STATEMENT OF BASIS

ITT NIGHT VISION FACILITY

ROANOKE, VIRGINIA

April 2009

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I. INTRODUCTION

A. ITT Night Vision

This Statement of Basis (SB) describes the United States Environmental Protection Agency's (EPA's) proposed remedy for soil and groundwater containing constituents of concern originating from the ITT Night Vision (ITT NV) Facility located at 7635 Plantation Road and at Enon Drive in Roanoke County, Virginia ("the Facility" or "the Site").

The Facility is subject to the corrective action program under the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act (RCRA) of 1976, and the Hazardous and Solid Waste Amendments (HSWA) of 1984, 42 U.S.C. Sections 6901 to 6992k. The corrective action program is designed to ensure that certain facilities subject to RCRA have investigated and cleaned up any releases of hazardous waste and hazardous constituents that have occurred at their property.

Information on the corrective action program as well as a fact sheet for the Facility can be found by navigating http://www.epa.gov/reg3wcmd/correctiveaction.htm.

B. EPA's Proposed Final Remedy

EPA is proposing soil vapor extraction with institutional controls for soils. For groundwater, EPA is proposing a combination of in situ enhanced cometabolic bioremediation, institutional controls, and monitored natural attenuation (MNA).

C. Importance of Public Input

The purpose of this document is to solicit public comment on EPA's proposed remedy prior to EPA making its final remedy selection for the Facility. The public may participate in the remedy selection process by reviewing this SB and documents contained in the Administrative Record and submitting written comments to EPA during the public comment period. The information presented in this SB can be found in greater detail in the work plans and reports submitted by the Facility to EPA and to the Virginia Department of Environmental Quality (VADEQ). To gain a more comprehensive understanding of the RCRA activities that have been conducted at the Facility, EPA encourages the public to review these documents which are found in the Administrative Record.

The locations of the Administrative Record and details of the public participation process are provided in Section IX of this SB. EPA will address all significant comments submitted in response to the proposed remedy described in this SB. EPA will make a final remedy decision and issue a Final Decision and Response to Comments (FDRTC) after considering information submitted during the public comment period. If EPA determines that new information or public comments warrant a modification of the proposed remedy, EPA may modify the proposed remedy or select other alternatives based on such new information and/or public comments.

II. FACILITY BACKGROUND

The ITT NV Facility is an active manufacturing complex in Roanoke, Virginia, engaged in the manufacture of night vision products for government and commercial customers. The Facility location is shown on **Figure 1** (locus map), and is bounded by commercial, industrial, agricultural, and residential properties. As shown on **Figure 1**, the Facility includes three major buildings on two parcels of land. One portion of the Facility is located east of, and adjacent to, Plantation Road (Route 115) on a 17.6-acre lot, and is occupied by two buildings referred to as Building No. 1 and Building No. 2. (VAD003123072). Building No. 3 (VAD980550909) is situated on a 4.8-acre lot adjacent to Enon Drive and bordered by Hi-Tech Road to the north. A field encompassing approximately 4.3 acres and owned by ITT NV separates Plantation Road from Building No. 3.

ITT NV has operated manufacturing processes at the Facility since 1959. Prior to ITT NV's development of the property in 1958, the principal land use was agricultural. Previous manufacturing processes involved the use of chlorinated solvents (trichloroethene (TCE); 1,1,1-trichloroethane (1,1,1-TCA); and methylene chloride), alcohols (methanol, ethanol, and isopropanol), acetone, toluene, xylene, acid solutions (nitric, sulfuric, hydrochloric, acetic, hydrofluoric), silicon sealing compounds, and cerium oxide grinding compounds.

The discovery of groundwater containing TCE in locations down gradient of the ITT NV Facility in 1992 prompted Roanoke County and the Alleghany Regional Health Department to curtail the use of groundwater for drinking water in the vicinity surrounding the plant. ITT NV and Roanoke County immediately connected residents and businesses in the affected area to the County water system supplied from Carvin Cove Reservoir. Along with providing residents and businesses with this alternate surface water supply, the Alleghany Regional Health Department prohibits drilling of new supply wells in the affected areas. This institutional control remains in effect as a key element of the overall risk reduction program for the Facility and affected area.

Concurrent with these actions, ITT NV embarked upon a phased program of site investigation and remediation focusing on on-site source areas where chemicals associated with manufacturing operations were believed to have entered the subsurface, as well as the on-site and off-site areas to define the extent of the detected chemicals (and their breakdown products) in groundwater. Investigative work also focused on characterization of the complex hydrogeologic conditions that governed the behavior of contaminants in the clay overburden and fractured bedrock underlying the site and down gradient area.

In May 1994, ITT NV entered into a consent order with EPA to continue investigation and remediation activities under the RCRA Corrective Action Program. The Final Administrative Order on Consent (U.S. EPA Docket Number RCRA-III-071 CA) (herein referred to as the Consent Order) had an effective date of May 25, 1994. This Consent Order set forth the framework for the corrective action program that has been implemented at the Facility under Section 3008(h) of RCRA, as amended, 42 U.S.C Section 6928(h).

III. SUMMARY OF PREVIOUS INVESTIGATION / INTERIM MEASURES

In February 1992, ITT NV was notified by the Virginia Department of Health, of the discovery of TCE in the supply well located at the Tinker View Trailer Park and in some private drinking water wells. ITT NV immediately began compiling and reviewing available site data along with developing plans for on-site investigations in order to determine the source of the TCE in groundwater. TCE had been used in manufacturing operations at the Facility until 1988. The resultant Phase I Investigation Report which included the data from a number of soil borings and monitoring wells was submitted to EPA and VADEQ in January 1994.

In May 1994, with investigative work still in progress, ITT NV signed the Consent Order which set forth the framework for conducting the RCRA Facility Investigation (RFI), Corrective Measures Study (CMS), and Interim Measures (IMs) to be implemented as appropriate during the performance of the RFI and CMS.

Given the hydrogeological complexity of the on-site and off-site study areas, the RFI was designed to be implemented in a phased approach. The final RFI work plan was submitted to EPA and VADEQ in October 1994, and the draft summary RFI report was submitted to EPA and VADEQ in October 1998. Between these submittals, the following reports were issued by ITT NV:

- Stage I Data Report (May 1995)
- Stage IIA Data Report (September 1995)
- Stage IIB Data Report (August 1996)
- Supplemental Stage IIB Report (March 1998)

At the start of each phase, ITT NV submitted a work plan to EPA and VADEQ outlining investigative objectives. Each phase culminated in the issuance of a report that summarized newly available data and updated the site conceptual model that explained the modes of contaminant entry into and migration within the subsurface. Investigative findings were also discussed in face-to-face meetings at EPA Region 3's offices and via conference calls to ensure that the scope of each subsequent stage of the investigation would address evolving site characterization objectives, in addition to supporting remedial decision-making.

Additional information was presented in the bimonthly progress reports submitted to EPA as required by the Consent Order. As a result, the site Administrative Record was updated throughout the course of the RFI and contains a wealth of information documenting the phased investigative efforts conducted at and down gradient of the Facility.

The RFI field work included the following investigative methodologies:

- Aerial photo interpretation for fracture trace identification and measurements of surficial bedrock fractures to identify fracture orientation and occurrence
- Performance of soil gas surveys

- Collection of surface and subsurface soil samples for field chemical screening, laboratory analysis for target chemicals and geochemical parameters such as pH and cation exchange capacity, along with soil physical properties
- Drilling and collection of bedrock cores to characterize bedrock weathering and fracturing in the transition zone between overburden and shallow bedrock and at depth
- Construction and development of groundwater monitoring wells (including some multi-depth well clusters) in overburden and fractured bedrock on the Facility property and in down gradient locations
- Performance of an extended pumping test to characterize site hydrogeology along with fracture interconnectivity
- Field testing of monitoring well samples for groundwater geochemical parameters including pH, temperature, dissolved oxygen (DO), reduction-oxidation (redox) potential, specific conductivity, and turbidity
- Laboratory analysis of groundwater samples for biochemical oxygen demand (BOD) and chemical oxygen demand (COD), total organic carbon, nitrogen, phosphorus, sulfur, and other inorganic indicator parameters
- Collection of multiple rounds of groundwater samples from on-site and off-site monitoring wells for analysis of volatile organic compounds (VOCs), total and soluble metals, and a comprehensive list of potential chemicals through the 40 CFR 264 Appendix IX ground-water monitoring list
- Laboratory analysis of microbiological parameters to determine whether site conditions supported intrinsic (natural) biodegradation of the contaminants of concern, and whether – if present – such processes could benefit from enhanced bioremediation efforts
- Packer testing and interval sampling of groundwater from selected deep on-site and off-site water wells and monitoring wells
- Borehole geophysical testing of monitoring and supply wells using multiple tools including the acoustic televiewer which determines the locations and orientations of bedrock fractures potentially serving as migration pathways for VOCs in groundwater
- Sampling and laboratory analyses of surface water (including springs where groundwater was discharging to surface water) and sediment samples for VOCs
- Survey of investigation points and Facility features and development of a site base plan
- Sampling and laboratory analyses of indoor air samples near source areas

The data derived from these investigative efforts were used to develop and refine a site conceptual model that described the interrelationships between source areas, on-site and off-site areas of dissolved VOCs in groundwater, along with potential human and ecological receptors. Once this understanding of the important site issues and parameters was acquired, the soil and groundwater cleanup could be developed and planned.

Using this information, ITT NV proposed and EPA approved a pilot testing of bioremediation for VOC cleanup at the Building No. 3 source area during the course of the RFI. The pilot test was performed as an Interim Measure pursuant to the interim measures provision of the Consent Order. This proactive effort was undertaken to curtail the VOC loading from the source area into the underlying and down gradient groundwater. One key factor in selecting a cleanup pilot test technology was the need to avoid any interruption of critical product delivery schedules for night vision devices being manufactured for the U.S. Government and commercial customers. This approach also aligned with EPA's and ITT NV's preference for destruction of VOCs as opposed to relocation to another media. Furthermore, a complex subsurface network of utilities posed a significant challenge to any subsurface activities such as drilling, trenching, or excavation of soil.

As noted above, microbiological sampling was undertaken to determine whether in situ subsurface conditions showed the presence of microbial communities capable of natural biodegradation processes. Within the Building No. 3 source, a diverse microbial community was identified which could be capable of biodegradation through multiple naturally occurring mechanisms. Chlorinated solvents can be degraded through aerobic cometabolic and anaerobic bioremediation processes. The pilot test used aerobic cometabolic bioremediation, which targets methanotrophs that produce an enzyme (soluble methane monooxygenase). This enzyme is capable of accelerating breakdown of chlorinated hydrocarbons (TCE; 1,1,1-TCA; etc.) and a number of other VOCs (including alcohols and ketones) under enhanced conditions. These conditions involve the presence of oxygen, nutrients (nitrogen and phosphorus), and methane as a carbon source for energy. Investigative work at the Facility indicated natural biodegradation of VOCs was occurring, although not at optimum rates.

These findings led ITT NV to consider deploying enhanced bioremediation as an IM at the Building No. 3 source area for several reasons. First, as an in situ treatment technology, it met EPA's and ITT NV's preference for destruction of the VOCs to harmless end-products (water and carbon dioxide). Second, it appealed to EPA and ITT NV as an innovative technology which had shown promise elsewhere (Westinghouse Savannah River site), but was untested in a fractured bedrock environment. As a manufacturer of innovative products, ITT NV was interested in advancing the state of the practice of remediation, as long as the selected method made sense in balancing human health and environmental risk reduction, cost, and reliability. Third, since some degree of natural breakdown was already occurring, enhanced bioremediation represented a logical engineered cleanup approach of a natural process that could proceed in the subsurface with minimal disruption of Facility activities, and without generating hazardous by-products or waste streams.

Because this was an innovative technology, and outside review and validation was an important consideration in further deployment at this site and other sites in the future, ITT NV submitted an application to EPA to participate in EPA's Host Site Demonstration under the Superfund Innovative Technology Evaluation (SITE) program. This application was approved, and EPA conducted independent sampling which corroborated ITT NV's analytical results and remedial achievements. Within a period of several years, VOC concentrations in groundwater within the Building No. 3 source area were generally reduced from concentrations in excess of 10,000 µg/l (microgram per liter) to levels near or below drinking water standards in some of the monitoring wells. Based on the initial results from this IM, enhanced bioremediation was shown to be a successful remedy. Subsequently, enhanced bioremediation became the cornerstone of the overall on-site remedy, and additional IMs were proposed by the Facility and approved by EPA and implemented at the Building No. 1 source areas.

Given the low permeable clay soils and the hydrogeologic complexity of the site subsurface, there were some isolated locations where additional remediation technologies were pilot tested and operated, including soil vapor extraction, dual-phase extraction, use of Oxygen Release

Compound (ORC) "socks" in selected monitoring wells to enhance aerobic conditions, phytoremediation as a "polishing" (i.e. final stage) step in areas where the major contaminant mass had been degraded, and injection of anaerobic bioremediation amendments in selected areas. Vapor extraction has been successfully applied within the overburden zone at locations that have elevated VOC concentrations in the soil and groundwater within the Building No. 1 and 3 source areas. The integrated deployment of these technologies has enabled ITT NV to adapt to evolving site conditions and the challenges of a complex and heterogeneous subsurface regime to make significant inroads towards meeting cleanup standards.

The results obtained from the IM implementation and associated chemical, geochemical, and microbiological groundwater monitoring (along with EPA SITE program findings) were documented in the RFI, the CMS, and the progress reports, and were used to update the site conceptual model. For example, helium and methane tracer testing used to help define the zone of influence of bioremediation injection wells provided further insights into the interconnectivity of bedrock fractures previously identified through drilling, coring, and borehole geophysical investigations. In addition to advancing site understanding, ITT NV's proactive implementation of IMs early in the course of its implementation of the Consent Order resulted in aggressive source control to halt continuing contributions to the down gradient/off-site plume while the RFI and CMS were conducted. The proven success of the enhanced bioremediation approach used for the IMs provided a strong basis for the proposal of this method as the final remedy based on its site-specific effectiveness.

Concurrent with implementation of the requirements of the Consent Order, ITT NV conducted RCRA Closure activities with oversight from the VADEQ. These activities included the closure of an above ground solvent storage tank and associated piping along with the remaining underground solvent lines in Building No. 1. In the course of these efforts, some additional soil and groundwater sampling was performed, and the resultant data were also used in support of the RFI and CMS.

The RFI was approved by EPA in a letter dated January 6, 2000. The draft CMS was submitted to EPA and VADEQ on June 22, 2000, and included a detailed evaluation of six alternatives incorporating source control, management of migration, and institutional controls to address site risks. As noted above, findings from the IMs were documented in the CMS and provided a technical basis for the evaluation of Long-Term and Short-Term Effectiveness. Long-Term and Short-Term Effectiveness are two of seven balancing/evaluation criteria used by EPA to identify the best remediation alternative. Based on this evaluation, ITT NV recommended Alternative 4 identified in the CMS as the site remedy. Alternative 4 consisted of in situ treatment including soil vapor extraction and enhanced bioremediation for the Building No. 1 and 2 source areas, enhanced bioremediation for the Building No. 3 source area, natural attenuation for down gradient groundwater, monitoring, and institutional controls.

On July 30, 2001, ITT NV submitted to EPA the Final Draft Performance Evaluation Work Plan. This document described the performance evaluation of Alternative 4 from the CMS. On August 27, 2001, ITT NV received verbal approval from EPA of the Performance Evaluation Work Plan. Since that time, monitoring results and summaries of ongoing response actions have been presented to EPA and the VADEQ in periodic progress reports. With EPA's approval, the frequency of progress reporting was reduced from bimonthly to quarterly in December 2002.

Within the Building No. 3 source area, ITT NV performed full scale aerobic cometabolic amendment injection at a number of locations to stimulate bioremediation from 1999 to 2005. SVE was performed within this source area intermittently from 2001 to 2005. In 2005, ITT NV, with EPA approval, suspended operation of these systems to monitor and evaluate potential rebound of the VOC concentration in groundwater within the source area. Only limited rebound was observed in one monitoring well within the source area. Some very limited and localized sodium lactate injection was performed in this source area during 2007 and 2008 to determine/evaluate whether the natural anaerobic bioremediation degradation rate could be enhanced with further active remediation activities.

ITT NV installed a number of monitoring and injection wells throughout the Building No. 1 source area from 2001 to 2008 to support the full scale soil and groundwater remediation activities. During this period of time, ITT NV performed aerobic cometabolic amendment injection along with anaerobic bioremediation amendment injections throughout the Building No. 1 source area. These injections are currently ongoing in areas with elevated VOC concentrations within the Building No. 1 source area. SVE operation was performed within this source area intermittently from 2000 to 2001 and 2006 to 2008 in areas exhibiting elevated VOC concentrations in soil and shallow groundwater. These activities along with the associated VOC reductions have been reported in the Quarterly Progress Reports.

IV. SITE CHARACTERIZATION

A. Surface Water Hydrology

There are no surface water bodies on the Facility. Carvin Creek is the largest surface water body near the site, originating north of the Facility at Carvin Creek Reservoir and flowing in a generally southeasterly direction, passing approximately 0.5 miles east of the Facility. Northeast of the Facility on the Huffman property, there is a perennial spring which feeds an unnamed intermittent creek which is a tributary to Carvin Creek. Another minor intermittent spring and stream are located south of Building No. 3, also discharging to Carvin Creek. These two springs and streams and several smaller springs and streams all drain to Carvin Creek.

According to the U.S. Geological survey, streams and creeks in the area receive approximately 90% contribution from groundwater. During periods of high water table conditions, groundwater will appear as seeps or springs. As part of the RFI, ITT investigated several off-site springs representing groundwater discharge. Water samples from these springs were sampled for VOCs, and discharge rates at three of the springs were measured using weirs. Measured discharge rates were all at or below 0.35 gallons per minute (gpm)

B. Groundwater Hydrology

Groundwater investigations at the Facility and in the associated study area focused on three zones: overburden, transition zone/shallow (top 15 feet) bedrock, and upper (top 150 feet) bedrock.

The natural unconsolidated overburden consists primarily of silty clay. Nine of the RFI monitoring wells installed by ITT NV were screened in the overburden, along with four soil gas points. Overburden thickness ranges from zero (at bedrock outcrops) to 29 feet, averaging 14 feet. Both the natural clay and the clay fill are characterized by very low hydraulic conductivity; testing on undisturbed samples yielded measurements of 4×10^{-7} centimeters per second (cm/sec) to 5×10^{-5} cm/sec. Groundwater flow direction in the overburden is to the south and southwest, mimicking local topography.

The shallow bedrock/transition zone reflects a gradational change between the overburden and competent bedrock. As part of the RFI field work, 35 monitoring wells were drilled and constructed with screened intervals in the shallow bedrock/transition zone. This unit ranges in thickness from zero (in areas of bedrock outcrops) to 11.5 feet thick. Due to the high degree of weathering and fracturing of this shale material, the upper portion of this zone is characterized by variable hydraulic conductivity. The water table fluctuates between overburden and the shallow bedrock/ transition zone depending upon seasonal precipitation events. ITT NV's RFI investigation found that groundwater elevations in the shallow bedrock/transition zone fluctuated over a range of 13 feet, such that the top 5 feet of this zone could be unsaturated at certain times of the year.

The upper bedrock consists of interlayered shale and limestone with sporadic calcite veins. The RFI subsurface investigation included installation of 19 monitoring wells, borehole geophysical surveys, and packer testing/interval sampling of wells in this unit, including the former ITT supply wells extending up to 500 feet in depth. The primary interval of focus from the perspective of VOC migration extended to a depth of approximately 150 feet. Within this upper bedrock zone, between 35 and 65 feet BGS, is where the highest transmissive zones were encountered that contained the highest VOC concentrations in groundwater. This zone is believed to be the principal zone where VOC migration has occurred away from the source areas. The most significant water-bearing zones included fractures with no visible weathering to very limited amounts of weathering along with weathered zones containing fine-grained materials.

Several on-site and off-site bedrock monitoring wells encountered "mud seams" which appeared to be highly fractured zones which are weathered beyond competency and structure, and which are relatively highly transmissive. These features were considered important in the site conceptual model as more rapid pathways for VOC migration to off-site areas. Overall groundwater flow direction in the upper bedrock mimics the flow in the overlying units, with flow primarily to the south and southeast. However, a portion of the VOC plume migrates to the northeast away from Building No. 1 which may be influenced by fracture orientation in the bedrock.

C. Constituents of Concern

1. Surface Water

Throughout the course of the RCRA Facility Investigation activities, surface water samples from several stream and spring locations in the vicinity of the ITT NV Facility were collected and laboratory tested. Analytical results indicated the two spring locations were reported to contain a chemical of concern (TCE reported to exceed the applicable Maximum Contaminant Level (MCL) promulgated at 40 C.F.R. Part 141, pursuant to Section 1412 of the Safe Drinking Water Act (SDWA), 42 U.S.C. Section 300g-1). Both of these sampling points are spring locations on a farm adjacent to ITT which are not being used for human consumption. The TCE concentrations in surface water were evaluated during the risk assessment and determined to not currently pose a significant risk to nearby residents or ecological receptors.

2. Groundwater

On-site groundwater sampling at the Facility began in 1991 and continued throughout the phased RFI. Additional groundwater sampling has been performed in support of effectiveness monitoring for the IMs that have been implemented at on-site source areas. Off-site sampling of monitoring wells and supply wells has also been performed during this same period. These efforts have addressed groundwater quality in overburden, shallow bedrock, and deep bedrock.

During the ITT NV Facility investigations, groundwater has been sampled and analyzed for metals (total and soluble), Appendix IX Ground-Water Monitoring List (VOCs, priority pollutant metals (total and soluble)), acid and base/neutral extractables (ABNs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), pesticides, herbicides, dioxins, and furans). The groundwater constituents of concern that have emerged from this effort to become the focus of the RFI and IMs as listed in the USEPA letter dated January 6, 2000 are as follows:

- Acetone
- Chloroethane
- 1,1-Dichloroethane
- 1,1-Dichloroethylene
- Cis-1,2-Dichloroethylene
- Trans-1,2-Dichloroethylene
- Isopropanol
- Methylene chloride
- Tetrachloroethene (PCE)
- 1,1,1-TCA
- TCE
- Toluene
- Vinyl chloride

It should be noted that 1,2-DCE and vinyl chloride were not used at the Facility but are breakdown products of TCE, thus their detection provides confirmation that biodegradation processes were occurring naturally (albeit at a very slow rate) prior to the implementation of enhanced bioremediation as IMs.

The above-listed VOCs occur in groundwater in a dissolved phase. ITT NV's groundwater investigations included testing for the presence of dense, non-aqueous-phase liquid (DNAPL) in zones where elevated concentrations of chlorinated VOCs had been detected and suggested the possible presence of DNAPL. Results yielded no identified DNAPL.

3. Soils

As in the case of groundwater, Facility soils have been sampled and analyzed for metals and VOCs. VOCs have emerged as the constituents of concern as a potential source for leaching into groundwater. The primary VOCs detected in Facility soils include:

- Acetone
- 1,2-DCE (total)
- Isopropanol
- TCE

D. Extent of VOCs in Groundwater

At the completion of the RFI, 71 on-site and off-site wells had been sampled between one and eight times. Additional groundwater sampling has been conducted in support of IM implementation and ongoing site-wide monitoring, as reported to EPA and VADEQ in the Progress Reports issued subsequent to the RFI report. These collective efforts have addressed the overburden and bedrock zones. As a result, there is a wealth of data to delineate the extent of VOCs in groundwater and changes in VOC concentrations over time.

Given the heterogeneous conditions in the complex fractured bedrock setting beneath the Facility and off-site area, it is important to recognize that the dissolved-phase of VOCs in groundwater does not occur as a clearly-defined "plume." However, the nature and extent of VOCs in groundwater are adequately defined to support cleanup activities. The migration of dissolved VOCs in groundwater is controlled by the location and interconnectivity of water-bearing fractures. In general, the resultant pattern of VOCs in groundwater reflects decreasing concentrations with increasing distance from the source areas, as expected. Implementation of multiple groundwater remediation IMs has also influenced this pattern of VOCs in groundwater, since significant VOC concentration reductions have occurred in the source area. In some source areas, the VOC concentrations are approaching MCLs.

Nonetheless, there are clearly defined source areas on site and areas of impacted groundwater on and off site as documented by multiple rounds of drilling, well installation, and groundwater sampling. **Figure 2** is an aerial view of the Facility with the approximate location of the source areas. **Figure 3** presents the total VOC concentrations within the Building No. 1

source area prior to active remediation. **Figure 4** presents the recent total VOC concentrations for the Building No. 1 source area. Due to the intermingled nature of the VOCs in the Building No. 3 source area, the acetone and isopropanol data are presented on **Figures 5** and **6** while the chlorinated hydrocarbon data are presented on **Figures 7** and **8**. Significantly lower concentrations are found in the down gradient portion of the Facility and at off-site down gradient locations. Each of the source areas is discussed below.

1. Buildings No. 1 and 2 Source Areas

Two areas of concern were identified in the vicinity of Buildings No. 1 and 2. The first is located adjacent to the former acetone and isopropanol underground storage tanks and associated piping. The second covers a larger area beneath the former drum storage area and former above-ground waste solvent storage tanks, extending to the south and northeast of these former features.

As expected, groundwater sampling for VOCs identified acetone and isopropanol as the constituents of concern in overburden and shallow bedrock in the first source area, with acetone concentrations reported on the order of 16,000,000 µg/l in vapor extraction monitoring wells. The variability of acetone concentrations over time at individual monitoring wells in this source area suggests that concentrations are related to fluctuations in water table elevation. Isopropanol has only been detected to a limited extent in overburden and shallow bedrock in this area at concentrations ranging up to 65,000 µg/l.

The second area of concern is south of Building No. 1, where VOC constituents including TCE and daughter products such as cis-1,2-DCE, 1,1-DCE, and Vinyl chloride were found in groundwater sampling. The highest concentration of TCE detected during the RFI was 89,000 µg/l. The highest concentration of breakdown product cis-1,2-DCE was 6,100 µg/l, and Vinyl chloride was only detected at concentrations up to 58 µg/l. Some detections of 1,1,1-TCA were noted up to 58 µg/l in this area during the RFI.

ITT NV's field investigations included interval sampling of the screened/open zones of deeper wells and in nested monitoring wells in order to characterize vertical differences in VOC concentrations. In the deeper bedrock zones in the Buildings No. 1 and 2 source areas, the only constituents of concern detected were the chlorinated VOCs, TCE and natural breakdown products.

2. Building No. 3 Source Area

The Building No. 3 source area is associated with an underground waste solvent storage tank formerly located to the west of Building No. 3. Groundwater beneath and to the south of the former tank location reflects dissolved-phase acetone, isopropanol, and chlorinated VOCs (TCE and 1,1,1-TCA) along with their breakdown products (1,1-DCE; cis-1,2-DCE; VC; 1,1-dichloroethane (1,1-DCA); and chloroethane. TCE was detected in the overburden and shallow bedrock at low concentrations relative to the daughter products suggesting that natural biodegradation was occurring. Specifically, daughter product cis-1,2-DCE was detected at the highest concentration of any of the chlorinated VOCs.

Acetone and isopropanol concentrations were significantly higher than those of the chlorinated VOCs in overburden and shallow bedrock. Acetone concentrations ranged as high as 980,000 μg/l, and isopropanol concentrations ranged as high as 3,900,000 μg/l.

Figures 3, 4, 5, 6, 7, and 8 present the dissolved VOC distribution and VOC changes overtime. The VOC distribution in groundwater does not conform to a continuous and homogeneous "plume," given the multiple water-bearing zones and preferential pathways formed by higher yielding bedrock fractures. Nonetheless, VOCs appear to have migrated downgradient from the Building No. 3 source area along the prevailing southerly groundwater flow direction.

ITT NV's groundwater sampling in monitoring wells open to the deeper bedrock found a similar relationship as compared to Building No. 1 with acetone and isopropanol being below detection limits and the chlorinated VOCs present. TCE appears to have broken down to cis-1,2-DCE and VC, either within the deeper bedrock, or at shallower depths with downward migration into the deeper bedrock.

a) Off-Site Downgradient Groundwater

ITT NV's sampling of off-site supply wells and monitoring wells provided information regarding the extent of dissolved-phase VOCs in groundwater downgradient of the source areas.

In the areas to the south of the Buildings No. 1 and 2 source areas, TCE concentrations from the RFI sampling ranged from 1.7 μg/l to 4,100 μg/l. Concentrations of cis-1,2-DCE (where detected) ranged up to 320 μg/l, suggesting natural breakdown of the TCE. In the areas to the south of the Building No. 3 source area, TCE concentrations from the RFI sampling ranged from 6.1 μg/l to 40 μg/l. These results suggest that natural attenuation effects (dilution, dispersion, degradation) are acting to reduce VOC concentrations with increasing distance from the source areas. Groundwater quality information was also collected for an area to the north of the Buildings No. 1 and 2 source areas at the Huffman well where TCE was detected on the order of 300 μg/l. Overall, the on-site and off-site plume appears to have been at a stable configuration during and after the RFI. There is evidence that the on-site source removal efforts conducted under the IM provisions of the Consent Order, along with natural attenuation processes, have led to VOC reductions in off-site groundwater.

E. Extent of VOCs in Soil

ITT NV's investigations included collection and analysis of 78 soil samples for the Buildings No. 1 and 2 source areas, and 42 samples for the Building No. 3 source area, as well as additional samples in support of RCRA Closure work and on-site construction. As noted above, the constituents of concern for soil were limited to VOCs, and detections were clearly linked to the source areas. The low permeable clay overburden soils and fill are likely a key factor in the limited lateral or vertical migration of the constituents of concern, and their presence in groundwater is likely the result of direct contact during periods of elevated water table conditions.

V. SUMMARY OF HUMAN HEALTH RISK ASSESSMENT

As part of the RFI process, ITT NV performed a site-specific human health risk assessment including identification of constituents of concern exposure assessment, toxicity assessment, and risk characterization. The results are presented in their entirety in Appendix I of the RFI and summarized in Section 10 of the RFI. Those results are summarized below.

A. Soil Exposure Pathways

Four constituents of concern were identified for soil on site, specifically:

- Acetone
- Isopropanol
- TCE
- cis-1,2-DCE

The human health risk assessment considered the following current and future exposure scenarios:

- Current Facility worker direct contact with surface soil
- Maintenance or utility worker direct contact with subsurface soil
- Maintenance or utility worker inhalation of VOC vapors from soil
- Hypothetical future on-site resident exposure to site soil

It should be noted that the Facility's current and reasonably foreseeable land use is industrial, and there are no expectations that the site would be converted to residential use. However, the evaluation of hypothetical residential scenarios for soil and groundwater exposure was a requirement of the risk assessment scope of work. ITT NV has maintained access controls and Facility-wide protocols that establish pre-planning procedures and health and safety protective measures for disturbance of site soils. These controls will remain in place to protect Facility workers, maintenance workers, and utility workers from exposure to VOCs in soil via direct contact, ingestion, or inhalation of particulates or vapors until the cleanup standards are met.

Off-site locations only contain chemicals in soil related to groundwater containing chemicals of concern and are therefore at depth (15 to 30 ft BGS). Due to the depth and low concentrations of chemicals of concern in off-site soil, the off-site soil does not pose a significant risk to residents and workers along with ecological receptors.

B. Groundwater Exposure Pathways

The human health risk assessment considered the following current and future exposure scenarios for the VOCs in groundwater:

- Current Facility worker inhalation of vapors volatilizing into indoor air from groundwater
- Off-site resident ingestion from currently inactive supply wells
- Off-site resident use of groundwater as a source of water for beef cattle

Each of the three exposure scenarios listed above was evaluated for the four classes of health effects listed under Section A, Soil Exposure Pathways, above. The only scenario that was found to present an unacceptable risk was the hypothetical scenario involving off-site resident ingestion of groundwater from inactive supply wells, which was found to result in estimated potential risks above the target carcinogenic risk level. However, it should be noted that ITT NV has taken proactive steps to ensure that this scenario remains hypothetical, as the moratorium on the use of supply wells in the affected area will remain in place until cleanup standards are met as determined by EPA.

C. Surface Water Exposure Pathways

While surface water was not found to be an environmental medium of concern based on ITT NV's investigations including the RFI, one surface water exposure scenario was evaluated. This scenario involved off-site resident exposure to surface water through wading in unnamed tributaries and Carvin Creek. The risk characterization for this scenario was not found to present unacceptable human health risks.

D. Air Exposure Pathways

As noted previously in Section A. Soil Exposure Pathways, the risk assessment considered the potential for Facility worker, maintenance worker, and utility worker exposure to VOC vapors from surface and subsurface soils. As part of the risk assessment, a mathematical model was used to evaluate the potential for indoor air issues based on available soil quality data and this evaluation determined that the current building configuration does not result in unacceptable risk levels to workers. Furthermore, prior to implementation of the VE components of the IMs at the Facility, air emissions from soil were estimated based upon sampling and analysis of soil vapor and reviewed with VADEQ. The levels were acceptable to VADEQ and did not require permits or controls.

Also, indoor air samples were collected and analyzed at areas of potential concern from soil gas intrusion inside of ITT NV Facility buildings. The laboratory results indicated that the indoor air quality did not pose unacceptable risk levels to workers. ITT NV submitted these results to EPA in a letter dated September, 1999. EPA determined that indoor air quality at the Facility is not adversely impacted by the volatile organic compounds present in the soils and groundwater and documented this review in a letter dated January 6, 2000.

Air exposure pathways for construction workers encountering site soils and groundwater in the subsurface can be controlled through implementation of ITT NV's soil management plan.

VI. SUMMARY OF ECOLOGICAL RISK ASSESSMENT

As part of the RFI, a qualitative ecological risk assessment was conducted, the results of which are presented in the RFI report. This risk assessment concluded that ecological receptors are not expected to contact chemicals in soil, soil gas, or groundwater, and that concentrations of site-related chemicals in surface water and sediment were well below levels of potential concern and thus unlikely to pose a risk to ecological receptors.

VII. SUMMARY OF PROPOSED REMEDY

Traditional and innovative remedial technologies were evaluated during the course of the phased RFI for deployment as IMs at the ITT NV Facility. The subsequent evaluation of remedial technologies and alternatives in the CMS utilized the site-specific findings from the implementation of the IMs to evaluate their adaptability and effectiveness. As a result, the technical components of the proposed remedy described below have already been "field tested" and proven effective in the hydrogeological and geochemical conditions prevailing at the ITT NV Facility. Further corroboration of the effectiveness of the enhanced bioremediation components of the proposed remedy was provided through ITT NV's involvement in EPA's Host Site Demonstration under the Superfund Innovative Technology Evaluation (SITE) program.

A. Scope of Remediation

ITT NV's remediation objective was based on the premise that aggressive source removal, coupled with early implementation of institutional controls to remove potential exposure pathways associated with off-site groundwater use in the affected area, would ensure protection of human health and the environment while other long-term remedial options were evaluated. Accordingly, several source control IMs were implemented, beginning during the course of the RFI, to address VOC mass in the Buildings No. 1 and 2 and Building No. 3 source areas. Of the numerous technologies applied and field tested, enhanced bioremediation and VE are attributed with the most significant VOC reductions within the source areas.

The source control IMs accelerated the destruction of VOCs in situ to cut off further contributions to underlying and down gradient groundwater. These IMs, coupled with implementation of institutional controls, set the stage for consideration of other remedy components that would be further protective of human health and the environment while taking into account the hydrogeological complexities of the site.

The proposed remedy incorporates on-site active remediation (VE and enhanced bioremediation), off-site institutional controls, and MNA, and was designated as Alternative 4 in the CMS. The enhanced bioremediation process represents an engineered optimization of the natural biodegradation processes that had been documented through available site data.

B. Groundwater Cleanup Standards

The groundwater cleanup standards for the site are drinking water standards. These standards are established by the Maximum Contaminant Levels (MCLs) promulgated at 40 CFR 141, pursuant to Section 1412 of the Safe Drinking Water Act (SDWA), 42 USC Section 300g-1. For contaminants of concern without an applicable MCL, EPA's Risk Based Concentration (RBC) for tap water established by EPA Region III in 2006 will be used. Since there is no promulgated RBC for isopropanol, EPA Region III developed 1200 ppb as a cleanup standard. Thus, the groundwater cleanup standards for the Facility are as follows:

- 1,1,1-TCA 200 ppb MCL
- 1,1-DCA 2.4 ppb RBC
- 1,1-DCE 7 ppb MCL
- Acetone 22,000 ppb RBC
- Chlorobenzene 100 ppb MCL
- Chloroethane 3.6 ppb RBC
- Isopropanol 1200 ppb Derived
- Methylene chloride 5 ppb MCL
- Tetrachloroethene 5 ppb MCL
- Toluene 1,000 ppb MCL
- TCE 5 ppb MCL
- VC 2 ppb MCL
- cis-1,2-DCE 70 ppb MCL

C. Proposed Remedy

1. Soil

As discussed above, none of the soil exposure scenarios evaluated in the risk assessment were found to pose an unacceptable risk to human health or the environment. Therefore, active soil remediation (i.e. vapor extraction) has only targeted site soil in locations (typically overburden/bedrock interface) that appeared to have contributed to elevated VOC concentrations in groundwater in support of the groundwater cleanup. The numerous vapor extraction areas of operation and monitoring data have been presented and discussed in previous Progress Reports. The soil in the Building No. 3 source area will continue to benefit from the "polishing" effects of phytoremediation through the tulip poplar trees already planted.

2. Groundwater

The proposed remedy incorporates vapor extraction and in situ enhanced bioremediation to address the on-site source areas. The vapor extraction is aimed at removing chlorinated VOC source material located above the bedrock surface in the partially saturated overburden to directly remove VOCs and stimulate aerobic bioremediation. Implementation of the IMs at the ITT NV Facility has demonstrated that mass removal via VE in conjunction with enhanced bioremediation have been effective in reducing VOC concentrations in groundwater by several orders of magnitude.

As discussed above, these technologies are already in use as IMs, and have been supplemented with other response actions (ORC "socks", and phytoremediation) as further efforts to deal with recalcitrant zones of residual material or to provide "polishing" of low concentrations of VOCs remaining in the source area overburden. ITT NV is currently performing vapor extraction and enhanced bioremediation in the Building No. 1 source areas as needed. The VOCs remaining within Building No. 3 source area are approaching a point when natural attenuation processes appear to be equal to degradation rates observed from continued active remediation efforts within this source area.

Figures 9 and **10** show the locations of the cleanup efforts conducted to date and show where remediation is focused to address the source areas. Given the complex site conditions at the ITT NV Facility, it is difficult to accurately determine the remediation time frames required to meet the cleanup standards at all locations across the site. The results of the IMs currently underway have successfully reduced VOC concentrations by several orders of magnitude in portions of the source areas. However, portions of the subsurface continue to retain residual source material that is resistant to remediation efforts and require additional focused bioremediation amendment injections.

MNA is an important component of the on-site and off-site remediation strategy to achieve the remedial endpoints. As source area contributions are eliminated, the dissolved-phase VOCs in groundwater will continue to be reduced through natural attenuation processes (dilution, dispersion, biodegradation). This approach is expected to result in attainment of the groundwater cleanup standards based on available site data. As noted above, the timeframe for achieving cleanup standards is difficult to determine, but ITT NV will continue to keep EPA apprised of progress toward these goals as determined through groundwater monitoring.

With EPA concurrence, ITT NV suspended aerobic cometabolic bioremediation in the Building No. 3 source area in November 2005 in order to evaluate potential "rebound" effects and determine the extent of remaining residual VOC mass in this source area. The VOC concentrations in groundwater have been reduced significantly with only limited rebound in one of the monitoring locations, and subsequent groundwater sampling events showed additional VOC concentration decreases. If this VOC concentration trend continues, MNA would be a feasible next step for this source area.

3. Institutional Controls

Institutional controls have been a cornerstone of ITT NV's risk reduction efforts and will be a key component of the proposed remedy.

a) Institutional Controls Already In Place

The institutional controls described above in Section II, Facility Background, will remain in effect. ITT NV has worked closely with Roanoke County and the Alleghany Regional Health Department to ensure that these institutional controls are maintained until cleanup standards are met for affected areas. ITT NV performs an annual visual tour of the affected area to confirm that no new supply wells have been installed, and contacts the Alleghany Regional Health Department to ensure that controls are maintained.

ITT NV also maintains access controls and construction protocols governing excavation and other work involving contact with potential VOC-laden media. All contractors engaged in Facility work are provided with written copies of these protocols and site-specific, task-specific safety briefings prior to the start of work that could involve contact with VOC-laden media.

The surface water supply for the area residences and businesses is monitored and controlled by Western Virginia Water Authority.

The two parcels of land in which ITT NV operates its manufacturing facilities are zoned for industrial use. Any zoning change would require Roanoke County approval.

b) Additional Proposed Controls

EPA is proposing additional institutional controls beyond what is currently in place to enhance the protectiveness of the remedy. Institutional controls are most effective if layered or implemented in series. Layering institutional controls means using different types of institutional controls at the same time to enhance the protectiveness of the remedy. For the two ITT parcels, additional institutional control mechanisms include informational control (i.e. deed notice) and proprietary control (i.e. restrictive covenant).

Informational Control: EPA proposes that a deed notice be filed and maintained by ITT NV to notify prospective owners of ITT properties of the restriction on the use of groundwater until such time that it is restored to the proposed cleanup standards. The notice will reflect the limitation on the use of the property to industrial use until such time that EPA determines that all cleanup standards have been met.

Proprietary Control: If ITT enters into an agreement for the transfer of the property , ITT will require the successor in interest to include and comply with the restrictions that run with the land until such time that the cleanup standards have been met.

EPA proposes to require ITT NV to submit biennial review reports on the effectiveness of the institutional controls in meeting the human health and environmental protection objectives. The review may include but not be limited to review of groundwater and land uses within 0.5 mile of the Facility, and zoning maps or planning documents that may affect future land use in the impacted area. Additionally, EPA proposes that ITT NV submit 5-year review reports on the progress of meeting the cleanup standards. Roanoke County, Alleghany Regional Health Department, and the Virginia Department of Environmental Quality, which entities are essential to the institutional controls program, will be provided with ITT NV's biennial review reports and 5-year review reports.

VIII. EVALUATION OF PROPOSED REMEDY

This section provides a description of the criteria EPA uses to evaluate proposed remedies under the Corrective Action Program. The criteria are applied in two phases. In the first phase, EPA evaluates three remedy "Threshold Criteria" as general goals. In the second phase, for those remedies which meet the threshold criteria, EPA evaluates seven "Balancing Criteria" to determine which proposed remedy alternative provides the best relative combination of attributes.

A. Threshold Criteria

1. Overall Protection of Human Health and the Environment

Activities undertaken have already resulted in protection of human health and the environment, and will continue to do so as further progress is made toward the remediation goals. The human health exposure pathway was removed prior to the start of the RFI through institutional controls and connecting drinking water systems of area residences and businesses to the Carvin Cove Reservoir. As previously mentioned, no adverse ecological impact was identified.

In addition, the active remediation has eliminated considerable VOC mass in the on-site source areas, curtailing continued groundwater VOC loading to the down gradient dissolved-phase VOCs. The active remediation will ensure that the MNA approach for the down gradient areas will continue to be protective of human health and the environment. This three-fold approach – active remediation, institutional controls, and MNA – provides an integrated approach to the protection of human health and the environment.

2. Attainment of Media Cleanup Standards

Results from the Building No. 3 enhanced bioremediation IM have indicated reductions in the concentrations of constituents of concern by several orders of magnitude, in some cases achieving levels at or below drinking water standards in source area monitoring wells. VOC concentrations in groundwater following active remediation indicate that MNA is continuing to reduce the VOC concentrations. Based on the currently available on-site and off-site data, the proposed active remediation technologies (vapor extraction and enhanced bioremediation) will be able to remove a significant (an estimated 99% at Building No. 3) amount of the VOCs in the source areas which leads to a decrease in the time to achieve media cleanup standards through MNA.

3. Source Removal

The application of vapor extraction and enhanced bioremediation have been achieving source removal as documented through Progress Reports. Source removal will continue with these technologies (vapor extraction and enhanced bioremediation) in areas that exhibit elevated VOC concentrations until either no longer technically feasible or the concentrations approach natural unamended (MNA) degradation rates.

B. Balancing Criteria

1. Long-Term Reliability and Effectiveness

The components of the proposed remedy and risk reduction for the ITT NV Facility and surrounding area have been shown to be effective during the 14 years of groundwater monitoring at the site. The active remediation methods have led to significant source removal in areas of elevated VOCs during their 10 years (approximate) of deployment at the site. Several off-site monitoring wells have long-term trends of decreasing VOCs which indicate that natural attenuation is effective under passive conditions. The technologies have proven their effectiveness in complex and challenging site-specific fractured bedrock conditions. After periods of system shutdown, the risk reduction benefits have continued, suggesting that these methods will provide the long-term reliability and effectiveness expected.

2. Reduction of Waste Toxicity, Mobility or Volume

In selecting a remedial approach, EPA evaluated in situ technologies that would reduce waste toxicity, mobility, and volume. The vapor extraction component of the proposed remedy has been successful in removing significant VOC mass; the enhanced bioremediation component is reducing toxicity by breaking down VOCs to non-toxic end products. This engineered acceleration of a natural biodegradation process was also viewed favorably as an "environmentally friendly" technology. Since the enhanced microbial populations will return to preinjection levels once the source area cleanup is completed, the groundwater will be suitable for future use once cleanup standards are met, thereby restoring it as a useable resource.

3. Short-Term Effectiveness

Based on the IMs currently in place, the proposed remedy has already proven its short-term effectiveness in meeting risk reduction goals with minimal hazards to site workers, remedial project participants, and local residents. By utilizing in situ methods, fugitive emissions and direct contact exposure scenarios are minimized or eliminated.

4. Implementability

Based on the success of the IMs implemented to date, the proposed remedy has been proven to be fully implementable with readily available methods and materials.

5. Cost

The proposed remedy represents an appropriate balance between cost and risk reduction, while still incorporating innovative elements that will offer benefits to other sites facing similar challenges. ITT NV has already expended the majority of capital costs required for implementation and a considerable portion of the operation and maintenance (O&M). The CMS estimated that the costs for implementation of Alternative 4 included $1,927,300 in capital cost and a net present worth O&M cost of $1,819,500 for a total of remedy cost of $3,746,800. To date, approximately $6.2 million has been expended on this project including investigation and remediation costs. The incremental additional costs of maintaining institutional controls are included in this total.

6. Community Acceptance

Community Acceptance of the proposed remedy will be determined based on comments from the public. To date, ITT NV's efforts have met with public approval. Public meetings were held on September 24, 1992, and November 29, 2000. An updated Community Relations Plan was submitted to EPA dated August 4, 1994. An updated/revised plan was submitted in October 2002 and approved by EPA in November 2002.

7. State Acceptance

The VADEQ agrees with EPA's proposed remedy for the Facility. ITT NV and EPA have kept VADEQ apprised of investigative findings, remediation results, and the continuing status of institutional controls. EPA has solicited input from VADEQ prior to issuing approvals to ITT NV at each stage of the RCRA Corrective Action process.

IX. PUBLIC COMMENT

On April 20, 2009, EPA placed an announcement in the Roanoke Times to notify the public of EPA's proposed remedy and the location of the Administrative Record. Copies of this Statement of Basis will be mailed to anyone who requests a copy. The Administrative Record, including this Statement of Basis, is available for review during business hours at two locations:

U.S. Environmental Protection Agency
Region III
1650 Arch Street
Philadelphia, Pennsylvania 19103
Telephone Number: (215) 814-3435
Attn: Mr. Michael Jacobi

and

Roanoke County Public Library
Hollins Library
6624 Peters Creek Road NW
Roanoke, Va. 24019.
Telephone Number: (540) 561-8024.

EPA is requesting comments from the public on the remedy proposed in this SB. The public comment period will last 30 calendar days beginning April 20, 2009, and ending May 20, 2009. Comments on, or questions regarding, EPA's preliminary identification of a proposed remedy may be submitted to:

Mr. Michael Jacobi
U.S. EPA, Region III
1650 Arch Street
Philadelphia, PA 19103
(215) 814-3435
FAX (215) 814-3113
Email: jacobi.mike@epamail.epa.gov

Following the 30-day public comment period, EPA will hold a public meeting on EPA's proposed remedy if sufficient public interest indicates that a meeting would be valuable for distributing information and communicating ideas. After evaluation of the public's comments, EPA will prepare a Final Decision Document and Response to Comments (FDRTC) that identifies the final selected remedy. The FDRTC will also address all significant written comments and any significant oral comments generated at the public meeting. The FDRTC will be made available to the public. If, on the basis of such comments or other relevant information, significant changes are proposed to the corrective measures identified by EPA in this SB, EPA may seek additional public comments.

The final remedy will be implemented using available legal authorities possibly including, but not necessarily limited to, RCRA Section 3008(h), 42 U.S.C. 6928(h).

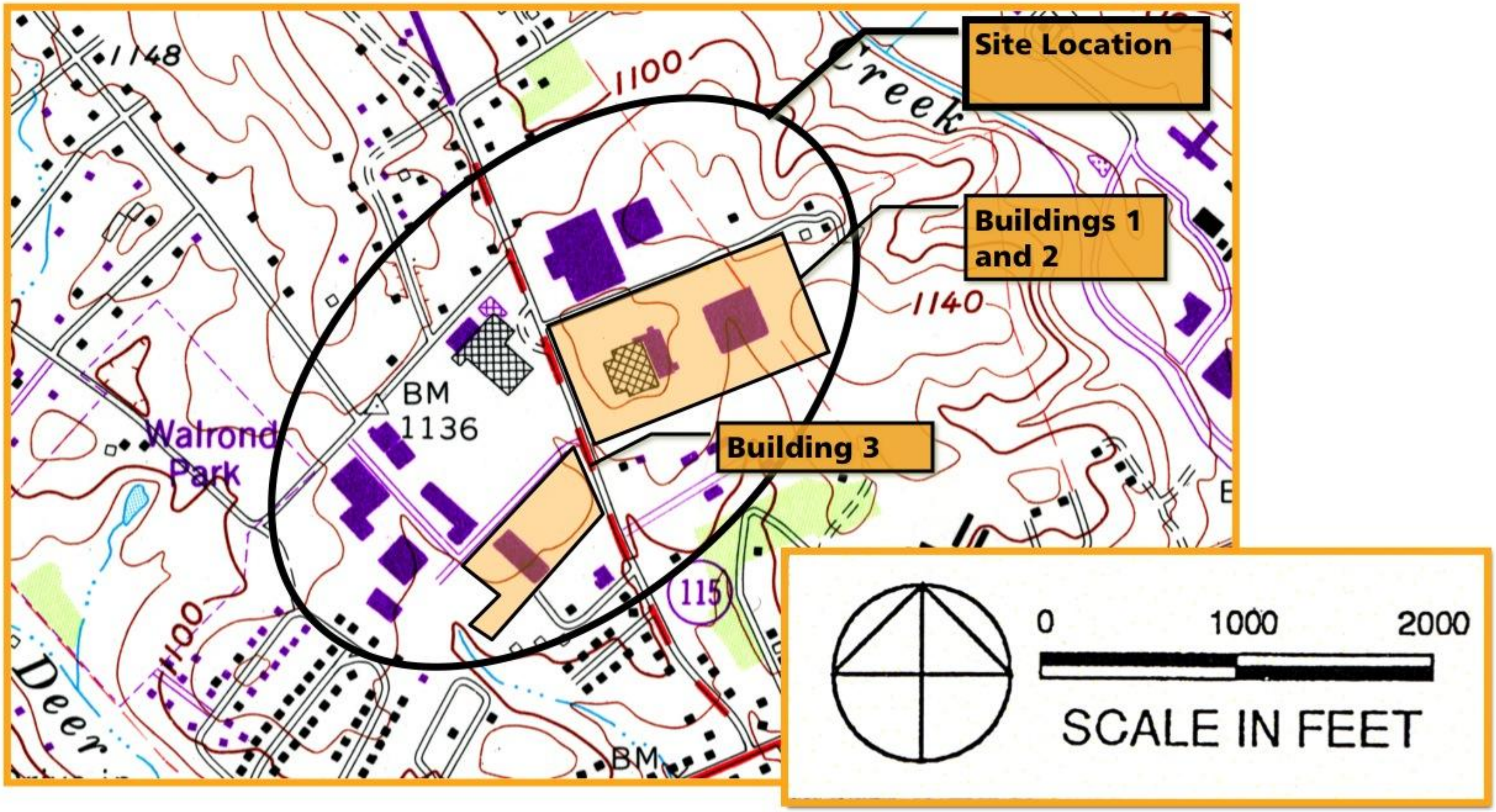


Figure 1. Site Location Map

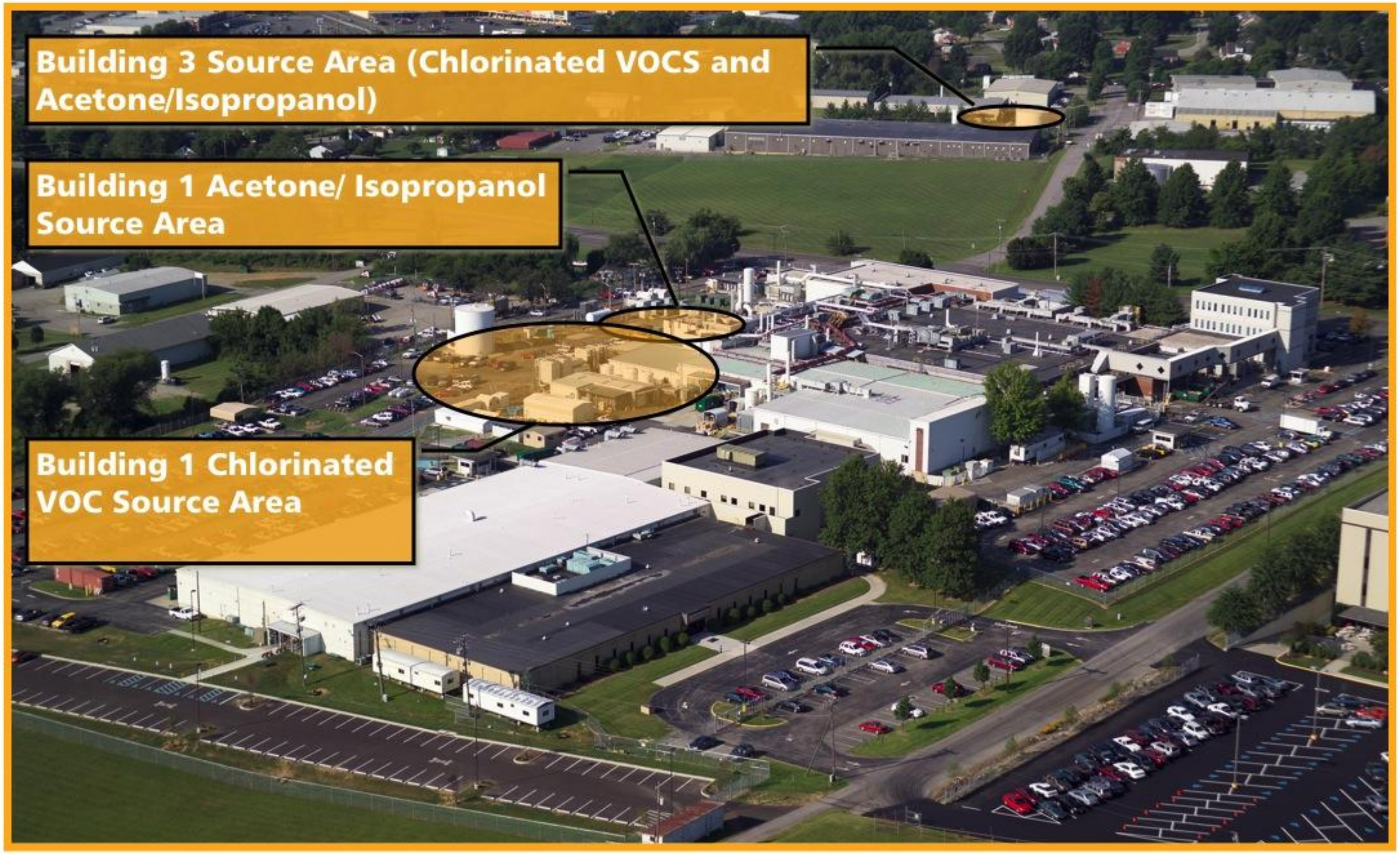


Figure 2. Photograph Showing Source Areas

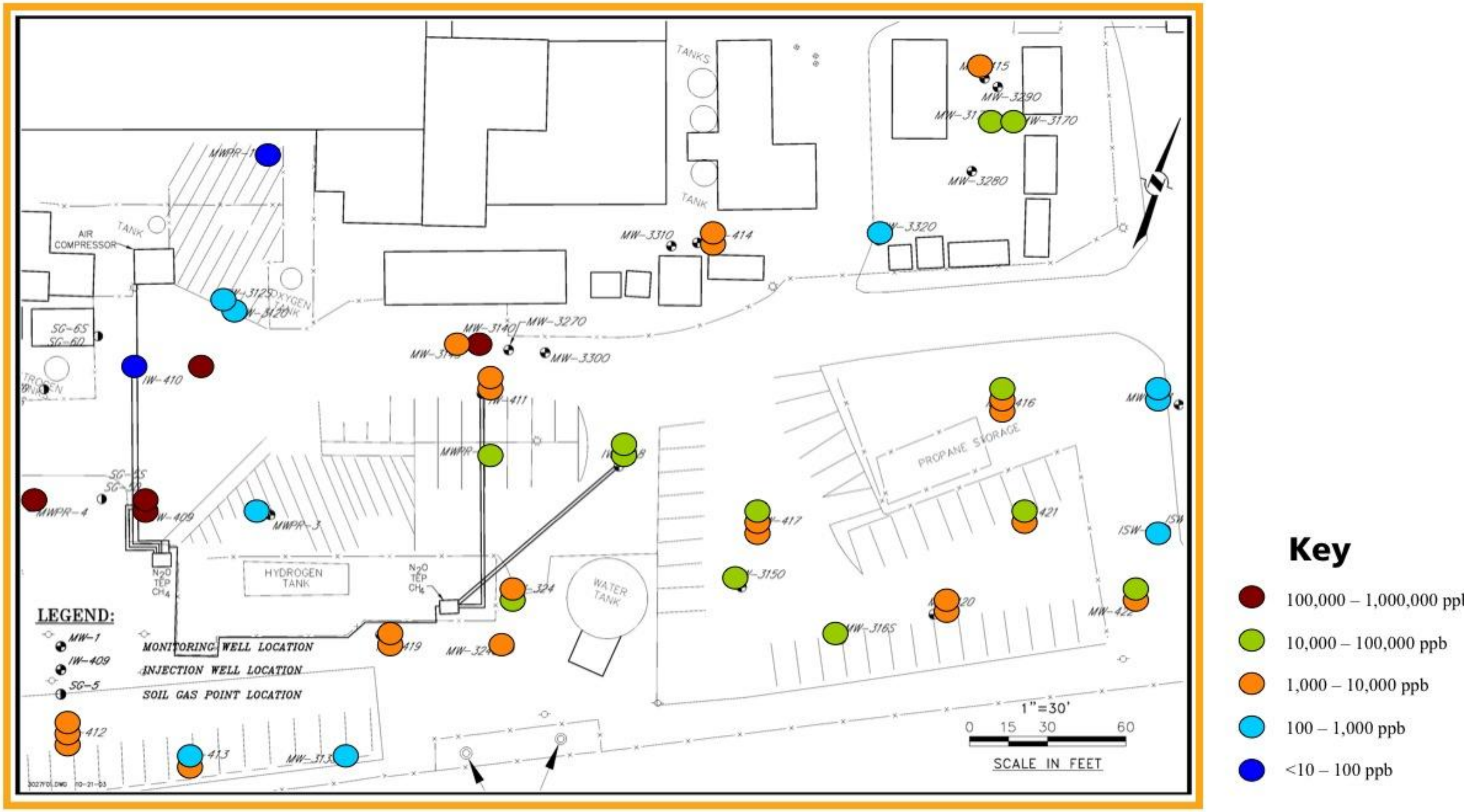
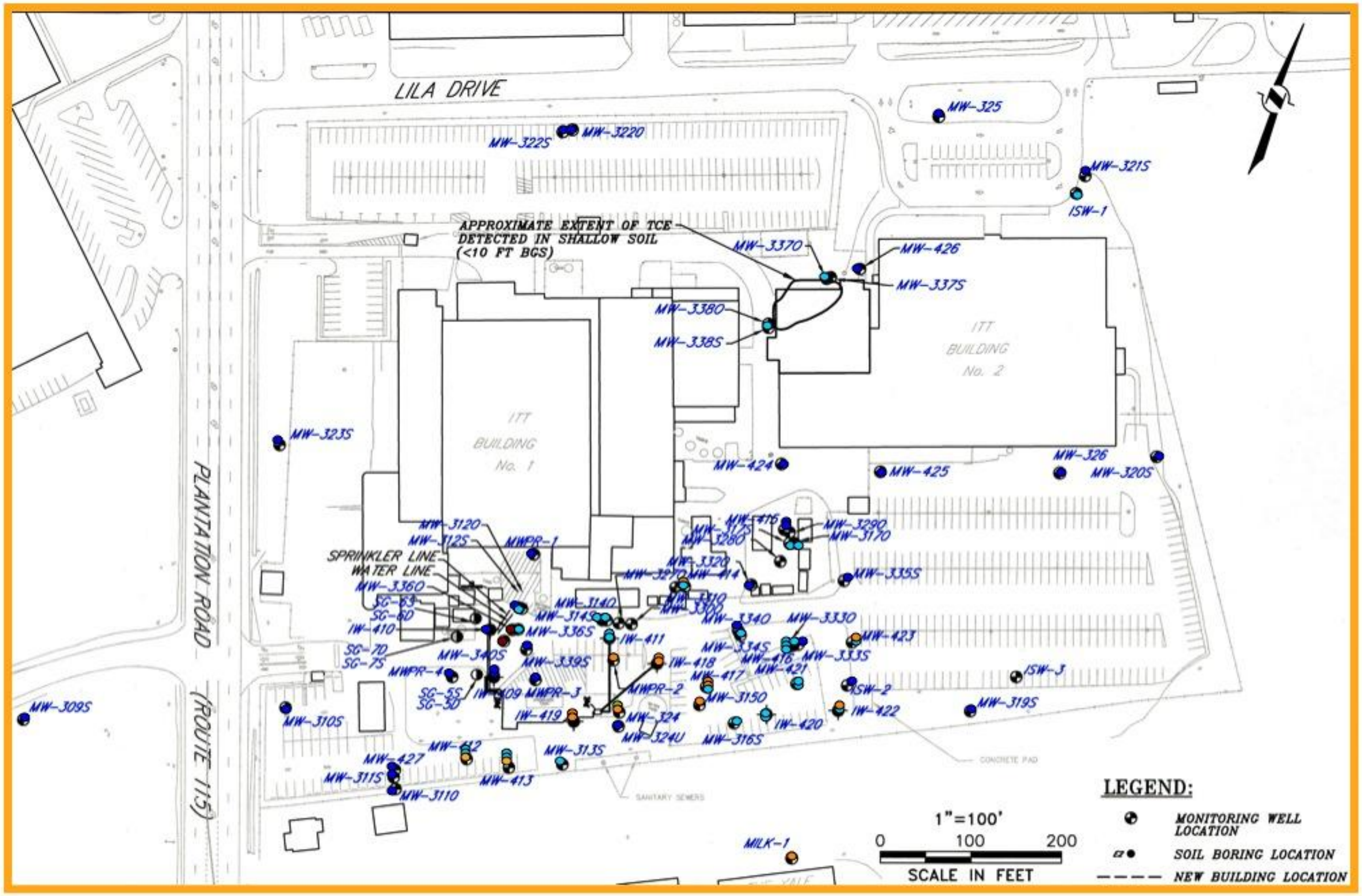


Figure 3. Initial Total VOC Concentrations in Groundwater 2001/2002--Building No. 1



Key

- 100,000 – 1,000,000 ppb
- 10,000 – 100,000 ppb
- 1,000 – 10,000 ppb
- 100 – 1,000 ppb
- <10 – 100 ppb

Figure 4. Recent VOC Concentrations in Groundwater--Building No. 1

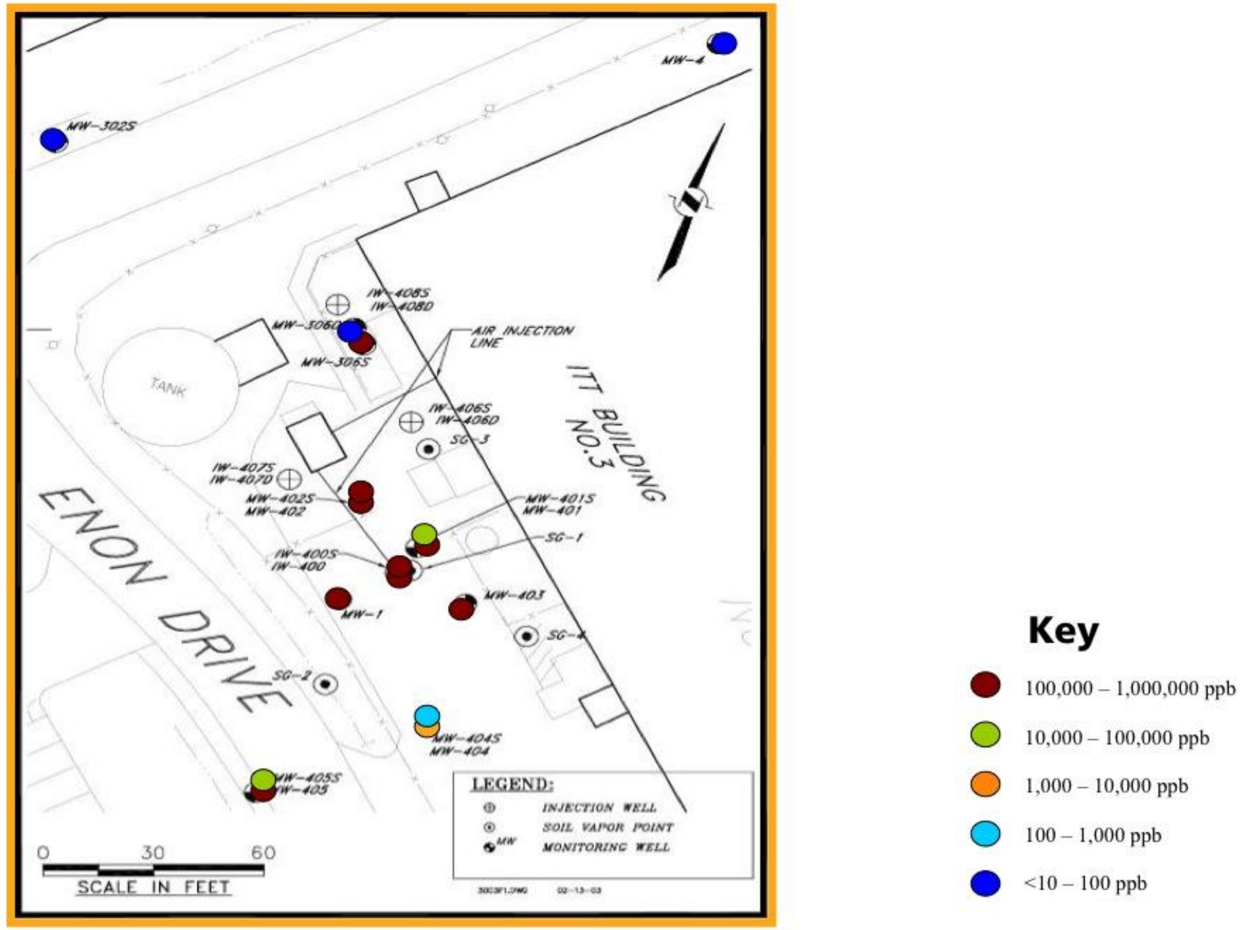


Figure 5. Initial Acetone and Isopropanol Concentrations in Groundwater--Building No. 3

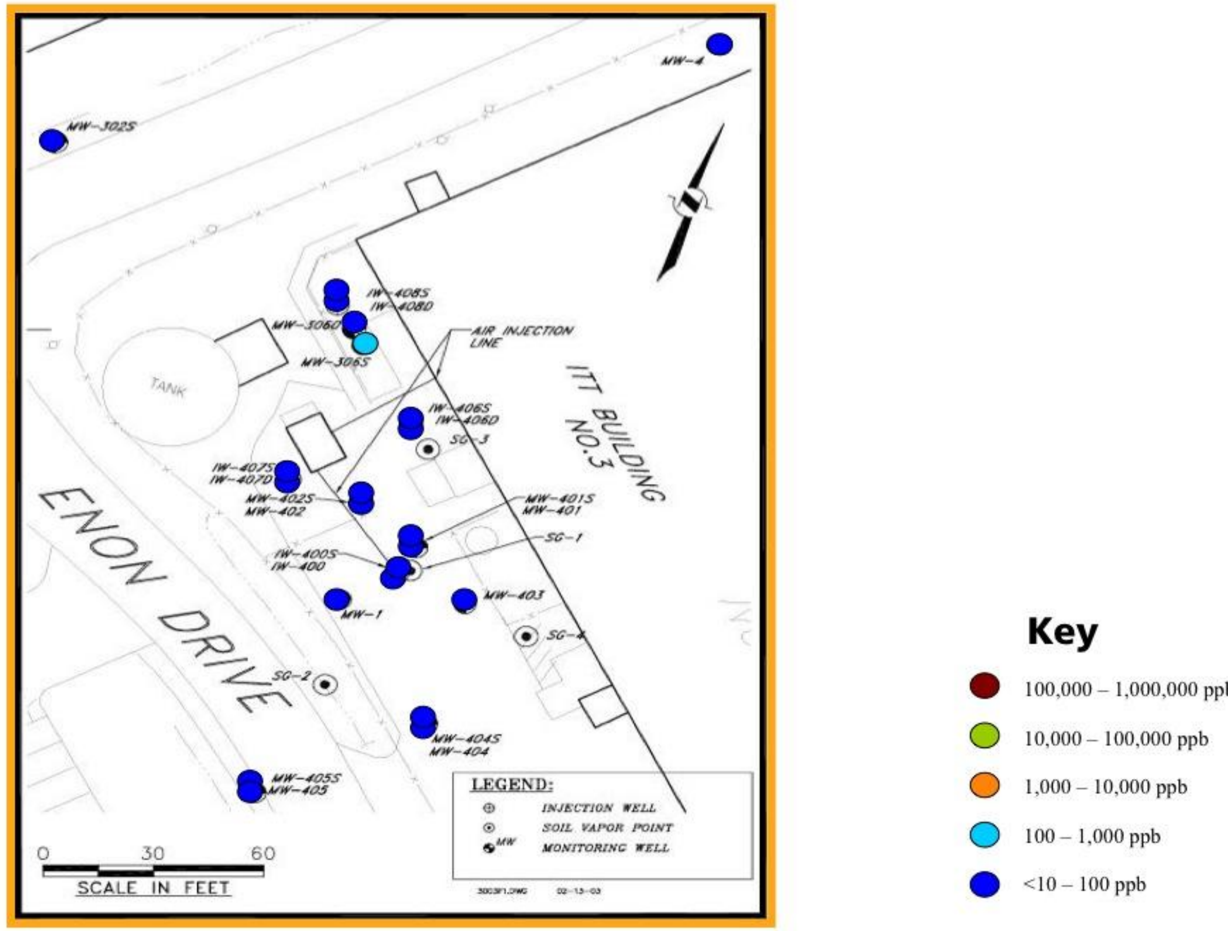


Figure 6. Recent Acetone and Isopropanol Concentrations in Groundwater--Building No. 3

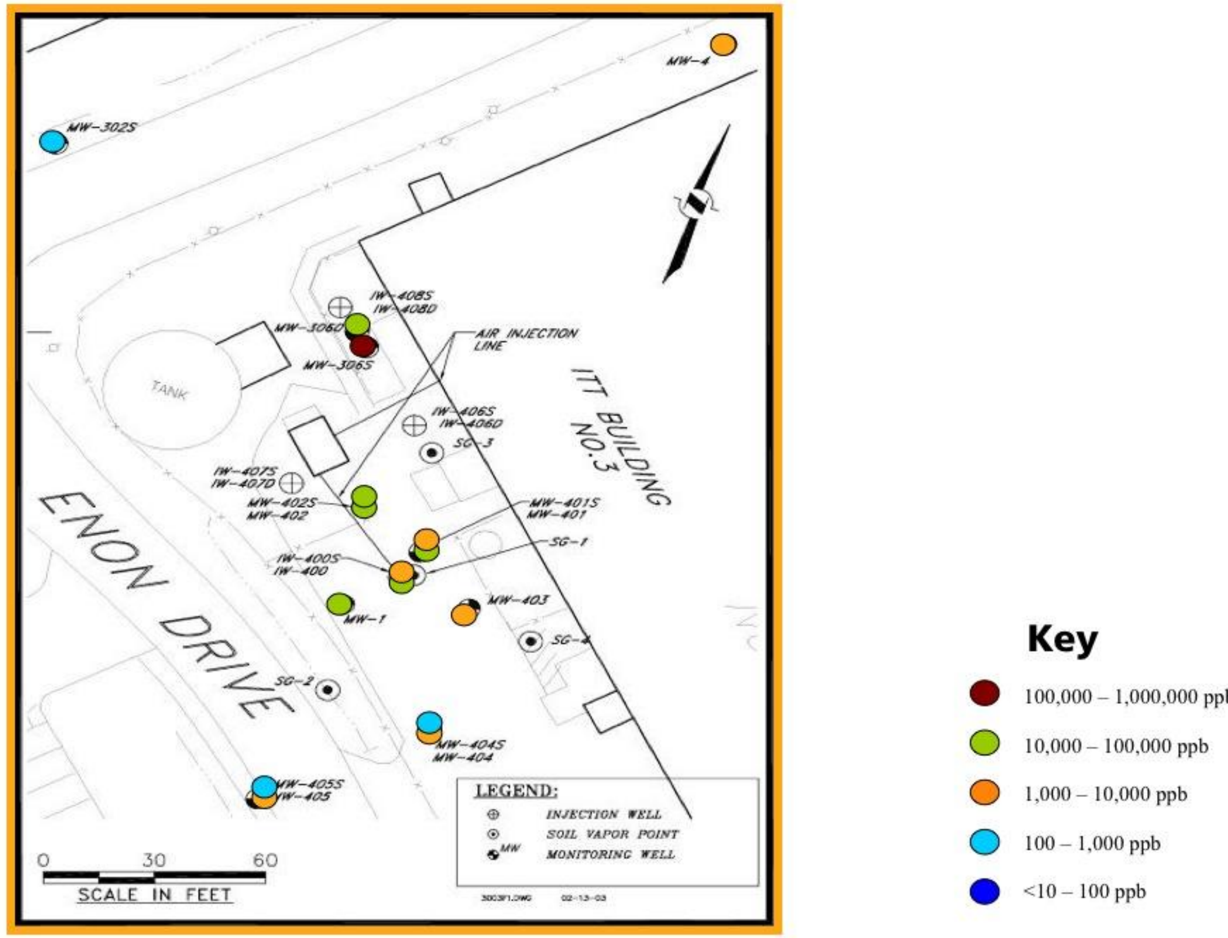


Figure 7. Initial Total Chlorinated VOC Concentrations in Groundwater--Building No. 3

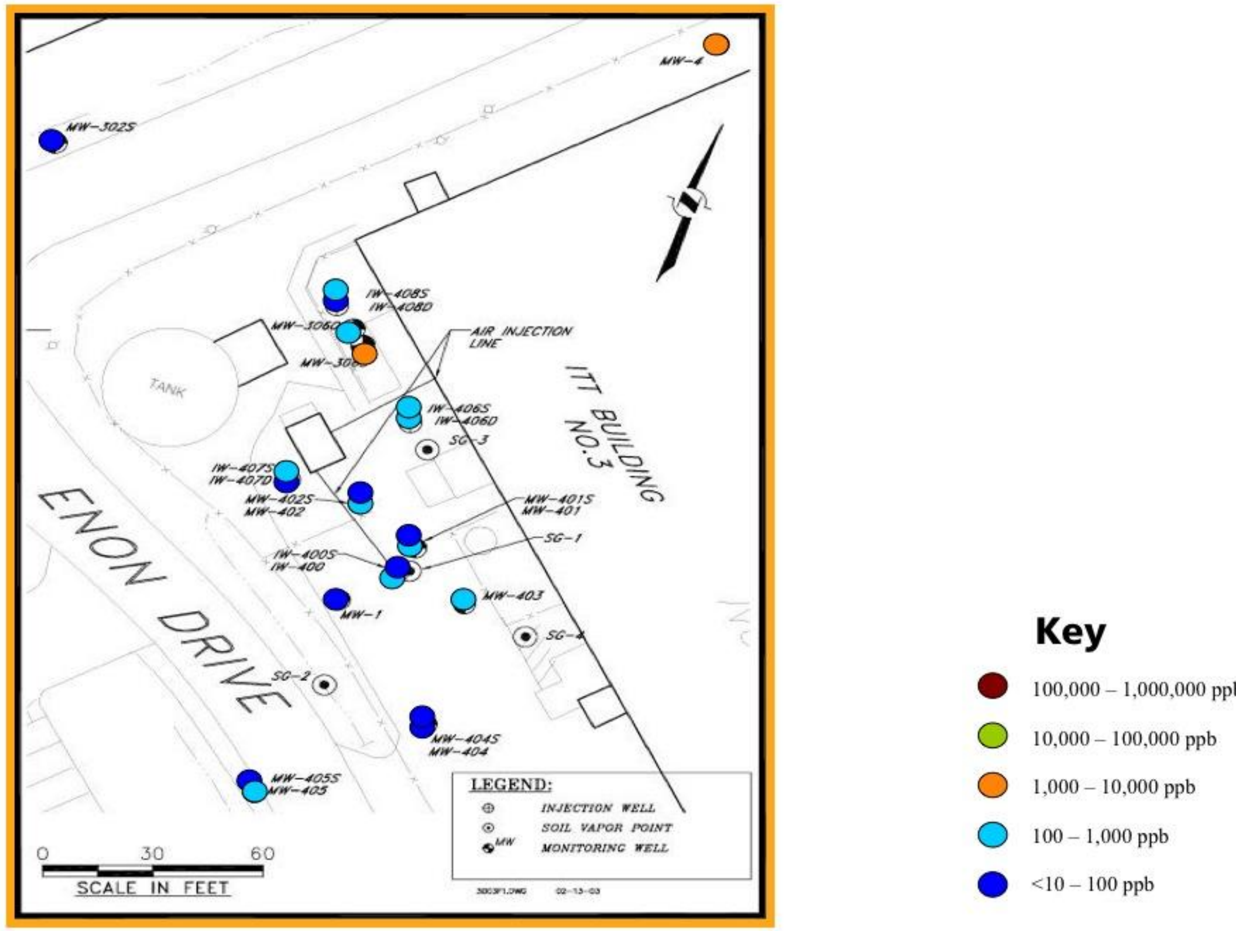


Figure 8. Recent Total Chlorinated VOC Concentrations in Groundwater--Building No. 3

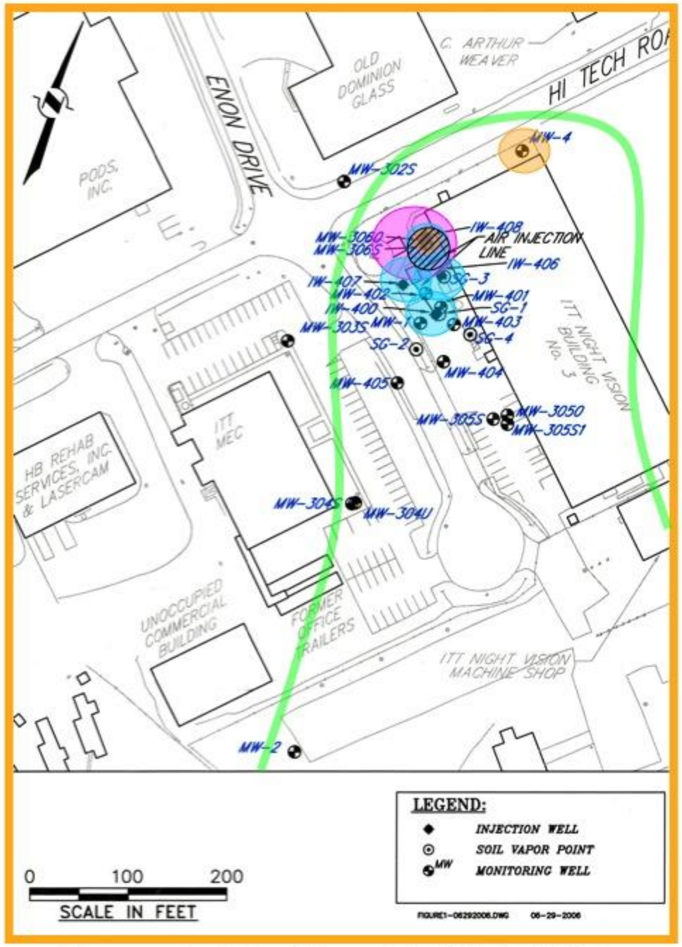
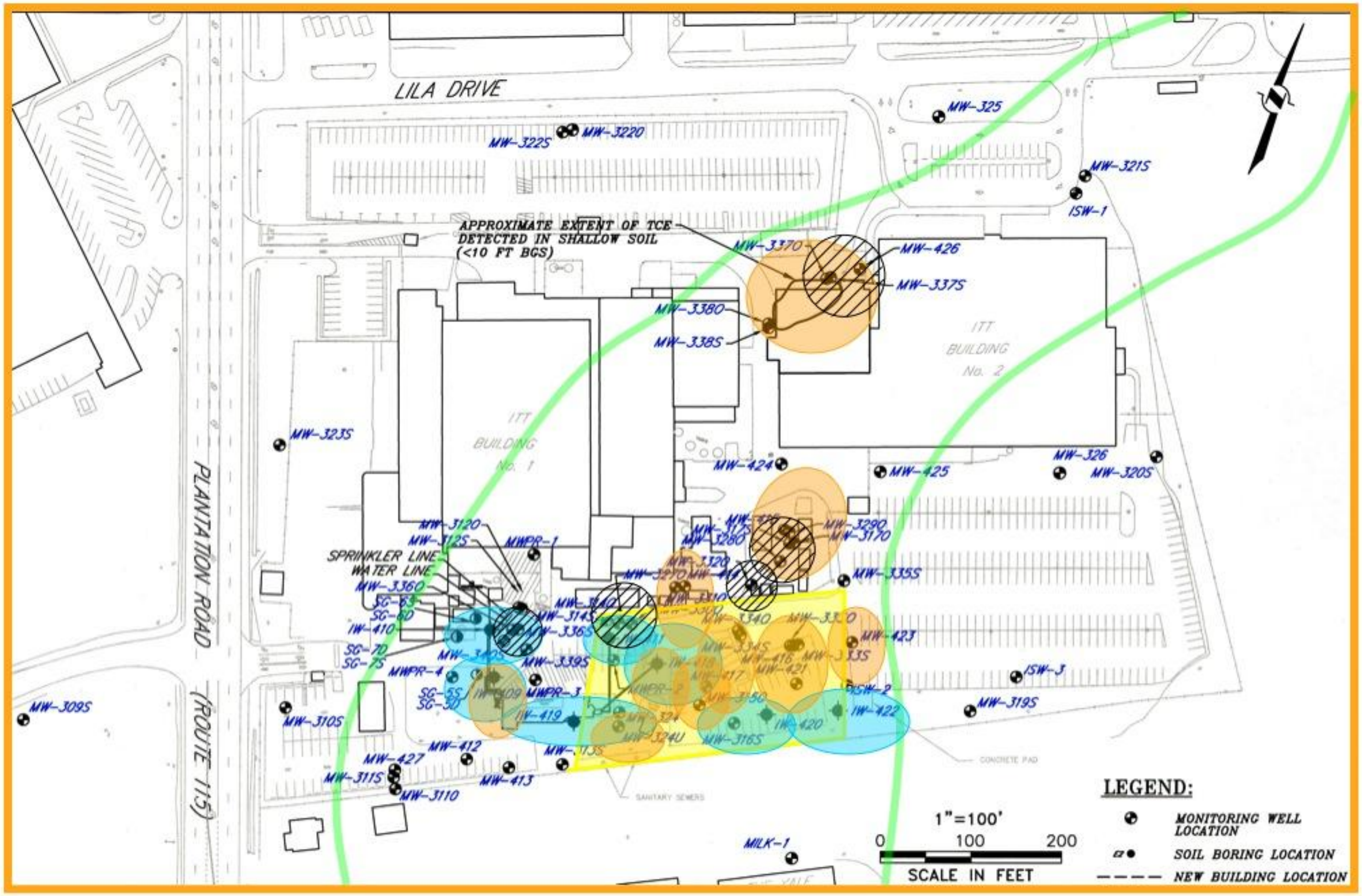


Figure 9. Site Map ITT Night Vision

Key

- Cometabolic Bioremediation
- Sodium Lactate Injection
- Photoremediation
- SVE
- Monitored Natural Attenuation



Key

- Cometabolic Bioremediatio
- Sodium Lactate Injection
- Anaerobic Biochem Plus Zero valent iron Injection
- SVE
- Monitored Natural Attenuation

Figure 10. Remediation Application Areas for Building 1