FINAL RCRA INVESTIGATION (RFI) REPORT/ PRELIMINARY CORRECTIVE MEASURES STUDY/ /INTERIM GROUND-WATER MONITORING PLAN

Former Norton Company/Nashua Tape Products Facility
2600 Seventh Avenue
Watervliet, New York
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SECTION 1.0

INTRODUCTION

This RCRA Facility Investigation (RFI) Report has been prepared to summarize data collection activities associated with an RFI conducted at the former Norton Company (Norton)/Nashua Tape Products (Nashua) manufacturing facility located at 2600 Seventh Avenue, Watervliet, New York (see Site Location Map, Figure 1-1). Generalized Area and Site Layout Maps are provided as Figures 1-2 & 1-3, respectively.

The principal objectives of the original RFI were to: 1) further define the spatial distribution and magnitude of residual subsurface impact associated with the four solid waste management units (SWMUs) identified in the June 4, 2002 New York State Department of Environmental Conservation (NYSDEC) Order on Consent Index No. CO: 4-20001205-3375 and eight other areas of concern (AOCs) identified at the Site (as described in Section 2.0 of this Report); and 2) assess the necessity and scope of future corrective actions, if any, subject to NYSDEC's prior approval. Following discussions between representatives of Saint-Gobain Corporation (Saint-Gobain) and the NYSDEC, an RFI Workplan was finalized and submitted to the NYSDEC in July 2003, and field activities were initiated in August 2003.

Field and laboratory data collected during the early phases of the RFI indicated that the investigation activities would extend north of the Former Tank Farm beyond the property boundaries of the former Norton/Nashua facility (see Figure 1-1). Off-site access was obtained from the property owner (Canadian Pacific Railroad) in November 2003, and Off-Site RFI activities were initiated in December 2003. Based upon subsequent ground-water sampling results, Saint-Gobain and the NYSDEC determined (at a June 2004 meeting) that the soil boring program would continue north to investigate the vicinity of Alden Street (see Figure 2-3).

After obtaining necessary permits, soil borings and ground-water and vapor monitoring points were installed adjacent to Alden Street in August & September 2004. Soil borings and a ground-water monitoring point were also installed in Craig Street (see Figure 2-3) in October 2004. Additional off-site activities included the completion of a geophysical survey. Details on these off-site activities are provided in Sections 6.0 & 7.0 of this report.

A Supplemental RFI Workplan and a Quality Assurance Project Plan (QAPP) were submitted to the NYSDEC in May 2005. The objectives of the Supplemental RFI were to: 1) further define the spatial distribution and magnitude of residual toluene located off site to the north of the Former Tank Farm SWMU; and 2) perform a vapor intrusion evaluation at selected residential properties located along Alden Street (see Figure 2-3). Following a Public Availability Session in September 2005, and procurement of access to residential properties in October & November 2005, Supplemental RFI activities were initiated in December 2005.

Because of the variability in the construction of the four residential properties selected for the vapor intrusion evaluation along Alden Street, the NYSDEC requested the preparation of an Addendum to the Supplemental RFI Workplan specifying additional vapor sampling procedures and contingencies. Following review and approval by the NYSDEC and the New York State Department of Health (NYSDOH), the finalized Addendum to the Supplemental RFI Workplan was submitted to the NYSDEC in January 2006, and vapor sampling activities were initiated in February 2006.

Data packages from off-site vapor sampling were finalized/validated in May 2006 and ground-water data from recently-installed off-site wells were available in June 2006. A meeting between Saint-Gobain and the NYSDEC was held on July 25, 2006 to discuss the results of the RFI. At that time it was determined that investigative activities were complete and the RFI Report could be prepared. On August 31, 2006, the NYSDEC granted a request to extend the deadline for submittal of the RFI Report from September 30 to November 15, 2006.

On-Site RFI data collection activities generally included: 1) installation of Geoprobe soil borings, and collection of soil and ground-water samples; 2) completion of small-diameter ground-water monitoring points; 3) installation of conventional monitoring wells; 4) collection of liquid-level data from both conventional monitoring wells and small-diameter ground-water monitoring points; 5) collection of hydraulic conductivity data; 6) quarterly ground-water quality sampling at selected monitoring points; 7) collection of vapor samples from sewer bedding materials; 8) sanitary/storm sewer sediment sampling; and 9) a preliminary assessment of potential corrective actions and prerequisite feasibility testing, as needed, subject to NYSDEC review and approval.

Off-Site (Supplemental) RFI data collection activities included: 1) installation of Geoprobe soil borings, and collection of soil and ground-water samples; 2) completion of small-diameter ground-water monitoring points; 3) collection of liquid-level and ground-water quality data from the small-diameter ground-water monitoring points; 4) ground-water quality sampling at existing private wells; 5) installation and sampling of residential sub-slab vapor monitoring points (VMPs); and 6) collection of co-located indoor air samples at the same residences.

The On-Site RFI was conducted in an iterative manner. Phase I consisted of the delineation of potential residual sources in the SWMUs and AOCs via installation of Geoprobe (and/or hand auger) borings and monitoring points (smaller diameter wells). Phase II consisted of the installation of permanent monitoring wells, and Phases III & IV focused on the establishment of temporal concentration trends in areas confirmed as residual sources during the delineation phase. Phase V evaluated the necessity and type of potential remedial actions, if any, subject to NYSDEC review and approval.

This RFI Report includes a Preliminary Corrective Measure Study (CMS) Report (Section 10.0), which: 1) establishes clean-up objectives and remediation goals; 2) evaluates, and preliminarily ranks and selects, various potential Corrective Measures; and 3) outlines pilot testing activities needed for the final CMS. An Interim Ground-Water Monitoring Plan (IGWMP), which includes contingencies for interim sampling schedules and remedial actions for utilization until the CMS is finalized, is included as Section 11.0. A tentative project schedule is presented in Section 12.0, and RFI Report references are listed in Section 13.0.

Unless otherwise noted in this Report, all RFI QA/QC activities were conducted in accordance with the procedures outlined in: 1) the July 2003 RFI Workplan; 2) the May 2005 Supplemental RFI Workplan QAPP; and 3) for instances where specific QA/QC procedures were not presented in the former two documents, the April 1994 QAPP, IRM and General RFA/RFI Sampling Investigation Work Plan prepared by Rust Environment & Infrastructure (Rust). QAPP contact tables were included in the September 2001 RCRA Facility Assessment (Enhanced RFA) Workplan and the May 2005 Supplemental RFI Workplan QAPP. Data validation was performed by the NYSDEC in accordance with NYSDEC and United States Environmental Protection Agency (USEPA) procedures.

All RFI field work was performed in compliance with applicable OSHA regulations and the site-specific master Health and Safety Plan (HASP) previously provided as Attachment B of the Enhanced RFA Workplan. Subcontractors developed their own site-specific HASPs that, at a minimum, complied with conditions/protocol identified in the master HASP.

SECTION 2.0

AREAS OF INVESTIGATION (SWMUs & AOCs)

Four SWMUs and eight AOCs were originally identified at the Former Norton/Nashua Site. Each of these areas, depicted on Figure 2-1, is briefly discussed below.

The following four SWMUs and four AOCs are associated with the 1969 release and/or previous investigation activities at the Site:

- Former Tank Farm SWMU – Previous investigations in the area surrounding the former tank farm north of Building #61 detected elevated concentrations of toluene and heptane in soil and ground water. Impact in this area was previously presumed to be associated with a leak(s) in the "solvent" lines (see Figure 2-1) that were taken out of service by Norton in 1969.

- Former Test Pit AOC – Following the discovery of the original release in 1969, a test pit was installed in Building #61 (see Figure 2-1) to recover free-phase product (see Rust, 1996). A soil gas sample collected in the vicinity of the test pit (see figure provided in Rust, 1996) detected minimal residual contamination in this area; however, soil gas survey results were not confirmed by laboratory analysis.

- Former Solvent Line AOC – Subsurface product lines were historically used to transport tolusol (toluene and heptane) and toluene between the tank farm and stub-ups in the northern portion of Building #58. Although previous investigations presumed that a line leak was located near the tank farm, it was also possible that there were leaks along the subsurface lines in Buildings #58 & #61.

- Former "Beartex" Sump Pit SWMU – This sump pit, closed in or about 1990, received liquids containing volatile organic compounds (VOCs) during the period of Norton "Beartex" operations. Previous reports indicate that VOCs were also detected in the sanitary sewer formerly connected to the sump.

- Building #61 Doorway Spill AOC – According to previous reports, a small area of asphalt near the doorway of Building #61 was damaged by a toluene spill in 1989, and methyl iso-butyl ketone (MIBK) was detected in soil samples collected from this area (see Rust, 1996).

- Building #58 AOC – Soil samples historically collected from geotechnical test borings installed in this building indicated the presence of toluene, heptane, and fuel oil at elevated concentrations. According to the April 1996 Rust Report, a possible source for the fuel oil was the Troy Malleable Iron Works, which operated at the Site prior to the 1940s. Until recently, there were two large cutouts in the concrete floor of the building, which were believed to be associated with footings for two pieces of heavy machinery used during former Nashua operations at the Site.

- <u>Storm Sewer & Sanitary Sewer SWMUs</u> - Elevated photoionization detector (PID) readings were historically obtained in storm sewer manholes during prior investigations. Elevated concentrations of volatile and semi-volatile organic compounds were detected in several water and sediment samples collected from sewer manholes during the December 1989 investigation, and in several sediment samples collected from sewer manholes during the Enhanced RFA sampling event (October 2001).

The SWMUs and AOCs listed above are located in the vicinity of the former solvent lines beneath, or adjacent to, on-site buildings currently used as warehouses. Field and laboratory data collected during the early phases of the RFI indicated that investigation activities would extend across intermediate areas between these SWMU/AOCs, primarily due to the presence of residual toluene (and to a lesser extent heptane) in soil and ground water. Although other minor compounds of concern (COCs) were detected in some of the original SWMU/AOCs (see Section 4.0 for details); in practical terms (i.e., for evaluation of Corrective Measures), there are, in effect, only two SWMUs/AOCs (see Figure 2-2) in the vicinity of the former solvent lines: 1) the Former Tank Farm SWMU; and 2) the impacted area beneath Buildings #58, #59 & #61 (Building SWMU/AOC).

The following four additional AOCs, which are not located in the immediate vicinity of the former solvent lines (see Figure 2-1), were identified for investigation in the RFI Workplan:

- <u>Quonset Hut B (adjacent to Building #61) AOC</u> – Quonset Hut B has an asphalt floor. Inside the hut, a bermed area of approximately 20 feet by 20 feet was reportedly used to store 55-gallon drums of waste toluene and adhesive. According to the 1993 TRC Report, this "hazardous waste management unit" was closed by Nashua in 1988; however, no confirmatory soil samples had been previously collected from beneath the asphalt of the hut.

- <u>Quonset Hut C (adjacent to Buildings #59 & #60) AOC</u> – A drum leaking epoxy-like material was observed in Quonset Hut C at the time of the Enhanced RFA sampling event (October 2001). The drum was not present during a subsequent site visit in July 2002; however, small spills of the epoxy-like material and black stains were noted on the floor of Quonset Hut C and in the area between Quonset Huts C & D, and it may have been possible for these spills or associated surface run-off to have entered the storm sewer system. (It should be noted that this AOC has no relation to any Norton operations at any point in time.)

- Filter Room (adjacent to Building #59) AOC – Process liquids were historically filtered in this room. No soil samples were collected from this area during previous site investigations.

- Solvent Recovery Room (adjacent to Building #59) AOC – According to previous reports (see TRC, 1993), this room was used during Norton and Nashua operations to recover toluene from the process air stream prior to its discharge to the atmosphere. A previous soil boring in this area (TB-3) detected low levels of toluene and creosols (2-methylphenol and 4-methylphenol). The April 1996 Rust Report speculated that the source for the creosols may be coal and cinders that were used as fill at the Site.

As discussed in Section 1.0, field and laboratory data collected during the early phases of the On-Site RFI indicated that the investigation activities would extend off-site north of the Former Tank Farm SWMU (see Figure 2-1) onto a railroad right-of-way (Canadian Pacific Railroad property), establishing a ninth AOC:

- Off-Site AOC – Residual toluene impact was detected in the railroad right-of-way extending along a relatively narrow band north of the Former Norton/Nashua Site. Based on field and laboratory data, the RFI (and the Off-Site AOC) was extended north toward the Maplewood Neighborhood in the Town of Colonie. Subsequent sampling determined that: 1) toluene was the only COC in this AOC; 2) toluene impact was limited to the ground water and deeper soils in the saturated zone and the capillary fringe (depth approximately 8 to 10 feet); and 3) toluene impact was limited to a relatively narrow band extending north from the Former Norton/Nashua Site across Alden Street.

  Additional soil and ground-water samples were collected: 1) in the vicinity of Alden Street; 2) in Craig Street to identify the general boundary of the AOC to the north; and 3) on residential properties north of Alden Street to delineate the boundaries of the dissolved toluene plume (see Figure 2-3). Because the dissolved toluene plume extends beneath residential structures, a vapor intrusion evaluation was performed at selected residences located along Alden Street. Details on Off-Site AOC sampling methods and results are provided in Sections 6.0 & 7.0, respectively.

SECTION 3.0

SAMPLING METHODS - ON-SITE INVESTIGATION

3.1 Field Screening Methods

Geoprobe borings were installed to: 1) qualitatively/semi-quantitatively evaluate (screen) areas of potential residual impact; and 2) collect samples for the quantitative (i.e., laboratory) assessment of the presence/absence and extent of residual soil and/or ground-water contamination. For field screening purposes during the RFI investigation, PID readings exceeding 100 parts per million by volume (ppmv) were considered evidence of residual soil impact and necessitated lateral expansion of the geoprobe array in accordance with the decision matrix set forth in Table 3-1. Field screening methods are discussed in Section 3.2.

If residual soil impact (as defined above) was detected in a given Geoprobe boring, additional borings, as appropriate, were installed at 20-foot (or greater) intervals in the same direction (and then laterally as necessary) until the areal extent of residual impact was defined based on the above-noted field screening criteria. If confirmatory laboratory data from an individual outermost/delimiting Geoprobe boring location exceeded the NYSDEC recommended soil cleanup objectives (SCOs) applicable at the time of the RFI field activities (as identified in Technical and Administrative Guidance Memorandum [TAGM] #4046, dated January 24, 1994), or NYSDEC ground-water standards/guidelines (as identified in Technical and Operational Series [TOGS] #1.1.1, dated June 1998), additional Geoprobe borings were installed during subsequent mobilizations to complete spatial delineation to the applicable soil cleanup objective and/or ground-water standard/guideline.

Except as noted in Section 3.2, a minimum of one soil sample was collected from each Geoprobe boring for laboratory analysis. If residual impact as defined above was detected during field screening in a specific SWMU/AOC, the Geoprobe was utilized to collect a water sample (see Section 3.3).

3.2 Geoprobe Boring Installation and Soil Sampling

Continuous soil samples were obtained via Geoprobe recovery “sleeves” (i.e., disposable four-foot acetate liners placed in the macro-core sampler). Each liner sleeve was extracted by the Geoprobe, opened with a liner or utility knife, and screened with a PID to select the portion of the recovered soil sample that was immediately placed in appropriate bottleware for possible laboratory analysis. Samples collected for VOC analysis were packed to minimize headspace in the container (refer to Table 3-2 for other details). A small sample (approximately 100 grams) of the remaining soil exhibiting the highest PID reading in the Geoprobe liner was placed in a sealable plastic bag, shaken for 15-30 seconds, and allowed to equilibrate to ambient temperature for several minutes before piercing the bag to obtain a PID reading with a MiniRae2000 equipped with a 11.6 eV lamp, which was calibrated twice-daily or after any two hour break.

Because there was the potential for residual fuel oil contamination in the Building #58 AOC, in addition to PID screening, soils from this area of investigation were screened using a qualitative jar/water test. A small sample of the most stained soil (or alternatively the highest remaining PID reading) from the Geoprobe liner (approximately 25 grams) was placed in a four ounce glass jar, filled halfway with water, agitated for approximately 15 seconds, and examined for the presence of a petroleum sheen.

In accordance with the decision matrix set forth in Table 3-1, a minimum of one soil sample from each Geoprobe boring was submitted for laboratory analysis (see Section 3.3). The soil sample interval submitted for laboratory analysis from each boring was selected according to the following order of priority: 1) the soil interval with the highest PID reading; 2) the most highly stained soil interval; or, if there was no evidence of residual impact, 3) the soil interval collected immediately above the water table. A second soil sample was submitted for laboratory analysis from selected Geoprobe borings where: 1) there was shallow staining or odors present; 2) unusual fill materials were present; or 3) to confirm the absence of shallow and deep impact.

Geoprobe soil samples were collected in appropriate laboratory bottleware (see Table 3-2), properly labeled, logged on a chain-of-custody form, and maintained at 4°C until laboratory receipt. Soil samples were generally analyzed for VOCs via EPA Method 8260 plus heptane and tentatively identified compounds (TICs), and semi-volatile organic compounds (SVOCs) plus TICs by EPA Method 8270. However, as the investigation continued it became apparent that samples for SVOC delineation were not needed at some locations, so the SVOC analysis was not performed. As indicated in Table 3-2, soil samples for VOC analysis were collected to minimize headspace.

One Geoprobe boring in each of following the areas: the Former Tank Farm SWMU, the Building #58 AOC, and the Quonset Hut B AOC, was extended into the water table for the collection of a soil sample for laboratory analysis of total organic carbon (TOC) via EPA Method via EPA Method 415.1. Vertically separated samples were collected from three soil borings and submitted for grain size analysis via ASTM D-422. All soil analyses included Category B laboratory deliverables.

The number of borings in several areas of investigation was expanded to delineate the spatial distribution of residual impact, and it was decided not to run soil samples for laboratory analysis from a number of Geoprobe boring locations that would not serve as outermost/delimiting locations (i.e., these boring locations were not required to define the areal extent of residual soil impact via confirmatory laboratory data).

After field screening to collect soil samples for laboratory analysis, remaining soil in the recovered Geoprobe liner was used for field descriptions. Soil sample field descriptions includes assessment via Unified Soil Classification System (USCS) for 1) composition, 2) consistency and density, 3) color, 4) moisture content, 5) grain size/sorting, and 6) presence/absence of staining, discoloration, and odors.

Geoprobe borings were advanced to the water table (approximate depth 5 to 12 feet), or approximately four feet below the water table if it was determined that a ground-water sample would also be collected (see Section 3.3). Geoprobe bore holes that were not converted to ground-water monitoring points (see Section 3-4) were abandoned by backfilling with any remaining soil cuttings followed by hydrated bentonite chips. The surface was restored with cold patch or concrete as applicable. Any excess soil cuttings were temporarily stored in 55-gallon drums prior to characterization for disposal. Soil borings logs are provided in Appendix A.

At the completion of each bore hole (and prior to leaving the site), all equipment that was exposed to site soils or ground water was decontaminated utilizing an Alconox wash and tap water rinse. The handling and disposal of liquids generated during the decontamination process is discussed in Section 3-7.

3. 3 Geoprobe Ground-Water Sampling

The decision matrix for the collection and submittal of Geoprobe ground-water samples for laboratory analysis presented as Table 3-1 was generally followed. However, it was decided not to collect or run ground-water samples for laboratory analysis from a number of Geoprobe boring locations that would not serve as outermost/delimiting locations (i.e., these boring locations were not required to define the areal extent of ground-water impact via confirmatory laboratory data).

Ground-water samples were collected at the selected Geoprobe boring locations utilizing a Geoprobe Screen Point sampler equipped with a four-foot screen length. The Geoprobe ground-water sampler was installed across the water table and the rods were retracted to expose the screened interval, allowing ground water to enter the sampler. A peristaltic pump was used to purge the boring of bulk sediments and reduce turbidity. Ground-water samples were collected after the stabilization of temperature, conductivity, and pH in the purge water.

If the boring went dry during the purging, ground-water samples were collected following the recharge of sufficient ground water for sampling. The handling and disposal of purge water is discussed in Section 3-7.

Ground-water samples collected from Geoprobe borings were placed in appropriate laboratory bottleware (see Table 3-2), properly labeled, logged on a chain-of-custody form, and maintained at 4°C until laboratory receipt via courier or overnight delivery. Ground-water samples were analyzed for VOCs via EPA Method 8260 plus heptane and TICs, and SVOCs plus TICs by EPA Method 8270. All analyses included Category B laboratory deliverables.

3.4 Monitoring Point/Well Installation

3.4.1 Small-Diameter Ground-Water Monitoring Point Installation

The four initial Geoprobe borings installed in the vicinity of the former Tank farm SWMU (see Figure 2-1), and five additional Geoprobe borings were completed as fixed ground-water monitoring points to further assess the extent and potential transport of residual ground-water contamination at the Site. Ground-water monitoring points were installed by extending the existing Geoprobe boring (via a 3.5-inch drive point) approximately ten feet below the level of the water table (or to boring refusal) to allow for seasonal ground-water fluctuations. Total monitoring point depths ranged from 15 to 20 feet. Monitoring point construction logs are provided in Appendix B.

Small-diameter ground-water monitoring points were constructed using 1.5-inch diameter Geoprobe "pre-pack" well and filter kits. The remaining annulus of each monitoring point was filled with #2 sand pack extending a minimum of one foot above the screened interval, sealed with approximately one to two feet of bentonite, and then grouted to the surface. Monitoring point construction information is summarized in Table 3-3.

Each ground-water monitoring point was completed with a bolt-down, flush-mounted vault anchored by a concrete skirt, and equipped with a locking gripper-plug to prevent unauthorized access. Following installation, each ground-water monitoring point was properly developed to remove fine-grained sediments from the sand pack and screen, and surveyed to existing site benchmark elevations. Well development water was staged and processed in a similar manner as ground-water sampling purge water (see Section 3-7).

3.4.2 Monitoring Well Installation

Seven monitoring wells were installed to further assess the extent and potential transport of residual ground-water contamination at the Site. No more than 15 feet of saturated overburden was encountered at any drilling locations, so no shallow/deep "nested" monitoring well pairs were installed during the RFI.

Monitoring well (MW-14) was installed via standard ten-inch outer diameter hollow-stem auger (HSA) methods to bedrock refusal (approximately 19 feet), and monitoring well (MW-15) was installed via a Geoprobe rig converted to advance six-inch outer diameter hollow-stem augers to bedrock refusal (approximately 15 feet). Due to drilling contractor equipment availability, split-spoons were not advanced at these two well locations and soil samples were not collected because Geoprobe soil borings were previously installed at each location.

Monitoring wells MW-14 & MW-15 were constructed of 15 feet and 10 feet, respectively, of Schedule 40 4-inch diameter PVC well screen (0.010 inch slot) installed across the water table (approximate depth 10 feet) to allow for any seasonal fluctuations, and completed with solid Schedule 40 4-inch diameter PVC well riser to the surface.

The five remaining on-site monitoring wells (MW-11, MW-12, MW-13, MW-16 & MW-17) were installed using the Geoprobe rig and a 3.5-inch diameter drive point, and were constructed of 10 feet of Schedule 40 2-inch diameter PVC well screen (0.010 inch slot) installed across the water table, and completed with solid Schedule 40 4-inch diameter PVC well riser to the surface. Monitoring well construction information is summarized in Table 3-3.

Clean #2 silica sand was used to fill the well annulus to approximately one foot above the top of the screened interval. A one to two-foot thick bentonite seal was installed above the gravel pack to prevent surface infiltration, and the remaining well annulus was grouted to surface. The surface treatment, development, and surveying at each monitoring well was similar to that described for ground-water monitoring points (see previous section). Monitoring well construction logs are provided in Appendix B.

3.4.3 Monitoring Point/Well Surveying

All newly installed monitoring points and wells were surveyed by a licensed New York Land Surveyor, the Laberge Group of Albany, New York (Laberge) on April 5, 2004 (on-site wells) and March 6, 2006 (off-site wells) to establish horizontal position and vertical elevation. The survey data, which also included existing monitoring wells and selected sewer manhole locations, were used to prepare the updated site maps presented in this Report.

3.5 Ground-Water Monitoring

3.5.1 Liquid-Level Data Collection

Prior to ground-water sampling, a synoptic round of liquid-level data was obtained from existing and newly installed small-diameter monitoring points and monitoring wells. VOC vapor concentrations were measured at each well with a PID immediately after removing the well cap.

Liquid-level data were collected using an interface probe capable of detecting free-phase product, and the total depth of the well was determined by lowering the probe to the bottom of the well and recording the depth. The interface probe was decontaminated after use at each well by the methods outlined in Section 3-8. To reduce the potential for cross-contamination, monitoring points/wells with previous analyte detections, and newly installed wells that demonstrated evidence of soil impact (via soil field-screening PID readings or laboratory analysis), were gauged last during each synoptic round**.**

3.5.2 Ground-Water Sampling

To establish temporal trends, the RFI Workplan proposed collecting ground-water samples from five existing monitoring wells (DGC-6 through DGC-10) and all newly installed monitoring wells at the Site on a quarterly basis for a minimum of four sampling events (one year). The four existing monitoring wells that had consistently demonstrated the absence of detectable VOCs (DGC-1, DGC-2, DGC-4 & DGC-5), were to be sampled during the first event only with a contingency for incorporation into the quarterly sampling program if any analytes were detected above analytical method detection limits.

Ground-water sampling events were conducted in February, June & September-November 2004; April, June & October 2005; and February, May & August 2006. Due to a greater than anticipated number of monitoring point/wells installed in conjunction with the RFI, and after discussions with the NYSDEC Project Engineer, changes were made to the monitoring well sampling array. Monitoring points/wells sampled on a regular basis included: 1) wells at the margins of, or downgradient from, the toluene plume; 2) a subgroup of selected wells within the toluene plume; 3) downgradient sewer bedding wells (see Section 5.0); and 4) off-site monitoring points/wells adjacent to the toluene plume. DGC series wells were generally only sampled once because these wells were outside of the main investigation areas and no analytes were detected.

Monitoring wells were sampled via the micropurge sampling method used during the 2001 "Enhanced RFA" sampling event. USEPA has encouraged the use of this method because of its reproducibility, accuracy, and cost-effectiveness (additional details are available in the April 1996 USEPA reference document). A micropurging pump capable of a flow rate of approximately 0.1 to 0.5 liters per minute (i.e., peristaltic/bladder pump) was used to minimize turbulence in the well bore and hydraulic stress on the formation. The pump was positioned in the middle of the saturated portion of the screened interval of the well.

Water quality indicator parameters (temperature, pH, specific conductivity, oxidation-reduction potential [ORP], and dissolved oxygen [DO]) were monitored during purging with a continuous "flow-through" cell device (YSI-600XL or equivalent). Readings were taken every three to five minutes until the following stabilization rates were achieved: pH ± 0.1 standard units, specific conductivity ± 3%, ORP ± 10 mV, and DO ± 10%. After the water quality parameters stabilized, ground-water samples were collected directly from the pump effluent line using dedicated tubing and pump bladders at each well. Field sampling forms for the ground-water sampling events are included as Appendix C.

Ground-water samples were collected in appropriate laboratory bottleware (see Table 3-2), properly labeled, logged on a chain-of-custody form, and maintained at 4°C until laboratory receipt via courier or overnight delivery. All monitoring well samples were analyzed for VOCs via EPA Method 8260 plus heptane and TICs. One round of ground-water samples collected in February 2004 was also analyzed for SVOCs plus TICs by EPA Method 8270. All analyses included Category B laboratory deliverables.

In addition to the analyses discussed above, monitoring wells DGC-8 & DGC-9 were sampled for the following electron acceptor and other natural bioattenuation parameters in February 2004 (see Table 3-2): redox, pH, and O_2 (via field instrumentation), Fe^{+2} (via field chemical analysis kit), Fe^{+3} (from total iron via EPA Method 7380), nitrate/nitrite (EPA Method

353.2), phosphate (EPA Method 365.1), sulfate (EPA Method 375.4) alkalinity (EPA Method 310.1), methane/ethane/ethene (Misc. GC Methods), sulfide via EPA Method 376.1, and total heterotrophic bacteria and toluene-xylene (TX)-degrading bacteria microbial counts (via Standard Plate Count Methods). Two additional samples, from off-site wells MP-17 & MW-19, were analyzed for the same parameters in May 2006. The supplemental analyses were performed to determine the extent of intrinsic bioremediation occurring at the Site and assist in the evaluation of enhanced bioremediation (i.e., the addition of oxygen and/or nutrients) as a future corrective measure.

3.6 Hydraulic Conductivity Testing

Hydraulic conductivity testing was conducted at monitoring wells DGC-6 & DCG-9 by placing a combination pressure transducer/data logger unit (In Situ-brand "Troll") near the bottom of each well, and inserting a drop tube from a surface-mounted pump a minimum of five feet below the standing water level. Following well equilibration (approximately 5 to 10 minutes), the data logger was activated, and the static water level was recorded manually and via pressure transducer.

Each well was then pumped at a flow rate of several gallons per minute (equivalent to "slug out"). Pumping continued until maximum drawdown (the minimum proposed drawdown of three feet could not be achieved during testing at DGC-6) was achieved. Total pumping time and the volume of water extracted were recorded. As the water elevation in the well recovered after pumping (equivalent to a "rising head" test), data logging continued on a logarithmic scale until the water level recovered to within 95 percent of its original elevation. Data were analyzed via the Bouwer and Rice Slug Test Method (1976 & 1989) to determine the hydraulic conductivity at each well.

Water removed during hydraulic conductivity testing was temporarily containerized in 5-gallon buckets. Containerized purge water was processed with other purge water as described in Section 3-7.

3.7 Purge Water Disposal

Purge water from monitoring well sampling, hydraulic conductivity testing, and other RFI activities was initially containerized in 55-gallon drums, which were stored at an approved staging location at the Site pending laboratory analysis of the ground-water samples. If the analyte concentrations in the ground-water samples were below NYSDEC Standards/Guidance Values set forth in NYSDEC TOGS 1.1.1, the drummed water was processed through a treatment vessel (bucket) filled with liquid-phase granular activated carbon (GAC) and discharged to the surface in the vicinity of the former tank farm area. Following discussions and approval by the NYSDEC Project Engineer, all purge water from subsequent sampling events was processed and discharged on site in the same manner. Twenty-four drums of decontamination, well development, and purge water remain in temporary storage and will be properly disposed in conjunction with Corrective Measures activities.

3.8 Decontamination Procedures

All non-disposable sampling and data procurement equipment was decontaminated using the following procedures:

1) manual scrub with alconox and potable water using a brush;
2) thorough rinse with potable water;
3) triple rinse with distilled water (ASTM Type II); and
4) air dry.

Liquids generated during the decontamination process were captured in properly labeled containers, and held pending receipt of laboratory analytical results. Decontamination liquids were treated on site (or held for proper disposal) according to the same criteria outlined in the previous section for purge and development water.

SECTION 4.0

RFI RESULTS

This section summarizes On-Site RFI field and laboratory data for the former Norton/Nashua Site. RFI data from the Storm and Sanitary Sewer SWMUs (sediment and sewer water) are discussed in Section 5.0, and Off-Site RFI data are reviewed in detail in Section 6.0.

4.1 Geoprobe Field Screening Results

Shallow soil lithology was highly variable across the site. At a depth of 0 to 5 feet below grade, recovered soils included fine sand associated with subslab/asphalt, mixed cinders, gravels, pebbles, and silty clays. Fill materials, which appeared to be somewhat randomly distributed, were found as shallow as 0 to 5 feet, but were also common from 5 to 10 feet below grade. Native materials also varied at a depth of 5 to 10 feet from dense clays to clean sands. Finer grained materials became less common with depth in all areas of the Site, and the predominant lithology was a coarse sand and gravel layer generally present at depths greater than 10 feet.

Depth to water ranged from 7 to 12 feet. Soil boring refusal was encountered as shallow as 10 to 13 feet due to the presence of fill materials, but most soil borings were terminated at a depth of 15 feet.

Generally, the highest PID reading in each RFI soil boring was obtained from the soil interval collected immediately above the water table (see soil boring logs; Appendix A), except for a limited number of borings (approximately seven) where deeper impact was not present, and the shallow soil sample contained pieces of wood with a creosote odor or a shallow cinder layer. PID field measurements at these locations were relatively low (200 ppmv or less), and none of these samples exceeded applicable NYSDEC SCOs (see next section).

Evidence of shallow soil impact (i.e., soils above a depth of 10 feet and PID readings greater than 100 ppmv) was only found: 1) in the vicinity of the Former Tank Farm; 2) in the immediate area, and east of the former Solvent Lines; and 3) at several locations near storm sewer lines east of the North Cut-Out in Building #61 (see Figure 4-1 for locations). Shallow soil samples subjected to laboratory analysis from the third area did not exceed applicable NYSDEC SCOs.

Shallow and deep soil samples were collected for laboratory analysis to investigate the vertical distribution of residual soil impact. Impact, if present, was restricted to the soil sample with the highest field PID reading. Based upon these data, no bimodal vertical distribution of residual soil impact (i.e., impacted intervals separated by at least four feet of clean soil) was noted within any On-Site RFI soil boring.

4.2 Laboratory Analytical Data

4.2.1 Soil Samples/VOC Analysis

A total of 144 soil samples were submitted for VOC analysis. Results are presented in Table 4-1 and depicted on Figure 4-2. Eleven VOC analytes were detected as follows: methylene chloride (reported in 123 samples), acetone (44 samples), toluene (43), heptane (19), xylenes (10), ethylbenzene (9), benzene (5), chloroform (2), 2-butanone (1), cis-1,2-dichloroethylene (1), and trichloroethene (1). VOC TICs were reported in 115 of the soil samples, but 66 of these detections were "B-qualified" (see below).

The laboratory "B-qualified" the majority of the methylene chloride and acetone detections (see Section 9.0), indicating that these analytes were also present in the laboratory blank samples. In combination with the fact that methylene chloride and acetone have not been associated with previous releases at the site, these two compounds were eliminated as COCs in soil.

Detected VOC analytes were compared to their respective NYSDEC unrestricted and restricted industrial use SCOs per 6 NYCRR Part 375, which became effective December 14, 2006. Note: an SCO for heptane (12,000 micrograms per kilogram [µg/kg]) was previously calculated per TAGM #4046 using a conservative soil to water partition coefficient (K_{oc}) of 2,400 (literature values are as high as 8,200). The heptane SCO was not recalculated per 6 NYCRR Part 375, but conservative values of 1,000 µg/kg and 1,000,000 µg/kg, respectively, were adopted for unrestricted and restricted use comparison purposes. Also, for comparison purposes only, the sum of all VOC TICs in each sample was compared to the TAGS #4046 clean-up standard of 10,000 µg/kg.

Maximum reported soil concentrations for the six of the eleven detected VOC analytes were below their respective unrestricted use SCOs (see Table 4-1): ethylbenzene (180 µg/kg; SCO 1,000 µg/kg), benzene (52 µg/kg; 60 µg/kg), chloroform (2 µg/kg; 250 µg/kg), 2-butanone (18 µg/kg; 120 µg/kg), cis-1,2-dichloroethylene (11 µg/kg; 250 µg/kg), and trichloroethene (12 µg/kg; 470 µg/kg). Therefore, these six VOC analytes are not considered to be COCs in soil at the former Norton/Nashua Site.

Five VOC analytes were present in soil samples collected in conjunction with this RFI at concentrations above their respective unrestricted use SCOs (see Table 4-1): acetone (21 samples exceeded the unrestricted use SCO of 50 µg/kg, but see previous discussion regarding B-qualified detections), methylene chloride (15 samples exceeded 50 µg/kg, but see same discussion), xylenes (2 samples exceeded 260 µg/kg), toluene (11 samples exceeded 700 µg/kg), and heptane (10 samples exceeded 1,000 µg/kg). Except for soil samples SB-25 & SB-83 (see Figure 4-2 for boring locations), all heptane exceedances are associated with toluene exceedances.

These five VOC analytes were also compared to their respective restricted industrial use SCOs (see Table 4-1), which will be utilized for the On-Site AOCs/SWMUs at the former Norton/Nashua Site (see Section 8.1). Restricted industrial use exceedances were limited to toluene at SB-66 & SB-72, and heptane at SB-102 (see Figure 4-2 for boring locations). Toluene and heptane were therefore retained as COCs in soil at the Former Norton/Nashua Site.

Eleven soil samples contained elevated VOC TICs; i.e., total VOC TICs exceeded 10,000 µg/kg (see Table 4-1). Except for soil samples SB-33, SB-110, & SB-112, all TIC exceedances were associated with toluene/heptane exceedances (see Figure 4-2 for boring locations).

4.2.2 Soil Samples/SVOC Analysis

A total of 119 soil samples were submitted for SVOC analysis. Results are presented in Table 4-2 and depicted on Figure 4-3. Twenty-six SVOC analytes and SVOCs TICs were detected. All SVOC TIC concentrations were below the TAGS #4046 clean-up standard of 500,000 µg/kg.

Detected SVOC analytes were compared to their respective NYSDEC unrestricted use SCOs per 6 NYCRR Part 375, which became effective December 14, 2006. . Note: 6 NYCRR Part 375 does not establish SCOs for four of the detected compounds (carbazole, 2-methylnaphthalene, and two phthalates); however, detected concentrations of these compounds were all less than the most conservative SCO of 330 µg/kg.

Maximum reported soil concentrations for 17 of the 26 detected SVOC analytes were below their respective unrestricted use SCOs (see Table 4-2). The 17 SVOC analytes are not considered to be COCs for soil at the former Norton/Nashua Site.

Nine SVOC analytes (seven polyaromatic hydrocarbons [PAHs] and two phenols) were present in soil samples collected in conjunction with this RFI at concentrations above their respective unrestricted use SCOs (see Table 4-2). The PAH exceedances tended to occur in the same soil samples.

These nine SVOC analytes were also compared to their respective restricted industrial use SCOs (see Table 4-2), which will be utilized for the On-Site AOCs/SWMUs at the former Norton/Nashua Site (see Section 8.1). Restricted industrial use exceedances were limited to benzo(a)pyrene at SB-6, SB-8, SB-26, SB-113 & SB-148. Benzo(a)pyrene was therefore the only SVOC retained as a COC in soil at the Former Norton/Nashua Site.

4.2.3 Ground-Water Samples/VOC Analysis

A total of 40 ground-water samples collected via Geoprobe were submitted for VOC analysis. Results are presented in Table 4-3 and depicted on Figure 4-4. Six VOC analytes were detected as follows: methylene chloride (reported in 33 samples), toluene (29 samples), acetone (7), heptane (4), xylenes (3), and chloroform (1). VOC TICs were reported in 20 of the ground-water samples; however, a number of these detections were B-qualified (see previous discussion).

Detected VOC analytes were compared to their respective NYSDEC ground-water standard/guideline (see TOGS #1.1.1). Maximum reported ground-water concentrations for two of the six detected VOC analytes were below their respective ground-water standard/guideline objectives (see Table 4-3): xylenes (maximum detected concentration 5 J micrograms per liter [µg/L]; standard 5 µg/L), and chloroform (3 J µg/L; 7 µg/L). Therefore, these two VOC analytes and B-qualified analytes, methylene chloride and acetone, are not considered to be COCs in ground water at the Former Norton/Nashua Site.

Two VOC analytes were present in ground-water samples collected in conjunction with this RFI at concentrations above their respective ground-water standard/guideline objectives (see Table 4-3): toluene (24 samples exceeded 5 µg/L) and heptane (4 samples, no standard). Except for ground-water sample SB-58, all heptane exceedances were associated with toluene exceedances. All total VOC TIC concentrations exceeding 10 µg/L were also associated with toluene exceedances (see Table 4-3). Toluene and heptane were retained as COCs in ground water at the Former Norton/Nashua Site.

4.2.4 Ground-Water Samples/SVOC Analysis

A total of 14 ground-water samples were submitted for SVOC analysis. Results are presented in Table 4-4 and depicted on Figure 4-5. Five SVOC analytes were detected. SVOC TICs were reported in 6 ground-water samples (additional samples were B-qualified).

Maximum reported ground-water concentrations for three of the five detected SVOC analytes were below their respective ground-water standard/guideline objectives (see Table 4-4). Therefore, these three SVOC analytes were not considered to be COCs in ground water at the Former Norton/Nashua Site.

Two phenolic compounds, 2-methylphenol and 4-methylphenol, were present in five ground-water samples collected in conjunction with this RFI at concentrations above the ground-water standard 1 µg/L at maximum detected concentrations of 9 J µg/L and 16 µg/L, respectively (see Table 4-4). Therefore, 2-methylphenol and 4-methylphenol are retained as COCs in ground water at the Former Norton/Nashua Site.

4.2.5 Supplemental Geoprobe Soil Analyses

Soil samples from geoprobe borings SB-124, SB-125 & SB-126 were submitted for grain size analysis via ASTM D-422 (all three borings are in Building #61, immediately east of the former solvent lines; see Figure 4-1). Results are presented in Table 4-5. Figures depicting grain size distribution for the soil samples are included in Appendix D.

Geoprobe borings SB-2, SB-43 & SB-72 were extended into the water table for the collection of soil samples for laboratory analysis of TOC via EPA Method 415.1. SB-2 is located in Quonset Hut C, SB-43 is near the west cut-out in Building #58, and SB-72 is in Building #61 immediately east of a north-south storm sewer line (see Figure 4-1 for boring locations). TOC concentrations in the three samples ranged from 2,940 mg/kg (SB-72) to 7,920 mg/kg (SB-2). Results are presented in Table 4-6.

A two-foot continuous soil sample collected at the water table (sample depth 10 to 12 feet) on February 18, 2004 from SB-142 (located just south of the former tank farm; see Figure 4-1) was analyzed for oil permeability, bulk and grain density, porosity, and water/oil saturation. The data were collected for possible use in Corrective Measures evaluations. The calculated oil permeability of the sample was 0.795 millidarcies, bulk and grain densities were 2.21 and 2.709 grams per cubic centimeter (g/cm^3), respectively, the porosity was 28.4%, and the water/oil saturation was 97.5%/2.5%.

4.3 Ground-Water Sampling

Results from the regular sampling of ground-water monitoring points and wells for VOCs analysis conducted in the On-Site AOC are discussed in this section. Other On-Site RFI ground-water monitoring activities include: 1) an SVOC sampling event; and 2) sampling for supplemental natural attenuation parameters at selected monitoring points.

4.3.1 Liquid-Level Data Collection

On-Site RFI ground-water sampling events were conducted in February, June & September-November 2004; April, June & October 2005; and February, May & August 2006. Prior to each round of ground-water sampling (except October 2005), a synoptic round of liquid-level data was collected using an interface probe capable of detecting free-phase product (FPP).

4.3.1a Depth to Water/Ground-Water Flow

Depth to water measurements at the Site have ranged from 4.35 feet (DGC-2; April 2005) to 12.46 feet (DGC-9; August 2006). Average depth to water at the Site (including all On-Site & Off-Site RFI wells) has ranged from 7.55 feet (April 2005) to 9.04 feet (February 2004). Historical liquid-level data are summarized in Table 4-7.

Ground-water flow at the site is consistently to the east-northeast. The water table gradient in the eastern portion of the Site (0.0133) is much greater than the gradient beneath the buildings and the Former Tank Area (0.0017 or less). Ground-water flow maps for each of the synoptic gauging rounds are presented as Figures 4-6 through 4-13.

Depth to water readings in the Former Tank Farm SWMU are generally less than one foot higher than in the wells along Alden Street in the Off-Site AOC, but two to four feet higher than depth to water in the wells in the eastern portion of the former Norton/Nashua Site (DGC-9 & DGC-10). Therefore, current ground-water flow and gradient do not indicate there is active transport of dissolved-phase toluene towards the Off-Site AOC. The presence of dissolved toluene in the Off-Site AOC is most likely a remnant of historical pumping activities in that area (see Section 7.4).

4.3.1b Free-Phase Product

Free-phase product (FPP) has only been detected in one monitoring well at the Site: MW-14, located in the Former Tank Farm SWMU (see Figure 1-3). FPP was detected at well MW-14 during four synoptic liquid-level rounds at apparent product thicknesses (APTs) ranging from 0.02 feet (February 2006) to 0.12 feet (June 2005). FPP gauging data are presented in Table 4-7. During the most recent gauging event (August 2006), the APT at MW-14 was 0.05 feet. Increased APT measurements in MW-14 generally correlate with periods of lower water depth (see Figure 4-14).

4.3.2 VOC Monitoring Point/Well Sampling

On-Site RFI ground-water sampling events were conducted in February, June & September-November 2004; April, June & October 2005; and February, May & August 2006. As approved by the NYSDEC Project Engineer, monitoring points/wells sampled on a regular basis were limited to: 1) a subgroup of selected wells within the on-site toluene plume; 2) on-site monitoring points/wells adjacent to the margins of the toluene plume; and 3) on-site monitoring points/wells in downgradient sewer bedding material (see Section 5.0). Ground-water sampling results are presented in Table 4-8.

Toluene concentrations in ground-water during the February 2004 sampling event are depicted on Figure 4-15. The most recent sampling results for each of the 26 On-Site RFI monitoring points/wells (results are summarized in Table 4-8, and toluene isoconcentrations are depicted on Figure 4-16) indicate that toluene concentration above the NYSDEC ground-water standard are limited to monitoring wells/points in the Former Tank Farm SWMU and Buildings #58 and #61: DGC-8, MW-14, MW-17, MP-1 through MP-4, MP-10 & MP-11.

However, a comparison of Figures 4-15 & 4-16 reveals that toluene concentrations in wells along the margins of the toluene plume exhibit a strong decreasing trend, and some wells where toluene was formerly present at milligram per liter (mg/L) concentrations are now non-detect (ND), suggesting active biodegradation. Regression curves for four wells (DGC-6, DGC-7, MW-17 & MP-1; see Figure 1-3 for locations), which demonstrate decreasing toluene slopes of –0.0016 to -0.0073 over a minimum of three sampling events, are presented in Appendix E.

Heptane was previously detected at three monitoring points (MW-15, MP-9 & MP-10; see Figure 4-16) at concentrations ranging from 34 J μg/L to 120 J μg/L, but recent sampling has confirmed heptane concentrations as ND at the three locations (see Table 4-8), providing further evidence of active biodegradation. In addition to toluene, heptane, and VOC TICs (excluding B-qualified detections), the following VOC analytes were detected during On-Site RFI ground-water sampling: benzene, chlorobenzene, cyclohexane, ethylbenzene, methylcyclohexane, 4-methyl-2-pentanone, and xylenes (see Table 4-8). However, except for methylcyclohexane, which was detected on two occasions at two wells (MP-1 & MP-2) in the Former Tank Farm SWMU, and VOC TICs, toluene and heptane are confirmed as the only VOC COCs in ground-water for the On-Site RFI.

4.3.3 SVOC Monitoring Point/Well Sampling

Ground-water samples collected in February 2004 from 25 On-Site RFI monitoring points/wells were analyzed for SVOCs plus TICs by EPA Method 8270. Monitoring wells MW-16 & MW-17 (see Figure 1-3 for well locations) were resampled in June 2004. SVOC analytes were detected at 11 sampling locations (see Table 4-9). Detected analytes included four phenols, two naphthalenes, and 3 phthalates; however, only 2-methylphenol and 4-methylphenol (detected at ten locations), and bis(2-ethylhexyl)phthalate (detected at MW-16) exceeded their respective NYSDEC ground-water standard/guideline (see Table 4-9).

The bis(2-ethylhexyl)phthalate exceedance and the previous detection of 9 PAHs at MW-16, in the asphalt area near the Solvent and Filter Room AOCs (see Figure 1-3), was not confirmed by the June 2004 resample event (see Table 4-9). The methylphenol exceedances are restricted to monitoring well/points located in the vicinity of the Former Tank Farm SWMU and within the dissolved toluene plume beneath the building south of the Former Tank Farm (see Table 4-9 and Figure 2-1 for well locations). SVOC TICs were detected at 14 monitoring points/wells, but total SVOC TICs concentrations were 5 J µg/L or less at ten of the sampling locations (see Table 4-9).

The February & June 2004 monitoring point/well sampling results confirm the Geoprobe ground-water sampling results (see Section 4.2.4), which identified methyphenols as a COC at the Site. The methylphenols will be addressed by Corrective Measures (see Section 10) that are directed towards the toluene plume.

4.3.4 Supplemental Ground-Water Parameters

Ground-water samples were collected from DGC-8 (impacted well) & DGC-9 (non-impacted well) in February 2004 for analysis of natural bioattenuation parameters (see Table 3-2 and Figure 1-3 for well locations). These analyses were performed to determine the extent of intrinsic biodegradation occurring in ground water in the On-Site AOC. Bioparameter sampling data are summarized in Table 4-10.

Dissolved oxygen concentrations, 0.90 mg/L in DGC-8 and 1.75 mg/L DGC-9, are low and probably rate limiting with respect to toluene degradation. Anaerobic conditions are also suggested by the higher ferrous iron, total iron, alkalinity, and methane concentrations detected at the more impacted well (DGC-8), which also had a more negative ORP and lower pH. Toluene-degrading bacteria were present in the DGC-8 sample, supporting the occurrence of active toluene degradation, but the total number and ratio to total heterotrophic bacteria were very low, possibly a result of the low dissolved oxygen and high dissolved-toluene (200,000 µg/L) concentrations.

4.4 Hydraulic Conductivity Testing

Hydraulic conductivity testing was conducted at monitoring wells DGC-6 & DGC-9 (see Figure 1-3 for well locations) by pumping each well at a flow rate of several gallons per minute (equivalent to “slug out”) and monitoring the recovery rate at each well (equivalent to a “rising head” test). Monitoring data, analyzed via the Bouwer and Rice Slug Test Method (1976 & 1989), resulted in calculated hydraulic conductivities of 1.9 feet per day and 1.3 feet per day at DGC-6 & DGC-9, respectively. Field data and summary figures and tables are presented in Appendix F.

4.5 AOC/SWMU Review

This section reviews soil and ground-water sampling results for each On-Site RFI SWMU/AOC, beginning with the outlying AOCs, and working in towards the central portion of the Site. A summary of the total numbers of soil borings, water samples, and monitoring wells/points installed in each SWMU/AOC is presented in Table 4-11. Geoprobe field screening and soil sampling data are presented in Tables 4-1 & 4-2 and depicted on Figures 4-2 & 4-3, ground-water geoprobe sampling data are summarized in Tables 4-3 & 4-4 and depicted on Figures 4-4 & 4-5, and monitoring well/point sampling data are reviewed in Tables 4-8 & 4-9 and depicted on Figure 4-16.

4.5.1 Quonset Hut C (adjacent to Buildings #59 & #60) AOC

Two borings were installed in this AOC via Geoprobe rig to investigate the epoxy/resin spill (see Figures 2-1 & 4-1); one in the asphalt area between Quonset Huts C & D (SB-1), and one inside Quonset Hut C (SB-2). Both borings were terminated at a depth of 13 feet due to refusal from fill materials. Depth to water was approximately 10 feet.

One soil sample was collected from each boring for laboratory analysis. Evidence of residual soil impact was not detected in these three borings (maximum PID reading 9.0 ppmv); however, per the RFI Workplan a ground-water sample was collected from the boring exhibiting the highest PID response (SB-1). Boring SB-1 produced little water and could not be fully purged, and the ground-water sample collected was highly turbid.

Except for "B-qualified" compounds (analyte also detected in the laboratory blank), all VOC analytes were below method quantitation limits in the two soil samples (see Table 4-1 and Figure 4-2). No SVOC analytes or TICs were detected in the two soil samples (see Table 4-2 and Figure 4-3).

Except for "B-qualified" compounds (analyte also detected in the laboratory blank), the only VOC analyte detected in the SB-1 water sample was toluene at a concentration of 7 µg/L (see Table 4-3 and Figure 4-4). No SVOC analytes were detected in the SB-1 water sample; however, SVOC TICs were present at a total concentration of 100 µg/L (see Table 4-4 and Figure 4-5).

Due to higher suspended sediments, which result from incomplete purging, the absence of a well pack, etc., analyte concentrations in ground-water samples collected via Geoprobe rig are typically higher than analyte concentrations reported for ground-water samples collected from conventional monitoring wells. As noted above, the ground-water sample collected from geoprobe boring SB-1 was highly turbid, potentially overestimating the toluene concentration.

Moreover, toluene has never been detected at downgradient monitoring wells DGC-2 & MW-13, and SVOC TICs were present at minimal concentrations of 2 J µg/L in these two wells. Therefore, no further investigation or remedial action is proposed for this AOC.

4.5.2 Quonset Hut B (adjacent to Building #61) AOC

As proposed, three borings were installed via Geoprobe rig inside the Quonset Hut B (see Figures 2-1 & 4-1) to depths of 10 to 15 feet. Depth to water ranged from 8.5 feet to 9.0 feet. One soil sample was collected from each boring for laboratory analysis. Evidence of residual soil impact was not detected in these three borings (maximum PID reading 13.5 ppmv), so no ground-water samples were collected.

Except for "B-qualified" compounds (analyte also detected in the laboratory blank), all VOC analytes were below method quantitation limits in the three soil samples (see Table 4-1 and Figure 4-2). No SVOC analytes were detected in the soil sample collected from SB-12, 10 SVOCs were detected in SB-11, and 11 SVOCs were detected in the SB-10 sample (see Table 4-2 and Figure 4-3). Detected SVOC concentrations were higher for each analyte in the SB-10 sample, ranging from 110 J µg/kg (anthracene and benzo(b)fluoranthene) to 380 µg/kg (fluoranthene). SVOCs were ND in ground water in adjacent monitoring wells (DGC-4 & DGC-7; see Table 4-9, Figure 1-3 for well locations).

The detected SVOC concentrations in this AOC are within the expected range for soil collected beneath asphalt. All concentrations were below their respective unrestricted use SCOs. Given the limited mobility of these compounds and their isolation beneath the asphalt floor, there is currently no exposure pathway. Therefore, no further investigation or remedial action is proposed for this AOC.

4.5.3 Former Solvent Recovery Room (adjacent to Building #59) AOC

Two borings (SB-3 & SB-4) were installed inside the former solvent recovery room (see Figures 2-1 & 4-1) via Geoprobe rig to the proposed depth of 15 feet. Depth to water was approximately 10 feet. One soil sample was collected from each boring for laboratory analysis. Evidence of residual soil impact was not detected in these two borings (maximum PID reading 4.7 ppmv), so no ground-water samples were collected.

All VOC analytes were below method quantitation limits in the soil sample collected from boring SB-4 (see Table 4-1 and Figure 4-2). Toluene was the only VOC analyte detected in the SB-3 soil sample at a concentration of 49 µg/kg. No SVOC analytes were detected in the two soil samples collected from this AOC (see Table 4-2 and Figure 4-3). Ground-water samples are discussed in the next section.

All VOC and SVOC analytes were below method quantitation limits in the two soil samples except toluene, which was detected at a concentration significantly below the unrestricted use SCO of 700 µg/kg (see Table 4-1). Therefore, no further investigation or remedial action is proposed for this AOC.

4.5.4 Former Filter Room (adjacent to Building #59) AOC

Following discussions and field inspection with the NYSDEC Engineer, the two borings proposed for the former filter room (SB-13 & SB-14) were relocated from the asphalt area outside the east and north walls of the room to inside the former filter room (see Figures 2-1 & 4-1). Both borings were installed via Geoprobe rig to a depth of 15 feet. Depth to water was approximately 10 feet. One soil sample was collected from each boring for laboratory analysis. Evidence of residual soil impact was not detected in these two borings (maximum PID reading 2.3 ppmv), so no ground-water samples were collected. Except for "B-qualified" compounds (analyte also detected in the laboratory blank), all VOC and SVOC analytes were below method quantitation limits in the two soil samples (see Tables 4-1 & 4-2, and Figures 4-2 & 4-3, respectively, for VOC and SVOC results).

As proposed in the RFI Workplan, one monitoring well (MW-16) was installed in the general vicinity of the Solvent Room and Filter Room AOCs (see Figure 1-3). Although toluene was detected during the initial sampling of this well (maximum concentration 190 µg/L), toluene concentrations were ND during the four most recent sampling events (see Table 4-8). All SVOCs were ND at MW-16 during the June 2004 sampling event (see Table 4-9). Based on the soil and ground-water sampling results, no further investigation or remedial action is proposed for this AOC.

4.5.5 Former "Beartex" Sump Pit SWMU/Building #61 Doorway Spill AOC

Upon field inspection and consultation with the NYSDEC Project Engineer, the location of the Former "Beartex" Sump Pit SWMU was adjusted to the west to match a floor cutout just inside the Building #61 Doorway. Therefore, discussions regarding data from these two areas have been combined.

No field evidence of residual soil impact (PID readings exceeding 100 ppmv) was detected in this SWMU/AOC during the RFI soil boring program (SB-5 through SB-9 and SB-60; see Table 4-1 and Figure 4-1). VOC analytes and TICs were ND or present at concentrations below NYSDEC soil objectives in all of the samples, except SB-6 where toluene exceeded the unrestricted use SCO (see Table 4-1 and Figure 4-2). Methyl isobutyl ketone (MIBK), previously reported in historical soil samples collected near the Building #61 doorway, was not detected in any of the soil samples. Because the extent of residual soil impact was limited, no ground-water samples were collected for analysis.

SVOC analytes and TICs concentrations were generally below NYSDEC soil objectives, but PAH concentrations exceeded the unrestricted use SCO at SB-6 & SB-8, and benzo(a)pyrene exceeded the restricted industrial use SCO at these two locations (see Table 4-2 and Figure 4-3). The detected PAHs are likely associated with the asphalt or are in cinder/fill materials. The presence of PAHs beneath the asphalt and in cinder/fill materials used at the Site, and the absence of a risk of exposure or off-site migration has been documented elsewhere in this Report, and the PAHs will not be further investigated or addressed as COCs at the Site.

4.5.6 Building #58 AOC

A minimum of ten Geoprobe borings were proposed in this AOC to assess the possible presence of oils in the two floor cutouts (see Figures 2-1 & 4-1). Evidence of residual soil impact was not detected by the presence of a visible sheen in the jar/water test in any soil samples collected in this area (see Section 3.2), but PID field screening reading above 100 ppmv were obtained from several borings in this AOC (see Figure 4-1), so additional borings were installed to define the nature and areal extent of residual soil impact. The AOC was expanded west to the Building #57 wall, north to the Former Solvent Lines AOC, and east into Building #59 (see Figures 2-1 & 4-1), and is contiguous with the larger On-Site toluene plume.

Toluene and heptane exceeded NYSDEC unrestricted use SCOs in three soil samples collected in this AOC (SB-66, SB-100 & SB-102; see Table 4-1 and Figure 4-2). Elevated VOC TICs were also detected at these boring locations, and in additional two soil samples (SB-110 & SB-112; see Table 4-1 and Figure 4-2). SVOC analytes were generally not detected in this AOC except in selected samples located towards Building #57 (see Table 4-2 and Figure 4-3), and benzo(a)pyrene concentrations exceeded SCOs at two sampling locations. The presence of

PAHs in these samples was clearly associated with historical cinder/fill materials used at the Site. Based upon the absence of a risk of exposure or off-site migration, the soil PAHs will not be further investigated or addressed as COCs at the Site.

Prior to boring installation, the standing water (several inches) in each floor cutout was removed, however, borings could not be installed in the middle of the two cutouts because there was a thick (minimum two to three feet) concrete slab present. Residual impact was detected in two soil borings near the cutouts in a fill layer containing pieces of wood, brick, and other debris, but soil samples collected from this layer and the underlying water table, were below applicable NYSDEC VOC/SVOC clean-up objectives (see Tables 4-1 & 4-2, respectively). Based on the depth to water in surrounding borings (8 to 10 feet), it was subsequently determined that the water formerly present in the cutouts was not ground water, but had accumulated from roof leaks.

Water samples from the cutouts, detected VOC and SVOC TICs and analytes at concentrations below their respective ground-water standards (see Tables 4-3 & 4-4, respectively), including toluene at a concentration of 1 J mg/L. A cutout water sample analyzed for total petroleum hydrocarbons – diesel-range organics (TPH-DRO) via EPA Modified Method 8015 demonstrated a concentration of 50.8 mg/L (see Table 4-4), but SVOC analytes were not elevated in surrounding soil samples (see Table 4-2). Based on these results, and subsequent discussions with the NYSDEC Project Engineer, the cutouts were not considered an item of environmental concern and were filled with cement by the current property owner.

4.5.7 Former Test Pit AOC

Although the actual location of the test pit formerly used to recover free-phase product in 1969 (see Section 2.0) could not be identified in the Building #61 floor, evidence of residual soil impact (PID field screening readings above 100 ppmv) was obtained from several borings in this AOC (see Table 4-1 and Figure 4-1), so additional borings were installed to define the nature and areal extent of residual soil impact. This AOC was expanded west to the Former Solvent Lines AOC and south to the Building #61 wall (see Figures 2-1 & 4-1), and is contiguous with the larger On-Site toluene plume.

Toluene and heptane exceeded NYSDEC unrestricted use SCOs in samples from SB-17 & SB-19 (see Table 4-1 and Figure 4-2). 2-Methylphenol exceeded the unrestricted use SCO at SB-19, but other SVOC analytes were generally not detected except at borings SB-20 & SB-26 (see Table 4-2 and Figure 4-3), where benzo(a)pyrene concentrations exceeded SCOs. The presence of PAHs in these samples was clearly associated with historical cinder/fill materials. Based upon the absence of a risk of exposure or off-site migration, the soil PAHs will not be further investigated or addressed as COCs at the Site. Ground-water samples collected from monitoring wells MP-10, MP-11, and MW-17 (see Table 4-8 and Figure 1-3) indicate that these wells are located within the dissolved toluene plume.

4.5.8 Former Solvent Line AOC

The location of the former solvent lines was identified from pavement cuts outside the building and stub-ups in Building #58 (see Figure 1-3). A series of five geoprobe borings installed along the line (SB-62, and SB-123 through SB-126; see Figure 4-1) detected field evidence of residual soil impact (i.e., PID field screening readings above 100 ppmv; see Table 4-1), so approximately 40 additional borings, including 18 borings in Building #59 (see Figure 4-1), were installed to define the areal extent of residual soil impact of this AOC.

Toluene, heptane, and/or xylenes exceeded NYSDEC unrestricted use SCOs in five soil samples collected in this AOC (see Table 4-1 and Figure 4-2): SB-22, SB-25, SB-72, SB-123 & SB-126. Elevated VOC TICs were also detected at these soil boring locations (except SB-72). Methylphenols exceeded the unrestricted SCO in soil sample SB-126 located immediately east of the solvent lines (see Table 4-2 and Figure 4-3), but other SVOC analytes were generally not detected in this AOC except in samples in the southwest corner of Building #61 (SB-68, SB-73 & SB-75; see Table 4-2 and Figure 4-3) and towards the Former Test Pit AOC in SB-22 (see Table 4-2 and Figure 4-3). The presence of PAHs in these samples was clearly associated with historical cinder/fill materials used at the Site. Based upon the absence of a risk of exposure or off-site migration, the soil PAHs will not be further investigated or addressed as COCs at the Site. No VOC or SVOC analytes exceeded NYSDEC SCOs in soil samples collected in Building #59 (see Tables 4-1 & 4-2, and Figures 4-2 & 4-3).

The Former Solvent Line AOC was expanded east to the Test Pit AOC, west into Building #61, and south to the Building #61 wall and into Building #59 (see Figures 2-1 & 4-1). It is contiguous with the larger On-Site toluene plume. Toluene was not detected in recent ground-water samples collected west of the former solvent lines (DGC-6 and MP-12).

4.5.9 Former Tank Farm SWMU

The presence of significant residual toluene in this SWMU was documented by the previous sampling of monitoring well DGC-8 and the presence of FPP in newly-installed monitoring well MW-14 (see Section 4.3.1b). Although field evidence of residual soil impact (PID field screening readings above 100 ppmv and odors), was apparent in soil borings installed in the immediate vicinity of this SWMU (see Figure 4-1), impact lessened to the east and west, and no VOC analytes or TICs were detected in confirmatory soil samples collected at delineation borings SB-78, SB-81, and SB-84 (see Table 4-2 and Figure 4-2). As discussed elsewhere in this Report, toluene impact clearly extended to the north, so the RFI continued into the newly designated Off-Site AOC (see Section 6.0 & 7.0).

Toluene and heptane exceeded their respective NYSDEC unrestricted use SCOs in soil samplesSB-31 & SB-83, respectively, and elevated VOC TICs were present in soil samples SB-33 & SB-83 (see Table 4-1 and Figure 4-2). Toluene concentrations were slightly above the ground-water standard in water samples collected from geoprobe borings SB-36 & SB-82 (see Table 4-3 & Figure 4-2).

2-Methylphenol exceeded the unrestricted use SCO in one soil sample collected in the immediate vicinity former Tank Farm (SB-31; see Table 4-2 and Figure 4-3). PAHs were generally absent in soil samples collected in this area; historical cinder/fill materials were not observed in the majority of the borings installed in this SWMU. This AOC is contiguous with the larger On-Site toluene plume (see Figure 2-1), and also is continuous with the Off-Site AOC to the north (see Sections 6.0 & 7.0).

SECTION 5.0

STORM AND SANITARY SEWER MONITORING & ASSESSMENT

5.1 Summary of the 2001 Sewer Sampling Evaluation

The 2001 sewer water sampling data indicated that, under prevailing conditions, there was no significant occurrence of VOCs in the water present in the sewer systems (see Table 5-1 for historical results). Specifically, volatile analytes were not detected in downstream sewer water samples MH-5 & MH-1[San] (see Figure 1-3). Except for chlorobenzene, VOC concentrations in sewer sediments demonstrated lower concentrations as compared with historical sampling events suggesting that the source of the previously detected VOCs in the sewer sediment and water samples was reduced or removed (see Table 5-2 for historical results).

Similarly, the 2001 sewer water sampling data demonstrated that there was no significant occurrence of SVOCs in the water present in the sewer systems (see Table 5-1). Specifically, SVOC concentrations in downstream sewer water samples were near or below detection limits (except for two analytes in the sanitary sewer).

In contrast to the VOC data, the 2001 SVOC sewer sediment sampling data identified the presence of numerous SVOC analytes (see Table 5-2). Based on compound-specific water to carbon and soil to water partitioning coefficients, ideal solubility, and maximum hypothetical soil equilibrium partitioning, the observed SVOC sewer sediments concentrations were determined to be too high to be a result of impacted ground water infiltrating the sewer. Therefore, semi-volatile impact in the sewer sediments was determined to be the result of historic or ongoing introduction of impacted SVOC sediments to the sewers.

5.2 Proposed RFI Sewer Activities

The storm and sanitary sewer systems were identified as SWMUs because of historical data indicating impact to sewer water and sediment, and the potential for these systems (and the surrounding bedding; see Section 5.3) to act as preferred pathways for contaminant transport within the site and off site. As discussed in Section 5.1, the 2001 investigation determined that there was no evidence of significant impact to storm or sanitary sewer water at the former Norton/Nashua Site, and impact to sewer sediments was limited primarily to SVOCs.

Therefore, the primary concern regarding the sewer systems is their potential to serve as a preferential pathway for off-site COC migration. On-Site RFI activities were directed towards further evaluating the potential for off-site migration of SVOC sediments and dissolved toluene via the sewer system. In addition, supplemental sewer sampling was proposed to confirm/expand previous sampling results and monitor water quality moving off site via the sewer systems.

5.3 Sewer Bedding Investigation

In addition to off-site migration directly through the sewer lines, VOCs could potentially have migrated via the bedding material surrounding the sewer lines. To investigate this potential, the RFI Workplan proposed the installation of monitoring wells in the storm and sanitary sewer bedding at two outdoor downstream/downgradient locations (see Figure 1-3): MH-5 & MH-1(San), respectively, and one indoor storm sewer manhole location: MH-12.

The RFI Workplan proposed using an "air knife" drilling rig to install the outdoor sewer bedding wells to allow advancement of the borehole immediately adjacent to the lines without damaging the pipes. However, an "air knife" rig could not be procured for RFI site work in a timely manner, so a Geoprobe rig was used to install all three sewer bedding wells by carefully advancing the drill point adjacent to the sewer line.

Sewer bedding wells were installed to approximately five to seven feet below the invert level of the sewer pipes (total depth 12.5 to 17.5 feet). Concrete and pieces of wood forms associated with sewer bedding materials were observed during the advancement of two of the well borings, and wet gravel was noted at the depth of the sewer line in the third boring (MH-5), indicating that all three wells were installed in the targeted sewer bedding.

Sewer bedding wells were constructed of approximately ten feet of Schedule 40 2-inch diameter PVC well screen (0.010 inch slot) installed from the bottom of the borehole to the top of the sewer bedding (approximate depth 3 to 8 feet), and completed with solid Schedule 40 2-inch diameter PVC well riser to the surface. Clean #2 silica sand was used to fill the well annulus to at least one foot above the top of the screened interval. A one to two-foot thick bentonite seal was installed above the gravel pack to prevent surface infiltration, and the remaining well annulus was grouted to surface. Wellhead completion, well development, and surveying of the three sewer bedding wells was performed as outlined in Section 3.4.

Prior to ground-water sampling, vapor samples were collected from MH-5, MH-12 & MH-1(San) for laboratory analysis via a specialized churney well plug (see Figure 1-3 for well locations). The exterior of the churney plug was equipped with a quick-connect fitting and the interior of the plug included a drop tube that extended to approximately six inches above the water table. Vapor samples collected in this manner were assumed to be representative of vapor conditions in the sewer bedding (and adjacent native soils) immediately above the water table.

Prior to vapor sample collection, each well was purged of approximately five volumes of standing air via low flow air pump (Gillian GilAir 5 or similar) at a flow rate of approximate 3.0 liters per minute (L/min.). A Summa canister was then connected to the quick-connect fitting with dedicated tubing, and the canister intake valve adjusted to collect each vapor sample over a time period of approximately 360 minutes.

Vapor samples were submitted for laboratory analysis of VOCs via EPA Method TO-15 plus library search and methane via EPA Modified Methods 18 & 25 (GC/FID). Following vapor sampling, liquid-level data collection and ground-water sampling for the three sewer bedding wells was performed as discussed in Section 3.0. Sewer bedding soil vapor sampling results are discussed in Section 5.6.2.

5.4 Supplemental Sewer Sediment Sampling

To supplement sewer sediment samples collected during the 2001 Enhanced RFA event, the RFI Workplan proposed the collection of samples from sanitary sewer manhole MH-1(San), four storm sewer manholes (MH-2.5, MH-5, MH-13 & MH-15), and contingent sewer manholes listed on Table 5-3. Sampling proceeded upstream to avoid agitating bottom sediments at succeeding sediment sample locations (see Figure 1-3). Despite renewed efforts, MH-15, or a manhole farther downstream to the east, could not be located.

Immediately after each sewer manhole cover was removed, VOC vapor concentration (via PID), the lower explosive limit (LEL), and O_2 concentration were measured approximately two to three feet below grade and at the bottom of the manhole. LEL and O_2 levels were monitored throughout sampling procedures at each sewer sampling point.

Sediment samples were collected from sewer manholes using a properly decontaminated shovel/bottom sampler. A PID was used to screen each sediment sample for VOCs. After removing any exotic debris (leaves, trash, stones, etc.), sewer sediment samples were transferred to appropriate laboratory bottleware and any excess sampling volume was returned to the sewer. The shovel/bottom sampler was properly decontaminated between samples (see Section 3.8).

Sewer sediment samples were properly labeled, logged on a chain-of-custody form, and maintained at 4°C until laboratory receipt for analysis of SVOCs via EPA Method 8270 plus TICs. All analyses included Category B laboratory deliverables.

During the February and June 2004 sewer sampling events, all manhole PID readings were 1.0 ppmv or less. LEL and O_2 levels remained at 0% and within normal limits, respectively. Standing water was present in several sewer manholes, but there was no apparent flow, so water velocity data were not collected.

Sediment samples were obtained from storm sewer manhole MH-13 as described (see Figure 1-3 for sewer manhole locations). No sediment was present at storm sewer manholes MH-2 or MH-5, so sediment samples were collected from contingent locations MW-2.5, MH-3.5 & MH-14 in February 2004 (see Table 5-1). No sediment was present at sanitary sewer manhole MH-1(San) or contingent manhole MH-Bldg.59(San), so no sanitary sewer sediment samples were collected (see Table 5-3).

5.5 Supplemental Sewer Water Sampling

To supplement sewer water samples collected during the 2001 Enhanced RFA event, the RFI Workplan proposed the collection of samples from sanitary sewer manhole MH-1(San), four storm sewer manholes (MH-2, MH-5, MH-10 & MH-15 or a manhole farther downstream towards New York State Route 32), and/or contingent sewer manholes listed on Table 5-3. Manhole MH-10 could not be located and was presumed to be paved over, and as noted above, manhole MH-15 (or a substitute downstream storm sewer) could not be located (see Figure 1-3 for sewer manhole locations).

Sewer water samples were obtained from sanitary sewer manhole MH-1(San) and storm sewer manhole MH-5 as described. No water was present at storm sewer manhole MH-2, so sewer water samples were collected from contingent locations MW-12, MH-13 & MW-14 in February 2004, and from manhole MH-1 in June 2004 (see Table 5-3).

Sewer water samples were collected by lowering a dedicated bailer or glass jar into the sewer flow and transferring the water sample to appropriate laboratory supplied bottleware (see Table 3-2). All sewer water samples were analyzed for VOCs via EPA Method 8260 plus heptane and TICs, and SVOCs via EPA Method 8270 plus TICs and included Category B laboratory deliverables.

Sewer water samples were properly labeled, logged on a chain-of-custody form, and maintained at 4°C until laboratory receipt. Sanitary sewer water samples were clearly identified as such and kept in separate sample coolers.

5.6 RFI Sewer Sampling Results

The following samples were collected in conjunction with the RFI activities at the former Norton/Nashua Site: 1) four sewer bedding soil samples for VOC analysis and five soil samples for SVOC analysis; 2) three sewer bedding vapor samples for VOC analysis; 3) four storm sewer sediment samples for SVOC analysis; and 4) six storm and sanitary sewer water samples for VOC/SVOC analysis. RFI sampling results are summarized below.

5.6.1 RFI Sewer Sampling Results - Sewer Bedding Soil

PID field screening readings in the sewer bedding soil borings ranged from less than 1 ppmv at SB-121 & SB-139 to 80 ppmv in SB-138 (see Table 4-1 and Figure 4-1). VOC detections in the four sewer bedding soil samples were limited to B-qualified VOC analytes and low concentrations of VOC TICs (18 µg/L or less), and toluene and heptane were not detected (see Table 4-1), indicating that the soil in the vicinity of the sewer lines does not contain significant VOC residual mass.

Multiple SVOCs were detected in the five sewer bedding soil samples. A total of 19 PAH compounds were detected in soil sample SB-121, and 11 PAHs were detected in the samples collected at SB-138 and SB-139 (see Table 4-2).

Detected PAH concentrations in the sewer bedding samples were generally J-qualified and all SVOC concentrations were less than 1 mg/kg except fluoranthene (1.4 mg/kg), pyrene (1.2 mg/kg), and total SVOC TICs (1.5 J mg/kg) in sample SB-121, and total SVOC TICs (34.3 mg/kg) in sample SB-138 (8.5-8.8 feet). All SVOC concentrations were below their corresponding NYSDEC unrestricted use SCOs except indeno(1,2,3-cd)pyrene, which slightly exceeded the SCO (510 µg/kg vs. 500 µg/kg) in soil sample SB-121 (see Table 4-2).

The source of the PAHs detected in the sewer bedding soil is likely the bedding/fill material noted in the samples, which contained asphalt-coated gravel. However, SVOC concentrations detected in the sewer bedding samples were generally several orders of magnitude lower than concentrations detected in the sediment samples collected from inside the adjacent sewers (see Section 5.7.3). Therefore, the source of the PAH compounds in the sewer sediments is most likely surface sediment (e.g., parking lot and roof runoff) entering the sewers.

5.6.2 RFI Sewer Sampling Results - Sewer Bedding Vapor

Vapor sampling results are presented in Table 5-4 (see Figure 1-3 for well locations). Total VOC analyte concentrations at the three sewer bedding sampling locations ranged from 25/23 parts per billion by volume (ppbv; MW-12/duplicate DGC-12) to 128 ppbv (MW-13), and total VOC TIC concentrations ranged from 102/222 ppbv (MW-12/duplicate DGC-12) to 477 ppbv (MW-11). The total VOC vapor concentration reported at outdoor sewer bedding well MW-13 is primarily due to the presence of pentane (40 ppbv), propene (37 ppbv), and methyl butyl tertiary ether (22 ppbv). These compounds, which may be associated with bus fueling activities recently conducted in the general area of the well, are not considered to be COCs associated with the former Norton/Nashua Site.

Vapor-phase toluene concentrations at sewer bedding wells MW-11, MW-12, and MW-13 were 22 ppbv, 2 ppbv, and 1 ppbv, respectively, and vapor-phase heptane concentrations were 12 ppbv, <0.2 ppbv, and 5 ppbv, respectively (see Table 5-4). Except for the sample collected at upgradient indoor monitoring well MW-11, detected vapor-phase toluene concentrations were all within or below the normal background residential concentration range of 1.1 ppbv to 6.6 ppbv (see NYSDOH, 2005a). The maximum toluene and heptane concentrations detected in the sewer bedding vapor samples indicate that no significant residual mass is present proximal to these sewers, and therefore, potential off-site movement of dissolved VOCs via the sewer bedding is not a current concern.

5.6.3 RFI Sewer Sampling Results - Sewer Sediment

A total of 19 SVOC analytes were detected in the four storm sewer sediment samples. SVOCs TICs were also detected in each of the four samples (see Table 5-2). The detected SVOC analytes generally exceeded the NYSDEC screening criteria cited in NYSDEC Technical Guidance for Screening of Contaminated Sediments, 1999, which are also presented in Table 5-2. SVOC concentrations were consistently highest in sample MH-3.5 (maximum SVOCs concentrations were greater than 50 mg/kg) and lowest in sample MH-13 (see Table 5-2).

As previously noted, sewer sediment SVOC concentrations were generally several orders of magnitude higher than SVOC concentrations detected in adjacent soil boring samples (see Table 4-2), suggesting a surface, rather than a subsurface, sediment source. No semi-volatiles were detected in the equipment blank sample.

5.6.4 RFI Sewer Sampling Results - Sewer Water

Six sewer water samples were analyzed for VOCs and SVOCs. Except for B-qualified samples, and VOC TICs in the sanitary sewer water sample (MH-1[San]), no VOC analytes were detected in the six sewer water samples, or the equipment or trip blanks (see Table 5-1 for sampling results and Figure 1-3 for sewer manhole locations). No semi-volatile analytes or TICs were detected in the sewer water equipment or trip blanks (see Table 5-1 for sampling results and Figure 1-3 for sewer manhole locations).

No SVOC analytes were detected in the sewer water samples collected from the three downstream storm sewer manholes: MH-1, MH-5, and MH-12 (see Table 5-1). A total of 19 SVOC analytes were detected at the remaining two storm sewer water sampling locations as follows: 11 PAHs and 2 phthalates were detected in upstream storm sewer sample MH-13 (however, all but a J-qualified phthalate were absent in blind replicate sample MH-20); the same 13 SVOCs plus 3 PAHs, dibenzofuran, carbazole, and phenol were detected in upstream storm sewer sample MH-14 (see Table 5-1 and Figure 1-3 for sewer manhole locations). Semi-volatile TICs were detected in each of the five storm sewer water samples (see Table 5-1) at total concentrations ranging from 2 JN µg/L in MH-12 to 214 JN µg/L in MH-14. Exceedances of NYSDEC Class C surface water (6 NYCRR Part 703) standards were limited to bis(2-ethylhexyl)phthalate in storm sewer samples MH-13 and MH-14.

RFI sewer water sampling data, consistent with historical (2001) results, indicate that under prevailing flow conditions, there is no significant off-site migration of dissolved VOCs or SVOCs via water in the sewer systems. No VOC analytes were detected in any storm sewer water samples, and no SVOC analytes were detected in the sewer water samples collected from the three downstream storm sewer manholes: MH-1, MH-5, and MH-12 (see Table 5-1).

A total of 12 SVOC analytes: 8 PAHs, 2 phthalates, and 2 phenols were detected in downstream sanitary sewer water sample MH-1(San) (see Table 5-1 for results and Figure 1-3 for sewer manhole location). All SVOC analytes were near or below detection limits in sanitary sewer water sample MH-1(San) except 4-methylphenol (concentration 29 µg/L) and bis(2-ethylhexyl)phthalate (13 µg/L); exceedances of NYSDEC Class C surface water (6 NYCRR Part 703) standard were limited to these two compounds. Semi-volatile TICs were detected (see Table 5-1) at a total concentration of 1,657 JN µg/L in MH-1(San). No semi-volatile analytes or TICs were detected in the sewer water equipment or trip blanks (see Table 5-1).

Site data were assessed to determine whether the previously-noted presence of SVOCs in sewer sediments was attributable to the presence of SVOCs in sewer water. Based on compound-specific water to carbon and soil to water partitioning coefficients, ideal solubility, and maximum hypothetical soil equilibrium partitioning, the observed SVOC sewer sediments concentrations were determined to be too high to result from impacted ground water infiltrating the sewer. The analysis provides additional evidence to indicate that the SVOCs in the sewer sediments are most likely a result of historical/ongoing introduction from surface sediments (e.g., parking lot and/or roof runoff).

The presence of bis(2-ethylhexyl)phthalate in multiple storm sewer water samples may be attributable to the presence of fine plastic pellets (often found in and around storm sewer manholes) associated with current operations at the site; however, bis(2-ethylhexyl)phthalate was not detected in the corresponding downgradient storm sewer water sampling locations.

5.7 RFI Sewer Investigation Conclusions

Multiple sampling rounds have demonstrated that VOC analytes are not present in water samples collected from the storm and sanitary sewer systems. The eastern portion of the storm and sanitary sewer systems are at or below the water table (refer to Table 5-5), which also overlaps with the area of the toluene/heptane plume. If infiltration to the sewers from ground-water was a significant transport mechanism, it would be expected that toluene and heptane would be present in sewer water samples collected from downgradient/downstream manholes in the eastern portion of the Site. The absence of VOCs in these samples demonstrates that the sewer lines are not a significant off-site transport mechanism for VOCs, and therefore, a detailed study on the interaction between ground water and the sewer systems is not necessary.

Residual VOCs were not detected in sewer bedding soil samples collected at downgradient storm and sanitary sewer bedding well locations. VOC concentrations in sewer bedding vapor samples collected at downgradient storm and sanitary sewer bedding well locations were below ambient (background) levels observed by the NYSDOH in residential dwellings. Therefore, the storm and sanitary sewer bedding is not a pathway of concern.

Phenols and bis(2-ethylhexyl)phthalate were detected in sanitary sewer water sample MH-1(San) at concentrations above their corresponding NYSDEC Class C surface water standard (see Table 5-1). The source of these SVOCs is unknown; phenols were detected in some On-Site RFI soil samples, but were absent in sewer sediment samples, and detected bis(2-ethylhexyl)phthalate concentrations in On-Site RFI soil and sewer sediment samples were minimal (see Tables 4-2 & 5-2).

Elevated PAH concentrations were detected in some storm and sanitary sewer sediment samples (see Table 5-2). Exceedances of the corresponding PAH ground-water standards were also detected in some storm and sanitary sewer water samples (see Table 5-1).

Neither the adjacent soils nor the water in the sewers is the source of the PAHs currently present in the sewer sediments. RFI sampling demonstrated that SVOC distribution and magnitude in soil does not correspond to its detection in sewer sediment samples. Based on RFI data, the source of the PAHs currently present in the sewer sediments is most likely: 1) historical site activities; and/or 2) run-off from asphalt covered areas of the roof (recently resealed/repaired) and the parking lot.

Incidental low-level VOC/SVOC concentrations in the sanitary sewer water are capable of ultimately being treated by the publicly owned treatment works (POTW). Future activities associated with the presence of PAHs in the storm sewer system are reviewed as part of the Preliminary Corrective Measure Evaluation (Section 10.0).

SECTION 6.0

SAMPLING METHODS - OFF-SITE INVESTIGATION

6.1 Geoprobe Field Screening, Sampling, and Well Installation Methods

Similar to On-Site RFI activities, Geoprobe borings were installed in the Off-Site AOC to: 1) qualitatively/semi-quantitatively evaluate areas of potential residual impact; and 2) collect samples for the quantitative assessment of the presence/absence and extent of residual soil and/or ground-water contamination. PID readings exceeding 100 ppmv were considered evidence of residual soil impact, and necessitated expansion of the geoprobe array until the areal extent of residual impact was defined based on the field screening criteria. If confirmatory laboratory data from an outermost boring location exceeded applicable NYSDEC recommended soil cleanup objectives, or NYSDEC ground-water standards/guidelines, additional borings were installed during subsequent mobilizations to complete spatial delineation of the impact.

6.1.1 Geoprobe Boring Installation and Soil Sampling

Continuous soil samples were obtained via Geoprobe recovery “sleeves”, field screened, described, and sampled as outlined in Section 3.2. One soil sample from each Geoprobe boring, the soil interval with the highest PID reading, was submitted for laboratory analysis. Except for soil borings SB-135 and SB-173 (see Figures 4-1 & 6-1), the highest PID reading was obtained from the soil interval collected immediately above the water table. Stained soils were not observed in off-site soil samples. The number of borings in the Off-Site AOC was expanded to delineate the spatial distribution of residually impacted soils, and soil samples were not run for laboratory analysis from a number of Geoprobe boring locations that would not serve as delimiting borings.

Geoprobe soil samples were collected in appropriate laboratory bottleware (see Table 3-2), properly labeled, logged on a chain-of-custody form, maintained at 4°C until laboratory receipt, and analyzed for VOCs via EPA Method 8260 plus heptane and TICs. Soils samples from the initial off-site Geoprobe boring locations (see Figures 4-1 & 6-1): SB-134, SB-135, and SB-136 were also analyzed for SVOCs plus TICs by EPA Method 8270. All soil analyses included Category B laboratory deliverables.

Soil samples from borings SB-197 & SB-199 (see Figure 6-1) were submitted for grain size analysis via ASTM D-422. Geoprobe borings SB-197 & SB-199 were extended into the water table for the collection of soil samples for laboratory analysis of TOC. Geoprobe borings in the Off-Site AOC were advanced to the water table (approximate depth 8 to 10 feet), or approximately four feet below the water table if it was determined that a ground-water sample would also be collected (see next section). Geoprobe bore holes that were not converted to ground-water monitoring points (see Section 6.1.3) were abandoned by backfilling with any remaining soil cuttings followed by hydrated bentonite chips. The surface was restored with cold patch/concrete or a turf plug as applicable. Any excess soil cuttings were temporarily stored in 55-gallon drums prior to characterization for disposal.

At the completion of each bore hole (and prior to leaving the site), all equipment that was exposed to soils or ground water was decontaminated utilizing an Alconox wash and tap water rinse. The handling and disposal of liquids generated during the decontamination process is discussed in Section 3.8.

6.1.2 Geoprobe Ground-Water Sampling

As the number of borings in the Off-Site AOC was expanded to delineate the spatial distribution of residual impact, ground-water samples were not run for laboratory analysis from a number of Geoprobe boring locations that would not serve as delimiting locations. Ground-water samples were collected at 22 selected Geoprobe boring locations (see Figure 7-1) utilizing a Geoprobe Screen Point sampler as discussed in Section 3.3.

Ground-water samples collected from Geoprobe borings were placed in appropriate laboratory bottleware (see Table 3-2), properly labeled, logged on a chain-of-custody form, and maintained at 4°C until laboratory receipt via courier or overnight delivery. Ground-water samples were analyzed for VOCs via EPA Method 8260 plus heptane and TICs. All analyses included Category B laboratory deliverables.

6.1.3 Monitoring Point/Well Installation

Thirteen selected off-site Geoprobe borings were completed as fixed ground-water monitoring points to further assess the extent and potential transport of residual ground-water contamination (see Figure 2-3). Ground-water monitoring points were installed, constructed, and developed as discussed in Section 3.4.1. The total depth of all off-site monitoring points is 15 feet. Monitoring point construction logs are provided in Appendix B, and monitoring point construction information is summarized in Table 3-3.

Two monitoring wells (MW-18 & MW-19) were installed off site north of Alden Street (see Figure 2-3) to further assess the extent and potential transport of residual ground-water contamination in the Off-Site AOC. The maximum thickness of the saturated overburden was fifteen feet; therefore, no shallow/deep “nested” monitoring well pairs were installed during the Off-Site RFI.

Monitoring wells MW-18 & MW-19 were installed using the Geoprobe rig and a 3.5-inch diameter drive point, and were constructed of 10 feet of Schedule 40 2-inch diameter PVC well screen (0.010 inch slot) installed across the water table, and completed with solid Schedule 40 4-inch diameter PVC well riser to the surface. Monitoring well construction was completed as described in Section 3.4.2. Monitoring point construction logs are provided in Appendix B, and monitoring point construction information is summarized in Table 3-3.

The newly installed off-site monitoring points and wells were surveyed by Laberge on March 6, 2006 (off-site wells) to establish horizontal position and vertical elevation. The survey data, which also included existing monitoring wells and selected sewer manhole locations, were used to update the site maps presented in this Report.

6.1.4 Geoprobe Vapor Monitoring Point Couplet Installation and Sampling

A vapor monitoring point (VP) couplet, consisting of VP-1, screened from a depth of 1 to 3 feet, and VP-2, screened from a depth of 5.5 to 7.5 feet, was installed in the north side of Alden Street (see Figure 2-3). Depth to water in this area is approximately 8 to 9 feet.

The VP wells were installed using the Geoprobe rig and a 3.5-inch diameter drive point. Each VP was constructed of Schedule 40 2-inch diameter PVC well screen (0.010 inch slot), and completed with solid Schedule 40 2-inch diameter PVC well riser to the surface. Monitoring well construction information is summarized in Table 3-3.

The annulus of each VP was filled with #2 sand pack extending a minimum of 2-3 inches above the screened interval, sealed with approximately 0.5-1.0 foot of bentonite, and then grouted to the surface. Each VP was completed with a bolt-down, flush-mounted vault, and equipped with a locking gripper-plug to prevent unauthorized access. VP construction logs are provided in Appendix B. Vapor samples (and an ambient outdoor air sample) were collected by connecting each VP to a Summa canister equipped with an eight-hour regulator.

6.2 Ground-Water Monitoring and Sampling

Prior to ground-water sampling, a synoptic round of liquid-level data was obtained from off-site small-diameter monitoring points and monitoring wells as described in Section 3.5.1. Off-Site RFI ground-water sampling events were conducted in February, June & September-November 2004; April, June & October 2005; and February, May & August 2006. Following NYSDEC approval, off-site monitoring points/wells sampled on a regular basis were limited to: 1) a subgroup of selected wells within the off-site toluene plume; and 2) off-site monitoring points/wells adjacent to the lateral and downgradient margins of the toluene plume.

Monitoring wells were sampled via the micropurge sampling method as discussed in Section 3.5.2. Field sampling forms for the ground-water sampling events are included as Appendix C.

Ground-water samples were collected in appropriate laboratory bottleware (see Table 3-2), properly labeled, logged on a chain-of-custody form, and maintained at 4°C until laboratory receipt via courier or overnight delivery. All monitoring well samples were analyzed for VOCs via EPA Method 8260 plus heptane and TICs. Samples collected from monitoring points MP-5, MP-6 & MP-7 in February 2004 were also analyzed for SVOCs plus TICs by EPA Method 8270. All analyses included Category B laboratory deliverables. Ground-water sampling results are discussed in Section 7.3 and presented in Tables 4-8, 4-9 & 7-2.

In addition to the analyses discussed above, samples collected from MP-17 & MW-19 in May 2006 were analyzed for the following electron acceptor and other natural bioattenuation parameters (see Table 3-2): redox, pH, and O_2 (via field instrumentation), Fe^{+2} (via field chemical analysis kit), Fe^{+3} (from total iron via EPA Method 7380), nitrate/nitrite (EPA Method 353.2), phosphate (EPA Method 365.1), alkalinity (EPA Method 310.1), methane/ethane/ethene (Misc. GC Methods), sulfide via EPA Method 376.1, and total heterotrophic bacteria and toluene-xylene (TX)-degrading bacteria microbial counts (via Standard Plate Count Methods). The supplemental analyses were performed to determine the extent of intrinsic bioremediation occurring in the Off-Site AOC. Supplemental ground-water sampling results are discussed in Section 7.3.3 and presented in Table 4-10.

Purge water collected during ground-water sampling and other Off-Site RFI activities was treated as discussed in Section 3.7. Decontamination procedures followed during Off-Site RFI activities were the same as described in Section 3.8.

6.3 Ground-Water Sampling – Private Wells

All homes in the Maplewood neighborhood are serviced by municipal water. Based on information obtained from the residents it was determined that there was an active private well at 32 Craig Street (see Figure 7-1), which is used for lawn/garden watering purposes. No other private wells in the vicinity of Alden and Craig Streets were located during Off-Site RFI activities.

The private well was inspected and a sample was collected before purging the well. After pumping the well for approximately 10 minutes, a second sample was collected directly from the pump spigot.

The ground-water samples were collected in appropriate laboratory bottleware (see Table 3-2), properly labeled, logged on a chain-of-custody form, and maintained at 4°C until laboratory receipt. The samples were analyzed for VOCs via EPA Method 8260 plus heptane and TICs, and included Category B laboratory deliverables. Private well sampling results are discussed in Section 7.3.4 and presented in Table 4-8.

6.4 Geophysical Survey

A geophysical survey was conducted by Quantum Geophysics, Inc. of Phoenixville, Pennsylvania in the vicinity of Alden Street during the week of October 25, 2004 to investigate possible preferential pathways for ground-water movement. The geophysical evaluation included four electrical resistivity transects as follows: 1) along Alden Street; 2) along Craig Street 3) north of the railroad embankment; and 4) south of the railroad embankment. Ground-penetrating radar (GPR) surveys were also performed along the latter two transects. A metal-detector survey was not viable along these transects due to the presence of numerous utilities and other interfering materials. In addition, the presence of heavy brush prevented the installation of a fully usable transect along the top of the railroad embankment. Geophysical survey results are discussed in Section 7.4. The geophysical survey report is attached as Appendix G.

6.5 Sub-Slab Vapor and Indoor Air Monitoring

Based on the off-site dissolved-phase toluene distribution, four private residences north of Alden Street were identified for subslab vapor and indoor air sampling (see Figure 2-3). Access was subsequently negotiated and received from the owners of three residences (21 Alden, 23 Alden, and 25 Alden Street) to allow the installation of subslab vapor (or alternatively outdoor soil vapor) sampling points and perform concurrent indoor air sampling.

Vapor and indoor air sampling protocol was based upon the following guidance documents: 1) the NYSDOH Draft Guidance for Evaluating Soil Vapor Intrusion in the State of New York, and Indoor Air Sampling & Analysis Guidance, dated February 2005; 2) USEPA Office of Soil Waste and Emergency Response (OSWER) Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soil, (Subsurface Vapor Intrusion Guidance), dated November 2002; 3) RCRA Draft Supplemental Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway (Vapor Intrusion Guidance), dated December 2001; 4)

Massachusetts Department of Environmental Protection, Indoor Air Sampling & Evaluation Guide, dated April 2002; and 5) Colorado Department of Public Health and Environment, Indoor Air Guidance, dated September 2004. Subslab vapor and indoor/outdoor air sampling results are discussed in Section 7.6 and presented in Table 7-4.

6.5.1 Pre-Installation Survey

At the time the Supplemental RFI was prepared (May 2005), construction details for the four private residences (e.g., basement, first floor on slab, crawlspace, etc.) were unknown. Based on preliminary conversations with the residents/property owners, it was understood that at least one residence did not have a solid concrete slab in the basement. Therefore, an Addendum to the May 2005 Supplemental RFI Workplan was prepared to address construction, installation, and sampling details associated with contingent soil vapor probe (SVPs) at locations where subslab vapor monitoring points (VMPs) were not viable.

Pre-installation surveys were conducted at each residence to: 1) review the layout and construction of the structure; 2) inspect the concrete slab, if present, for water leaks, cracks, floor drains, sump holes, and other penetrations; 3) select a subslab VMP location, if applicable; 4) review the proposed vapor monitoring location with the homeowner and receive permission to proceed with installation; and 5) perform other preliminary activities associated with vapor and indoor air sampling.

The pre-installation survey determined that solid concrete floors were present in the basements of the homes at 23 Alden Street and 25 Alden Street, but the floor of the basement at 21 Alden Street consisted of broken cement and dirt. Proposed VMP locations at 23 Alden Street and 25 Alden Street (and a modified vapor sampling point location for 21 Alden Street) were reviewed with the homeowners and the NYSDEC/NYSDOH for approval. Later, the homeowner denied permission to install a subslab VMP at 23 Alden Street.

6.5.2 Vapor Sampling Point Installation

After further discussion with representatives of the NYSDEC/NYSDOH, it was determined that a subslab VMP would be installed at 25 Alden Street, an outdoor SVP would be installed at 23 Alden Street, and a modified SVP (MSVP) would be installed in the basement floor of 21 Alden Street. For simplification, this report collectively refers to VMPs, SVPs, and MSVPs as vapor sampling points. Details on the final construction and installation of the vapor sampling points are provided below.

6.5.2a VMP Installation

A VMP was installed at 25 Alden Street on January 24, 2006. The VMP had to be relocated approximately 15-20 feet from the originally selected location due to the presence of a thick concrete slab (greater than 18 inches). This change was reviewed and approved by the NYSDEC and the NYSDOH.

The VMP assembly, patterned after DiGiulio (2004), consisted of a 1/4-inch outer diameter (OD) threaded pipe approximately 2.25 inches long. The pipe was open at the bottom end and equipped with a 1/4-inch inner diameter (ID) threaded nipple fitting at the top end. A recessed plug was used to seal the nipple fitting. All VMP materials were made of brass.

An oversize diameter “outer” hole approximately one-inch in diameter was installed with a drill to a depth of approximately 1.5 inches in the concrete slab. A smaller diameter “inner” hole (approximately three-eighths of an inch in diameter) was installed with the drill through the remainder of the slab (total thickness 4.5 inches), and extended approximately 1.5 inches below the slab. VMP construction information is summarized in Table 3-3 and a construction log is provided in Appendix B.

The VMP assembly was sealed in place in the smaller diameter hole with quick-drying Portland cement, so the top of VMP assembly did not extend above the top of the slab and the bottom of the Assembly did not extend below the base of the slab. Care was taken to fill the annular space between the VMP assembly and the "outer" hole wall. The cement was allowed to cure for two weeks before sampling.

6.5.2b SVP Installation

An SVP was installed at 23 Alden Street on January 24, 2005. Construction and installation of the SVP followed the draft February 2005 NYSDEC draft guidance document. A one-inch diameter stainless-steel soil gas implant (Geoprobe sampling screen) was attached to a 2.0-inch diameter expendable drive point and installed to an approximately depth of six feet. Teflon tubing (0.5-inch OD) extended from the top of the soil gas implant to the surface. The annulus surrounding the gas implant, and extending approximately six inches above the implant, was filled with glass bead packing material to create a one foot soil vapor sampling zone (depth 5 to 6 feet). The SVP was completed by adding one-inch of #2 sand to the SVP, and sealing the remaining annulus with bentonite slurry. SVP construction information is summarized in Table 3-3 and a construction log is provided in Appendix B.

6.5.2c MSVP Installation

An MSVP was installed at 21 Alden Street on January 23, 2005. Construction and installation of the MSVP followed the draft February 2005 NYSDEC draft guidance document, and the January 2006 Addendum to the RFI Workplan, and was similar to the construction of the SVP (see previous section) except as noted below. Modifications to "standard" SVP construction and installation were reviewed and approved by the NYSDEC/NYSDEC in the field prior to implementation.

Plastic sheeting was affixed to the basement floor in the immediate area of the MSVP to minimize any disturbance (and reduce potential surface air infiltration). Due to access constraints, the preferred method of installation via direct push technology was not possible and a portable power auger with a two-inch diameter drill bit was substituted. A one-inch diameter stainless-steel soil gas implant (Geoprobe sampling screen) was placed in the borehole, which was extended to a total depth of approximately two feet. Teflon tubing (0.5-inch OD) extended from the top of the soil gas implant to the surface.

Glass bead packing material was used to fill the annulus surrounding the gas implant and create a 0.5 foot soil vapor sampling zone (depth 1.5 to 2.0 feet). The MSVP was completed by adding one-inch of #2 sand to the SVP, and sealing the remaining annulus with bentonite slurry. The MSVP was completed as a "flush-mount" point to eliminate a potential "trip" hazard in the basement floor. MSVP construction information is summarized in Table 3-3 and a construction log is provided in Appendix B.

6.5.3 Pre-Sampling Inspection

Scheduling appointments were made with the residents of the three Alden Street vapor and indoor sampling locations. The residents were given a handout asking them to refrain from the following activities during the 24 hours prior to sampling (adopted from NYSDOH, 2005):

- opening any windows, fireplace dampers, opening, or vents
- operating ventilation fans unless special arrangements are made
- using wood stoves, fireplaces, or auxiliary heating equipment (e.g., kerosene heaters)
- smoking in the house
- painting in the house
- using cosmetics, including hair spray, nail polish, nail polish remover, etc.
- using perfume/cologne
- cleaning, waxing, or polishing furniture or floors with petroleum or oil-based products
- using air fresheners or odor eliminators
- engaging in any hobbies/activities that use materials containing VOCs
- applying pesticides
- operating or storing automobiles in an attached garage
- allowing containers of gasoline or oil to remain within the house (except fuel oil tanks)

Ideally, a pre-sampling inspection to document conditions in the residence was to be conducted at least 24 hours prior to sampling. The pre-sampling inspection was completed two days before sampling at 21 Alden Street, but due to the residents' schedules, the sampling inspections at 23 Alden Street and 25 Alden Street could not be performed until the day of sampling. During each pre-sampling inspection, an Indoor Air Quality Questionnaire and Building Characteristics Inventory form as outlined in the draft February 2005 NYSDOH draft guidance document, was completed.

The pre-sampling survey and inspection included: 1) a brief interview of the residents; 2) preparation of floor plans for the basement and first floor of each residence; 3) PID field screening of the proposed sampling area; and 4) an inventory of household products and other potentially contributing substances present in the proposed sampling areas and throughout the home. The goal of the household inventory was to identify household products (or other substances stored or present in the home) that could potentially interfere with the testing and/or contribute COCs (toluene) to the vapor samples. Copies of the Indoor Air Quality Questionnaire and Building Characteristics Inventory forms are included as Appendix H.

6.5.4 Vapor Sampling

Concurrent with the indoor air sampling discussed in Section 6.4.6, subsurface vapor sampling was conducted at the three Alden Street residences on February 15, 2006. Prior to vapor sampling, a final site inspection and PID field screening survey were performed to document conditions in each residence at the time of sampling. The integrity of each vapor sampling point was also inspected.

All vapor sampling points (VMP, SVP, and MSVP) were sampled by removing the sampling plug and connecting approximately one foot of dedicated ¼-inch ID Teflon tubing to the sampling nipple and a low-flow peristaltic pump calibrated for a flow rate of 0.1-0.2 Lpm.

The peristaltic pump was activated to collect a one-liter (L) Tedlar bag sample for tracer gas (SVP and MSVP only, see next section) and PID field screening. The extraction of one liter of air also served to purge the vapor sampling point (and surrounding VMP subslab area) of the required 1-3 volumes. (Note: the total volume of a two-inch diameter vapor sampling point with a one foot sampling zone and 2.0 feet of sample tubing is less than 0.63 liters.)

After the Tedlar bag was filled, the pump was deactivated, the Tedlar bag sealed, and the Teflon tubing from the vapor sampling point was attached to a 6L Summa canister equipped with a particulate filter and a 4-hour regulator preset by the laboratory. The pre-sample vacuum of the Summa canister was recorded (all initial vacuums were greater than 25 inches of mercury) and the canister valve was opened to begin vapor collection at an extraction rate of approximately 0.025 liters per minute (6 liters/240 minutes). Vapor samples were recovered approximately 4 to 5 hours later.

After completing concurrent outdoor ambient air sampling activities, vapor sampling was terminated by: 1) recording the final Summa canister vacuum; 2) closing the sampling valve; 3) disconnecting the sample tubing; and 4) plugging the vapor sampling point. All vapor samples were submitted for laboratory analysis of VOCs via EPA Method TO-15 plus TICs. The laboratory was required to achieve the NYSDOH requested reporting limit of one microgram per cubic meter ($\mu g/m^3$) for off-site vapor sample compounds of concern (i.e., toluene).

6.5.5 Vapor Sampling Tracer Gas Monitoring Protocol

Tracer gas monitoring was performed per the February 2005 NYSDOH draft guidance document immediately before and immediately after the collection of vapor samples from the SVP and MSVP sampling locations to confirm the integrity of each SVP (and associated fittings). Off-Site RFI tracer gas monitoring followed the procedures outlined in the January 2006 Addendum to the May 2005 Supplemental RFI Workplan, which are summarized below.

Pre-sampling tracer gas monitoring was performed as follows (see Figure 6-2 for a schematic drawing of the tracer gas monitoring chamber):

1) A piece of plastic sheeting measuring approximately 2 feet by 2 feet was placed over the SVP/MSVP and sealed to the ground/floor with duct tape. The plastic sheeting was punctured to expose the SVP/MSVP assembly.

2) The SVP/MSVP plug was removed and approximately two to three feet of dedicated ¼-inch ID Teflon tubing was connected to the SVP/MSVP nipple. The SVP/MSVP plug was used to seal the open end of the tubing.

3) The plugged end of the Teflon tubing was inserted through the opening on the top of the tracer gas flux chamber (a modified plastic bucket). The tubing penetration was sealed with beeswax.

4) The flux chamber was sealed to the plastic sheeting with beeswax.

5) The inlet valve and outlet valve on the flux chamber were opened and connected to short lengths of Teflon tubing.

6) The helium source was connected to the inlet valve tubing and the valve on the helium source was opened allowing helium to enter the flux chamber. Any excess helium vapor pressure was relieved via the outlet valve.

7) A helium detector was activated and connected to the outlet valve tubing. Helium continued to be introduced into the flux chamber until helium was detected at the outlet valve. The helium source valve and flux chamber inlet valve were closed.

8) The % helium in the flux chamber was recorded (see Table 6-1), and the flux chamber outlet valve was closed.

9) The sample tubing was unplugged and connected to a low-flow peristaltic pump calibrated for a flow rate of 0.1-0.2 Lpm. A one-liter (L) Tedlar bag sample was collected.

10) After the Tedlar bag was filled, the pump was deactivated, the Tedlar bag was sealed, and the sample tubing was connected to a 6L Summa canister positioned adjacent to the flux chamber.

11) The Tedlar bag sample was screened for helium by connecting it to the helium detector. No helium was detected in the SVP/MSVP Tedlar bag samples, so SVP/MSVP sampling proceeded as described in the previous section.

12) The Tedlar bag sample was sealed and set aside for VOC screening with a PID outside of the residence.

Post-sampling tracer gas monitoring was performed as follows:

1) SVP/MSVP sampling was terminated by recording the post-sample vacuum, closing the Summa canister sample valve, and disconnecting and plugging the sampling tubing.
2) The flux chamber was screened by connecting the helium detector to the outlet valve tubing and opening the outlet valve. Helium was detected, so the flux chamber outlet valve was closed.
3) The SVP/MSVP sample tubing was unplugged and connected to a low-flow peristaltic pump calibrated for a flow rate of 0.1-0.2 Lpm. A one-liter (L) Tedlar bag sample was collected.
4) After the Tedlar bag was filled, the pump was deactivated, and the SVP/MSVP tubing and the Tedlar bag were sealed.
5) The Tedlar bag sample was screened for helium by connecting it to the helium detector. Helium was not detected in the SVP Tedlar bag sample, and the ratio of the helium in the MSVP Tedlar bag versus the flux chamber was less than 1%, so tracer gas monitoring was complete (see Table 6-1).
6) The Tedlar bag sample was sealed and set aside for VOC screening with a PID outside of the residence.
7) The sample tubing was removed and the SVP/MSVP was plugged.

6.5.6 Indoor Air Sampling

Concurrent with the vapor sampling discussed in Section 6.4.4, indoor air sampling was conducted at the three Alden Street residences on February 15, 2006. Ambient indoor air samples were collected from the lowest accessible level (i.e., the basement) and the next higher living space (i.e., first floor) at each of the three residences, and from one outdoor location. In addition, a blind replicate indoor air sample (see Section 9.0) was collected at one residence by co-locating two Summa canisters with equal initial vacuums.

Ambient indoor air samples were collected as follows. A certified-clean 6L Summa canister, equipped with a particulate filter and a 4-hour regulator preset by the laboratory, was placed in the center of the sampling area approximately three feet off the floor (where physically possible) to collect a representative "breathing air" sample. The Summa canister was not attached to any tubing. The pre-sample vacuum of the Summa canister was recorded (all initial vacuums were greater than 25 inches of mercury) and the Summa canister valve was opened to begin ambient indoor air collection. A similar procedure was followed for collection of the outdoor ambient air sample.

The residents were asked to stay out of the active sampling area, if possible, for the duration of testing, or to restrict their movements in the active sampling area and avoid opening and/or closing doors and windows in the home. Ambient air samples were recovered approximately 4 hours later. Indoor (and outdoor) ambient air sampling activities were terminated as follows: 1) record the final Summa canister vacuum; 2) close the sampling valve; 3) proceed with termination of concurrent subsurface vapor sampling at the same location (see Section 6.5.4).

Ambient indoor/outdoor air samples were submitted for laboratory analysis of VOCs via EPA Method TO-15 plus TICs. The laboratory was required to achieve the NYSDOH requested reporting limit of one $\mu g/m^3$ for off-site vapor sample compounds of concern (i.e., toluene).

SECTION 7.0

SAMPLING RESULTS - OFF-SITE INVESTIGATION

7.1 Geoprobe Field Screening Results

During Off-Site RFI activities, the same criteria defined in the July 2003 RFI Workplan (i.e., PID field screening reading exceeding 100 ppmv or detectable odors) continued to be used to screen for residual soil impact. Only two Off-Site RFI soil sampling locations (SB-129 & SB-191; see Figures 4-1 & 6-1, respectively) had VOC (toluene and/or heptane) concentrations exceeding their respective NYSDEC unrestricted use SCOs (see Table 7-1); the PID field screening reading at these two locations, and SB-186, where elevated VOC TICs were detected, also exceeded 100 ppmv (see Table 7-1).

The highest PID reading in each Off-Site RFI boring was obtained from the soil interval collected immediately above the water table (see soil boring logs; Appendix A) except for soil borings SB-135 & SB-173 (see Table 7-1). Maximum PID readings in these two borings, which were installed just south of Alden Street (see Figure 6-1), were less than 100 ppmv, but samples were submitted for laboratory analysis to assess shallow soil quality. Subsequent analysis demonstrated that no VOCs analytes were detected in these two samples, and TICs (total concentration 9 J mg/kg) were detected only in sample SB-173 (see Table 7-1).

These results demonstrate that Off-Site AOC impact is limited to dissolved-phase COCs (i.e., toluene) present in the smear zone and below the water table. No evidence of residual shallow soil impact was detected during the Off-Site RFI.

7.2 Off-Site RFI Geoprobe Soil and Ground-Water Samples

7.2.1 Geoprobe Borings in the Railroad Right-of-Way

Geoprobe soil borings (SB-128 through SB-137; SB-158) were installed in the railroad right-of-way in December 2003 (see Figure 4-1). Based on PID field screening results and confirmatory laboratory analytical data (see Table 7-1), evidence of residual soil in this area south of the railroad embankment (see Figure 4-1) was limited to the three borings installed immediately north of the Former Tank Farm SWMU (SB-128, SB-129 & SB-132).

Toluene was detected in soil samples from borings SB-128 and SB-129 at concentrations of 180 μg/kg and 120,000 μg/kg, respectively (sample SB-132 was not analyzed);heptane and VOC TICs were also detected in sample SB-129 at concentrations of 39,000 μg/kg and 70,000 μg/kg, respectively. Evidence of significant residual soil impact was not detected at the lateral soil borings installed in this area (SB-130, SB-131 & SB-158); toluene and heptane concentrations were ND or less than 5 μg/kg. Off-site field screening results and soil analytical data are summarized in Table 7-1. A geoprobe ground-water sample collected at boring SB-158 was ND for VOC analytes (see Figure 4-4). Geoprobe ground-water analytical data are summarized in Table 7-2.

Similarly, evidence of residual soil impact based on PID field screening in the vicinity of the northern railroad tracks (see Figure 6-1) was present at three central soil borings (SB-133, SB-134 & SB-137), but absent at two lateral delineation borings (SB-135 & SB-136). Toluene concentrations in ground-water samples collected from three geoprobe borings in the vicinity of the northern railroad tracks ranged from 12 and 15 μg/L in lateral borings (SB-135 & SB-136) to 120 μg/L at the central boring (SB-133, see Table 7-2 and Figure 7-1). Heptane and xylenes were also detected in the sample from SB-133 at concentrations of 16 μg/L and 5 J μg/L, respectively, and VOC TICs were detected in the SB-136 & SB-133 samples at concentrations of 6 J μg/L and 42 J μg/L, respectively.

Three small-diameter monitoring points (MP-5 through MP-7) were installed in the vicinity of the northern railroad tracks (see Figure 2-3). During the most recent ground-water sampling event at each location, toluene concentrations were ND (see Figure 4-16). Monitoring point ground-water sampling results are summarized in Table 7-2 and discussed in the Section 7.3.1. Except for J-qualified detections during the initial sampling of MP-5 & MP-7, toluene is the only VOC analyte that has been detected at these three monitoring points.

7.2.2 Geoprobe Borings – SVOC Analysis

Soil samples from eight selected geoprobe borings installed in the railroad right-of-way (see Figures 4-1 & 6-1) were also analyzed for SVOCs. All SVOC analytes were ND in the eight samples; SVOC TIC concentrations ranged from ND to 39,400 μg/kg in the four samples collected along the southern railroad tracks, and from ND to 400 μg/kg in the four samples collected along the northern railroad tracks, (see Table 7-1). All SVOC TIC concentrations were well below the TAGS #4046 clean-up standard of 500 mg/kg. Therefore, no additional soil sampling for SVOC analysis was performed in the Off-Site AOC.

Ground-water samples were collected from three geoprobe soil borings (SB-133, SB-135 & SB-158, see Figure 4-1 for boring locations) and submitted for SVOC analysis. SVOC TICs were detected in the three samples at concentrations ranging from 4 J μg/L to 7 μg/L, and no SVOC analytes were detected except in sample SB-158 (see Table 7-2).

Five PAHs were detected in the SB-158 sample at J-qualified concentrations of 1 μg/L or less. Soil boring SB-158 is located adjacent to an active railroad track (see Figure 4-1) and oil-stained gravel was present in the railroad bed. Therefore, these SVOCs are not believed to be related to the former Norton/Nashua Site. Further, SVOC analytes were not detected in ground-water samples collected from the permanent monitoring points during the Off-Site RFI (see Section 7.3.2). Therefore, no additional ground-water sampling for SVOC analysis was performed in the Off-Site AOC.

7.2.3 Geoprobe Borings Installed Adjacent to Alden and Craig Streets

Based upon the sampling results from the railroad right-of-way, Saint-Gobain and the NYSDEC determined at a June 2004 meeting that the Off-Site RFI soil boring program would continue north to investigate the vicinity of Alden and Craig Streets. After obtaining a road opening permit from the Town of Colonie, soil borings and corresponding monitoring points (SB-159 through SB-163; MP-13 through MP-17) were installed adjacent to Alden Street in August 2004 (see Figure 6-1).

Additional soil borings (SB-164 through SB-175), monitoring points (MP-18 through MP-21), and a vapor monitoring point couplet (see Section 7.5) were installed adjacent to Alden Street in September 2004 (see Figure 6-1). In October 2004, soil borings and a monitoring point (SB-176 through SB-180, MP-22) were installed in Craig Street (see Figure 6-1). A geophysical survey to investigate possible preferential pathways for ground-water movement was also completed in October 2004 (see Section 7.4).

All PID field screening readings obtained from the Alden Street borings (see Table 7-1) were less than 100 ppmv (see Figure 6-1) except for centrally located borings SB-159 (1,800 ppmv) & SB-163 (3,500 ppmv). As noted previously, elevated PID readings in the Off-Site AOC were limited to the saturated soil zone.

Soil samples from one geoprobe boring along Alden Street and the five borings along Craig Street (see Figure 6-1) were submitted for VOC laboratory analysis. No VOC analytes or TICs were detected in these six soil samples (see Table 7-1).

Ground-water samples were collected from five geoprobe soil borings and submitted for VOC analysis (see Figure 7-1). Toluene was detected at concentrations of 1 J µg/L in sample SB-178 and 68,000 µg/L in sample SB-163. No other VOC analytes or TICs were detected in the geoprobe ground-water samples (see Table 7-2). A permanent ground-water monitoring point (MP-17, see discussion below) was installed at the location of boring SB-163 (see Figure 6-1).

A total of nine small-diameter monitoring points (MP-13 through MP-21) were installed in the vicinity of Alden Street, and a tenth point (MP-22) was installed in Craig Street (see Figure 6-1). It is apparent that the same narrow distribution of dissolved toluene in ground water continues from the railroad right-of-way to the soil borings installed along Alden Street (see Figure 4-16).

During the most recent ground-water sampling event at each monitoring point (see Table 4-8), toluene concentrations were ND in all samples except MP-17 (160 µg/L). Monitoring point ground-water sampling results are summarized in Table 4-8, presented on Figure 7-1, and discussed in more detail in Section 7.3.1. Except for unconfirmed detections of methylcyclohexane and bromodichloromethane, toluene is the only VOC analyte that has been detected at these ten monitoring points.

To further delineate the width of the residual toluene impact in ground water, soil borings SB-171 through SB-175 were installed on either side of boring SB-159 (see Figure 6-1). The maximum (water table) PID field screening reading (see Table 7-1) at boring SB-172 (located 8 feet west of SB-159) was 4,500 ppmv, but maximum PID readings at SB-175 (11.5 feet west of SB-159) & SB-173 (15 feet west of SB-159) were 0 ppmv and 7 ppmv, respectively. (Note: a PID reading of 60 ppmv was obtained at SB-173 from a depth of 0 to 5 feet; however, a soil sample collected from this depth was ND for all VOC analytes; see Table 7-1). The maximum PID field screening reading at boring SB-174 (10 feet east of SB-159) was 1,100 ppmv, but the maximum PID reading at SB-175 (20 feet east of SB-159) was 0.0 ppmv (see Table 7-1). The lateral borings define the width of toluene impact in ground water along the south side of Alden Street to less than 30 to 35 feet.

7.2.4 Geoprobe Borings Installed Between Alden and Craig Street

Off-Site RFI geoprobe boring activities were initiated in December 2005 at the three properties where access agreements were finalized: 21, 23 & 25 Alden Street. An additional soil boring (SB-196) was installed at the western end of Alden Street at the request of the property owner (see Figure 6-1).

A total of 20 soil borings were installed, and 13 soil samples and 13 ground-water samples were collected for laboratory analysis of VOCs. Field evidence of residual soil impact as previously defined was encountered in three soil borings located north-northwest of MP-17 (SB-186, SB-188 & SB-191; see Figure 6-1). All field PID readings exceeding 100 ppmv were limited to soils collected at or below the water table (see Table 7-1).

Toluene was detected in six of the thirteen soil samples, but concentrations were J-qualified (7 J µg/kg or less) in all of the soil samples except SB-191, which had a toluene concentration of 230,000 µg/kg (see Table 7-1). Toluene was the only VOC detected in the soil samples except methylcyclohexane at SB-186 (11,000 µg/kg), and VOC TICs detected at SB-186 (35,000 J µg/kg) and SB-189 (70 J µg/kg). The source of the methylcyclohexane and the VOC TICs, which have not been identified as COCs associated with the former Norton/Nashua Site, is unknown.

Toluene was not detected in four of the thirteen geoprobe ground-water samples (see Figure 7-1). Toluene was detected at concentrations less than 5 µg/L in two samples, and at concentrations ranging from 6 J µg/L (SB-196) to 3,900 µg/L (SB-188) in the remaining seven samples. No other VOC analytes or TICs were detected in the geoprobe ground-water samples (see Table 7-2).

Permanent ground-water monitoring wells MW-18 & MW-19, were installed north-northwest of Alden Street (see Figure 6-1) to complete the delineation of dissolved toluene in ground water in the Off-Site AOC. The same narrow distribution of toluene in ground water was observed from Alden Street towards MW-18 (see Figure 4-16).

During the most recent ground-water sampling event at these monitoring wells (see Table 4-8), the toluene concentration was 590 µg/L at MW-18, and was ND at two monitoring points that define the northwest and northern margins of the residual toluene plumes, MW-19 & MP-22. Monitoring point ground-water sampling results are summarized in Table 4-8 and discussed in more detail in Section 7.3.1. Because toluene concentrations exceeded the NYSDEC ground-water standard, an evaluation of the potential for vapor migration was performed at three residences along Alden Street (see Section 7.6).

7.2.5 Supplemental Geoprobe Soil Analyses

Soil samples from geoprobe borings SB-197 & SB-199 (see Figure 6-1 for boring locations) were submitted for grain size analysis via ASTM D-422. Shallow soil sample SB-197, collected at a depth of 4 to 5 feet, consists of approximately 35% clays and silts, 20% fine and medium sands, and 45% coarse sands and gravels. In contrast, the deeper sample from SB-199 collected at a depth of 14 to 15 feet, displays much better sorting, and consists of over 90% coarse sand and gravel. Results are presented in Table 4-5. Figures depicting grain size distribution for the two samples are included in Appendix D.

Geoprobe borings SB-197 & SB-199 were extended into the water table for the collection of soil samples for laboratory analysis of TOC. The laboratory performed a combustion analysis method (SM20 5310B modified) instead of the method specified in the Supplemental RFI Workplan (EPA Method 415.1). Both TOC results were ND, but these results were rejected because the requested analysis method was not performed.

7.3 Ground-Water Sampling

Results from the regular sampling of ground-water monitoring points and wells for VOCs analysis conducted in the Off-Site AOC are discussed in this section. Other Off-Site RFI ground-water monitoring activities discussed in this section include: 1) an SVOC sampling event; 2) sampling for supplemental natural attenuation parameters at selected monitoring points; and 3) VOC sampling of a private "garden" well.

7.3.1 VOC Monitoring Point/Well Sampling

Off-Site RFI ground-water sampling events were conducted in February, June & September-November 2004; April, June & October 2005; and February, May & August 2006. Sampling results for the 15 Off-Site RFI monitoring points/wells (see Table 4-8) indicate that confirmed detections of toluene are limited to "centerline" plume wells (see Figures 4-16 & 7-1): MP-6, MP-14, MP-17, and MW-18 (except for two J-qualified detections during initial sampling at MP-7). Moreover, toluene concentrations at the three centerline plume wells that have been sampled more than twice exhibit a strong decreasing trend that is not associated with water table fluctuations, indicating natural attenuation. Regression curves for the three wells, which all demonstrate slopes of –0.006 to 0.007 over a minimum of five sampling events, are presented in Appendix E.

Further evidence of active biodegradation is the absence of heptane, which biodegrades even more readily than toluene, in all Off-Site RFI ground-water samples. In addition to toluene, the following VOC analytes were detected during Off-Site RFI sampling: acetone, benzene, chloroform, methylene chloride, methylcyclohexane, and bromodichloromethane. VOC TICs were also detected in some samples. However, except for toluene, all detections in Off-Site RFI ground-water samples are either B-qualified analytes or unconfirmed, which confirms that toluene is the only COC in ground-water in the Off-Site AOC.

7.3.2 SVOC Monitoring Point/Well Sampling

Ground-water samples collected in February 2004 from monitoring points MP-5, MP-6 & MP-7, which are located on the northern side of the railroad right-of-way (see Figure 6-1), were analyzed for SVOCs plus TICs by EPA Method 8270. No SVOC analytes were detected in the three ground-water samples, and SVOC TICs were only reported in sample MP-7 at a total concentration of 9 J μg/L (see Table 4-9).

The February 2004 sampling results confirm the Geoprobe sampling results (see Section 7.2.1) and demonstrate that there is no off-site residual SVOC impact from the former Norton/Nashua Site. Therefore, no additional SVOC analyses were performed during the Off-Site RFI. SVOC sampling results are summarized in Table 4-9.

7.3.3 Supplemental Ground-Water Parameters

Ground-water samples were collected from MP-17 (impacted well) & MW-19 (non-impacted well) in May 2006 for analysis of natural bioattenuation parameters (see Table 3-2). These analyses were performed to determine the extent of intrinsic biodegradation occurring in ground water in the Off-Site AOC. Bioparameter sampling data are summarized in Table 4-10.

Dissolved oxygen concentrations in both ground-water samples, 0.18 mg/L in MP-17 and 0.31 mg/L in MW-19 (see Table 4-10), were very low and probably rate limiting with respect to biodegradation of toluene. Anaerobic conditions are also suggested by the higher ferrous iron, total iron, alkalinity, and methane concentrations detected at the more impacted well (MP-17), which also had a more negative ORP and lower pH. Toluene-degrading bacteria were present in both samples indicating active toluene degradation, but the total number and ratio to total heterotrophic bacteria were lower at MP-17, possibly a result of the lower dissolved oxygen concentrations.

7.3.4 Ground-Water Sampling – Private "Garden" Well

One private well located at 32 Craig Street (see Figure 7-1) was identified during RFI activities. According to the property owner, this well is only used for lawn/garden watering purposes and is normally inactive. Two ground-water samples were collected from this well on October 26, 2005 for analysis of VOCs via EPA Method 8260 plus heptane and TICs. The first sample was collected before purging the well, and the second sample was collected after pumping the well for approximately 10 minutes.

Except for B-qualified TICs and methylene chloride, which is considered to be a laboratory artifact (see Section 9.0), no analytes were detected in the well water samples. Results are presented in Table 4-8.

7.4 Geophysical Survey

A geophysical survey was conducted in the vicinity of Alden Street during the week of October 25, 2004 to investigate possible preferential pathways for ground-water movement. The geophysical evaluation included four electrical resistivity transects as follows: 1) along Alden Street; 2) along Craig Street 3) north of the railroad embankment; and 4) south of the railroad embankment (see Figures 1-2 & 2-3). GPR surveys were also performed along the latter two transects. A metal-detector survey was not viable along these transects due to the presence of numerous utilities and other interfering materials. In addition, the presence of heavy brush prevented the installation of a fully usable transect along the top of the railroad embankment.

The geophysical survey report, attached as Appendix G, did not indicate evidence of a preferred pathway via manmade conduits, fill or lithological change, bedrock surface channeling, or bedrock fractures. At this time, the most likely reason for the presence of residual toluene in the Off-Site AOC is historical dewatering activities that were performed in conjunction with the installation of the Dry River Interceptor storm sewer system that runs slightly south of and parallel to Alden Street (see Figure 1-2). Continued dewatering activities along Alden Street, which were reportedly centered near the current location of the toluene plume, may have pulled ground water containing elevated dissolved toluene concentrations north from the former Norton/Nashua Site towards Alden Street. Also, it is purported that when dewatering activities were completed, the pumped water was discharged without treatment and allowed to infiltrate in the same general area.

7.5 Geoprobe Vapor Monitoring Point Couplet Sampling

The Alden Street VP couplet (see Figure 2-3), consisting of VP-1, screened from a depth of 1 to 3 feet, and VP-2, screened from a depth of 5.5 to 7.5 feet, was sampled on September 10, 2004. Each VP was purged for approximately 20 minutes using a low flow peristaltic pump (flow rate 0.2 Lpm or less) and then sampled by connecting the VP to a Summa canister equipped with a six-hour regulator. An ambient air sample was also collected at that time.

Laboratory analysis indicated that toluene was detected in the VP-1 (shallow), VP-2 (deep), and ambient air samples at concentrations of 24 ppbv, 2 ppbv, and 1 ppbv, respectively. Vapor sampling results are presented in Table 7-3. Except for shallow sample (VP-1), detected vapor-phase toluene concentrations were within or below the range of residential background concentrations (1.1 ppbv to 6.6 ppbv) reported by the NYSDOH. In addition to other VOCs, methyl tertiary butyl ether (MTBE), benzene, ethylbenzene, xylenes, and other fuel components were detected in the shallow vapor sample. None of these VOCs are Off-Site RFI COCs. Some or all of the toluene detected in vapor sample VP-1 may also be attributable to a surface fuel spill and unrelated to the Off-Site RFI.

7.6 Vapor and Indoor Air Monitoring Samples

As discussed in Section 6.0, subsurface vapor sampling and concurrent indoor/outdoor ambient air sampling was conducted at 21, 23, and 25 Alden Street (see Figure 2-3) on February 15, 2006 to coincide with the local heating season (general time frame approximately November 15 to March 31). All sampling was performed using 6L Summa canisters equipped with laboratory-calibrated regulators that collected the vapor and air samples over a four hour period.

7.6.1 Field Screening

All pre-sampling Summa canister vacuums ranged between 28.5 and greater than 30 inches of mercury (inHg), and all post-sampling Summa canister vacuums were 0.0 inHg except the 21 Alden Basement duplicate sample (3 inHg) and the 25 Alden Basement sample (5 inHg). Field sampling data are summarized in Table 6-1.

Pre and post-sampling PID field screening was performed at each residence. All PID field screening readings were 0.0 ppmv except for the pre-sampling reading at the 25 Alden Street VMP (25 ppbv), and the pre-sampling (0 to 81 ppbv) and post-sampling readings (28 to 126 ppbv) at the 21 Alden Street MSVP. Also, PID field screening readings between 100 ppbv and 190 ppbv were obtained from the kitchen area of 21 Alden Street (occupant smoking and gas stove running). PID field screening data are summarized in Table 6-1.

7.6.2 Vapor and Ambient Air Results

Toluene concentrations in the February 2006 sub-slab/soil vapor samples ranged from 8.0 μg/m^3 at VMP-1 (25 Alden Street) to 22 μg/m^3 at MSVP-1 (21 Alden Street). Toluene concentrations in the February 2006 ambient indoor air samples ranged from 2.0 J μg/m^3 (basement samples at 21 Alden Street & 23 Alden Street) to 11 μg/m^3 (first floor sample at 23 Alden Street). Vapor and air data are summarized in Table 7-4 (see Figure 2-3 for sample locations).

According to data presented in the February 2005 NYSDOH draft guidance document for evaluating soil vapor intrusion, background residential toluene concentrations in a 1997-2003 NYSDOH study ranged from 4.2 μg/m^3 to 25 μg/m^3. Therefore, toluene concentrations in all ambient indoor air samples and all sub-slab/soil vapor samples collected in conjunction with the February 2006 Alden Street sampling event were within or below normal background range.

A total of 30 TOC analytes and additional TICs were detected in the February 2006 sub-slab/soil vapor and indoor ambient air samples. Total VOC concentrations in the February 2006 sub-slab/soil vapor samples ranged from 143 μg/m^3 at VMP-1 (25 Alden Street) to 258 μg/m^3 at MSVP-1 (21 Alden Street). Total VOC concentrations in the February 2006 ambient indoor air samples ranged from 24 J μg/m^3 (basement sample at 23 Alden Street) to 442 J μg/m^3 (first floor sample at 21 Alden Street). Concentrations of individual VOC analytes were generally J-qualified and less than 5 μg/m^3, and all individual VOC analytes concentrations were less than 50 μg/m^3 except 1,4-dichlorobenzene (possibly from residential use of mothballs?), which was detected at concentrations ranging from 18 μg/m^3 to 270 μg/m^3 in the 21 Alden Street sample (see Table 7-4).

The total VOC concentration in the outdoor ambient air sample collected on February 15, 2006 was 78 µg/m^3. The toluene concentration in the outdoor ambient sample was 2.4 J µg/m^3, which is below the normal indoor residential background range found in the 1997-2003 NYSDOH study. Outdoor air ambient sampling results are summarized in Table 7-4.

A replicate ambient air sample was collected in February 2006 by co-locating two Summa canisters. Results are summarized in Table 7-4. The same subset of VOC analytes was detected in each sample at total concentrations of 83 µg/m^3 and 75 µg/m^3. Variability in VOC analytes in the duplicate samples ranged from 4% to 8% for non-J qualified concentrations, and was 1.1 µg/m^3 or less for J-qualified concentrations.

Eight VOC analytes and multiple TICs were detected at a total concentration of 38 µg/m^3 in the vapor equipment/trip blank collected in February 2006; however, toluene was not detected in the February 2006 trip blank. Results are summarized in Table 7-4. The laboratory achieved the NYSDOH requested reporting limit of 1.0 µg/m^3 for off-site vapor sample compounds of concern (i.e., toluene).

SECTION 8.0

EVALUATION OF POTENTIAL EXPOSURE PATHWAYS/ THREAT TO HUMAN HEALTH AND THE ENVIRONMENT

This section, which is not intended to be a formal risk analysis, briefly reviews potential exposure pathways and threat to human health and the environment in the four remaining areas of concern identified by the RFI. Proposed actions or controls, which will remain in effect until the project goals are reached, are discussed.

8.1 Former Tank Farm SWMU

Potential exposure pathways associated with the Former Tank Farm SWMU include migration via ground water to off-site areas, and on-site worker exposure to toluene (and other VOCs noted elsewhere) through direct contact with ground water and affected soils at and below the water table. Based on the RFI results, there is currently little or no risk of off-site VOC migration via ground water. VOC analytes have consistently been absent in ground-water samples collected from downgradient monitoring wells/points. The toluene/heptane release occurred more than 35 years ago, and there have been no documented releases/spills at the Site for at least ten years. Empirical data collected during the RFI demonstrate that the remaining VOC mass (dissolved and sorbed) is in equilibrium with the ground water, and natural attenuation is actively removing VOCs within and at the margins of the current plume. Further, the presence of an asphalt cover restricts precipitation infiltration and remobilization of VOCs in this area. Activities proposed in the Preliminary Corrective Measure Evaluation (Section 10.0) will address residual mass in the soil and ground water.

Although the Former Tank Farm SWMU is covered by asphalt, and there are no excavation activities planned for this area, there is no protocol currently in place to specifically prohibit excavation activities in the Former Tank Farm SWMU. To minimize this possible exposure pathway, Saint-Gobain will establish a formal agreement with the property owner, such that notice will be provided before any excavation work is performed, so appropriate plans to manage soils and limit exposure can be developed and implemented. Details, including a Community Air Monitoring Plan and a Soil Management Plan that will restrict future use of soil and ground water at the Site following the completion of Corrective Measures, if necessary and acceptable to the property owner, will be discussed in the CMS. A deed restriction, if determined to be necessary following the completion of Corrective Measures, and acceptable to the property owner, will also be instituted limiting property use to industrial only.

8.2 Beneath the Buildings SWMUs & AOCs

The same potential exposure pathways that are present in the Former Tank Farm SWMU apply to the On-Site SWMUs & AOCs located beneath the buildings. Accordingly, it is concluded that there is currently little or no risk of off-site VOC migration via ground water from the On-Site SWMUs & AOCs for the reasons discussed above. Activities proposed in the Preliminary Corrective Measure Evaluation (Section 10.0) will address the residual soil and ground-water mass associated with On-Site SWMUs & AOCs located beneath the buildings.

The On-Site SWMUs & AOCs located beneath the buildings are covered by a thick concrete slab; therefore, excavation activities are unlikely. However, because there is no protocol currently in place that would specifically prohibit excavation in this area, Saint-Gobain will establish a formal agreement with the property owner such that notice will be provided before any excavation work is performed, so appropriate plans to manage soils and limit exposure can be developed and implemented.

One additional potential exposure pathway associated with the On-Site SWMUs & AOCs located beneath the buildings is the potential for vapor intrusion from ground water into the buildings. In December 2004, ambient air samples were collected from Buildings #58 & #61 using Summa canisters equipped with laboratory-calibrated six-hour regulators. Air sampling results, presented in Table 8-1, indicated that total VOC concentrations in the Building #58 & #61 samples were 88 ppbv and 77 ppbv, respectively. However, propene, which is believed to be related to forklift activity in the warehouses, was present in the two samples at concentrations of 60 ppbv and 50 ppbv, respectively. The remaining VOC concentrations of 28 ppbv and 27 ppbv, respectively (including toluene concentrations of 5.0 ppbv, and 7.0 ppbv) are not considered elevated and contained VOC analytes typical of warehousing operations, specifically extensive use of forklifts.

Therefore, the VOC volatilization pathway from ground water to the warehouse buildings is considered incomplete. To verify this conclusion, sub-slab vapor sampling will be performed inside the building in conjunction with the CMS. Future ground-water monitoring plans for SWMUs & AOCs located beneath the buildings will include contingencies to reevaluate this pathway if there is a change in ground-water conditions.

8.3 Off-Site RFI AOC

Based on the most recent RFI ground-water sampling data, all dissolved toluene concentrations in the vicinity of off-site residences are below the Federal Maximum Concentration Limit (MCL) of 1,000 μg/L. Although a formal risk assessment has not been performed, the MCL should generally be protective of human health and the environment. However, the lower NYSDEC ground-water standard of 5 μg/L remains the applicable goal, and the following discussion relates to possible risks in the Off-Site AOC where the dissolved toluene concentrations exceed the 5 μg/L limit.

Potential exposure pathways to dissolved toluene in the Off-Site include vapor intrusion from the ground water, ingestion of toluene in ground water, and direct contact with toluene in ground water and soils below the water table. The RFI vapor intrusion study determined that the toluene volatilization pathway to residential structures is incomplete. Interim and future Off-Site AOC ground-water monitoring plans include contingencies to reevaluate this pathway if there is a change in ground-water conditions.

Institutional controls (a Town of Colonie ordinance) prohibit the installation of potable wells at locations served by municipal water. All residential locations in the Off-Site AOC are currently served by municipal water eliminating this exposure pathway. Although local ordinances do not prohibit the installation of private wells for irrigation purposes (and one currently exists at Craig Street), the Town of Colonie requires that all wells be permitted by the Albany County Health Department (ACHD). Therefore, Saint-Gobain will submit a formal request that the ACHD provide notification if any private well permit applications are requested for the Maplewood Neighborhood, so appropriate ground-water testing can be performed to minimize any potential exposure via this pathway.

The private well at 32 Craig Street was sampled during the Off-Site RFI and toluene was not detected. The owner of the private well did not accept an offer from Saint-Gobain to abandon the well at no cost. Saint-Gobain plans to reissue the abandonment offer.

There is a potential exposure pathway to impacted soil and ground water if a deep excavation is conducted in the Off-Site AOC; but this pathway is unlikely to be complete because the excavation must extend to the ground water (depth 8 to 10 feet in this area). This is much deeper than typical excavations for utilities and landscaping, and building construction typically does not extend to the water table. There are no local ordinances prohibiting or requiring a permit for deep excavation in the Town of Colonie; however, Saint-Gobain will formally request that the Town of Colonie provide prior notification for any proposed excavation work in this specific area, so appropriate plans to manage soil/ground water and limit potential exposure can be developed and implemented. A similar request will be made to the owners of the four properties in the vicinity of the dissolved toluene plume.

8.4 Evaluation of Sanitary & Storm Sewer SWMUs

As discussed in Section 5.0, VOCs were not detected in sanitary and storm sewer water samples collected in association with the RFI and previous studies. Based upon these data, it was determined that the sewer lines and associated bedding are not a significant off-site transport mechanism for VOCs. Therefore, there is not a complete exposure pathway associated with VOCs in the Sewer SWMUs at the Site.

Elevated PAH, phenol, and phthalate concentrations were detected in some storm and sanitary sewer sediment and water samples, but the presence of these compounds does not correspond with SVOC distribution and magnitude in soil samples collected adjacent to the sewer lines. Based on the RFI results, there is no migration of SVOC-impacted sediments and/or water into the sewer lines via ground-water infiltration. Potential off-site risk of exposure to SVOCs in sewer water is unlikely given the: 1) absence of significant SVOC concentrations as documented through RFI samples; and 2) low SVOC soil to water partitioning coefficients.

Therefore, any potential risk of exposure to SVOCs in the sewer lines is limited to direct exposure to the sewer sediments. Activities proposed in the Preliminary Corrective Measure Evaluation (Section 10.0) will attempt to remove accessible SVOC sediments and determine whether their source was from: 1) historical site activities; and/or 2) run-off from asphalt covered areas of the roof (recently resealed/repaired) and the parking lot. The latter source is not related to the former Norton/Nashua Site. However, the removal of the existing storm sewer sediments will also eliminate the potential off-site migration of any sediments remaining from historical operations at the former Norton/Nashua Site.

There is currently no protocol precluding either on-site workers or utility personnel from entering the sewer manholes for maintenance activities. To minimize this possible exposure pathway, Saint-Gobain will establish an agreement with the property owner and file a notice with the town of Colonie municipal utility department, such that prior notice will be provided before workers enter the sewer manholes, so appropriate plans to manage sediment/limit exposure can be developed and implemented. These procedures will be in effect until the proposed Corrective Measures are completed.

SECTION 9.0

QUALITY ASSURANCE/QUALITY PROCEDURES AND SAMPLES

All soil and ground-water samples collected for VOC/SVOC analysis (and supplemental ground-water quality analysis except as noted below) were submitted to Adirondack Environmental Services, Inc., of Albany, New York, and all vapor samples collected for VOC analysis were submitted to Lancaster Laboratories, Inc. (LLI) of Lancaster, Pennsylvania. Both laboratories are certified by the NYSDOH – Environmental Laboratory Approval Program (NYSDOH-ELAP). Samples were generally submitted for analysis via standard turn around times. All samples were analyzed following NYSDEC, ASP (June 2000) CLP procedures with complete NYSDEC CLP/Category B laboratory deliverables including TICs.

Samples for supplemental analyses were submitted as follows: 1) soil samples for grain size analysis were submitted to LLI; 2) ground-water samples for microbial counts were submitted to Shaw Environmental Analytical and Treatability Laboratories (Shaw) of Lawrenceville, New Jersey; and 3) a soil sample for oil permeability, bulk and grain density, porosity, and water/oil saturation was submitted to TerraTek, Inc. of Salt Lake City, Utah. Analytical data packages received from each contract laboratory (and the supplemental analyses listed above) were compared with the list of analyses requested on the chain-of-custody record and the project work plan to ensure all analyses were performed as requested.

All laboratory analyses were performed within the method-specific holding times (see Table 3-2). Several ground-water samples collected for VOC analysis in 2005 exceeded 4°C upon arrival at the laboratory and were rejected for quantitative interpretation; the data were utilized only in a qualitative manner.

Copies of all laboratory data packages were previously provided to the NYSDEC in hard copy or electronic format and are not reproduced herein. Additional copies of the laboratory data packages are available by request.

Final data validation, independent of the laboratory deliverables, was performed by the NYSDEC in accordance with the approved QA/QC Plan. Copies of the NYSDEC QA/QC reviews are included in Appendix I.

Unless otherwise noted in this Report, all RFI QA/QC activities were conducted in accordance with the procedures outlined in: 1) the July 2003 RFI Workplan; 2) the May 2005 Supplemental RFI Workplan QAPP; and 3) the April 1994 Rust "IRM and General RFA/RFI Sampling Investigation" work plan, and consistent to the extent applicable with NYSDEC RCRA QAPP Guidance (3/29/91). The program included the collection of trip blanks, equipment blanks, MS/MSD samples, and blind replicate samples. QA/QC sample collection is summarized in Table 9-1.

9.1 Trip Blanks

Trip blanks were prepared and supplied by the laboratory, and transported and handled in the same manner as other ground-water sampling bottleware. One trip blank sample was analyzed for VOC target parameters for each ground-water and sewer water sampling cooler utilized. The trip blanks were received in the field within one day of laboratory preparation and were not held in the field for more than two days.

A total of 30 trip blanks were analyzed in conjunction with RFI soil and ground-water sampling events. Except as noted below, all trip blank VOCs were below method detection limits. Although methylene chloride (detected in 23 samples), TICs (23 samples), and acetone

(19 samples) were detected in multiple trip blanks, the majority of these detections were B-qualified (as were detections in corresponding soil and water samples), indicating that these compounds were also present in the laboratory method blank (see discussion in Section 9.5).

Chloroform was reported in three trip blank samples at concentrations ranging from 1 J µg/L to 2 J µg/L, but was not detected in corresponding soil samples. Toluene was reported in two trip blank samples at concentrations of 7 µg/L & 8 µg/L. It is possible that similar or lower toluene concentrations detected in the corresponding soil samples are the result of field or laboratory cross-contamination.

9.2 Equipment (Field) Blanks

One equipment blank sample was collected from each medium sampled (water, soil/sediment, and vapor) during each mobilization as described in the approved QA/QC Plan and analyzed for the complete list of target analytes. A total of 31 water and soil/sediment equipment blanks were analyzed. Except as noted below, all VOCs/SVOCs were below method detection limits.

Methylene chloride (detected in 12 samples), VOC TICs (12 samples), and acetone (4 samples) were detected in multiple equipment blanks, but many of these detections were B-qualified (as were detections in corresponding samples), indicating these compounds were present in the laboratory method blank; and therefore, not likely introduced into the samples during field collection. Chloroform was reported in three equipment blanks at concentrations of 2 J µg/L and 3 JB µg/L, but was not detected in the corresponding soil or ground-water samples. Toluene was detected in one equipment blank at a concentration of 3 JB µg/L. It is possible that similar or lower toluene concentrations detected in corresponding ground-water samples are the result of field or laboratory cross-contamination.

Bis-(2-ethylhexyl)phthalate was detected in one soil and one ground-water equipment blank, and was also detected in corresponding soil and ground-water samples. All of the ground-water sample detections were B-qualified, indicating possible cross-contamination in the laboratory or in the field as bis-(2-ethylhexyl)phthalate is found in some of plastic tubing used for sampling.

Phenol, 2-methylphenol, and 4-methylphenol were detected in a ground-water equipment blank collected in February 2004 at concentrations of 0.5 J μg/L, 79 μg/L, and 49 μg/L, respectively. The elevated concentration of the methylphenols, which were also detected in nine corresponding ground-water samples, suggests the possibility of incomplete equipment decontamination between sampling locations, especially at locations with lower methylphenol concentrations sampled towards the end of the mobilization.

Methane was detected at a concentration of 3.6 J ppmv in the vapor equipment blank collected in February 2004. Similar (or greater) methane concentrations were detected in the corresponding vapor samples. Eight VOC analytes and multiple TICs were detected at a total concentration of 38 $\mu g/m^3$ in the vapor trip blank collected in February 2006. Analyte concentrations in the blank did not correlate with concentrations in the corresponding vapor samples. Toluene was not detected in the February 2006 vapor trip blank.

9.3 Blind Replicate Sampling

The RFI Workplan specified the collection of one blind replicate sample for every twenty samples collected from each medium (water, soil/sediment, and vapor) and analysis for the complete set of target analytes. The following blind replicate samples were collected during the RFI: 11 soil/sediment samples (vs. 145 total samples), 15 VOC water samples (vs. 191 total samples), 4 SVOC ground-water well samples (vs. 54 total samples), and 2 vapor samples (vs. 15 total samples).

In general, the blind replicate samples demonstrate the reproducibility of the RFI field sampling results. Variability in VOC and SVOC concentrations in soil and ground-water replicate samples were generally only a few ppb at lower concentrations (less than 100 ppb) and less than an order of magnitude at higher concentrations (ppm range). However, TIC concentrations and some J-qualified and B-qualified analyte concentrations tended to exhibit higher variability between the two replicate samples. Also, significantly different results were obtained from the SB-148 SVOC soil replicate sample pair. Variability in the PAH concentrations in this replicate pair was probably a result of the number of individual asphalt particles (very high PAH content) incorporated into each sample from the fill/cinder material observed at this soil boring location. Variability in PAH concentrations in sewer sediments, which was also high (but less than an order of magnitude), probably resulted from the same field and sampling conditions.

A blind replicate vapor sample was collected in February 2004 by connecting two Summa canisters with equal initial vacuums to a laboratory supplied air flow "splitter", which concurrently directed sample vapors into two sampling vessels. Variability in VOC analyte concentrations between the two samples was 1 ppbv or less; VOC TICs had higher variability. A replicate ambient air sample was collected in February 2006 by co-locating two Summa canisters. Variability in VOC analyte and TIC concentrations between the two samples was generally less than 10%.

9.4 MS/MSD Samples

The RFI Workplan specified the collection of one set of MS/MSD samples for every twenty samples from each applicable medium (water and soil/sediment) for analysis via the complete set of target parameters. The following MS/MSD samples were collected during the RFI: 8 soil/sediment sets (vs. 145 total samples), and 11 water sample sets (vs. 191 total samples). MS/MSD results were reviewed in conjunction with NYSDEC validation of the data.

9.5 Laboratory Qualifiers

Numerous soil, ground-water, vapor, and sewer sediment volatile and semi-volatile analyte concentrations, and all TIC concentrations, were laboratory qualified as “J” values, indicating a “best” estimated concentration below the laboratory method quantitation limit. These J-qualified concentrations were used for quantitative interpretation.

Undiluted concentrations of toluene in several ground-water samples were laboratory qualified as “E” values, indicating a “best” estimate of a concentration above the laboratory quantitation limit. These samples were diluted, rerun in accordance with NYSDEC ASP methods, and identified by the laboratory as “D” qualified.

The laboratory reports also qualified some detected analyte and TIC concentrations with a “B”, which indicated that the compound was also detected in the laboratory method blank. Numerous detections of acetone, methylene chloride, bis-(2-ethylhexyl)phthalate, and VOC/SVOC TICs in soil/sediment and ground-water samples were B-qualified by laboratory. In addition, one detection of di-n-butyl phthalate and three detections of toluene in ground water were both J-qualified and B-qualified.

As discussed in Section 4.0, acetone, methylene chloride, bis-(2-ethylhexyl)phthalate, di-n-butyl phthalate, and B-qualified VOC/SVOC TICs are not considered to be COCs at the former Norton/Nashua Site because the following criteria apply: 1) these compounds were not historically utilized at the facility; 2) these compounds were not detected in previous analytical sampling (unless B-qualified); and 3) acetone, methylene chloride, bis-(2-ethylhexyl)phthalate, and B-qualified VOC/SVOC TICs were frequently detected in trip and/or field blank samples (see discussion in Sections 9.1 & 9.2). Therefore, the reported presence of these compounds in RFI samples is considered an artifact of laboratory sample preparation/analysis, and analytical data for these compounds were not used in a quantitative or qualitative manner. Consistent detection of these compounds in the laboratory method blanks suggests a laboratory contamination problem or other general problems with internal laboratory QA/QC procedures.

SECTION 10.0

PRELIMINARY CORRECTIVE MEASURES STUDY (CMS) AND REMEDIAL ACTION TECHNOLOGY SCREENING

This Preliminary Corrective Measures Study (CMS) includes: 1) a statement of Corrective Measures objectives and remedial action performance goals; 2) identification of potential treatment areas; 3) identification, and preliminary screening/evaluation of potential treatment technologies; and 4) an outline of proposed feasibility testing necessary for the final Corrective Measure Study (CMS). Proposed response actions for the sanitary and storm sewers, also subject to subsequent NYSDEC review and approval, are also discussed.

Final Corrective Measures objectives are to achieve New York State soil clean-up standards and ground-water standards/guidelines at all on-site and off-site SWMUs and AOCs. These objectives will be met through a combination of aggressive short-term remedial actions and longer-term monitoring.

10.1 Corrective Measures Performance Goals

The principal Corrective Measures goals for the former Norton/Nashua Site include: 1) to the extent practicable, remove residual toluene source mass present in the soil column and floating FPP in the area of the former tank farm; 2) accelerate the reduction of dissolved-phase toluene concentrations beneath the on-site buildings; 3) prevent future off-site movement of dissolved-phase toluene; and 4) monitor off-site wells to evaluate the natural decay of toluene. Although there are generally overall declining trends in dissolved toluene concentrations at the former Norton/Nashua Site, more aggressive remedial technologies are proposed as a short-term remedial action to address localized areas of residual source mass in the overburden (both vadose and saturated zones) with the intent of accelerating the long-term reduction of dissolved ground-water concentrations via natural attenuation.

A summary of all on-site and off-site AOCs/SWMUs and corresponding COCs for each area is presented in Table 10-1. As discussed elsewhere in this Report and summarized in Table 10-1, although other VOC and SVOCs exceed their corresponding soil and/or ground-water standards in spatially limited areas at the former Norton/Nashua Site, the primary on-site COC, and the only off-site COC, is toluene. Selected remedial actions for toluene may also be effective at addressing minor concentrations of the other COCs present at the Site. However, the focus of this preliminary CMS is toluene.

At this time, insufficient data are available to establish short-term numerical performance goals. Following NYSDEC approval of the preliminary technology screening proposed herein, pilot and or bench-scale testing will be conducted to determine short-term remedial performance goals and target concentrations, which will be presented as part of the final CMS Report. If these short-term remedial performance goals and targets are not achieved via the selected Corrective Measures, the final CMS Report will also include contingencies to address this condition, but it would be premature to attempt to discuss the need for or scope of contingency alternatives in detail before the collection of additional data.

One of the principal Corrective Measures goals is the removal of residual source mass. Based on site conditions and preliminary technology screening, any short-term remedial action is unlikely to fully achieve this goal. Therefore, monitored natural attenuation (MNA) will be an integral component of the site remedy. The final CMS will include details for an MNA program with contingencies that will ensure that no adverse risk to human health, safety, public welfare, and the environment occurs.

Interim Corrective Measures (ICMs) are not necessary because there is no imminent hazard to human health or the environment. Sampling performed in association with the RFI demonstrates that: 1) the distribution of free-phase, residual soil, and dissolved-phase toluene is stable and there is no ongoing off-site migration via ground water (or the sewer systems); 2) on-site and off-site toluene concentrations are stable or decreasing; 3) there is no complete exposure pathway for off-site residents; and 4) current (and anticipated future) activities, do not result in a complete exposure pathway for on-site workers.

Eliminating potential exposure pathways during the implementation of the Corrective Measures will be achieved, in part, through the use of institutional controls. Some local institutional controls are already in place. For example, a Town of Colonie ordinance prohibits the use of a potable well at a property that is connected to municipal water. All residential properties within the Off-Site AOC are currently connected to municipal water and there are no known potable wells; therefore, the residential drinking water pathway is eliminated.

Potential off-site exposure is still possible (although remote) via the installation of a "garden" well or deep excavation of soils on residential properties. Saint-Gobain will contact the property owners in the Off-Site AOC (the four homes previously identified for subslab and indoor air sampling; see Figure 2-3) in writing annually and ask them to provide voluntary notification of such activities until DEC approves or provides closure for off-site issues. The notification will clearly state that if any additional soil and/or ground-water sampling is determined to be necessary in the Off-Site AOC, Saint-Gobain will perform these activities at no cost to the residents. Identification of formal institutional controls to eliminate potential on-site and off-site exposure pathways is ongoing, and will be reviewed in the final CMS Report.

10.2 Identification of Potential Corrective Measures

Based on available site data, potential Corrective Measures were identified and evaluated for implementation at the Site. The following methods were selected for initial screening and evaluation:

1. <u>Ground-Water Extraction</u>
   Also known as "pump-and-treat", ground-water extraction as a stand-alone technology can reduce source mass via removal of dissolved- and liquid-phase (FPP) components. Ground-water extraction is frequently used in conjunction with SVE (#2) to enhance vapor recovery, or vapor extraction may be used to enhance ground-water recovery directly (DPVE; #3).

2. <u>Soil Vapor Extraction (SVE)</u>
   Soil Vapor Extraction (SVE) utilizes vapor flow in the vadose zone to remove source mass via direct volatilization and indirectly via increased rates of biodegradation. Vapor extraction is accomplished via horizontal or vertical wells placed within the vadose zone.

3. <u>Dual Phase Vapor Extraction (DPVE)</u>
   The concurrent removal of ground water and vapors from extraction wells is known as Dual Phase Vapor Extraction (DPVE). Vapor recovery is enhanced by depressing the water table and exposing more soil column, and ground-water well yields are increased (at least temporarily) by applying a vacuum to the well.

4. <u>In-Situ Air Sparging (IAS)</u>
   In-situ air sparging (IAS) utilizes the injection of air into the ground water to stimulate direct volatilization (and associated biodegradation). Without concurrent SVE or DPVE, IAS has the potentially negative effect of inducing vapor migration in the subsurface. Pilot testing is required to demonstrate that vapor migration can be controlled. Air sparging may also cause localized ground-water mounding.

5. <u>Excavation and Off-Site Treatment or Disposal</u>
   Direct excavation is used to remove soils with elevated COC concentrations for on-site treatment, off-site treatment, or disposal at an approved facility. Excavated areas are returned to grade with clean backfill (or treated soils).

6. <u>Passive FPP Recovery</u>
   Passive FPP recovery devices (e.g.; absorbent "socks") are deployed in recovery wells to selectively remove mobile-phase FPP within the immediate location of the recovery well.

7. <u>Enhanced Fluid Removal (EFR)</u>
   This technique is essentially a portable version of DPVE (see #3). A high vacuum is applied to extract ground water within monitoring points via vacuum truck or other methods. This remedial activity is implemented on a periodic basis to address "hot-spots" and/or recurring FPP removal.

8. In-Situ Chemical Oxidation (ISCO)
   In-situ chemical oxidation (ISCO) technology utilizes injection points to introduce chemicals to the subsurface to oxidize (mineralize) COCs. Any excess reagents and catalysts are monitored and neutralized naturally or through the introduction of buffer solutions.

9. Enhanced/Augmented Bioremediation
   This alternative attempts to accelerate the in-situ biodegradation described in #10 by the addition of: 1) concentrated cultures of non-native microbes or concentrated native microbes cultured ex situ; 2) oxygen via hydrogen peroxide, proprietary products such as oxygen release compound (ORC), or sparging and diffusions; and/or 3) potentially limiting nutrients such as nitrogen and phosphorus.

10. Monitored Natural Attenuation (Intrinsic Remediation)
    Naturally occurring processes such as volatilization, dispersion, adsorption, chemical degradation, and biodegradation act to reduce contaminant concentrations in ground water. When implemented as a remedial alternative, monitored natural attenuation (MNA) is not a "no action" response. Monitoring and continuous evaluation are required for a prolonged period. A contingency plan needs to be developed in the event that monitoring indicates increased risk. Natural attenuation has proven to be a dynamic process ultimately contracting dissolved-phase plumes.

10.3 Target Treatment Areas

Soil and ground-water data collected as part of this investigation indicate that COC impact at the site is generally limited to the "smear zone" and shallow ground water (approximate depth eight to ten feet). Significant toluene residual mass is limited to deep vadose and saturated soils beneath the former tank farm. For purposes of screening potential Corrective Measures, three target treatment areas were identified at the Site (see Figures 2-2 & 2-3) based on toluene impact (distribution and magnitude) and accessibility for treatment: 1) vadose and saturated overburden beneath the former tank farm; 2) the vadose and saturated overburden beneath the floor of the main on-site buildings; and 3) off-site areas with dissolved-phase toluene impact. Note: potential treatment of the sewer SWMUs is considered separate and unique from soil/ground-water issues and is discussed in 10.10.

10.4 Initial Screening of Potential Corrective Measures

Each potential Corrective Measure was initially screened relative to its feasibility and effectiveness:

1. Ground-Water Extraction
   This technology is useful for: 1) establishing hydraulic control; 2) limited mass recovery; and 3) enhancing FPP recovery in the vicinity of extraction wells. Based on multiple rounds of ground-water monitoring, the potential for migration of dissolved toluene is presently extremely limited at the Site, so ground-water extraction is not necessary to maintain hydraulic control.

   Free-phase product thickness (i.e., oil head) and achievable drawdown in the vicinity of the former tank farm may be insufficient to mobilize residual FPP trapped by capillary forces. Pump-and-treat is not a cost-effective means of mass recovery with respect to the dissolved toluene plume. Establishing hydraulic capture of the dissolved plume beneath the main building would require numerous wells and an extensive piping array within the building at high or prohibitive costs. Based on previous experience, system reliability is relatively poor.

2. Soil Vapor Extraction (SVE)
   This technology can be effective at removing VOCs from the vadose zone and the capillary fringe (especially with the addition of air sparging, see #4) via vapor-phase transport. However, subsurface conditions at the Site (sand with silt/clay and fill layers) are not conducive for the use of this technology. Due to a limited radius of influence, numerous wells and an extensive piping array would be required within the building to achieve vapor capture at high/prohibitive costs. Costs in other areas are considered average. System equipment may not be suitable for residential areas due to noise issues.

3. Dual Phase Vapor Extraction (DPVE)
   Because DPVE technology combines ground-water extraction (#1) and SVE (#2), it can potentially be effective at removing VOCs from both the vadose and saturated zones. However, given the silty/clay-rich soils present in the source area, it is likely that individual vertical DPVE wells would achieve a limited radius of influence, thereby requiring numerous wells and an extensive piping array. Provisions for vapor treatment would also be required, and the same drawbacks noted for ground-water extraction (relatively high equipment and treatment costs) and SVE (limited radius of influence) apply. As noted above, reliability is relatively poor for ground-water recovery systems. DPVE costs and treatment times are considered average to above average.

4. In-Situ Air Sparging (IAS)
   IAS/SVE is only effective in the saturated overburden where there is a direct pathway for sparged air to reach the residual toluene mass. Silt/clay-rich soils can limit IAS effectiveness and applicability of the requisite SVE component. IAS is not recommended unless: 1) pilot testing demonstrates that vapor migration can be controlled; and 2) all floating FPP has been removed from a site. Implementation costs are average.

5. Excavation and Treatment or Disposal
   Excavation is the most direct method of source mass removal and can significantly reduce treatment/monitoring times. Excavation is readily implemented in shallow, accessible soils, and is cost-effective in limited target areas. Deeper and/or more saturated excavations, potentially requiring engineered shoring and dewatering, become much less cost-effective, and very expensive if the removed materials must be treated as hazardous waste as is the case at the former Norton/Nashua Site. Also, excavation activities can be disruptive to normal business operations, and access beneath the building is precluded. Soil excavation is not considered a stand-alone remedy because elevated dissolved toluene concentrations would remain in the saturated zone; therefore, a secondary treatment phase such as ISCO (#6), enhanced bioremediation (#9), or MNA (#10) will also be necessary.

6. In-Situ Chemical Oxidation (ISCO)
   ISCO technology can be effective for toluene destruction, but ISCO is relatively expensive, and bench scale and pilot testing is required to determine site-specific effectiveness and reagent requirements. ISCO may not be effective in treating contamination above the water table or in clay-rich layers beneath the water table because channeling often limits contact between reagents and the impacted soils.

7. Enhanced Fluid Recovery (EFR)
   This technique is often effective for wells with measurable thicknesses of FPP that are not otherwise utilized as recovery wells. This technology has the ability to enhance FPP recovery through removal of "stranded" FPP pockets via the development of preferred fluid pathways. Residual mass is also recovered from the vadose zone via vapor extraction. Disposal costs are relatively high, but risks and potential adverse impacts are low. This alternative is generally not intended to directly address dissolved-phase constituents.

8. Passive FPP Recovery
   This technology can be a highly efficient and cost-effective means of local FPP capture and removal when there is mobile FPP present in the vicinity of the recovery well. However, the potential area of FPP capture is limited, and passive FPP recovery cannot capture residual FPP mass or dissolved constituents, and therefore, additional Corrective Measures are necessary.

9. Enhanced Bioremediation
   Dissolved oxygen appears to be the key limiting factor for biodegradation at the Site. Regularly sampled wells beneath the main building have generally demonstrated significant decreases in toluene concentrations over time. This trend is likely a result of physical mixing (and oxygenation) of ground water near each sampling location. The addition of dissolved oxygen at selected wells may produce a similar effect on the overall aquifer beneath the building.

Previous projects attempting to utilize ORC via direct injection or placement of "socks" into wells, suggest this method of delivery is: 1) relatively ineffective at establishing elevated dissolved oxygen concentrations; 2) less successful in clay-rich soils; and 3) relatively expensive. A second technology, in-situ submerged oxygen curtain (iSOC), uses microporous fibers to introduce oxygen directly into ground water. Other field tests suggest that the iSOC technology may achieve the necessary dissolved oxygen concentrations with a higher degree of reliability and lower cost.

10. Monitored Natural Attenuation (Intrinsic Remediation)
MNA is a viable remediation strategy for treatment of residual dissolved-phase toluene at the site based on: 1) results demonstrating decreasing toluene concentrations at monitoring wells sampled during the RFI; and 2) bioattenuation sampling data suggesting that limited toluene biodegradation is occurring. Costs, risks, and ease of implementation are all favorable, especially in off-site areas where dissolved toluene concentrations are relatively low.

    Although MNA will likely be a component of the final on-site remedy, it is not a viable stand-alone remedial alternative for the on-site area because the treatment time is too long. The effectiveness of MNA may be enhanced (see #9) to reduce treatment time or active source mass removal, via another remedial technologies is necessary prior to the implementation of MNA at on-site areas to reduce the total treatment time.

10.5 Remedial Action Alternative Evaluation Criteria

The Technology Screening Matrix used below is patterned after a U.S. EPA model (Guidance for Conducting Remedial Investigation and Feasibility Studies under CERCLA; October 1989), but adds an evaluation of potential risks and certainty of outcome. Each remedial alternative was evaluated for its potential use as a remedial action in the three treatment areas of the Site.

Applicability/Effectiveness (A)

Corrective Measures were rated with respect to their ability to reduce toluene concentrations in the overburden. The following rankings were used:

- 0 = not applicable, available, or possible to implement
- 1 = probably not applicable and not widely used or difficult to implement
- 2 = may not be applicable and not widely used, or widely used but probably not applicable
- 3 = likely applicable but not widely used, or widely used but may not be applicable
- 4 = proven but not widely used, or widely used and probably applicable
- 5 = applicable, available, and widely used

Reliability/Risks (R)

Corrective Measures were rated with respect to their potential risk and the degree of certainty the alternative will achieve a Permanent Remedy as follows:

- 0 = very low certainty and very high degree of risk
- 1 = low certainty or high degree of risk
- 2 = high certainty and moderate risk, or moderate certainty and low risk
- 3 = high certainty and low risk

Ease of Implementation/Permissibility (P)

Corrective Measures were rated with respect to ease of implementation (excluding financial concerns) and potential access, permitting, and/or approval problems. The following rankings were used:

- 0 = not possible or not permissible
- 1 = very difficult to implement or permit
- 2 = minor difficulties
- 3 = easy to implement, no anticipated problems

Costs (C)

Corrective Measures were rated with respect to potential costs including design, installation, and operation, and environmental restoration. The following rankings were used:

- 0 = prohibitive
- 1 = very high relative to other alternatives
- 2 = high
- 3 = average
- 4 = low
- 5 = very low

Treatment Time (T)

Corrective Measures were rated according to anticipated length of time to meet remediation goals and potential operational impact to business or residences. The following rankings were used:

- 0 = prohibitive
- 1 = very long treatment time or adverse impact
- 2 = average treatment time, moderate impact
- 3 = very rapid treatment and no adverse impact

10.6 Detailed Evaluation of Corrective Measures

Each remedial action alternative was scored using the following formula:

Rating = A x R x P x (C + T), Maximum Rating = 5 x 3 x 3 x (5 + 3) = 360.

Scores above 150 were considered favorable for the Site, ratings between 75 and 150 were considered feasible, and scores below 75 were considered infeasible. Technology Screening Matrix results are presented in Table 10-2 for each proposed treatment area. A summary evaluation of each remedial action alternative is presented below.

1. <u>Ground-Water Extraction</u>
   This technology generally received average to below average ratings. As noted previously, mass removal (and applicability) is limited to dissolved-phase and mobile FPP. Extensive system infrastructure (piping/trenching network), capital equipment, and permitting requirements result in low cost and permissibility ratings. A total score of 11 indicates that this method is not a cost-effective or otherwise viable alternative for any proposed treatment areas at the Site.

2. <u>Soil Vapor Extraction (SVE)</u>
   This technology does not address toluene impact in the saturated zone, and pilot testing would be necessary to confirm the effectiveness of SVE in the vadose zone. Therefore, SVE receives low ratings for applicability and reliability. Extensive system infrastructure (piping/trenching network), capital equipment, and permitting requirements result in low cost and permissibility ratings. A total score of 41 ranks this as an unfeasible technology in all proposed treatment areas at the Site.

3. <u>Dual Phase Vapor Extraction (DPVE)</u>
   Similar to ground-water extraction, DPVE received low ratings for applicability, reliability, and treatment time because of its low effectiveness at overburden mass removal. Extensive system infrastructure (piping/trenching network), capital equipment, and permitting requirements result in low cost and permissibility ratings. A total score of 20 ranks this as an unfeasible technology in all proposed treatment areas at the Site.

4. <u>In-Situ Air Sparging</u>
   As previously noted, IAS should be performed in conjunction with an operating SVE system. In the absence of pilot testing data, ratings for this technology are speculative. Extensive system infrastructure (piping/trenching network), capital equipment, and permitting requirements result in low cost and permissibility ratings. Further, in a worst-case scenario, this technology may present risks due to potential FPP migration in the former tank farm area. Total scores ranging from 20 to 30 in the three proposed treatment areas at the Site rank this as an unfeasible technology.

5. Excavation and Treatment or Disposal

   This technology received relatively high ratings for applicability, risks, and treatment time. High costs and disruption to business activities make excavation infeasible beneath the building, and disruption to residents and the absence of concentrated source mass eliminate excavation as a feasible technology for off-site areas.

   Assuming that a secondary technology is implemented to address residual aqueous-phase mass after excavation is completed; this technology is considered feasible in the former tank farm area. Relatively high costs for deeper and/or saturated soil conditions can be controlled by limiting excavation to the most easily accessible highly-impacted saturated soils and/or potential on-site treatment and reuse of soil. In the former tank farm area, this technology received a total screening score of 100, and is retained for further evaluation.

6. In-Situ Chemical Oxidation (ISCO)

   ISCO technology received relatively high ratings for treatment time, average ratings for cost, and lower ratings for applicability and risk because it is not widely used and pilot testing would be required. Total screening scores ranged from 74 to 105; feasible but not favorable. The highest ranking of 105 was assigned to the area beneath the building, and this technology is retained for further evaluation.

7. Enhanced Fluid Removal (EFR)

   Because this method is effective at FPP recovery and potentially effective at dissolved “hot-spot” locations, this technology received relatively high ratings for permissibility, but ratings for applicability, reliability, and costs were variable. Assuming that a secondary technology is implemented to address residual aqueous-phase mass, this technology is considered favorable for FPP recovery in the former tank farm area, and is feasible beneath the building for limited “hot spot” remediation. Fluid and vapor removal may also stimulate intrinsic remediation by circulating and oxygenating stagnant water. Due to the ease of implementation and low risk involved, this method is retained for future consideration for use on a trial basis in combination with another technology.

8. Passive FPP Recovery

   This technology’s applicability is limited to mobile-phase FPP in close proximity to a recovery well (this condition is found in the former tank farm area only) where it has variable reliability. High ratings were received for permissibility and costs. This alternative ranked third overall in the former tank farm area but it is not considered a “stand-alone” technology. Due to the ease of implementation and low cost and risk involved, this method is retained for future consideration in combination with another technology.

9. Enhanced Bioremediation

   Enhanced bioremediation generally received slightly lower scores than monitored natural attenuation (MNA) due to higher costs and greater difficulty in implementation. For off-site areas, where dissolved toluene concentrations are generally low (ppm range or less), this technology had the second highest technology score of 195.

In areas with more elevated dissolved toluene concentrations (beneath the building), this technology received the highest rating of 195 and it is retained for future consideration. Treatment time, costs, ease of implementation, and applicability are all highly favorable for single well treatment systems (no/limited system infrastructure), but pilot testing will be required to confirm applicability.

In areas with FPP (former tank farm), Enhanced Bioremediation is not suitable as a stand-alone technology, and it was rated under the assumption that another technology would be used prior/concurrently for the removal of any FPP. With that assumption, applicability, risks, and costs ratings are highly favorable, and the rating for Enhanced Bioremediation was tied for first with a total score of 137.

10. Monitored Natural Attenuation (Intrinsic Remediation)
For off-site areas, where dissolved toluene concentrations are generally low, this technology received high ratings for applicability, reliability/risks, permissibility, and costs. The total score of 219 was the highest technology score for treatment of the off-site areas.

    In areas with elevated dissolved toluene concentrations (beneath the building), MNA is less suitable because of its unfavorable treatment time, but the total score of 137 was the second highest and it is retained for future consideration. In areas with FPP (former tank farm), MNA is not feasible, and it was rated only as a secondary technology suitable for dissolved-phase constituents following more aggressive source removal. With that assumption, applicability, risks, and costs ratings are highly favorable, and the rating for MNA was tied for first with a total score of 137.

10.7 Selected Corrective Measure Alternatives

The following corrective measures alternatives were identified as feasible via the Technology Screening Matrix: 1) off-site areas (in descending order): MNA, enhanced bioremediation, ISCO; 2) beneath the main building: enhanced bioremediation, MNA, ISCO, EFR; and 3) the former tank farm: (a) FPP removal: passive FPP recovery, EFR; (b) primary treatment: enhanced bioremediation, soil excavation, ISCO; and (c) secondary treatment: MNA. The Corrective Measures Alternative(s) identified for each AOC are summarized in Table 10-3.

The primary Corrective Measure for off-site areas is MNA. Overall decreasing concentration trends in the off-site areas during monitoring performed in conjunction with the RFI demonstrate that natural attenuation is actively reducing dissolved toluene. Although this technology has a fairly long treatment time, it is the least intrusive method to use in residential areas and there is currently no complete exposure pathway (see Section 8.3). If MNA sampling data indicate that off-site toluene concentrations are increasing or do not demonstrate continued decreasing trends then it will be necessary to evaluate more active technologies such as enhanced bioremediation or ISCO.

The primary remedial action alternative selected for dissolved plume areas under the building is enhanced bioremediation. Pilot testing is required to determine the effectiveness of this technology and to establish remedial action performance objectives. If pilot testing indicates that enhanced bioremediation will not achieve the necessary remedial action performance objectives, ISCO technology will be pilot tested as a potential primary remedial technology. EFR will be evaluated on a pilot basis as an alternative primary or secondary remedial technology for dissolved plume areas under the building.

Passive FPP recovery (via petrophilic socks) with a contingency for EFR was selected as the proposed FPP removal technology in the former tank farm area. Passive FPP recovery is highly applicable for the maximum observed APTs in the former tank farm area (0.10 foot or less), and this technology will be applied on an interim basis while the CMS is finalized (see Section 11.0). If measurable APTs continue to occur after the deployment of the petrophilic socks, EFRs via vacuum truck extraction will also be performed as an interim remedial measure (see Section 11.0).

Soil excavation was rated as a feasible technology by the Technology Screening Matrix for the former tank farm area, but bench scale treatability testing and additional information from contractors must be obtained before the effectiveness of this technology can be fully evaluated. If soil excavation is conducted and post-excavation sampling indicates significant residual source mass remains in the former tank farm area, pilot testing will be necessary to evaluate an additional primary remedial action, such as enhanced bioremediation or ISCO, in the former tank farm area.

If soil excavation is not conducted, ISCO technology will be pilot tested as a potential primary remedial technology in the former tank farm area. Pilot testing data will also be used to establish remedial action performance objectives.

10.8 Feasibility of the Selected Corrective Measure Alternatives to Achieve the Clean-Up Objectives and Goals

The selected Corrective Measure alternatives are anticipated to be effective in achieving the general remedial action clean-up objectives for the Site, which are: 1) remove residual toluene source mass present in the soil column and floating FPP, to the extent practicable; 2) accelerate the reduction of dissolved-phase toluene concentrations beneath the on-site buildings; 3) prevent future off-site movement of dissolved-phase toluene; and 4) monitor the natural decay of dissolved-phase toluene in off-site wells. Additional feasibility testing is required to establish performance-based objectives.

Overall decreasing concentration trends in the Off-Site AOC during monitoring performed in conjunction with the RFI demonstrate that natural attenuation is actively reducing dissolved toluene concentrations, and it is anticipated that the primary remedial action alternative selected for off-site areas, MNA, will ultimately achieve the ground-water clean-up objective of 5 μg/L. Although this technology has a fairly long treatment time, there is currently no complete exposure pathway (see Section 8.3), and toluene concentrations are below the Federal MCL and other target concentrations established by the USEPA and other States for direct and indirect exposure to toluene in ground water. Pilot testing is required to determine the effectiveness of enhanced bioremediation for treatment of the dissolved plume areas under the building, and to establish Corrective Measures performance objectives, which are likely to be in the ppm range. Pilot testing is also required to evaluate alternative technologies such as EFR and ISCO, which are likely to have similar performance objectives.

Regardless of the primary technology selected, a secondary remedial action, such as MNA, will probably be necessary to achieve the ground-water and soil clean-up objectives. Although MNA has a fairly long treatment time, there is currently no complete exposure pathway (see Section 8.2), and toluene concentrations beneath the building have demonstrated overall decreasing trends during monitoring performed in conjunction with the RFI.

Passive FPP recovery (via petrophilic socks) with a contingency for EFR should be effective at removing mobile FPP in the former tank farm. Soil excavation and/or ISCO will also remove significant residual soil mass, but the effectiveness of these technologies cannot be determined without treatability or bench testing. Corrective Measures performance objectives are likely to range in the tens of ppms for toluene following the primary remedial actions, and a secondary technology, such as enhanced bioremediation, may be necessary to achieve a performance objective in the ppm range for toluene.

Present data suggest that intrinsic attenuation is effectively managing the fringe of the dissolved toluene plume in the vicinity of the former tank farm. Reduction of source mass via the primary (and contingent secondary) remedial actions will result in diminished dissolved-phase toluene concentrations, and MNA will be used to achieve the ultimate project objectives.

Currently, there are no complete on-site exposure pathways (see Section 8.1), but toluene concentrations exceed the Federal MCL, and target concentrations established by the USEPA and other States for direct and indirect exposure to toluene in soil and ground water, so continued institutional controls (i.e., the presence of a concrete slab beneath the building and limitations on soil excavation) are necessary to prevent potential exposure.

10.9 Feasibility Testing

Based on the Corrective Measures evaluation presented above, alternatives were identified for each of the three treatment areas at the Site. Overall decreasing concentration trends in the off-site areas demonstrate that natural attenuation is actively reducing dissolved toluene concentrations and suggest the effectiveness of the selected Corrective Measure, MNA, can be tested by continuing performance of a ground-water monitoring program (see Section 11.0).

For the two on-site treatment areas, pilot testing will be required to: 1) validate the results of the Technology Screening Matrix; 2) determine appropriate design criteria for the development of remedial system equipment specifications, where applicable; and 3) establish performance goals. Currently, additional technical, financial, and logistical information is being obtained from contractors to: 1) complete a preliminary evaluation of soil excavation; and 2) determine the final scope of the pilot testing. Following NYSDEC approval of the Preliminary CMS evaluation, a bench-scale testing and/or pilot testing workplan, which will include details on proposed sampling locations and laboratory analyses, additional monitoring points, frequency of field measurements, and the duration and number of tests, will be developed and submitted to the NYSDEC for review and approval. The results of the bench-scale testing and/or pilot testing will be used to prepare the final CMS Report.

10.10 Sewer SWMUs Corrective Measures

As discussed in Section 5.7, the storm and sanitary sewer lines and associated bedding are not current pathways for the off-site transport of toluene, heptane, or other VOCs. PAHs exceeding corresponding standards were found in RFI sewer sediment samples and to a lesser degree sewer water samples.

Proposed Corrective Measures are limited to addressing the presence of PAHs in the storm sewer system as the presence of any PAHs in the sanitary sewers are ultimately treated by the POTW. The RFI data indicate that the source of the PAHs currently present in the sediments is most likely: 1) historical site activities; and/or 2) run-off from asphalt covered areas, e.g., parking lots and/or the roof of the main building (note: a large section of the roof was recently resealed/repaired).

Removing accumulated sediment from the storm sewer manholes may allow identification of the source of the PAH-impacted sediment. If the PAH-impacted sediments are associated with historical site activities, their removal will eliminate the potential migration of sediments from the site via the storm sewer system. If PAH-impacted sediments return after removal of the current sewer sediments, the source is more likely ongoing run-off to the storm sewer system, and thus unrelated to activities associated with NYSDEC Order on Consent Index No. CO: 4-20001205-3375.

The proposed preliminary Corrective Measure for the Storm Sewer SWMU is sediment removal via vacuum truck extraction. All visible sediment and standing water will be removed from each of the accessible on-site storm sewer manholes. Accumulated vacuum truck waste materials will be sent off-site for proper disposal. Following sediment removal, and at least two significant (greater than 0.5 inches) rainfall events or equivalent snow melts, a sewer inspection and sampling event will be performed.

If sewer sediment is present, sediment samples will be collected from five storm sewer manholes (MH-2, MH-3, MH-5, MH-6, MH-13 & MH-14). If no sediment is present at manholes MH-2 or MH-3, alternate locations upstream along the same sewer line will be assessed for possible substitution. Sampling will proceed upstream to avoid agitation of bottom sediments at succeeding sediment sample locations (see Figure 1-3). Sewer sampling will be performed according to the RFI sampling procedures documented in Section 5.5. Sewer sediment samples will be analyzed for SVOCs via EPA Method 8270 plus TICs. All analyses will include Category B laboratory deliverables.

Regardless of whether or not sewer sediment is present, sewer water samples will be collected from the same manholes listed above according to the RFI sampling procedures documented in Section 5.6. If a specific sewer manhole is dry, no samples will be collected, but alternate sampling locations upstream along the same sewer line will be assessed for possible substitution.

All sewer water samples will be analyzed for SVOCs via EPA Method 8270 plus TICs. All sewer sample analyses will include Category B laboratory deliverables.

Sewer sediment removal and sampling activities will begin following NYSDEC approval of the proposed Preliminary CMS activities. Sewer sampling results will be used to prepare the final CMS Report for the Storm Sewer SWMU.

SECTION 11.0

INTERIM GROUND-WATER MONITORING PLAN (IGWMP)

Prior to implementation of the final CMS, time will be required for field activities (see pilot testing discussed in Section 10.0), data evaluation, report preparation and submittal, administrative review and approval, and a public review period. In the interim, ground-water sampling and other site activities proposed in this section will be continued to ensure that there is no change in subsurface site conditions potentially resulting in: 1) increased migration of COCs in soils or ground water; 2) completion of potential exposure pathways for human and environmental receptors; and/or 3) other threats to human health and/or the environment.

11.1 Ground-Water Sampling

The following interim ground-water sampling schedule is proposed for the former Norton/Nashua Site:

Quarterly (6 sampling locations):

- off-site wells: MP-6, MP-14, MP-17, MP-22, MW-18 & MW-19
- liquid-level gauging: all off-site wells
- product gauging and recovery: former tank farm wells

Semi-Annual (10-12 sampling locations):

- off-site wells: MP-6, MP-14, MP-17, MP-22, MW-18 & MW-19
- on-site “sentinel” wells: MW-12 (or DGC-10), MW-13 & MW-15
- “plume” wells: 1-3 selected wells (DGC-7/MP-12 next event)
- liquid-level gauging: all off-site and on-site wells
- product gauging and recovery: former tank farm wells

Annual (12-15 sampling locations):

- off-site wells: MP-6, MP-14, MP-17, MP-22, MW-18 & MW-19
- on-site “sentinel” wells: MW-12 (or DGC-10), MW-13 & MW-15
- “plume” wells: MP-10 or MP-11, MW-17
- “plume” wells: 1-3 wells near the former tank farm
- liquid-level gauging: all off-site and on-site wells
- product gauging and recovery: former tank farm wells

Ground-water sampling will be performed via the micropurge sampling method; other gauging and sampling protocol will follow the procedures described elsewhere in this Report. Ground-water samples will be analyzed for VOCs via EPA Method 8260 plus heptane and TICs. All analyses will include Category B laboratory deliverables.

IGWMP activities were initiated in Fourth Quarter 2006. Quarterly ground-water sampling events were completed in December 2006 and May & September 2007, and an annual ground-water sampling event was completed in March 2007.

11.2 Ground-Water Sampling Contingencies

If COCs are detected at concentrations above 5 µg/L at off-site monitoring points MP-6, MP-14, or MP-17, the corresponding downgradient off-site point (MP-5, MP-15/MP-16, or MP-18, respectively), will be sampled during the next scheduled sampling event. If COC concentrations increase more than one order of magnitude at any off-site monitoring location, confirmatory sampling will be conducted at the well and adjacent/downgradient wells will also be sampled during the next scheduled sampling event. If COC concentrations increase more than one order of magnitude at any on-site monitoring location (except monitoring locations in the vicinity of the former tank farm area), confirmatory sampling will be conducted during the next scheduled sampling event.

During the most recent 2006 sampling event at each off-site monitoring location, and at each on-site "sentinel" sampling location, all COC concentrations were less than 1.0 mg/L. If COC concentrations increase to greater than 1.0 mg/L at any of these monitoring locations: 1) the NYSDEC Engineer will be notified within 72 hours; 2) confirmatory sampling will be conducted within 30 days of receipt of results; and 3) the need for increased monitoring and/or implementation of ICMs will be discussed with the NYSDEC Engineer.

11.3 Product Recovery

Liquid-level data will be collected using an interface probe capable of detecting FPP. If measurable FPP (APT of 0.05 foot or more) is detected at a monitoring well location, product recovery activities under the IGWMP will consist of the deployment of petrophilic socks. Passive PSH recovery (via absorbent socks) with a contingency for EFR was selected as the proposed PSH removal technology in the former tank farm area (see Section 10.0).

11.4 Product Recovery Contingency

If measurable APTs continue to occur after the deployment of petrophilic socks (or if sock deployment is not possible due to monitoring point construction constraints), a contingency for an EFR event will be invoked. A full-well, high-vacuum EFR event via vacuum truck extraction will be performed at all product-bearing wells for a minimum time period of 30-60 minutes per well.

In addition, if this contingency occurs EFR pilot testing will be performed at several selected plume wells within the building and at off-site locations. The EFR pilot test will evaluate the potential of this technology: 1) to remove dissolved-phase mass from the vicinity of each well; and 2) to circulate stagnant ground water and air flow in the vicinity of each extraction well, potentially stimulating biodegradation.

A minimum of two quarterly EFR events will be conducted under the IGWMP contingency. Following each EFR event, ground-water quality will be monitored at the EFR extraction wells to determine the effect of the vacuum event on dissolved COC concentrations. Following the second EFR event, the field data and sampling results will be evaluated with the NYSDEC to determine if continued EFR events are warranted as part of the IGWMP.

SECTION 12.0

SCHEDULE & REPORTING

Per NYSDEC CO: 4-20001205-3375, RFI Report revisions will be submitted within 45 days of receipt of comments from the NYSDEC (or within 30 days of a meeting with the NYSDEC to discuss the RFI Report, if determined to be necessary). Implementation of the proposed IGWMP, as outlined in Section 11.0 of this Report, began in the Fourth Quarter of 2006. Future activities will be modified, as necessary, based on comments received from the NYSDEC on the IGWMP.

Following NYSDEC approval of the Preliminary CMS section of the RFI Report, a pilot testing and/or bench-scale testing workplan will be developed and submitted within 45 days of receipt of comments from the NYSDEC (or within 30 days of a meeting with the NYSDEC to discuss the Workplan, if determined to be necessary). Pilot testing and/or bench-scale testing associated with the CMS will be initiated within 45 days of receipt of Workplan approval from the NYSDEC. (Note: implementation of any outdoor field activities, which may be dependent upon weather conditions and contractor availability, will likely require additional time.)

Progress reports summarizing the status of all ongoing activities associated with: 1) the continued implementation of the IGWMP; and 2) the scheduling and completion of pilot testing and other activities needed to complete the final CMS, will be submitted to the NYSDEC on a monthly basis. Storm sewer sediment sampling/EFR events are proposed on a contingency basis dependent upon observed Site conditions.

Soil, ground-water, and/or vapor samples collected in association with post-RFI activities will be submitted for standard laboratory turn-around times (two to three weeks). Copies of all final soil, sediment, ground-water, and vapor sampling laboratory data packages will be forwarded upon receipt to the NYSDEC for data validation.

Within 60 days of receipt of data validation from NYSDEC for all CMS pilot and/or bench-scale testing data, Saint-Gobain will submit the draft CMS Report to the NYSDEC for review and comment. A finalized CMS Report will be submitted for approval within 45 days of receipt of comments from the NYSDEC (or within 30 days of a meeting with the NYSDEC to discuss the Report, if determined to be necessary). A proposed post-RFI schedule is provided as Table 12-1.

SECTION 13.0

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