United States Air Force Base
Environmental Restoration Program

Remedial Action Completion Report

Site SS-018 Auto Hobby Shop and Site SS-028 Open Storage Area

Former Plattsburgh Air Force Base
Plattsburgh, New York

January 2012

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REMEDIAL ACTION COMPLETION REPORT

FOR

SITE SS-018 (AUTO HOBBY SHOP) AND SITE SS-028 (OPEN STORAGE AREA)

FORMER PLATTSBURGH AIR FORCE BASE
PLATTSBURGH, NEW YORK

CONTRACT NO. FA4890-06-D-0006
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Prepared For:
THE AIR FORCE CENTER FOR ENGINEERING AND THE ENVIRONMENT

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ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
Air Force	United States Air Force
BCT	BRAC Closure Team
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DCE	dichloroethene
FOST	finding of suitability to transfer
MTBE	methyl tert-butyl ether
NYCRR	New York Codes, Rules, and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PARC	Plattsburgh Airbase Redevelopment Corporation
PAH	polycyclic aromatic hydrocarbon
PCE	perchloroethene
RACR	Remedial Action Completion Report
ROD	Record of Decision
SVI	soil vapor intrusion
TCE	trichloroethene
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
µg/L	microgram per liter

1.0 INTRODUCTION

The purpose of this *Remedial Action Completion Report (RACR)* is to describe the activities that were performed at this site in accordance with the *SS-018 (Auto Hobby Shop)/SS-028 (Open Storage Area) Record of Decision (ROD)* (URS 2000) and to document that the remediation goals have been achieved.

2.0 SITE BACKGROUND

The former Plattsburgh Air Force Base (AFB) is located in Clinton County in northeastern New York State and about 26 miles south of the Canadian border. The base was closed on September 30, 1995 during the third round of base closures mandated under the Defense Base Realignment and Closure Act of 1993.

As part of the United States Air Force (Air Force) Installation Restoration Program (IRP) and the Base Realignment and Closure (BRAC) program, activities were initiated at the base to identify, evaluate, and remediate hazardous material disposal and spill sites. The IRP at Plattsburgh AFB was implemented according to a Federal Facilities Agreement, Docket No. II-CERCLA-FFA-10201, signed on July 10, 1991, by the Air Force, the United States Environmental Protection Agency (USEPA), and the New York State Department of Environmental Conservation (NYSDEC). Plattsburgh AFB was placed on the National Priorities List in 1989. Sites SS-018 and SS-028 are included in the IRP program.

Civilian reuse of the base was administered by the Plattsburgh Airbase Redevelopment Corporation (PARC). The property which included Sites SS-018 and SS-028 was transferred to civilian use via deed in 2004 (AFRPA 2004). The two sites are currently in use as the Champlain Valley Transportation Museum. Historic aerial photographs are included in Appendix A and current site photographs are included in Appendix B.

Sites SS-018 and SS-028 are located adjacent to one another near the intersection of Wisconsin Street and Ohio Street (Figures 1 and 2). SS-018 (Building 509, the Auto Hobby Shop) was built in 1936 by the United States Army for use as a regimental parking garage (Plattsburgh AFB was formerly Plattsburgh Army Barracks). From the mid-1950s until the early 1970s, Building 509 was used as a vehicle maintenance shop by the United States Air Force (Air Force), and then from the early 1970s until

base closure, the facility was used as an auto hobby shop for the maintenance of private vehicles owned by base personnel.

Site SS-028, the Open Storage Area, is associated with Building 508, which housed several base engineer maintenance shops. Building 508 was built in 1935 and also initially served as a regimental parking garage. North and east of Building 508 is an open, paved area, which the Air Force used for the general storage of equipment and containerized product. Building 508 also housed several PARC caretaker maintenance shops from 1995 to 2003.

Sites SS-018 and SS-028 were combined into one action because they are adjacent to each other and were impacted by the same level, type, and pattern of contamination. According to land use plans (PARC 1995), the planned reuse at the sites is commercial, with a strip of land nearest Lake Champlain designated for recreational use. A bike/walk path was constructed east of Site SS-018/SS-028 during the spring and summer of 2000.

Subsurface soil and groundwater contamination was identified during previous site investigations and remedial investigations performed between 1994 and 1999 (URS 1995 and 1999a; Malcolm Pirnie 1996). Contamination identified at SS-018 and SS-028 included polycyclic aromatic hydrocarbons (PAHs) and metals in fill materials and underneath pavements; chemicals in soils related to past small spills of fuels and solvents; and volatile organic compounds (VOCs) and metals in groundwater (URS 1999a).

The presence of PAHs in soil is likely attributable to the widespread use in the early 1900s of coal for heating and for fueling steam locomotives that ran on the rail lines adjacent to the site. Between 1903 and 1924, the United States Army stored about 800 tons of coal in a shed at the location of what is now Building 508. The highest concentrations of PAHs were found in soil samples collected from an approximately 7-foot thick fill layer adjacent to the northwest corner of Building 508. A fire or fires in 1924 also reportedly destroyed the coal storage building and a building used for storing lamp oil, and, since PAHs result from the incomplete burning of fossil fuels, the PAHs found in the soil samples are also likely the result of the fires and the subsequent re-grading of the area. The fill layer contained ash, cinders, and coal pieces that probably contributed to the elevated PAH concentrations in the soil samples (URS 1999a).

Based on a human health risk assessment, it was concluded that contaminants in soil at Site SS-018/SS-028 do not represent an unacceptable risk to human health for the planned use of this site; that is, commercial and a recreational bike path (URS 1999a and 2000). A residential use scenario was not considered because of the planned future use of the site.

Metals concentrations in groundwater samples were higher in wells upgradient of the site, so SS-018/SS-028 did not appear to be a source of metals contamination in groundwater (URS 2000). Also, upgradient concentrations generally fell within the expected range of background groundwater concentrations (URS 1996), so an upgradient source for elevated metals concentrations was not suspected (URS 2000).

A removal action at Site SS-028 was initiated in December 1998 to excavate contaminated soil believed to be a source of chlorinated hydrocarbon contamination in groundwater. The location of the removal action is shown on Figure 2. Tetrachloroethene, also known as perchloroethene or PCE, and its degradation products trichloroethene (TCE) and dichloroethene (DCE) had been detected in groundwater samples collected at the site. The highest concentration of PCE was 28 micrograms per liter (µg/L) found in a groundwater sample collected in October 1996 from monitoring well MW-28-004, located immediately downgradient of the soil removal area (see Appendix C Table C-1).

Approximately 158 tons of soil were removed and transported to a thermal desorption facility in New Hampshire for disposal (URS 1999b). Confirmatory soil samples were collected from the excavation to ensure that the source was effectively removed. In June 1999, after regulatory agency concurrence that a sufficient quantity of soil had been removed during the removal action, the excavation was backfilled with clean soil and the site was restored. Confirmatory soil sample analytical results, summarized in Appendix D, show that the soil left in place meets the current unrestricted use soil cleanup objectives stipulated by *Title 6 of the New York Codes, Rules, and Regulations, Part 375* (NYSDEC 2006).

Groundwater in this area has also been impacted by methyl tert-butyl ether (MTBE), an additive to unleaded gasoline used from 1979 until its statewide ban in January 2004. The presence of the MTBE contamination was investigated in 1999/2000 by the Air Force, in consultation with the New York State Department of Environmental Conservation (NYSDEC) Region 5 Bureau of Spill Prevention and

Response. The investigation concluded that the MTBE contamination in groundwater was most likely attributable to an upgradient source (URS 2001a).

There are no known on-base gasoline spill sites or sources upgradient of SS-018 or SS-028; however, at the time of the investigation, there were two gasoline fueling stations located off base and on the west side of Route 9. One of the fueling stations (Sunoco) had documented gasoline spills with MTBE concentrations in 1996 groundwater samples of 3,600 µg/L (URS 2001a). In 2000, MTBE concentrations in samples collected from monitoring wells around the station were as high as 300 µg/L. The groundwater flow direction from the Sunoco station is generally to the east towards the site, so past releases at the Sunoco station could be responsible for the MTBE observed in groundwater at Sites SS-018 and SS-028 (URS 2001a).

3.0 GEOLOGY/HYDROGEOLOGY

The sites lie approximately 150 feet west of Lake Champlain. An active Delaware and Hudson rail line is situated between the sites and the lake. The topography drops off steeply between the sites and the lake; the rail line lies approximately 10 feet below the grade of the sites and the lake lies approximately 50 feet below the grade of the sites.

The stratigraphy in the SS-018/SS-028 area generally consists of four hydrogeologic units: an upper unconfined sand aquifer, an underlying confining layer formed by a silty clay unit, a confined glacial till water-bearing unit, and a confined thinly-bedded limestone bedrock aquifer (Figure 3). Fill (re-graded material) about seven feet thick overlying the sand aquifer consists of sand with gravel, coal fragments and coal dust, cinders, ash, and debris (metal, brick, plastic, and paint chips). As stated in Section 2.0, in the early 1900s, the United States Army had a coal storage shed at the location of what is now Building 508. The coal storage at the site probably accounts for the coal fragments and dust found in the fill, and the destruction of the coal storage shed and a lamp oil storage building by fire in 1924 probably accounts for the cinders, ash, and building debris (URS 1999a).

Groundwater flow is eastward beneath the site toward the steep embankment above the shoreline of Lake Champlain, where it is expressed along a seepage face at the sand/silty clay geologic contact. Interpreted groundwater elevation contours are also shown on Figure 3.

4.0 RECORD OF DECISION

The combined *SS-018/SS-028 ROD* was signed in September 2000 (URS 2000). The selected remedy was institutional controls. According to the *SS-018/SS-028 ROD*, chemical contaminants present in soils and groundwater at these sites do not pose a significant threat to human health or the environment; however, because the human health risk assessment did not include a residential development scenario, and because there were still contaminants present in groundwater beneath the site exceeding regulatory standards, institutional controls were included in the remedy as follows:

- Restriction on the development of the sites to facilities that support only non-residential use;
- Prohibition of the installation of any wells for drinking water or any other purposes which could result in the use of the underlying groundwater;
- Prohibition of discharge of groundwater withdrawn during construction dewatering to the ground or surface water without prior approval of the New York State Department of Environmental Conservation (NYSDEC);
- Periodic monitoring of site groundwater and groundwater seeps for VOCs and MTBE until groundwater contaminant levels are below current regulatory standards; and,
- Evaluation of the above institutional controls, which will be implemented through lease and deed restrictions, and review of groundwater monitoring data will be undertaken as part of five-year reviews of the remedy in accordance with Section 121(c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

The boundaries of the areas subject to these institutional controls are shown on Figure 4. Two boundaries have been established, one for non-residential use only and another for groundwater.

A Finding of Suitability to Transfer (FOST) for parcel A2.9, which included Sites SS-018 and SS-028, was finalized in December 2004 (AFRPA 2004). The FOST contained the institutional controls specified in the *SS-018/SS-028 ROD* (URS 2000) and it also stated that the institutional controls will be placed upon the property in the deed in the form of use/access/deed restrictions. The FOST concluded that the future use of the property did not present a current or future risk to human health or the environment, subject to inclusion of appropriate use restrictions in real property documents and landowner compliance with the restrictions. Therefore, the property was considered suitable for transfer.

An added restriction was included in the FOST that was not in the *SS-018/SS-028 ROD* because of the potential for soil vapor intrusion into buildings on the site due to groundwater contamination. Prior to any structure being erected or any existing structure being used that is located in the groundwater-contaminated area of the parcel, there must be an evaluation of the potential for soil vapor intrusion. If it is determined that a potential human exposure is possible, then mitigation of the vapor intrusion must be included in the design/construction of the structure prior to occupancy.

5.0 REMEDIAL ACTIONS

5.1 Groundwater Monitoring VOCs and MTBE

The *Groundwater Monitoring Plan* (URS 2001b) for this site was completed in February 2001, as required by the *SS-018/SS-028 ROD*. Six monitoring wells (MW-18-004, MW-19-001, MW-28-02R, -004, -005, and -007), plus two groundwater seeps along the lake shore (SW-28-001, and -002) were to be sampled semi-annually (twice per year) with analysis for VOCs and MTBE. The locations of the monitoring wells and groundwater seeps are shown on Figure 2. The program was implemented in May 2001 and continued unchanged through 2004. A summary of the analytical data for the post-ROD groundwater monitoring program is provided in Appendix C Tables C-2 and C-3.

During the period from 2001 through 2004, only PCE and MTBE were detected at concentrations exceeding their respective groundwater quality standards (URS 2004). PCE concentrations decreased following the soil removal action in 1998/1999 and had been below the PCE groundwater quality standard of 5 µg/L since October 2001, except for one sample in October 2002 with a concentration of 5.05 µg/L, only slightly above the standard. These data indicated that the soil removal action had been effective in mitigating chlorinated hydrocarbon contamination in groundwater beneath the two sites.

5.2 Groundwater Monitoring MTBE Only

Between 2001 and 2004, in groundwater samples collected as part of the post-ROD groundwater monitoring program, MTBE was consistently detected at concentrations exceeding its NYSDEC groundwater quality standard. During this same period, PCE was the only other VOC detected at concentrations higher than its groundwater quality standard and only in MW-28-004 (see Attachment C Table C-2). In 2003 and 2004, PCE concentrations in groundwater samples from MW-28-004 were all less than the standard. Therefore, beginning in April 2005, based on a recommendation in the *Second*

Five-Year Review Report (URS 2004), semi-annual groundwater samples have only been analyzed for MTBE.

The combined *SS-018/SS-028 ROD* listed 50 µg/L as the water quality standard for MTBE. Although not specifically called out as such in the *SS-018/SS-028 ROD*, this implied remediation goal was taken from Title 10 of New York Codes, Rules, and Regulations, Part 5, Sub-Part 5.1, which governs drinking water for public water supplies (URS 1999a); however, the current public water supply standard cited in this regulation is 10 µg/L (NYSDOH 2007).

Promulgated NYSDEC groundwater quality standards are listed in 6NYCRR Part 703 (NYSDEC 2008). There is no promulgated standard for MTBE; however, NYSDEC has established a groundwater guidance value of 10 µg/L for MTBE (NYSDEC 2000). The United States Environmental Protection Agency (USEPA) also has not established a drinking water maximum contaminant level for MTBE (USEPA 2008), and it considers that there is little likelihood of adverse health effects from MTBE in drinking water in the range of 20 to 40 µg/L (USEPA 2010).

Figure 5 is a summary of all the MTBE concentrations in groundwater samples collected during the various investigations and monitoring programs conducted at Site SS-018/SS-028. Table 1 lists all the available historical MTBE concentrations from the six monitoring wells and the two groundwater seeps sampled as part of the post-ROD monitoring program. Figure 6 is a summary plot of the MTBE concentrations for the four monitoring wells (MW-19-001, MW-28-002R, MW-28-005, and MW-28-007) that were sampled for the entire post-ROD monitoring program. MTBE concentrations from the individual wells and the two seeps are shown on Figure 7 through Figure 11. A discussion of the MTBE concentrations follows.

MW-18-004 and MW-28-004. Initially included in the post-ROD monitoring program, these two wells were sampled from 2001 through 2006. At MW-18-004, the highest concentration of MTBE detected was only 0.5 µg/L and, in four out of five samples collected between October 2004 and October 2006, MTBE was not detected at all. At MW-28-004, in 12 samples, MTBE was never detected above 50 µg/L and only twice was it detected above the current groundwater guidance value of 10 µg/L. Based on these results, sampling at these two wells was discontinued starting with the April 2007 sampling event (URS 2007).

MW-19-001. This well is the most upgradient well included in the post-ROD monitoring program and sample results for MTBE are available from 1999 through June 2010 (Table 1). In 1999, the concentration of MTBE in groundwater was 440 µg/L at this well, and, since that time, the concentrations have steadily decreased (Figures 6 and 7). Beginning in 2003, MTBE concentrations have all been less than 50 µg/L, the standard cited in the *SS-018/SS-028 ROD*. In October 2009 and June 2010, MTBE was not detected in the samples from this well. This well was damaged subsequent to the June 2010 sampling event and could not be sampled in December.

MW-28-007. Groundwater sample data are available at this well beginning in 1997. MTBE concentrations have generally been higher than those at MW-19-001, located about 40 feet upgradient. In November 1999, the concentration of MTBE in MW-28-007 was 580 µg/L and, as in MW-19-001, the concentrations have steadily decreased with time (Figures 6 and 8). Starting in October 2005, MTBE concentrations have been less than the standard cited in the *SS-018/SS-028 ROD* (Figure 8). In the October 2009 event, as well as the two events in 2010, MTBE was not detected in the groundwater samples from this well.

MW-28-002R. This is the farthest downgradient well, located about 160 feet from MW-28-007. It was installed in January 2001 as a replacement for MW-28-002, which was decommissioned during construction of the paved recreational path just east of the site. Locations of these two wells are shown on Figure 2. MTBE concentrations have typically been higher at MW-28-002R than the other two upgradient wells, MW-19-001 and MW-28-007, but the concentrations have also been steadily decreasing with time (Figures 6 and 9). Beginning in October 2008, MTBE concentrations have been less than 50 µg/L, the standard cited in the *SS-018/SS-028 ROD*. In the two 2010 samples, MTBE was detected at 4.51 and 1.86 µg/L, both of which are less than the current NYSDEC guidance value of 10 µg/L for MTBE.

MW-28-005. MTBE concentrations in this well have historically been lower than the levels found in the other three wells currently sampled (Figure 6). MW-28-005 is side-gradient to the other three wells (Figure 2) and possibly situated on the north edge of the MTBE plume moving through the site. Groundwater sampling data are available dating from 1997 and MTBE concentrations have never exceeded the 50 µg/L standard cited in the *SS-018/SS-028 ROD*. On average, MTBE concentrations in this well also have decreased with time (Figure 10) and in 2008 they started fluctuating about the 10 µg/L level. In 2010, MTBE was not detected in the samples from this well.

SW-28-001 and SW-28-002. There are two groundwater seeps located on the down-slope to Lake Champlain east of the site (Figure 2) that have been sampled since 2001. One of the seeps, SW-28-001, is approximately downgradient of monitoring well MW-28-005 and the other seep, SW-28-002, is downgradient of monitoring wells MW-19-001, MW-28-007, and MW-28-002R. Since April 2002, at seep location SW-28-001, MTBE concentrations have been less than 50 µg/L, and since April 2003, they have been less than 10 µg/L (Figure 11). MTBE has not been detected at this location in the six sampling events since April 2008. At seep location SW-28-002, MTBE has only been detected once since 2001 at a concentration greater than 10 µg/L and it also has not been detected in five of the six sample events in since April 2008 (in April 2009, this seep was dry).

5.3 Summary

Six monitoring wells and two groundwater seeps were sampled for VOCs and MTBE from 2001 through 2004 as part of the post-ROD groundwater monitoring program. VOCs, except for MTBE, were dropped from the program starting in 2005. Sampling at two of the wells, MW-18-004 and MW-28-004, was discontinued in 2007 because MTBE was no longer of concern at these two wells. The other four monitoring wells (MW-19-001, MW-28-002R, MW-28-005, and MW-28-007), plus two groundwater seeps (SW-28-001 and SW-28-002) were sampled twice each year for MTBE from 2005 through 2010.

Since October 2005, MTBE concentrations in three of the four wells (MW-19-001, MW-28-005, and MW-28-007) have all been less than 50 µg/L. In fact, at MW-28-005, the MTBE concentrations have never exceeded 50 µg/L. Beginning in October 2008, the MTBE concentrations in the fourth well (MW-28-002R) have also been less than 50 µg/L.

Since October 2009, MTBE has not been detected in samples collected at MW-19-001 or MW-28-007, and since October 2008, MTBE concentrations have been less than 10 µg/L at MW-28-005 except for a small exceedance (10.5 µg/L) in October 2009. In the two events conducted in 2010, MTBE was only detected in the samples collected at one of the four wells, MW-28-002R, and at levels less than 10 µg/L.

Based on groundwater data from the two seeps, there is no apparent impact on Lake Champlain from groundwater contamination at the site. Since 2002, MTBE concentrations in the seep samples have all been less than 50 µg/L and, except for one sample, since 2003 they have been less than 10 µg/L.

The remedy specified in the *SS-018/SS-028 ROD* required that the groundwater monitoring program for VOCs and MTBE continue until the groundwater contaminant levels are less than regulatory standards. The Air Force has met this obligation. Monitoring of VOCs except for MTBE was discontinued at the end of 2004 because VOCs were no longer an issue. Concentrations of MTBE in groundwater have been less than the implied remediation goal, 50 µg/L, cited in the *SS-018/SS-028 ROD* for some time and there is no apparent impact on Lake Champlain. In 2010, there also were no exceedances of the newer NYSDEC groundwater quality guidance value for MTBE of 10 µg/L.

After reviewing the MTBE groundwater data at Site SS-018/SS-028 through December 2010 (Farnsworth 2011), at the February 2011 Base Realignment and Closure (BRAC) Cleanup Team (BCT) meeting, NYSDEC and USEPA agreed that remediation goals had been achieved, that MTBE in groundwater was no longer an issue, and that groundwater samples no longer needed to be collected (URS 2011a). At the May 2011 BCT Meeting, NYSDEC and USEPA also agreed that the remaining groundwater monitoring wells at the site could be decommissioned (URS 2011b).

6.0 MONITORING WELL DECOMMISSIONING

The thirteen monitoring wells associated with this Site SS-018/SS-028 are shown on Figure 2. Nine of the wells were decommissioned at various times between 2001 and 2008. The remaining four monitoring wells, which were still in use as part of the groundwater monitoring program (i.e., MW-19-001, MW-28-002R, MW-28-005, and MW-28-007), were decommissioned in September 2011.

Table 2 is a summary of the history of the site monitoring wells. Well decommissioning records for the four wells recently decommissioned are included in Appendix E. Well decommissioning records for the other nine wells, if available, can be found in the references cited in Table 2.

7.0 SOIL VAPOR INTRUSION POTENTIAL

Subsequent to the signing of the *SS-018/SS-028 ROD* in 2000, the potential for contaminants volatilizing from soil and groundwater and impacting indoor air quality, particularly for chlorinated compounds, has been an issue in New York State. In 2006, the New York State Department of Health (NYSDOH 2006) established indoor air soil vapor intrusion (SVI) guidance concentrations for two of the chlorinated compounds, PCE and TCE, which had been historically detected in groundwater samples at

the site. Chlorinated compound-contaminated soil at the site, thought to be the source of the chlorinated compounds in groundwater, was excavated in 1998 (see Section 2.0).

As an initial screening regarding the potential for SVI into buildings at this site, Appendix F presents theoretical predictions of the concentrations in indoor air from PCE and TCE volatilizing from groundwater. The predicted concentrations were all less than the NYSDOH action level concentrations requiring mitigation of indoor air. It should be noted that there are currently no buildings located downgradient of the soil removal area and the monitoring well with the highest concentrations of PCE and TCE in groundwater samples (see Figure 2).

8.0 REMEDIAL ACTION COMPLETION

The remedial action required by the *SS-018/SS-028 ROD*, namely that groundwater monitoring for VOCs and MTBE continue until groundwater contaminant levels are less than regulatory standards, has been completed. Based on the groundwater data presented in Section 5.0, NYSDEC and USEPA agreed that groundwater monitoring could be discontinued and that the remaining site monitoring wells could be decommissioned.

The groundwater related institutional controls can be discontinued, but the non-residential use restriction will remain in place. According to the SS-018/SS-028 ROD, chemical constituents remaining in the soil do not pose a significant risk to human health or the environment, but the health risk assessment for this site did not include a residential use scenario, so a non-residential use restriction was included in the remedy. Because of the continued use restriction, Site SS-018/SS-028 will be included in future five-year reviews for the former Plattsburgh Air Force Base.

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TABLES

TABLE 1
HISTORIC MTBE CONCENTRATIONS
SS-018 (AUTO HOBBY SHOP) AND SS-028 (OPEN STORAGE AREA)

Sample Date	MW-18-004	MW-19-001	MW-28-002R	MW-28-004	MW-28-005	MW-28-007	SW-28-001	SW-28-002
Aug-97	See Note 2	NS	See Note 3	NA	16	270	NA	NA
Apr/May-99		180			24	430	NS	NS
Nov-99		440		NS	38	580	NS	NS
Jan-00		110		NS	31	41	NS	NS
Apr-00		160		NS	30	380	NS	NS
Jun-00		40		NS		380	NS	NS
May-01		49	375	5.5	5.7	271		0.7
Oct-01	0.3	231	487	3.7	29.1	179	121	3.3
Apr-02	0.3	81.4	529	14.2	25.9	284	13.6	3.0
Oct-02	0.3	86.3	218	2.1	20.5	106	20.1	
Apr-03	0.5	42.8	268	14.1	19.9	312	2.8	1.7
Oct-03	R	44.6	49.8	7.8	16.8	24.1	5.6	3.9
Apr-04	0.2	30.1	137	3.3	17.8	89.8	3.8	0.9
Oct-04		33.1	113	1.1	2.5	58.8	2.2	0.9
Apr-05		25	122	8.0	11.3	71.8	1.7	1.4
Oct-05		15	69.2	1.0	10.6	40	1.7	4.8
Apr-06	0.1	14	72.8	2.2	22.3	39.8	2.6	1.8
Oct-06		19.4	46.9	1.5	11.7	10.1	1.8	19.1
Apr-07	NS	15.4	67.8	NS	11.8	28.3	6.0	1.9
Oct-07	NS	29.4	NS	NS	10.2	9.0	NS (Dry)	NS (Dry)
Apr-08	NS	25.6	54.8 [5]	NS	13	13.2		
Oct-08	NS	29.9	49.2	NS	8.3	11.6		
Apr-09	NS	15.5	38.7	NS	9.4	16.6		NS (Dry)
Oct-09	NS		26.7	NS	10.5			
Jun-10	NS		4.51	NS				
Dec-10	NS	NS [6]	1.86	NS				

Concentrations are in µg/L
MW = Monitoring well
SW = Groundwater seep
NS = No Sample
NA = Not Analyzed
R = Analysis result rejected during data validation process

Shading indicates that the concentration is greater than the 50 µg/L standard cited in the ROD.

Notes:
1. Blanks indicate that the compound was not detected.
2. MW-18-004 was installed on May 17, 2001.
3. MW-28-002R was installed on January 18, 2001 as a replacement for MW-28-002, which was decommissioned during the construction of a recreational trail.
4. The New York State groundwater quality guidance value for MTBE is 10 µg/L (NYSDEC 2000). The groundwater quality standard cited in the *SS-018/SS-028 ROD* (URS 2000) is 50 µg/L.
5. MW-28-002R was sampled on June 12, 2008. Well was blocked by tree roots in April. They were later removed so that sampling could occur.
6. MW-19-001 was destroyed during construction at this site following the June sampling event.

TABLE 2

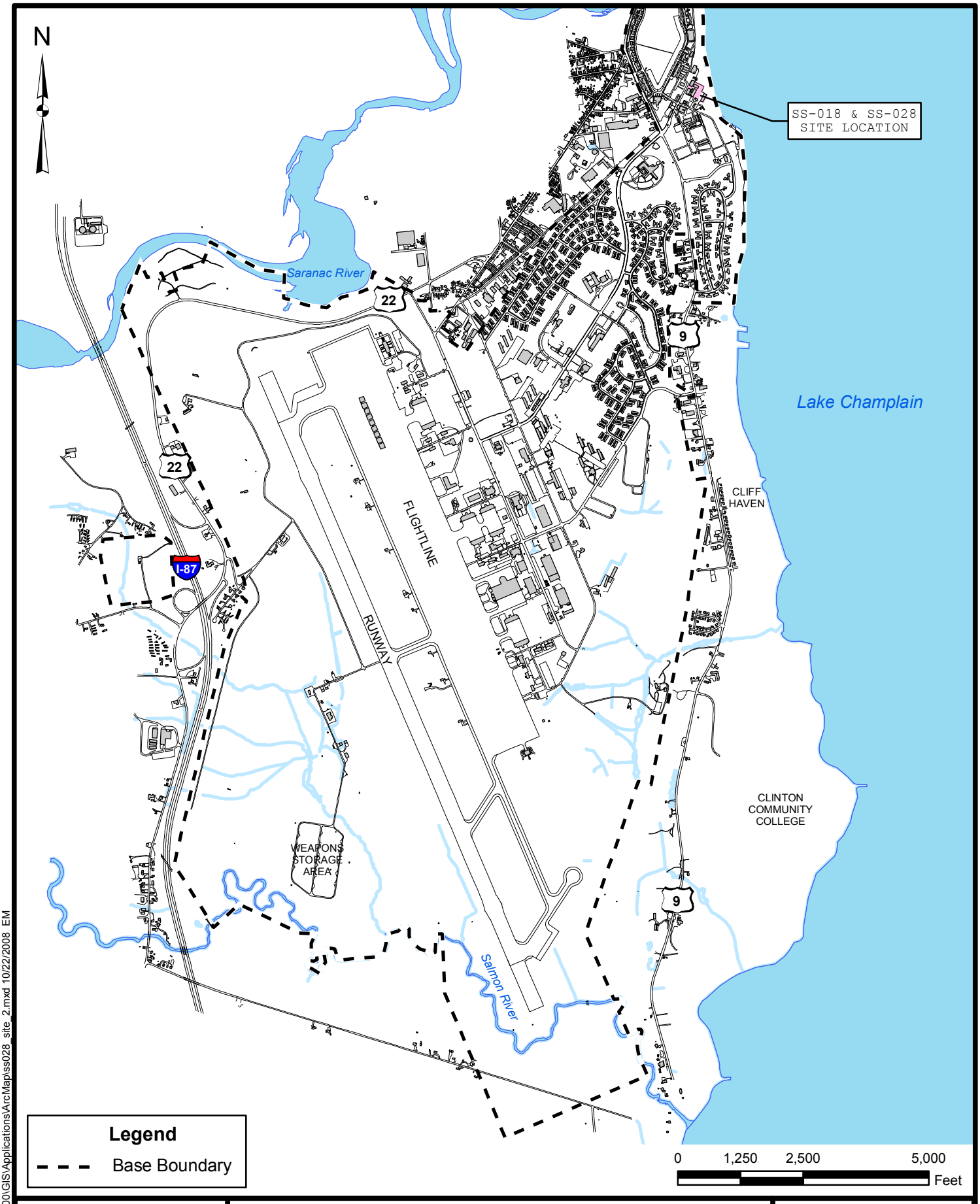
SITE SS-018/SS-028

MONITORING WELL HISTORY

Well ID	Date Installed	Date Decommissioned	Decommissioning Method	Screen Depth (ft)	Screen Installed in	Reference
MW-18-001	Jan '93	Nov '05	Grouted while Riser/Screen Pulled	18-28	Unconfined Aquifer	URS 2006
MW-18-002	Jan '93	June '01	Grouted while Riser/Screen Pulled	18-28	Unconfined Aquifer	URS 2002a
MW-18-003	Jan '93	June '01	Grouted while Riser/Screen Pulled	18-28	Unconfined Aquifer	URS 2002a
MW-18-004	May '01	Dec '08	Grouted while Riser/Screen Pulled	17.5-27.5	Unconfined Aquifer	URS 2009
MW-19-001	Nov '92	Aug '11	Grouted in Place	11.2-21.2	Unconfined Aquifer	Appendix D
MW-28-001	Oct '94	Nov '05	Grouted while Riser/Screen Pulled	9.5-19.5	Unconfined Aquifer	URS 2006
MW-28-002	Oct '94	Jan '01	Grouted while Riser/Screen Pulled	17-27	Unconfined Aquifer	URS 2002a
MW-28-002R	Jan '01	Aug '11	Grouted in Place	18-28	Unconfined Aquifer	Appendix D
MW-28-003	Aug '96	Dec '08	Grouted while Riser/Screen Pulled	30-40	Unconfined Aquifer	URS 2009
MW-28-004	Aug '96	Dec '08	Grouted while Riser/Screen Pulled	11-26	Unconfined Aquifer	URS 2009
MW-28-005	Jul '97	Aug '11	Grouted in Place	16-26	Unconfined Aquifer	Appendix D
MW-28-006	Jul '97	Nov '05	Grouted while Riser/Screen Pulled	16-26	Unconfined Aquifer	URS 2006
MW-28-007	Jul '97	Aug '11	Grouted in Place	11-21	Unconfined Aquifer	Appendix D

Notes:
1. The installation depth, screen depth, and geologic unit the screen was installed in are per URS 2002b.
2. The date decommissioned and the decommissioning methods are per the reference cited in the table.

FIGURES

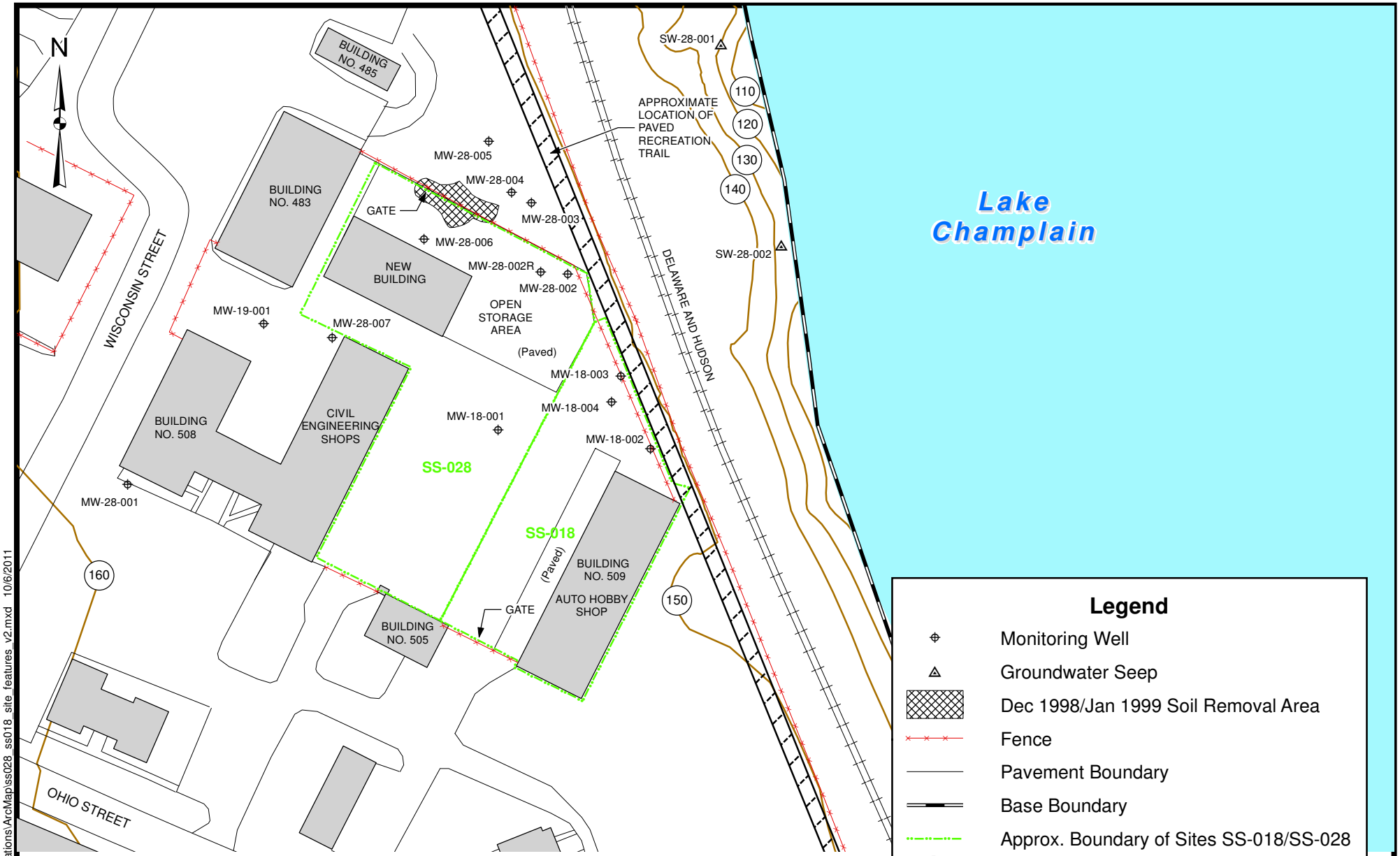


N:\111168476.00000\GIS\Applications\ArcMapss028_site_2.mxd 10/22/2008 EM

URS

FORMER PLATTSBURGH AFB, NY
AUTO HOBBY SHOP (SS-018) & BUILDING 508 (SS-028)
SITE LOCATION

FIGURE 1

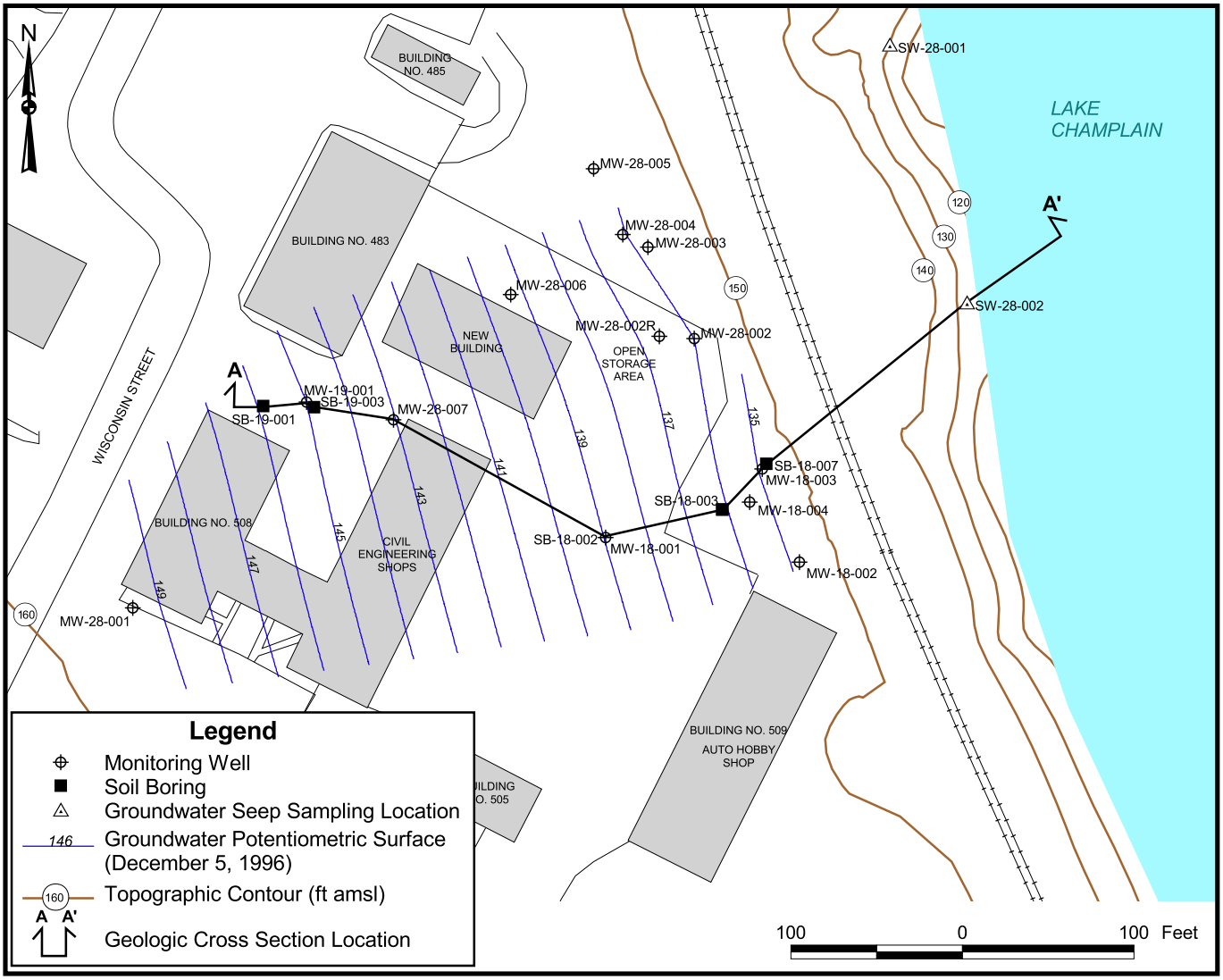


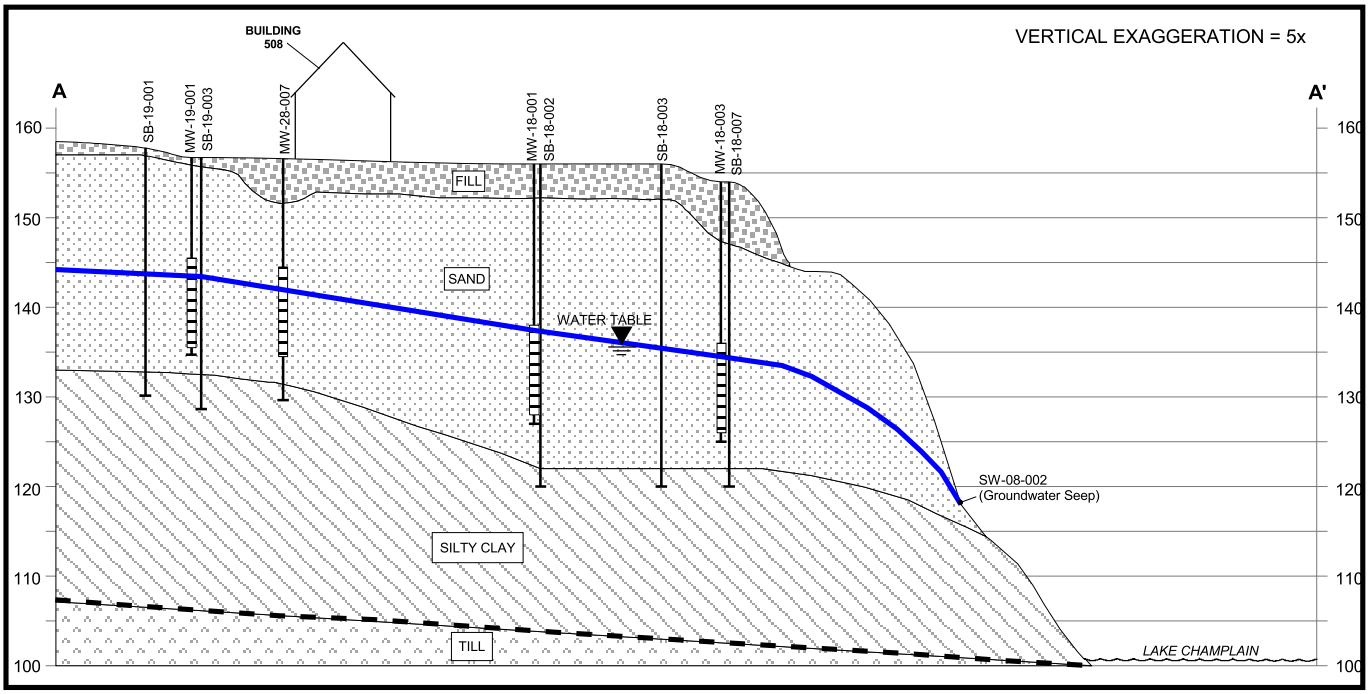
N:\11168476.00000\GIS\Applications\ArcMap\ss028_ss018_site_features_v2.mxd 10/6/2011

URS

SS-018 (AUTO HOBBY SHOP) AND SS-028 (OPEN STORAGE AREA)
SITE FEATURES

FIGURE 2





CROSS SECTION MODIFIED FROM FIGURE 3-5 OF SS-028 RI (URS 1999)

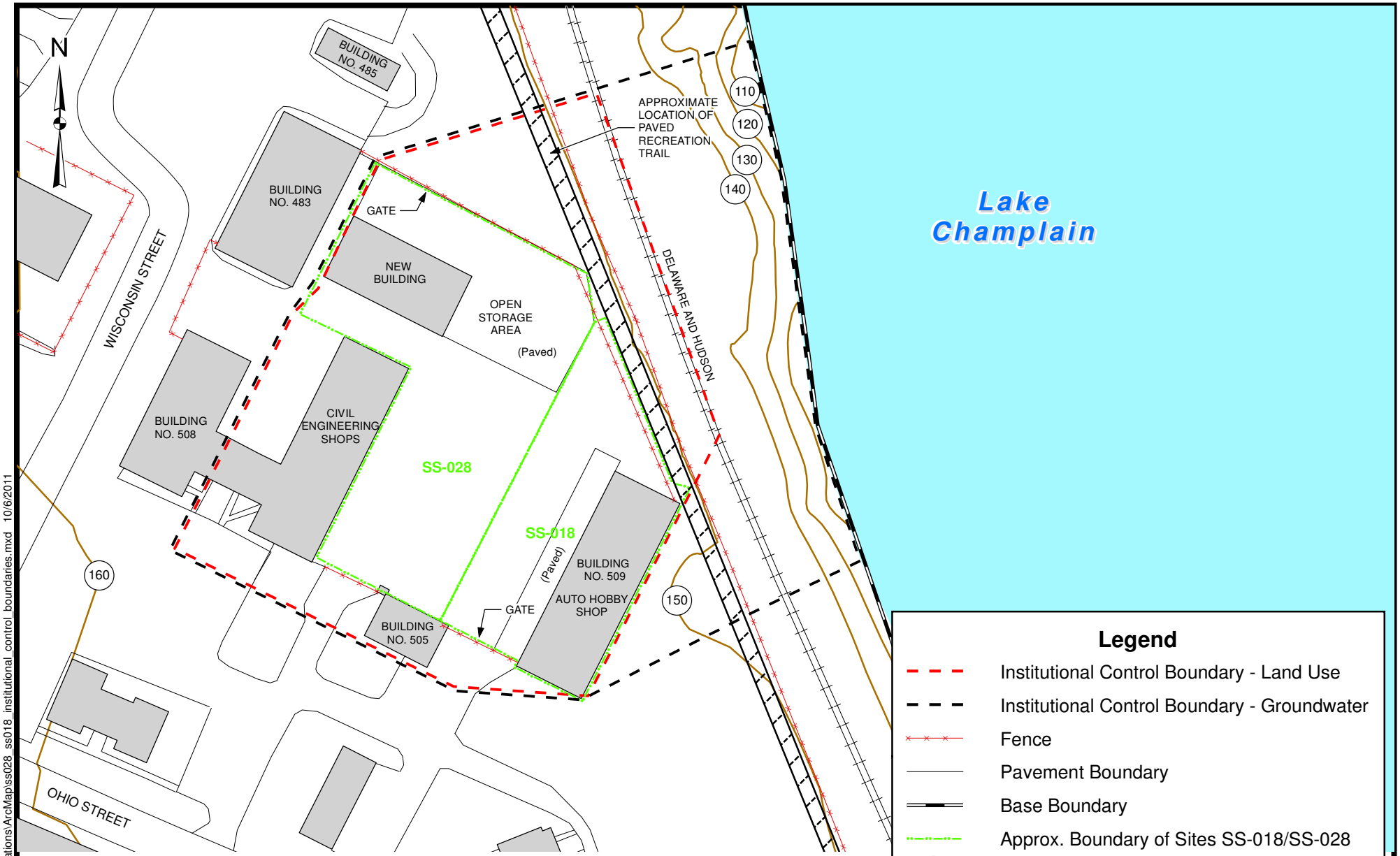
WATER TABLE FROM 12/5/96.

URS

PLATTSBURGH AIR FORCE BASE - SS-018/SS-028
GEOLOGIC CROSS SECTION A - A'

FIGURE 3

N:\11168476.00000\GIS\Applications\ss-028.apr 8.5 X 11 CROSS-SECTION 1/25/2011



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URS

SS-018 (AUTO HOBBY SHOP) AND SS-028 (OPEN STORAGE AREA)
INSTITUTIONAL CONTROL BOUNDARIES

FIGURE 4

N

MW-28-007
08/06/1997, 270 UG/L
05/03/1999, 430 UG/L
11/16/1999, 580 UG/L
01/11/2000, 41 UG/L
04/19/2000, 380 UG/L
06/29/2000, 380 UG/L
05/02/2001, 271.09 UG/L
10/24/2001, 179 UG/L
04/17/2002, 284 UG/L
10/21/2002, 106 UG/L
04/29/2003, 312 UG/L
10/23/2003, 24.07 UG/L
04/21/2004, 89.8 UG/L
10/20/2004, 58.8 UG/L
04/20/2005, 71.8 UG/L
10/19/2005, 40 UG/L
04/18/2006, 39.8 UG/L
10/24/2006, 10.1 UG/L
04/19/2007, 28.3 UG/L
10/31/2007, 9.01 UG/L
04/15/2008, 13.2 UG/L
10/15/2008, 11.6 UG/L
04/13/2009, 16.6 UG/L
10/13/2009, ND
06/14/2010, ND
12/13/2010, ND

MW-28-005
08/06/1997, 16 UG/L
04/29/1999, 24 UG/L
11/16/1999, 38 UG/L
01/11/2000, 31 UG/L
04/19/2000, 30 UG/L
06/29/2000, ND
05/02/2001, 5.69 UG/L
10/25/2001, 29.1 UG/L
04/18/2002, 25.9 UG/L
10/22/2002, 20.5 UG/L
04/30/2003, 19.9 UG/L
10/23/2003, 16.81 UG/L
04/22/2004, 17.8 UG/L
10/21/2004, 2.5 UG/L
04/21/2005, 11.3 UG/L
10/20/2005, 10.6 UG/L
04/19/2006, 22.3 UG/L
10/25/2006, 11.7 UG/L
04/19/2007, 11.8 UG/L
10/31/2007, 10.2 UG/L
04/15/2008, 13 UG/L
10/15/2008, 8.31 UG/L
04/13/2009, 9.41 UG/L
10/13/2009, 10.5 UG/L
06/14/2010, ND
12/13/2010, ND

MW-28-004
04/29/1999, ND
05/02/2001, 5.52 UG/L
10/25/2001, 3.7 UG/L
04/18/2002, 14.2 UG/L
10/22/2002, 2.07 UG/L
04/30/2003, 14.1 UG/L
10/23/2003, 7.79 UG/L
04/22/2004, 3.29 UG/L
10/21/2004, 1.13 UG/L
04/20/2005, 7.99 UG/L
10/20/2005, 0.98 UG/L
04/19/2006, 2.18 UG/L
10/25/2006, 1.52 UG/L

SW-28-001
05/03/2001, ND
10/25/2001, 121 UG/L
04/18/2002, 13.6 UG/L
10/22/2002, 20.1 UG/L
04/30/2003, 2.81 UG/L
10/23/2003, 5.57 UG/L
04/22/2004, 3.76 UG/L
10/21/2004, 2.24 UG/L
04/21/2005, 1.67 UG/L
10/20/2005, 1.73 UG/L
04/19/2006, 2.56 UG/L
10/25/2006, 1.83 UG/L
04/19/2007, 5.98 UG/L
10/31/2007, NS
04/15/2008, ND
10/15/2008, ND
04/13/2009, ND
10/13/2009, ND
06/14/2010, ND
12/13/2010, ND

MW-19-001
05/03/1999, 180 UG/L
11/16/1999, 440 UG/L
01/11/2000, 110 UG/L
04/19/2000, 160 UG/L
06/29/2000, 40 UG/L
05/02/2001, 49.02 UG/L
10/24/2001, 231 UG/L
04/17/2002, 81.4 UG/L
10/21/2002, 86.3 UG/L
04/29/2003, 42.8 UG/L
10/23/2003, 44.6 UG/L
04/21/2004, 30.1 UG/L
10/20/2004, 33.1 UG/L
04/20/2005, 25 UG/L
10/19/2005, 15 UG/L
04/18/2006, 14 UG/L
10/24/2006, 19.4 UG/L
04/19/2007, 15.4 UG/L
10/31/2007, 29.4 UG/L
04/15/2008, 25.6 UG/L
10/15/2008, 29.9 UG/L
04/13/2009, 15.5 UG/L
10/13/2009, ND
06/14/2010, ND
12/13/2010, NS

MW-8
04/19/2000, ND
06/29/2000, ND

MW-28-001
04/29/1999, ND
04/19/2000, ND

MW-28-006
08/06/1997, 190 UG/L
04/29/1999, 150 UG/L
04/19/2000, 140 UG/L

MW-28-002
04/29/1999, 38 UG/L
11/16/1999, 44 UG/L
01/11/2000, 28 UG/L
06/29/2000, 19 UG/L

SW-28-002
05/03/2001, 0.65 UG/L
10/25/2001, 3.29 UG/L
04/18/2002, 2.98 UG/L
10/22/2002, ND
04/30/2003, 1.67 UG/L
10/23/2003, 3.94 UG/L
04/22/2004, 0.86 UG/L
10/21/2004, 0.88 UG/L
04/21/2005, 1.42 UG/L
10/20/2005, 4.78 UG/L
04/19/2006, 1.77 UG/L
10/25/2006, 19.1 UG/L
04/19/2007, 1.90 UG/L
10/31/2007, NS
04/15/2008, ND
10/15/2008, ND
04/13/2009, NS
10/13/2009, ND
06/14/2010, ND
12/13/2010, ND

MW-18-004
10/24/2001, 0.29 UG/L
04/18/2002, 0.32 UG/L
10/21/2002, 0.26 UG/L
04/29/2003, 0.51 UG/L
10/24/2003, ND*
04/21/2004, 0.16 UG/L
10/21/2004, ND
04/21/2005, ND
10/19/2005, ND
04/18/2006, 0.11 UG/L
10/24/2006, ND

MW-9
04/19/2000, ND
06/29/2000, ND

MW-28-002R
05/03/2001, 375 UG/L
10/24/2001, 487 UG/L
04/17/2002, 529 UG/L
10/22/2002, 218 UG/L
04/29/2003, 268 UG/L
10/24/2003, 49.81 UG/L
04/21/2004, 137 UG/L
10/20/2004, 113 UG/L
04/21/2005, 122 UG/L
10/19/2005, 69.2 UG/L
04/18/2006, 72.8 UG/L
10/25/2006, 46.9 UG/L
04/19/2007, 67.8 UG/L
10/31/2007, NS
04/15/2008, NS
06/12/2008, 54.8 UG/L
10/15/2008, 49.2 UG/L
04/13/2009, 38.7 UG/L
10/13/2009, 26.7 UG/L
06/14/2010, 4.51 UG/L
12/13/2010, 1.86 UG/L

MW-7
04/19/2000, 5.6 UG/L
06/29/2000, 0.2 UG/L

MW-6
04/19/2000, ND
06/29/2000, ND

MW-1
04/19/2000, 230 UG/L

MW-2
04/19/2000, 300 UG/L

MW-5
04/19/2000, ND

MW-3
04/19/2000, ND

MW-4
04/19/2000, 1.9 UG/L

SUNOCO GASOLINE STATION

US ROUTE 9

WISCONSIN STREET

OHIO STREET

Lake Champlain

Legend

- Monitoring Well
- Groundwater Seep
- Groundwater Flow Direction
- Base Boundary

MW-7 (Location ID)
04/19/2000, 5.6 UG/L
Date Sampled
Concentration
Units

NOTE:
ND = Not Detected
NS = Not Sampled
* = The ND result in MW-18-004 is qualified "R" per AFCEE QAPP.

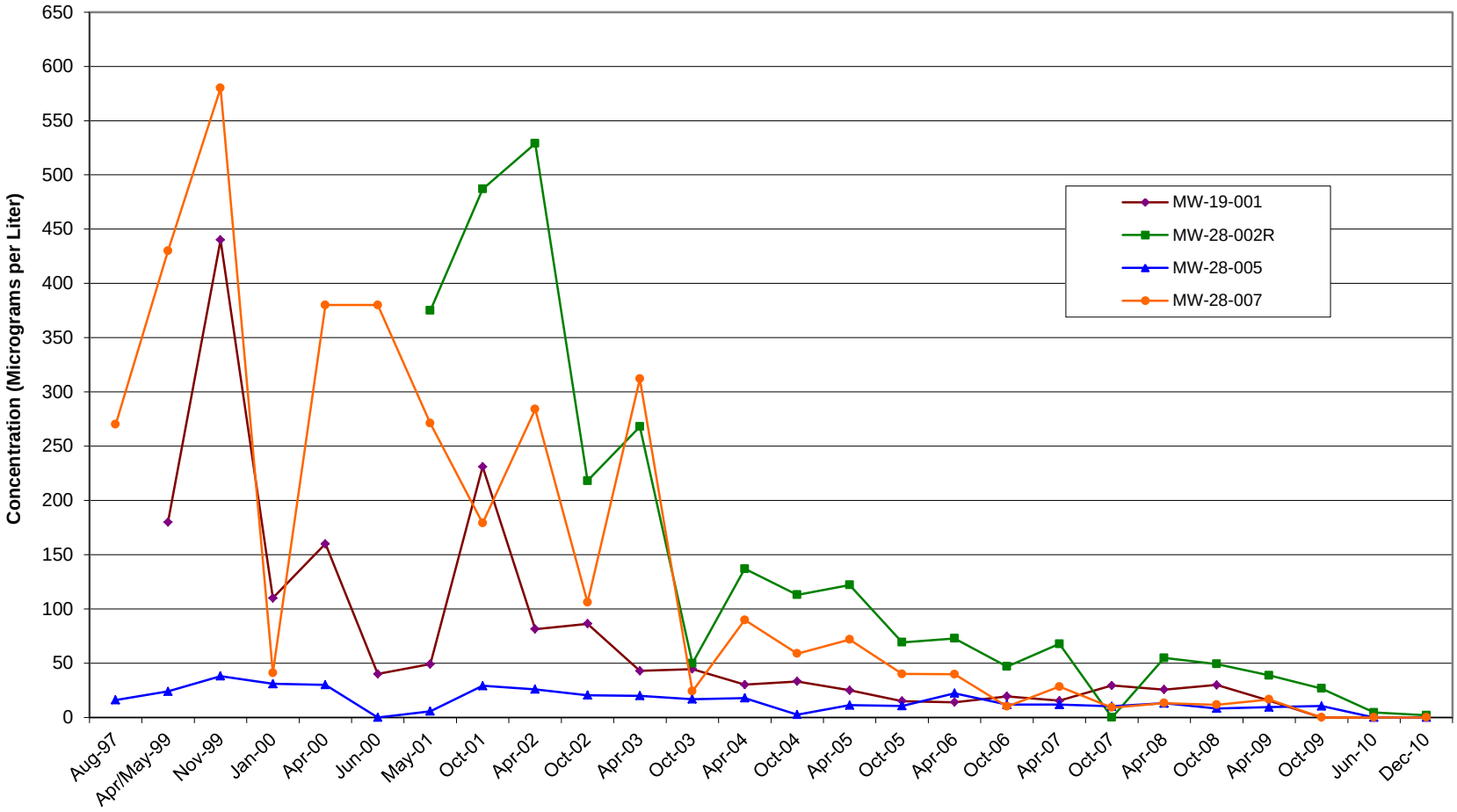
150 0 150 Feet

SITE SS-018/SS-028
HISTORIC MTBE DETECTIONS

URS

FIGURE 5

N:\11168476.00000\GIS\Applications\ArcMap\SS028 HISTORIC MTBE DETECTIONS.mxd 1/24/2011

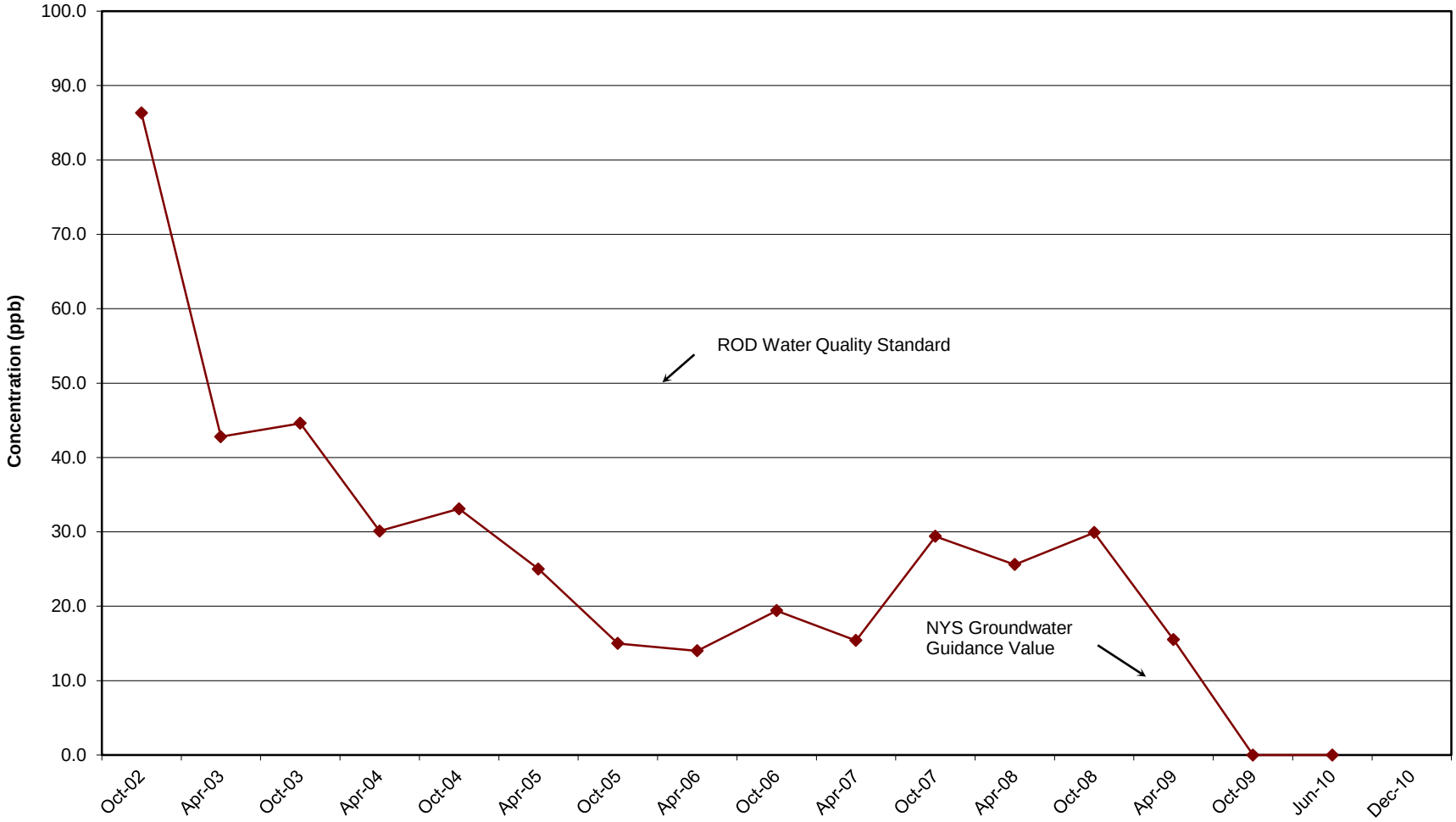


The MTBE water quality standard cited in the ROD is 50 µg/L.
The current New York State groundwater quality guidance value for MTBE is 10 µg/L.

URS

PLOT OF MTBE CONCENTRATIONS
SITE SS-018 (AUTO HOBBY SHOP) AND SS-028 (OPEN STORAGE AREA)

FIGURE 6

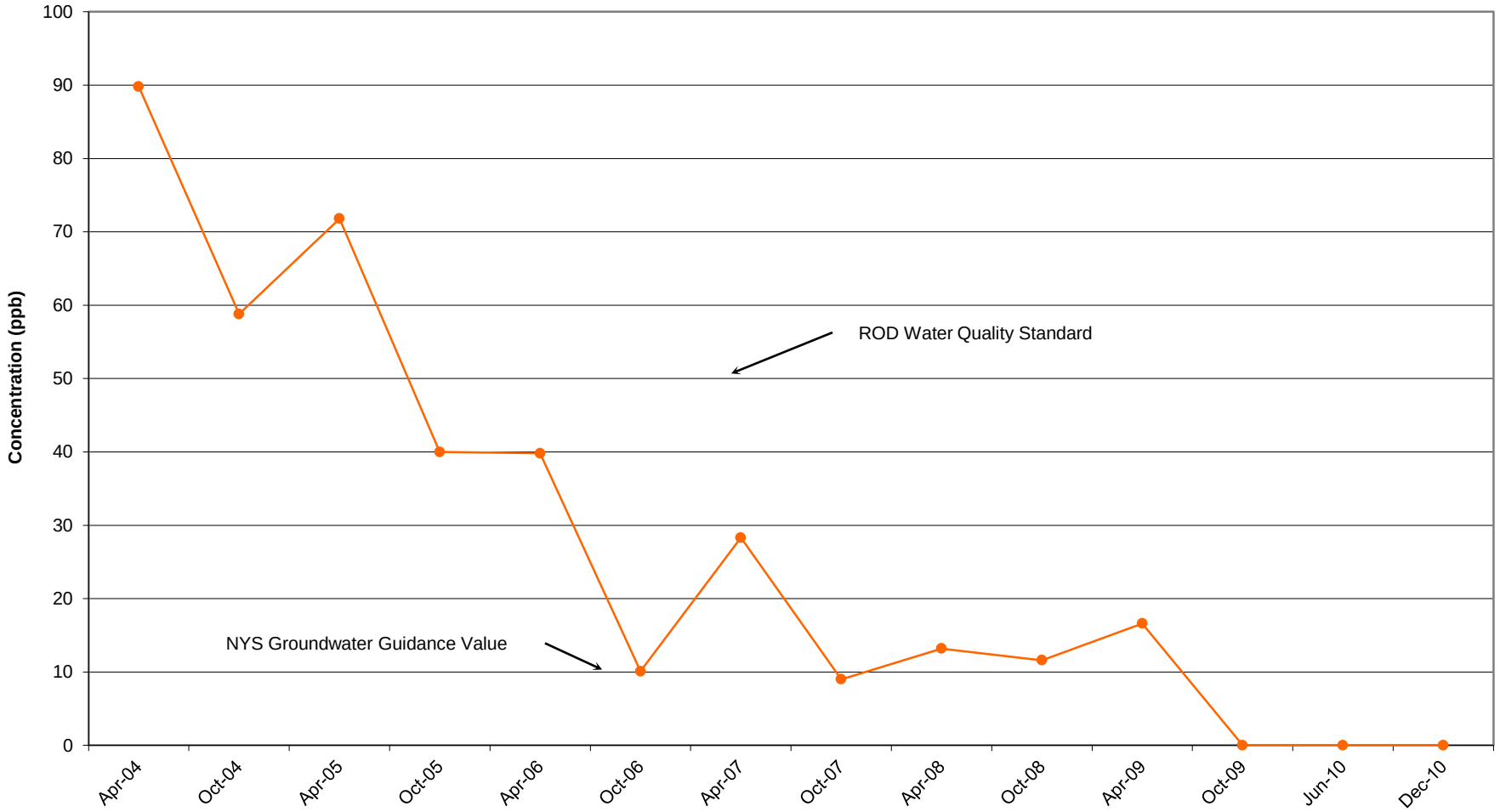


The MTBE water quality standard cited in the ROD is 50 µg/L.
The current New York State groundwater quality guidance value for MTBE is 10 µg/L.
This well could not be sampled in December 2010.

URS

MTBE CONCENTRATIONS
MW-19-001

FIGURE 7

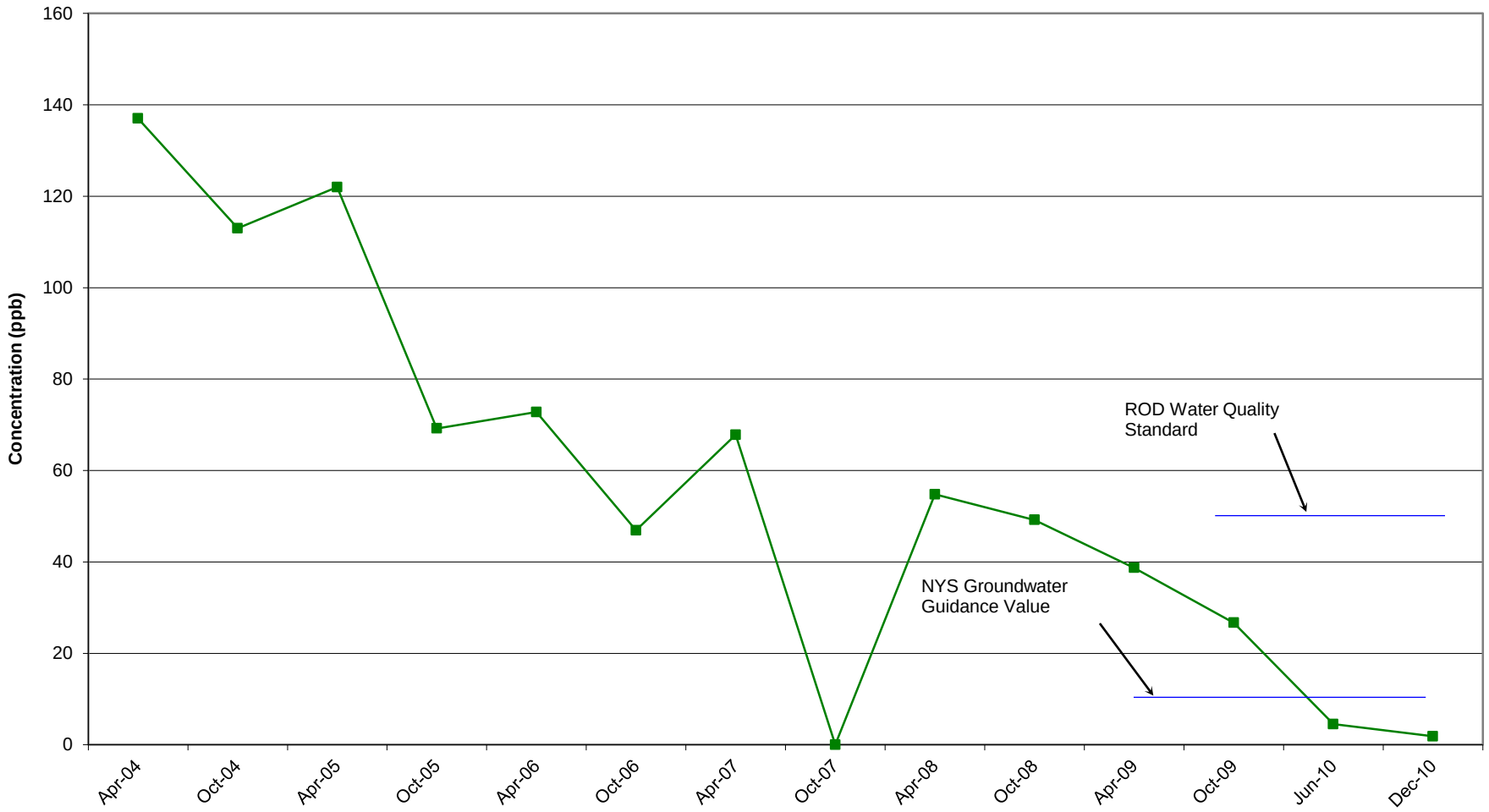


The MTBE water quality standard cited in the ROD is 50 µg/L.
The current New York State groundwater quality guidance value for MTBE is 10 µg/L.

URS

MTBE CONCENTRATIONS
MW-28-007

FIGURE 8

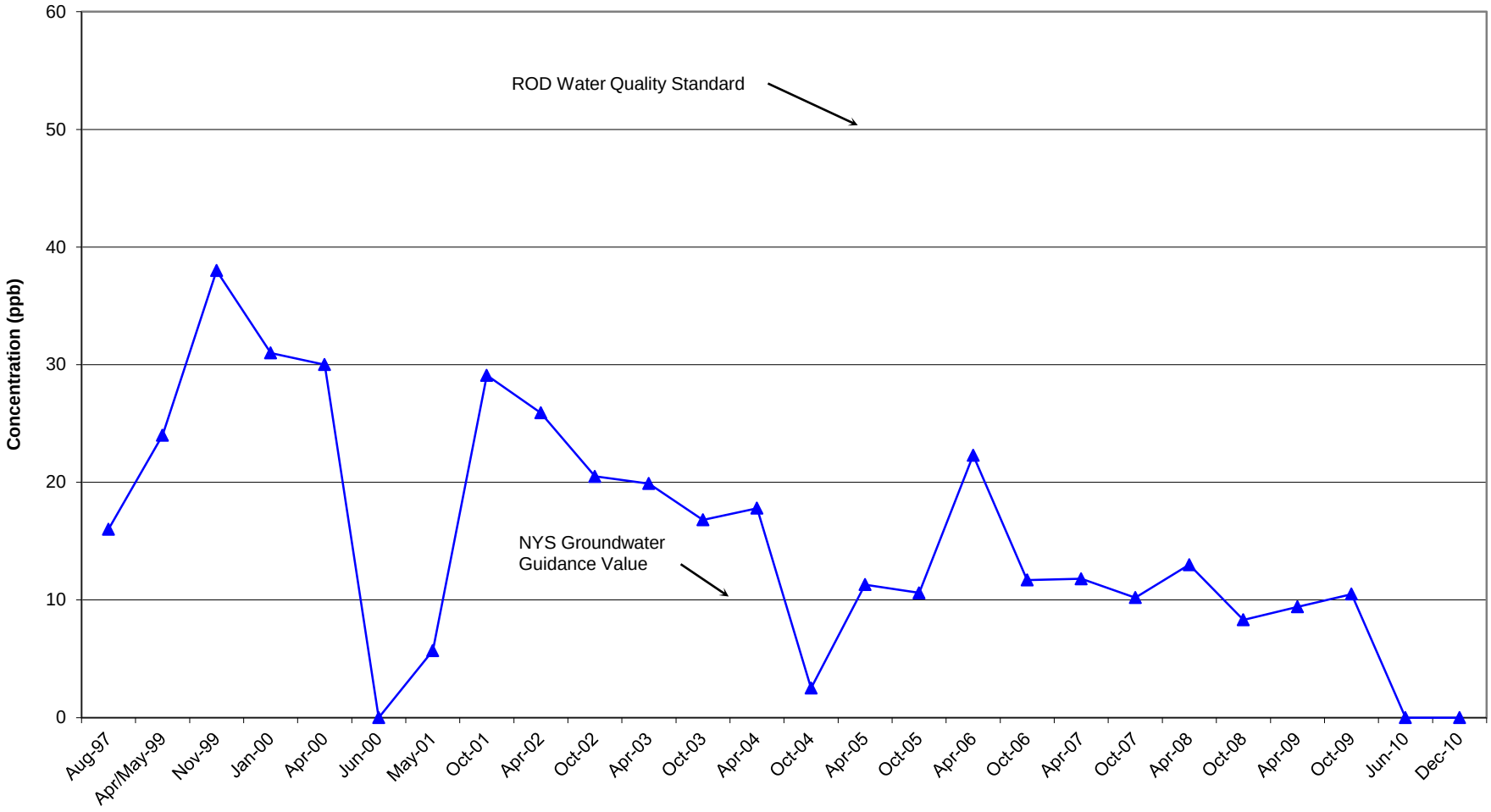


The MTBE water quality standard cited in the ROD is 50 µg/L.
The current New York State groundwater quality guidance value for MTBE is 10 µg/L.

URS

MTBE CONCENTRATIONS
MW-28-002R

FIGURE 9



The MTBE water quality standard cited in the ROD is 50 µg/L.
The current New York State groundwater quality guidance value for MTBE is 10 µg/L.

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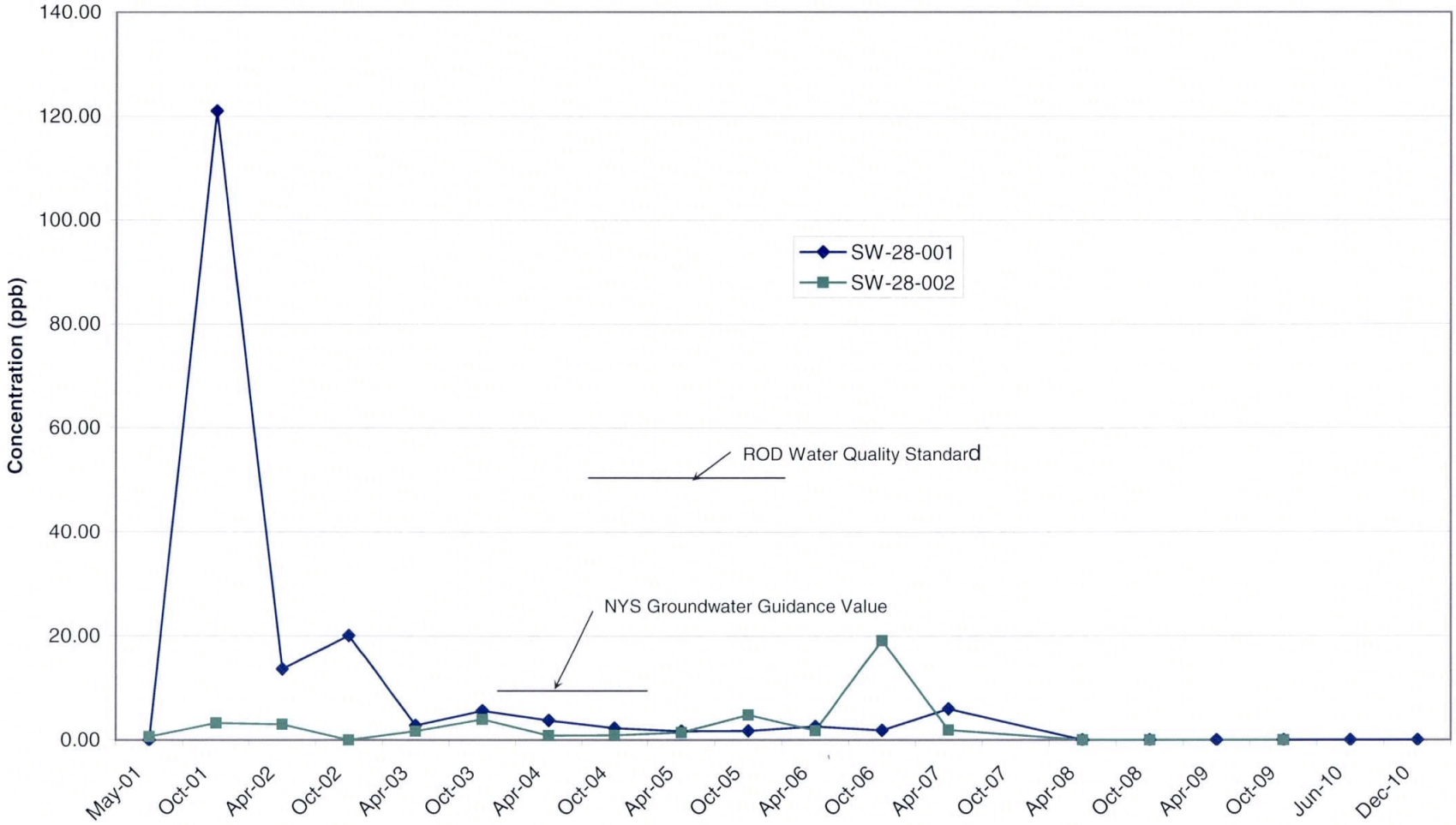
MTBE CONCENTRATIONS
MW-28-005

FIGURE 10



The MTBE water quality standard cited in the ROD is 50 µg/L.
The current New York State groundwater quality guidance value for MTBE is 10 µg/L.

URS

MTBE CONCENTRATIONS
SW-28-001 and SW-28-002

FIGURE 11

APPENDIX A
HISTORIC AERIAL PHOTOGRAPHS

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URS

FORMER PLATTSURGH AIR FORCE BASE, NY
SS-018/028 - 2003

FIGURE A -1

N:\11168476.00000\GIS\Applications\ArcMap\orthophotoSS016_2008.mxd 10/5/2011

URS

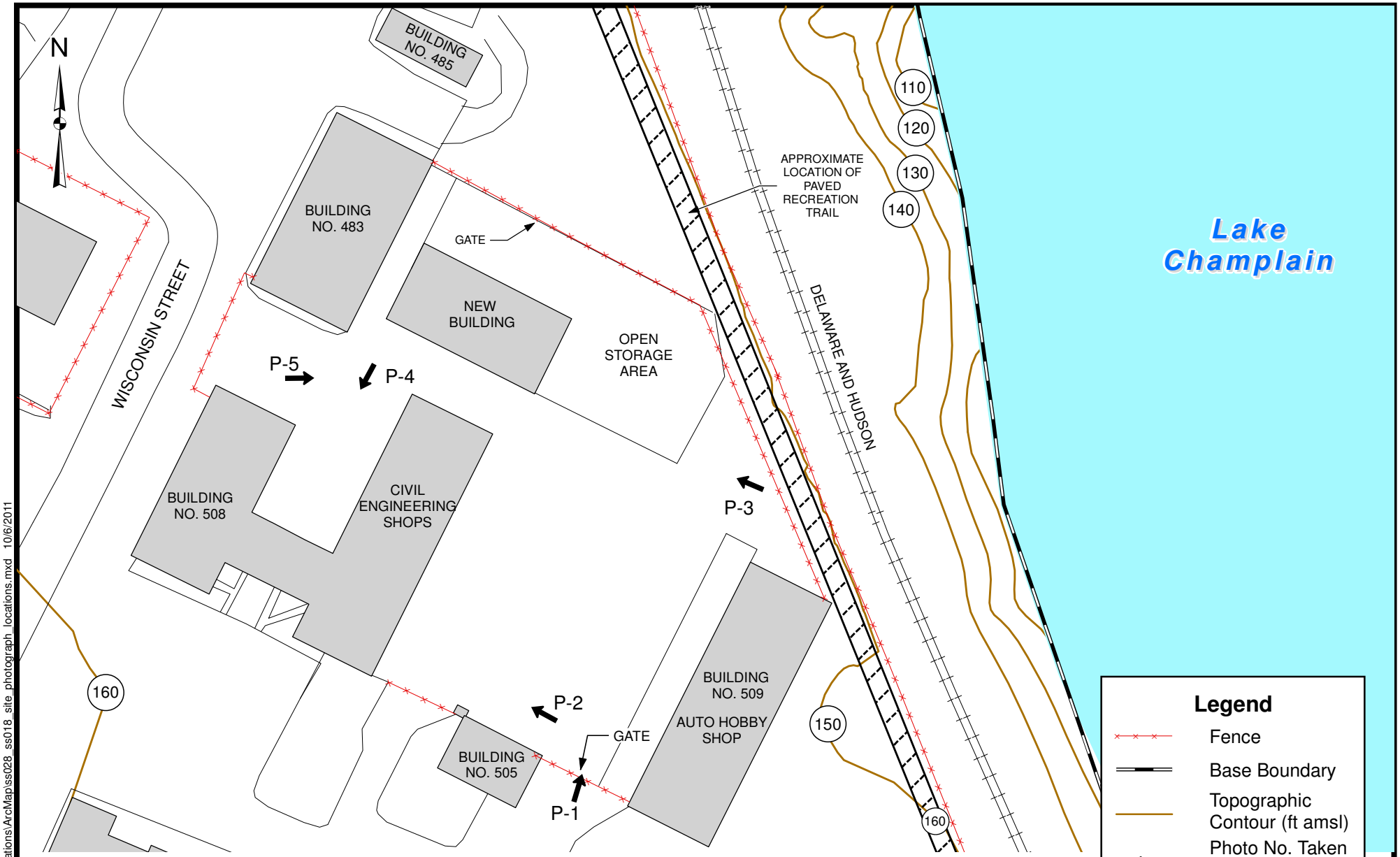
FORMER PLATTSURGH AIR FORCE BASE, NY
SS-018/028 - 2008

FIGURE A -2

APPENDIX B

SITE PHOTOGRAPHS

SEPTEMBER 2011



N:\11168476.00000\GIS\Applications\ArcMap\ss028_ss018_site_photograph_locations.mxd 10/6/2011

URS

SS-018 (AUTO HOBBY SHOP) AND SS-028 (OPEN STORAGE AREA)
SITE PHOTOGRAPH LOCATIONS

FIGURE B -1

Photo 1: Standing At Main Gate Looking East Into Site.

Photo 2: Standing Next To Building 505 Looking West.

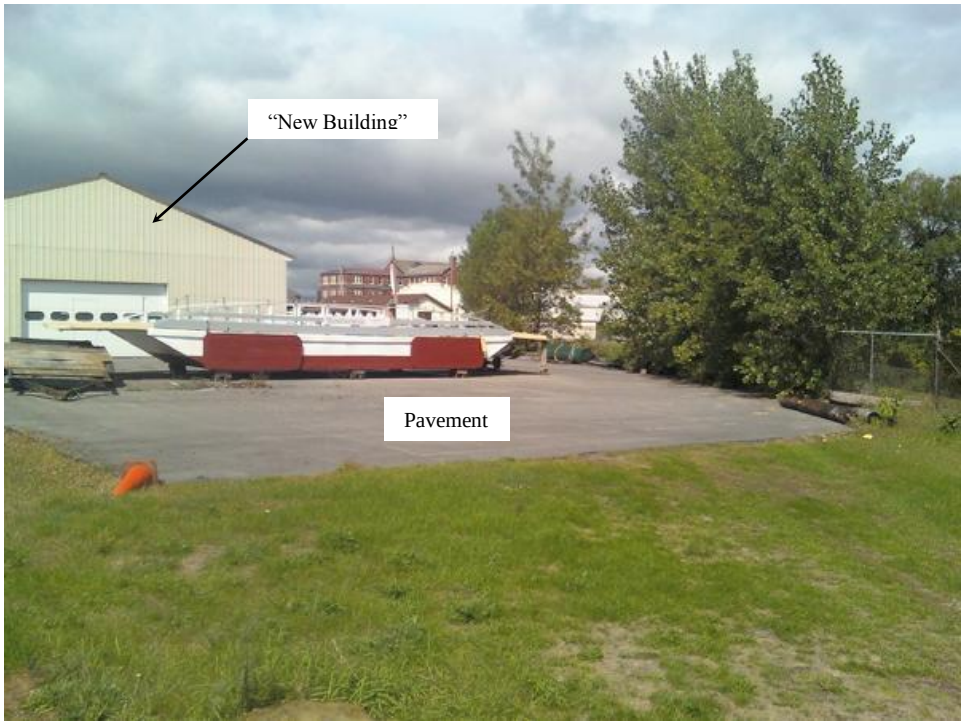


Photo 3: Standing North of Building 509 Looking West.

Photo 4: Standing At "New Building" Looking Southwest.

Photo 5: Standing Between Building 483 and Building 508 Looking East.

APPENDIX C
HISTORIC GROUNDWATER DATA

TABLE C-1
SS-018/SS-028 PRE-ROD GROUNDWATER SAMPLING
PRE-ROD HISTORICAL GROUNDWATER DATA 1993 THROUGH 2000
VOLATILE ORGANIC COMPOUNDS

Parameter	Criteria (1)	MW-19-001						MW-18-001		MW-18-002			MW-18-003				MW-28-001			MW-28-002 (2)							MW-28-003		MW-28-004			MW-28-005						MW-28-006			MW-28-007						SW-28-001	SW-28-002
		Jan '93	May '99	Nov '99	Jan '00	Apr '00	June '00	Jan '93	Apr '93	Jan '93	Apr '93	Aug '95	Jan '93	Apr '93	Aug '95	Aug '97	Nov '94	Apr '99	Apr '00	Nov '94	Aug '95	Aug '97	Apr '99	Nov '99	Jan '00	Jun '00	Oct '96	Aug '97	Oct '96	Jul '97	Aug '97	Apr '99	Aug '97	Apr '99	Nov '99	Jan '00	Apr '00	Jun '00	Aug '97	Apr '99	Apr '00	Aug '97	May '99	Nov '99	Jan '00	Apr '00	Jun '00	Aug '97	Aug '97
1,1,1-Trichloroethane	5		NA	NA	NA	NA	NA											NA	NA		0.30		NA	NA	NA	NA				NA		NA		NA	NA	NA	NA	NA		NA	NA		NA	NA	NA	NA	NA		
1,1,2,2-Tetrachloroethane			NA	NA	NA	NA	NA											NA	NA				NA	NA	NA	NA				NA		NA		NA	NA	NA	NA	NA		NA	NA		NA	NA	NA	NA	NA		
1,1,2-Trichloroethane			NA	NA	NA	NA	NA											NA	NA				NA	NA	NA	NA				NA		NA		NA	NA	NA	NA	NA		NA	NA		NA	NA	NA	NA	NA		
1,1-Dichloroethane			NA	NA	NA	NA	NA											NA	NA				NA	NA	NA	NA				NA		NA		NA	NA	NA	NA	NA		NA	NA		NA	NA	NA	NA	NA		
1,1-Dichloroethene	5		NA	NA	NA	NA	NA			7								NA	NA				NA	NA	NA	NA				NA		NA		NA	NA	NA	NA	NA		NA	NA		NA	NA	NA	NA	NA		
1,2-Dichloroethane			NA	NA	NA	NA	NA											NA	NA				NA	NA	NA	NA				NA		NA		NA	NA	NA	NA	NA		NA	NA		NA	NA	NA	NA	NA		
1,2-Dichloroethene (total)	5		NA	NA	NA	NA	NA											NA	NA				NA	NA	NA	NA			9		3	NA		NA	NA	NA	NA	NA		NA	NA		NA	NA	NA	NA	NA		
1,2-Dichloropropane			NA	NA	NA	NA	NA											NA	NA				NA	NA	NA	NA				NA		NA		NA	NA	NA	NA	NA		NA	NA		NA	NA	NA	NA	NA		
1,3-Dichloropropene (cis)			NA	NA	NA	NA	NA											NA	NA				NA	NA	NA	NA				NA		NA		NA	NA	NA	NA	NA		NA	NA		NA	NA	NA	NA	NA		
1,3-Dichloropropene (trans)			NA	NA	NA	NA	NA											NA	NA				NA	NA	NA	NA				NA		NA		NA	NA	NA	NA	NA		NA	NA		NA	NA	NA	NA	NA		
2-Hexanone			NA	NA	NA	NA	NA							R				NA	NA				NA	NA	NA	NA				NA		NA		NA	NA	NA	NA	NA		NA	NA		NA	NA	NA	NA	NA		
4-Methyl-2-pentanone			NA	NA	NA	NA	NA											NA	NA				NA	NA	NA	NA				NA		NA		NA	NA	NA	NA	NA		NA	NA		NA	NA	NA	NA	NA		
Acetone	50		NA	NA	NA	NA	NA											NA	NA				NA	NA	NA	NA				NA		NA		NA	NA	NA	NA	NA	23	NA	NA		NA	NA	NA	NA	NA		
Benzene	1									2								0.45												NA						0.32													
Bromodichloromethane	50		NA	NA	NA	NA	NA					1.8						NA	NA				NA	NA	NA	NA				NA		NA		NA	NA	NA	NA	NA		NA	NA		NA	NA	NA	NA	NA		
Bromoform			NA	NA	NA	NA	NA											NA	NA				NA	NA	NA	NA				NA		NA		NA	NA	NA	NA	NA		NA	NA		NA	NA	NA	NA	NA		
Bromomethane			NA	NA	NA	NA	NA											NA	NA				NA	NA	NA	NA				NA		NA		NA	NA	NA	NA	NA		NA	NA		NA	NA	NA	NA	NA		
Carbon disulfide			NA	NA	NA	NA	NA											NA	NA				NA	NA	NA	NA				NA		NA		NA	NA	NA	NA	NA		NA	NA		NA	NA	NA	NA	NA		
Carbon tetrachloride			NA	NA	NA	NA	NA											NA	NA				NA	NA	NA	NA				NA		NA		NA	NA	NA	NA	NA		NA	NA		NA	NA	NA	NA	NA		
Chlorobenzene	5		NA	NA	NA	NA	NA			2								NA	NA				NA	NA	NA	NA				NA		NA		NA	NA	NA	NA	NA		NA	NA		NA	NA	NA	NA	NA		
Chloroethane			NA	NA	NA	NA	NA											NA	NA				NA	NA	NA	NA				NA		NA		NA	NA	NA	NA	NA		NA	NA		NA	NA	NA	NA	NA		
Chloroform	7		NA	NA	NA	NA	NA					49			0.5			NA	NA				NA	NA	NA	NA				NA		NA		NA	NA	NA	NA	NA		NA	NA	3	NA	NA	NA	NA	NA		
Chloromethane			NA	NA	NA	NA	NA											NA	NA				NA	NA	NA	NA				NA		NA		NA	NA	NA	NA	NA		NA	NA		NA	NA	NA	NA	NA		
Dibromochloromethane			NA	NA	NA	NA	NA											NA	NA				NA	NA	NA	NA				NA		NA		NA	NA	NA	NA	NA		NA	NA		NA	NA	NA	NA	NA		
Ethylbenzene																														NA																	
Methyl ethyl ketone			NA	NA	NA	NA	NA				R			R				NA	NA				NA	NA	NA	NA				NA		NA		NA	NA	NA	NA	NA		NA	NA		NA	NA	NA	NA	NA		
Methyl tert-butyl ether	10	NA	180	440	110	160	40	NA		NA	NA	NA	NA	NA	NA	NA	NA			NA	NA	NA	38	44	28	19	NA	NA	NA	NA	NA		16	24	38	31	30		190	150	140	270	430	580	41	380	380	NA	NA
Methylene chloride			NA	NA	NA	NA	NA											NA	NA				NA	NA	NA	NA				NA		NA		NA	NA	NA	NA	NA		NA	NA		NA	NA	NA	NA	NA		
Styrene			NA	NA	NA	NA	NA											NA	NA				NA	NA	NA	NA				NA		NA		NA	NA	NA	NA	NA		NA	NA		NA	NA	NA	NA	NA		
Tetrachloroethene	5		NA	NA	NA	NA	NA		0.4		0.2	1.2	3	0.4				NA	NA	8	5	5	NA	NA	NA	NA			28	15	17	NA		NA	NA	NA	NA	NA		NA	NA		NA	NA	NA	NA	NA		
Toluene	5									2																				NA																	
Trichloroethene	5		NA	NA	NA	NA	NA				0.4							NA	NA		0.6		NA	NA	NA	NA			5.7		3	NA		NA	NA	NA	NA	NA		NA	NA		NA	NA	NA	NA	NA		
Vinyl Acetate								NA	NA	NA		NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride			NA	NA	NA	NA	NA											NA	NA				NA	NA	NA	NA				NA		NA		NA	NA	NA	NA	NA		NA	NA		NA	NA	NA	NA	NA		
Xylene (total)																														NA																	

All analytes are shown. Blanks indicate that the analyte was not detected.
Concentrations are in micrograms/Liter (µg/L). NA = Not Analyzed. R = Data Rejected.
Shading indicates an exceedance of the groundwater quality criteria.

Compiled By: D. Hart Date: 9/30/11

Checked By: S.M. Col Date: 9/30/11

Notes:

1. NYSDEC groundwater quality criteria are only shown for compounds detected.
   a. VOCs except those noted below are per 6 NYCRR Part 703 (NYSDEC 2008).
   b. Acetone and bromodichloromethane are guidance values per NYSDEC 1998.
   c. MTBE is a guidance value per NYSDEC 2000.

2. MW-28-002 was replaced by MW-28-002R, located about 25 feet east, in January 2001. The original monitoring well was decommissioned during construction of the paved recreational trail.

TABLE C-2
SITE SS-018/SS-028 POST-ROD MONITORING PROGRAM
POST-ROD HISTORICAL MONITORING WELL GROUNDWATER DATA 2001 THROUGH 2004
VOLATILE ORGANIC COMPOUNDS

Parameter	Criteria (1)	MW-18-004							MW-19-001							MW-28-002R							MW-28-004						
		Oct '01	Apr '02	Oct '02	Apr '03	Oct '03	Apr '04	Oct '04	May '01	Oct '01	Apr '02	Oct '02	Apr '03	Oct '03	Apr '04	Oct '04	May '01	Oct '01	Apr '02	Oct '02	Apr '03	Oct '03	Apr '04	Oct '04	May '01	Oct '01	Apr '02	Oct '02	Apr '03	Oct '03	Apr '04	Oct '04
1,1,1,2-Tetrachloroethane																															
1,1,1-Trichloroethane	5																				0.15			0.20				0.21			0.20
1,1,2,2-Tetrachloroethane																															
1,1,2-Trichloroethane																															
1,1-Dichloroethane																															
1,1-Dichloroethene																															
1,1-Dichloropropene																															
1,2,3-Trichlorobenzene																															
1,2,3-Trichloropropane																															
1,2,4-Trichlorobenzene																															
1,2,4-Trimethylbenzene																															
1,2-Dibromo-3-chloropropane																															
1,2-Dibromoethane																															
1,2-Dichlorobenzene																															
1,2-Dichloroethane																															
1,2-Dichloroethene (cis)																															
1,2-Dichloroethene (trans)																															
1,2-Dichloropropane																															
1,3,5-Trimethylbenzene																															
1,3-Dichlorobenzene																															
1,3-Dichloropropane																															
1,3-Dichloropropene (cis)																															
1,3-Dichloropropene (trans)																															
1,4-Dichlorobenzene																															
1-Chlorohexane																															
2,2-Dichloropropane																															
2-Chlorotoluene																															
4-Chlorotoluene																															
4-Isopropyltoluene																															
Benzene																															
Bromobenzene																															
Bromochloromethane																															
Bromodichloromethane																															
Bromoform																															
Bromomethane																															
Carbon tetrachloride																															
Chlorobenzene																															
Chloroethane																															
Chloroform																															
Chloromethane																															
Dibromochloromethane																															
Dibromomethane																															
Dichlorodifluoromethane																															
Ethylbenzene																															
Hexachlorobutadiene																															
Isopropylbenzene																															
m&p-Xylene		NA	NA	NA		NA	NA	NA		NA	NA	NA		NA	NA	NA		NA	NA	NA		NA	NA	NA		NA	NA	NA		NA	NA	NA
Methyl tert-butyl ether	10	0.29	0.32	0.26	0.51	R	0.16		49	231	81.4	86.3	42.8	44.6	30.1	33.1	375	487	529	218	268	49.8	137	113	5.52	3.7	14.2	2.07	14.1	7.79	3.29	1.13	5.69	29.1	25.9	20.5	19.9	16.8	17.8	2.5	271	179	284	106	312	24.1	89.8	58.8
Methylene chloride																															
Naphthalene																															
n-Butylbenzene																															
n-Propylbenzene																															
o-Xylene		NA	NA	NA		NA	NA	NA		NA	NA	NA		NA	NA	NA		NA	NA	NA		NA	NA	NA		NA	NA	NA		NA	NA	NA
sec-Butylbenzene																															
Styrene																															
tert-Butylbenzene																															
Tetrachloroethene	5																0.38		0.82	0.09	1.43	0.41	1.12	9.04	3.08	0.65	5.05	0.85	2.77	1.88	4.59	3.51				0.09			1.22						
Toluene				0.33																																							
Trichloroethene	5							0.18													0.12			1.66	0.64	0.32	1	0.24	0.7	0.5	1.16	0.38						0.2						
Trichlorofluoromethane																															
Vinyl chloride																															
Xylene (total)									NA								NA							NA							NA												

Parameter	Criteria (1)	MW-28-005								MW-28-007							
		May '01	Oct '01	Apr '02	Oct '02	Apr '03	Oct '03	Apr '04	Oct '04	May '01	Oct '01	Apr '02	Oct '02	Apr '03	Oct '03	Apr '04	Oct '04
1,1,1,2-Tetrachloroethane																	
1,1,1-Trichloroethane	5																
1,1,2,2-Tetrachloroethane																	
1,1,2-Trichloroethane																	
1,1-Dichloroethane																	
1,1-Dichloroethene																	
1,1-Dichloropropene																	
1,2,3-Trichlorobenzene																	
1,2,3-Trichloropropane																	
1,2,4-Trichlorobenzene																	
1,2,4-Trimethylbenzene																	
1,2-Dibromo-3-chloropropane																	
1,2-Dibromoethane																	
1,2-Dichlorobenzene																	
1,2-Dichloroethane																	
1,2-Dichloroethene (cis)																	
1,2-Dichloroethene (trans)																	
1,2-Dichloropropane																	
1,3,5-Trimethylbenzene																	
1,3-Dichlorobenzene																	
1,3-Dichloropropane																	
1,3-Dichloropropene (cis)																	
1,3-Dichloropropene (trans)																	
1,4-Dichlorobenzene																	
1-Chlorohexane																	
2,2-Dichloropropane																	
2-Chlorotoluene																	
4-Chlorotoluene																	
4-Isopropyltoluene																	
Benzene																	
Bromobenzene																	
Bromochloromethane																	
Bromodichloromethane																	
Bromoform																	
Bromomethane																	
Carbon tetrachloride																	
Chlorobenzene																	
Chloroethane																	
Chloroform																	
Chloromethane																	
Dibromochloromethane																	
Dibromomethane																	
Dichlorodifluoromethane																	
Ethylbenzene																	
Hexachlorobutadiene																	
Isopropylbenzene																	
m&p-Xylene			NA	NA	NA		NA	NA	NA		NA	NA	NA		NA	NA	NA
Methyl tert-butyl ether	10	271	179	284	106	312	24.1	89.8	58.8								
Methylene chloride																	
Naphthalene																	
n-Butylbenzene																	
n-Propylbenzene																	
o-Xylene			NA	NA	NA		NA	NA	NA		NA	NA	NA		NA	NA	NA
sec-Butylbenzene																	
Styrene																	
tert-Butylbenzene																	
Tetrachloroethene	5				0.09			1.22									
Toluene																	
Trichloroethene	5							0.2									
Trichlorofluoromethane																	
Vinyl chloride																	
Xylene (total)			NA							NA							

All analytes are shown. Blanks indicate that the analyte was not detected.
Concentrations are in micrograms/Liter (µg/L). NA = Not Analyzed. R = Data Rejected.
Shading indicates an exceedance of the groundwater quality criteria.

Notes:
1. NYSDEC groundwater quality criteria are only shown for compounds detected.
   VOCs except MTBE per 6 NYCRR Part 703 (NYSDEC 2008).
   MTBE per NYSDEC 2000.

Compiled By: DHT Date: 9/29/11
Checked By: SMcL Date: 9/30/11

TABLE C-3
SITE SS-018/SS-028 POST-ROD MONITORING PROGRAM
POST-ROD HISTORICAL GROUNDWATER SEEP DATA 2001 THROUGH 2004
VOLATILE ORGANIC COMPOUNDS

Parameter	Criteria (1)	SW-28-001								SW-28-002							
		May-01	Oct-01	Apr-02	Oct-02	Apr-03	Oct-03	Apr-04	Oct-04	May-01	Oct-01	Apr-02	Oct-02	Apr-03	Oct-03	Apr-04	Oct-04
1,1,1,2-Tetrachloroethane																	
1,1,1-Trichloroethane																	
1,1,2,2-Tetrachloroethane																	
1,1,2-Trichloroethane																	
1,1-Dichloroethane																	
1,1-Dichloroethene																	
1,1-Dichloropropene																	
1,2,3-Trichlorobenzene																	
1,2,3-Trichloropropane																	
1,2,4-Trichlorobenzene																	
1,2,4-Trimethylbenzene																	
1,2-Dibromo-3-chloropropane																	
1,2-Dibromoethane																	
1,2-Dichlorobenzene																	
1,2-Dichloroethane																	
1,2-Dichloroethene (cis)																	
1,2-Dichloroethene (trans)																	
1,2-Dichloropropane																	
1,3,5-Trimethylbenzene																	
1,3-Dichlorobenzene																	
1,3-Dichloropropane																	
1,3-Dichloropropene (cis)																	
1,3-Dichloropropene (trans)																	
1,4-Dichlorobenzene																	
1-Chlorohexane																	
2,2-Dichloropropane																	
2-Chlorotoluene																	
4-Chlorotoluene																	
4-Isopropyltoluene																	
Benzene																	
Bromobenzene																	
Bromochloromethane																	
Bromodichloromethane																	
Bromoform																	
Bromomethane																	
Carbon tetrachloride																	
Chlorobenzene																	
Chloroethane																	
Chloroform	7	0.39															
Chloromethane																	
Dibromochloromethane																	
Dibromomethane																	
Dichlorodifluoromethane																	
Ethylbenzene																	
Hexachlorobutadiene																	
Isopropylbenzene																	
m&p-Xylene			NA	NA	NA		NA	NA	NA		NA	NA	NA		NA	NA	NA
Methyl tert-butyl ether	10		121	13.6	20.1	2.81	5.57	3.76	2.24	0.65	3.29	2.98		1.67	3.94	0.86	0.88
Methylene chloride																	
Naphthalene																	
n-Butylbenzene																	
n-Propylbenzene																	
o-Xylene			NA	NA	NA		NA	NA	NA		NA	NA	NA		NA	NA	NA

TABLE C-3
SITE SS-018/SS-028 POST-ROD MONITORING PROGRAM
POST-ROD HISTORICAL GROUNDWATER SEEP DATA 2001 THROUGH 2004
VOLATILE ORGANIC COMPOUNDS

Parameter	Criteria (1)	SW-28-001								SW-28-002							
		May-01	Oct-01	Apr-02	Oct-02	Apr-03	Oct-03	Apr-04	Oct-04	May-01	Oct-01	Apr-02	Oct-02	Apr-03	Oct-03	Apr-04	Oct-04
sec-Butylbenzene																	
Styrene																	
tert-Butylbenzene																	
Tetrachloroethene	5		0.45	0.8	0.39	0.54	0.46	0.72	0.4		1.01	0.9		0.56	0.48	0.47	0.3
Toluene																	
Trichloroethene																	
Trichlorofluoromethane																	
Vinyl chloride																	
Xylene (total)		NA								NA							

All analytes are shown. Blanks indicate that the analyte was not detected.
Concentrations are in micrograms/Liter (µg/L). NA = Not Analyzed.
Shading indicates an exceedance of the groundwater quality criteria.

Compiled By: D Hart Date: 9/29/11
Checked By: M.C. Date: 9/30/11

Notes:
1. NYSDEC groundwater quality criteria are only shown for compounds detected.
   VOCs except MTBE per 6 NYCRR Part 703 (NYSDEC 2008).
   MTBE per NYSDEC 2000.

APPENDIX D

SS-028 SOIL REMOVAL

CONFIRMATORY SOIL SAMPLE DATA

URS

CALCULATION COVER SHEET

Client: AFCEE Project Name: Former Plattsburgh AFB

Project/Calculation Number: Performance-Based Remediation - 11176211

Title: SS-028 – Confirmation Soil Sample Data From Time Critical Removal Action

Total Number of Pages (including cover sheet): 7

Total Number of Computer Runs: None

Prepared by: Donald Hunt DH Date: 12-22-11

Checked by: David Coulter DHC Date: 12-28-11

Description and Purpose:

Document the confirmation soil sample results that were collected as part of a time-critical removal action in 1998/1999 at the SS-028 Open Storage Area and verify that the concentrations found in the soil samples meet the current unrestricted use soil cleanup objectives in 6 NYCRR Part 375 (Ref 1).

References:

1. New York State Department of Environmental Conservation (NYSDEC), 2006. *Title 6 New York Codes, Rules, and Regulations (6 NYCRR), Part 375 Environmental Remediation Programs, Table 375-6.8(a): Unrestricted Use Soil Cleanup Objectives*; effective date December 14.
2. URS Consultants, Inc. (URS), 1999. *Closure Report Building 508 Open Storage Area (SS-028) Time Critical Removal Action*; October.
3. New York State Department of Environmental Conservation (NYSDEC), 1994. *Technical and Administrative Guidance Memorandum (TAGM) 4046, Determination of Soil Cleanup Objectives and Cleanup Levels*; January 24.
4. New York State Department of Environmental Conservation (NYSDEC), 2010. *Soil Cleanup Guidance, Final Commissioner Policy CP-51*; Division of Environmental Remediation; October 21.

Remarks/Conclusions/Results:

Concentrations of compounds detected in the confirmatory soil samples that were not excavated and are therefore representative of residual soils left in place were all less than the unrestricted use soil cleanup objectives presented in 6 NYCRR Part 375 (Ref 1). See summary table on page 4.

Calculation Approved By:

Donald Hunt

Donald Hunt, Project Manager

Soil Removal Action

Between December 1998 and June 1999, a time-critical soil removal action was executed at Site SS-028 (Ref 2). The objective of the removal action was to excavate an area of soil that was found to be contaminated with chlorinated compounds. This soil contamination was thought to be the source of groundwater contamination in downgradient wells. The location of the soil removal is shown on Figure 2 included as an attachment. Concentrations of compounds detected in confirmatory soil samples collected during the removal action were compared to the recommended soil cleanup objectives listed in the New York State Department of Environmental Conservation (NYSDEC) Technical and Administrative Guidance Memorandum (TAGM) 4046 (Ref 3).

For instance, tetrachloroethene, also known as perchloroethene (PCE) was found in a soil sample from a boring (G-17, see attached Figure 6) in this area at a concentration of 1,900 micrograms per kilogram (µg/kg), which exceeded its NYSDEC soil cleanup objective of 1,400 µg/kg. This soil sample was immediately upgradient of monitoring well MW-028-004 where PCE, trichloroethene (TCE) and dichloroethene (DCE) were detected at concentrations higher than their respective NYSDEC groundwater quality standards. These chlorinated compounds were not detected in a well upgradient of the soil removal area. Therefore, the chlorinated compounds detected in the soil in the vicinity of G-17 were determined to be a source of PCE, TCE, and DCE in downgradient groundwater (Ref 2).

In December 1998, approximately 112 cubic yards of chlorinated hydrocarbon contaminated soil were excavated in two stages (Ref 2). On December 21st, 99 cubic yards of soil were excavated from an area of about 1,104 square feet (see excavation plan/confirmatory soil sample location plan included as an attachment). Following this initial excavation, confirmatory soil samples (SO-1 through SO-9) collected on December 21st indicated that soil still remained in place at four locations (SO-1, SO-2, SO-6, and SO-8) with concentrations that were close to or exceeded NYSDEC's recommended soil cleanup objectives at that time (Ref 3). Consequently, on December 30th, 13 additional cubic yards of soil were removed from the vicinity of these four locations.

Three additional confirmatory soil samples (SO-10 through SO-12) were collected on December 30th, but they were delayed in transit and did not reach the laboratory until January 6, 1999. Because the holding times were not exceeded and the samples were still at the required 5° C, the samples were analyzed. These same three samples were, however, recollected on January 21, 1999, followed by three more samples (SO-13 through SO-15) in May 1999 at the request of the United States Environmental Protection Agency (USEPA) to verify that clean closure had been achieved in the excavation; i.e., that all concentrations detected in the soil samples were less than NYSDEC's recommended soil cleanup objectives stipulated in TAGM 4046 (Ref 3). USEPA and NYSDEC gave approval for backfilling the excavation, which was completed on June 8, 1999 (Ref 2).

Confirmatory Soil Sample Results

The analytical results from the confirmatory soil samples are summarized on page 4 compared to the TAGM 4046 soil cleanup objectives in effect at the time of the removal action (Ref 3). The soil samples were analyzed for Target Compound List volatile organic compounds, but only the detected compounds are listed in the summary table. Note that the soil represented by samples

SO-1, SO-2, SO-6, and SO-8 was removed and disposed of. The other soil samples are representative of soil that was left in place and not excavated. There were no exceedances of TAGM 4046 recommended soil cleanup objectives in these samples indicating that the limit of the chlorinated compound contaminated soil had been defined, so the excavation was backfilled.

In 2010, NYSDEC rescinded the TAGM 4046 soil cleanup objectives (Ref 4) and replaced them with new criteria presented in Title 6 of the New York Codes, Rules, and Regulations (6 NYCRR) Part 375 (Ref 1). Also shown in the confirmatory soil sample data table on page 4 are the unrestricted use soil cleanup objectives from 6 NYCRR Part 375. Concentrations of compounds detected in the confirmatory samples representative of the residual soils left in place when the excavation was declared complete are all less than the unrestricted use soil cleanup objectives.

URS

Job: Former Plattsburgh AFB
Decsription: SS-028 Confirmation Soil Sample Data

Project No: 11176211 Page 4 of 5
Computed By: D. Hunt Date: 12-22-11
Checked By: D. Coulter Date: 12-28-11

1998/1999 Site SS-028 Soil Removal Action
Confirmation Soil Sample Data [1]

Parameter	Soil Cleanup Objectives		Soil Samples [2]																	
			December 21, 1998									December 30, 1998			January 21, 1999			May 10, 1999		
	TAGM 4046 [3]	6 NYCRR Part 375 [4]	SO-1	SO-2	SO-3	SO-4	SO-5	SO-6	SO-7	SO-8	SO-9	SO-10	SO-11	SO-12	SO-10	SO-11	SO-12	SO-13	SO-14	SO-15
Tetrachloroethene	1,400	1,300	18	20,000	310	81	170	3,500	260	580	45	10	40	3	160	160	3	36	1	10
Trichloroethene	700	470	36	350	94	8	55	75	43	58	5	1	2		47	24		4		1
1,2-Dichloroethene (total)	300	NV [5]	280	250	28	21	27	47	38	650			1		41	21		4		
1,1,1-Trichloroethane	800	680		4	4	6	2													
Acetone	200	50																3	3	3
Benzene	60	60								1										
Toluene	1,500	700	2					1		5		4	10	3	1					
Ethylbenzene	5,500	1,000	4					93		2										
Xylene	1,200	260	34	3		6		370		23	6		2		5	12				
4-Methyl-2-Pentanone	1,000	NV						17												
2-Butanone (Methyl Ethyl Ketone)	300	120								2										
Chloroform	300	370		1																
Methylene Chloride	100	50						45							10	2		1	1	1

NV = No Value

Units are microgram per kilogram (µg/kg). Only detected compounds are reported. Blanks indicate that the compound was not detected.

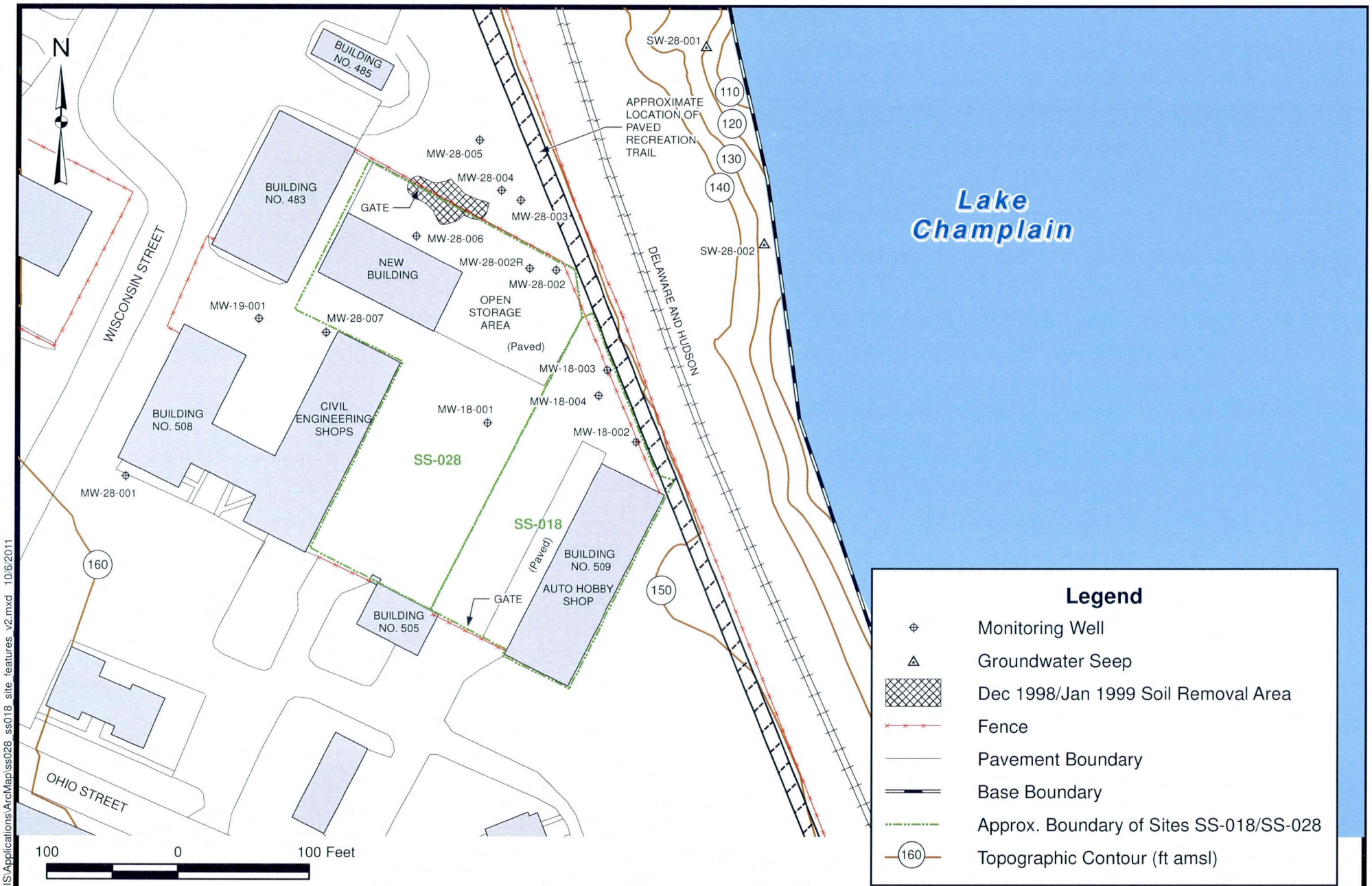
Sample concentration exceeds TAGM 4046 soil cleanup criteria. See Note 2.

Soil represented by this sample left in place.

Soil represented by this sample removed during later excavation.

1. URS Consultants, Inc. (URS), 1999. *Closure Report Building 508 Open Storage Area (SS-028) Time Critical Removal Action* ; October.
2. Soil represented by samples SO-1, SO-2, SO-6, and SO-8 was removed by subsequent excavation.
3. New York State Department of Environmental Conservation (NYSDEC), 1994. *Technical and Administrative Guidance Memorandum (TAGM) 4046, Determination of Soil Cleanup Objectives and Cleanup Levels* ; January 24.
4. New York State Department of Environmental Conservation (NYSDEC), 2006. *Title 6 New York Codes, Rules, and Regulations (6 NYCRR), Part 375 Environmental Remediation Programs, Table 375-6.8(a): Unrestricted Use Soil Cleanup Objectives* ; effective December 14.
5. 1,2-Dichloroethene (cis) = 250 µg/L; 1,2-Dichloroethene (trans) = 190 µg/L.

ATTACHMENTS



N:\11168476.00000\GIS\Applications\ArcMap\ss028_ss018_site_features_v2.mxd 10/6/2011

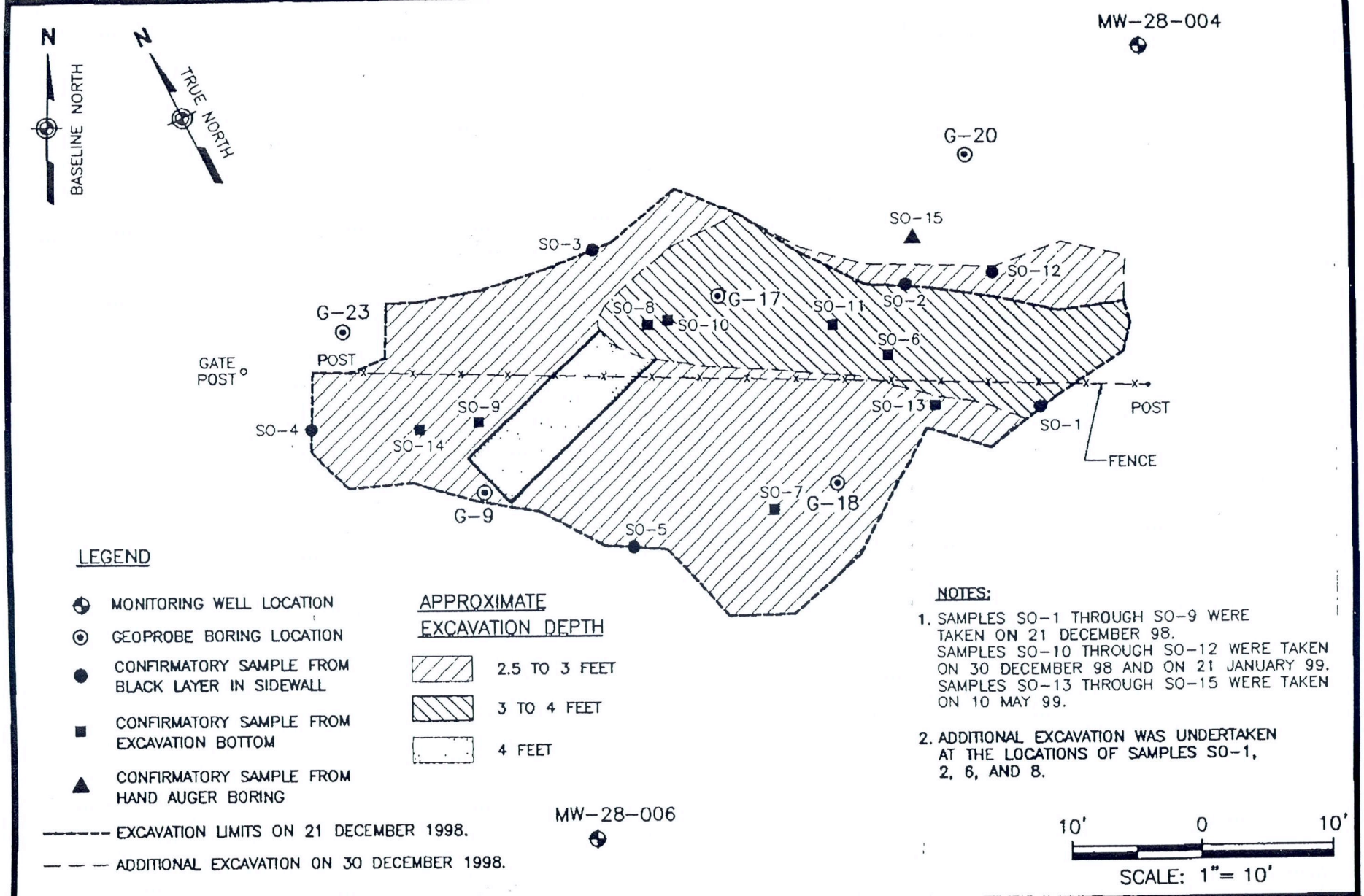
URS

SS-018 (AUTO HOBBY SHOP) AND SS-028 (OPEN STORAGE AREA)
SITE FEATURES

FIGURE 2

AC-13620A

0100057.10\CAD\1=10 8/3/99-1 RAL (COLOR)



URS Greiner Consultants, Inc.

SS-028 REMOVAL ACTION CONFIRMATORY SAMPLE LOCATIONS

FIGURE 6

Reference: URS Consultants, Inc. (URS), 1999. *Closure Report Building 508 Open Storage Area (SS-028) Time Critical Removal Action*; October

APPENDIX E

WELL DECOMMISSIONING RECORDS – 2011

WELL DECOMMISSIONING RECORD

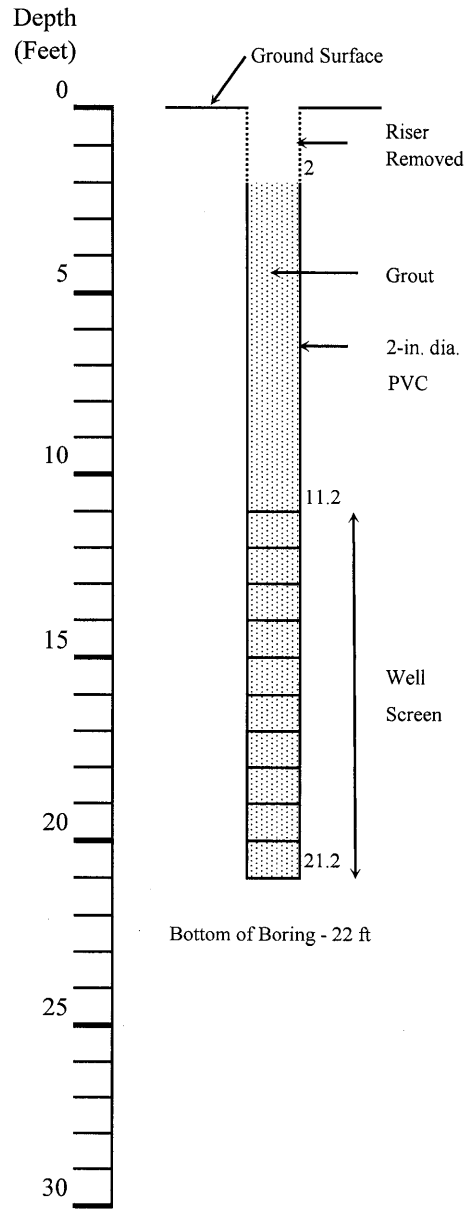
Site Name: SS-018/SS-028	Well ID: MW-19-001
Site Location: Former Plattsburgh AFB, Plattsburgh, NY	Driller: Tim Martin
Drilling Co.: Northern Technical Services	Inspector: Adam Simmons (URS)
	Date: August 22, 2011

DECOMMISSIONING DATA

(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing Type/Dia. (in)	
Method of Installing	
CASING PULLING	
Method Employed	
Casing retrieved (ft)	
Casing Type/Dia (in)	
CASING PERFORATING	
Equipment Used	
Perforations/Foot	
Size of Perforations	
Interval Perforated	
GROUTING	
Interval Grouted (ft)	2 - 21.2
No. of Batches Prepared	1
For Each Batch Record:	
Quantity of Water Used (gal)	~7.8
Quantity of Cement Used (lbs)	94
Cement Type	Portland Type 1
Quantity of Bentonite Used (lbs)	~3.9
Quantity of Calcium Chloride Used (lbs)	—
Volume of Grout Prepared (gal)	15
Volume of Grout Used (gal)	3

WELL SCHEMATIC *



COMMENTS:

Riser removed at 2 feet below ground surface.
Rest of riser and well screen grouted in place.
Flush-mount road box removed and surface restored.

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stick up, etc.

WELL DECOMMISSIONING RECORD

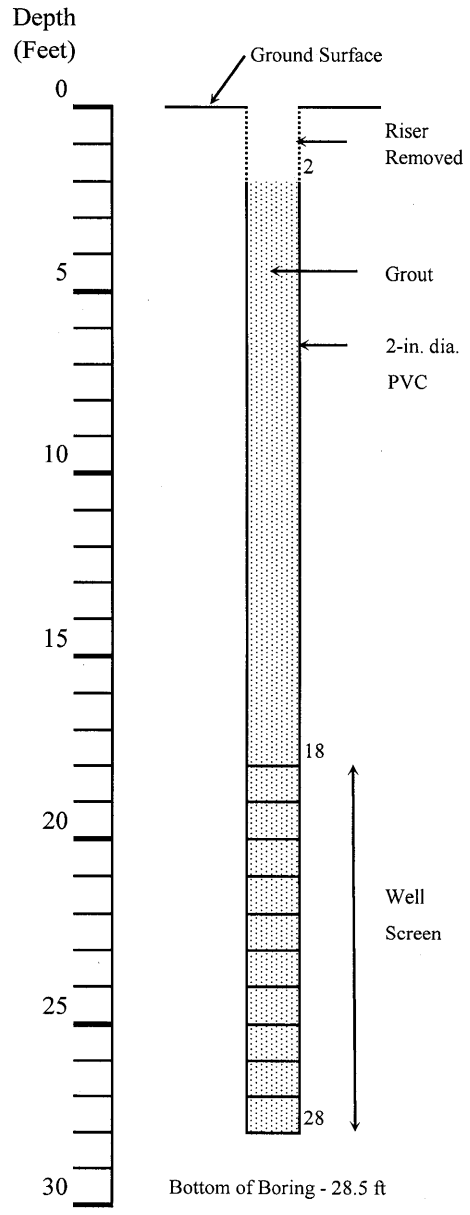
Site Name: SS-018/SS-028	Well ID: MW-28-002R
Site Location: Former Plattsburgh AFB, Plattsburgh, NY	Driller: Tim Martin
Drilling Co.: Northern Technical Services	Inspector: Adam Simmons (URS)
	Date: August 22, 2011

DECOMMISSIONING DATA

(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing Type/Dia. (in)	
Method of Installing	
CASING PULLING	
Method Employed	
Casing retrieved (ft)	
Casing Type/Dia (in)	
CASING PERFORATING	
Equipment Used	
Perforations/Foot	
Size of Perforations	
Interval Perforated	
GROUTING	
Interval Grouted (ft)	2 - 28
No. of Batches Prepared	1
For Each Batch Record:	
Quantity of Water Used (gal)	~7.8
Quantity of Cement Used (lbs)	94
Cement Type	Portland Type 1
Quantity of Bentonite Used (lbs)	~3.9
Quantity of Calcium Chloride Used (lbs)	–
Volume of Grout Prepared (gal)	15
Volume of Grout Used (gal)	4

WELL SCHEMATIC *



COMMENTS:

Riser removed at 2 feet below ground surface.
Rest of riser and well screen grouted in place.
Flush-mount road box removed and surface restored.

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stick up, etc.

WELL DECOMMISSIONING RECORD

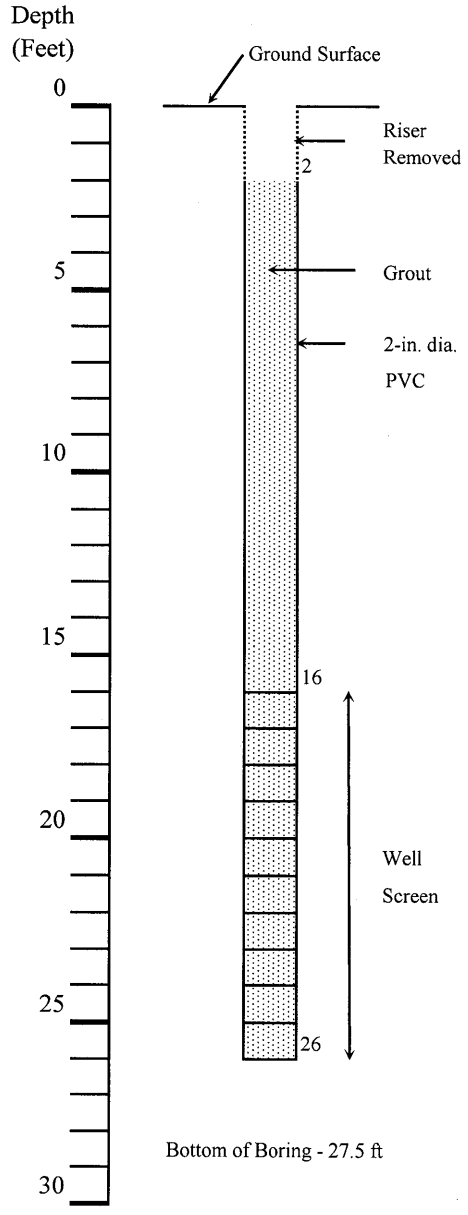
Site Name: SS-018/SS-028	Well ID: MW-28-005
Site Location: Former Plattsburgh AFB, Plattsburgh, NY	Driller: Tim Martin
Drilling Co.: Northern Technical Services	Inspector: Adam Simmons (URS)
	Date: August 22, 2011

DECOMMISSIONING DATA

(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing Type/Dia. (in)	
Method of Installing	
CASING PULLING	
Method Employed	
Casing retrieved (ft)	
Casing Type/Dia (in)	
CASING PERFORATING	
Equipment Used	
Perforations/Foot	
Size of Perforations	
Interval Perforated	
GROUTING	
Interval Grouted (ft)	2 - 26
No. of Batches Prepared	1
For Each Batch Record:	
Quantity of Water Used (gal)	~7.8
Quantity of Cement Used (lbs)	94
Cement Type	Portland Type 1
Quantity of Bentonite Used (lbs)	~3.9
Quantity of Calcium Chloride Used (lbs)	–
Volume of Grout Prepared (gal)	15
Volume of Grout Used (gal)	4

WELL SCHEMATIC *



COMMENTS:

Riser removed at 2 feet below ground surface.
Rest of riser and well screen grouted in place.
Flush-mount road box removed and surface restored.

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stick up, etc.

WELL DECOMMISSIONING RECORD

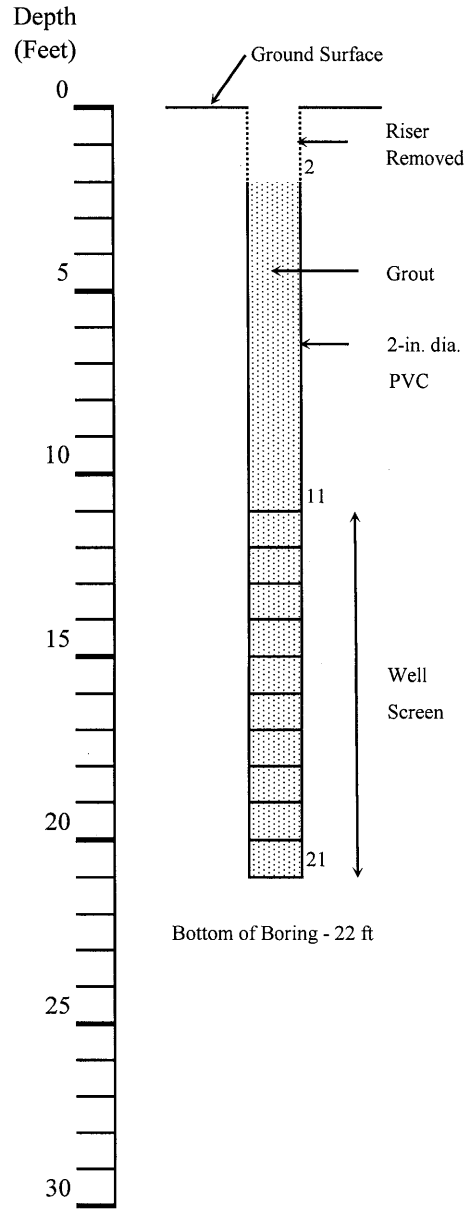
Site Name: SS-018/SS-028	Well ID: MW-28-007
Site Location: Former Plattsburgh AFB, Plattsburgh, NY	Driller: Tim Martin
Drilling Co.: Northern Technical Services	Inspector: Adam Simmons (URS)
	Date: August 22, 2011

DECOMMISSIONING DATA

(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing Type/Dia. (in)	
Method of Installing	
CASING PULLING	
Method Employed	
Casing retrieved (ft)	
Casing Type/Dia (in)	
CASING PERFORATING	
Equipment Used	
Perforations/Foot	
Size of Perforations	
Interval Perforated	
GROUTING	
Interval Grouted (ft)	2 - 21
No. of Batches Prepared	1
For Each Batch Record:	
Quantity of Water Used (gal)	~7.8
Quantity of Cement Used (lbs)	94
Cement Type	Portland Type 1
Quantity of Bentonite Used (lbs)	~3.9
Quantity of Calcium Chloride Used (lbs)	–
Volume of Grout Prepared (gal)	15
Volume of Grout Used (gal)	3

WELL SCHEMATIC *



COMMENTS:

Riser removed at 2 feet below ground surface.
Rest of riser and well screen grouted in place.
Flush-mount road box removed and surface restored.

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stick up, etc.

APPENDIX F
EVALUATION OF POTENTIAL FOR SOIL VAPOR INTRUSION

URS

CALCULATION COVER SHEET

Client: AFCEE Project Name: Plattsburgh AFB

Project/Calculation Number: Performance-Based Remediation - 11176211

Title: SS-018/SS-028 - Estimated Indoor Air Concentrations of Chlorinated Compounds Volatilizing from Groundwater

Total Number of Pages (including cover sheet): 5

Total Number of Computer Runs: None

Prepared by: Donald Hunt Date: 11-20-11

Checked by: David Coulter Date: 12-08-11

Description and Purpose: Provide a theoretical estimate of the concentration in indoor air of chlorinated compounds that may volatilize from groundwater based on historical average concentrations observed in groundwater samples at Site SS-018/SS-028. This calculation will be included in the *SS-018/SS-028 Remedial Action Completion Report* as the basis for rescinding a use restriction related to soil vapor intrusion (SVI) into buildings at the site.

References:

1. URS, 2011. *SS-018/SS-028 Remedial Action Completion Report, Appendix C – Historical Analytical Data;* December.
2. NYSDOH, 2006. *Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York*; October.
3. NYSDOH, 2007. *Letter from G. Litwin (NYSDOH) to D. Desnoyers (NYSDEC), re: Soil Vapor/Indoor Air Matrices*; June 25.
4. URS, 2000. *Site SS-018 Auto Hobby Shop and Site SS-028 Open Storage Area Record of Decision, Plattsburgh Air Force Base*; August.
5. URS, 2004. *Second Five-Year Review Report for Plattsburgh AFB*, June.
6. NYSDEC, 1999. *6NYCRR Part 703.5 Water Quality Standards for Taste- Color-, and Odor-Producing, Toxic, and Other Deleterious Substances*; August.
7. http://www.epa.gov/athens/learn2model/part-two/onsite/esthenry.html (For Henry's Law Constant).
8. USEPA, 2002. *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway From Groundwater and Soils (Subsurface Vapor Intrusion Guidance), EPA530-D-02-004, Appendix F – Empirical Attenuation Factors and Reliability Assessment*; Office of Solid Waste and Emergency Response, Washington D.C.; November.
9. USEPA, 2008. *USEPA's Vapor Intrusion Database: Preliminary Evaluation of Attenuation Factors – Draft*; Office of Solid Waste; March 4.

Remarks/Conclusions/Results: The predicted indoor air concentrations are less than New York State Department of Health (NYSDOH) guidance levels for indoor air so that the SVI restriction (page 2) would not apply; i.e., mitigation would not be necessary. The SVI restriction can be rescinded. See Page 5 for a summary of predicted concentrations.

Calculation Approved By:

Donald Hunt, Project Manager

Soil Vapor Intrusion (SVI) Use Restriction

The following use restriction was included in the December 2004 *Finding of Suitability to Transfer (FOST) Parcel A2.9* to civilian use, which included Site SS-018/SS-028:

> "Prior to any structure being erected or any existing building or structure being used in the groundwater contaminated area of the parcel, the potential for vapor intrusion must be evaluated and if it is determined that a potential human exposure is possible, then mitigation of the vapor intrusion must be included in the design/construction of the structure prior to occupancy."

The restriction was included in the 2004 property transfer documents primarily because of the concentrations of chlorinated compounds detected in wells at the site (Ref 1). This use restriction was not included in the *SS-018/SS-028 Record of Decision* (Ref 4). Since the time of the FOST, NYSDOH has established indoor air quality guidance concentrations of 5 $\mu g/m^3$ for trichloroethene (TCE), vinyl chloride, and carbon tetrachloride and 100 $\mu g/m^3$ for tetrachloroethene (PCE), 1,1,1-trichloroethane (TCA), 1,1-dichlororethene (1,1-DCE), and cis-1,2-dichloroehene (cis-DCE) (Refs 2 and 3).

This calculation will provide a theoretical prediction of the indoor air concentrations of the chlorinated compounds that have been found in Site SS-018/SS-028 groundwater based on average concentrations observed through 2004. The NYSDOH indoor air guidance values will be used as screening levels to evaluate whether or not the use restriction can be removed.

Historical Groundwater Data

Figure 1 is a summary of the historic concentrations of chlorinated compounds detected in samples collected at the site from 1993 through 2004. The data are from the Historical Data Summary provided in Reference 1.

Beginning in 2001, groundwater samples were collected as part of a groundwater monitoring program mandated by the *SS-018/SS-028 Record of Decision* (Ref 4) which required periodic monitoring of groundwater for volatile organic compounds (VOCs) plus methyl tert-butyl ether (MTBE). Consequently, historical data from 2001 through 2004 for chlorinated compounds are only available for wells that were included in the monitoring program, namely MW-18-004, MW-19-001, MW-28-002R, -004, -005, and -007.

Starting in 2005, groundwater samples were only analyzed for MTBE, based on a recommendation made in the *Second Five-Year Review Report for Plattsburgh Air Force Base* (Ref 5). The recommendation was made because VOC concentrations, except for MTBE, had been less than New York State groundwater quality standards for some time. Therefore, data for other VOCs are not available after 2005.

URS

Job: Plattsburgh AFB
Description: SS-018/SS-028 Indoor Air Concentrations

Project No: 11176211 Page 3 of 5
Computed by: D. Hunt Date: 11-20-11
Checked by: D. Coulter Date: 12-08-11

Chlorinated Compounds

Chlorinated compounds detected at the site for which there are NYSDOH indoor air guidance concentrations are PCE and TCE. The highest concentrations occurred in groundwater samples collected from MW-28-004. This well is immediately downgradient of a 1998/1999 soil removal that was performed to remove the source of chlorinated compounds in groundwater. A summary table of chlorinated compounds in MW-28-004 is shown below. Only detections are shown; blanks indicate that the compound was not detected. Shading indicates that the concentration exceeded the New York State Department of Environmental Conservation (NYSDEC) groundwater quality standard of 5 µg/L (Ref 6).

Sample Date	1,1,1-Trichloroethane	1,2-Dichloroethene (Total)	Tetrachloroethene (PCE)	Trichloroethene (TCE)
11-Oct-96		9	28	5.7
10-Jul-97	NA		15	
6-Aug-97		3	17	3
2-May-01	0.2	NA	9.04	1.66
25-Oct-01		NA	3.08	0.64
18-Apr-02		NA	0.65	0.32
22-Oct-02	0.21	NA	5.05	1.0
30-Apr-03		NA	0.85	0.24
23-Oct-03		NA	2.77	0.7
22-Apr-04		NA	1.88	0.5
21-Oct-04	0.2	NA	4.59	1.16

NA = Not Analyzed

Beginning in 2001, the two isomers, cis and trans, of 1,2-dichloroethene were analyzed for, but they were never detected (see Ref 1). Therefore, 1,2-dichloroethene is not considered further and there is no NYSDOH indoor air guidance value for 1,1,1-trichloroethane.

Figure 2 is a summary plot of the concentrations of PCE and TCE shown in the table above. The average detected concentrations for these two compounds are 8 µg/L and 1.5 µg/L, respectively. The figure shows that following the soil removal, the concentration of PCE in groundwater quickly reduced to less than NYSDEC's groundwater quality standard. There is a similar trend for TCE, but the effect is not as dramatic.

Equilibrium Soil Gas Concentration

Henry's Law is used to estimate the equilibrium soil gas concentration of PCE and TCE that may volatilize from groundwater as follows:

$$C_{SG} = C_{GW} \times HLC \times CF$$

where,

C_{SG} = Soil gas concentration in micrograms per cubic meter ($\mu g/m^3$)
C_{GW} = Groundwater concentration in $\mu g/L$
HLC = Dimensionless Henry's Law Constant (Ref 7 - Attached)
PCE – 0.752; TCE - 0.421
CF = Conversion factor = 1000 L/m^3 (Attached)

Predicted Indoor Air Concentration

As the soil gas migrates through the vadose zone in the soil, through the building, and into the indoor air space, the soil gas concentration is generally reduced. To account for this reduction, an attenuation factor is applied to the equilibrium soil gas concentration to predict the indoor air concentration as follows:

$$C_{IA} = C_{SG} \times \alpha$$

where,

C_{IA} = Concentration in indoor air in $\mu g/m^3$
C_{SG} = Soil gas concentration in $\mu g/m^3$
α = Groundwater-to-indoor air attenuation factor

Based on a review of data from residential sites with paired indoor air and soil gas and/or groundwater concentrations, USEPA proposed an empirical groundwater-to-indoor air attenuation factor of 0.001. USEPA found that 95% of the residences in its database had attenuation factors less than 0.001, so this value was considered a reasonable upper-bound value (Ref 8). In 2008, USEPA evaluated a larger database and found that the 95th percentile groundwater-to-indoor air attenuation factor was still about 0.001 (Ref 9).

New York State Soil Vapor Intrusion Guidance

In 2006, NYSDOH developed guidelines for several chlorinated compounds, including TCE and PCE in indoor air (Ref 2). In 2007, NYSDOH added additional compounds (Ref 3). Copies of portions of the guidance are attached.

The NYSDOH guideline for TCE in indoor air is 5 $\mu g/m^3$ and the guideline for PCE is 100 $\mu g/m^3$ (Ref 2). At indoor air concentrations higher than these levels NYSDOH recommends taking action to mitigate the indoor air concentrations, regardless of the sub-slab soil gas concentrations. This interpretation of the NYSDOH SVI guidance (Ref 2) is supported by fact sheets (attached) developed by NYSDOH in which it is clearly stated that the NYSDOH guideline is 5 $\mu g/m^3$ for TCE and 100 $\mu g/m^3$ for PCE. These values will be used as screening levels to compare against the indoor air concentrations predicted from the average historical groundwater concentrations observed at Site SS-018/SS-028.

Predicted Indoor Air Concentrations

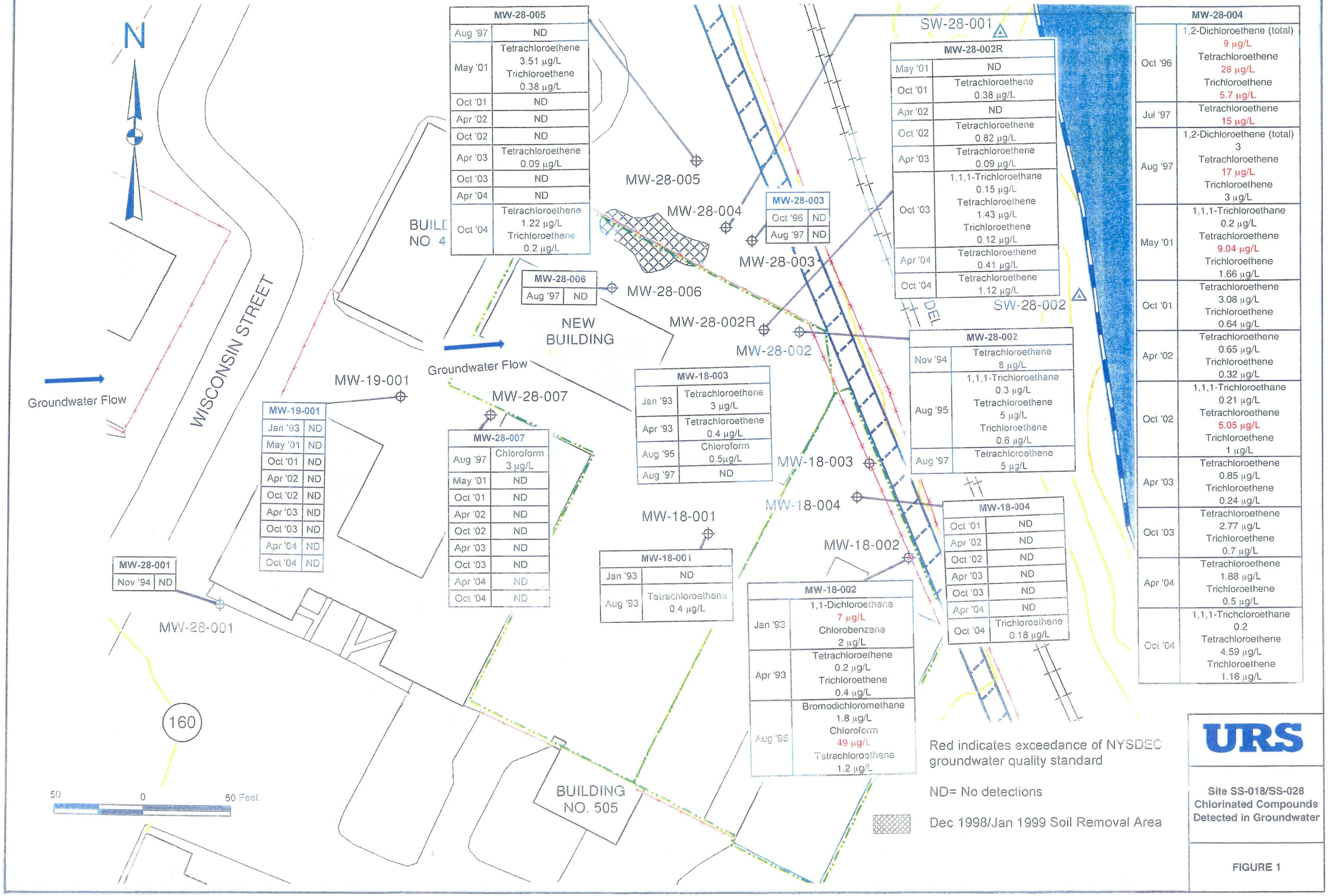
The following is a summary of the predicted indoor air concentrations based on the maximum historical average groundwater concentrations for the three compounds of interest:

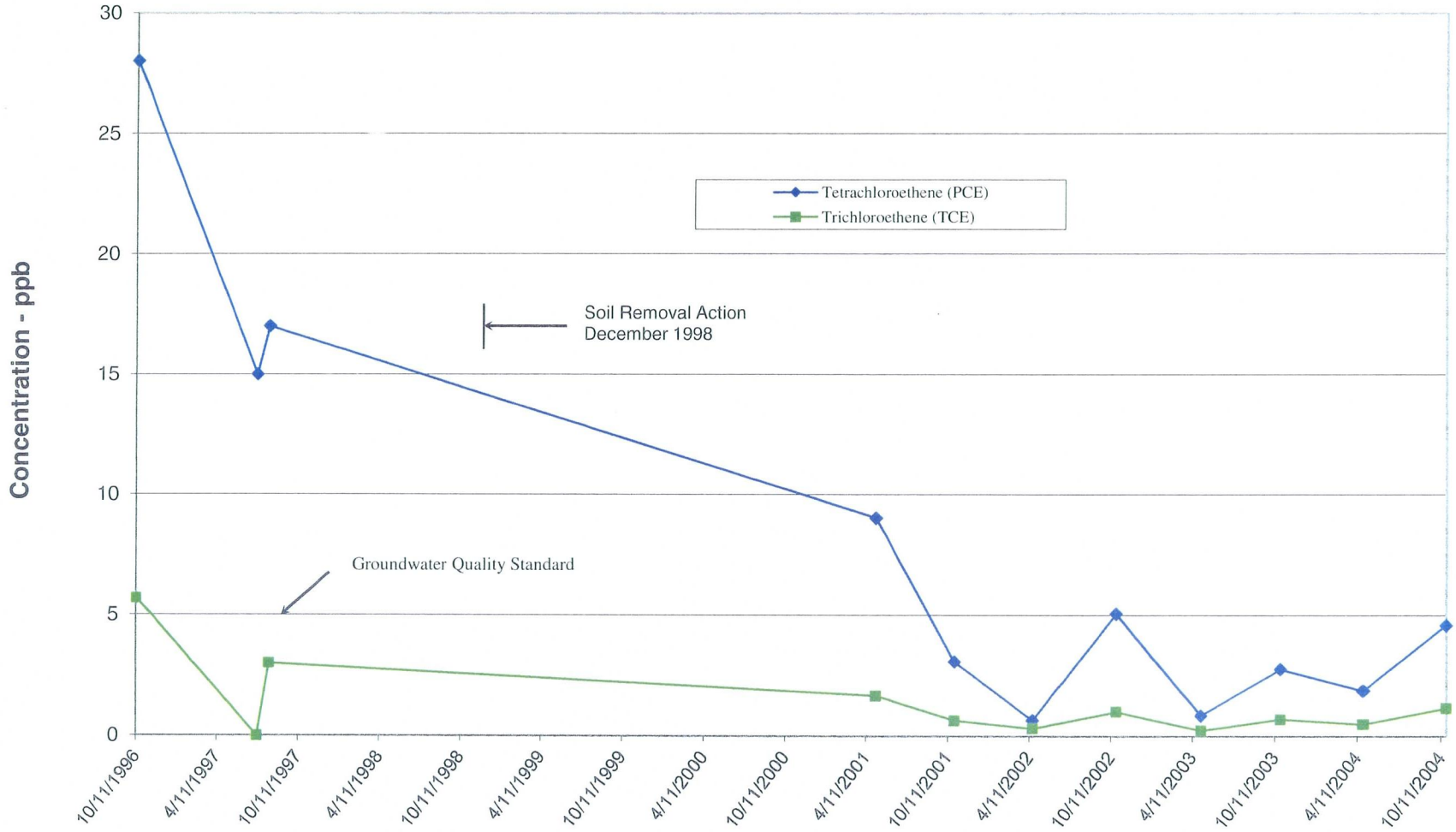
TCE:
Soil Gas: $C_{SG} = C_{GW} \times HLC \times CF = 1.5 \times 0.421 \times 1000 = 632\ \mu g/m^3$
Indoor Air: $C_{IA} = C_{SG} \times \alpha = 632 \times 0.001 = 0.6\ \mu g/m^3$

PCE
Soil Gas: $C_{SG} = C_{GW} \times HLC \times CF = 8 \times 0.752 \times 1000 = 6{,}016\ \mu g/m^3$
Indoor Air: $C_{IA} = C_{SG} \times \alpha = 6{,}016 \times 0.001 = 6\ \mu g/m^3$

Compound	NYSDEC Groundwater Quality Standard (µg/L)	Average Groundwater Concentration, C_{GW} (µg/L)	Equilibrium Soil Gas Concentration C_{SG} (µg/m³)	Predicted Indoor Air Concentration C_{IA} (µg/m³)	NYSDOH Guidance Level (µg/m³)
TCE	5	1.5	632	0.6	5
PCE	5	8	6,016	6	100

The predicted indoor air concentrations are less than NYSDOH guidance levels for indoor air so that the SVI restriction (page 2) would not apply; i.e., mitigation would not be necessary. The SVI restriction can be rescinded.


N
WISCONSIN STREET
Groundwater Flow
Groundwater Flow
BUILDING NO. 4
NEW BUILDING
BUILDING NO. 505
160
50 0 50 Feet
MW-28-005
MW-28-004
MW-28-003
MW-28-006
MW-28-002R
MW-28-002
MW-19-001
MW-28-007
MW-18-003
MW-18-001
MW-18-004
MW-18-002
MW-28-001
SW-28-001
SW-28-002
DEL
MW-28-005
Aug '97 ND
May '01 Tetrachloroethene 3.51 µg/L Trichloroethene 0.38 µg/L
Oct '01 ND
Apr '02 ND
Oct '02 ND
Apr '03 Tetrachloroethene 0.09 µg/L
Oct '03 ND
Apr '04 ND
Oct '04 Tetrachloroethene 1.22 µg/L Trichloroethene 0.2 µg/L
MW-28-003
Oct '96 ND
Aug '97 ND
MW-28-006
Aug '97 ND
MW-28-002R
May '01 ND
Oct '01 Tetrachloroethene 0.38 µg/L
Apr '02 ND
Oct '02 Tetrachloroethene 0.82 µg/L
Apr '03 Tetrachloroethene 0.09 µg/L
Oct '03 1,1,1-Trichloroethane 0.15 µg/L Tetrachloroethene 1.43 µg/L Trichloroethene 0.12 µg/L
Apr '04 Tetrachloroethene 0.41 µg/L
Oct '04 Tetrachloroethene 1.12 µg/L
MW-28-004
Oct '96 1,2-Dichloroethene (total) 9 µg/L Tetrachloroethene 28 µg/L Trichloroethene 5.7 µg/L
Jul '97 Tetrachloroethene 15 µg/L
Aug '97 1,2-Dichloroethene (total) 3 Tetrachloroethene 17 µg/L Trichloroethene 3 µg/L
May '01 1,1,1-Trichloroethane 0.2 µg/L Tetrachloroethene 9.04 µg/L Trichloroethene 1.66 µg/L
Oct '01 Tetrachloroethene 3.08 µg/L Trichloroethene 0.64 µg/L
Apr '02 Tetrachloroethene 0.65 µg/L Trichloroethene 0.32 µg/L
Oct '02 1,1,1-Trichloroethane 0.21 µg/L Tetrachloroethene 5.05 µg/L Trichloroethene 1 µg/L
Apr '03 Tetrachloroethene 0.85 µg/L Trichloroethene 0.24 µg/L
Oct '03 Tetrachloroethene 2.77 µg/L Trichloroethene 0.7 µg/L
Apr '04 Tetrachloroethene 1.88 µg/L Trichloroethene 0.5 µg/L
Oct '04 1,1,1-Trichcloroethane 0.2 Tetrachloroethene 4.59 µg/L Trichloroethene 1.16 µg/L
MW-19-001
Jan '93 ND
May '01 ND
Oct '01 ND
Apr '02 ND
Oct '02 ND
Apr '03 ND
Oct '03 ND
Apr '04 ND
Oct '04 ND
MW-28-007
Aug '97 Chloroform 3 µg/L
May '01 ND
Oct '01 ND
Apr '02 ND
Oct '02 ND
Apr '03 ND
Oct '03 ND
Apr '04 ND
Oct '04 ND
MW-18-003
Jan '93 Tetrachloroethene 3 µg/L
Apr '93 Tetrachloroethene 0.4 µg/L
Aug '95 Chloroform 0.5µg/L
Aug '97 ND
MW-18-001
Jan '93 ND
Aug '93 Tetrachloroethene 0.4 µg/L
MW-28-002
Nov '94 Tetrachloroethene 8 µg/L
Aug '95 1,1,1-Trichloroethane 0.3 µg/L Tetrachloroethene 5 µg/L Trichloroethene 0.6 µg/L
Aug '97 Tetrachloroethene 5 µg/L
MW-18-004
Oct '01 ND
Apr '02 ND
Oct '02 ND
Apr '03 ND
Oct '03 ND
Apr '04 ND
Oct '04 Trichloroethene 0.18 µg/L
MW-18-002
Jan '93 1,1-Dichloroethene 7 µg/L Chlorobenzene 2 µg/L
Apr '93 Tetrachloroethene 0.2 µg/L Trichloroethene 0.4 µg/L
Aug '95 Bromodichloromethane 1.8 µg/L Chloroform 49 µg/L Tetrachloroethene 1.2 µg/L
MW-28-001
Nov '94 ND
Red indicates exceedance of NYSDEC groundwater quality standard
ND= No detections
Dec 1998/Jan 1999 Soil Removal Area
URS
Site SS-018/SS-028
Chlorinated Compounds
Detected in Groundwater
FIGURE 1



Following the October 2004 event, samples were analyzed only for methyl tert-butyl ether (MTBE).

URS

SITE SS-018/SS-028
MONITORING WELL MW-28-004
HISTORIC CHLORINATED COMPOUND CONCENTRATIONS

Figure 2

ATTACHMENTS

US Environmental

Ecosystems Research

EPA On-line Tools for Site Assessment Calculation

Estimated Henry's Law Constants

Background: Henry's Law Constants characterize the equilibrium distribution of dilute concentrations of volatile, soluble chemicals between gas and liquid. For this calculator, the liquid is water. Temperature-dependence is calculated by two methods: one developed by the EPA Office of Solid Waste and Emergency Response and the other published in the journal *Ground Water* and written by John Washington in 1996. Background information on each method is given on a separate page.

Special background information on methyl *tert*-butyl ether (MTBE) is available

Notes:
1) Chemicals are only included if there is data for the temperature-dependence calculation. Henry's Constants for many petroleum hydrocarbons and oxygenated additives are available from a data set of estimated properties. For other chemicals see the chemical properties page.
2) The unit choices for Henry's constants include atm-m3/mol, atm, and two separate dimensionless values. These are listed below.
3) Previously the calculator contained some single-temperature values. These have been eliminated from the calculation but are available for reference.

Inputs

Example Data | Calculate | Clear
Save Data | Recall Data | Go Back

Title

Date 11/29/11 Current Date

Chemical (PCE) tetrachloroethene or perchloroethene

Desired Temperature 25 oC Temperature Map

Results

Henry's Constant Estimates in units of Hcc at 25.00 C

OSWER Method 0.752 dimensionless

Washington (1996) Method 0.711 dimensionless

Washington (1996) Method Notes:

```
Value calculated using thermodynamic data
reported in Washington, J.W. 1996. Ground Water.
Vol. 34. pp. 709-718.
```

Unit Choices for the Henry's Law Constant

H_{cc} = Concentration/Concentration (dimensionless--volumetric basis) [1]
H_{yx} = Mole Fraction Y / Mole Fraction X (dimensionless)
H_{px} = Partial Pressure / Mole Fraction X (atmospheres)
H_{pc} = Partial Pressure / Solubility (atm m 3 /mol)

[1]The dimensionless form based on concentrations (volumetric basic) is the most commonly used of the dimensionless values. See Staudinger and Roberts, 1996, A Critical Review of Henry's Law Constants for Environmental Applications, in Critical Reviews in Environmental Science and Technology, 26(3):205-297 for more information on various units (specifically page 292).

Home | Glossary | Notation | Links | References | Calculators

US Environmental

Ecosystems Research

EPA On-line Tools for Site Assessment Calculation

Estimated Henry's Law Constants

Background: Henry's Law Constants characterize the equilibrium distribution of dilute concentrations of volatile, soluble chemicals between gas and liquid. For this calculator, the liquid is water. Temperature-dependence is calculated by two methods: one developed by the EPA Office of Solid Waste and Emergency Response and the other published in the journal *Ground Water* and written by John Washington in 1996. Background information on each method is given on a separate page.

Special background information on methyl *tert*-butyl ether (MTBE) is available

Notes:
1) Chemicals are only included if there is data for the temperature-dependence calculation. Henry's Constants for many petroleum hydrocarbons and oxygenated additives are available from a data set of estimated properties. For other chemicals see the chemical properties page.
2) The unit choices for Henry's constants include atm-m3/mol, atm, and two separate dimensionless values. These are listed below.
3) Previously the calculator contained some single-temperature values. These have been eliminated from the calculation but are available for reference.

Inputs

Example Data | Calculate | Clear | Save Data | Recall Data | Go Back

Title

Date 11/1/2011 Current Date

Chemical (TCE) trichloroethene

Desired Temperature 25 oC Temperature Map

Results

Henry's Constant Estimates in units of Hcc at 25.00 C

OSWER Method 0.421 dimensionless

Washington (1996) Method 0.372 dimensionless

Washington (1996) Method Notes:

```
Value calculated using thermodynamic data
reported in Washington, J.W. 1996. Ground Water.
Vol. 34. pp. 709-718.
```

Unit Choices for the Henry's Law Constant

H_{cc} = Concentration/Concentration (dimensionless--volumetric basis) [1]
H_{yx} = Mole Fraction Y / Mole Fraction X (dimensionless)
H_{px} = Partial Pressure / Mole Fraction X (atmospheres)
H_{pc} = Partial Pressure / Solubility (atm m^3/mol)

[1]The dimensionless form based on concentrations (volumetric basic) is the most commonly used of the dimensionless values. See Staudinger and Roberts, 1996, A Critical Review of Henry's Law Constants for Environmental Applications, in Critical Reviews in Environmental Science and Technology, 26(3):205-297 for more information on various units (specifically page 292).

Home | Glossary | Notation | Links | References | Calculators

CONVERSIONS, PHYSICAL CONSTANTS, AND UNITS

Length:
1 inch (in) = 2.54 centimeters (cm) exactly
1 foot (ft) = 0.305 meters (m)
1 yard (yd) = 0.914 meters (m)
1 mile (mi) = 5280 feet (ft) = 1.61 kilometers (km)
1 centimeter (cm) = 0.394 inches (in)
1 meter (m) = 100 centimeters (cm) = 39.4 inches (in) = 3.28 feet (ft) = 1.09 yards (yd)
1 kilometer (km) = 1000 meters (m) = 0.621 miles (mi)
1 rod = 16.5 feet (ft) = 5.5 yards (yd) = 5.03 meters (m)
1 astronomical unit (AU) = 1.50×10^8 kilometers (km) = 9.29×10^7 miles (mi)
1 light year (LY) = 9.461×10^{12} kilometers (km) = 5.88×10^{12} miles (mi) = 0.307 parsec
1 parsec = approximately 3.26 light years (LY)

Area = length x width
1 square inch (in^2) = 0.00694 square feet (ft^2 = 6.45 square centimeters, cm^2
1 square foot, (ft^2) = 144 square inches (in^2 = 0.0929 square meters, m^2
1 square yard (yd^2 = 1296 square inches (in^2 = 9 square feet (ft^2 = 0.836 square meters (m^2
1 square mile (mi^2 = 640 acres = 2.59 square kilometers (km^2
1 acre = 160 square rods = 43,560 square feet (ft^2) = 0.405 hectares
1 hectare = 10,000 square meters (m^2 = 100 ares = 2.47 acres
1 square rod = 30,25 square yards (yd^2 = 25.29 square meters (m^2
1 are = 100 square meters (m^2 = 0.01 hetares = 119.6 square yards (yd^2

Volume = length x width x height
1 cubic inch (in^3) = 0.000579 cubic feet (ft^3) = 16.4 cubic centimeters (cm^3)
1 cubic foot (ft^3) = 1728 cubic inch (in^3) = 0.0283 cubic meters (m^3)
1 cubic yard (yd^3) = 27 cubic feet (ft^3) = 4.65×10^4 cubic inch (in^3) = 0.765 cubic meters (m^3)
1 cubic meters (m^3) = 106 cubic centimeters (cm^3) = 1,000 liters (L) = 35.3 cubic feet (ft^3)
1 quart (qt) = 2 pints (pt) = 946 milliliters (mL) = 0.946 liters (L)
1 gallon (gal) = 4 quarts = 231 cubic inch (in^3) = 3.79 liters (L)
1 liter (L) = 1000 cubic centimeters (cm^3) = 1.06 quarts (qt) = 0.265 gallons (gal)

Mass
1 slug = 14.6 kilograms (kg)
1 kilogram (kg) = 1,000 grams = 0.0685 slugs
1 atomic mass unit (**u**) = 1.66×10^{-27} kilogram (kg) = 1.66×10^{-24}
1 electron mass = 9.11×10^{-31} kilogram (kg) = 9.11×10^{-28} grams (g) = 5.46×10^{-4} atomic mass unit (**u**)
1 proton mass = 1.00728 atomic mass unit (**u**)
1 neutron mass = 1.00866 atomic mass unit (**u**)

Conversion Between Weight and Mass on Earth
A slug is the mass unit in the British system and is equal to 32.2 pounds (lb)
A kilogram weighs 9.81 newtons (N) or 2.21 pounds (lb)
A mass of one (1) gram (g) weighs 981 dynes or 0.0353 ounces (oz)

FINAL

Guidance for Evaluating Soil Vapor Intrusion in the State of New York

October 2006

Prepared by:

NEW YORK STATE DEPARTMENT OF HEALTH
Center for Environmental Health
Bureau of Environmental Exposure Investigation

3.4.2 Matrices

The NYSDOH has developed two matrices, which are included at the end of Section 3.4, to use as tools in making decisions when soil vapor may be entering buildings. The first decision matrix was originally developed for TCE and the second for PCE. As summarized in Table 3.3, four chemicals have been assigned to the two matrices to date.

Table 3.3 Volatile chemicals and their decision matrices

Chemical	Soil Vapor/Indoor Air Matrix*
Carbon tetrachloride	Matrix 1
Tetrachloroethene (PCE)	Matrix 2
1,1,1-Trichloroethane (1,1,1-TCA)	Matrix 2
Trichloroethene (TCE)	Matrix 1

*The decision matrices are available at the end of Section 3.4.

Soil Vapor/Indoor Air Matrix 1

October 2006

SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m^3)	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m^3)			
	< 0.25	0.25 to < 1	1 to < 5.0	5.0 and above
< 5	1. No further action	2. Take reasonable and practical actions to identify source(s) and reduce exposures	3. Take reasonable and practical actions to identify source(s) and reduce exposures	4. Take reasonable and practical actions to identify source(s) and reduce exposures
5 to < 50	5. No further action	6. MONITOR	7. MONITOR	8. MITIGATE
50 to < 250	9. MONITOR	10. MONITOR / MITIGATE	11. MITIGATE	12. MITIGATE
250 and above	13. MITIGATE	14. MITIGATE	15. MITIGATE	16. MITIGATE

No further action:
Given that the compound was not detected in the indoor air sample and that the concentration detected in the sub-slab vapor sample is not expected to significantly affect indoor air quality, no additional actions are needed to address human exposures.

Take reasonable and practical actions to identify source(s) and reduce exposures:
The concentration detected in the indoor air sample is likely due to indoor and/or outdoor sources rather than soil vapor intrusion given the concentration detected in the sub-slab vapor sample. Therefore, steps should be taken to identify potential source(s) and to reduce exposures accordingly (e.g., by keeping containers tightly capped or by storing volatile organic compound-containing products in places where people do not spend much time, such as a garage or outdoor shed). Resampling may be recommended to demonstrate the effectiveness of actions taken to reduce exposures.

MONITOR:
Monitoring, including sub-slab vapor, basement air, lowest occupied living space air, and outdoor air sampling, is needed to determine whether concentrations in the indoor air or sub-slab vapor have changed. Monitoring may also be needed to determine whether existing building conditions (e.g., positive pressure heating, ventilation and air-conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined on a site-specific and building-specific basis, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

MITIGATE:
Mitigation is needed to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system, and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building-specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

MONITOR / MITIGATE:
Monitoring or mitigation may be recommended after considering the magnitude of sub-slab vapor and indoor air concentrations along with building- and site-specific conditions.

See additional notes on page 2.

Soil Vapor/Indoor Air Matrix 2

October 2006

	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m^3)			
SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m^3)	< 3	3 to < 30	30 to < 100	100 and above
< 100	1. No further action	2. Take reasonable and practical actions to identify source(s) and reduce exposures	3. Take reasonable and practical actions to identify source(s) and reduce exposures	4. Take reasonable and practical actions to identify source(s) and reduce exposures
100 to < 1,000	5. MONITOR	6. MONITOR / MITIGATE	7. MITIGATE	8. MITIGATE
1,000 and above	9. MITIGATE	10. MITIGATE	11. MITIGATE	12. MITIGATE

No further action:
Given that the compound was not detected in the indoor air sample and that the concentration detected in the sub-slab vapor sample is not expected to significantly affect indoor air quality, no additional actions are needed to address human exposures.

Take reasonable and practical actions to identify source(s) and reduce exposures:
The concentration detected in the indoor air sample is likely due to indoor and/or outdoor sources rather than soil vapor intrusion given the concentration detected in the sub-slab vapor sample. Therefore, steps should be taken to identify potential source(s) and to reduce exposures accordingly (e.g., by keeping containers tightly capped or by storing volatile organic compound-containing products in places where people do not spend much time, such as a garage or outdoor shed). Resampling may be recommended to demonstrate the effectiveness of actions taken to reduce exposures.

MONITOR:
Monitoring, including sub-slab vapor, basement air, lowest occupied living space air, and outdoor air sampling, is needed to determine whether concentrations in the indoor air or sub-slab vapor have changed. Monitoring may also be needed to determine whether existing building conditions (e.g., positive pressure heating, ventilation and air-conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined on a site-specific and building-specific basis, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

MITIGATE:
Mitigation is needed to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system, and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building-specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

MONITOR / MITIGATE:
Monitoring or mitigation may be recommended after considering the magnitude of sub-slab vapor and indoor air concentrations along with building- and site-specific conditions.

See additional notes on page 2.

STATE OF NEW YORK
DEPARTMENT OF HEALTH

Flanigan Square, 547 River Street, Troy, New York 12180-2216

Richard F. Daines, M.D.
Commissioner

June 25, 2007

Mr. Dale Desnoyers, Director
Division of Environmental Remediation
NYS Dept. of Environmental Conservation
625 Broadway — 12th Floor
Albany, NY 12233-7011

Re: Soil Vapor/Indoor Air Matrices

Dear Mr. Desnoyers,

In the wake of recent investigations of soil vapor intrusion at remedial sites, I would like to advise you that the Department has assigned three new volatile chemicals to our existing soil vapor/indoor air decision matrices: vinyl chloride to Matrix 1, and 1,1-dichloroethene and *cis*-1,2-dichloroethene to Matrix 2.

The NYSDOH has made these assignments on the basis of several factors that are consistent with those listed in the *Guidance for Evaluating Soil Vapor Intrusion in New York State* (NYSDOH 2006):

a. human health risks, including such factors as a chemical's ability to cause cancer, reproductive, developmental, liver, kidney, nervous system, immune system or other effects, in animals and humans and the doses that may cause those effects;

b. the data gaps in a chemical's toxicologic database;

c. background concentrations of a chemical in indoor air; and

d. analytical capabilities currently available.

With the assignment of these three volatile chemicals, the decision matrices now provide recommendations for a total of seven chemicals. The following table summarizes the assignments to date:

Volatile Chemical	Soil Vapor/Indoor Air Matrix
carbon tetrachloride	Matrix 1
1,1-dichloroethene	Matrix 2
cis-1,2-dichloroethene	Matrix 2
tetrachloroethene	Matrix 2
1,1,1-trichloroethane	Matrix 2
trichloroethene	Matrix 1
vinyl chloride	Matrix 1

If you have any questions about this information, please feel free to contact me at 402-7850.

Sincerely,

Gary A. Litwin, Director
Bureau of Environmental Exposure Investigation

cc: N. Kim, Ph.D.
G. A. Carlson, Ph.D./A. Salame-Alfie, Ph.D.
E. Horn, Ph.D./A. Grey, Ph.D.
D. Luttinger, Ph.D.
S. Bates

P:\Sections\Secretary\soilvapor_indoorairmatricesLTR.doc

www.bcnys.org/inside/env/2007/fallconference/ws8-Anders.pdf

Soil Vapor / Indoor Air Matrix 1

SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m^3)	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m^3)			
	< 0.25	0.25 to < 1	1 to < 5.0	5.0 and above
< 5	1. No further action	2. Take reasonable and practical actions to identify source(s) and reduce exposures	3. Take reasonable and practical actions to identify source(s) and reduce exposures	4. Take reasonable and practical actions to identify source(s) and reduce exposures
5 to < 50	5. No further action	6. MONITOR	7. MONITOR	8. MITIGATE
50 to < 250	9. MONITOR	10. MONITOR / MITIGATE	11. MITIGATE	12. MITIGATE
250 and above	13. MITIGATE	14. MITIGATE	15. MITIGATE	16. MITIGATE

Trichloroethene (TCE)

Vinyl Chloride (VC)

Carbon Tetrachloride

DOH

Soil Vapor / Indoor Air Matrix 2

SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m³)	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m³)			
	< 3	3 to < 30	30 to < 100	100 and above
< 100	1. No further action	2. Take reasonable and practical actions to identify source(s) and reduce exposures	3. Take reasonable and practical actions to identify source(s) and reduce exposures	4. Take reasonable and practical actions to identify source(s) and reduce exposures
100 to < 1,000	5. MONITOR	6. MONITOR / MITIGATE	7. MITIGATE	8. MITIGATE
1,000 and above	9. MITIGATE	10. MITIGATE	11. MITIGATE	12. MITIGATE

Tetrachloroethene (PCE)

1,1,1-Trichloroethane (1,1,1-TCA)

1,1-Dichloroethene (1,1-DCE)

cis-1,2-Dichloroethene (*c*-1,2-DCE)

DOH

Tenant Notification Fact Sheet for Trichloroethene (TCE)

- Tenant Notification Fact Sheet for Trichloroethene (TCE) is available in Portable Document Format (PDF, 25KB, 2pg.)

This fact sheet is provided to fulfill New York State Department of Health (NYS DOH) requirements for preparation of generic fact sheets under Article 27 (Title 24, Section 27-2405) of the Environmental Conservation Law.

Trichloroethene (TCE)

Trichloroethene (also known as trichloroethylene or TCE) is a man-made, volatile organic chemical. It was used as a solvent to remove grease from metal. Trichloroethene was also used as a paint stripper, an adhesive solvent, an ingredient in paints and varnishes, and is used in the manufacture of other organic chemicals.

Sources of TCE in Indoor Air

Household products containing TCE could be a possible source for TCE in indoor air. Another source could be evaporation from contaminated well water that is used for household purposes. TCE may also enter homes through soil vapor intrusion, which occurs when the chemical evaporates from groundwater, enters soil vapor (air spaces between soil particles), and migrates through building foundations into the building's indoor air. TCE has also been found at low concentrations in outdoor air.

Levels Typically Found in Air

The NYS DOH reviewed and compiled information from studies in New York State as well as from homes and office buildings across the United States on typical levels of TCE in indoor and outdoor air. Levels of TCE in the indoor air of homes and office settings and in outdoor air are expected to be less than 1 microgram per cubic meter (mcg/m^3).

Health Risks Associated with Exposure

Some studies of people exposed for long periods of time to high levels of TCE in workplace air or in drinking water show an association between TCE exposure and increased risks for certain types of cancer. These studies have limitations, and therefore we do not know with certainty if the increased risks are due to TCE or some other factor. Lifetime exposure to high levels of TCE has caused cancer in laboratory animals. Overall, the studies of humans and in animals do not prove that TCE causes cancer in people, but are highly suggestive that there may be an increased risk for cancer in people who are exposed (particularly at high concentrations) to TCE over long periods of time.

Long term exposure to high levels of TCE in workplace air is linked to effects on the central nervous system and irritation of the mucous membranes. One study showed an association between elevated levels of TCE in drinking water and effects on human fetal development. Other studies suggest an association between workplace TCE exposure and reproductive effects in men. Due to limitations in the studies, we do not know if the observed effects on fetal development and reproduction are due to TCE or some other factor is not known. In laboratory animals, exposure to high levels of TCE has damaged the central nervous system, liver and kidneys, and adversely affected reproduction and development of offspring. Taken together, the human and animal studies indicate that human exposure to high levels of TCE causes effects on the nervous system, and suggest that human exposure to high levels of TCE may increase the risk for reproductive and developmental health effects.

NYS DOH Air Guideline

The NYS DOH guideline for TCE in air is 5 mcg/m^3. This level is many times lower than the levels that have caused health effects in animals and humans. The guideline is based on the assumption that people are continuously exposed to TCE in air all day, every day for as long as a lifetime. This is rarely true for most people who, if exposed, are likely to be exposed for only part of the day and part of their lifetime. In setting

this level, the NYS DOH also considered the possibility that certain members of the population (infants, children, the elderly, and those with pre-existing health conditions) may be especially sensitive to the effects of TCE.

The purpose of the guideline is to help guide decisions about the nature of the efforts to reduce TCE exposure. Reasonable and practical actions should be taken to reduce TCE exposure when indoor air levels are above those typically found in indoor air, even when they are below the guideline of 5 mcg/m^3. The urgency to take actions increases as indoor air levels increase, especially when air levels are above the guideline.

Ways to Limit Exposure to TCE in Indoor Air

In all cases, the specific actions to limit exposure to TCE in indoor air depend on a case-by-case evaluation of the situation. Removing household sources of TCE and maintaining adequate ventilation will usually help reduce indoor air levels of the chemical. A sub-slab depressurization system can reduce the amount of TCE entering indoor air by soil vapor intrusion. Use of an activated carbon filter on the water supply can reduce the amount of the chemical in contaminated well water that evaporates into indoor air.

Reportable Detection Level

The reportable detection level for a chemical can vary depending on the analytical method used, the laboratory performing the analysis, and several other factors. Most laboratories that use the analytical methods recommended by the NYS DOH for measuring TCE in air (and approved by the National Environmental Laboratory Accreditation Conference or New York State's Environmental Laboratory Approval Program) can routinely detect the chemical at concentrations below 1 mcg/m^3.

Additional Information

Additional information on TCE, ways to reduce exposure, indoor air contamination resulting from soil vapor intrusion, indoor and outdoor air levels and the Environmental Conservation Law can be found on the NYS DOH website on the Tenant Notification page.

If you have further questions about TCE and the information in this fact sheet, please call the NYS DOH at 518-402-7800 or 800-458-1158, e-mail to ceheduc@health.state.ny.us, or write to the following address:

New York State Department of Health
Bureau of Toxic Substance Assessment
Flanigan Square
547 River Street
Troy, New York 12180-2216

Questions or comments: btsa@health.state.ny.us
Revised: February 2011

Tetrachloroethene (PERC) in Indoor and Outdoor Air

A copy of the Tetrachloroethene (PERC) In Indoor and Outdoor Air Fact Sheet is available in Adobe Portable Document Format (PDF, 493KB, 6pg).

This fact sheet answers a few questions about a chemical called tetrachloroethene (PERC), which is widely used to dry-clean clothes. It provides information on health effects seen in humans and animals exposed to PERC in air. It also provides information about the New York State Department of Health (NYSDOH) guideline of 100 micrograms of PERC per cubic meter of air (100 mcg/m^3) or 0.1 milligrams of PERC per cubic meter of air (0.1 mg/m^3). The fact sheet focuses on the health risks from air exposures because most of the PERC released into the environment goes into air.

1. **WHAT IS TETRACHLOROETHENE (PERC)?**

   Tetrachloroethene is a manufactured chemical that is widely used in the dry-cleaning of fabrics, including clothes. It is also used for degreasing metal parts and in manufacturing other chemicals. Tetrachloroethene is found in consumer products, including some paint and spot removers, water repellents, brake and wood cleaners, glues, and suede protectors. Other names for tetrachloroethene include PERC, tetrachloroethylene, perchloroethylene, and PCE. PERC is a commonly used name and will be used in the rest of the fact sheet.

   PERC is a nonflammable, colorless liquid at room temperature. It readily evaporates into air and has an ether-like odor. Because most people stop noticing the odor of PERC in air after a short time, odor is not a reliable warning signal of PERC exposure.

2. **HOW CAN I BE EXPOSED TO PERC?**

   People are exposed to PERC in air, water, and food. Exposure can also occur when PERC or material containing PERC (for example, soil) gets on the skin. For most people, almost all exposure is from PERC in air.

   PERC gets into outdoor and indoor air by evaporation from industrial or dry-cleaning operations and from areas where chemical wastes are stored or disposed. Groundwater near these areas may become contaminated if PERC is improperly dumped or leaks into the ground. People may be exposed if they drink the contaminated water. They may also be exposed if PERC evaporates from contaminated drinking water into indoor air during cooking and washing. PERC may evaporate from contaminated groundwater and soil and into the indoor air of buildings above the contaminated area. PERC also may evaporate from dry-cleaned clothes and into indoor air or may get into indoor air after PERC-products, such as spot removers, are used. Indoor air PERC levels may get high if PERC-products are used in poorly ventilated areas.

3. **HOW DOES PERC ENTER AND LEAVE MY BODY?**

   When people breathe air containing PERC, the PERC is taken into the body through the lungs and passed into the blood, which carries it to all parts of the body. A large fraction of this PERC is breathed out, unchanged, through the lungs into the air. Some of this PERC is stored in the body (for example, in fat, liver, and brain) and some is broken down in the liver to other compounds and eliminated in urine. PERC can also be found in breastmilk. Once exposure stops, most of the PERC and its breakdown products leave the body in several days. However, it may take several weeks for all of the PERC and its breakdown products to leave the body.

4. **WHAT KINDS OF HEALTH EFFECTS CAN BE CAUSED BY EXPOSURE TO PERC IN AIR?**

   In humans and animals, the major effects of PERC exposure are on the central nervous system, kidney, liver, and possibly the reproductive system. These effects vary with the level and length of exposure. Figure 1 shows the types of health effects seen in humans and animals and the lowest levels of PERC in air at which the effects were seen. The diagram on the right side of the figure shows the effects of long-term exposures in humans and animals whereas the diagram on the left side shows the same information for short-term exposures. Because there is a large amount of information on the human effects of PERC, the rest of the fact sheet will discuss only the human data.

   The human effects shown in Figure 1 represent the average response of a group of individuals at an estimated level of exposure (typically, the average of the measured air levels). Because data for individual people are not usually reported, some people (those sensitive to the effects of PERC) may

have experienced effects at air levels below the average air level, whereas other people (those resistant to the effects of PERC) may not have experienced effects at air levels above the average air level. The difference in how people respond to the same or similar exposure levels is due, in part, to the individual differences among people. People, for example, differ in age, sex, diet, family traits, lifestyle, genetic background, the presence of other chemicals in their body (e.g., alcohol, prescription drugs), and state of health. These differences can affect how people will respond to a given exposure. One person may feel fine during and after an exposure while another person may become sick. This is known as sensitivity. Differences in sensitivity should be kept in mind when reading the following information on the human health effects of PERC.

Short-Term Exposure - Studies with volunteers show that exposures of 8-hours or less to 700,000 micrograms per cubic meter of air (mcg/m^3) cause central nervous system symptoms such as dizziness, headache, sleepiness, lightheadedness, and poor balance (Figure 1). Exposures to 350,000 mcg/m^3 for 4 hours affected the nerves of the visual system and reduced scores on certain behavioral tests (which, for example, measure the speed and accuracy of a person's response to something they see on a computer screen). These effects were mild and disappeared soon after exposure ended.

Long-Term Exposure - Numerous studies of dry-cleaning workers indicate that long-term exposure (9 to 20 years, for example) to workplace air levels averaging about 50,000 mcg/m^3 to 80,000 mcg/m^3 reduces scores on behavioral tests and causes biochemical changes in blood and urine (Figure 1). The effects were mild and hard to detect. How long these effects would last if exposure ended is not known.

One study reported reduced scores on behavioral tests in 14 healthy adults living (for 10.6 years, on average) in apartments near dry-cleaning shops. The effects were small; the average test scores of the residents were slightly lower than the average score of unexposed people. The range of measured air levels in 13 apartments was 7.6 mcg/m^3 to 23,000 mcg/m^3; one air level was below 100 mcg/m^3, five values were between 100 and 1,000 mcg/m^3, and seven values were above 1,000 mcg/m^3. The average air level in all apartments was 5,000 mcg/m^3 and the median value was about 1,400 mcg/m^3 (that is, half the measured air levels were above 1,400 mcg/m^3 and half were below it). As with the long-term occupational studies, how long these effects would last if exposure ended is not known. Confidence in the understanding of exposure in this study is less than that in the occupational studies.

Some studies show a slightly increased risk of some types of cancer and reproductive effects among workers, including dry-cleaning workers, exposed to PERC and other chemicals. Cancers associated with exposures include cancers of the esophagus, bladder, and non-Hodgkin's lymphoma. Cancers less clearly associated with exposures include cancers of the cervix, tongue, and lung. The reproductive effects associated with exposure included increased risks of spontaneous abortion, menstrual and sperm disorders, and reduced fertility. The data suggest, but do not prove, that the effects were caused by PERC and not by some other factor or factors.

Data on the workplace air levels in these studies ranged from none (reproductive studies) to some (cancer studies); however, workplace air levels during the times these studies were conducted were considerably higher than those found in indoor or outdoor air (see next question).

5. **WHAT ARE BACKGROUND LEVELS FOR PERC IN INDOOR AND OUTDOOR AIR IN AREAS THAT ARE NOT NEAR A KNOWN SOURCE OF PERC?**

The United States Environmental Protection Agency (US EPA) has collected and analyzed information on PERC levels in indoor and outdoor air. Table 1 contains the results from air samples collected inside and outside of buildings that were not near known sources of PERC and other chemicals (for example, a home not known to be near a chemical spill, a hazardous waste site, a dry-cleaner, or a factory). The middle half (25^{th} to 75^{th} percentile) of PERC levels in indoor and outdoor air samples is about 1 to 10 mcg/m^3. A similar result was found for NYS homes not near known PERC sources. NYSDOH sampled 138 homes between 1989 and 1996 and the level of PERC in the indoor air was below 10 mcg/m^3 in 95% of the homes. Collectively, these data show that background levels of PERC in air are seldom above 10 mcg/m^3.

Table 1

Sample	PERC Air Levels (mcg/m^3)[A]			Sample Size
	25^{th} Percentile	50^{th} Percentile (Median)	75^{th} Percentile	
Homes & Offices: Nationwide 1970 - 1988[B]				
Indoor	1.7	5.0	11	2,195
Outdoor	0.82	2.4	5.9	3,226

Offices: Nationwide 1994 - 1996[C]				
Indoor	not detected*	3.0	5.9	298
Outdoor		not detected*	3.0	100

[A] These databases contain air-testing results from studies where there were no known sources of chemicals or chemical spills. Outdoor samples were taken at the same time as indoor samples and at a location close to the building sampled.

[B] The US EPA Volatile Organic Compounds Database was published in March 1988.

[C] From 1994 through 1996, US EPA measured volatile organic compounds in indoor and outdoor air at 100 randomly selected public and private office buildings across the US.

* Not detected means that the amount of PERC in the air sample was less than the smallest amount of PERC that could be accurately measured (that is, the level was less than the detection limit); in these studies, the detection limit ranged from 1.4 to 2.0 mcg/m^3.

6. **WHAT IS THE NEW YORK STATE DEPARTMENT OF HEALTH'S (NYSDOH) GUIDELINE FOR PERC IN AIR?**

NYSDOH recommends that the average air level in a residential community not exceed 100 micrograms of PERC per cubic meter of air (100 mcg/m^3), considering continuous lifetime exposure and sensitive people. Three other ways of expressing the guideline are 0.1 milligrams per cubic meter of air (0.1 mg/m^3), 15 parts per billion (ppb) or 0.015 parts per million (ppm).

The purpose of the guideline is to help guide decisions about the nature of efforts to reduce PERC exposure. Reasonable and practical actions should be taken to reduce PERC exposure when indoor air levels are above background, even when they are below the guideline of 100 mcg/m^3. The urgency to take actions increases as indoor air levels increase, especially when air levels are above the guideline. Finally, NYSDOH recommends taking immediate action to reduce exposure when an air level is ten-times or more higher than the guideline (that is, when the air level is 1,000 mcg/m^3 or higher). In all cases, the specific corrective actions to be taken depend on a case-by-case evaluation of the situation. The goal of the recommended actions is to reduce PERC levels in indoor air to as close to background as practical.

7. **SHOULD I BE CONCERNED ABOUT HEALTH EFFECTS IF I AM EXPOSED TO AN AIR LEVEL SLIGHTLY ABOVE THE GUIDELINE?**

The guideline is lower than the air levels that caused either non-cancer or cancer effects (see Figure 1); thus, the possibility of health effects is low even at air levels slightly above the guideline. In addition, the guideline is based on the assumption that people are continuously exposed to PERC in air all day, every day for as long as a lifetime. This is rarely true for most people, who are more likely to be exposed for a part of the day and part of their lifetime.

8. **WHEN SHOULD MY CHILDREN OR I SEE A PHYSICIAN?**

If you believe you or your children have symptoms that you think are caused by PERC exposure, you and your children should see a physician. You should tell the physician about the symptoms and about when, how, and for how long you think you and/or your children were exposed to PERC.

9. **WHERE CAN I GET MORE INFORMATION?**

If you have any questions about the information in this fact sheet or would like to know more about PERC, please call the New York State Department of Health at 1-518-402-7800 or 1- 800-458-1158 (extension 2-7800) or write to the following address.

New York State Department of Health
Bureau of Toxic Substance Assessment
Flanigan Square, 547 River Street
Troy, NY 12180-2216

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