor slab. The points will be constructed of 1/4-inch stainless steel pipe connected to 1/4-inch polyethylene tubing.

The sampling probe will be placed two inches directly beneath the slab. A three-way "T" connector valve assembly will be connected to a vacuum pump and a pre-cleaned six-liter SUMMA® air sampling canister. The vapor probe assembly will be sealed at the slab surface with liquid beeswax.

Before collecting the soil vapor sample, the sample tubing will be purged using a vacuum pump set at a rate of approximately 0.2 liters per minute. A tedlar® bag will be used to contain the purged soil vapor. A helium tracer gas will be used to enrich the atmosphere around the sampling location. The tracer gas verifies that interior ambient air is not inadvertently drawn down into the sub-slab soil vapor sample. Both the purge volume from the sampling tube and the helium-enriched air within the container will be screened for the tracer gas using a Gowmac® Model 21-250, or equivalent, gas leak detector. If there is a detection of more than 10% helium, more bees wax will be placed around the top of the sampling probe point and the process will be repeated. Soil vapor point installation logs will be generated to document local condition(s) that occurred during the sampling that may influence interpretation of the results (i.e. weather).

Following the purging and tracer gas verification steps, the sub-slab soil vapor samples will be collected using the SUMMA® canister set to fill at a rate of not more than 0.2 liters per minute with an approximate fill time of 2-hours. One duplicate sub-slab soil gas sample will be collected for QA/QC purposes. The duplicate sample will be collected concurrently with the designated field sample via a "Y" connection. The samples will be analyzed for VOCs using USEPA Method T0-15 by a NYS-certified laboratory.

Concurrent with the interior sub-slab soil vapor sampling, the collection of an indoor ambient air sample from inside each residence is planned. Also, one centrally located outdoor air sample will be collected for the purposes of documenting "background" air quality. These samples will be collected from the breathing zone. The indoor ambient air and outdoor "background" air samples will be collected using SUMMA® canisters equipped with regulators to collect the samples over an approximate 8-hour period and analyzed for VOCs using USEPA Method T0-15 by a NYS-certified laboratory. Additional field and laboratory QA/QC protocol is included in the attached QAPP (Appendix A).

3.0 Investigation Summary Report

Once the laboratory results are obtained, an Investigation Summary Report will be prepared for NYSDEC. The Summary Report will be delivered in an electronic format acceptable to the Department and the data packages will be EDD / EQuIS compliant. At a minimum, the Report will include the following items:

- A description of the work performed;
- Laboratory summary tables and maps;
- A Data Usability Summary Report including the laboratory data; and
- Conclusions and Recommendations.

4.0 Schedule

The following Schedule is provided for this Investigation.

Event	Schedule
Draft Work Plan Submission	August 19, 2011
NYSDEC Review Period (Estimated)	September, 2011
Submission of Final Work Plan	October, 2011
Groundwater Testing and Soil Vapor Intrusion Evaluation	November, 2011
Laboratory Analysis	December, 2011
Investigation Summary Report	January-February, 2012

5.0 References

1. NYSDEC, March 1999, Record of Decision – Minuteman Cleaners Site Number 1-30-065, East Massapequa, Nassau County, New York

2. NYSDOH, October 2006, Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York

If you have any questions regarding this Work Plan, please do not hesitate to call our Office.

Sincerely,

CA RICH CONSULTANTS, INC.

Steve Sobstyl
Senior Project Manager

Eric A. Weinstock
Vice President

cc: Via email: amtamuno@gw.dec.state.ny.us
Alali M. Tamuno, Esq. Senior Attorney
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Via email: Cbiblow@FarrellFritz.com
Charlotte A. Biblow, Esq.
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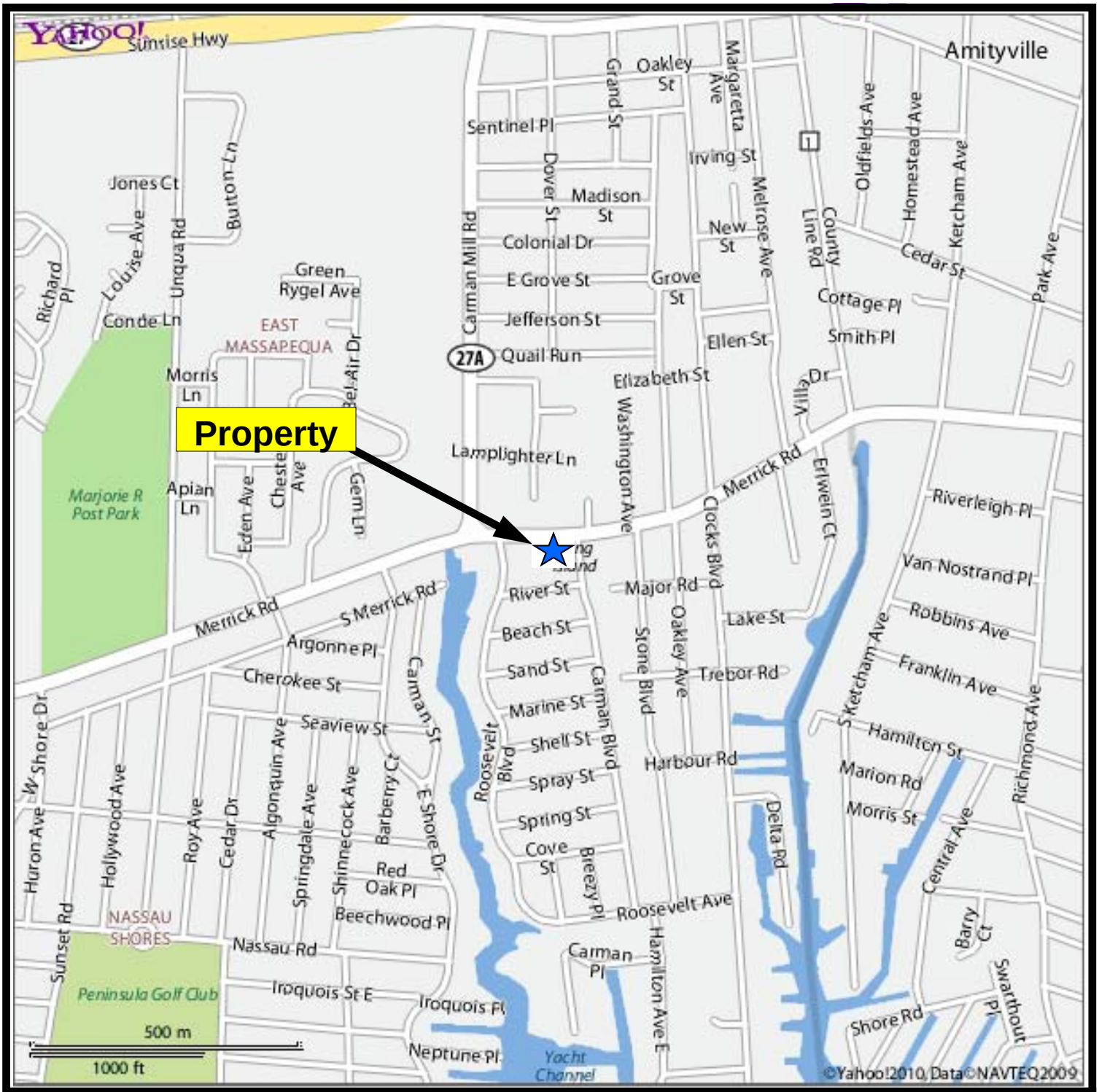
Via email: jcarmentano@FarrellFritz.com
John C. Armentano, Esq.
Farrell Fritz, P.C.

US Mail: Merrick Cleaners, Inc.
Sun Ja Jang
213 Rivendale Court
Melville, NY 11747

Figures



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Adapted from Yahoo Maps.

CA RICH CONSULTANTS, INC.
17 Dupont Street,
Plainview, NY 11803

TITLE: **SITE LOCATION MAP**	DATE: **08/17/11**
	SCALE: **As Shown**
FIGURE: **1**	**Merrick Cleaners** **5640 Merrick Road** **East Massapequa, New York**
DRAWING:	DRAWN BY: **J.T.C.**
	APPR. BY: **S.T.S.**

LEGEND

Existing Monitoring Well

#9 Proposed Residences For Soil Vapor Testing

0 50 100
Approximate Graphic Scale in Feet

Note:
Map Adapted from Google Earth Image Dated September 19, 2010.

CA RICH CONSULTANTS, INC.
Environmental Specialists Since 1982
17 Dupont Street, Plainview, New York 11803

TITLE: Area Map with Groundwater Monitoring Well and Proposed Residences for Soil Vapor Testing Locations		DATE: 8/17/2011
		SCALE: As Shown
FIGURE: 2	Merrick Cleaners 5640 Merrick Road East Massapequa, NY	DRAWN BY: S.T.M.
DRAWING NO: 2011-816		APPR. BY: S.T.S.

Appendix A

Quality Assurance Project Plan

QUALITY ASSURANCE PROJECT PLAN

For

MERRICK CLEANERS (a.k.a MINUTE MAN CLEANERS)
5640 Merrick Road, East Massapequa, New York
NYSDEC SITE #1-30-065

August 2011

Prepared for:

Merrick Cleaners, Inc.
213 Rivendale Court
Melville, NY 11747

Prepared by:

CA RICH CONSULTANTS, INC.
17 Dupont Street
Plainview, NY 11803-1614

Quality Assurance Project Plan

1.1 Introduction - The following Quality Assurance Project Plan ("QAPP") has been prepared specifically for the Investigation Work Plan in connection Merrick Cleaners at 5640 Merrick Road in East Massapequa, New York. This Plan was prepared and approved as stated below.

Prepared by: _____ Date: 8/19/11
Jason Cooper, Project Manger

Approved by: _____ Date: 8/19/11
Steve Sobstyl, Senior Project Manager

1.2 QAPP - Table of Contents

The following elements are included in this QAPP:

1.3 Project Description - The Work Plan subject to this QAPP have been prepared to address the following issues:

- Determination of the present-day nature and extent of groundwater contamination at the subject Site and at off-site locations hydraulically downgradient from the Site; and

- Obtain the necessary information needed in connection with a Soil Vapor Intrusion Evaluation at off-site residences.

The investigative methods that will be used include monitoring well sampling, sub-slab soil vapor sampling, and indoor/outdoor ambient air sampling. These are described in detail in the Work Plan.

1.4 Project Organization – Steve Sobstyl will serve as the Senior Project Manager (PM) and will be responsible for the overall scheduling and performance of all investigative activities.

Jason Cooper will serve as a Project Manager and the Quality Assurance Officer (QAO) for this project. His duties will include:

- Review of laboratory data packages
- Interface with laboratory
- Performance of Field Audits

Experienced CA RICH staff will perform and/or oversee completion of all the field activities described in the Investigation Work Plan.

1.5 Quality Assurance Objectives and Data Measurement

Chemical Analysis – All environmental samples will delivered to a New York State-Certified laboratory contracted to CA RICH for chemical analysis. This data is intended to determine the potential of soil gas vapor intrusion in nearby residences and the quality of groundwater. Soil vapor and ambient air will be chemically analyzed utilizing the procedures and protocols described in Sampling, Sample Preparation, & Analysis Requirements of EPA Compendium Method T0-15. Each stainless steel SUMMA air sampling canister required for analysis utilizing EPA Method T0-15 will be specially pre-calibrated and prepared for the requisite six liter sampling volumes. The laboratory will follow the NYSDEC – Analytical Services Protocol dated 1995 for groundwater samples and analytical reports will be prepared in NYSDEC ASP Category B deliverables. Groundwater samples will be placed in iced-filled coolers and delivered to the laboratory within 48 hours of collection.

Quality assurance objectives are generally defined in terms of five parameters:

- **Representativeness -** Representativeness is the degree to which sampling data accurately and precisely represents site conditions, and is dependent on sampling and analytical variability. The Work Plan has been designed to assess the presence of the constituents in the target media at the time of sampling. The Plan presents the rationale for sample quantities and location. The Plan also presents field sampling methodologies and laboratory analytical methodologies.

  The use of the prescribed field and laboratory analytical methods with associated holding times and preservation requirements are intended to provide representative data. Further discussion of QC checks is presented in Section 1.11.

- **Comparability** - Comparability is the degree of confidence with which one data set can be compared to another data set. Comparability between this investigation and to the extent possible, with existing data will be maintained through consistent sampling and analytical methodology set forth in the QAPP; the Work Plan; the NYSDEC ASP analytical methods (1995) with NYSDEC ASP QA/QC requirements (1995); and through use of QA/QC procedures and appropriately trained personnel.

- **Completeness -** Completeness is defined as a measure of the amount of valid data obtained from a sampling event compared to the amount that was expected to be obtained under normal conditions. This will be determined upon assessment of the analytical results.

- **Precision -** Precision is the measure of reproducibility of sample results. The goal is to maintain a level of analytical precision consistent with the objectives of the Work Plan. To maximize precision, sampling and analytical procedures will be followed. All work for the investigation phase of this project will adhere to established protocols presented in the QAPP, and the Work Plan. Checks for analytical precision will include the analysis of matrix spike duplicated, laboratory duplicates, and field duplicates. Checks for field measurement precision will include obtaining duplicate field measurements. Further discussion of precision QC checks is provided in Section 1.11.

- **Accuracy** - Accuracy is the deviation of a measurement from the true value of a known standard. Both field and analytical accuracy will be monitored through initial and continuing calibration of instruments. In addition, internal standards, matrix spikes, blank spikes, and surrogates (e.g. system monitoring compounds) will be used to assess the accuracy of the laboratory analytical data.

1.6 Sampling Procedures - The sampling procedures that will be employed are discussed in detail in the Work Plan.

1.7 Sample and Document Custody Procedures

- **General** - The Chain-of-Custody program allows for the tracing of possession and handling of the sample from its time of collection through its chemical analysis in the laboratory. The chain-of-custody program at this site will include:

  - Sample labels
  - Chain-of-Custody records
  - Field records

- **Sample Container Details**

Sample Matrix and Parameters	Container Type and Preservative	Method	Holding Time*
Groundwater			
VOCs	Two (2) - 40 Vial - ICE	USEPA 8260	14 Days
Sub Slab Vapor			
VOCs	Six-liter SUMMA Canister	TO-15	30 Days

*Holding Time is calculated from collection date

- **Sample Labels** - To prevent misidentification of samples, a label will be affixed to the sample container and will contain the following information:

  - Site Name
  - Sample identification number
  - Date and time of collection
  - Initials of Sampler
  - Preservation (if any)
  - Type of analysis to be conducted.

- **Chain-of-Custody Records** - To establish the documentation necessary to trace sample possession from the time of collection, a chain-of-custody record will be filled out and will accompany samples at all times. The record will contain the following information:

  - Project name:
  - Printed name and signature of samplers
  - Sample Identification
  - Date and time of collection
  - Sampling location
  - Number of containers for each sample
  - Signature of individuals involved in sample transfer (when relinquishing and accepting samples)
  - Inclusive dates and times of possession.

- **Field Records** - Field records will be maintained during each sampling effort in a logbook. All aspects of sample collection, handling and visual observations will be recorded. All sample collection equipment, field analytical equipment and equipment utilized to make physical measurements will be identified in the field logbook.

  All calculations, results and calibration data for field sampling, field analytical and field physical measurement equipment will also be recorded in the field logbook. Entries will be dated and initialed. Entries will be made in ink, and will be legible.

1.8 Calibration Procedures and Frequency - The contracted laboratory will follow the NYSDEC Category-B requirements for equipment calibration procedures and frequency. Soil vapor and ambient air samples soil vapor will be analyzed utilizing EPA Compendium Method T0-15

1.9 Analytical Procedures - All laboratory groundwater analysis will follow NYSDEC ASP (1995) protocols with Category B deliverables. The following samples will be collected for QA/QC purposes: 1 trip blank, 1 field blank, 1 duplicate sample, 1 matrix spike, and 1 matrix spike duplicate per every twenty field samples. A qualified data validator will review the laboratory data and a Data Usability Summary Report (DUSR) will be prepared.

Soil vapor and ambient air samples will be chemically analyzed utilizing the procedures and protocols described in Sampling, Sample Preparation, & Analysis Requirements of EPA Compendium Method T0-15. Each stainless steel SUMMA air sampling canister required for analysis utilizing EPA Method T0-15 will be specially pre-calibrated and prepared for the requisite six liter sampling volumes.

1.10 Data Reduction, Validation and Reporting

- **Field Data** - All field data recorded in logbooks or on log sheets will be evaluated in the Office and transferred to word processor text by field personnel or clerical staff. PID readings will be included on the logs. The QAO and/or PM will review this data for accuracy and completeness. Construction diagrams will be prepared for all monitoring wells and soil vapor probes installed by CA RICH.

- **Laboratory Data** - The laboratory will transfer the instrument readings to laboratory report forms. A qualified Firm will perform independent data validation of all analytical data using NYSDEC DUSR protocols.

  The Data Validator will provide CA RICH with a Data Validation Summary Report. The QAO will review the summary report as well as other field data and prepare a Data Usability Report. CA RICH will prepare summary tables of the validated analytical data using an imported spreadsheet received from directly the laboratory.

1.11 Internal Quality Control Checks

Both field and laboratory quality control checks are proposed for this project. In the event that there are any deviations from these checks, the Project Manager and Quality Assurance Officer will be notified. The proposed field and laboratory control checks are discussed below.

Field Quality Control Checks

- **Field Measurements -** To verify the quality of data collected using field instrumentation, at least one duplicate measurement will be obtained per day and reported for all field analytical measurements.

- **Sample Containers -** Certified-clean sample containers will be supplied by the contracted laboratory.

- **Field Duplicates** – Field duplicates will be collected to check reproducibility of the sampling methods. Field duplicates will be prepared as discussed in the Work Plan. Field duplicates will be analyzed every 20 field samples.

- **Field Rinse Blanks** – Field rinse blanks are used to monitor the cleanliness of the sampling equipment and the effectiveness of the cleaning procedures. Field rinse blanks will be prepared by filling sample containers with analyte-free water (supplied by the laboratory), which has been routed through a cleaned sampling device (groundwater only).

- **Trip Blanks** – Trip blanks will be used to assess whether site samples have been exposed to non-site-related volatile constituents during storage and transport. Trip blanks will be analyzed at a frequency of once per day, and will be analyzed for volatile organic constituents. A trip blank will consist of a container filled with analyte-free water (supplied by the laboratory), which remains unopened with field samples throughout the sampling event. Trip blanks will only be analyzed for volatile organic constituents (groundwater only).

1.12 Performance and Systems Audits

Performance and systems audits will be completed in the field and the laboratory during the investigation phase of this project as described below.

- **Field Audits –** CA RICH's Project Manager and Quality Assurance Officer will monitor field performance and field meter calibrations to verify that measurements are taken according to established protocols. The Project Manager will review all field logs. In addition, the Project Manager and the Quality Assurance Officer will review the field rinse and trip blank data to identify potential deficiencies in field sampling and cleaning procedures.

- **Laboratory Audits** – The contracted laboratory will perform internal audits consistent with NYSDEC ASP (1995) and EPA Method T0-15.

1.13 Preventive Maintenance

Preventive maintenance schedules have been developed for both field and laboratory instruments. A summary of the maintenance activities to be performed is presented below.

- **Field Instruments and Equipment -** Prior to any field sampling, each piece of field equipment will be inspected to assure it is operational. If the equipment is not operational, it must be serviced prior to use. All meters which require charging or batteries will be fully charged or have fresh batteries. If instrument servicing is required, it is the responsibility of the field personnel to follow the maintenance schedule and arrange for prompt service.

- **Laboratory Instruments and Equipment -** The laboratory will document Laboratory instrument and equipment procedures. Documentation includes details of any observed problems, corrective measure(s), routine maintenance, and instrument repair (which will include information regarding the repair and the individual who performed the repair).

  Preventive maintenance of laboratory equipment generally will follow the guidelines recommended by the manufacturer. A malfunctioning instrument will be repaired immediately by in-house staff or through a service call from the manufacturer.

1.14 Data Assessment Procedures

The analytical data generated during implementation of the Work Plan will be evaluated with respect to precision, accuracy, and completeness. The procedures utilized when assessing data precision, accuracy, and completeness are presented below.

- **Data Precision Assessment Procedures -** Field precision is difficult to measure because of temporal variations in field parameters. However, precision will be controlled through the use of experienced field personnel, properly calibrated meters, and duplicate field measurements. Field duplicates will be used to assess precision for the entire measurement system including sampling, handling, shipping, storage, preparation and analysis.

  Laboratory data precision for organic analyses will be monitored through the use of matrix spike duplicate sample analyses. For other parameters, laboratory data precision will be monitored through the use of field duplicates and/or laboratory duplicates.

  The precision of data will be measured by calculation of the standard deviation (SD) and the coefficient of variation (CV) of duplicate sample sets. The SD and CV are calculated for duplicate sample sets by:

  $$SD = (A-B)/1.414$$
  $$CV = SD/((A+B)/2) = 1.414(A-B)/(A+B)$$

  Where:

  A = Analytical result from one of two duplicate measurements
  B = Analytical result from the second measurement.

  Where appropriate, A and B may be either the raw measurement or an appropriate mathematical transformation of the raw measurement (e.g., the logarithm of the concentration of a substance).

  Alternately, the relative percent difference (RPD) can be calculated by the following equation:

  $$RPD = \frac{(A-B)}{(A+B)/2} \times 100$$

  $$RPD = 1.414\ (CV)(100)$$

- **Data Accuracy Assessment Procedures -** The accuracy of field measurements will be controlled by experienced field personnel, properly calibrated field meters, and adherence to established protocols. The accuracy of field meters will be assessed by review of calibration and maintenance logs.

  Laboratory accuracy will be assessed via the use of matrix spikes, surrogate spikes, and internal standards. Where available and appropriate, QA performance standards will be analyzed periodically to assess laboratory accuracy. Accuracy will be calculated as a percent recovery as follows:

  $$Accuracy = \frac{A-X}{B} \times 100$$

  Where:

  A = Value measured in spiked sample or standard
  X = Value measured in original sample
  B = True value of amount added to sample or true value of standard

This formula is derived under the assumption of constant accuracy over the original and spiked measurements. If any accuracy calculated by this formula is outside of the acceptable levels, data will be evaluated to determine whether the deviation represents unacceptable accuracy, or variable, but acceptable accuracy. Accuracy objectives for matrix spike recoveries and surrogate recovery objectives are identified in the NYSDEC, ASP (1995).

- **Data Completeness Assessment Procedures -** Completeness of a field or laboratory data set will be calculated by comparing the number of samples collected or analyzed to the proposed number.

$$\text{Completeness} = \frac{\text{No. Valid Samples Collected or Analyzed}}{\text{No. Proposed Samples Collected or Analyzed}} \times 100$$

As general guidelines, overall project completeness is expected to be at least 90 percent. The assessment of completeness will require professional judgment to determine data usability for intended purposes.

1.15 Corrective Action

Corrective actions are required when field or analytical data are not within the objectives specified in this QAPP, or the Work Plan. Corrective actions include procedures to promptly investigate, document, evaluate, and correct data collection and/or analytical procedures. Field and laboratory corrective action procedures for this project are described below.

- **Field Procedures** - When conducting the investigative fieldwork, if a condition is noted that would have an adverse effect on data quality, corrective action will be taken so as not to repeat this condition. Condition identification, cause and corrective action implemented will be documented as a memo to the project file and reported to the Project Manager.

  Examples of situations, which would require corrective actions, are provided below:

  - Protocols as defined by the QAPP and the Work Plan have not been followed;
  - Equipment is not in proper working order or properly calibrated;
  - QC requirements have not been met; and
  - Issues resulting from performance or systems audits.

  Project field personnel will continuously monitor ongoing work performance in the normal course of daily responsibilities.

- **Laboratory Procedures -** In the laboratory, when a condition is noted to have an adverse effect on data quality, corrective action will be taken so as not to repeat this condition. Condition identification, cause and corrective action to be taken will be documented, and reported to the Quality Assurance Officer.

Corrective action may be initiated, at a minimum, under the following conditions:

- Specific laboratory analytical protocols have not been followed;
- Predetermined data acceptance standards are not obtained;
- Equipment is not in proper working order or calibrated;
- Sample and test results are not completely traceable;
- QC requirements have not been met; and
- Issues resulting from performance or systems audits.

Laboratory personnel will continuously monitor ongoing work performance in the normal course of daily responsibilities.

1.16 Quality Assurance Reports and Management

- **Internal Reporting -** The analytical laboratory will submit analytical reports using NYSDEC ASP (1995), Category B requirements. The analytical reports will be submitted to the Data Validator for review. Supporting data (i.e., historic data, related field or laboratory data) will also be reviewed to evaluate data quality, as appropriate. The Quality Assurance Officer will incorporate results of data validation reports (if any) and assessments of data usability into a summary report. This report will be filed in the project file and will include the following:

  - Assessment of data accuracy, precision, and completeness for field & laboratory data;
  - Results of the performance and systems audits;
  - Significant QA/AC problems, solutions, corrections, and potential consequences;
  - Analytical data validation report; and
  - Data usability report.

- **Reporting** - The Site Characterization Report will contain a separate QA/QC section including the DUSR and a summary of data collected and/or used as appropriate to the project DQOs. The Quality Assurance Officer will prepare the QA/QC summary tables and reports and memoranda documenting the data assessment and validation.