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Source Investigation Work Plan
Monitoring Well MW-18 Area

United Technologies/Carrier - Thompson Road Facility
Syracuse, New York

Corrective Action Order – Index CO 7-20051118-4

Revision No.: 0

EnSafe Project No. 0888803666

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March 2007

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1.0 INTRODUCTION

Carrier Corporation (Carrier), a wholly-owned subsidiary of United Technologies Corporation (UTC), has prepared this work plan in response to the requirements outlined in the New York State Department of Environment and Conservation (NYSDEC) Consent Order CO 7-20051118-4 (order) dated February 13, 2006, and a subsequent February 9, 2007, follow-up letter from Larry Rosenmann of NYSDEC. This work plan is proposed as an initial phase of investigation to identify the source of site-related volatile organic compounds (VOCs) being detected in monitoring well MW-18 in the northeastern portion of the Carrier Corporation, Thompson Road facility in Syracuse, New York. Well MW-18 is directly north of the storm water treatment system area and Outfall 011, outside the northeastern corner of Building TR-3 at the Carrier facility.

1.1 Facility Description

The Carrier facility is in the northeast portion of Syracuse, New York, approximately 1 mile south of the New York State Thruway (Figure 1 — Site Location Map). The facility is bordered by Sanders Creek to the north, Thompson Road to the west, Kinne Street to the east, and a residential area to the south. The property slopes slightly north toward Sanders Creek. The facility property covers approximately 175 acres and most is either paved or covered by manufacturing and office buildings.

1.2 Facility History

The facility was purchased in the 1950s by Carrier. The Carrier facility produced a variety of products associated with the heating, ventilation, and air-conditioning (HVAC) industry for home and commercial applications over the years. Operations have included the manufacture and assembly of various components associated with HVAC units, including Carlyle compressors. Currently, development and testing of HVAC components and systems, research and development, customer service, and warehousing functions occur in various facility buildings.

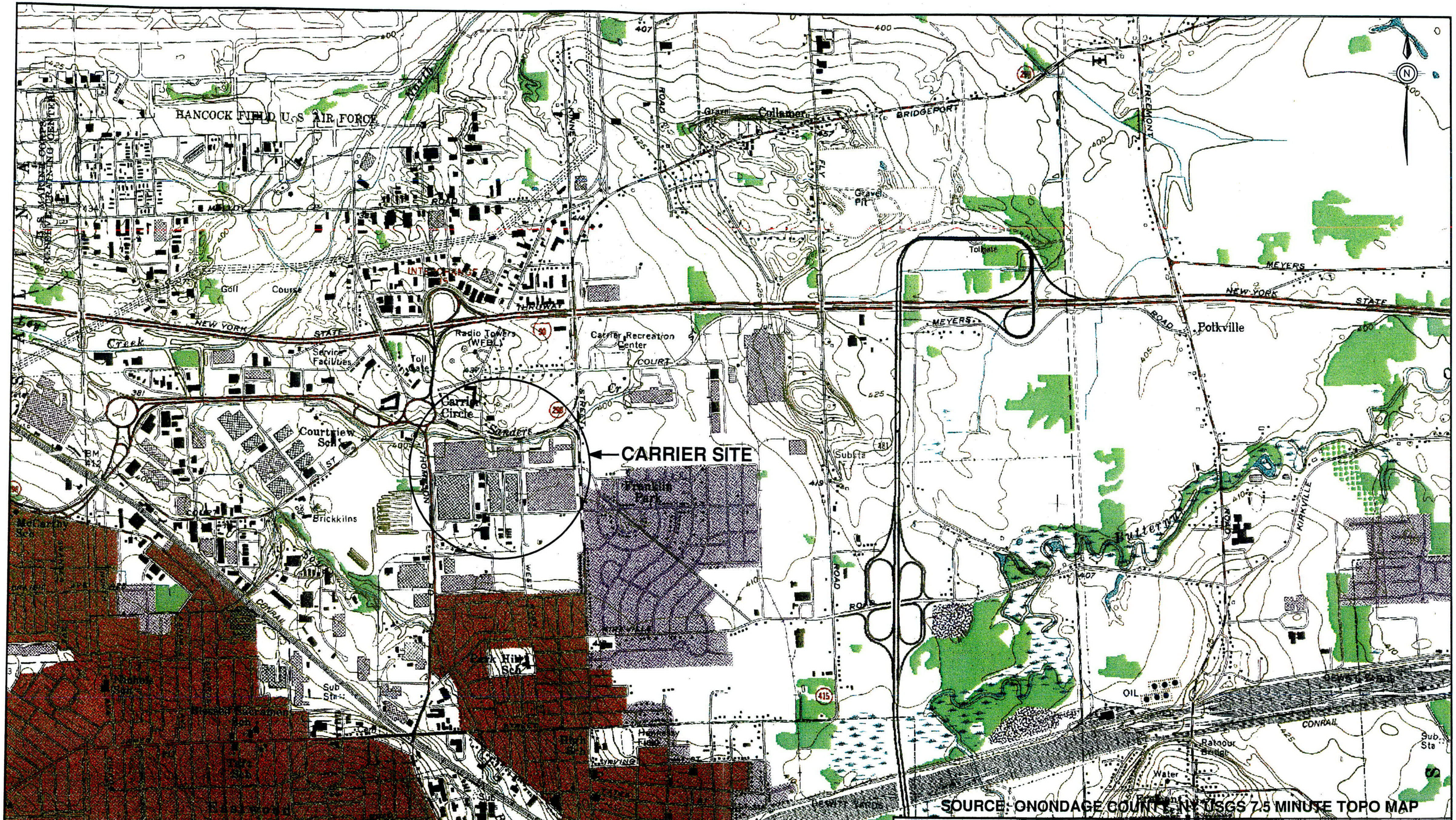

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FIGURE 1
SITE LOCATION MAP
CARRIER CORPORATION
SYRACUSE, NEW YORK

DWG DATE: 17APR03 | DWG NAME:3133049R006

Several phases of solid waste management unit (SWMU) investigations, groundwater sampling events, indoor air quality evaluations, storm line sediment removal remedial actions, and stream sampling investigations have been conducted at the facility from approximately 1986 through 2005. Of relevance to the MW-18 source investigation are the following:

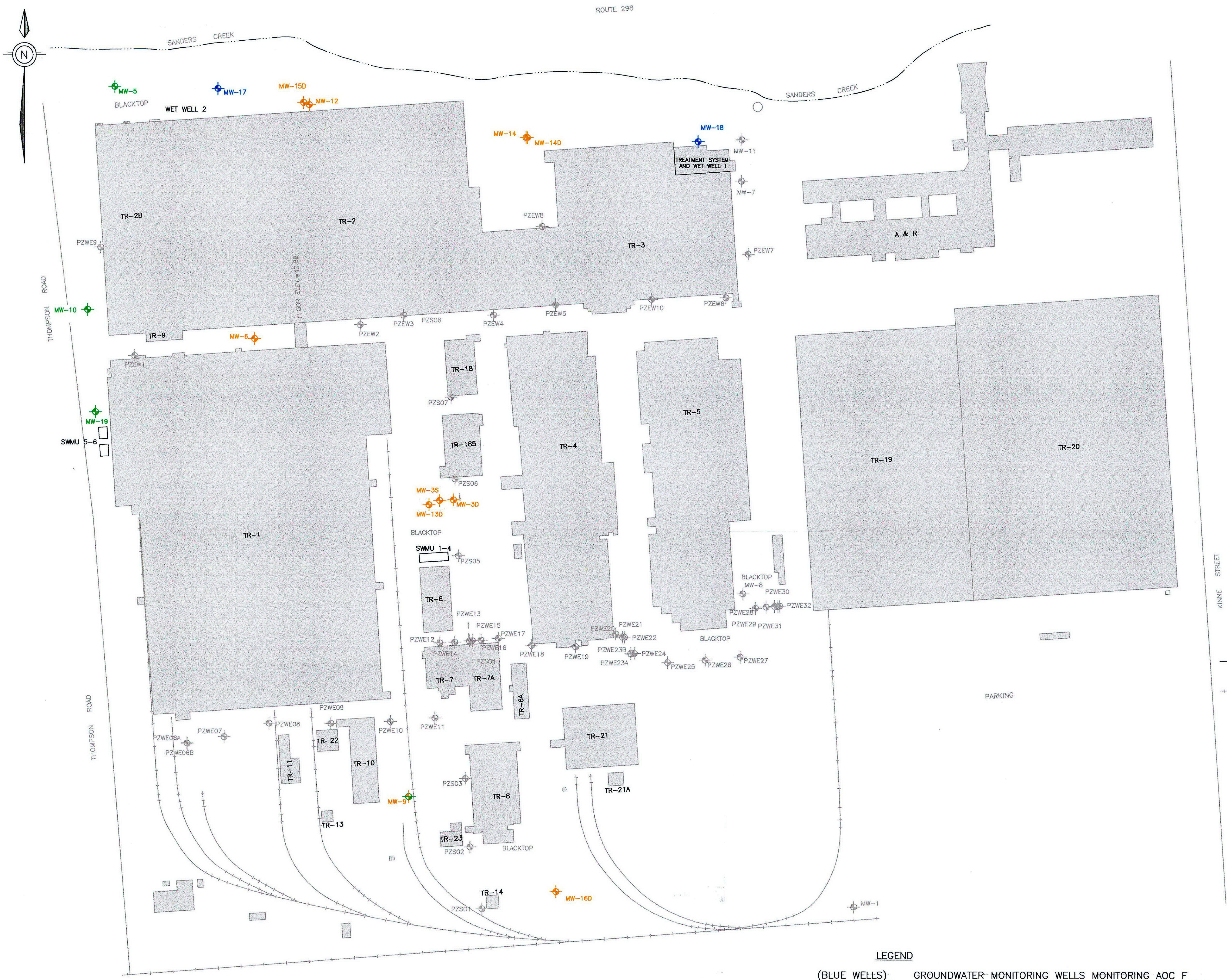
1) *RFI Report,* September 2001, Revised December 2001 — The investigation described in this report was conducted in response to recommendations by NYSDEC to investigate the bedding material underlying the piping of storm water treatment outfalls 010 and 011. This investigation was to determine if offsite migration was occurring through the storm sewers or through the bedding material beneath the sewer lines. In order to comply with the NYSDEC request, Carrier prepared an *RCRA Facility Investigation (RFI) Work Plan* in January 2001 and responded to NYSDEC comments regarding the RFI Work Plan (May 2001). In July 2001, Carrier installed one shallow groundwater monitoring well within the bedding material at each of the two facility outfalls; MW-17 at Outfall 010 and MW-18 at Outfall 011. Wells were installed to a maximum depth of 15.5 feet below ground surface (bgs) with 5-foot screens and were installed as close as possible to the outfall piping to intercept the bedding material surrounding the piping. Specifically, well MW-18 is constructed of a five-foot length of stainless steel screen emplaced such that water within the bedding material is monitored by this well. The screen is attached to a 10 foot length of stainless steel riser. The well is positioned upgradient of the barrier wall at Outfall 011. More details on the installation of the wells within the bedding materials of the outfall can be found in the *RCRA Facility Investigation Report* (EnSafe 2001).

   The initial sampling of groundwater from these wells indicated the presence of several site-related VOCs including trichloroethene (TCE) and associated breakdown compounds. The initial sampling of MW-17 installed at Outfall 010 indicated the presence of several VOCs including TCE, cis-1,2-dichloroethene (cis-1,2-DCE), trans-1,2-dichloroethene (trans-1,2-DCE), and vinyl chloride (VC). Since the initial sampling, MW-17 has been non-detect for site-related compounds. Since its initial sampling, MW-18 has continued to indicate the presence of several compounds including cis-1,2-DCE, TCE, trans-1,2-DCE, 1,1-dichloroethene (1,1-DCE), 1,1-dichloroethane (1,1-DCA), and VC.

2) In late 2002, an interim corrective measure was initiated at the facility to facilitate the Corrective Measures Study (CMS) process that resulted, in part, from the previously mentioned investigation. Two barrier walls and groundwater recovery wells were installed, one each at Outfall 010 and Outfall 011, to reduce potential for contaminated groundwater to discharge to Sanders Creek. These activities are discussed in detail in the *Corrective Measures Study Report* submitted to the NYSDEC in May 2003.

The Outfall 011 and 010 recovery system is not in operation at the present time. A report was submitted to the New York State Department of Health (NYSDOH) that contained air modeling results for the increased groundwater volume to the air strippers at the facility. NYSDOH and NYSDEC have not completed review of this modeling and report, and have not issued a notice to proceed to Carrier for the groundwater recovery from Outfalls 011 and 010.

As part of the consent order, a site-wide groundwater monitoring program was instituted at the facility in November 2006. Select groundwater monitoring wells (Figure 2) associated with SWMUs 1-4, SWMUs 5 and 6, and Area of Concern (AOC) F were sampled in November 2006 and again in February 2007 as part of a one-year duration, quarterly groundwater monitoring program. Groundwater potentiometric surface maps and analytical data associated with the November 2006 sampling event was provided to the NYSDEC in the report titled *Groundwater Monitoring Report, Carrier Thompson Road Facility, Syracuse, New York* submitted on January 26, 2007. Additional information on this site-wide monitoring program can be found in the *Corrective Measures Implementation Work Plan — Site-Wide Monitoring Plan*, September 2006.



LEGEND

(BLUE WELLS)	GROUNDWATER MONITORING WELLS MONITORING AOC F
(GREEN WELLS)	GROUNDWATER MONITORING WELLS MONITORING SWMUs5&6
(BROWN WELLS)	GROUNDWATER MONITORING WELLS MONITORING SWMUs1-4

200 0 200

GRAPHIC SCALE IN FEET

NOTES:

BENCHMARKS: (NOT SHOWN)

BM 164 (ELEV.=42.68)
IRON BOLT AT NORTHEAST CORNER OF CONCRETE SLAB, APPROX. 80 FEET NORTH AND APPROX. 30 FEET EAST OF THE SOUTHEAST CORNER OF BUILDING TR-4.

BM 500 (ELEV.=44.87)
CHISELED CROSS ON EAST NUT OF POSITION INDICATION VALVE, APPROX. 75 FEET NORTHWEST OF THE SOUTHWEST CORNER OF BUILDING TR-7 AND APPROX. 90 FEET NORTHEAST OF THE SOUTHEAST CORNER OF BUILDING TR-1.

MONITORING WELL IDENTIFICATION KEY

FORMER WELL IDENTIFICATION	NEW WELL IDENTIFICATION
MW-99-01	MW-10
MW-99-02	MW-11
MW-99-03	MW-12
MW-99-04	MW-13D
MW-00-5S	MW-14
MW-00-5D	MW-14D
MW-00-06	MW-15D
MW-00-BG	MW-16D

LEGEND

- TR-2 – BUILDING
- – MONITORING WELL
- PZ – PIEZOMETER
- – FORMER RAILROAD SPUR LOCATION

SOURCE:
PHILLIPS & ASSOCIATES SURVEYORS, P.C.
LIVERPOOL, NEW YORK
(FILE 2700.001)

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FIGURE 2
SITE-WIDE MONITORING WELL NETWORK
CARRIER CORPORATION
SYRACUSE, NEW YORK

DWG DATE: 15MAR07 | DWG NAME:080366R008

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2.0 GEOLOGY AND HYDROGEOLOGY

A thorough description of the regional and site-specific geology and hydrogeology can be found in the NYSDEC-approved *Corrective Measures Implementation Work Plan — Site Wide Monitoring Plan* submitted to the NYSDEC in September 2006.

Groundwater occurs at approximately 8 feet bgs near the northern property boundary where this investigation is focused. Groundwater is present in the "native" silty clays and silty sands, beneath the fill material and throughout the lacustrine and glacial till material encountered with depth. Based on previous water level elevation data collected, the potentiometric surface map of the facility indicates that the storm sewer system is exerting an influence over the local groundwater flow system. In general, shallow groundwater flows to the north.

3.0 INVESTIGATION PLAN

The following plan is an initial phase of investigation aimed at identifying the source of VOCs identified in MW-18 groundwater samples collected since 2001. Additional investigations may be performed depending on the results of this initial investigation of the MW-18 source. Any future investigations will build upon data collected from previous investigations.

3.1 Technical Approach

In reviewing the MW-18 groundwater data, the relatively high concentrations of facility-related compounds indicate a nearby source area. Little fluctuation in contaminant concentrations has been observed over the time period in which this well has been sampled, also indicating a nearby source area. MW-18 is outside of the north wall of Building TR-3, just north of the storm water treatment system in the northeast corner of TR-3. Communication with Carrier facility personnel has indicated that a degreaser was formerly located in the southeast corner of Building TR-3. The degreaser was used in the compressor manufacturing and assembly process as a means to clean parts after machining. TCE was reportedly used as the degreasing compound in this degreaser. The degreaser was reportedly removed from the building in the early 1990s.

Previous sampling events, which included monitoring of MW-7 and MW-11, have not indicated any migration of contaminants emanating from the east, or contaminant migration to the east in the area where these wells are located. Also, MW-8, located south of the area near the southeast corner of Building TR-5, does not contain facility-related VOCs. Therefore, based on the lack of concentrations of facility-related VOCs in these peripheral wells, and because well MW-18 is constructed to a depth of 15.5 feet bgs and monitors the shallow groundwater at the site, the investigation will focus on the shallow groundwater in the following areas:

- beneath the floor of Building TR-3
- the area along the storm line beneath TR-3
- shallow groundwater in the area immediately east and south of TR-3.

A direct-push technology (DPT) drilling rig will be employed to conduct this shallow groundwater investigation. At each location inside TR-3, the concrete building floor will be cored using a concrete coring machine to provide a clean access point. Once coring is complete, the DPT drilling rig will advance steel rods containing acetate sleeves that will allow collection of the soil column encountered. The DPT rig is a hydraulically powered soil probing machine that utilizes static force and percussion to advance small diameter sampling tools into the subsurface for collecting soil core and groundwater samples. A closed-piston sampling tool with plastic liner will be used for soil sample collection. From the ground surface, the sampler is advanced 48- or 60-inches (depending on the sampling tool length) and retrieved from the borehole with the first sample. The plastic sleeve and soil core are removed, a new sleeve is installed, and the sampler is inserted back down the same hole to collect the next interval's sample.

Soil and Headspace Logging

The soil column will be evaluated at 2-foot intervals and split for description purposes and field screening using a photoionization detector (PID). After the soil has been in the sealable plastic bag or glass jar for a sufficient amount of time, the volatile organic vapor concentration will be measured from the headspace of each bag or jar. The concentrations will be recorded in the field logbook or on soil boring logs for each boring. Descriptions of the soils encountered will also be placed on soil boring logs and/or recorded in the field logbook.

Temporary Well Installation

The depth of DPT soil borings is not expected to exceed 16 feet as the depth to groundwater may average approximately 7 feet in the TR-3 area. A temporary 1-inch diameter monitoring well constructed of polyvinyl chloride (PVC) materials will be installed in the borehole and will be used to collect grab groundwater samples at each location. The temporary monitoring wells will be installed with the DPT rig using a double push rod system of inner and outer rods. One section of inner rod will be fitted with a drive point and inserted into a section of outer rod. The drive point on the inner rod prevents soil from entering the outer rod as the rod string is pressed into the ground. New inner and outer rods are added as the rod string is advanced into the ground. Once the target depth is reached, the inner rods will be removed, leaving the outer rods in place to hold the hole open during temporary well installation.

If the cohesiveness of the soil allows the hole to stay open when the rods are removed, single rods may be used instead of the dual-wall system. Use of single rods instead of dual wall will expedite temporary well installation.

The 1-inch diameter PVC temporary well screen and riser materials will be lowered through the outer rods to the bottom of the hole. Once the temporary well is in place, the rods are slowly pulled to approximately 2 feet above the temporary well screen, allowing the formation material to collapse around the screen. A filter sock will be used around the screen to prevent large fragments of formation material from entering the temporary well screen and increasing sample turbidity. If a filter sock is not available then a filter pack will be installed if the formation material fails to collapse.

After the rods have been pulled above the screened interval, the remaining portion of the hole will be sealed to ground surface with granulated bentonite, which will be slowly poured down the annulus as the rods are pulled from the hole. The bentonite granules in the vadose zone will be hydrated with deionized water. All temporary wells will be completed flush with ground surface and sealed with a water-tight cap. The temporary wells may be abandoned after groundwater results have been received and evaluated.

Figure 3 shows the number and location of DPT borings proposed for this investigation.

3.2 Shallow Groundwater Sample Collection

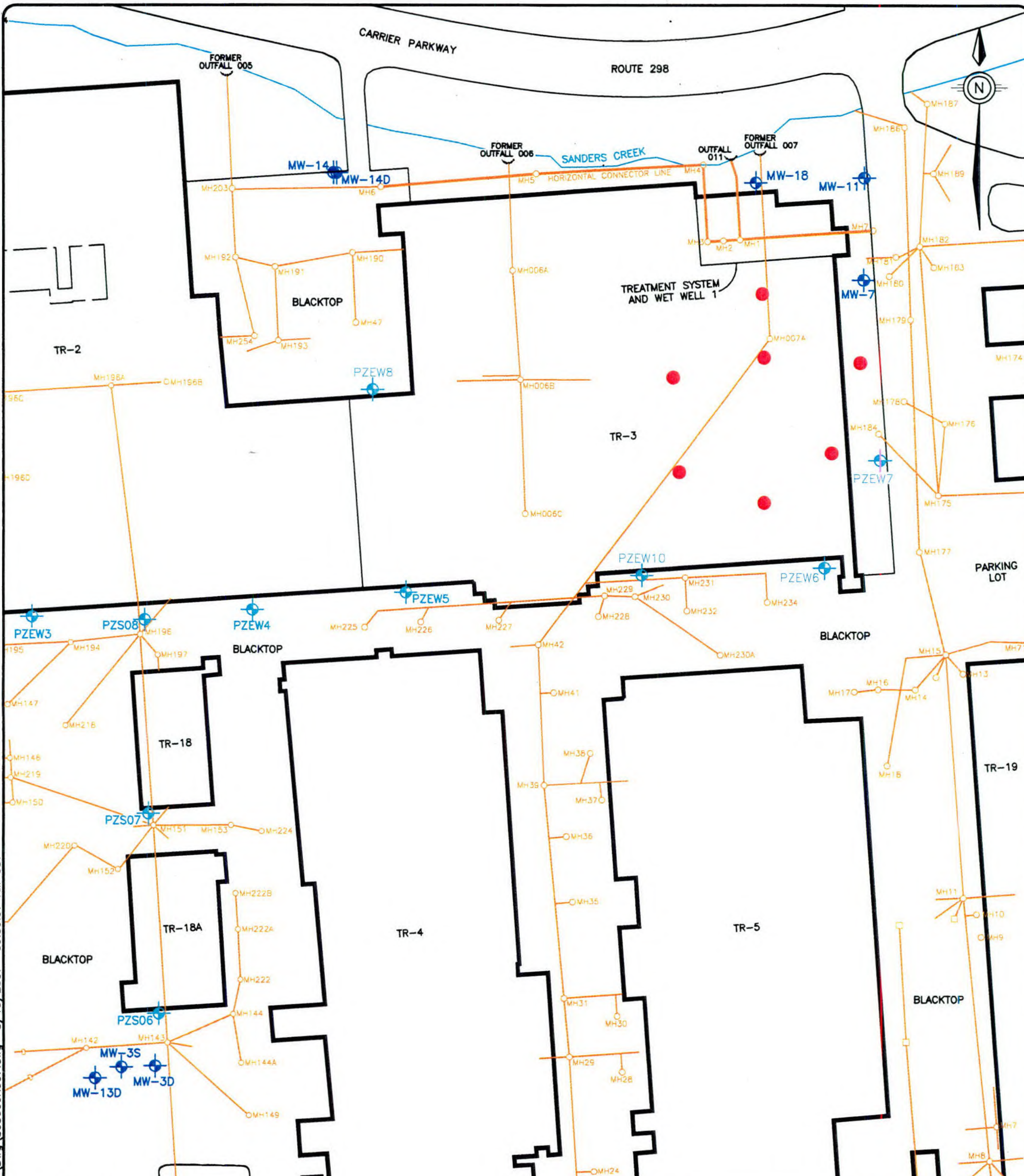
Carrier proposes to collect grab groundwater samples from each temporary well location and analyze the samples for VOCs using U.S. Environmental Protection Agency (USEPA) SW-846 method 8260B (or equivalent method). Additionally, groundwater samples will be collected from existing groundwater monitoring wells MW-7, MW-11, and MW-18 and analyzed for the same VOC parameters. Construction details of the existing wells proposed for groundwater sampling as part of this initial phase of source investigation are shown in Table 1 below.

Table 1
Carrier Thompson Road Facility Monitoring Point Construction Details

Well ID	Total Depth (ft. below top of casing)	Well Screen Interval (ft. below top of casing)	TOC Elevation
MW-7	14.70	4.70-14.70	41.40
MW-11	16.0	6.00-16.00	40.82
MW-18	15.0	10.0-15.0	36.30

Notes:
Well elevations are referenced to mean sea level (msl).
TOC — Top of Casing

After allowing the temporary points to equilibrate overnight, groundwater samples will either be collected using dedicated, disposable bailers at each temporary well or existing groundwater monitoring well location, or will be collected using a length of new dedicated polyethylene tubing attached to a peristaltic pump by which the water can be drawn up into the tubing. Once the tubing has been filled with water, the pump is deactivated and the tubing crimped to prevent backflow into the sampler. The tubing is pulled free from the pump and then the tube's contents are gently drained into the sample containers. If no groundwater enters the temporary well after a period of time, another location will be installed in an attempt to obtain a sample from the general area.



LEGEND

MW EXISTING FACILITY MONITORING WELL

PZ EXISTING FACILITY PIEZOMETER

PROPOSED DIRECT PUSH WATER SAMPLE LOCATION

MH MANHOLE

STORM LINE LOCATION

0 160 320

SCALE IN FEET

FIGURE 3

MW-18 GROUNDWATER SAMPLING POINT LOCATION MAP

CARRIER CORPORATION

SYRACUSE, NEW YORK

REQUESTED BY:	J.G.
DRAWN BY:	E.R.
DWG DATE:	19MAR07
DWG NO:	803666R007

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3.3 Sampling Schedule

Carrier will conduct a one-time sampling of the temporary wells installed and the select facility groundwater monitoring wells as part of this investigation.

3.4 Reporting

A synopsis of the investigation methods, sampling event procedures, and results will be submitted to NYSDEC within 60 days following the receipt of final hardcopy analytical results from the laboratory. The report will also discuss trends identified in the data (if any) and recommendations for future groundwater monitoring.

3.5 Disposition of Investigation-Derived Waste

Groundwater generated during temporary well purging and sampling activities will be treated as investigation-derived waste (IDW) and managed as such. All groundwater IDW will be disposed of onsite, into the nearest inlet for the onsite storm sewer system. Thus, all groundwater generated as a result of sampling activities will be treated by the existing onsite storm water treatment system and ultimately discharged to Sanders Creek via Outfall 011.

3.6 Decontamination Procedure

To prevent cross-contamination during sampling, all drilling and sampling equipment will be decontaminated between each boring. All decontamination procedures requiring pressure washing will be conducted prior to arrival onsite by the drilling firm. Decontamination required onsite will be conducted at a portable decontamination station established prior to the initiation of the sampling activities. The decontamination station will consist of separate buckets of soapy water and rinse water placed on a double-layered sheets of visquine, allowing the station to be easily moved from one investigation location to another.

The following discusses the decontamination procedures for each type of equipment.

- Continuous sampling tubes will be brush scrubbed with a potable water alconox wash followed by a potable water rinse between each sampling interval.
- All stainless steel sampling bowls and spoons, will be decontaminated in the following procedure:
  - Sampling equipment will be brush scrubbed with a potable water and liquinox wash.
  - Equipment will be rinsed with potable water.

  - Equipment then will receive a final distilled water rinse.

  - Once decontaminated, the equipment will be wrapped in aluminum foil until needed again.

- The water level indicator will be decontaminated by rinsing with an alconox solution followed by a distilled water rinse.

4.0 HEALTH AND SAFETY PLAN

All activities in support of this work plan will be conducted in compliance with a site-specific Health and Safety Plan for the Carrier facility, which was previously prepared by EnSafe Inc. prior to beginning field activities associated with the Carrier Thompson Road facility's Consent Order. The health and safety plan was submitted to the NYSDEC as noted in the order, Attachment III, Section B.3.

5.0 IMPLEMENTATION SCHEDULE

Source Investigation Work Plan Sampling and Reporting Schedule

The schedule for the MW-18 Source Investigation activities outlined in this work plan is as follows:

Submittal to NYSDEC:	March 29, 2007
NYSDEC Review	32 days after Submittal (April 30, 2007)
NYSDEC Approval	32 days after Submittal (April 30, 2007)
Preparation/Mobilization for Field Activities	21 days after Approval (May 21, 2007)
Field Activities Commencement	21 days after Approval (May 21, 2007)
Lab Analysis	20 to 45 days after completion of field activities (June 13 to July 9, 2007)
Report generated for submittal to NYSDEC	45 days after receipt of final hard copy laboratory data (July 28 to August 23, 2007)

Note: Dates are conditional based upon approval date of Work Plan, site conditions, and other factors.

The report generated will detail the sampling activities and procedures, results, and further actions, if warranted.

6.0 REFERENCES

EnSafe. (2001a), *RCRA Facility Investigation Work Plan*, Carrier Corporation, Thompson Road Facility, Syracuse, New York; Nashville, Tennessee; 43 p.

— (2001b), *RCRA Facility Investigation Report*, Carrier Corporation, Thompson Road Facility, Syracuse, New York; Nashville, Tennessee; 52 p.

— (2003), *Corrective Measures Study Report*, Carrier Corporation, Thompson Road Facility, Syracuse, New York; Nashville, Tennessee; 39 p.

— (2006), *Corrective Measures Implementation Work Plan — Site-Wide Monitoring Plan*, United Technologies/Carrier — Thompson Road Facility, Syracuse, New York; Nashville, Tennessee; 33 p.

— (2007), *Groundwater Monitoring Report*, Carrier — Thompson Road Facility, Carrier parkway, Syracuse, New York; Nashville, Tennessee; 18 p.

NYSDEC. (2002, December). *Draft DER-10 Technical Guidance for Site Investigation and Remediation*. Division of Environmental Remediation; December 25, 2002.

USEPA. (1996, December). *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846). Third edition Update III. Office of Solid Waste; December 1996.

Attachment A

Sampling and Analysis Plan

1.0 SAMPLING AND ANALYSIS PLAN

Previous groundwater sampling at the site identified trichloroethene (TCE) and associated daughter products in a monitoring well located in the northeastern portion of the Carrier Thompson Road facility. These compounds were identified in shallow groundwater at well MW-18 installed in the bedding material of Outfall 011. This Sampling and Analysis Plan (SAP) discusses the objectives that must be met to identify the source for the volatile organic compounds (VOCs) in MW-18. Sampling rationale and methods are discussed below.

1.1 Objective

The objective of the sampling program is to collect samples representative of conditions at the site. Samples will be collected and transported in a manner that maintains their integrity and composition until they are received in the laboratory. This objective may best be achieved by consistently following the sample collection procedures outlined below. These procedures describe sample collection, preservation, and holding times to be followed in the field. Related activities are also described in Section 6.

Scope

As discussed earlier in Section 4, this Work Plan is designed to identify the source of contaminants in the shallow groundwater in well MW-18 at the Carrier Thompson Road facility.

1.2 Field Methods — Boring Installation

Direct-push technology (DPT) drilling methods, outlined in Section 4 of this Work Plan are to be employed to collect shallow groundwater samples beneath and in the vicinity of the eastern portion of Building TR-3. Borings will be installed in which temporary 1-inch-diameter groundwater monitoring points will be installed to sample shallow groundwater. In addition, select existing groundwater monitoring wells will also be used to collect representative samples of groundwater.

1.2.1 Water Level Measurements

Prior to groundwater sampling, static water levels will be measured in existing wells and temporary wells installed as part of this investigation. Water levels may be measured immediately before each well is purged and sampled or may be completed first prior to purging and sampling any permanent well at the site. Water levels will be measured from the designated survey mark at the top of the casing with an electronic water level indicator to within 0.01 foot. Specific procedures for water level measurements are presented in Appendix A.

1.2.2 Groundwater Sampling

Groundwater samples will be collected from the proposed DPT investigation temporary well locations as well as existing facility wells MW-7, MW-11, and MW-18. Temporary wells are proposed to be installed in each bring advanced as part of the investigation for collection of a groundwater sample. These samples will be collected using dedicated bailers, a peristaltic pump, or an electric submersible pump and analyzed for VOCs in accordance with U.S. Environmental Protection Agency (USEPA) SW-846 Method 8260B. Each facility groundwater monitoring well designated as part of this investigation will be purged prior to sampling by removing three well casing volumes or by using low-flow purging techniques and monitored for stabilization (typically within 10% of the previous reading) of conductivity, turbidity, temperature, and pH values. Proposed purging/sampling methods for each of the wells to be utilized in this investigation are shown below in Table 1.

Table 1
Facility Well Purging/Sampling Methods

Well Designation	Purging/Sampling Method
MW-7	Disposable bailer
MW-11	Disposable bailer
MW-18	Disposable bailer
Investigation Temporary Wells (TW)	Disposable bailer/peristaltic pump

If recharge rates are low, wells will be purged to dryness, allowed to recharge, and then sampled within the same day. Sampling procedures are outlined in Appendix B.

After samples are collected, they will be preserved on ice for delivery to Accutest Laboratories in Dayton, New Jersey, an analytical laboratory approved by both Carrier and the State of New York (Appendix C). Sample processing, identifications, and validation are presented in the Quality Assurance Project Plan (QAPP) (Attachment B). Analytical results will be presented in a synopsis of the investigation, submitted to NYSDEC within 60 days following the receipt of final hardcopy analytical results from the laboratory.

All activities will be recorded in the facility-dedicated field logbook or on dedicated Well Purging and Sampling Forms. An outline of information to be recorded in the field notebook is presented in Appendix D.

1.2.3 Investigative-Derived Waste

Groundwater generated during well purging and sampling activities will be treated as investigation-derived waste (IDW) and managed as such. All groundwater IDW will be disposed of onsite, into the nearest inlet for the onsite storm sewer system. Thus, all groundwater generated as a result of sampling activities will be treated by the existing onsite storm water treatment system and ultimately discharged to Sanders Creek via Outfall 011.

1.2.4 Other Waste

General refuse such as packing materials, plastic sheeting, discarded string, and tubing may be generated during field activities. This refuse will be managed as nonhazardous material and disposed of in an onsite solid waste Dumpster.

1.3 Execution

1.3.1 Equipment Decontamination

Before collecting each sample, all nondisposable or nondedicated small sampling and downhole (intrusive) equipment will be decontaminated manually in accordance with the following procedures:

- Wash equipment with potable water and laboratory (phosphate-free) detergent using a brush, if necessary, to remove particulate and surface film.
- Rinse with distilled water.
- Air dry thoroughly.
- If there is insufficient time to air dry, rinse a second time with distilled water.
- If necessary, wrap in aluminum foil to prevent recontamination prior to use.

Complete decontamination activities in the field away from the well openings and areas thought to be contaminated or in safe, facility-approved areas to prevent accidental contamination. Specifically for this site, equipment will be decontaminated near but away from the individual well locations included as part of this investigation.

1.4.2 Analytical Schedule – Groundwater

Up to 15 groundwater samples (including quality assurance samples) will be collected and analyzed for VOCs. These samples will represent upgradient and cross-gradient conditions from MW-18.

Groundwater samples collected from temporary wells, and existing facility groundwater monitoring wells will be analyzed in accordance with USEPA Method 8260 by Accutest Laboratories in Dayton, New Jersey, a qualified New York State-approved laboratory selected by Carrier. The laboratory will report the results for all VOCs on its 8260 list. Laboratory analysis will be conducted in accordance with approved USEPA procedures as outlined in *Test Methods For Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition.* Table 2 lists the parameters, matrix, holding times, and method numbers for these analyses.

Appropriate industry standard sample handling, sampling documentation, and quality assurance/quality control (QA/QC) procedures will be used. QA/QC samples will include one duplicate per 20 samples and one trip blank per sample cooler. All samples will be submitted for analysis under chain-of-custody records and analyzed within the holding time specified for each method. Reports for all samples will be provided to EnSafe within four weeks of the date the samples arrived at the laboratory. At a minimum, the data quality objectives (DQOs) for this activity will be equivalent to USEPA Level II DQOs.

Analytical Methods, Holding Times, and Detection Limits

Groundwater samples will be analyzed for VOCs by Method 8260B within a holding time of 14 days, as outlined in Table 2.

Table 2
Analytical Methods for Groundwater Samples

Parameter	Matrix	Analytical Method	Holding Times	Data Use
VOCs	Groundwater	8260B	14 days	Used to determine the extent of contamination, contaminant mass present, and the potential for migration offsite.

Appendix A
Static Water Level Measurement Procedures

STATIC GROUNDWATER LEVEL MEASUREMENTS

Before collecting the sample from each well, water levels will be measured with an electronic water level indicator in the following manner:

- Unlock and loosen well cap.

- Detection of immiscible layers is not expected; however, a photoionization detector (PID) will be used to determine the presence of organic vapors in the well. Place the tip of the PID under the cap and record the reading in the field notebook. If organic vapors do exist, the well will be sampled before purging to verify the existence of immiscible layers.

- Put on a clean pair of nitrile gloves.

- Decontaminate the instrument by rinsing first with tap water, then with distilled water.

- Turn the water level indicator to the ON position and press the test button. The light should come on and/or the buzzer should sound. If the light does not come on or the buzzer does not sound, check connections and/or replace the battery.

- Unreel the cable slowly down the well and listen for the buzzer or light to indicate the probe is in the water.

- Pull the cable up a few inches.

- Lower the cable down the well slowly until the buzzer sounds. The measurement is made at the point where the cable crosses the surveyed mark on the top of the well riser pipe. Mark this point with a fingernail, the edge of a finger, or a pen.

- If the cable is marked to 100th of a foot, read the water level directly. If not, use an engineer's scale to measure down from the nearest foot marker to the water level marked in the last step. Then add the measured length to the value of the foot marker.

- Record the depth to water in the field notebook to the nearest 100th of a foot.

- Reel up the cable and rinse the instrument with distilled/deionized water.

Appendix B
Groundwater Sampling Procedures

SAMPLING PROCEDURES

After water level measurements have been made, at least three well volumes of water will be purged from each well before sampling, unless the particular well is to be sampled using low-flow or passive diffusion bag sampling.

To determine the volume of water to be purged:

- Subtract the depth to water measurement from the total depth of the well (should be measured from the top of the well riser pipe).
- Multiply the number obtained by 0.16 (volume of a 2-inch-diameter well in gallons per foot).
- Multiply the number obtained above by three. The result is the number of gallons equivalent to three casing volumes for a 2-inch-diameter well. This is the minimum number of gallons that must be removed to allow representative groundwater to enter the well casing, if well is not to be purged using low-flow or passive diffusion bag methods.

Second, the order in which wells are purged will be to purge any upgradient wells before wells in source area or wells downgradient from the source area. Each well to be purged by using a submersible pump, peristaltic pump, dedicated bladder pump, or disposable bailer:

- Place a bucket of known volume near the well to be purged.
- Put plastic around the well.
- Put on a clean pair of nitrile gloves and change the gloves between each well, or any time that they become damaged or contaminated.
- Use a dedicated bailer, precleaned submersible pump, peristaltic pump, or dedicated bladder pump to purge the required volume from each well.
- If any well does not produce a sufficient amount of water for such an evacuation, bail or pump the well dry and allow it to recharge for at least one hour before sample collection.
- Record the total volume removed.
- Record the color and odor of the water and the amount of sediment.

Field sampling will be conducted in accordance with the following procedures:

- Collect groundwater samples in precleaned glass or plastic bottles depending on the parameter of concern.

- Label all sample bottles with sample ID, date/time, project number, site name, analyses to be performed, and preservatives used.

- If the well has been purged using a precleaned submersible pump, use a dedicated bailer and new nylon cord to collect the representative groundwater sample. If the well was purged using dedicated a bladder pump or peristaltic pump, collect the representative groundwater sample directly from the end of the Teflon-lined discharge tube.

- Wear disposable nitrile gloves during all sampling activities and discard the gloves between each well.

- Lower the bailer down the well, taking care not to allow the bailer or cable to touch the ground or any other potentially contaminated surface.

- Raise the bailer to the surface.

- Pour water directly from the bailer into the sample bottles.

- Continue bailing until an adequate volume has been collected.

- Replace well cap and lock.

Appendix C
Sample Handling Procedures

SAMPLE HANDLING PROCEDURES

- Immediately after sample collection, check the label for completeness. Place the samples in a cooler containing ice.

- Sample bottles will be placed in plastic storage bags, providing secondary containment for shipping.

- The chain-of-custody form will be completed and kept with the samples at all times inside the cooler in a plastic bag. Before shipping, the plastic bag containing the chain-of-custody form shall be taped securely to the inside lid of the cooler.

- The sampler will maintain custody from the time of sampling until the coolers are prepared for transport and shipped via overnight air freight, or until the samples are delivered by the sampler to the laboratory.

- Glass sample bottles will be wrapped in bubble wrap packaging to eliminate the possibility of breakage. All sample containers will be placed upright in the cooler. Inert packaging materials will be used.

- Prior to shipping, the cooler will be securely taped shut, including the drain plug, with plastic tape.

- Samples will be shipped, at a minimum, the end of every other sampling day. If time prohibits daily shipments, sufficient ice will be added to the sample cooler and the cooler will be secured for the night in the manner described above.

- The laboratory will be notified in advance of the expected arrival, including the number of samples, the method of transport, and the types of analyses to be performed.

- Field personnel will use bound logbooks for the maintenance of all field records pertaining to well drilling, installation, and sampling activities. These records will be maintained in the project file and will document all visual observations, calculations, and equipment adjustments.

Appendix D
Recording Information on Field Activities

RECORDING INFORMATION ON FIELD ACTIVITIES

Field notes will be maintained in the following manner:

- Entries in the field logbook will be legibly written in indelible ink.

- A new page will be used at the beginning of each day's activities. This page will identify the date, time, location, onsite personnel, and observed weather conditions.

- Sketches or maps of the site will be included to identify well, sample, and/or photograph locations. Maps should include a north arrow and scale, if possible.

- Information for water level measurements will include a well number, date, time, and current weather conditions.

- When sampling is complete, the notes will include date, time, sample locations, sample ID numbers, and whether or not the sample was a duplicate.

- None of the documents are to be destroyed or thrown away, even if they are illegible or contain inaccuracies.

Attachment B

Quality Assurance Project Plan

Quality Assurance Project Plan
for the
Source Investigation Work Plan
Monitoring Well MW-18 Area

United Technologies/Carrier — Thompson Road Facility
Syracuse, New York

Corrective Action Order – Index CO 7-20051118-4

EnSafe Project Number.: 0888803666

Prepared for:

United Technologies Corporation
UTC Shared Remediation Services
United Technologies Building
Hartford, Connecticut 06010

Submitted by:

ENSAFE

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(615) 255-9300
www.ensafe.com

March 2007

A-1 TITLE AND APPROVAL SHEET

Quality Assurance Project Plan
for the
Source Investigation Work Plan
Monitoring Well MW-18 Area
United Technologies/Carrier - Thompson Road Facility
Syracuse, New York

Submitted To:

UTC Shared Remediation Services
United Technologies Building
Hartford, Connecticut 06010

Submitted by:

EnSafe Inc.
220 Athens Way, Suite 410
Nashville, Tennessee 37228

March 2007

Project Signatures:

Tina Cantwell
Tina Cantwell, CHMM - QA Manager
EnSafe Inc.

March 29, 2007
Date

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A-3 DISTRIBUTION LIST

The following individuals will receive copies of the approved Quality Assurance Project Plan (QAPP) and subsequent revisions:

William E. Penn — Program Manager, United Technologies Corporation, Hartford, Connecticut

Nelson Wong — Carrier Thompson Road Facility EH&S Manager, Syracuse New York

Craig Wise, PE — Program Manager, EnSafe Inc.

May M. Heflin, PE — Project Manager, EnSafe Inc.

Tina Cantwell, CHMM — QA Manager, EnSafe Inc.

Larry Rosenmann — New York State Department of Environmental Conservation (NYSDEC) Project Manager, Albany, New York

A-4 PROJECT/TASK ORGANIZATION

This QAPP documents the planning, implementation, and assessment procedures for the investigation of a source for facility-related volatile organic compounds (VOCs) in well MW-18 at the Carrier Corporation Thompson Road facility, Syracuse, New York. United Technologies Corporation (UTC) has prepared the QAPP in response to the requirements outlined in the NYSDEC Consent Order CO 7-20051118-4 (order) dated February 13, 2006, and follow-up letter from Larry Rosenmann with NYSDEC to William E. Penn of UTC on February 9, 2007.

This QAPP addresses sample collection activities for the MW-18 source investigation, which will be conducted by EnSafe Inc. personnel. The laboratory analyses will be conducted by Accutest Laboratories, Dayton, New Jersey, a laboratory certified by the New York State Department of Health. Figure 1 is a project organizational chart that outlines the specific organization of this project.

PROJECT ORGANIZATION

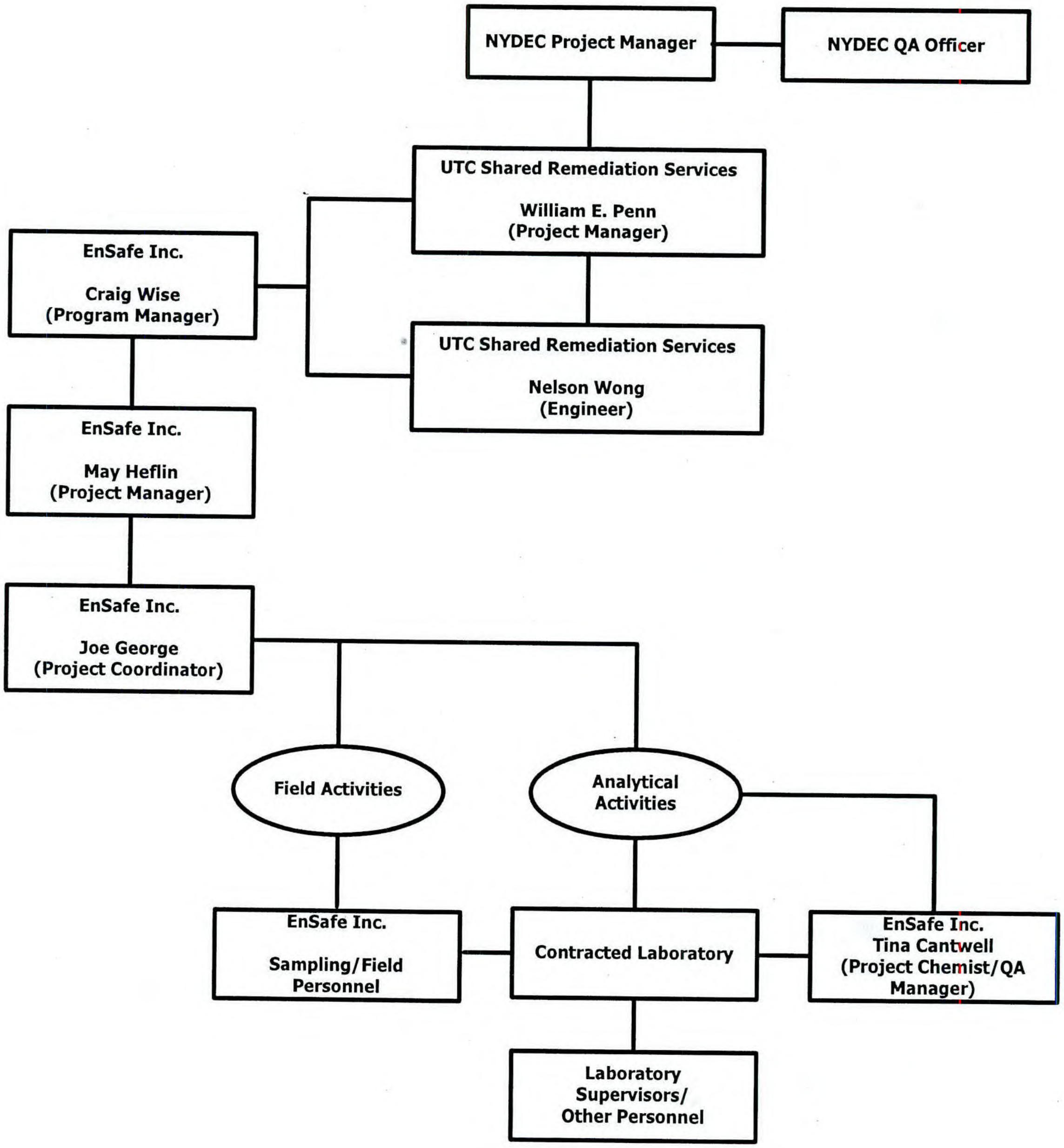

Figure 1 Project Organization

As Carrier's subcontractor for this project, EnSafe Inc. will be responsible for implementing the project. EnSafe Project Manager May Heflin is responsible for project implementation and has the authority to commit the resources necessary to meet project objectives and requirements. The Project Manager's (PM) primary function is to ensure that technical, financial, and scheduling objectives are achieved successfully. The PM also will be responsible for maintaining the official, approved QAPP. The PM will work closely with Project Coordinator Joe George to see that project tasks are appropriately completed. The PM will primarily be responsible for all EnSafe project activities. EnSafe's Program Manager Craig Wise will also report directly to Carrier and will provide the major point of contact and control for matters concerning the project. EnSafe Quality Assurance (QA) Manager Tina Cantwell will be responsible for ensuring that all EnSafe procedures for this project are being followed. The QA Manager, who is independent of data generation activities, will be responsible for the adherence to all quality assurance/quality control (QA/QC) as defined in the QAPP, and will recommend and implement corrective measures and perform audits for proper performance and compliance with the QAPP, as necessary. The EnSafe field technical staff for this project will be drawn from EnSafe's pool of corporate resources. The technical team staff will be utilized to gather and analyze data and to prepare various task reports and support materials. All of the designated technical team members are experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work.

The laboratory subcontractor will be responsible for furnishing all equipment, supplies, and personnel needed to accomplish the analytical requirements specified in this QAPP. The contracted laboratory will be approved Certified by the New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program.

A-5 PROBLEM DEFINITION/BACKGROUND

A 1997 RCRA [Resource Conservation and Recovery Act] Facility Assessment Report (RFA) summarized a visual site inspection in which 17 solid waste management units (SWMUs) and 2 areas of concern (AOCs) were identified at the Thompson Road facility. The RFA determined that most of these units identified at the facility are located indoors over concrete. The RFA further states that there is minimal potential for release from these units and that they require no further action. Those units where it was concluded there is more than a minimal potential for release are: two former 20,000-gallon concrete storage tanks (SWMUs 1 and 2), two former 8,000-gallon steel storage tanks (SWMUs 3 and 4) in the immediate area of SWMUs 1 and 2, and two former 8,000-gallon concrete storage tanks (SWMUs 5 and 6).

AOC F, identified by NYSDEC during the RCRA Facility Investigation (RFI), included the bedding material at two existing storm water outfalls (010 and 011) that discharge into Sanders Creek. AOC D, also identified by NYSDEC during the RFI, includes the source area for polychlorinated biphenyls at the facility.

More in-depth discussions of these SWMUs and areas of investigation can be found in the following documents and reports submitted to NYSDEC:

RCRA Facility Assessment Report, 1997
Release Assessment Report, 2001
Carrier Thompson Road Facility RFI Work Plan, January, 2001
Carrier Thompson Road Facility RFI Report, September, 2001
Carrier Thompson Road Facility RFI Report, September 2001, Revised December 2001
Carrier Thompson Road Facility RFI Report, September 2001, Revised December 2001, Revised September 2002
Carrier Thompson Road Facility CMS Work Plan, January 2002
Carrier Thompson Road Facility CMS Report, May 2003

The MW-18 investigation is being conducted to determine the source of facility-related VOCs that have been detected in monitoring well MW-18 since its installation in 2001. Compounds detected in MW-18 include cis-1,2-dichloroethene (cis-1,2-DCE), trichloroethene (TCE), trans 1,2-dichloroethene (trans-1,2-DCE), 1,1-dichloroethene (1,1-DCE), 1,1-dichloroethane (1,1-DCA), and vinyl chloride (VC) in concentrations above NYSDEC action levels for groundwater. The proposed initial phase of investigation strategy includes installing direct-push technology (DPT) soil borings and, subsequently, temporary shallow groundwater wells through a portion of the floor in the eastern section of Building TR-3 at the Thompson Road facility. EnSafe proposes to collect shallow groundwater samples from the temporary wells and from select existing groundwater monitoring wells in the general vicinity of MW-18.

This QAPP documents how specific QA/QC activities will be applied during the investigation activities to identify the source of facility-related VOCs in well MW-18. The purpose of this sampling is to determine the location of the source for the VOCs identified in MW-18. To this end, this QAPP defines the minimum field and laboratory QA, and the methodological and reporting requirements to be used for this project, as specified in the NYSDEC February 9, 2007, letter, and the New York State Department of Environmental Conservation Program Policy DSHM-HW-05-15, *Quality Assurance Project Plans.* This QAPP has been prepared in accordance with the specifications of *EPA Requirements for Quality Assurance Project Plans,* (United States Environmental Protection Agency [USEPA], March 2001).

A-6 PROJECT/TASK DESCRIPTION

This purpose of this project is to identify the source for the VOCs being detected in well MW-18 in the northeastern portion of the facility. A program has been developed that proposes to install DPT borings to intercept shallow groundwater. Temporary wells are proposed for installation within the DPT borings and grab groundwater samples collected in select areas upgradient from MW-18. In addition, grab groundwater samples are proposed for collection from existing onsite shallow groundwater monitoring wells in the vicinity of MW-18. All groundwater samples collected will be analyzed for VOCs. Up to 15 groundwater samples (including quality assurance samples) will be collected during the duration of this investigation. Carrier will submit a report summarizing the data and if applicable, proposing future monitoring requirements for review and approval by the NYSDEC. All results will be compared to applicable state and federal groundwater quality criteria.

Monitoring at Well MW-18

Table 1 lists the temporary well monitoring points and existing facility shallow groundwater monitoring wells from which groundwater samples will be collected for this investigation. Figure 3 in the MW-18 source investigation work plan shows the general investigation area and the location of the monitoring points to be sampled.

Table 1
MW-18 Source Investigation Monitoring Points

Designation	**Shallow Existing Facility Monitoring Wells**
Wells	MW-7, MW-11, MW-18
Designation	**Shallow Temporary Wells**
Well	TW-1 though TW-7 (depending on site conditions)

A-7 QUALITY OBJECTIVES AND CRITERIA

The overall QA objective for this project is to develop and implement procedures for field sampling, chain of custody, laboratory analysis, and reporting that will provide results that are scientifically valid at levels that are sufficient to meet data quality objectives (DQOs). Specific procedures for sampling, chain of custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal quality control, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP.

In combination, QA/QC represents a set of procedures designed to produce analytical data of known and measurable quality. A useful distinction between QA and QC can be made as follows: QC represents the set of measurement procedures (spikes, blanks, replicates, calibration, etc.) used to provide overall evidence of the quality of a particular analytical batch; QA represents the set of procedures used to ensure that this evidence is available and used properly to evaluate and, if necessary, to qualify the data quality.

A-7.1 Data Quality Objectives

The QA objectives during the MW-18 source investigation will be to ensure that the data meet the DQOs that were developed for the Carrier facility to ensure data of known and acceptable quality are produced to comply with the NYSDEC request. The following sections describe the DQO process for the MW-18 source investigation.

A-7.1.1 State the Problem

Previous sampling at MW-18 identified TCE and associated daughter products from an unknown source. The site information and requirements for groundwater investigation are outlined in NYSDEC's February 9, 2007, letter. This DQO process discusses the objectives that must be met to identify the source of facility-related VOCs.

A-7.1.2 Identify the Decision

Analytical data obtained from groundwater samples in the vicinity and upgradient of MW-18 will be provided to NYSDEC to determine:

- Whether there is a source of TCE and daughter products in shallow groundwater beneath the floor in the eastern portion of Building TR-3.

- whether there is a continuing source of TCE and daughter products in the storm sewer bedding upgradient of MW-18

- whether any of the investigated areas will require corrective action.

A brief summary of the investigative areas, the objectives, and the investigative approach are provided in Table 2.

Table 2
Data Quality Objective Summary

Investigation Area	State the Problem	Identify the Decision	Define the Study Boundaries
Vicinity and Upgradient of MW-18	Contaminated groundwater was discovered migrating through the storm sewer bedding, bypassing the water treatment plant and entering Sanders Creek beyond outfalls 010 and 011. An interim remedial action was performed and included cut-off walls and recovery wells to collect the contaminated water and send it to the onsite treatment plant. The system has not yet been brought online. Residual VOC contamination is identified in MW-18 installed in the Outfall 011 bedding material upgradient from the cut-off wall. This investigation is to identify the source of the VOCs detected in MW-18.	Identify the source of VOCs identified in MW-18. The remedial goal for the source is that significant levels of VOCs are no longer migrating through groundwater and offsite, and are not causing a threat to human health or the environment.	Investigation is to include: • Sampling groundwater from eight temporary shallow aquifer upgradient wells TW-1 through TW-7 installed inside and around the eastern section of Building TR-3. • Sampling groundwater from existing shallow facility groundwater monitoring wells MW-7, MW-11, and MW-18.

A-7.1.3 Identify Inputs to the Decision

Inputs include analytical results and regulatory guidance. Table 6 provides the reporting limits and analytical site screening objectives for the MW-18 source investigation. If groundwater standards are not met, monitoring must demonstrate that natural attenuation continues to reduce the concentration of contaminants in the already contaminated areas; or that contaminant concentrations have stabilized and do not pose a significant threat to human health or the environment.

A-7.1.4 Define the Study Boundaries

Grab groundwater samples from the investigative area were based on the historical use of the area upgradient from MW-18 and the analytical information obtained from previous sampling results of wells in the vicinity of MW-18. Monitoring points included as part of this investigation have been previously identified in Table 1.

A-7.1.5 Develop a Decision Rule

If monitoring indicates that the remedial requirements are not met, then the area will be evaluated for corrective measures.

A-7.1.6 Specify Limits on Decision Errors

a) The null hypothesis is that each of the areas investigated (or to be investigated) is not contaminated. Sampling and analyses will be performed based on historical uses in the area. This sampling and analysis is performed to determine the source for the concentrations identified in MW-18, and if found, the nature and extent of contamination will be determined.

b) A sampling design error occurs when the data collection design does not capture the complete variability within the area of investigation to the extent appropriate for a decision to be made. This could potentially lead to the extent of contamination not being defined properly and/or corrective measures not adequately treating the true problem area.

c) A false rejection decision error may occur if a limited amount of sampling and analysis is performed, causing a broader area of contamination to be outlined. This may result in additional expense related to corrective measures implementation.

While the possibilities of making decision errors cannot be eliminated totally, the occurrence of such errors can be minimized by developing better work plans.

A-7.1.7 Optimize the Design for Obtaining Data

The sampling plan for the MW-18 source investigation is based on reasonable sample numbers for the size of the area. The analytical methods for analysis of the groundwater samples are USEPA-approved, definitive analytical methods, which satisfy the decision criteria (Step 5.5). The design has been and will be used to focus all sampling and analysis activities on the decision (Step 5.2) in an efficient and cost-effective manner.

A-7.2 Measurement Performance Criteria

Performance criteria selected for the analytical measurement systems will ensure the project objectives in Section A-7.1 are met. The following paragraphs provide performance criteria for the project specific analytical measurement systems.

A-7.2.1 Precision

Precision measures the reproducibility of measurements and methods, and is defined for qualitative data as a group of values' variability compared with its average value. To assess the precision of the measurement systems used in this project, field duplicates will be obtained and analyzed with the samples collected. Precision of laboratory analysis will be assessed by comparing the analytical results between matrix spike and matrix spike duplicates (MS/MSDs). The relative percent difference (RPD) will be calculated for each pair of duplicate analysis using the following equation:

$$RPD = \frac{(S - D)}{(S + D)/2} x\,100$$

Where:

S = sample result
D = duplicate result

A-7.2.2 Accuracy

Accuracy is the degree to which a given result agrees with the true value. The accuracy of an entire measurement system is an indication of any bias that exists. Spiked sample results provide information needed to assess the accuracy of analyses. Specifically, surrogate spike, MS/MSD, and laboratory control sample (LCS) percent recoveries (%Rs) are used to assess accuracy. Every organic sample is spiked with known quantities of nontarget surrogate compounds.

Five percent of all samples analyzed are spiked with target chemicals for the MS/MSD. If the calculated %Rs for the known spike concentrations are within defined control limits set by each method, the reported sample concentrations are considered accurate. Accuracy is calculated using the following equation.

$$\%R = \frac{(SSR - SR)}{SA} x100$$

Where:

SSR	=	spike sample recovery
SR	=	sample recovery
SA	=	concentration of spike added

A-7.2.3 Representativeness

Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative parameter that is dependant upon the proper design of the sampling program and proper laboratory protocol. The sampling approach was designed to provide data representative of site conditions and the number of sampling points was selected based on requirements set forth in the order. During development of this approach, consideration was given to past waste disposal practices, existing analytical data, physical setting, and processes previously conducted and/or used in the vicinity of MW-18. The sampling approach was discussed in the Work Plan. Representativeness will be satisfied by ensuring that the MW-18 source investigation work plan, QAPP, and USEPA protocols are followed; proper sampling techniques are used; proper analytical procedures are followed; and holding times of the samples are not exceeded by the laboratory.

A-7.2.4 Comparability

Comparability expresses the confidence with which one data set can be compared to another. Comparability is also dependent on similar QA objectives. Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring proper sampling techniques are used.

The objective of this QA/QC plan is to produce a high level of comparability between data sets. Heterogeneous investigative samples make it difficult to obtain consistently high comparability values. However, the use of standard methods for sampling and analysis (USEPA protocols), reporting data in standard units, and using standard and comprehensive reporting formats will optimize the potential for high levels of data comparability.

A-7.2.5 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount expected to be obtained under correct normal conditions. It is expected that 100% of the planned sampling points will be collected. The area within Building TR-3 is expected to be accessible and the shallow groundwater monitoring wells in the vicinity are also expected to be accessible. The completeness goal for field measurements will be greater than 90%. Laboratory analysis for this project will have a completeness goal greater than 95% to account for unanticipated results that may be rejected during data validation. Completeness can be calculated using the following equation.

$$\%Completeness = \frac{No.\ of\ Valid\ Tests}{Total\ Tests\ Taken} x100$$

A-7.2.6 Sensitivity

Sensitivity is the measure of the concentration at which an analytical method can positively identify and report analytical results. The sensitivity of a given method is commonly referred to as the detection limit. Definitions for common detection limits are defined below.

1. Method detection limit (MDL) is a statistically determined concentration. It is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero.

2. Method reporting limit (MRL) is a multiple of the MDL and is regarded as the minimum level of target analyte in a sample that can be reliably achieved within specified limits of precision and accuracy. The MRL is variable and highly matrix-dependent.

The sensitivity goal (or method detection limit) for laboratory measurements reported for this project shall at least meet or be lower than the NYSDEC water quality standards.

A-7.2.7 Summary of Matrix Types, Analytical Methods and QA Targets

Table 3 summarizes the analytes, detection limits, and action levels for the MW-18 source investigation. Routine QA targets listed in the contracted laboratory's New York State approved Quality Assurance Plan (QAP) will be used to assessed precision and accuracy of analytical data generated for this effort (Table 4). The QAP outlines the laboratory's capabilities, the routinely used quality control measures, the routine QA targets for precision and accuracy, and all documentation, calibration and maintenance activities that are necessary to produce data of a known and acceptable quality.

Table 3
Analytes, Detection Limits, and Action Levels

Chemical Abstract Services No	Analyte Name	Method Reporting Limit [a]	Method Detection Limit [a]	NYSDEC Standard [b]	NYSDEC Guidance [b]	Units
Groundwater Samples						
71-55-6	1,1,1-Trichloroethane	1	0.28	5		µg/L
79-34-5	1,1,2,2-Tetrachloroethane	1	0.28	5		µg/L
79-00-5	1,1,2-Trichloroethane	1	0.32	1		µg/L
75-34-3	1,1-Dichloroethane	1	0.23	5		µg/L
75-35-4	1,1-Dichloroethene	1	0.33	5		µg/L
107-06-2	1,2-Dichloroethane	1	0.29	0.6		µg/L
78-87-5	1,2-Dichloropropane	1	0.20	1		µg/L
78-93-3	2-Butanone (MEK)	10	2.6		50	µg/L
591-78-6	2-Hexanone	5	1.3		50	µg/L
108-10-1	4-Methyl-2-pentanone (MIBK)	5	1.1	[c]		µg/L
67-64-1	Acetone	10	2.4		50	µg/L
71-43-2	Benzene	1	0.21	1		µg/L
75-27-4	Bromodichloromethane	1	0.17		50	µg/L
75-25-2	Bromoform	4	0.54		50	µg/L
74-83-9	Bromomethane	2	0.22	5		µg/L
75-15-0	Carbon disulfide	2	0.21	[c]		µg/L
56-23-5	Carbon tetrachloride	1	0.29	5		µg/L
108-90-7	Chlorobenzene	1	0.22	5		µg/L
75-00-3	Chloroethane	1	0.56	5		µg/L
67-66-3	Chloroform	1	0.22	7		µg/L
74-87-3	Chloromethane	1	0.35	[c]		µg/L
156-59-2	cis-1,2-Dichloroethene	1	0.18	5		µg/L
10061-01-5	cis-1,3-Dichloropropene	1	0.15	0.4 [d]		µg/L
124-48-1	Dibromochloromethane	1	0.19		50	µg/L
100-41-4	Ethylbenzene	1	0.20	5		µg/L
75-09-2	Methylene chloride	2	0.27	5		µg/L
100-42-5	Styrene	5	0.16	5		µg/L
127-18-4	Tetrachloroethene	1	0.28	5		µg/L
108-88-3	Toluene	1	0.20	5		µg/L
156-60-5	trans-1,2-Dichloroethene	1	0.42	5		µg/L
10061-02-6	trans-1,3-Dichloropropene	1	0.20	0.4 [d]		µg/L
79-01-6	Trichloroethene	1	0.29	5		µg/L
75-01-4	Vinyl chloride	1	0.29	2		µg/L
1330-20-7	Xylene (total)	1	0.31	5		µg/L

Notes:

[a] Reporting limits and method detection limits developed in 2006 by Accutest Laboratories are subject to change throughout the life of the project.

[b] NYSDEC Standard and Guidance values were obtained from: Division of Water Technical and Operational Guidance Series (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limits (June 1998).

[c] No state or federal groundwater quality standards exist for the chemical indicated.

[d] Applies to the sum of cis- and trans-1,3-dichloropropene.

Table 4
Laboratory Accuracy and Precision Report

Chemical Abstract Services No	Analyte Name	Method Reporting Limit [a]	Method Detection Limit [a]	MS/MSD Accuracy[b]	MS/MSD Precision[b]	LCS Accuracy
Groundwater Samples						
71-55-6	1,1,1-Trichloroethane	1	0.28	67-143	17	77-135
79-34-5	1,1,2,2-Tetrachloroethane	1	0.28	68-126	11	72-123
79-00-5	1,1,2-Trichloroethane	1	0.32	76-128	12	81-123
75-34-3	1,1-Dichloroethane	1	0.23	70-132	14	77-123
75-35-4	1,1-Dichloroethene	1	0.33	63-135	15	64-125
107-06-2	1,2-Dichloroethane	1	0.29	62-150	15	66-146
78-87-5	1,2-Dichloropropane	1	0.20	74-127	12	80-122
78-93-3	2-Butanone (MEK)	10	2.6	45-146	19	53-141
591-78-6	2-Hexanone	5	1.1	25-166	30	47-154
108-10-1	4-Methyl-2-pentanone (MIBK)	5	2.4	45-145	26	67-137
67-64-1	Acetone	10	0.21	21-170	24	28-159
71-43-2	Benzene	1	0.17	50-141	13	77-122
75-27-4	Bromodichloromethane	1	0.54	76-134	13	82-129
75-25-2	Bromoform	4	0.22	58-139	13	71-135
74-83-9	Bromomethane	2	0.21	62-137	15	68-133
75-15-0	Carbon disulfide	2	0.29	47-135	19	52-134
56-23-5	Carbon tetrachloride	1	0.22	65-152	17	73-146
108-90-7	Chlorobenzene	1	0.56	73-124	12	80-118
75-00-3	Chloroethane	1	0.22	61-144	18	69-138
67-66-3	Chloroform	1	0.35	73-133	14	79-128
74-87-3	Chloromethane	1	0.18	53-145	20	55-159
156-59-2	cis-1,2-Dichloroethene	1	0.15	64-133	11	75-120
10061-01-5	cis-1,3-Dichloropropene	1	0.19	72-127	12	79-125
124-48-1	Dibromochloromethane	1	0.20	70-135	11	80-131
100-41-4	Ethylbenzene	1	0.27	51-143	14	80-124
75-09-2	Methylene chloride	2	0.16	69-128	12	74-121
100-42-5	Styrene	5	0.28	71-134	11	82-128
127-18-4	Tetrachloroethene	1	0.20	60-138	14	63-141
108-88-3	Toluene	1	0.42	49-147	13	78-124
156-60-5	trans-1,2-Dichloroethene	1	0.20	67-128	13	72-121
10061-02-6	trans-1,3-Dichloropropene	1	0.29	70-131	13	78-129
79-01-6	Trichloroethene	1	0.29	64-139	13	81-123
75-01-4	Vinyl chloride	1	0.31	56-146	18	13-150
1330-20-7	Xylene (total)	1	0.28	46-147	13	82-121
1868-53-7	Dibromofluoromethane					77-121
17060-07-0	1,2-Dichloroethene-D4					65-133
2037-26-5	Toluene-D8					80-117
460-00-4	4-Bromofluorobenzene					79-124

Notes:

[a] Reporting limits and method detection limits developed in 2006 by Accutest Laboratories are subject to change throughout the life of the project.

[b] MS/MSD accuracy and precision and LCS Accuracy were developed by Accutest Laboratories in 2006 and are subject to change throughout the life of the project.

All values reported for aqueous samples for volatile organic compounds.

A-8 SPECIAL TRAINING/CERTIFICATION

Sampling personnel will have current Hazardous Waste Operations and Emergency Response training/certifications as required by Title 29 Code of Federal Regulations 1910.120. Sample collection personnel shall be trained in proper sample collection methods.

A-9 DOCUMENTS AND RECORDS

The records for this project will include miscellaneous correspondence, field logs and field data worksheets, laboratory analytical reports, and draft and final reports. The final report will be submitted to Carrier, who will then submit the report to the NYSDEC project manager.

A field log will be maintained as the primary documentation of the actual site conditions and field activities. It will be maintained concurrently with the conduct of the field activities by the Project Coordinator or his/her designee. Specific information to be included in the field log includes:

- Date, time, and description of site conditions.
- Date, time, and description of work activities.
- Names of team members present.
- Names, time of arrival, and time of departure of any visitors.
- Number, type, date, time, and identification of any samples collected.
- Records of field measurements, including calibration data and reference to corresponding sample identification numbers.
- Health and safety data, including site data (e.g., organic vapor, explosimeter, oxygen, etc. measurements), and any deviation from established standard operating procedures.
- Any unusual circumstances, occurrences or QAPP deviations.

The field log will consist of a bound, waterproof logbook containing numbered pages. Entries will be made in the field log using waterproof ink. No pages will be removed from the field logbook for any reason. When corrections or revisions are necessary, these will be made by drawing a single line through the original entry in such a manner that the original entry remains legible. Corrections will then be made alongside or above the original entry. All corrections and revisions will be initialed and dated by the individual making them. At the completion of the field activities, the field logbook will be returned to the Project Manager as a part of the permanent project record.

One laboratory analytical report will be generated for all the samples received by the laboratory. The analytical data report will include an original signed report of the analytical results, a narrative report about the analysis, original complete chain of custody forms, and any other documentation received with the samples. A summary of the calibration data, and laboratory quality control data will also be included in the analytical report. The raw analytical data (e.g., instrument printouts and manual records) will be available to NYSDEC upon request. The Project Manager shall retain copies of all analytical reports generated.

The Project Manager shall retain copies of all updates and revisions of this QAPP and disseminate updated versions, as appropriate. The Project Manager shall also retain copies of all sampling procedures and analytical procedures used for collection and analysis of project samples, and/or copies of all laboratory analytical reports and correspondence with the laboratories. In addition, the Project Manager shall retain copies of all management report and copies of all communications to and from outside agencies and other interested parties. All reports generated electronically shall be sorted on EnSafe Inc.'s network, which is backed up on a nightly basis.

B-1 SAMPLING PROCESS DESIGN

Sample collection points and a justification for these points are described in the MW-18 source investigation work plan. The MW-18 source investigation work plan provides more specific information regarding site history, rational, and sample locations. The following sections provide a summary of the sampling design for this project.

Schedule

Grab groundwater samples will be collected during a one-time sampling event.

Proposed Samples

Table 5 outlines the proposed samples and analytical methods for groundwater sampled as part of this Work Plan. Sample locations and quantities were previously provided in Section A-6. All sample locations/monitoring points are anticipated to be accessible. It is anticipated there will be a sufficient volume of groundwater for sampling. Samples collected and submitted to the laboratory for analyses are critical in fulfilling the order.

Table 5
Proposed Critical Samples and Analytical Methods

Parameter	Analytical Method	Samples to be Analyzed
Groundwater		
VOCs	SW-846 Method 8260	Temporary Monitoring points installed as part of the MW-18 Source Investigation and existing groundwater monitoring wells MW-7, MW-11, and MW-18.

Notes:
Analytical methods from *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846), Third Edition, Update III, (USEPA, December 1996).

Field Measurements

Several noncritical determinations will be made in the field at existing facility groundwater monitoring wells included as part of this investigation. Noncritical determination for water samples will include water quality characteristics (pH, temperature, specific conductance, turbidity, oxidation-reduction potential, and dissolved oxygen). This information will simply be used to supplement the critical data; it is not needed to make the decision of whether or not remediation is needed. Noncritical measurements, collected during groundwater purging, are outlined in Table 6.

Table 6
Existing Groundwater Well Noncritical Field Measurements

Parameter	Precision	Accuracy	Stability Range	Method
pH	± 0.05 Standard Units	± 0.1 Standard Units	± 0.2 Standard Units	Horiba U-22 pH probe or equivalent (based on USEPA 150.1).
Specific Conductance	± 1%	± 3%	± 5.0% of reading	Horiba U-22 specific conductance probe or equivalent (based on USEPA 120.1
Temperature	± 1°C	± 0.3°C	± 1° C	Horiba U-22 electronic thermometer or equivalent (based on USEPA 170.1
Turbidity	± 3%	± 5%	No greater than 100 Nephelometric Turbidity Units (NTUs)	Horiba U-22 turbidity probe or equivalent (based on USEPA 180.1
Oxidation Reduction Potential (ORP)	± 5 mV	± 15 mV	± 1999 mV	Horiba U-22 ORP probe or equivalent (based on USEPA 180.1)
Dissolved Oxygen (DO)	± 0.1 mg/L	± 0.2 mg/L	No greater than 20% of saturation at the field measured temperature	Horiba U-22 DO probe or equivalent (based on ASTM D5543-94/D888-87).

If it is impossible to get dissolved oxygen at or below 20% of saturation at the field-measured temperature, or turbidity at or below 100 NTUs, then three consecutive measurements of field parameters will be collected where dissolved oxygen is ± 0.2 mg/L or 10%, and turbidity is ± 10 NTUs or 10%, whichever is greater. Temperature, pH, and specific conductance will have stability ranges as stated above.

B-2 SAMPLING METHODS

This section describes the data-collection requirements for groundwater sampling activities. Specific DQOs for groundwater sampling activities were previously presented in Section A-7. Detailed sampling procedures are outlined in the Sampling and Analysis Plan presented in the MW-18 Source Investigation Work Plan and summarized below.

Sampling Equipment

Table 7 details the field equipment that will be used to collect groundwater samples at the facility.

Table 7
Groundwater Field Sampling Equipment

Equipment Description	Use
Water-Level Meter	Measure static water levels for each well
Submersible electric Pump	Well purging/groundwater sampling
Polyethylene tubing (various inch OD and ID)	Well purging/groundwater sampling
Polyethylene Precleaned Disposable Bailers	Well purging/groundwater sampling
Nylon Cord	Well purging/groundwater sampling
Peristaltic pump	Well Purging/groundwater sampling
Horiba U-22 or equivalent Water Quality Meter	Field measurements of water quality parameters

Groundwater Sampling Procedures

Prior to groundwater sampling, the static water level in each temporary well and facility groundwater monitoring well used in the in this investigation well will be measured using an electronic water-level indicator. This information will be used to calculate the height of the water column in each well for determining the well's volume, and will also be used to evaluate groundwater flow patterns. Groundwater samples will be collected using a variety of methods at the site due to the various hydraulic characteristics of the wells. The shallow monitoring points may be purged and sampled using bailers, peristaltic pumps, or electric submersible pumps.

Only grab groundwater samples are proposed to be collected from the one-inch diameter temporary monitoring wells installed as part of this investigation. For the existing facility groundwater monitoring wells MW-7, MW-11, and MW-18, each will be purged to ensure the sample collected is representative of true aquifer conditions. During the purging process, the field parameters listed in Table 6 will be monitored periodically using appropriate field instruments. Field parameters will be documented on groundwater sampling forms or in a field logbook. After at least three well volumes have been purged, groundwater will be considered to be representative after consecutive measurements in which the field parameters have reached their stability ranges.

Groundwater samples collected for VOCs will be collected directly from the sampling apparatus and will not be filtered after collection. Samples will be collected in the required number of laboratory-supplied, pre-cleaned and certified VOC vials, with Teflon lids, pre-preserved with hydrochloric acid. VOC samples bottles will be completely filled and have no headspace. Filled containers will be properly labeled and immediately placed into coolers and chilled.

Precautions will be taken to prevent cross-contamination during sampling. If the field team encounters any problems or unexpected situations while in the field (e.g., access problems, safety issues, inadequate supplies), the Project Coordinator will be responsible for documentation and corrective actions.

Decontamination

When feasible, the use of disposable equipment (which does not need to be decontaminated) will be implemented. Sufficient precleaned, wrapped sampling equipment will be available to reduce the amount of field decontamination performed. If equipment must be decontaminated prior to use or in between sampling points, the cleaning procedures will be rinsing with detergent water, followed by a distilled water rinse. The equipment may then be placed in clean plastic or wrapped with aluminum foil for transport to the next sampling location. Equipment rinseate blanks will be collected when samples require field decontamination. An equipment rinseate blank is made by taking distilled water and placing it in contact with the field sampling apparatus (e.g., bailer, pump, stainless-steel scoop) after decontaminating equipment. The water will be collected in the same type of containers as the other samples, preserved in the same manner, and analyzed for the same parameters of interest.

Decontamination fluids generated sampling activities will be treated as investigation-derived waste and managed as such. All groundwater fluids generated as a result of sampling activities will be treated by the existing onsite storm water treatment system, which is permitted by NYSDEC.

B-3 SAMPLE HANDLING AND CUSTODY

Sample Handling and Management

Samples will be collected in certified, precleaned, prepreserved (if applicable) containers provided by the contracted analytical laboratory. Table 8 shows the sample containers, preservation, and holding times required for samples collected during this sampling effort.

Table 8
Sample Containers, Preservation, and Holding Times

Analytical Method	Matrix	Container Type	Sample Volume	Preservation	Holding Time
SW-846 8260B	Water	glass (Teflon lined septum)	3 X 40 milliliter	4°C, hydrochloric acid to pH <2	14 days preserved with acid

Sample Identification

All samples collected in the course of a project will be identified by a unique sample identification code. That identification code will be recorded on the sample label affixed to the sample container, in the field log and on the analytical chain-of-custody form. The sample identification code will be used to track each sample as well as cross-reference sample data with other activities.

A sample identification label will be affixed directly to each sample container to document activities associated with collection of that specific sample. Sample labels will be completed in waterproof ink at the time of sample collection by the individual(s) collecting the samples. Specific information to be recorded on each sample label includes the following information:

- Site name and location
- Date and time of sample collection
- Type of analysis to be performed
- Preservation
- Sample identification number

Packaging Samples

All samples must be packed so as to avoid breakage during transport and to prevent cross-contamination. A clean sample cooler in good condition will be used. Samples will be wrapped in bubble wrap or other suitable packaging materials to prevent breakage. Sample containers will be placed inside the cooler so that they do not touch each other and cooling material (e.g., bagged ice, blue ice) will be placed around and between the samples to chill them to 4°C (+/- 2°C). Any remaining space will be filled with additional inert packaging material. A temperature blank will be included in each sample cooler. A chain-of-custody record describing the contents of each cooler will be placed in a plastic bag and sealed inside each cooler, and the cooler will be sealed with tape and custody seals so that the cooler cannot be opened without breaking the seal.

Sample Custody

Custody is one of several factors that are necessary for the admissibility of environmental data as evidence in a court of law. Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory analysis, and final evidence files. Final evidence files, including all originals of laboratory reports and purge files, are maintained under document control in a secure area.

A sample or evidence file is under your custody if:

- The item is in actual possession of a person.
- The item is in the view of the person after being in actual possession of the person.
- The item was in actual physical possession but is locked up to prevent tampering.
- The item is in a designated and identified secure area.

Field-Specific Custody Procedures

The field sampling team will be responsible for the care and custody of the collected samples until they are properly dispatched. The Project Coordinator will review all field activities to ensure/confirm that proper custody procedures are followed during the field activities. The Project Coordinator or field personnel will complete a chain-of-custody form to accompany each cooler shipped from the field to the laboratory. The following sections describe the specific field custody procedures.

Initiation of Chain-of-Custody Field Procedures

The laboratory, which is the source of the custody train, will provide precleaned containers in accordance with USEPA bottle-cleaning requirements. Bottle lot documentation, in the form of bar codes, is affixed to each bottle and is traceable throughout the containers' lifespan. Containers are sent into the field with chain-of-custody documentation, which is kept with the containers during field efforts. The containers will remain in the custody of EnSafe during sampling and will be sent to the laboratory using the chain-of-custody procedures described in this section. The field sampler is personally responsible for the care and custody of the samples until they are transferred. The sampler will keep a written record of the sampling operation and the samples' identities. The sample packaging and shipment procedures summarized below will ensure that the samples will arrive at the laboratory with the chain of custody intact.

a. The field sampler is personally responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible should handle the samples.

b. All bottles will be identified by use of sample labels with sample numbers, sampling locations, date/time of collection, and type of analysis. Sample labels are to be completed for each sample using waterproof ink unless prohibited by weather conditions. The label must remain legible and attached to the sample bottle, even when wet.

c. Samples are accompanied by a properly completed chain-of-custody form. The sample numbers and locations will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to the permanent laboratory, or to/from a secure storage area.

d. Samples will be properly packaged and dispatched to the appropriate laboratory for analysis, with a separate signed custody record enclosed in each sample cooler. The original chain-of-custody form will accompany the shipment. At least one copy of the form will be retained by the sampler. Shipping containers will be locked and secured with strapping tape and custody seals for shipment to the laboratory.

e. Ideally, samples will be transported to the laboratory the same day the samples are collected in the field by overnight carrier. In some instances, samples may be retained by the sampler beyond the sample collection day. In these instances, the samples will be shipped and the laboratory will be informed, if necessary, so that sample-holding times will not be exceeded.

Official custody of samples must be maintained and documented from collection until completion of analysis. Chain-of-custody will be documented. The chain-of-custody procedures can provide an accurate record to trace a sample's possession and handling. Sampling personnel will record the following minimum information on the chain-of-custody form:

- Sample identification number and location
- Signatures of any individuals with control over samples
- Date and time of collection
- Any preservatives used in the samples
- Additional comments, (e.g., air-bill numbers, request for faster turnaround time)
- Total number of sample containers and the required analysis

Laboratory Chain-of-Custody Procedures

The laboratory sample custodian shall inspect the samples and record any problems encountered on the chain-of-custody (COC) form or internal laboratory "discrepancy report." The sample custodian shall inspect and record the following:

- Condition of shipping container
- Temperature of shipping container
- Condition of sample containers
- Condition (including presence or absence) of custody seals on shipping containers
- Presence or absence of COC records
- Conflicting COC and sample container information
- Preservation
- Resolution of problems or discrepancies (e.g., absent documents, conflicting information, broken custody seals, broken/leaking samples, etc.)

The sample custodian shall sign all COC forms and discrepancy reports. The laboratory will contact the Project Coordinator, Project Manager, and/or QA Manager to resolve any discrepancies and/or problems upon sample receipt. Samples will be properly identified, logged in, and assigned the correct analyses. In addition, the sample COC will be maintained during the sample receiving and analytical processes at all times.

The laboratory will have a specific method for maintaining identification of samples while they are in the laboratory, including sample containers, extraction/digestion vessel, and sample extract/digestate containers. The laboratory identifier shall be cross-referenced with the field sample identifier on the laboratory reports.

All samples will be maintained in a secure location and will be stored in appropriate areas to maintain proper preservation requirements. After sample analyses are complete, the laboratory may discard samples only with the concurrence of the Project Manager or as the contract stipulates. If sample is discarded, time and date must be recorded. Analytical data is to be kept secured and released to authorized personnel only.

Final Evidence File Custody Procedure

The final evidence file will be the central repository for all documents that constitute evidence relevant to sampling and analysis activities as described in this QAPP. EnSafe Inc. will be the custodian of the evidence file and will maintain the contents of evidence files for the site, including all relevant records, reports, logs, field notebooks, pictures, subcontractor reports, and data reviews. The evidence file will be kept in a secured, limited access area that is under EnSafe Inc. custody. The final evidence file will include at a minimum:

- Field logbooks and other field records
- Field data and data deliverables
- Photographs
- Drawings
- Soil boring logs
- Laboratory data deliverables
- Data validation reports
- Data assessment reports
- Progress reports, QA reports, interim project reports, and all other reports generated
- All custody documentation (forms, airbills, etc.)
- Correspondence and other records relevant to the project

The evidence file will be maintained for a minimum of three years past the submittal data of the final report.

B-4 ANALYTICAL METHODS

Standard SW-846 sampling methods that have been evaluated and approved for use in complying with the RCRA regulations will be used to analyze the groundwater collected as a result of the MW-18 source investigation at the Carrier Thompson Road facility. These methods are specified in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846), Third Edition Update III (USEPA, December, 1996). Table 9 outlines the methods to be used for the monitoring for this investigation. Noncritical field measurement methods and instrumentation was previously discussed in Section B-1.

Table 9
Laboratory Analytical Methods

Method	Application	Target Analytes
SW-846 8260	VOCs by Gas Chromatography/Mass Spectrometry	VOCs

Notes:
SW-846 = *Test Methods for the Evaluation of Solid Wastes, SW-846,* Third Edition. (USEPA, December 1996). Office of Solid Waste and Emergency Response.
VOC = Volatile organic compound

A copy of the laboratory data in level "B" format will be provided in electronic format to the NYSDEC for review.

B-5 QUALITY CONTROL

Level of Quality Control Effort

Field QC samples will be collected at the specified frequencies stated in the following sections. Precision will be assessed by evaluating the results of the duplicate and matrix spike duplicate samples. Accuracy will be assessed by evaluating the analyses of the field blanks, equipment rinseate blanks (if collected), and trip blanks. Table 10 lists the QA/QC samples that will be collected from each site during the sampling event. The types of QA/QC samples that will be utilized during the monitoring activities are discussed below.

Table 10
Quality Assurance/Quality Control Samples

Event	Site Area	QA/QC Samples
MW-18 Source Investigation	Northeastern area of Building TR-3, Both upgradient and downgradient (one event)	1 Field duplicate Sample (one for each 20 samples minimum) 1 Matrix Spike/Matrix Spike Duplicate 1 Precleaned or Field-Cleaned Equipment Blank* Trip Blanks (per shipping container with VOC samples)

* Precleaned or field-cleaned equipment will be collected one per sampling event. As such, a precleaned equipment blank will be collected if new, nondedicated sample tubing is used to sample any well. A field-cleaned equipment blank will be collected if any field decontamination is performed, with sampling equipment reused at a different sampling point.

Quality Control Samples

Quality control samples that are pertinent to this sampling effort are discussed below.

Precleaned Equipment Blanks

Precleaned equipment blanks monitor onsite sampling environment, sampling equipment decontamination, sample container cleaning, the suitability of sample preservatives and analyte-free water, and sample transport and storage conditions. A precleaned equipment blank will be collected on sample tubing that has been brought to the site precleaned and ready for use. If dedicated sample tubing already in the wells to be sampled is used for sampling, or if equipment is not cleaned in the field, a precleaned equipment blank is not required.

Field-Cleaned Equipment Blanks

If dedicated sample tubing already in the wells to be sampled is used for sampling, or if equipment is not cleaned in the field, an equipment blank is not required. Field-cleaned equipment blanks monitor onsite sampling environment, sampling equipment decontamination, sample container cleaning, the suitability of sample preservatives and analyte-free water, and sample transport and storage conditions. A field-cleaned equipment blank will be collected on sampling equipment that has been cleaned in the field (i.e., between sampling points) and reused at additional sample points.

Field Blanks

Field blanks monitor onsite sampling environment, sample container cleaning, the suitability of sample preservatives and analyte-free water, and sample transport and storage conditions. Prepare field blanks by pouring analyte-free water into sample containers for each parameter set to be collected. Field blanks are not required if precleaned or field-cleaned equipment blanks are collected.

Trip Blanks

Trip blanks monitor sample container cleaning, the suitability of sample preservatives and analyte-free water, and both contain and sample transport and storage conditions. These blanks are applicable if samples are to be analyzed for VOCs. The laboratory that is providing the VOC vials must provide the trip blanks by filling one or more VOC vials with analyte-free water. A set of trip blanks will be placed in each transport container used to ship/store empty VOC vials. They must remain with the VOC vials during the sampling episode and must be transported to the analyzing laboratory in the same shipping or transport container(s) as the VOC samples.

Duplicate Sample

Duplicate samples are field samples obtained from one location. They are divided into separate containers and are treated as separate samples throughout the remaining sample handling and analytical processes. Duplicate samples are used to assess total error (precision) associated with sample heterogeneity, sample methodology, and analytical procedures. Soil duplicate samples are homogenized in a precleaned intermediate vessel (e.g., mixing bowl) prior to being split; however, samples submitted for VOC analysis are not homogenized. Water duplicate samples are collected by repeating simultaneously or in rapid succession the entire sample acquisition technique that was used to obtain the first sample. Duplicates are collected, preserved, transported, and documented in the same manner as the samples. Different sample identifications are used for duplicates than for original samples.

Matrix Spike and Matrix Spike Duplicate Samples

MS/MSD are environmental samples that are spiked in the laboratory with a known concentration of a target analyte(s) to verify percent recoveries. Matrix spike and matrix spike duplicate samples are primarily used to check sample matrix interferences, precision, and accuracy. They can also be used to monitor laboratory performance. MS/MSDs are required to be performed by laboratories per the analytical methods at a frequency of 1 per 20 samples analyzed. Aqueous MS/MSDs are to be collected in triplicate volume using the same sample procedures as field duplicates. Soil MS/MSDs are also collected using the same procedures for duplicate samples; however, triplicate volume is not required. MS/MSDs must be identified using the same identification as the parent sample and must be identified on the chain of custody to inform the laboratory that the sample is intended to be used for spiking. Samples chosen for spiking should be representative of the matrix indicative of site conditions. MS/MSDs collected, preserved, transported, and documented in the same manner as the samples.

Surrogate Spikes

Surrogate spikes are also used to determine the accuracy of the analytical method with respect to the matrix under investigation. Surrogate spike compounds are compounds similar in chemical nature to the target compounds, but would not be expected in affected media (i.e., radioisotopically labeled compounds, etc.). These compounds are introduced into each sample before analysis. By comparing the reported results for these compounds with the quantities introduced, a percent recovery can be determined. The percent recovery data are subsequently used to assess the accuracy of results for target compounds within each specific sample. Surrogate spike analyses will be performed by the laboratory on each sample analyzed for organic parameters, but extra sample volume will not be required.

Control Limits

Control limits are the maximum and/or minimum values defining a range for a specific parameter, as outlined within each analytical procedure, and are considered to satisfactorily meet quality control criteria. When the parameter falls outside that range, the procedure is considered to be out of control. Formulas for calculating precision and bias associated with QC samples were previously described in Section A-7.2. These formulas will be used to assess whether precision and accuracy of analytical results are in control. Whenever the analytical procedure is or becomes out of control which render the results unusable, corrective action should be taken to bring the analysis back into control. The corrective action should include: (1) finding the cause of the problem, (2) correcting the problem, (3) demonstrating the problem has been corrected by reanalyzing appropriate laboratory reference samples, if necessary, and (4) repeating the analyses of any investigative samples that may have been affected by the control problem, if necessary.

Exceptions will be made, on a case-specific basis. If the control limit is technically impracticable for a particular sample or analysis, documentation and narrative explanation should be submitted with the data report and raw data. The documentation must include evidence that a good faith effort was made to meet the control limit.

B-6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

Field measurement equipment will be checked for operation in accordance with the manufacturer's specifications. This includes battery checks, routine replacement of membranes, and cleaning of conductivity electrodes. All equipment will be inspected when first handed out and when returned from use for damage. Equipment used to gather, generate, or measure environmental data will be calibrated within the frequency stipulated by the manufacturer's instructions and/or analytical method in such a manner that accuracy and reproducibility of results are consistent. Prior to use, field-measuring equipment will be examined to certify that it is in operating condition. Field personnel will be responsible for inspecting equipment before use and they will follow the manufacturer's instructions for assembly, operation, and maintenance of field instruments and equipment. They will verify that the calibration requirements have been met for the instruments used and that all equipment is in proper working condition prior to use. The preventive maintenance of field equipment is described in detail in the associated manufacturer's equipment manuals. Records of equipment maintenance will be maintained by the field logbook. Maintenance records for leased equipment must be kept by the vendor and made available upon request.

Laboratory preventive maintenance will be implemented in accordance with the Laboratory QA Plan and associated standard operating procedures (SOPs). At a minimum, all major instrumentation will have associated records and logbooks, including schedules and criteria for maintenance.

B-7 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

Calibration is the process by which the correlation between instrument response and actual value of a measured parameter is determined. Field personnel will document acceptable calibration and calibration verification for each instrument unit and field test or analysis, linking this record with affected sample measurements. Field equipment will be calibrated according to manufacturer's specifications.

The laboratory will calibrate analytical instruments in accordance with the USEPA's published methods, the Laboratory QA Plan, and associated SOPs.

B-8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

Consumables such as baggies, plastic sheeting, aluminum foil, gloves, tape, etc., are expected to be used during the MW-18 source investigation at the Carrier facility. No special requirements are needed or expected for consumables or rental equipment/supplies. Supplies and consumables needed for sampling will be properly inspected and decontaminated prior to use by the field samplers. Consumables, such as standards, needed for field measurements will be inspected prior to use and only those that have not exceeded their shelf life will be used. The laboratory's SOPs incorporate procedures for critical supplies and consumables, including standard supply sources, acceptance criteria, for tracking and retrieving these materials.

B-9 NONDIRECT MEASURMENTS

No data or information from nondirect measurement sources are expected to be used for this project.

B-10 DATA MANAGEMENT

Data for this project will be produced in two locations: onsite and at the contracted laboratory. Data collected onsite will be recorded on field data worksheets and/or into field logbooks. These field data worksheets and logbooks will become a part of the project file. Laboratory data will be submitted by the contracted laboratory within 30 calendar days of the laboratory's receipt of the samples. The Project Manager will be responsible for ensuring the analytical report meets the requirements specified in the order. All field records and the analytical report will be submitted to the Project Manager.

C-1 ASSESSMENTS AND RESPONSE ACTIONS

Due to the limited duration of the sampling events, no audits are anticipated.

C-2 REPORTS TO MANAGEMENT

Internal Reports

The Project QA Manager or Project Coordinator will provide status reports to the Project Manager. The reports will address the items outlined as follows:

- Quality assurance activities and quality of collected data
- Equipment calibration and preventive maintenance activities
- Results of data precision and accuracy calculations
- Evaluation of data completeness
- QA problems and recommended and/or implemented corrective actions, and results of corrective action taken.

Analytical reports will be generated by the contracted laboratory within 30 calendar days after receipt of the samples who will then forward the analytical information to the Project Manager, or designee.

External Reports

Due to the short duration of this project, the only external reports to management will be a final project report that will include a field activities report and an analytical data report for all the samples. The final project report will be generated by the Project Manager, or designee, for inclusion in the project file at the completion of the project. This report will include a summary description of all project activities; a summary of all data, a discussion of any problems encountered and associated corrective actions, a discussion of the conclusions drawn from the results of this project and the rationale for those conclusions, and the results of the data quality assessment.

Draft and final reports will be delivered to UTC per a mutually acceptable schedule between UTC and EnSafe. Final reports will be forwarded to NYSDEC.

D-1 DATA REVIEW, VERIFICATION, AND VALIDATION

Data will be accepted if they meet the following criteria:

- Field data sheets are complete.
- Field data and laboratory data are validated.
- Actual sample locations and collection procedures match the proposed sample locations and collection procedures identified in sections B1 and B2, respectively.
- Sample handling procedures documented on chain-of-custody forms, the field activity report and case narrative match the proposed sample handling procedures identified in sections B2 and B3 (e.g., holding times not exceeded, etc.).
- Field QC was conducted as planned and meets the acceptance criteria in section B5.

Data generated by project activities will be reviewed against the data quality objectives cited in Section A-7 and the quality assurance/quality control practices cited in Section B-5. Data will be separated into three categories: data meeting all data quality objectives, data failing to meet precision or recovery criteria, and data failing to meet accuracy criteria. Data meeting all data quality objectives, but with failures of quality assurance/quality control practices will be set aside until the impact of the failure on data quality is determined. Once determined, the data will be moved into either the first category or the last category.

Data meeting all data quality objectives is considered usable by the project. Data failing to meet accuracy criteria is considered not usable. Data failing to meet precision or recovery criteria will have all aspects assessed. If sufficient evidence is found supporting data quality for use in this project, the data will be moved to data meeting all quality objectives, but will be flagged as estimated (with a J-flag) as per USEPA guidelines. The Project Manager will evaluate the cause of the data failures and make the decision whether to discard the data or re-sample.

Copies of data validation reports for will be provided electronically to NYSDEC.

D-2 VERIFICATION, REVIEW, AND VALIDATION METHODS

The field data package will include all logbooks, field records, and measurements obtained onsite. The package will be verified by conducting:

- A review of the field data compiled on sampling logs for completeness. Failure in this area may result in the data being invalidated for the intent of the project.
- Verification that field equipment blanks and trip blanks were properly prepared, identified, and analyzed. Failure in this area may compromise the analytical data package and result in some data being considered qualitative or invalid.
- A check on field analyses for equipment calibration and condition. Failure in this area may result in the field measurements being invalid.
- A review of the chain-of-custody forms for proper completion, signatures of field personnel, and the laboratory sample custodian, and dates. Failure in this area may result in the data being invalid for the purpose of the project.

The Project Coordinator will review/validate the field data and any problems identified during this process will be reported to the Project Manager, who will include this information in the Management Report, as necessary. The contracted laboratory will review/validate the laboratory data according to their SOPs. Any problems identified during this process will be reported in the analytical data report.

D-3 RECONCILIATION WITH USER REQUIREMENTS

Once the data results are compiled, the QA Manager, or designee, will review the data to determine if they fall within the acceptance limits as defined in this QAPP. Completeness will also be evaluated to determine if the completeness goal for this project has been met. If data quality indicators do not meet the project's requirements as outlined in this QAPP, the data may be discarded and resampling may occur. The Project Manager will evaluate the cause of the failure (if possible) and make the decision whether to discard the data and resample.

REFERENCES

Code of Federal Regulations. Title 29, Part 1910.120.

Code of Federal Regulations. Title 40, Part 264 Appendix IX.

NYSDEC. (2002, December). *Draft DER-10 Technical Guidance for Site Investigation and Remediation*. Division of Environmental Remediation; December 25, 2002.

USEPA. (2001, March). *EPA Requirements for Quality Assurance Project Plans.* EPA/240/B-01/003.

— (1996, December). *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846). Third edition Update III. Office of Solid Waste; December 1996.