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FINAL VAPOR INTRUSION SAMPLING REPORT FOR SOLID WASTE MANAGEMENT UNIT 16 (SWMU 16) CAST HIGH EXPLOSIVE FILL/B-146 INCINERATOR BUILDING 146 NSA EXPLOSIVE FILL/B-146 INCINERATOR BUILDING 146 NSA CRANE IN
11/01/2014
TETRA TECH

FINAL
Vapor Intrusion Sampling Report
FOR
SWMU 16 Cast High Explosive Fill/B-146 Incinerator - Building 146

Naval Support Activity Crane
Crane, Indiana

Naval Facilities Engineering Command
Mid-Atlantic

Contract Number N62470-08-D-1001

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FINAL
VAPOR INTRUSION SAMPLING REPORT FOR SWMU 16 - CAST HIGH EXPLOSIVE FILL/B-146 INCINERATOR - BUILDING 146

NAVAL SUPPORT ACTIVITY CRANE
CRANE, INDIANA

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

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1.0 INTRODUCTION

This Vapor Intrusion (VI) Sampling Report details the activities associated with the indoor air, outdoor air, and sub-slab vapor sampling conducted at Solid Waste Management Unit (SWMU) 16 - Cast High Explosives Fill/Building 146 (B-146) Incinerator, at the Naval Support Activity (NSA) Crane, located in Crane, Indiana. This report was prepared for the Department of the Navy (Navy), Naval Facilities Engineering Command Midwest (NAVFAC MW) under Contract Task Order (CTO) F27G, Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract No. N62470-08-D-0001.

1.1 BACKGROUND

SWMU 16, approximately 16 acres in size, is located in the north-central portion of NSA Crane (Figure 1-1). B-146 was an explosive fill and washout facility with a trichloroethene (TCE) degreaser present in the northern portion of the building. Discharges from the degreaser entered floor drains and discharged through cast iron pipes to sumps located to the east and west of B-146. In 1995, voluntary interim measures (VIM) were conducted to remediate TCE contamination which was found in the east and west sumps. The floor drains were sealed at that time to prevent any further discharges to the sumps. A third sump was designed and installed with a connection to the sanitary sewer.

Resource Conservation and Recovery Act (RCRA) Facility Investigations (RFIs) conducted at SWMU 16 during the early 2000s showed that TCE was present in soils underlying the northern portion of B-146 and exterior to the building, to the north and northwest near the sumps at concentrations greater than the U.S. EPA human health soil screening level (2.8 µg/kg) and at concentrations that posed and unacceptable risk. The highest TCE concentrations were found in soils underlying the approximate location of the TCE degreaser, and along the path of the piping that previously discharged to the western sump. RFI field investigations also showed that the upper zone of groundwater has been contaminated with explosives and chlorinated volatile organic compounds (VOCs), primarily TCE, 1,1,2-trichloroethane (1,1,2-TCA), and their degradation products. The maximum TCE concentration was 330,000 µg/L and the maximum 1,1,2-TCA concentration was 220 µg/L. Detected TCE degradation products include cis-1,2-dichloroethene and vinyl chloride with reported maximum concentrations of 4,200 µg/L and 390 µg/L, respectively. The highest TCE concentrations were found in groundwater wells located to the north and northwest of B-146.

The incremental lifetime cancer risk ($7x10^{-3}$) and hazard index (57) for future groundwater users exposed to TCE and other chlorinated solvents in groundwater and soil underlying SWMU 16 exceeded USEPA

and IDEM acceptable levels. The Navy has conducted interim measures to address sources of TCE (the primary contaminant) in soils exterior to B-146 to reduce continuing releases to groundwater. Interim remedial actions were taken in 1995 to plug off the east and west sumps, clean out the east and west sumps, and divert all flow from the Building 146 floor drains into the sanitary sewer. Interim measures conducted between 1996 and 1998 included sampling and treating water that had drained into the east and west sumps containing elevated levels of TCE. Future corrective measures for groundwater will consist of monitored natural attenuation (MNA). The Navy developed an Interim Measures Work Plan (Tetra Tech, 2013) for the removal of chlorinated-solvent-contaminated soil located beyond the B-146 footprint and this removal action was completed in early 2014. Remediation of contaminated soil beneath the building was not feasible without compromising the building integrity.

In 2008, the United States Environmental Protection Agency (USEPA) Region 5 recommended that indoor air quality (IAQ) sampling be performed at SWMU 16 - B-146, to determine if TCE (present in underlying soil) might be migrating to the indoor air space of B-146. The IAQ sampling study was conducted in 2009 as part of an RFI at NSA Crane (Tetra Tech, 2008). Results of the study indicated that TCE was present in indoor air within three of the five rooms (work bays) sampled, and that the TCE eight-hour concentration in two of these rooms exceeded the Indiana Department of Environmental Management (IDEM) 25-Year Commercial Chronic Action Level [screening level of 8.8 microgram per cubic meter ($\mu g/m^3$) . However, the risk assessment concluded that these concentrations represent risks that are in the acceptable range (10^{-4} to 10^{-6}).

Because sub-slab vapor sampling was not required as part of IAQ studies at that time, the USEPA then requested that the indoor air study at B-146 be repeated in conjunction with a sub-slab vapor study. The collection of sub-slab vapor samples in conjunction with indoor air samples would allow calculation of a site-specific attenuation to estimate the amount of TCE (and associated degradation products) entering B-146 from the underground sources.

1.2 OBJECTIVES

The objective of the activities summarized in the SWMU 16 Vapor Intrusion Sampling Work Plan (Tetra Tech, 2014) were to collect information to determine TCE and its degradation product are entering the B-146 work air space at concentrations that present unacceptable risk to human health.

1.3 SAMPLING DESIGN AND RATIONALE

The sampling design and rationale for the vapor intrusion air sampling were developed based on known TCE contamination in SWMU 16 soil and groundwater (Tetra Tech, 2011), the previous B-146 indoor air study discussed in Section 1.1 (Tetra Tech, 2009), current VI technical guidance (DOD, 2009; USEPA, 2010; Navy, 2011), and an example VI study prepared for USEPA Region 5 (CH2MHill, 2009).

Ten subsurface soil borings collected beneath Bays 1 and Bay 2 of Building 146 in Round 3 of the RFI indicated that TCE and associated degradation products are present under Building 146. TCE concentrations ranged from 11 µg/kg to 9,000 µg/kg with the highest concentrations occurring beneath the southwest corner of Bay 1. There are no groundwater wells located inside of Building 146. However, there is one well (16MWT16) located adjacent to the east side of Building 146 that has reported TCE concentrations in the range of 190 to 340 µg/l. In addition to TCE, the ten borings from beneath the building also reported positive detections for the following VOCs: acetone, chloroform, dichlorofluoromethane, toluene, and trichlorofluoromethane. The most detections were reported for dichlorofluoromethane, and chloroform.

The SWMU 16 RFI and Soil Delineation Sampling Data Report identified TCE concentrations in soil and groundwater (Tetra Tech, 2011 and 2012). In surface soil [0 to 2 feet below ground surface (bgs)], TCE contamination is located under the northern portion of B-146. TCE soil contamination is also present in the depth intervals of 2 to 6 and 6 to 10 feet bgs.

In 2009, an indoor air quality study was conducted to determine if TCE and associated degradation products are penetrating the building floor from contaminated groundwater located beneath the building. The focus of this field event was to collect air quality samples from the interior of B-146 and compare contaminant concentrations to IDEM Screening Action Levels. Results of the study indicated that TCE was present in air only within three of the sampled work bay areas, located in the central and northern portions of B-146. Indoor air concentrations of TCE ranged from 4.50 to 11.00 micrograms per cubic meter (µg/m^3) (Table 1-1). Two samples had TCE concentrations greater than the IDEM Action Level (screening) of 8.8 µg/m^3. These samples were collected with the building closed, unoccupied, all windows and doors closed and the HVAC system turned off. The locations where TCE was detected are consistent with the primary location of TCE contamination found in surface and subsurface soil, which is in the north end of the building. A human health risk assessment (HHRA) was completed following the indoor air sampling event at B-146. This study indicated no unacceptable risk was present based on an evaluation of constituents present in air.

The following factors were considered during the design of the 2014 indoor air and sub-slab vapor intrusion sampling investigation:

- The proposed vapor intrusion (indoor) and sub-slab vapor samples would be collected in an environment that represents the occupational employee exposure, as requested by USEPA.

- During the collection of all vapor intrusion (indoor), outdoor, and sub-slab air samples, the B-146 ventilation system settings would be identical to those used during the receptor's actual work hours.

- The vapor intrusion (indoor) air samples would be collected from a height of 4 to 5-feet above the surface of the floor in order to represent the receptor's breathing zone
  .
- The detected air concentrations for indoor air and sub-slab samples in this investigation will be compared to USEPA industrial and residential Vapor Intrusion Screening Levels (VISL).

- Since NSA Crane has banned the routine use of chlorinated solvents, none are anticipated to be present in the work area to be sampled. The focus of the VI study was the impact of chlorinated solvent soil contamination (i.e., TCE and degradation products) on the B-146 indoor air quality.

- It is important to note that tetrachloroethene (PCE) and chlorinated alkanes [1,1,2-TCA and 1,1,2,2-tetrachloroethane (1,1,2,2-PCA)] were also detected in groundwater at SWMU 16. These target analytes and their associated degradation products have also been added to the analytical suite for this project.

All vapor intrusion (indoor) and sub-slab samples were collected in accordance with the Standard Operating Procedures (SOPs) provided in Appendix A of the SWMU 16 Vapor Intrusion Sampling Work Plan (Tetra Tech, 2014).

1.4 REPORT ORGANIZATION

This report consists of five sections:

- Section 1.0, the introduction, includes description of the site background, objectives, sampling design and rationale, and the report organization.
- Section 2.0 describes the field effort associated with the vapor intrusion sampling.
- Section 3.0 presents the analytical data.

- Section 4.0 presents the human health risk assessment.
- Section 5.0 presents the conclusions and recommendations.

The appendices include the following:

- Appendix A – Field Forms
- Appendix B – Site Photographs
- Appendix C – Data Validation Reports

TABLE 1-1

2009 INDOOR AIR QUALITY SAMPLING RESULTS
SWMU 16 - BUILDING 146
VAPOR INTRUSION REPORT
NSA CRANE
CRANE, INDIANA

Location Identification Number	Validated Results (ppbv)	Validated Results ($\mu g/m^3$)	Validation Qualifier
1,1-Dichloroethane (CAS: 75-34-3)			
146ASIN01	0.90	3.50	U
146ASIN02	0.90	3.60	U
146ASIN03	0.90	3.60	U
146ASIN04	0.90	3.80	U
146ASIN05	0.90	3.80	U
146ASIN06	0.80	3.30	U
146ASIN06	0.90	3.50	U
146ASIN07	0.90	3.70	U
146ASIN08	0.90	3.70	U
146ASOT01	1.00	4.10	U
1,1-Dichloroethene (CAS: 75-35-4)			
146ASIN01	0.90	3.50	U
146ASIN02	0.90	3.60	U
146ASIN03	0.90	3.60	U
146ASIN04	0.90	3.70	U
146ASIN05	0.90	3.70	U
146ASIN06	0.80	3.20	U
146ASIN06	0.90	0.90	U
146ASIN07	0.90	3.60	U
146ASIN08	0.90	3.60	U
146ASOT01	1.00	4.00	U
Chloroethane (CAS: 75-00-3)			
146ASIN01	0.90	2.30	U
146ASIN02	0.90	2.40	U
146ASIN03	0.90	2.40	U
146ASIN04	0.90	2.50	U
146ASIN05	0.90	2.50	U
146ASIN06	0.80	2.20	U
146ASIN06[(2)]	0.90	2.30	U
146ASIN07	0.90	2.40	U
146ASIN08	0.90	2.40	U
146ASOT01	1.00	2.70	U
cis-1,2-Dichloroethene (CAS: 156-59-2)			
146ASIN01	0.90	3.50	U
146ASIN02	0.90	3.60	U
146ASIN03	0.90	3.60	U
146ASIN04	0.90	3.70	U
146ASIN05	0.90	3.70	U
146ASIN06	0.80	3.20	U
146ASIN06	0.90	3.40	U
146ASIN07	0.90	3.60	U
146ASIN08	0.90	3.60	U
146ASOT01	1.00	4.00	U

TABLE 1-1

2009 INDOOR AIR QUALITY SAMPLING RESULTS
SWMU 16 - BUILDING 146
VAPOR INTRUSION REPORT
NSA CRANE
CRANE, INDIANA

Location Identification Number	Validated Results (ppbv)	Validated Results ($\mu g/m^3$)	Validation Qualifier
Trichloroethene (CAS: 79-01-6)			
146ASIN01	0.90	5.10	---
146ASIN02	0.90	4.80	U
146ASIN03	0.90	4.80	U
146ASIN04	2.10	11.00	---
146ASIN05	1.90	10.00	---
146ASIN06	1.40	7.40	---
146ASIN06	1.40	7.70	---
146ASIN07	0.90	4.90	U
146ASIN08	0.80	4.50	J
146ASOT01	1.00	1.00	U
Vinyl Chloride (CAS: 75-01-4)			
146ASIN01	0.90	2.20	U
146ASIN02	0.90	2.30	U
146ASIN03	0.90	2.30	U
146ASIN04	0.90	2.40	U
146ASIN05	0.90	2.40	U
146ASIN06	0.80	2.10	U
146ASIN06	0.90	2.20	U
146ASIN07	0.90	2.30	U
146ASIN08	0.90	2.30	U
146ASOT01	1.00	2.60	U

CAS = Chemical Abstracts Service Registry Number

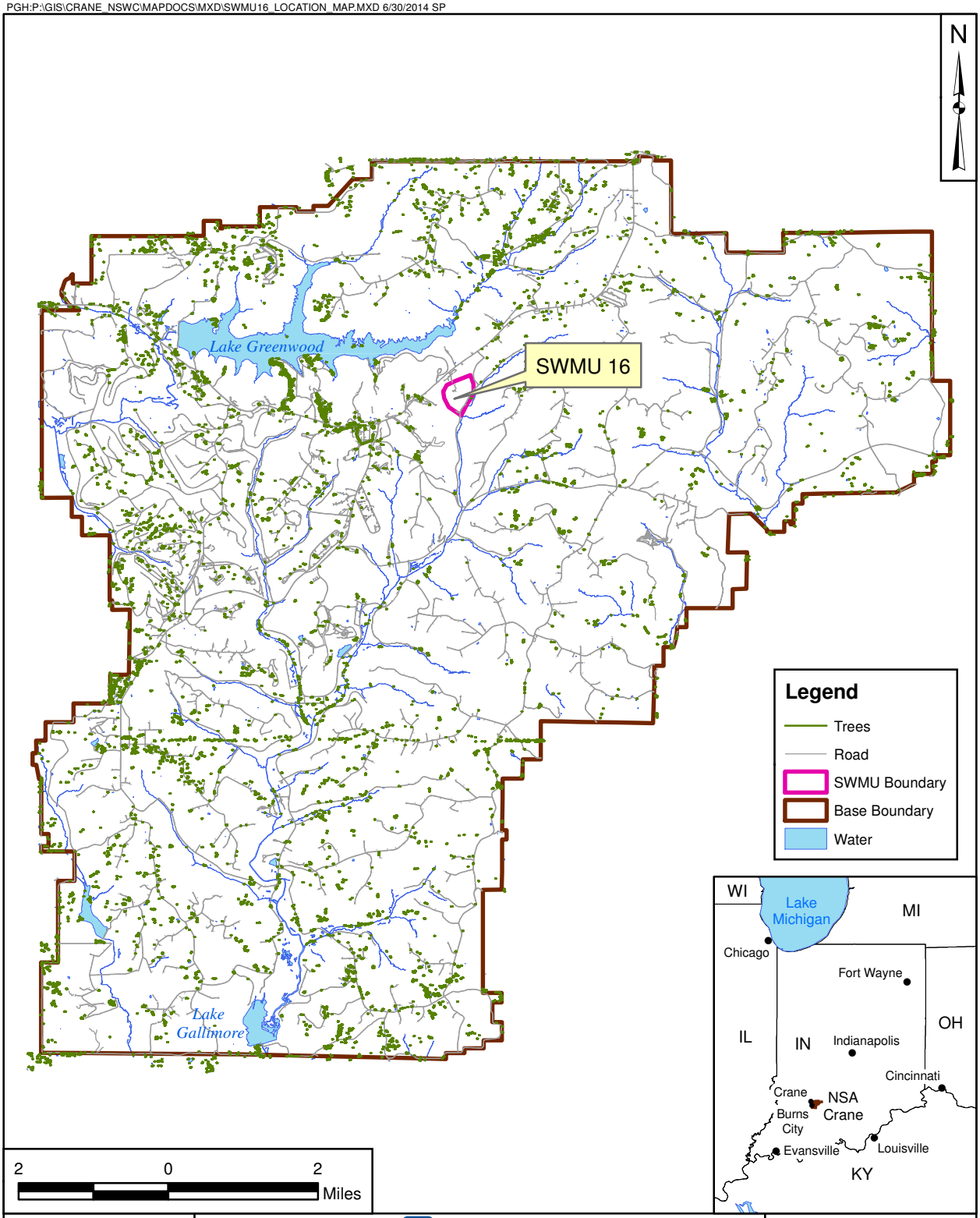
ppbv = parts per billion by volume

$\mu g/m^3$ = micrograms per cubic meter

Data Qualifiers:
J = Indicates that the chemical was detected; however, the associated numerical result is not a precise representation of the concentration that is actually in the sample. The laboratory-reported concentration is considered to be an estimate of the true concentration.

U = Indicates that the chemical was not detected at the numerical detection limit (sample-specific detection limit) noted.

PGH:P:\GIS\CRANE_NSWC\MAPDOCS\MXD\SWMU16_LOCATION_MAP.MXD 6/30/2014 SP



DRAWN BY K. MOORE	DATE 09/26/08	TETRA TECH	CONTRACT NUMBER CTO F27G
CHECKED BY J. GOERDT	DATE 06/30/14	SITE LOCATION MAP SWMU 16 - CAST HIGH EXPLOSIVES FILL / BUILDING 146 INCINERATOR NSA CRANE CRANE, INDIANA	OWNER NO. —
REVISED BY S. PAXTON	DATE 06/30/14		APPROVED BY — / DATE —
SCALE AS NOTED			FIGURE NO. FIGURE 1-1 / REV 0

2.0 FIELD ACTIVITIES

This section presents a summary of the field activities that were performed to address the objectives of the vapor intrusion study as discussed in Section 1.0. The outdoor air, vapor intrusion (indoor), and sub-slab soil gas sample locations are shown on Figure 2-1.

2.1 ITINERARY FOR BUILDING STAKEHOLDERS

Tetra Tech was notified of specific dates when no activity was planned for B-146 and these dates were referred to when deciding on particular sampling dates. Prior to the air sampling event, a schedule of activities was developed and presented to the Navy. The schedule indicated the proposed dates of sampling, the proposed locations of each type of sample, and a directive to building occupants requesting verification that no chlorinated solvents were present within the building, and, if determined to be present, a request that any such solvents be removed prior to the sampling dates.

2.2 BUILDING PREPARATIONS

In contrast to the 2009 indoor air quality study at B-146 in which all building doors were to remain closed during the study, this VI study was designed to simulate normal inside building conditions when personnel are working in B-146. The routine heating and ventilation systems were to remain active during the sampling period to maintain normal air circulation/exchange conditions. Since the sampling event was conducted in late spring, weather conditions were warm enough that the heating system was not used during the sampling effort; however, random doors to the building were left open during the majority of the sampling event to simulate spring/summer working conditions inside the building.

2.3 UTILITY CLEARANCE

Prior to the air sampling event, a proposed sample location figure was provided to the Navy to review the drilling locations against sub-slab utilities location figures. Additionally, Tetra Tech personnel marked out the proposed sampling locations with white marking paint on the concrete floor. All of the buildings utilities were reported to be located above ground and none of the proposed sub-slab sample locations interfered with drain pipes running under the building.

2.4 SAMPLE COLLECTION

The VI sampling included the collection of three types of time-integrated samples including vapor intrusion (indoor), sub-slab vapor, and outdoor air. Samples were collected using Summa canisters. The Summa canisters were received directly from the laboratory with each canister containing documentation of the serial number of each canister and its associated flow regulator and certification of the canisters pressure. The collection of these sample types is described below, in Sections 2.4.1, 2.4.2, and 2.4.3. Appendix A contains the sample log sheets associated with the field event.

The sample collection was conducted in accordance with the approved SWMU 16 Vapor Intrusion Sampling Work Plan (Tetra Tech, 2014.

B-146 consists of five divided work bays. Four of the work bays (Bays 1 through 4) are approximately 1,500 ft^2 in size, while the northernmost bay (Bay 5) measures approximately 2,000 ft^2. Previous investigations have indicated that TCE contamination is located at the northern portion of B-146 (Tetra Tech, 2011 and 2012). Because the area of Bay 5 is greater than 1,500 ft^2 and the majority of the TCE-contaminated area is located in this area of B-146, two sub-slab vapor samples were collected from within Bay 5, and only one sub-slab sample in each of Bays 1 through 4. A building survey had been conducted to confirm there is no crawl space beneath the floor of B-146.

2.4.1 Indoor Vapor Intrusion Sampling

One vapor intrusion (indoor) sample was collected in each of the five work bays using evacuated summa canisters at the locations shown on Figure 2-1 (samples 146-AS-IN-09 through 13). Prior to initiating sampling, the serial number of the Summa canister and the associated flow regulator were noted on the sample-specific log sheet. The dust cap was removed from the canister and the flow regulator was attached. The canister was placed directly on the concrete floor and a 5-foot long stiff plastic rod was attached to the Summa canister with plastic twist ties. The sample tubing was then attached to the plastic rod with one end of the tubing connected to the flow regulator and the other sample end placed at a height approximately 4 to 5-feet above the floor surface. The Summa canisters were then opened and operated continuously for 8 hours. The initial sample time, air temperature, and canister pressure was noted on the respective sample log sheet. Over the course of the 8-hour sampling period, each sample location was visited every hour noting time, air temperature, and canister pressure on the sample log sheet (Appendix A). At the end of the 8-hour sampling event, the valve was closed on each canister, the tubing was removed, the regulator was detached from the canister, and the dust cap was placed back on the canister. Two identical sample labels were completed with sample identification (ID), date, and time

with one label attached to the Summa canister and the other label placed on the individual box in which the Summa canister was shipped. The sample information was then put on a chain-of-custody form which remained with the samples until they were shipped to the laboratory. In addition to the five samples noted above, one duplicate sample (FD051314-01) was collected for quality assurance (QA) purposes. The duplicate sample was collected in Bay 1 next to sample 146-AS-IN-09. Table 2-1 lists the sample identification numbers for the samples collected, along with their respective general locations.

2.4.2 Sub-Slab Vapor Sampling

Six sub-slab air samples were collected from below the B-146 concrete floor using evacuated Summa canisters at the locations shown on Figure 2-1 (samples 146-AS-SS-15 through 20). One sample was collected from within each of Bays 1 through 4 and two samples were collected within Bay 5. A Bosch hammer drill with a 1-inch bit was used to drill through the concrete floor slab at each of the sample locations. The thickness of the concrete was approximately 6 to 7-inches and gravel was encountered just below the slab which continually caved in when the bit was removed from the hole preventing any type of sample cavity below the concrete.

Helium Leak Test

Prior to initiating sampling, a helium leak test was performed at each of the sub-slab sampling locations. After drilling through the concrete floor, sample tubing was placed down through the concrete at a depth of 5 to 6-inches so the end of the tubing was just above the gravel layer. Modeling clay was used to hold the tubing in place and to create an air-tight seal. To complete the helium leak test, a small hole was drilled in the bottom center of a 7-quart plastic wastebasket (shroud) through which the sample tubing was directed (see Figure 2-2). Each shroud was additionally equipped with a valve for introducing laboratory-grade helium. Double-sided tape was then placed on the top rim of the shroud, which was then inverted over the sample point and tubing. The shroud was attached securely to the building floor by the tape. The sample tubing was pulled through the shroud as it was inverted being careful not to disturb the sample tubing down hole. Modeling clay was used to create an air tight seal between the sample tubing and the shroud.

Helium was then slowly introduced into the shroud via the side valve and a hand-held helium detector was used to monitor the area around the bottom of the shroud. Once the helium was detected around the bottom of the shroud, indicating the interior of the shroud was saturated with helium, the valve was closed restricting any additional helium from entering the shroud. The sample tubing was attached to the inlet port of a small pump and a tedlar bag was attached to the outlet port of the sampling pump. The sample

pump, calibrated at a rate of 0.2 liters per minute (lpm), was turned on and allowed to fill the tedlar bag, after which time the helium detector was then attached to the tedlar bag via tubing to monitor the concentration of helium. If the seal between the sample tubing and the sample point was adequate, less than five percent of helium should have been detected in the tedlar bag. All helium leak tests passed during the first test at each of the six sub-slab sample points. The sample tubing was then purged by filling the tedlar bags utilizing the air pump for 10 minutes.

Soil Vapor Collection

Per Section 2.4.2 of the SWMU 16 Vapor Intrusion Sampling Work Plan (Tetra Tech, 2014), a 3-hour waiting period was observed between the completion of the helium leak test and the initiation of the sub-slab vapor sampling.

Prior to opening the control valve on the Summa canister at each of the sub-slab sample locations, the date, time, temperature, and barometric pressure were noted on the associated sample log sheets. The Summa canisters were then opened and they operated continuously for 8 hours. The initial sample time, air temperature, and canister pressure was noted on the respective sample log sheet. Over the course of the 8-hour sampling period, each sample location was visited every hour noting time, air temperature, and canister pressure on the sample log sheet (Appendix A). At the end of the 8-hour sampling event, the valve was closed on each canister, the tubing was removed, the regulator was detached from the canister, and the dust cap was placed back on the canister. Two identical sample labels were completed with sample ID, date, and time with one label attached to the Summa canister and the other label placed on the individual box in which the Summa canister was shipped. The sample information was then put on a chain-of-custody form which remained with the samples until they were shipped to the laboratory. In addition to the above six samples, one duplicate sample (FD051414-01) was collected for QA purposes. The duplicate sample was collected in Bay 5 along with sample 146-SS-IN-20. Table 2-1 lists the sample identification numbers for the samples collected, along with their respective general locations.

At the end of the sampling period, the sampling apparatus was removed and the borehole was temporarily sealed with the modeling clay. The following day, all of the sample boreholes were permanently sealed using concrete.

2.4.3 Outdoor Air Sampling

The area of TCE contamination in soil and groundwater extends beyond the footprint of Building 146. The RFI has shown that TCE is present in soils exterior to B-146, to the north and northwest. This

outside area represents a potential background source of TCE that could possibly bias the indoor air sampling results if outside air cross-contaminated indoor air during the sampling period. The purpose of the indoor air samples being collected for this study was to measure the impact of vapor intrusion via the soil, and not contributions from VOCs from sources outside B-146.

Therefore, one outdoor air sample was collected using a Summa canister along the prevailing upwind direction (southerly) from Building 146 away from any wind obstructions such as trees and buildings and any contaminated soils. A Summa Canister for Sample 146-AS-OU-14 was placed approximately 45 feet from the southern end of B-146 with the canister inlet tube at approximately 5 feet above ground level. (Figure 2-1). The intake of the sample port was placed approximately five feet above the ground surface. The outdoor air sampling was initiated approximately 1-hour prior to the start of the indoor air sampling (0814) and was terminated approximately 1-hour before the indoor air sampling was complete (1614). The sample canister was observed every hour during the sample duration at which time the regulator pressure was recorded as well as wind direction, temperature, and barometric pressure. The weather conditions at the start and end of the sampling period are given below.

Temperature (°F)	Atmospheric Pressure (mb)	Wind Direction/Speed
Start 69	1013.6	South - 10 mph
End 77	1014.7	Southwest - 12 mph; Gust to 18 mph
Max 81		Max - South 15 mph; Gust to 30 mph

2.5 SAMPLE MANAGEMENT

The following procedures for proper management of the samples were conducted throughout the course of the VI study as discussed below.

Record-Keeping

The following records were maintained to document sample collection and handling and are presented in Appendix A of this report:

- Sample collection log sheets and a field logbook
- Chain-of-custody records

All air/vapor samples collected during the course of the VI study were placed in the appropriate laboratory-supplied containers for transport back to the analytical laboratory.

- Security of the sample during field activities: The area around B-146 was closed to public access during sampling activities. Upon collection, the samples were in the possession of the sampling crew until shipped to the laboratory via Federal Express (overnight). Samples were shipped to the laboratory the day following their collection.

A chain-of-custody form was completed in the field. The original chain-of-custody accompanied the samples and copies were maintained.

Field Quality Control

Two field duplicates were collected during the VI study, one indoor air sample and one sub-slab vapor sample, to monitor the precision of the field sampling process.

Equipment Decontamination

No non-dedicated sampling equipment was utilized during the course of the sampling event.

Investigation-Derived Waste

Investigation-derived waste (IDW) such as personal protective equipment (PPE), expended air sample tubing, and other consumables related to preparing the sub-slab sampling points were generated during this sampling event. The IDW was packed into garbage bags and added to the NSA Crane trash disposal system (dumpster) for collection.

2.6 HEALTH AND SAFETY

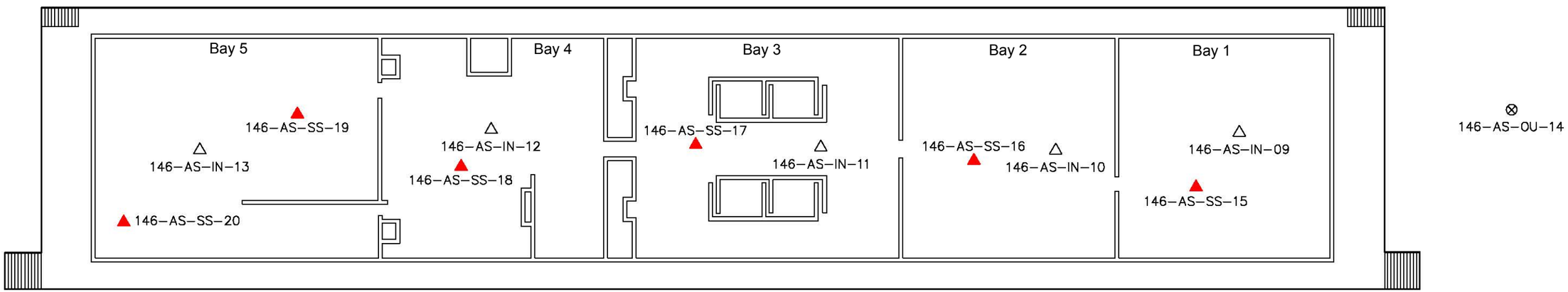
A Health and Safety Plan (HASP) Addendum was developed in accordance with 29 Code of Federal Regulations (CFR) 1910.120, and included information such as personnel training requirements, record-keeping, and emergency response procedures. The site safety officer (SSO) was responsible for ensuring the field personnel were familiar with the work in accordance with the HASP Addendum. The SSO conducted a brief safety “tailgate meeting” prior to initiating sampling activities.

TABLE 2-1

SAMPLE SUMMARY AND ANALYSES
SWMU 16 - BUILDING 146
VAPOR INTRUSION REPORT
NSA CRANE
CRANE, INDIANA

SAMPLE TYPE	SAMPLE IDENTIFICATION	SAMPLE LOCATION	SAMPLE DATE	SAMPLE METHOD	FBL ANALYSIS
Indoor Air	146-AS-IN-09	Bay 1	5/13/2014	SC	X
	146-AS-IN-10	Bay 2	5/13/2014	SC	X
	146-AS-IN-11	Bay 3	5/13/2014	SC	X
	146-AS-IN-12	Bay 4	5/13/2014	SC	X
	146-AS-IN-13	Bay 5	5/13/2014	SC	X
	FD051314-01	Bay 1	5/13/2014	SC	X
Sub-Slap Vapor	146-AS-SS-15	Bay 1	5/14/2014	SC	X
	146-AS-SS-16	Bay 2	5/14/2014	SC	X
	146-AS-SS-17	Bay 3	5/14/2014	SC	X
	146-AS-SS-18	Bay 4	5/14/2014	SC	X
	146-AS-SS-19	Bay 5	5/14/2014	SC	X
	146-AS-SS-20	Bay 5	5/14/2014	SC	X
	FD051414-01	Bay 5	5/14/2014	SC	X
Outdoor Air	146-AS-OU-14	Outdoor	5/13/2014	SC	X

AS = Air sample
IN = Indoor
OU = Outside
SC = Suma canister
SS = Sub-slab
FBL = Fixed base laboratory



BUILDING 146

LEGEND

△ 146-AS-IN-XX	INDOOR AIR SAMPLE
▲ 146-AS-SS-XX	SUB-SLAB VAPOR SAMPLE
⊗ 146-AS-OU-XX	OUTDOOR AIR SAMPLE

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SAMPLE LOCATIONS OF INDOOR, OUTDOOR, AND SUB-SLAB AIR SAMPLING AT SWMU 16, BUILDING 146

DATE:	6/27/14
PROJECT NO.:	112G03105
DESIGNED BY:	
DRAWN BY:	CK
CHECKED BY:	
SHEET: 1 OF 1	

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FIGURE 2-1

Figure 2-2

Helium Leak Test Shroud and

Sample Collection

3.0 DATA PRESENTATION

This section presents the analytical results of VI sampling activities conducted at B-146 in May 2014 at NSA Crane SWMU 16. The detected air concentrations for indoor air and sub-slab samples are compared to USEPA industrial and residential Vapor Intrusion Screening Levels (VISL), with screening levels for noncarcinogens corresponding to a hazard quotient of 0.1 and for carcinogens corresponding to a cancer risk of 1×10^{-6}.

3.1 SAMPLE ANALYSIS AND VALIDATION

All samples were analyzed in accordance with Modified USEPA Method TO-15 – Volatile organic compounds by gas chromatograph (GC)/mass spectrometry (MS) in full scan mode. The method involves concentrating up to 0.2 liters of air in a stainless steel canister. The concentrated aliquot is then flash vaporized and swept through a water management system to remove water vapor. Following dehumidification, the sample passes through the GC/MS for analysis.

All laboratory results contained in sample data groups (SDGs) were validated with regard to the following parameters:

- Data Completeness
- Hold Times
- GC/MS Tuning
- Initial and Continuing Calibration
- Blank Results
- Surrogate Spike Recoveries
- Blank Spike/Blank Spike Duplicate Results
- Detection Limits
- Field Duplicate Results
- Compound Quantification
- Compound Identification

All quality control criteria for these parameters were met. As a result, there were no problems that affected data quality. The Data Validation Report is presented in Appendix C of this report.

3.2 SAMPLING RESULTS

Tables 3-1 and 3-2, respectively, present the analytical results for indoor air sampling in comparison to industrial and residential VISLs. As indicated in Tables 3-1 and 3-2 for indoor air samples, positive detections were measured for 1,2-dichloroethane, dichlorodifluoromethane, methylene chloride, PCE, TCE, and trichlorofluoroemethane. There were two exceedances of industrial screening values and five exceedances of residential screening values. TCE exceeded its industrial screening value in the indoor air sample collected from Bay 5 and exceeded its residential screening value in samples collected from 4 of the 5 bays. 1,2-DCA exceeded its industrial and residential screening value in the indoor air sample collected from Bay 1. However, 1,2-DCA was not detected in the sample collected from Bay 1.

Tables 3-3 and 3-4, respectively, present the analytical results for sub-slab sampling in comparison to industrial and residential VISLs. As indicated in Tables 3-3 and 3-4, there were positive detections of chloroform, cis-1,2-dichloroethene, dichlorodifluoromethane, PCE, TCE, and trichlorofluoroemethane. There were five exceedances of industrial screening values and six exceedances of residential screening values. TCE was detected in soil gas samples collected from all bays and exceeded its industrial and residential screening values in 3 of the 5 bays. Chloroform exceeded its residential screening value in the soil gas sample collected from Bay 4.

Tables 3-5 and 3-6, respectively, present the analytical results for outdoor air sampling in comparison to industrial and residential VISLs. As indicated in Tables 3-5 and 3-6, there were positive detections of dichlorodifluoromethane, PCE, TCE, and trichlorofluoroemethane. TCE exceeded its residential screening value.

Methylene chloride and 1,2-dichloroethane were detected in one indoor air sample, but these constituents were not detected in sub-slab soil gas samples which suggests the presence of these chemicals in indoor air samples may be due to an indoor source and is not the result of vapor intrusion. Chloroform and cis-1,2-dichloroethene were detected in sub-slab soil gas samples but were not detected in indoor air samples indicating these chemicals are not migrating from the subsurface into indoor air.

Dichlorodifluoromethane, trichlorofluoromethane, and PCE were detected at similar concentrations in indoor air, sub-slab soil gas, and outdoor air samples. Dichlorodifluoromethane and trichlorofluoromethane are Freon related compounds and their presence in samples collected at B- 146 may be associated with the air conditioning system. PCE's presence may be residual as a result of potentially past usage.

TCE concentrations in soil gas are greater than those in indoor air, but the indoor air concentrations are similar to the outdoor air concentration. It cannot be discerned as to whether the presence of TCE in indoor air is solely due to vapor intrusion.

Table 3-7 presents the indoor air and sub-slab soil gas concentrations for each work bay, their associated attenuation factors (subslab/indoor air), and a comprehensive attenuation factor for the building. The derivation of attenuation factors was only based on TCE concentrations because TCE is the only VOC that may be present in indoor air as a result of vapor intrusion. Figure 3-1 presents of the indoor air, sub-slab, and outdoor air sample locations along with detected target analyte concentrations. With the exception of TCE, VOCs were detected at low concentrations in both subslab soil gas and indoor air concentrations. At low concentrations, attenuation factors can be biased by background concentrations (USEPA, 2012). For example, at Bays 1 and 2 the indoor air concentrations of TCE were less than the outdoor air concentration (0.75 $\mu g/m^3$) and the soil gas concentrations were less than the industrial screening level. Consequently, the best data for calculating a site-specific attenuation factor are the data for TCE at Bays 3, 4, and 5. The calculated attenuation factor for Bay 3 was 0.0079, for Bay 4 it was 0.00069, and for Bay 5 it was 0.0125 and 0.0074 (using the original soil gas sample and its duplicate). The average of the individual attenuation factors for specific sampling locations is 0.0071 as compared to the default attenuation factor of 0.03. When considering the average indoor air concentration versus the average soil gas concentration of samples collected from Bays 3, 4, and 5, the attenuation factor is 0.003. The attenuation factor for TCE would be even lower if the influence of the concentration of TCE in outdoor air on the indoor air concentration was taken into account. The low attenuation factor for TCE indicates that significant migration of trichloroethene through the building foundation and into indoor air is not occurring.

TABLE 3-1

INDOOR AIR CONCENTRATIONS COMPARISON TO INDUSTRIAL VISLs
SWMU 16 - BUILDING 146
VAPOR INTRUSION REPORT
NSA CRANE
CRANE, INDIANA

LOCATION	USEPA INDUSTRIAL	BAY 1		BAY 2	BAY 3	BAY 4	BAY 5
SAMPLE ID	VISL Target	146ASIN09	146ASIN09-D	146ASIN10	146ASIN11	146ASIN12	146ASIN13
SAMPLE DATE	Indoor Air	20140513	20140513	20140513	20140513	20140513	20140514
SAMPLE CODE	Concentration[1, 2]	ORIG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
Volatile Organic Compounds (ug/m^3)							
1,1,2,2-TETRACHLOROETHANE	0.21 C	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U
1,1,2-TRICHLOROETHANE	0.088 N	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U
1,1-DICHLOROETHANE	7.7 C	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,1-DICHLOROETHENE	88 N	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,2-DICHLOROETHANE	0.47 C	**0.53 J**	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
CHLOROETHANE	4,400 N	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U
CHLOROFORM	0.53 C	0.49 U	0.49 U	0.49 U	0.49 U	0.49 U	0.49 U
CIS-1,2-DICHLOROETHENE	NA	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DICHLORODIFLUOROMETHANE	44 N	1.63 J	1.34 J	1.38 J	1.19 J	1.63 J	2.72
METHYLENE CHLORIDE	260 N	4.86 J	0.56 U	0.87 U	0.87 U	2.71 U	2.08 U
TETRACHLOROETHENE	18 N	1.36 J	0.34 J	0.34	0.95	0.61	0.47
TRICHLOROETHENE	0.88 N	0.43	0.16 U	0.16 U	0.59	0.7	**1.88**
TRICHLOROFLUOROMETHANE	310 N	1.8 J	1.74 J	1.74 J	1.63 J	1.74 J	1.97 J
VINYL CHLORIDE	2.8 C	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U

1 - USEPA's Vapor Intrusion Screening Level (VISL) Calculator Version 3.3.1 (USEPA, May 2014). Values correspond to a target cancer risk level of 1E-6 or HQ = 0.1.
2 - C - carcinogen; N - noncarcinogen

µg/m^3 = Micrograms per cubic meter
NA = No criteria

Data Qualifiers:
J = Indicates that the chemical was not detected at the numerical detection limit (sample-specific detection limit) noted.
U = Indicates that the chemical was detected; however, the associated numerical result is not a precise representation of the concentration that is actually in the sample. The laboratory-reported concentration is considered to be an estimate of the true concentration.

Light shading indicates chemical was detected.
Dark shading indicate exceedance of VISL criteria.

TABLE 3-2

INDOOR AIR CONCENTRATIONS COMPARISONS TO RESIDENTIAL VISLs
SWMU 16 - BUILDING 146
VAPOR INTRUSION REPORT
NSA CRANE
CRANE, INDIANA

LOCATION	USEPA RESIDENTIAL	BAY 1		BAY 2	BAY 3	BAY 4	BAY 5
SAMPLE ID	VISL Target	146ASIN09	146ASIN09-D	146ASIN10	146ASIN11	146ASIN12	146ASIN13
SAMPLE DATE	Indoor Air	20140513	20140513	20140513	20140513	20140513	20140514
SAMPLE CODE	Concentration[1, 2]	ORIG	DUP	NORMAL	NORMAL	NORMAL	NORMAL
Volatile Organic Compounds (µg/m^3)							
1,1,2,2-TETRACHLOROETHANE	0.048 C	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U
1,1,2-TRICHLOROETHANE	0.021 C	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U
1,1-DICHLOROETHANE	1.8 C	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,1-DICHLOROETHENE	21 N	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,2-DICHLOROETHANE	0.11 C	**0.53 J**	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
CHLOROETHANE	1,000 N	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U
CHLOROFORM	0.12 C	0.49 U	0.49 U	0.49 U	0.49 U	0.49 U	0.49 U
CIS-1,2-DICHLOROETHENE	NA	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DICHLORODIFLUOROMETHANE	10 C	1.63 J	1.34 J	1.38 J	1.19 J	1.63 J	2.72
METHYLENE CHLORIDE	63 N	4.86 J	0.56 U	0.87 U	0.87 U	2.71 U	2.08 U
TETRACHLOROETHENE	4.2 N	1.36 J	0.34 J	0.34	0.95	0.61	0.47
TRICHLOROETHENE	0.21 N	**0.43**	0.16 U	0.16 U	**0.59**	**0.7**	**1.88**
TRICHLOROFLUOROMETHANE	73 N	1.8 J	1.74 J	1.74 J	1.63 J	1.74 J	1.97 J
VINYL CHLORIDE	0.17 C	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U

1 - USEPA's Vapor Intrusion Screening Level (VISL) Calculator Version 3.3.1 (USEPA, May 2014). Values correspond to a target cancer risk level of 1E-6 or HQ = 0.1.
2 - C - carcinogen; N - noncarcinogen

µg/m^3 = Micrograms per cubic meter
NA = No criteria

Data Qualifiers:
J = Indicates that the chemical was not detected at the numerical detection limit (sample-specific detection limit) noted.
U = Indicates that the chemical was detected; however, the associated numerical result is not a precise representation of the concentration that is actually in the sample. The laboratory-reported concentration is considered to be an estimate of the true concentration.

Light shading indicates chemical was detected.
Dark shading indicate exceedance of VISL criteria.

TABLE 3-3

SUB-SLAB SOIL GAS CONCENTRATIONS COMPARISON TO INDUSTRIAL VISLs
SWMU 16 - BUILDING 146
VAPOR INTRUSION REPORT
NSA CRANE
CRANE, INDIANA

LOCATION	USEPA INDUSTRIAL	BAY 1	BAY 2	BAY 3	BAY 4	BAY 5		
SAMPLE ID	VISL Target	146ASSS15	146ASSS16	146ASSS17	146ASSS18	146ASSS19	146ASSS20	146ASSS20-D
SAMPLE DATE	Sub Slab	20140514	20140514	20140514	20140514	20140514	20140514	20140514
SAMPLE CODE	Concentration[1, 2]	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	ORIG	DUP
Volatile Organic Compounds (µg/m^3)								
1,1,2,2-TETRACHLOROETHANE	7 C	0.21 U	0.21 U	0.21 U	0.21 UJ	0.21 U	0.21 U	0.21 U
1,1,2-TRICHLOROETHANE	2.9 N	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U
1,1-DICHLOROETHANE	260 C	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,1-DICHLOROETHENE	2,900 N	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,2-DICHLOROETHANE	16 C	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
CHLOROETHANE	150,000 N	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U
CHLOROFORM	18 C	0.49 U	1.03 J	0.49 J	4.35	1.22 J	0.73 J	0.73 J
CIS-1,2-DICHLOROETHENE	NA	0.4 U	0.4 U	0.4 U	0.56 J	0.4 U	2.74	2.58
DICHLORODIFLUOROMETHANE	1,500 N	2.77	1.93 J	2.97	2.97	2.97	2.87	2.92
METHYLENE CHLORIDE	8,800 N	2.54 U	2.19 U	0.56 U	1.25 U	3.47 U	1.22 U	0.97 U
TETRACHLOROETHENE	580 N	0.61	0.27	0.2 U	0.34	4.2	0.47 J	1.29 J
TRICHLOROETHENE	29 N	1.77	5.05	**74.7**	**1021**	**151**	**255**	**242**
TRICHLOROFLUOROMETHANE	10,000 N	1.97 J	1.52 J	1.57 J	1.74 J	1.85 J	1.57 J	1.57 J
VINYL CHLORIDE	93 C	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U

1 - USEPA's Vapor Intrusion Screening Level (VISL) Calculator Version 3.3.1 (USEPA, May 2014). Values correspond to a target cancer risk level of 1E-6 or HQ = 0.1 and an attenuation factor of 0.03.
2 - C - carcinogen; N - noncarcinogen

µg/m^3 = Micrograms per cubic meter
NA = No criteria

Data Qualifiers:
J = Indicates that the chemical was not detected at the numerical detection limit (sample-specific detection limit) noted.
U = Indicates that the chemical was detected; however, the associated numerical result is not a precise representation of the concentration that is actually in the sample. The laboratory-reported concentration is considered to be an estimate of the true concentration.

Light shading indicates chemical was detected.
Dark shading indicate exceedance of VISL criteria.

TABLE 3-4

SUB-SLAB SOIL GAS CONCENTRATIONS COMPARISON TO RESIDENTIAL VISLs
SWMU 16 - BUILDING 146
VAPOR INTRUSION REPORT
NSA CRANE
CRANE, INDIANA

LOCATION	USEPA RESIDENTIAL	BAY 1	BAY 2	BAY 3	BAY 4	BAY 5		
SAMPLE ID	VISLTarget	146ASSS15	146ASSS16	146ASSS17	146ASSS18	146ASSS19	146ASSS20	146ASSS20-D
SAMPLE DATE	Sub Slab	20140514	20140514	20140514	20140514	20140514	20140514	20140514
SAMPLE CODE	Concentration[1, 2]	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	ORIG	DUP
Volatile Organic Compounds (µg/m^3)								
1,1,2,2-TETRACHLOROETHANE	1.6 C	0.21 U	0.21 U	0.21 U	0.21 UJ	0.21 U	0.21 U	0.21 U
1,1,2-TRICHLOROETHANE	5.8 C	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U	0.55 U
1,1-DICHLOROETHANE	58 C	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,1-DICHLOROETHENE	700 N	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,2-DICHLOROETHANE	3.6 C	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
CHLOROETHANE	3500 N	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U
CHLOROFORM	4.1 C	0.49 U	1.03 J	0.49 J	**4.35**	1.22 J	0.73 J	0.73 J
CIS-1,2-DICHLOROETHENE	NA	0.4 U	0.4 U	0.4 U	0.56 J	0.4 U	2.74	2.58
DICHLORODIFLUOROMETHANE	350 C	2.77	1.93 J	2.97	2.97	2.97	2.87	2.92
METHYLENE CHLORIDE	2100 N	2.54 U	2.19 U	0.56 U	1.25 U	3.47 U	1.22 U	0.97 U
TETRACHLOROETHENE	140 N	0.61	0.27	0.2 U	0.34	4.2	0.47 J	1.29 J
TRICHLOROETHENE	7 N	1.77	5.05	**74.7**	**1021**	**151**	**255**	**242**
TRICHLOROFLUOROMETHANE	2400 N	1.97 J	1.52 J	1.57 J	1.74 J	1.85 J	1.57 J	1.57 J
VINYL CHLORIDE	5.6 C	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U	0.08 U

1 - USEPA's Vapor Intrusion Screening Level (VISL) Calculator Version 3.3.1 (USEPA, May 2014). Values correspond to a target cancer risk level of 1E-6 or HQ = 0.1 and an attenuation factor of 0.03.
2 - C - carcinogen; N - noncarcinogen

µg/m^3 = Micrograms per cubic meter
NA = No criteria

Data Qualifiers:
J = Indicates that the chemical was not detected at the numerical detection limit (sample-specific detection limit) noted.
U = Indicates that the chemical was detected; however, the associated numerical result is not a precise representation of the concentration that is actually in the sample. The laboratory-reported concentration is considered to be an estimate of the true concentration.

Light shading indicates chemical was detected.
Dark shading indicate exceedance of VISL criteria.

TABLE 3-5

OUTDOOR AIR CONCENTRATIONS COMPARISON TO INDUSTRIAL VISLs
SWMU 16 - BUILDING 146
VAPOR INTRUSION REPORT
NSA CRANE
CRANE, INDIANA

LOCATION **SAMPLE ID** **SAMPLE DATE** **SAMPLE CODE**	**USEPA VISL Industrial Target Indoor Air Concentration**[1, 2]	**146ASOU14** **146ASOU14** **20140513** **NORMAL**
Volatile Organic Compounds (µg/m^3)		
1,1,2,2-TETRACHLOROETHANE	0.21 C	0.21 U
1,1,2-TRICHLOROETHANE	0.088 N	0.55 U
1,1-DICHLOROETHANE	7.7 C	0.4 U
1,1-DICHLOROETHENE	88 N	0.4 U
1,2-DICHLOROETHANE	0.47 C	0.4 U
CHLOROETHANE	4,400 N	0.26 U
CHLOROFORM	0.53 C	0.49 U
CIS-1,2-DICHLOROETHENE	NA	0.4 U
DICHLORODIFLUOROMETHANE	44 N	1.34 J
METHYLENE CHLORIDE	260 N	3.82 U
TETRACHLOROETHENE	18 N	1.22
TRICHLOROETHENE	0.88 N	0.75
TRICHLOROFLUOROMETHANE	310 N	1.69 J
VINYL CHLORIDE	2.8 C	0.08 U

1 - USEPA's Vapor Intrusion Screening Level (VISL) Calculator Version 3.3.1 (USEPA, May 2014). Values correspond to a target cancer risk level of 1E-6 or HQ = 0.1.
2 - C - carcinogen; N - noncarcinogen

µg/m^3 = Micrograms per cubic meter
NA = No criteria

Data Qualifiers:

J = Indicates that the chemical was detected; however, the associated numerical result is not a precise representation of the concentration that is actually in the sample. The laboratory-reported concentration is considered to be an estimate of the true concentration.

U = Indicates that the chemical was not detected at the numerical detection limit (sample-specific detection limit) noted.

Light shading indicates chemical was detected.

TABLE 3-6

OUTDOOR AIR CONCENTRATIONS COMPARISON TO RESIDENTIAL VISLs
SWMU 16 - BUILDING 146
VAPOR INTRUSION REPORT
NSA CRANE
CRANE, INDIANA

LOCATION **SAMPLE ID** **SAMPLE DATE** **SAMPLE CODE**	**USEPA VISL Residential Target Indoor Air Concentration**[1, 2]	**146ASOU14** **146ASOU14** **20140513** **NORMAL**
Volatile Organic Compounds (µg/m^3)		
1,1,2,2-TETRACHLOROETHANE	0.048 C	0.21 U
1,1,2-TRICHLOROETHANE	0.021 C	0.55 U
1,1-DICHLOROETHANE	1.8 C	0.4 U
1,1-DICHLOROETHENE	21 N	0.4 U
1,2-DICHLOROETHANE	0.11 C	0.4 U
CHLOROETHANE	1,000 N	0.26 U
CHLOROFORM	0.12 C	0.49 U
CIS-1,2-DICHLOROETHENE	NA	0.4 U
DICHLORODIFLUOROMETHANE	10 C	1.34 J
METHYLENE CHLORIDE	63 N	3.82 U
TETRACHLOROETHENE	4.2 N	1.22
TRICHLOROETHENE	0.21 N	**0.75**
TRICHLOROFLUOROMETHANE	73 N	1.69 J
VINYL CHLORIDE	0.17 C	0.08 U

1 - USEPA's Vapor Intrusion Screening Level (VISL) Calculator Version 3.3.1 (USEPA, May 2014). Values correspond to a target cancer risk level of 1E-6 or HQ = 0.1.
2 - C - carcinogen; N - noncarcinogen

µg/m^3 = Micrograms per cubic meter
NA = No criteria

Data Qualifiers:
J = Indicates that the chemical was detected; however, the associated numerical result is not a precise representation of the concentration that is actually in the sample. The laboratory-reported concentration is considered to be an estimate of the true concentration.

U = Indicates that the chemical was not detected at the numerical detection limit (sample-specific detection limit) noted.

Light shading indicates chemical was detected.
Dark shading indicate exceedance of VISL criteria.

TABLE 3-7

CALCULATED TRICHLOROETHENE ATTENUATION FACTORS
SWMU 16 - BUILDING 146
VAPOR INTRUSION REPORT
NSA CRANE
CRANE, INDIANA

BAY	BAY 1			BAY 2			BAY 3		
SAMPLE TYPE	INDOOR AIR	SUB-SLAB SOIL GAS	IA/SS Attenuation Factor (1)(2)	INDOOR AIR	SUB-SLAB SOIL GAS	IA/SS Attenuation Factor (1)(2)	INDOOR AIR	SUB-SLAB SOIL GAS	IA/SS Attenuation Factor (1)(2)
LOCATION		146ASSS15		146ASIN10	146ASSS16		146ASIN11	146ASSS17	
SAMPLE ID	146ASIN09	146ASSS15		146ASIN10	146ASSS16		146ASIN11	146ASSS17	
SAMPLE DATE	20140513	20140514		20140513	20140514		20140513	20140514	
Volatile Organic Compounds (µg/m^3)									
TRICHLOROETHENE	0.43	1.77	0.24	0.16 U	5.05	--	0.59	74.7	0.0079

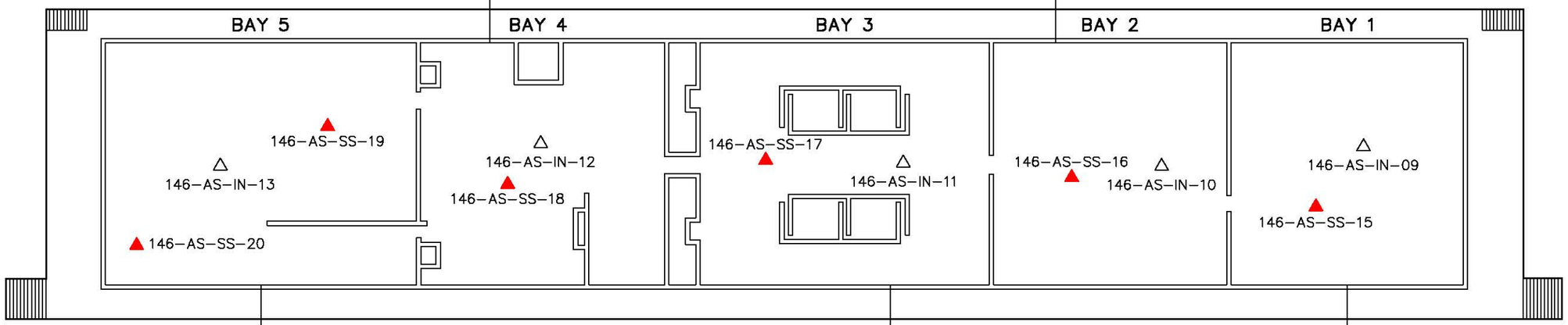
BAY	BAY 4			BAY 5					AMBIENT AIR
SAMPLE TYPE	INDOOR AIR	SUB-SLAB SOIL GAS	IA/SS Attenuation Factor (1)(2)	INDOOR AIR	SUB-SLAB SOIL GAS	IA/SS Attenuation Factor (1)(2)	SUB-SLAB SOIL GAS	IA/SS Attenuation Factor (1)(2)	
LOCATION	146ASIN12	146ASSS18		146ASIN13	146ASSS19		146ASSS20		146ASOU14
SAMPLE ID	146ASIN12	146ASSS18		146ASIN13	146ASSS19		146ASSS20		146ASOU14
SAMPLE DATE	20140513	20140514		20140514	20140514		20140514		20140513
Volatile Organic Compounds (µg/m^3)									
TRICHLOROETHENE	0.7	1021	0.00069	1.88	151	0.012	255	0.0074	0.75

BAY	AVERAGE OF BAYS 3, 4, AND 5		
SAMPLE TYPE	AVERAGE INDOOR AIR	AVERAGE SUB-SLAB SOIL GAS	IA/SS Attenuation Factor (1)(2)
Volatile Organic Compounds (µg/m^3)			
TRICHLOROETHENE	1.06	375	0.003

1 - The calculated attenuation factor is the ratio of the indoor air concentration divided by the soil-sub soil gas concentration.
2 - Attenuation factors were not calculated when the indoor air or sub-slab concentration was non-detected.
Yellow highlight indicates Indoor air concentration exceeded the ambient concentration.

LOCATION	BAY 4	
SAMPLE ID	146-AS-IN-12	146-AS-SS-18
Volatile Organic Compounds (ug/m^3)	Indoor	Sub slab
CHLOROFORM	ND	4.35
CIS-1,2-DICHLOROETHENE	ND	0.56 J
DICHLORODIFLUOROMETHANE	1.63 J	2.97
TETRACHLOROETHENE	0.61	0.34
TRICHLOROETHENE	0.7	1021
TRICHLOROFLUOROMETHANE	1.74 J	1.74 J

LOCATION	BAY 2	
SAMPLE ID	146-AS-IN-10	146-AS-SS-16
Volatile Organic Compounds (ug/m^3)	Indoor	Sub slab
CHLOROFORM	ND	1.03 J
DICHLORODIFLUOROMETHANE	1.38 J	1.93 J
TETRACHLOROETHENE	0.34	0.27
TRICHLOROETHENE	ND	5.05
TRICHLOROFLUOROMETHANE	1.74 J	1.52 J



BUILDING 146
NOT TO SCALE

146-AS-OU-14

LOCATION	BAY 5		
SAMPLE ID	146-AS-IN-13	146-AS-SS-19	146-AS-SS-20
Volatile Organic Compounds (ug/m^3)	Indoor	Sub slab	Sub slab
CHLOROFORM	ND	1.22 J	0.73 J
CIS-1,2-DICHLOROETHENE	ND	ND	2.74
DICHLORODIFLUOROMETHANE	2.72	2.97	2.87
TETRACHLOROETHENE	0.47	4.2	0.47 J
TRICHLOROETHENE	1.88	151	255
TRICHLOROFLUOROMETHANE	1.97 J	1.85 J	1.57 J

LOCATION	BAY 3	
SAMPLE ID	146-AS-IN-11	146-AS-SS-17
Volatile Organic Compounds (ug/m^3)	Indoor	Sub slab
DICHLORODIFLUOROMETHANE	1.19 J	2.97
TETRACHLOROETHENE	0.95	ND
TRICHLOROETHENE	0.59	74.7
TRICHLOROFLUOROMETHANE	1.63 J	1.57 J

LOCATION	Outdoor
SAMPLE ID	146-AS-OU-14
Volatile Organic Compounds (ug/m^3)	Outdoor
1,2-DICHLOROETHANE	1.34 J
METHYLENE CHLORIDE	3.82
TETRACHLOROETHENE	1.22
TRICHLOROETHENE	0.75
TRICHLOROFLUOROMETHANE	1.69 J

LOCATION	BAY 1	
SAMPLE ID	146-AS-IN-09	146-AS-SS-15
Volatile Organic Compounds (ug/m^3)	Indoor	Sub slab
1,2-DICHLOROETHANE	0.53 J	ND
DICHLORODIFLUOROMETHANE	1.63 J	2.77
METHYLENE CHLORIDE	4.86 J	ND
TETRACHLOROETHENE	1.36 J	0.61
TRICHLOROETHENE	0.43	1.77
TRICHLOROFLUOROMETHANE	1.8 J	1.97 J

LEGEND

△ 146-AS-IN-XX — INDOOR AIR SAMPLE

▲ 146-AS-SS-XX — SUB-SLAB VAPOR SAMPLE

⊗ 146-AS-OU-XX — OUTDOOR AIR SAMPLE

NOTES:

1. RESULTS ARE IN µg/m3.
2. ND = NON-DETECT

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SAMPLE DETECTION COMPARISONS PER BAY
SWMU 16, BUILDING 146

DATE:	6/27/14
PROJECT NO.:	112G03105
DESIGNED BY:	
DRAWN BY:	CK
CHECKED BY:	
SHEET: 1 OF 1	

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FIGURE 3-1

4.0 HUMAN HEALTH RISK ASSESSMENT

This section presents the HHRA for evaluation of VI at B-146 at NSA Crane. The objective of the HHRA is to determine whether chemicals in subsurface media beneath Building 146 could migrate through the building foundation into indoor air and pose a significant threat to potential human receptors under current and/or future land use. The potential risks to human receptors were estimated based on the assumption that no actions were taken to control contaminant releases.

4.1 SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Chemicals of potential concern (COPCs) are target analytes detected in an environmental media that are selected for evaluation in the risk assessment process. In general, a chemical is selected as a COPC and retained for further quantitative risk evaluation when the maximum detection in a sampled medium exceeds the lowest screening level [e.g., risk-based concentration (RBC)] established for a project and is present above established background levels. Chemicals eliminated from further evaluation are assumed to present minimal risks to potential human receptors.

4.1.1 Derivation of Screening Criteria

The primary criteria used to identify COPCs for indoor air and sub-slab soil gas are based on USEPA VISLs (2014) and correspond to a systemic hazard quotient (HQ) of 0.1 for non-carcinogens or an incremental lifetime cancer risk (ILCR) of $1x10^{-6}$ for carcinogens. The default VISLs for sub-slab soil gas assume an attenuation factor of 0.1 based on information from USEPA's Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (USEPA, 2002). However, the screening levels used in this evaluation for sub-slab soil gas assume an attenuation factor of 0.03 as recommended in USEPA's Vapor Intrusion Database: Evaluation and Characterization of Attenuation Factors for Chlorinated Volatile Organic Compounds and Residential Buildings (USEPA, 2012).

The IDEM screening levels for vapor exposure to indoor air (IDEM, 2014) were also used to select COPCs. There are no IDEM screening levels for sub-slab soil gas. The IDEM screening levels correspond to systemic HQ of 1 (for noncarcinogens) or an ILCR of $1x10^{-5}$ (for carcinogens).

Indoor air and subslab soil gas concentrations will also be compared to upwind outdoor air concentrations. Chemicals will not be retained as COPCs if their maximum detected concentrations are less than their respective upwind outdoor air concentrations.

4.1.2 COPCs Selected for HHRA

COPCs were selected for indoor air and sub-slab soil gas using the risk-based COPC screening levels described in Section 4.1.1. A discussion of the chemicals identified as COPCs and the rationale for COPC selection is provided in the following subsections. A discussion of the chemicals detected in site media is presented in Section 3.0 and is not repeated in this section.

4.1.2.1 Indoor Air

A comparison of maximum detected indoor air concentrations to screening levels based on VISLs and IDEM screening levels for residential exposure to indoor air is presented in Table 4-1. Concentrations of 1,2-dichloroethane and TCE exceeded the screening levels, and were retained as COPCs for indoor air at B-146. However, 1,2-dichloroethane was not detected in sub-slab soil gas samples collected at B-146 and is unlikely to be present as a result of vapor intrusion.

4.1.2.2 Sub-Slab Soil Gas

A comparison of maximum detected sub-slab soil gas concentrations to screening levels based on VISLs for residential exposure to indoor air is presented in Table 4-2. Concentrations of chloroform and TCE exceeded the screening levels, and were retained as COPCs for sub-slab gas at B-146. Chloroform was not detected in indoor samples collected at B-146. The presence of TCE in sub-slab soil gas and indoor air suggests that TCE is the only contaminant likely to present in indoor air as a result of vapor intrusion.

4.2 EXPOSURE ASSESSMENT

This section presents the exposure assessment for B-146. Receptors evaluated in the risk assessment are identified, and the methodology used to determine exposure point concentrations (EPCs) (i.e., concentrations to which a receptor is exposed) is presented.

Section 1.2 presents the CSM for B-146 which includes a detailed discussion of the site location, site description, and site history for B-146. B-146, which covers approximately two-thirds acre, was an explosives fill and pressure washout facility and included three oil-fired, rotary kiln incinerators with fuel storage tanks. During incinerator operation, incinerator ash and slag residue were stored in waste piles adjacent to the incinerator. The incinerators were closed in the early 1990s, and the waste ash piles were removed along with some obviously contaminated soil.

The current and anticipated future land use is industrial. Industrial workers are the only potential current and future receptors at the B-146. Industrial workers could be exposed via inhalation of VOC that have migrated from the subsurface beneath B-146 through the foundation and into indoor air. B-146 is not suitable for residential use and there are no plans to develop the site for residential use. Hypothetical residents were evaluated in this HHRA to support risk management decision making.

Building 146 is divided into five bays. A wall separates each bay; therefore each bay was treated as a separate exposure unit (EU) in this HHRA. One indoor air sample was collected in each bay. One sub-slab soil gas sample was collected in Bays 1 through 4 and two sub-slab soil gas samples were collected in Bay 5. The indoor air concentrations and sub-slab soil gas concentrations in each bay were evaluated as the EPC.

4.3 RISK CHARACTERIZATION

This section provides a characterization of human health risks associated with potential exposures to COPCs at the site. Potential risks (noncarcinogenic and carcinogenic) for human receptors resulting from exposures outlined in the exposure assessment were quantitatively determined and are discussed in this section.

4.3.1 Quantitative Analysis of Constituents

Quantitative risk estimates were calculated for the chemicals retained as COPCs. Non-carcinogenic risk estimates are presented in the form of HQs, derived by dividing the non-carcinogenic RBC into the exposure point concentration. The USEPA VISLs were used as the RBCs in this evaluation; RBCs based on an HQ of 1 represent a no-adverse non-carcinogenic effect level. The following equations were used to calculate non-carcinogenic risk estimates:

$$HQ_i = \frac{C_i}{RBC}$$

$$HI = \sum_{i=1}^{n} HQ_i$$

where: HQ_i = Hazard quotient for compound i.
C_i = Exposure point concentration (µg/m^3) for compound i.
RBC_i = Risk-based concentration (µg/m^3) for compound i.
HI = Hazard index.

The HQs for all COPCs were summed to account for potential non-carcinogenic effects associated with receptor exposure to multiple chemicals (i.e., the HI was calculated). The total HI was then compared to the USEPA's target level of 1. "Acceptable" exposure levels are generally concentration levels that represent a HI less than or equal to 1. However, because all chemicals do not exhibit the same mechanism of action or impact the same target organ, the exceedance of this value does not necessarily constitute an "unacceptable" non-carcinogenic risk. If the estimated HI was greater than 1, non-carcinogenic effects were segregated according to the affected target organs and target organ HIs were calculated, which represent the sum of those chemicals that impact similar target organs or exhibit similar mechanisms of action. Generally, estimated HIs greater than 1 for the same target organs are considered to be "unacceptable."

Carcinogenic risks are expressed in the form of dimensionless probabilities, referred to as ILCRs. The ILCR was derived by dividing the carcinogenic RBC into the exposure point concentration. The following equation was used to calculate cancer risk estimates:

$$ILCR = \sum_{i=1}^{n} \left(\frac{C_i}{RBC_i} \times 10^{-6} \right)$$

where: ILCR = Incremental lifetime cancer risk.
C_i = Exposure point concentration ($\mu g/m^3$) for compound i.
RBC_i = Risk-based concentration ($\mu g/m^3$) for compound i.
10^{-6} = Risk assessment point of departure risk level.

Multiplying the C_i/RBC ratio by USEPA's point of departure risk level, $1x10^{-6}$ produces a cancer risk estimate for the detected COPC. The ratios are multiplied by $1x10^{-6}$ because the RBCs correspond to a $1x10^{-6}$ risk level. The ILCR values for all COPCs were summed to account for potential cumulative effects of receptor exposure to multiple carcinogens in an environmental medium. The total ILCR was then compared to USEPA's target cancer risk range of $1x10^{-4}$ to $1x10^{-6}$, which is used to determine whether a potential for human health risk exists at a site. According to the USEPA, for known or suspected carcinogens, "acceptable" exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk between $1x10^{-4}$ to $1x10^{-6}$ or less than $1x10^{-6}$. A $1x10^{-4}$ ILCR estimate corresponds to the potential for the occurrence of one additional incidence of cancer in an exposed population of 10,000 individuals. Generally, an estimated ILCR greater than $1x10^{-4}$ is regarded as "unacceptable."

Some chemicals exhibit both carcinogenic and noncarcinogenic effects. The more restrictive USEPA VISL was used for selecting COPCs but both carcinogenic and noncarcinogenic risks were estimated for those chemicals having RBCs for both cancer and non-cancer effects. Cancer risks and hazard indices were estimated assuming industrial and hypothetical residential land use.

The indoor air concentration in each bay was used as the exposure point concentration since this concentration is most representative of the concentration a receptor would be exposed to.

4.3.2 Results of the Risk Characterization

HIs and ILCRs for exposures to COPCs in indoor air at B-146 are presented in Tables 4-3 and 4-4 for industrial and hypothetical residential building use, respectively. As discussed in Section 4.3, B-146 was constructed for and is used for industrial purposes; the building could not be used for residential purposes as it is currently configured. The residential risks were calculated for informational purposes only and to support risk management decision making. In all cases evaluated (Bays 1 through 5), HIs for industrial and hypothetical residential exposures were less than the acceptable level of 1, indicating that adverse noncarcinogenic health effects are not anticipated for these receptors under the defined exposure conditions. In all cases evaluated, ILCRs for industrial and hypothetical residential exposures were also less than or within USEPA's and IDEM's target risk range of $1x10^{-4}$ to $1x10^{-6}$.

The risks presented above were calculated using the indoor air concentrations. Concentrations of some COPCs in sub-slab soil gas were significantly higher than the indoor air concentrations. If the floor of B-146 is comprised in the future (or if contaminant migration from the sub-slab to the indoor air is otherwise increased) then the indoor air concentrations and corresponding risks could be higher than those measured in this investigation.

TABLE 4-1

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - INDOOR AIR
SWMU 16 - BUILDING 146
VAPOR INTRUSION REPORT
NSA CRANE
CRANE, INDIANA

CAS Number	Chemical	Minimum Concentration	Maximum Concentration	Units	Sample of Maximum Concentration	Frequency of Detection	Range of Nondetects(1)	Concentration Used for Screening(2)	Outdoor Air Concentration(3)	USEPA VISL Target Indoor Air Concentration Residential(4)	IDEM Vapor Exposure Indoor Air Residential(5)	COPC Flag	Rationale for Contaminant Deletion or Selection(6)
Volatile Organic Compounds													
107-06-2	**1,2-Dichloroethane**	0.53 J	0.53 J	µg/m^3	146ASIN09	1/5	0.4 - 0.4	0.53	0.4 U	**0.11 C**	0.94 C	**Yes**	ASL
75-71-8	Dichlorodifluoromethane	1.19 J	2.72	µg/m^3	146ASIN13	5/5	-	2.72	1.34 J	10 N	100 N	No	BSL
75-09-2	Methylene Chloride	4.86 J	4.86 J	µg/m^3	146ASIN09	1/5	0.56 - 2.71	4.86	3.82 U	63 N	630 N	No	BSL
127-18-4	Tetrachloroethene	0.34 J	1.36 J	µg/m^3	146ASIN09	5/5	-	1.36	1.22	4.2 N	42 N	No	BSL
79-01-6	**Trichloroethene**	0.43	1.88	µg/m^3	146ASIN13	4/5	0.16 - 0.16	1.88	0.75	**0.21 N**	2.1 N	**Yes**	ASL
75-69-4	Trichlorofluoromethane	1.63 J	1.97 J	µg/m^3	146ASIN13	5/5	-	1.97	1.69 J	73 N	730 N	No	BSL

Footnotes:
1 - Values presented are sample-specific quantitation limits.
2 - The maximum detected concentration is used for screening purposes.
3 - Outdoor air sample was collected outside of south end of Building 146.
4 - USEPA's Vapor Intrusion Screening Level (VISL) Calculator Version 3.3.1 (USEPA, May 2014). Values correspond to a target cancer risk level of 1E-6 or HQ = 0.1.
5 - IDEM Closure Guide, March 1, 2014.
6 - The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level.
Shaded criterion indicates that the maximum detected concentration exceeds one or more screening criteria. Shaded chemical name indicates that the chemical was retained as a COPC.

Associated Samples
146ASIN09
146ASIN10
146ASIN11
146ASIN12
146ASIN13

Definitions:
C = Carcinogen
COPC = Chemical Of Potential Concern
J = Estimated value
N = Noncarcinogen
NA = Not Applicable/Not Available

Rationale Codes:
For selection as a COPC:
ASL = Above Screening Level.

For elimination as a COPC:
BSL = Below COPC Screening Level

TABLE 4-2

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - SUB-SLAB GAS
SWMU 16 - BUILDING 146
VAPOR INTRUSION REPORT
NSA CRANE
CRANE, INDIANA

CAS Number	Chemical	Minimum Concentration	Maximum Concentration	Units	Sample of Maximum Concentration	Frequency of Detection	Range of Nondetects(1)	Concentration Used for Screening(2)	Outdoor Air Concentration(3)	USEPA VISL Target Sub-Slab Soil Gas Concentration(4)	Potential ARAR/TBC	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection(5)
Volatile Organic Compounds														
67-66-3	**Chloroform**	0.49 J	4.35	$\mu g/m^3$	146ASSS18	5/6	0.49 - 0.49	4.35	0.49 U	**4.1 C**	NA	NA	**Yes**	ASL
156-59-2	cis-1,2-Dichloroethene	0.56 J	2.74	$\mu g/m^3$	146ASSS20	2/6	0.4 - 0.4	2.74	0.4 U	NA	NA	NA	No	NTX
75-71-8	Dichlorodifluoromethane	1.93 J	2.97	$\mu g/m^3$	146ASSS17, 146ASSS18, 146ASSS19	6/6	-	2.97	1.34 J	350 N	NA	NA	No	BSL
127-18-4	Tetrachloroethene	0.27	4.2	$\mu g/m^3$	146ASSS19	5/6	0.2 - 0.2	4.2	1.22	140 N	NA	NA	No	BSL
79-01-6	**Trichloroethene**	1.77	1,021	$\mu g/m^3$	146ASSS18	6/6	-	1,021	0.75	**7 N**	NA	NA	**Yes**	ASL
75-69-4	Trichlorofluoromethane	1.52 J	1.97 J	$\mu g/m^3$	146ASSS15	6/6	-	1.97	1.69 J	2,400 N	NA	NA	No	BSL

Footnotes:
1 - Values presented are sample-specific quantitation limits.
2 - The maximum detected concentration is used for screening purposes.
3 - Outdoor air sample was collected outside of south end of Building 146.
4 - USEPA's Vapor Intrusion Screening Level (VISL) Calculator Version 3.3.1 (USEPA, May 2014). Values correspond to a target cancer risk level of 1E-6 or HQ = 0.1 and an attenuation factor of 0.03.
5 - The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level.
Shaded criterion indicates that the maximum detected concentration exceeds one or more screening criteria. Shaded chemical name indicates that the chemical was retained as a COPC.

Associated Samples
146ASSS15
146ASSS16
146ASSS17
146ASSS18
146ASSS20
146ASSS19

Definitions:
ARAR/TBC = Applicable or Relevant and Appropriate Requirements To Be Considered
C = Carcinogen
COPC = Chemical Of Potential Concern
J = Estimated value
N = Noncarcinogen
NA = Not Applicable/Not Available

Rationale Codes:
For selection as a COPC:
ASL = Above Screening Level.

For elimination as a COPC:
BSL = Below COPC Screening Level
NTX = No toxicity criteria available

TABLE 4-3

CANCER RISKS AND HAZARD INDICES FOR COPCS INDUSTRIAL EXPOSURES TO INDOOR AIR
SWMU 16 - BUILDING 146
VAPOR INTRUSION REPORT
NSA CRANE
CRANE, INDIANA

Location	USEPA VISL		BAY 1			BAY 2			BAY 3		
Sample ID	Indoor Air - Industrial[1]		146ASIN09			146ASIN10			146ASIN11		
Sample Date	($\mu g/m^3$)		20140513			20140513			20140513		
	Cancer	Noncancer	Result ($\mu g/m^3$)	Cancer Risk	Hazard Index	Result ($\mu g/m^3$)	Cancer Risk	Hazard Index	Result ($\mu g/m^3$)	Cancer Risk	Hazard Index
1,2-Dichloroethane	0.47	31	0.53 J	1E-06	0.02	ND	--	--	ND	--	--
Trichloroethene	3	8.8	0.43	1E-07	0.05	ND	--	--	0.59	2E-07	0.07
Total Risk				1E-06	0.07		--	--		2E-07	0.07

Location	USEPA VISL		BAY 4			BAY 5		
Sample ID	Indoor Air - Industrial[1]		146ASIN12			146ASIN13		
Sample Date	($\mu g/m^3$)		20140513			20140514		
	Cancer	Noncancer	Result ($\mu g/m^3$)	Cancer Risk	Hazard Index	Result ($\mu g/m^3$)	Cancer Risk	Hazard Index
1,2-Dichloroethane	0.47	31	ND	--	--	ND	--	--
Trichloroethene	3	8.8	0.7	2E-07	0.08	1.88	6E-07	0.2
Total Risk				2E-07	0.08		6E-07	0.2

1 - USEPA's Vapor Intrusion Screening Level (VISL) Calculator Version 3.3.1 (USEPA, May 2014). Values correspond to a target cancer risk level of 1E-6 or HQ = 1.
ND = Not detected.
$\mu g/m^3$ = Micrograms per cubic meter

Cancer Risk = Indoor Air Concentration x 1E-6 / Cancer VISL.
Hazard Index = Indoor Air Concentration / Noncancer VISL.

TABLE 4-4

CANCER RISKS AND HAZARD INDICES FOR COPCS RESIDENTIAL EXPOSURES TO INDOOR AIR
SWMU 16 - BUILDING 146
VAPOR INTRUSION REPORT
NSA CRANE
CRANE, INDIANA

Location	USEPA VISL		BAY 1			BAY 2			BAY 3		
Sample ID	Indoor Air - Residential[1]		146ASIN09			146ASIN10			146ASIN11		
Sample Date	($\mu g/m^3$)		20140513			20140513			20140513		
	Cancer	Noncancer	Result ($\mu g/m^3$)	Cancer Risk	Hazard Index	Result ($\mu g/m^3$)	Cancer Risk	Hazard Index	Result ($\mu g/m^3$)	Cancer Risk	Hazard Index
1,2-Dichloroethane	0.11	7.3	0.53 J	5E-06	0.07	ND	--	--	ND	--	--
Trichloroethene	0.48	2.1	0.43	9E-07	0.2	ND	--	--	0.59	1E-06	0.3
Total Risk				6E-06	0.3		--	--		1E-06	0.3

Location	USEPA VISL		BAY 4			BAY 5		
Sample ID	Indoor Air - Residential[1]		146ASIN12			146ASIN13		
Sample Date	($\mu g/m^3$)		20140513			20140514		
	Cancer	Noncancer	Result ($\mu g/m^3$)	Cancer Risk	Hazard Index	Result ($\mu g/m^3$)	Cancer Risk	Hazard Index
1,2-Dichloroethane	0.11	7.3	ND	--	--	ND	--	--
Trichloroethene	0.48	2.1	0.7	1E-06	0.3	1.88	4E-06	0.9
Total Risk				1E-06	0.3		4E-06	0.9

1 - USEPA's Vapor Intrusion Screening Level (VISL) Calculator Version 3.3.1 (USEPA, May 2014). Values correspond to a target cancer risk level of 1E-6 or HQ = 1.
ND = Not detected.
$\mu g/m^3$ = Micrograms per cubic meter

Cancer Risk = Indoor Air Concentration x 1E-6 / Cancer VISL.
Hazard Index = Indoor Air Concentration / Noncancer VISL.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

A VI study was conducted at SWMU 16, B-146 in May, 2014. The objective of the investigation was to collect indoor and sub-slab air quality information to determine if chlorinated solvents (primarily TCE) and degradation product vapors are entering the B-146 air space at concentrations that present significant human health risks. A second objective was to evaluate site-specific attenuation factors. An RFI conducted during the early 2000s showed that TCE was present in soils underlying the northern portion of B-146 and exterior to the building, to the north and northwest.

Analytical results indicate that TCE and other chemicals are present primarily in building work bays and sub-slab locations underlying the northern portion of B-146, which also occurred in the previous indoor air study (Tetra Tech, 2009). Indoor air samples included positive detections for 1,2-dichloroethane, dichlorodifluoromethane, methylene chloride, tetrachloroethene, trichloroethene, and trichlorofluoromethane. There were two exceedances of industrial screening values and five exceedances of residential screening values (Tables 3-1 and 3-2, respectively). Indoor air concentrations of TCE in this study ranged from 0.43 to 1.88 µg/m^3 in comparison to 4.43 to 11.21 µg/m^3 in the 2009 study.

The analytical results for sub-slab soil gas samples included positive detections for chloroform, cis-1,2-dichloroethene, dichlorodifluoromethane, tetrachloroethene, trichloroethene, and trichlorofluoromethane. There were five exceedances of industrial screening values and six exceedances of residential screening values (Tables 3-3 and 3-4, respectively).

A HHRA was conducted assuming industrial workers and hypothetical residents were exposed to VOCs in indoor air at B-146. 1,2-Dichloroethane and trichloroethene were identified as COPCs in indoor air samples. For Bays 1 through 5, HIs for industrial and hypothetical residential exposures were less than the acceptable level of 1, indicating that adverse noncarcinogenic health effects are not anticipated for these receptors under the defined exposure conditions. Also ILCRs for industrial and hypothetical residential exposures were also less than or within USEPA's and IDEM's target risk range.

The risks were calculated using indoor air concentrations. Concentrations of some chemicals in sub-slab soil gas were significantly higher than the indoor air concentrations. TCE was the compound most likely to present in indoor as a result of vapor intrusion with a derived attenuation factor of 0.003. If the floor of

B-146 is compromised in the future (or if contaminant migration from the sub-slab to the indoor air is otherwise increased), then the indoor air concentrations and corresponding risks could be higher than those measured in this investigation.

5.2 RECOMMENDATIONS

No actions are recommended to address any existing human health risk. Maintenance of the integrity of the floor in Bays 3, 4, and 5 is recommended.

TABLE 5-1

CALCULATED ATTENUATION FACTORS
SWMU 16 - BUILDING 146
VAPOR INTRUSION REPORT
NSA CRANE
CRANE, INDIANA

BAY	BAY 1			BAY 2			BAY 3			BAY 4			BAY 5				
SAMPLE TYPE	INDOOR AIR	SUB-SLAB SOIL GAS	IA/SS Attenuation Factor (1)(2)	INDOOR AIR	SUB-SLAB SOIL GAS	IA/SS Attenuation Factor (1)(2)	INDOOR AIR	SUB-SLAB SOIL GAS	IA/SS Attenuation Factor (1)(2)	INDOOR AIR	SUB-SLAB SOIL GAS	IA/SS Attenuation Factor (1)(2)	INDOOR AIR	SUB-SLAB SOIL GAS	IA/SS Attenuation Factor (1)(2)	SUB-SLAB SOIL GAS	IA/SS Attenuation Factor (1)(2)
LOCATION	146ASIN09	146ASSS15		146ASIN10	146ASSS16		146ASIN11	146ASSS17		146ASIN12	146ASSS18		146ASIN13	146ASSS19		146ASSS20	
SAMPLE ID	146ASIN09	146ASSS15		146ASIN10	146ASSS16		146ASIN11	146ASSS17		146ASIN12	146ASSS18		146ASIN13	146ASSS19		146ASSS20	
SAMPLE DATE	20140513	20140514		20140513	20140514		20140513	20140514		20140513	20140514		20140514	20140514		20140514	
Volatile Organic Compounds (µg/m^3)																	
1,1,2,2-TETRACHLOROETHANE	0.21 U	0.21 U	1.0	0.21 U	0.21 U	1.0	0.21 U	0.21 U	1.0	0.21 U	0.21 UJ	1.0	0.21 U	0.21 U	1.0	0.21 U	1.0
1,1,2-TRICHLOROETHANE	0.55 U	0.55 U	1.0	0.55 U	0.55 U	1.0	0.55 U	0.55 U	1.0	0.55 U	0.55 U	1.0	0.55 U	0.55 U	1.0	0.55 U	1.0
1,1-DICHLOROETHANE	0.4 U	0.4 U	1.0	0.4 U	0.4 U	1.0	0.4 U	0.4 U	1.0	0.4 U	0.4 U	1.0	0.4 U	0.4 U	1.0	0.4 U	1.0
1,1-DICHLOROETHENE	0.4 U	0.4 U	1.0	0.4 U	0.4 U	1.0	0.4 U	0.4 U	1.0	0.4 U	0.4 U	1.0	0.4 U	0.4 U	1.0	0.4 U	1.0
1,2-DICHLOROETHANE	0.53 J	0.4 U	1.3	0.4 U	0.4 U	1.0	0.4 U	0.4 U	1.0	0.4 U	0.4 U	1.0	0.4 U	0.4 U	1.0	0.4 U	1.0
CHLOROETHANE	0.26 U	0.26 U	1.0	0.26 U	0.26 U	1.0	0.26 U	0.26 U	1.0	0.26 U	0.26 U	1.0	0.26 U	0.26 U	1.0	0.26 U	1.0
CHLOROFORM	0.49 U	0.49 U	1.0	0.49 U	1.03 J	0.48	0.49 U	0.49 J	1.0	0.49 U	4.35	0.11	0.49 U	1.22 J	0.40	0.73 J	0.67
CIS-1,2-DICHLOROETHENE	0.4 U	0.4 U	1.0	0.4 U	0.4 U	1.0	0.4 U	0.4 U	1.0	0.4 U	0.56 J	0.71	0.4 U	0.4 U	1.0	2.74	0.15
DICHLORODIFLUOROMETHANE	1.63 J	2.77	0.59	1.38 J	1.93 J	0.72	1.19 J	2.97	0.40	1.63 J	2.97	0.55	2.72	2.97	0.92	2.87	0.95
METHYLENE CHLORIDE	4.86 J	2.54 U	1.9	0.87 U	2.19 U	0.40	0.87 U	0.56 U	1.6	2.71 U	1.25 U	2.2	2.08 U	3.47 U	0.60	1.22 U	1.7
TETRACHLOROETHENE	1.36 J	0.61	2.2	0.34	0.27	1.3	0.95	0.2 U	4.8	0.61	0.34	1.8	0.47	4.2	0.11	0.47 J	1.0
TRICHLOROETHENE	0.43	1.77	0.24	0.16 U	5.05	0.032	0.59	74.7	0.0079	0.7	1021	0.00069	1.88	151	0.012	255	0.0074
TRICHLOROFLUOROMETHANE	1.8 J	1.97 J	0.91	1.74 J	1.52 J	1.1	1.63 J	1.57 J	1.0	1.74 J	1.74 J	1.0	1.97 J	1.85 J	1.1	1.57 J	1.3
VINYL CHLORIDE	0.08 U	0.08 U	1.0	0.08 U	0.08 U	1.0	0.08 U	0.08 U	1.0	0.08 U	0.08 U	1.0	0.08 U	0.08 U	1.0	0.08 U	1.0

1 - The calculated attenuation factor is the ratio of the indoor air concentration divided by the soil-sub soil gas concentration.
2 - The full non-detected value was used for non-detects for the calculated attenuation factor.

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APPENDIX A

FIELD DOCUMENTATION

TETRA TECH, INC. | CHAIN OF CUSTODY | NUMBER 052014 -001 | PAGE _1_ OF _1__

PROJECT NO:	FACILITY:	PROJECT MANAGER	PHONE NUMBER	LABORATORY NAME AND CONTACT:
112G02362	NSA Crane – B 146	Tim Evans	412-921-7281	Chemtech /
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER: Jim Goerdt	PHONE NUMBER: 412-443-0244	ADDRESS: 284 Sheffield Street
		CARRIER/WAYBILL NUMBER: Fed Ex / 8020 3157 6539		CITY, STATE: Mountainside, NJ 07092

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

DATE YEAR: 2014	TIME	SAMPLE ID	LOCATION ID	TOP DEPTH (feet)	BOTTOM DEPTH (feet)	MATRIX (GW, SO, SW, SD, QC, ETC.)	COLLECTION METHOD GRAP (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS	VOCs			Regulator #	Suma Canister #	Final Gauge Reading	COMMENTS
									Container Type Stainless Steel (SS)	SS						
									Preservative Used	—						
5/13	915	146-AS-IN-09	Bay 1	—	—	Air	G	1		1			10701	10267	9.0	
5/13	917	146-AS-IN-10	Bay 2	—	—	Air	G	1		1			10700	10001	8.0	
5/13	918	146-AS-IN-11	Bay 3	—	—	Air	G	1		1			10231	10406	10.0	
5/13	920	146-AS-IN-12	Bay 4	—	—	Air	G	1		1			10559	10032	11.0	
5/13	814	146-AS-OU-14	Out-door	—	—	Air	G	1		1			10565	10608	10.5	
5/13	0000	FD051314-01	QC	—	—	Air	G	1		1			10688	10272	7.0	

1. RELINQUISHED BY	DATE	TIME	1. RECEIVED BY	DATE	TIME
	5/14/14	1500			
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME

COMMENTS

TETRA TECH, INC. | CHAIN OF CUSTODY | NUMBER 052014 -002 | PAGE _1_ OF _1__

PROJECT NO:	FACILITY:	PROJECT MANAGER	PHONE NUMBER	LABORATORY NAME AND CONTACT:
112G02362	NSA Crane – B 146	Tim Evans	412-921-7281	Chemtech / 908-728-3146
SAMPLERS (SIGNATURE)		FIELD OPERATIONS LEADER: Jim Goerdt	PHONE NUMBER: 412-443-0244	ADDRESS: 284 Sheffield Street
		CARRIER/WAYBILL NUMBER: Fed Ex / 8020 3157 6540		CITY, STATE: Mountainside, NJ 07092

STANDARD TAT ☒
RUSH TAT ☐
☐ 24 hr. ☐ 48 hr. ☐ 72 hr. ☐ 7 day ☐ 14 day

DATE YEAR: 2014	TIME	SAMPLE ID	LOCATION ID	TOP DEPTH (feet)	BOTTOM DEPTH (feet)	MATRIX (GW, SO, SW, SD, QC, ETC.)	COLLECTION METHOD GRAP (G) COMP (C)	No. OF CONTAINERS	TYPE OF ANALYSIS	VOCs			Regulator #	Suma Canister #	Final Gauge Reading	COMMENTS
									Container Type Stainless Steel (SS)	SS						
									Preservative Used	–						
5/14	1500	146-AS-SS-15	Bay 1	–	–	Soil Gas	G	1		1			10518	10156	7.5	
5/14	1500	146-AS-SS-16	Bay 2	–	–	Soil Gas	G	1		1			10103	10488	10	
5/14	1400	146-AS-SS-17	Bay 3	–	–	Soil Gas	G	1		1			10640	10268	5.5	
5/14	1335	146-AS-SS-18	Bay 4	–	–	Soil Gas	G	1		1			10781	10589	10.5	
5/14	1225	146-AS-SS-19	Bay 5	–	–	Soil Gas	G	1		1			10641	10159	11	
5/14	1300	146-AS-SS-20	Bay 5	–	–	Soil Gas	G	1		1			10711	10291	7.0	
5/14	0000	FD051414-01	QC	–	–	QC	G	1		1			10563	10292	27.5	Regulator started at high 30+
5/13	922	146-AS-IN-13	Bay 5	–	–	Air	G	!		1			10245	10303	8.0	

1. RELINQUISHED BY	DATE 5/15/14	TIME 1600	1. RECEIVED BY	DATE	TIME
2. RELINQUISHED BY	DATE	TIME	2. RECEIVED BY	DATE	TIME
3. RELINQUISHED BY	DATE	TIME	3. RECEIVED BY	DATE	TIME

COMMENTS: Regulator #10563 for Field Duplicate sample started at a very high 30+ (max). It did not get below 30 until into the 7th hour of sampling. Unsure if it was working properly.

B-146 Air Sampling

Rite in the Rain®
ALL-WEATHER
JOURNAL
№ 391

PL-313

May 2014

Rite in the Rain®
ALL-WEATHER WRITING PAPER

TETRA TECH

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Project

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CONTENTS

PAGE	REFERENCE	DATE
	Jim Goerdt	
	Kevin Losekamp	
	B-146 Air Sampling	
	112G02362	

5-12-14

Mobilization from Pittsburgh & Cincinnati.

KL picked up B-146 keys from John Jerome. Canisters & regulators checked in preparation of sampling.

KL picked up helium tank from Indiana Oxygen & purchased additional field supplies.

5-13-14

AM: mc low 50's
PM: cloudy w/ periods of heavy rain

0740 - Arrive @ Crane field trailer. KL on site. Packed up air canisters enroute to B-146.

0800 - At B-146. Setting out air samplers per Work Plan. Sample logs contain all of the details.

FD051314 associated w/ location 146-AS-IN-09

Regulator associated w/ sample 146-AS-IN-12 remained at 28 in Hg for the first hour. During the second hour of

Rite in the Rain

sampling, pressure began to drop.

1310 - Heavy rain storm passed through the area.

1340 - Skies cleared & became partly cloudy.

Late afternoon showers.

No HVAC running during sampling. Building does not have AC & it was too warm for heating. A few of entrance doors & bay doors were open during sampling event.

5-14-14

AM: Cloudy low 50's - periods of rain
PM: Cloudy low 60's - periods of very heavy rain.

0730 - Crane field trailer. Packed up canisters & equipment & loaded to B-146.

0815 - Began drilling first hole for sub-slab sampling. Concrete is 7-8" thick w/ gravel directly below. Unable to create a void space. Tubing placed directly above the gravel layer.

Tom Brent on-site to observe sampling process. Tim Sears also on site for a short

Rite in the Rain

period of time.

All helium leak tests were less than 5% so no seals had to be redone.

First sample was initiated at 1300. Regulators were all checked at regular 1 hour frequency.

Only regulator that seemed not to be working correctly was #10863 which was associated w/ the Field Dup sample. At the start of sampling, it was well above 30 in. Hg. & stayed thereabouts) about the 7th hour of sampling at which time it dropped

slightly below 30. At the end of the 8-hour sampling event it was 27.5. The lab was notified.

Last sample was complete at 2300.

Rite in the Rain

5-15-14

All holes were patched.

End of Activities

5/15/14

Rite in the Rain

Tetra Tech, Inc.

AIR & SOIL GAS SAMPLE LOG SHEET

Project Site Name: NSA Crane - B 146
Project No.: 112G02362
Sample Date: 5-13-14
Sample Time: 915
Soil Gas from: Sub-Slab [ ] Near Slab [ ] QC [ ]
Air Sample from: Indoor [✓] Outdoor [ ] Other: [ ]

Sample ID No.: 146-AS-IN-09
Sample Location: Bay 1
Sampled By: J. Goerdt / K. Losekamp
Canister Leak Check Date:

PURGE INFORMATION

START TIME	STOP TIME	VOLUME PURGED	LEAK TEST RESULT (ppm of He)
—	—	—	—

SAMPLING INFORMATION

	TIME	CANISTER PRESSURE (Inches Hg)	TEMPERATURE (°F)
START	915	27	71
STOP	1718	9.0	75

SAMPLE COLLECTION INFORMATION:

ANALYSIS	CONTAINER REQUIREMENTS	COLLECTED	Other
TO-15	SUMMA Canister	Yes	NA

NOTES / OBSERVATIONS:

Serial Number:
Canister: 10267
Valve: 10201

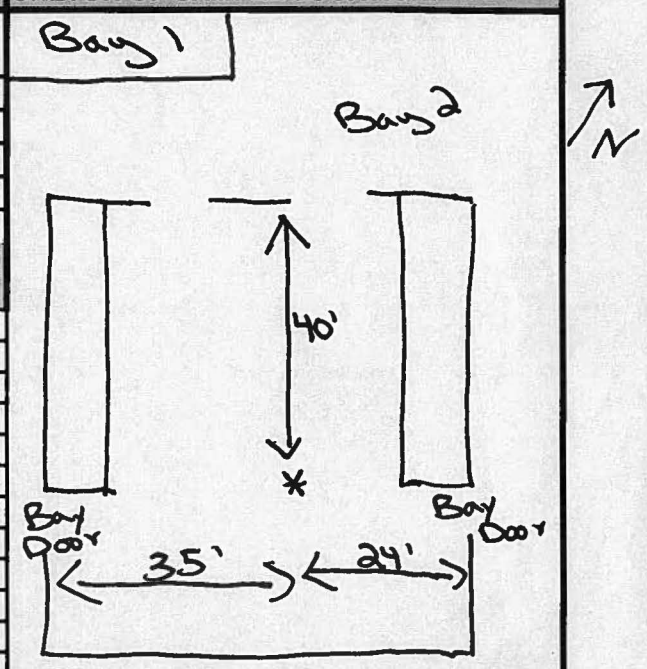
Calculated:
Flow Rate (ml/min):
Sample Duration (min): 483

COMMENTS:

Gauge reading prior to start of sampling (off position):	0	in. Hg
Gauge reading at sample start up (on position):	27	in. Hg
Gauge reading at the end of sampling:	9.0	in. Hg
Cylinder intake @	5'	ft.
Ambient Air PID Reading	—	ppm

Time	Canister Pressure (In Hg)	Temp (°F)	Barometric Pressure (In Hg)
915	27	71	
1016	24	72	
1118	20.5	74	
1217	18.0	74	
1312	16	73	29.94
1416	14	72	30.04
1520	12.0	74	—
1615	10.0	76	30.03
1718	9	75	30.01

SKETCH OF SAMPLE LOCATION:



Duplicate ID No.: FD051314-01

Signature(s):

FD051314-01

Tetra Tech, Inc.

AIR & SOIL GAS SAMPLE LOG SHEET

Project Site Name: NSA Crane - B 146
Project No.: 112G02362
Sample Date: 5-13-14
Sample Time: 915
Soil Gas from: Sub-Slab [ ] Near Slab [ ] QC [✓]
Air Sample from: Indoor [✓] Outdoor [ ] Other: [ ]

Sample ID No.: FD051314-01 ~~146-AS-IN-20~~ FD
Sample Location: ~~Bay 5~~ QC
Sampled By: J. Goerdt / K. Losekamp
Canister Leak Check Date:

PURGE INFORMATION

START TIME	STOP TIME	VOLUME PURGED	LEAK TEST RESULT (ppm of He)
—	—	—	—

SAMPLING INFORMATION

	TIME	CANISTER PRESSURE (Inches Hg)	TEMPERATURE (°F)
START	915	30+	71
STOP	1718	7.5	75

SAMPLE COLLECTION INFORMATION:

ANALYSIS	CONTAINER REQUIREMENTS	COLLECTED	Other
TO-15	SUMMA Canister	Yes	NA

NOTES / OBSERVATIONS:

Serial Number:
Canister: 10272
Valve: 10688

Calculated:
Flow Rate (ml/min):
Sample Duration (min): 483

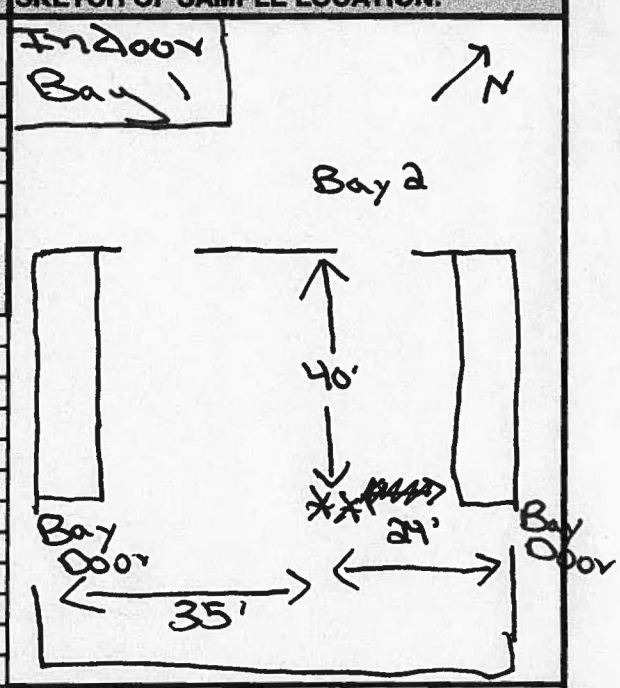
Associated w/ 146-AS-IN-09

COMMENTS:

Gauge reading prior to start of sampling (off position):	0	in. Hg
Gauge reading at sample start up (on position):	30+	in. Hg
Gauge reading at the end of sampling:	7.0	in. Hg
Cylinder intake @	5'	ft.
Ambient Air PID Reading	—	ppm

Time	Canister Pressure (In Hg)	Temp (°F)	Barometric Pressure (In Hg)
915	30+	71	
1016	27	72	
1118	22.5	74	
1217	20.0	74	
1312	17	73	29.94
1416	14.5	72	30.04
1519	12.0	74	—
1616	9.5	76	30.03
1718	7.0	75	30.01

SKETCH OF SAMPLE LOCATION:



Duplicate ID No.: —

Signature(s):

Tetra Tech, Inc.

AIR & SOIL GAS SAMPLE LOG SHEET

Project Site Name: NSA Crane - B 146
Project No.: 112G02362
Sample Date: 5-13-14
Sample Time: 917
Soil Gas from: Sub-Slab [ ] Near Slab [ ] QC [ ]
Air Sample from: Indoor [✓] Outdoor [ ] Other: [ ]

Sample ID No.: 146-AS-IN-10
Sample Location: Bay 2
Sampled By: J. Goerdt / K. Losekamp
Canister Leak Check Date:

PURGE INFORMATION

START TIME	STOP TIME	VOLUME PURGED	LEAK TEST RESULT (ppm of He)
—	—	—	—

SAMPLING INFORMATION

	TIME	CANISTER PRESSURE (Inches Hg)	TEMPERATURE (°F)
START	917	30+	71
STOP	1720	8.0	75

SAMPLE COLLECTION INFORMATION:

ANALYSIS	CONTAINER REQUIREMENTS	COLLECTED	Other
TO-15	SUMMA Canister	Yes	NA

NOTES / OBSERVATIONS:

Serial Number:
Canister: 10001
Valve: 10700

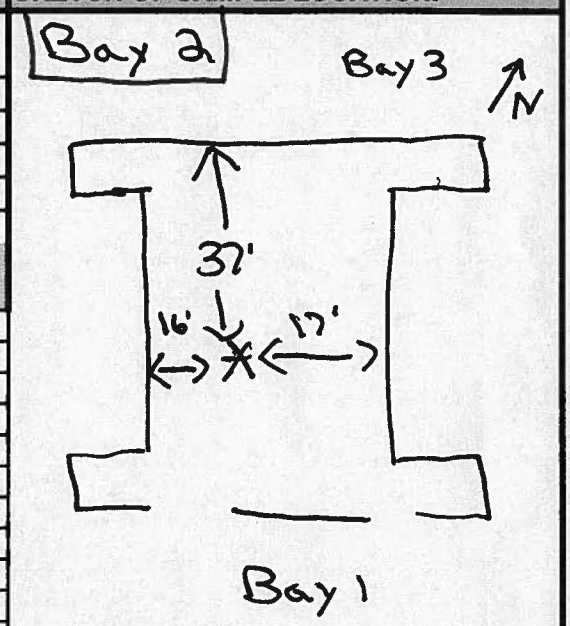
Calculated:
Flow Rate (ml/min):
Sample Duration (min): 483

COMMENTS:

Gauge reading prior to start of sampling (off position):	0	in. Hg
Gauge reading at sample start up (on position):	30+	in. Hg
Gauge reading at the end of sampling:	8.0	in. Hg
Cylinder intake @	5	ft.
Ambient Air PID Reading	—	ppm

Time	Canister Pressure (in Hg)	Temp (°F)	Barometric Pressure (in Hg)
917	30+	71	
1017	27	72	
1119	24	74	
1218	20.50	74	
1314	18	73	29.94
1417	15	72	30.04
1519	12.0	74	—
1618	10.0	76	30.03
1720	8.0	75	30.01

SKETCH OF SAMPLE LOCATION:



Duplicate ID No.: —

Signature(s):

Tetra Tech, Inc.

AIR & SOIL GAS SAMPLE LOG SHEET

Project Site Name: NSA Crane - B 146
Project No.: 112G02362
Sample Date: 5-13-14
Sample Time: 918
Soil Gas from: Sub-Slab [ ] Near Slab [ ] QC [ ]
Air Sample from: Indoor [✓] Outdoor [ ] Other: [ ]

Sample ID No.: 146-AS-IN-11
Sample Location: Bay 3
Sampled By: J. Goerdt / K. Losekamp
Canister Leak Check Date:

PURGE INFORMATION

START TIME	STOP TIME	VOLUME PURGED	LEAK TEST RESULT (ppm of He)
–	–	–	–

SAMPLING INFORMATION

	TIME	CANISTER PRESSURE (Inches Hg)	TEMPERATURE (°F)
START	918	30	71
STOP	1722	10	75

SAMPLE COLLECTION INFORMATION:

ANALYSIS	CONTAINER REQUIREMENTS	COLLECTED	Other
TO-15	SUMMA Canister	Yes	NA

NOTES / OBSERVATIONS:

Serial Number:
Canister: 10406
Valve: 10231

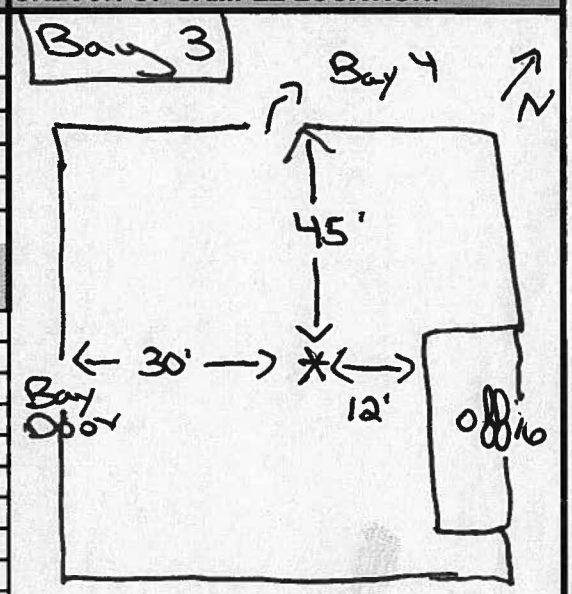
Calculated:
Flow Rate (ml/min):
Sample Duration (min): 484

COMMENTS:

Gauge reading prior to start of sampling (off position):	0	in. Hg
Gauge reading at sample start up (on position):	30	in. Hg
Gauge reading at the end of sampling:	10	in. Hg
Cylinder intake @	5	ft.
Ambient Air PID Reading	–	ppm

Time	Canister Pressure (in Hg)	Temp (°F)	Barometric Pressure (in Hg)
0918	30	71	
1019	27	72	
1122	25	74	
1221	20.50	74	
1317	19	73	29.94
1419	14	72	30.04
1518	13.5	74	–
1619	11.5	76	30.03
1722	10	75	30.01

SKETCH OF SAMPLE LOCATION:



Duplicate ID No.: –

Signature(s):

Tetra Tech, Inc.

AIR & SOIL GAS SAMPLE LOG SHEET

Project Site Name: NSA Crane - B 146
Project No.: 112G02362
Sample Date: 5-13-14
Sample Time: 920
Soil Gas from: Sub-Slab [ ] Near Slab [ ] QC [ ]
Air Sample from: Indoor [✓] Outdoor [ ] Other: [ ]

Sample ID No.: 146-AS-IN-12
Sample Location: Bay 4
Sampled By: J. Goerdt / K. Losekamp
Canister Leak Check Date:

PURGE INFORMATION

START TIME	STOP TIME	VOLUME PURGED	LEAK TEST RESULT (ppm of He)
—	—	—	—

SAMPLING INFORMATION

	TIME	CANISTER PRESSURE (Inches Hg)	TEMPERATURE (°F)
START	0920	28	71
STOP	1800	11	74

SAMPLE COLLECTION INFORMATION:

ANALYSIS	CONTAINER REQUIREMENTS	COLLECTED	Other
TO-15	SUMMA Canister	Yes	NA

NOTES / OBSERVATIONS:

Serial Number:
Canister: 10032
Valve: 10559

Calculated:
Flow Rate (ml/min):
Sample Duration (min): 520

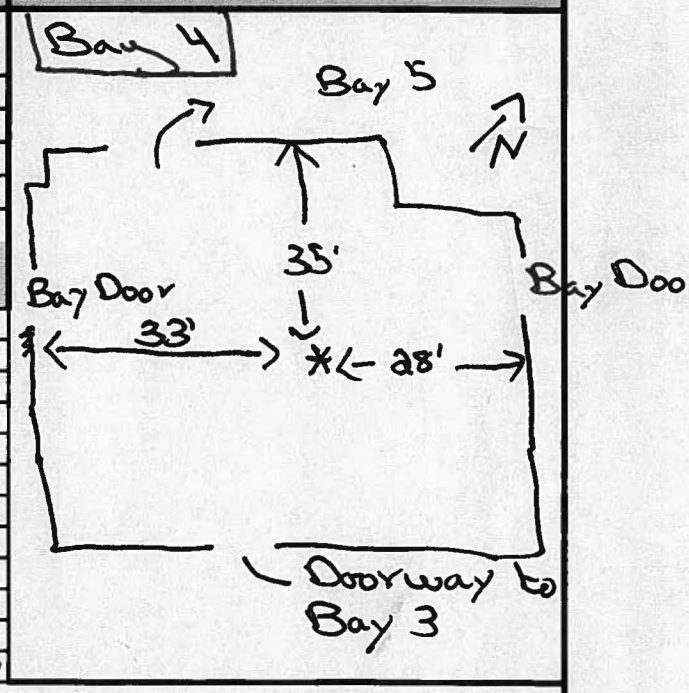
Appeared to be little to no change in the regulator pressure. Adjusted knob @ 1021. Working OK now.

COMMENTS:

Gauge reading prior to start of sampling (off position):	0	in. Hg
Gauge reading at sample start up (on position):	28	in. Hg
Gauge reading at the end of sampling:	11	in. Hg
Cylinder intake @	.5	ft.
Ambient Air PID Reading	—	ppm

Time	Canister Pressure (in Hg)	Temp (°F)	Barometric Pressure (in Hg)
0920	28	71	
1021	28	72	
1049	26	74	
1122	25	74	
1223	22.5	74	
1316	19.5	73	29.94
1420	18	72	30.04
1522	15.0	74	—
1618	14.5	76	30.03
1724	12.5	75	30.01
1800	11	74	30.01

SKETCH OF SAMPLE LOCATION:



Duplicate ID No.: —

Signature(s):

Tetra Tech, Inc.

AIR & SOIL GAS SAMPLE LOG SHEET

Project Site Name: NSA Crane - B 146
Project No.: 112G02362
Sample Date: 5-13-14
Sample Time: 922
Soil Gas from: Sub-Slab [ ] Near Slab [ ] QC [ ]
Air Sample from: Indoor [✓] Outdoor [ ] Other: [ ]

Sample ID No.: 146-AS-IN-13
Sample Location: Bay 5
Sampled By: J. Goerdt / K. Losekamp
Canister Leak Check Date:

PURGE INFORMATION

START TIME	STOP TIME	VOLUME PURGED	LEAK TEST RESULT (ppm of He)
—	—	—	—

SAMPLING INFORMATION

	TIME	CANISTER PRESSURE (Inches Hg)	TEMPERATURE (°F)
START	0922	27	71
STOP	1725	8.0	75

SAMPLE COLLECTION INFORMATION:

ANALYSIS	CONTAINER REQUIREMENTS	COLLECTED	Other
TO-15	SUMMA Canister	Yes	NA

NOTES / OBSERVATIONS:

Serial Number:
Canister: 10303
Valve: 10245

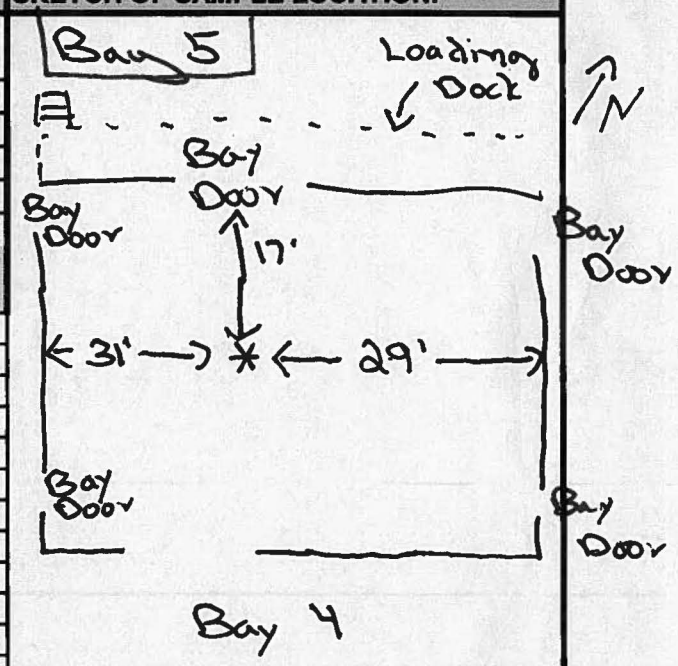
Calculated:
Flow Rate (ml/min):
Sample Duration (min): 483

COMMENTS:

Gauge reading prior to start of sampling (off position):	0	in. Hg
Gauge reading at sample start up (on position):	27	in. Hg
Gauge reading at the end of sampling:	8	in. Hg
Cylinder intake @	5	ft.
Ambient Air PID Reading	—	ppm

Time	Canister Pressure (in Hg)	Temp (°F)	Barometric Pressure (in Hg)
0922	27	71	
1022	25	72	
1130	22	74	
1225	19.0	74	
1318	17	73	29.94
1421	15.5	72	30.04
1523	12.0	74	—
1618	10.0	76	30.03
1725	8.0	75	30.01

SKETCH OF SAMPLE LOCATION:



Duplicate ID No.: —

Signature(s):

Tetra Tech, Inc.

AIR & SOIL GAS SAMPLE LOG SHEET

Project Site Name:	NSA Crane - B 146	**Sample ID No.:**	146-AS-~~IN~~-14 OU
Project No.:	112G02362	**Sample Location:**	Outdoor
Sample Date:	5-13-14	**Sampled By:**	J. Goerdt / K. Losekamp
Sample Time:	0814	**Canister Leak Check Date:**	

Soil Gas from: Sub-Slab [ ] Near Slab [ ] QC [ ]

Air Sample from: Indoor [ ] Outdoor [✓] Other: [ ]

PURGE INFORMATION

START TIME	STOP TIME	VOLUME PURGED	LEAK TEST RESULT (ppm of He)
—	—	—	—

SAMPLING INFORMATION

	TIME	CANISTER PRESSURE (Inches Hg)	TEMPERATURE (°F)
START	0814	28	70°
STOP	1614	10.5	75°

SAMPLE COLLECTION INFORMATION:

ANALYSIS	CONTAINER REQUIREMENTS	COLLECTED	Other
TO-15	SUMMA Canister	Yes	NA

NOTES / OBSERVATIONS:

Serial Number:

Canister: 10608

Valve: 10565

Calculated:

Flow Rate (ml/min):

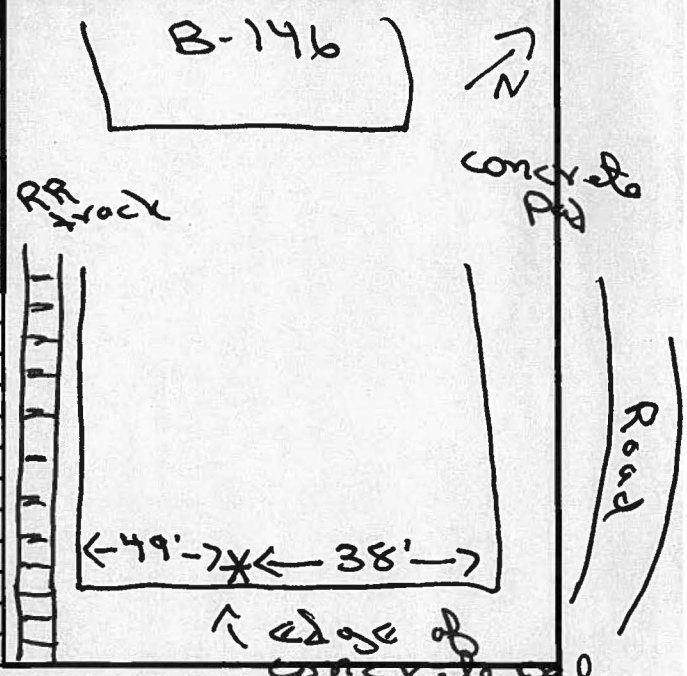
Sample Duration (min): 480

COMMENTS:

Gauge reading prior to start of sampling (off position):	0	in. Hg
Gauge reading at sample start up (on position):	28	in. Hg
Gauge reading at the end of sampling:	10.5	in. Hg
Cylinder intake @	5	ft.
Ambient Air PID Reading	—	ppm

Time	Canister Pressure (in Hg)	Temp (°F)	Barometric Pressure (in Hg)
0814	28	70	1015.6
0915	25	72	—
1014	22.5	73	—
1117	20	75	1015.9
1216	17.5	76	—
1311	16	80	29.94
1414	14	72	30.04
1518	12.0	73	—
1614	10.5	75	30.03

SKETCH OF SAMPLE LOCATION:



Duplicate ID No.: —

Signature(s): [signature]

Tetra Tech, Inc.

AIR & SOIL GAS SAMPLE LOG SHEET

Project Site Name: NSA Crane - B 146
Project No.: 112G02362
Sample Date: 5-14-14
Sample Time: 1500
Soil Gas from: Sub-Slab [✓] Near Slab [ ] QC [ ]
Air Sample from: Indoor [✓] Outdoor [ ] Other: [ ]

Sample ID No.: 146-AS-SS-15
Sample Location: Bay 1
Sampled By: J. Goerdt / K. Losekamp
Canister Leak Check Date:

PURGE INFORMATION

START TIME	STOP TIME	VOLUME PURGED	LEAK TEST RESULT (ppm of He)
TO 1143	1153	2000 cc	7200 (.72%)

SAMPLING INFORMATION

	TIME	CANISTER PRESSURE (Inches Hg)	TEMPERATURE (°F)
START	1500	25	68
STOP			

SAMPLE COLLECTION INFORMATION:

ANALYSIS	CONTAINER REQUIREMENTS	COLLECTED	Other
TO-15	SUMMA Canister	Yes	NA

NOTES / OBSERVATIONS:

Serial Number:
Canister: 10156
Valve: 10518

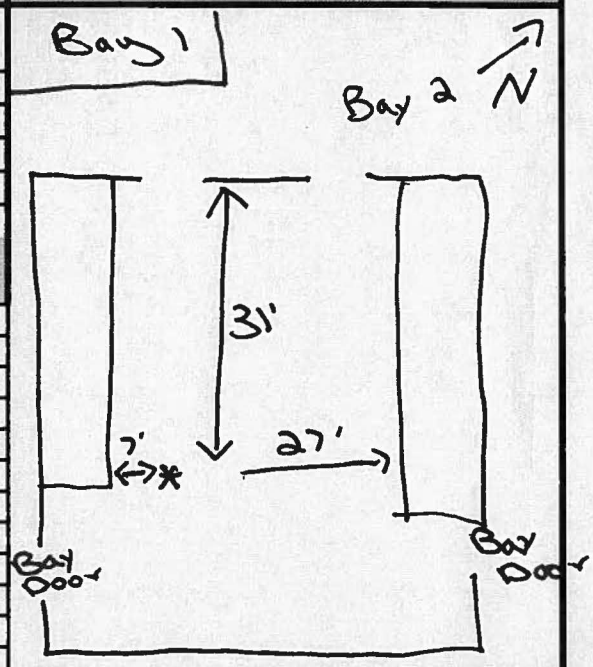
Calculated:
Flow Rate (ml/min):
Sample Duration (min):

COMMENTS:

Gauge reading prior to start of sampling (off position):	0	in. Hg
Gauge reading at sample start up (on position):	25	in. Hg
Gauge reading at the end of sampling:		in. Hg
Cylinder intake @	—	ft.
Ambient Air PID Reading	—	ppm

Time	Canister Pressure (In Hg)	Temp (°F)	Barometric Pressure (In Hg)
1500	25	68	30
1600	22	69	30.0
1705	19.5	68	29.9
1800	17.0	67	29.87
1900	15.0	69	29.86
2000	12.0	69	29.87
2100	10.0	68	29.88
2200	9.0	68	29.89
2300	7.5	67	29.91

SKETCH OF SAMPLE LOCATION:



Duplicate ID No.: —

Signature(s):

Tetra Tech, Inc.

AIR & SOIL GAS SAMPLE LOG SHEET

Project Site Name: NSA Crane - B 146
Project No.: 112G02362
Sample Date: 5-14-14
Sample Time: 1500
Soil Gas from: Sub-Slab [✓] Near Slab [ ] QC [ ]
Air Sample from: Indoor [✓] Outdoor [ ] Other: [ ]

Sample ID No.: 146-AS-SS-16
Sample Location: Bay 2
Sampled By: J. Goerdt / K. Losekamp
Canister Leak Check Date:

PURGE INFORMATION

START TIME	STOP TIME	VOLUME PURGED	LEAK TEST RESULT (ppm of He)
1031 1120	1130	2000 cc	625 (.06%)

SAMPLING INFORMATION

	TIME	CANISTER PRESSURE (Inches Hg)	TEMPERATURE (°F)
START	1500	30	68
STOP	2300	10	67

SAMPLE COLLECTION INFORMATION:

ANALYSIS	CONTAINER REQUIREMENTS	COLLECTED	Other
TO-15	SUMMA Canister	Yes	NA

NOTES / OBSERVATIONS:

Serial Number:
Canister: 104488
Valve: 10103

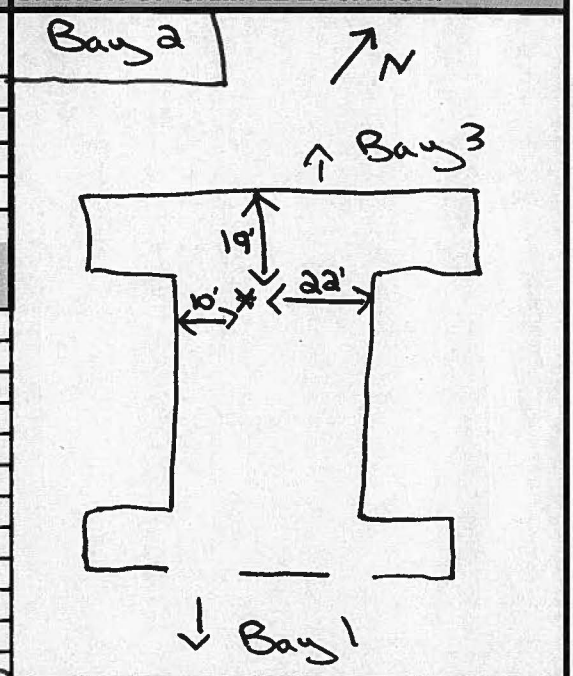
Calculated:
Flow Rate (ml/min):
Sample Duration (min): 480

COMMENTS:

Gauge reading prior to start of sampling (off position):	0	in. Hg
Gauge reading at sample start up (on position):	30	in. Hg
Gauge reading at the end of sampling:		in. Hg
Cylinder intake @	—	ft.
Ambient Air PID Reading	—	ppm

Time	Canister Pressure (in Hg)	Temp (°F)	Barometric Pressure (in Hg)
1500	30	68	30
1600	26	69	30
1705	23.5	68	29.9
1800	20.0	67	29.87
1900	17.0	69	29.86
2000	15.0	69	29.87
2100	13.0	68	29.88
2200	11.0	68	29.89
2300	10	67	29.91

SKETCH OF SAMPLE LOCATION:



Duplicate ID No.: —

Signature(s):

Tetra Tech, Inc.

AIR & SOIL GAS SAMPLE LOG SHEET

Project Site Name:	NSA Crane - B 146	**Sample ID No.:**	146-AS-SS-17
Project No.:	112G02362	**Sample Location:**	Bay 3
Sample Date:	5-14-14	**Sampled By:**	J. Goerdt / K. Losekamp
Sample Time:	1400	**Canister Leak Check Date:**	

Soil Gas from: Sub-Slab [✓] Near Slab [ ] QC [ ]

Air Sample from: Indoor [✓] Outdoor [ ] Other: [ ]

PURGE INFORMATION

START TIME	STOP TIME	VOLUME PURGED	LEAK TEST RESULT (ppm of He)
1080	1100	2000 cc	800 (.08%)

SAMPLING INFORMATION

	TIME	CANISTER PRESSURE (Inches Hg)	TEMPERATURE (°F)
START	1400	28.5	68
STOP	2200	5.5	68

SAMPLE COLLECTION INFORMATION:

ANALYSIS	CONTAINER REQUIREMENTS	COLLECTED	Other
TO-15	SUMMA Canister	Yes	NA

NOTES / OBSERVATIONS:

Serial Number:

Canister: 10268

Valve: 10640

Calculated:

Flow Rate (ml/min):

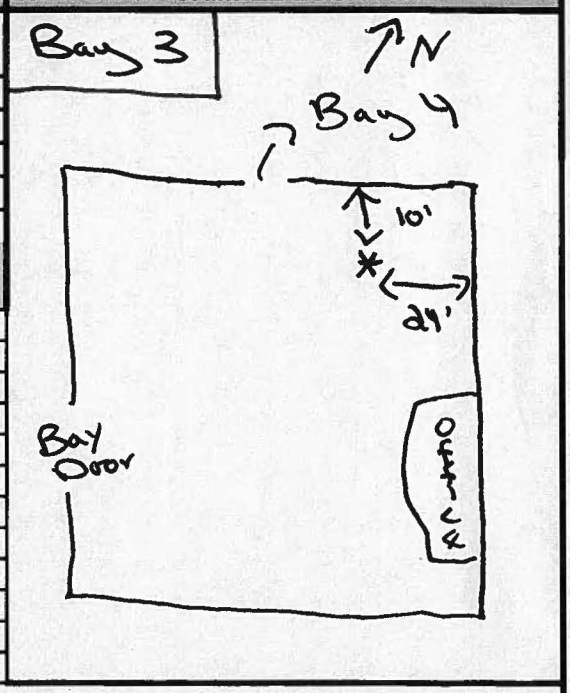
Sample Duration (min): 480

COMMENTS:

Gauge reading prior to start of sampling (off position):	0	in. Hg
Gauge reading at sample start up (on position):	28.5	in. Hg
Gauge reading at the end of sampling:		in. Hg
Cylinder intake @	—	ft.
Ambient Air PID Reading	—	ppm

Time	Canister Pressure (in Hg)	Temp (°F)	Barometric Pressure (in Hg)
1400	28.5	68	30
1500	25	68	30
1600	21	69	30
1704	18.0	68	29.9
1800	15.0	67	29.87
1900	12.0	69	29.86
2000	10.0	69	29.87
2100	8.0	68	29.88
2200	5.5	68	29.89

SKETCH OF SAMPLE LOCATION:



Duplicate ID No.: —

Signature(s):

Tetra Tech, Inc.

AIR & SOIL GAS SAMPLE LOG SHEET

Project Site Name: NSA Crane - B 146
Project No.: 112G02362
Sample Date: 5-14-14
Sample Time: 1335
Soil Gas from: Sub-Slab [✓] Near Slab [ ] QC [ ]
Air Sample from: Indoor [✓] Outdoor [ ] Other: [ ]

Sample ID No.: 146-AS-SS-18
Sample Location: Bay 4
Sampled By: J. Goerdt / K. Losekamp
Canister Leak Check Date:

PURGE INFORMATION

START TIME	STOP TIME	VOLUME PURGED	LEAK TEST RESULT (ppm of He)
1025	1035	2000 cc	2000 (0.2%)

SAMPLING INFORMATION

	TIME	CANISTER PRESSURE (Inches Hg)	TEMPERATURE (°F)
START	1335	28.5	68
STOP	2135	10.5	68

SAMPLE COLLECTION INFORMATION:

ANALYSIS	CONTAINER REQUIREMENTS	COLLECTED	Other
TO-15	SUMMA Canister	Yes	NA

NOTES / OBSERVATIONS:

Serial Number:
Canister: 10589
Valve: 10781

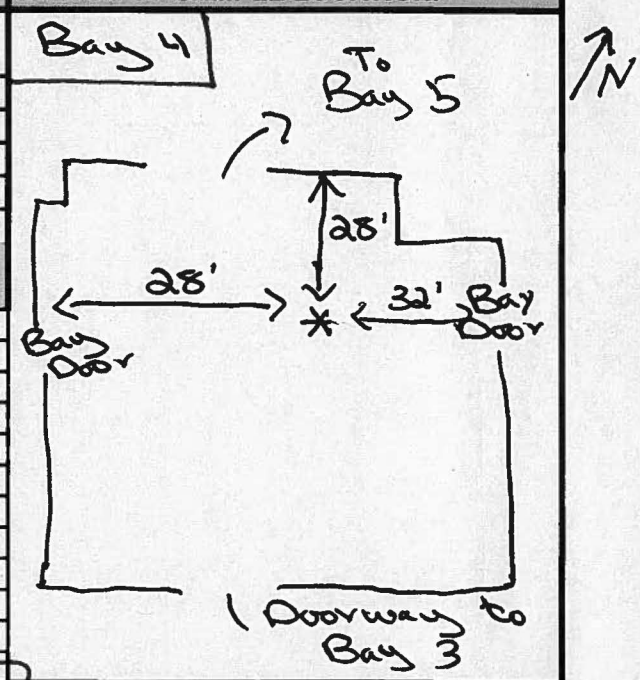
Calculated:
Flow Rate (ml/min):
Sample Duration (min): 480

COMMENTS:

Gauge reading prior to start of sampling (off position):	0	in. Hg
Gauge reading at sample start up (on position):	28.5	in. Hg
Gauge reading at the end of sampling:		in. Hg
Cylinder intake @	—	ft.
Ambient Air PID Reading	—	ppm

Time	Canister Pressure (in Hg)	Temp (°F)	Barometric Pressure (in Hg)
1335	28.5	68	30
1500	25.5	68	30
1600	22.5	69	30.0
1700	20.0	68	29.9
1800	18.0	67	29.87
1900	15.0	69	29.86
2000	14.0	69	29.87
2100	~~8.5~~ 11.5	68	29.88
2135	10.5	68	29.89

SKETCH OF SAMPLE LOCATION:



Duplicate ID No.: —

Signature(s):

Tetra Tech, Inc.

AIR & SOIL GAS SAMPLE LOG SHEET

Project Site Name: NSA Crane - B 146
Project No.: 112G02362
Sample Date: 5-14-14
Sample Time: 1225
Soil Gas from: Sub-Slab [X] Near Slab [ ] QC [ ]
Air Sample from: Indoor [X] Outdoor [ ] Other: [ ]

Sample ID No.: 146-AS-SS-19
Sample Location: Bay 5
Sampled By: J. Goerdt / K. Losekamp
Canister Leak Check Date:

PURGE INFORMATION

START TIME	STOP TIME	VOLUME PURGED	LEAK TEST RESULT (ppm of He)
915	925	2000 cc	0.0925 % (925)

SAMPLING INFORMATION

	TIME	CANISTER PRESSURE (Inches Hg)	TEMPERATURE (°F)
START	1225	28	68
STOP	2025	11	69

SAMPLE COLLECTION INFORMATION:

ANALYSIS	CONTAINER REQUIREMENTS	COLLECTED	Other
TO-15	SUMMA Canister	Yes	NA

NOTES / OBSERVATIONS:

Serial Number:
Canister: 10159
Valve: 10641

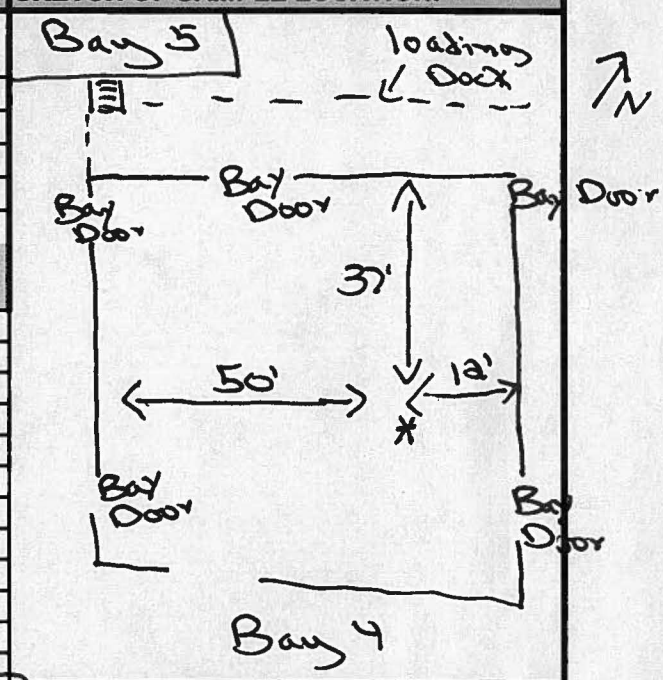
Calculated:
Flow Rate (ml/min):
Sample Duration (min): 480

COMMENTS:

Gauge reading prior to start of sampling (off position):	0	in. Hg
Gauge reading at sample start up (on position):	28	in. Hg
Gauge reading at the end of sampling:	11	in. Hg
Cylinder intake @	—	ft.
Ambient Air PID Reading	—	ppm

Time	Canister Pressure (in Hg)	Temp (°F)	Barometric Pressure (in Hg)
1225	28	~~56~~ 68	30
1425	22.5	68	30
1500	21	68	30
1600	19	69	30
1700	17	68	~~30~~ 29.90
1800	15.0	67	29.87
1900	14.0	69	29.86
2000	11.5	69	29.87
2025	11	69	29.87

SKETCH OF SAMPLE LOCATION:



Duplicate ID No.: —

Signature(s):

Tetra Tech, Inc.

AIR & SOIL GAS SAMPLE LOG SHEET

Project Site Name: NSA Crane - B 146
Project No.: 112G02362
Sample Date: 5-14-14
Sample Time: 1300
Soil Gas from: Sub-Slab [✓] Near Slab [ ] QC [ ]
Air Sample from: Indoor [✓] Outdoor [ ] Other: [ ]

Sample ID No.: 146-AS-IN-20
Sample Location: Bay 5
Sampled By: J. Goerdt / K. Losekamp
Canister Leak Check Date:

PURGE INFORMATION

START TIME	STOP TIME	VOLUME PURGED	LEAK TEST RESULT (ppm of He)
950	1000	2000 cc	0.1% 1000

SAMPLING INFORMATION

	TIME	CANISTER PRESSURE (Inches Hg)	TEMPERATURE (°F)
START	1300	28.5	68
STOP	2100	7.0	68

SAMPLE COLLECTION INFORMATION:

ANALYSIS	CONTAINER REQUIREMENTS	COLLECTED	Other
TO-15	SUMMA Canister	Yes	NA

NOTES / OBSERVATIONS:

Serial Number:
Canister: 10291
Valve: 10711

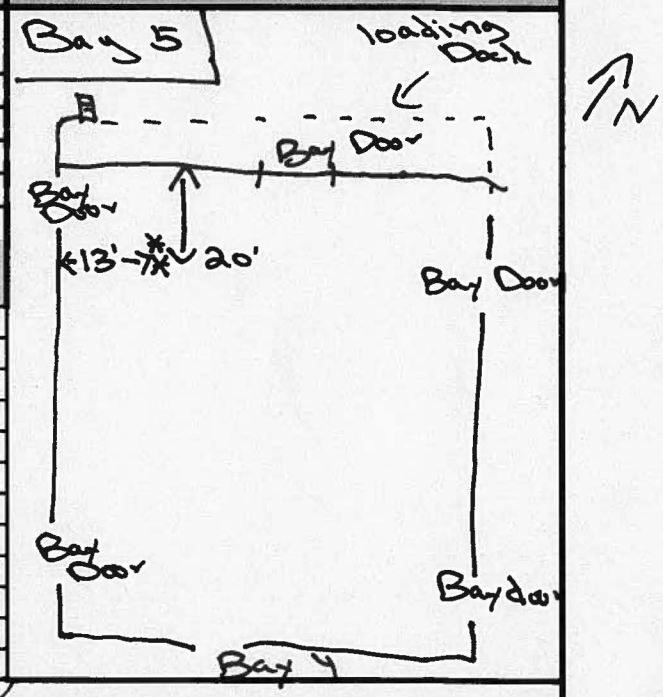
Calculated:
Flow Rate (ml/min):
Sample Duration (min): 480

COMMENTS:

Gauge reading prior to start of sampling (off position):	0	in. Hg
Gauge reading at sample start up (on position):	28.5	in. Hg
Gauge reading at the end of sampling:	7	in. Hg
Cylinder intake @	—	ft.
Ambient Air PID Reading	—	ppm

Time	Canister Pressure (in Hg)	Temp (°F)	Barometric Pressure (in Hg)
1300	28.5	68	30
1400	22	68	30
1500	21	68	30
1600	18.5	69	30
1700	15.0	68	29.9
1800	12.5	67	29.87
1900	10.5	69	29.86
2000	8.5	69	29.87
2100	7.0	68	29.89

SKETCH OF SAMPLE LOCATION:



Duplicate ID No.: FD051414-01

Signature(s):

Tetra Tech, Inc.

AIR & SOIL GAS SAMPLE LOG SHEET

Project Site Name: NSA Crane - B 146
Project No.: 112G02362
Sample Date: 5-14-14
Sample Time: 1300
Sample ID No.: FD051414-01
Sample Location:
Sampled By: J. Goerdt / K. Losekamp
Canister Leak Check Date:

Soil Gas from: Sub-Slab [✓] Near Slab [ ] QC [ ]
Air Sample from: Indoor [✓] Outdoor [ ] Other: [ ]

PURGE INFORMATION

START TIME	STOP TIME	VOLUME PURGED	LEAK TEST RESULT (ppm of He)
950	1000	2000 cc	0.1% 1000

SAMPLING INFORMATION

	TIME	CANISTER PRESSURE (Inches Hg)	TEMPERATURE (°F)
START	1300	30+	68
STOP	2100	27.5	68

SAMPLE COLLECTION INFORMATION:

ANALYSIS	CONTAINER REQUIREMENTS	COLLECTED	Other
TO-15	SUMMA Canister	Yes	NA

NOTES / OBSERVATIONS:

Serial Number:
Canister: 10292
Valve: 10563
Calculated:
Flow Rate (ml/min):
Sample Duration (min): 480

Associated w/ 146-AS-IN-20

COMMENTS:

Gauge reading prior to start of sampling (off position):	17	in. Hg
Gauge reading at sample start up (on position):	30+	in. Hg
Gauge reading at the end of sampling:	27.5	in. Hg
Cylinder intake @	–	ft.
Ambient Air PID Reading	–	ppm

Time	Canister Pressure (in Hg)	Temp (°F)	Barometric Pressure (in Hg)
1300	30+	68	30
1400	30+	68	30
1500	30+	68	30
1600	30+	69	30
1700	30+	68	29.90
1800	30+	67	29.87
1900	30+	69	29.86
2000	29	69	29.87
2100	27.5	68	29.89

SKETCH OF SAMPLE LOCATION:

See 146-AS-IN-20

Duplicate ID No.: –

Signature(s):

APPENDIX B

SITE PHOTOGRAPHS

NSA Crane – SWMU 16 B-146 VI Report

SITE: NSA Crane SWMU 16 B-146	**PHOTOGRAPHER:** J. Goerdt	**DESCRIPTION:** Suma canister with regulator.	1 05/13/14

SITE: NSA Crane SWMU 16 B-146	**PHOTOGRAPHER:** J. Goerdt	**DESCRIPTION:** Indoor air sample location within B-146. Tubing intake approximately 5 feet above ground surface.	2 05/13/14

NSA Crane – SWMU 16 B-146 VI Report

SITE: NSA Crane SWMU 16 B-146	**PHOTOGRAPHER:** J. Goerdt	**DESCRIPTION:** Duplicate indoor air sample location.	3 05/13/14

SITE: NSA Crane SWMU 16 B-146	**PHOTOGRAPHER:** J. Goerdt	**DESCRIPTION:** Outdoor air sample location south of B-146 approximately 45 feet from end of building.	4 05/13/14

NSA Crane – SWMU 16 B-146 VI Report

SITE: NSA Crane SWMU 16 B-146	**PHOTOGRAPHER:** J. Goerdt	**DESCRIPTION:** Outdoor air sample location.	5 05/13/14

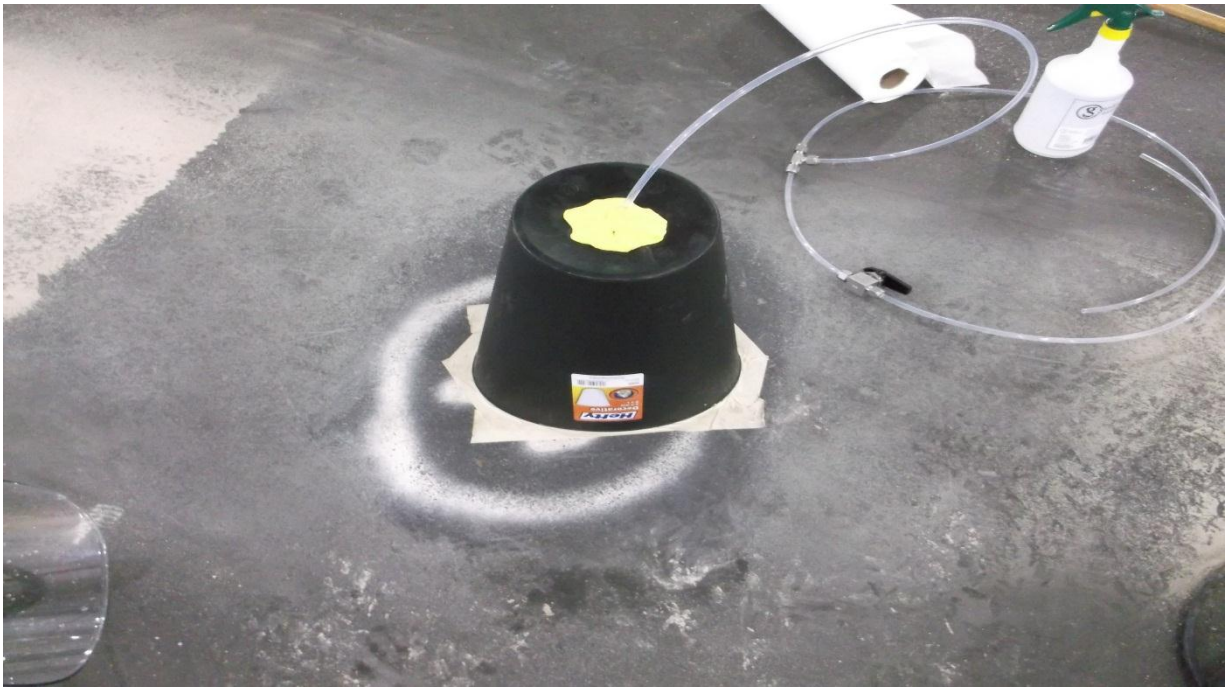
SITE: NSA Crane SWMU 16 B-146	**PHOTOGRAPHER:** J. Goerdt	**DESCRIPTION:** Equipment for installing sub-slab sample point.	6 05/14/14

NSA Crane – SWMU 16 B-146 VI Report

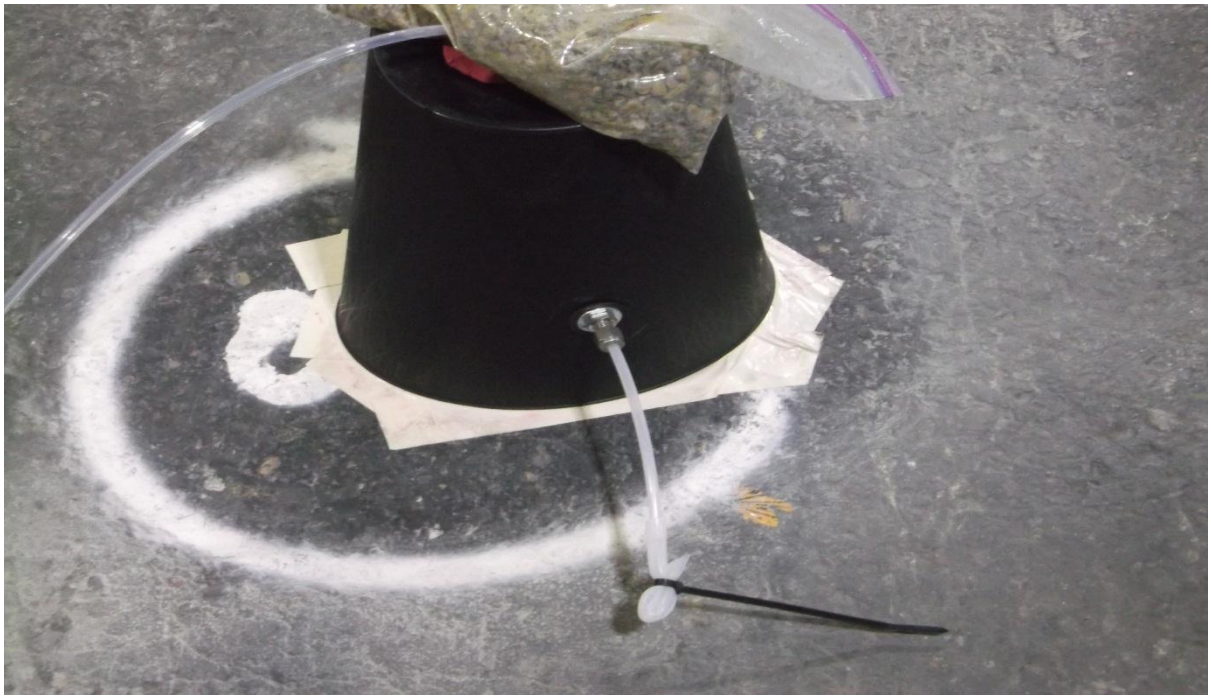
SITE: NSA Crane SWMU 16 B-146	**PHOTOGRAPHER:** J. Goerdt	**DESCRIPTION:** Drilling through building floor for sub-slab sample point.	7 05/14/14

SITE: NSA Crane SWMU 16 B-146	**PHOTOGRAPHER:** J. Goerdt	**DESCRIPTION:** Up close view of sub-slab sample point.	8 05/14/14

NSA Crane – SWMU 16 B-146 VI Report



SITE: NSA Crane SWMU 16 B-146	**PHOTOGRAPHER:** J. Goerdt	**DESCRIPTION:** Typical sub-slab sample point setup.	9 05/14/14



SITE: NSA Crane SWMU 16 B-146	**PHOTOGRAPHER:** J. Goerdt	**DESCRIPTION:** Up close view of sub-slab sample setup with helium port.	10 05/14/14

NSA Crane – SWMU 16 B-146 VI Report

SITE: NSA Crane SWMU 16 B-146	**PHOTOGRAPHER:** J. Goerdt	**DESCRIPTION:** Sub-slab duplicate sample location.	11 05/14/14

SITE: NSA Crane SWMU 16 B-146	**PHOTOGRAPHER:** J. Goerdt	**DESCRIPTION:** Up close view of sub-slab duplicate sample setup.	12 05/14/14

APPENDIX C

DATA VALIDATION REPORTS

Tetra Tech **INTERNAL CORRESPONDENCE**

TO:	**J. LUCAS**	**DATE:**	**JUNE 18, 2014**
FROM:	**EDWARD SEDLMYER**	**COPIES:**	**DV FILE**
SUBJECT:	**ORGANIC DATA VALIDATION: SELECT VOC** **NSA CRANE, CTO F27G** **SDG F2321**		
SAMPLES:	6 / Air / VOC		

146-AS-IN-09	146-AS-IN-10	146-AS-IN-11
146-AS-IN-12	146-AS-OU-14	FD051314-01

OVERVIEW

The sample set for NSA Crane, CTO F27G, SDG F2321 consisted of six (6) air samples. All samples were analyzed for select volatile organic compounds (VOC). One field duplicate was associated with this SDG: 146-AS-IN-09 / FD051314-01.

The samples were collected by Tetra Tech on May 13, 2014 and analyzed by ChemTech. All analyses were conducted using EPA Method TO-15 analytical and reporting protocols.

The data contained in this SDG were fully validated with regard to the following parameters:

- Data Completeness
- * Holding Times
- * GC/MS Tuning
- * Initial and Continuing Calibration
- Laboratory Blank Analyses
- * Surrogate Recoveries
- * Blank Spike/Blank Spike Duplicate Results
- * Internal Standard Recoveries
- Field Duplicate Results
- * Analyte Quantitation
- * Analyte Identification
- * Detection Limits

The symbol (*) indicates that quality control criteria were met for this parameter. Problems affecting data quality are discussed below; documentation supporting these findings is presented in Appendix C. Qualified Analytical results are presented in Appendix A. Results as reported by the laboratory are presented in Appendix B.

SELECT VOC

The following contaminant was detected in the method blank at the following maximum concentration:

Analyte	Maximum Concentration	Action Level
Methylene Chloride	0.45 ug/M^3	4.5 ug/M^3

An action level of 10X the maximum contaminant level for methylene chloride has been used to evaluate sample data for blank contamination. Sample aliquot and dilution factors, if applicable, were taken into consideration when evaluating for blank contamination. Results less than the action level have been qualified (U) due to blank contamination.

The field duplicate precision exceeded either the 50% relative percent difference (RPD) or had a difference between results greater than 2X the limit of quantitation quality control limit for methylene chloride and tetrachloroethene in the field duplicate pair 146-AS-IN-09 / FD051314-01. Detected results for methylene chloride and tetrachloroethene were qualified as estimated (J), in samples 146-AS-IN-09 / FD051314-01. No action was taken on the nondetected methylene chloride result for sample FD051314-01 because it was previously qualified due to blank contamination.

ADDITIONAL COMMENTS

The laboratory EDD and PDF summary Form1s did not match for the nondetected values for 1,1,2,2-tetrachloroethane. The laboratory was contacted and the summary Form1s were re-submitted by the laboratory.

Detected results reported greater than the method detection limit (MDL) but below the limit of quantitation (LOQ) were qualified as estimated, (J).

Nondetected results were reported to the limit of detection (LOD).

EXECUTIVE SUMMARY

Laboratory Performance Issues: Blank contamination resulted in the qualification of methylene chloride data.

Other factors affecting data quality: Field duplicate imprecision resulted in the qualification of data for methylene chloride and tetrachloroethene. Detected results reported greater than the MDL but below the LOQ were qualified as estimated.

The data for these analyses were reviewed with reference to the EPA Compendium Method TO-15 (Jan. 1999), USEPA National Functional Guidelines for Organic Data Validation (June 2008), and the Department of Defense (DoD) document entitled "Quality Systems Manual (QSM) for Environmental Laboratories" (July 2013).

The text of this report has been formulated to address only those problem areas affecting data quality.

Edward Sedlmyer

Tetra Tech
Edward Sedlmyer
Chemist/Data Validator

Tetra Tech
Joseph A. Samchuck
Data Validation Manager

Attachments:
Appendix A – Qualified Analytical Results
Appendix B – Results as Reported by the Laboratory
Appendix C – Support Documentation

Tetra Tech **INTERNAL CORRESPONDENCE**

TO:	**J. LUCAS**	**DATE:**	**JUNE 18, 2014**
FROM:	**EDWARD SEDLMYER**	**COPIES:**	**DV FILE**

SUBJECT: **ORGANIC DATA VALIDATION: SELECT VOC**
NSA CRANE, CTO F27G
SDG F2335

SAMPLES: 7 / Soil Gas / VOC

146-AS-SS-15	146-AS-SS-16	146-AS-SS-17
146-AS-SS-18	146-AS-SS-19	146-AS-SS-20
FD051414-01		

1 / Air / VOC

146-AS-IN-13

OVERVIEW

The sample set for NSA Crane, CTO F27G, SDG F2335 consisted of seven (7) soil gas samples and one (1) air sample. All samples were analyzed for select volatile organic compounds (VOC). One field duplicate was associated with this SDG: 146-AS-SS-20 / FD051414-01.

The samples were collected by Tetra Tech on May 14, 2014 and analyzed by ChemTech. All analyses were conducted using EPA Method TO-15 analytical and reporting protocols.

The data contained in this SDG were fully validated with regard to the following parameters:

- Data Completeness
- * Holding Times
- * GC/MS Tuning
- * Initial and Continuing Calibration
- Laboratory Blank Analyses
- * Surrogate Recoveries
- * Blank Spike/Blank Spike Duplicate Results
- Internal Standard Recoveries
- Field Duplicate Results
- * Analyte Quantitation
- * Analyte Identification
- * Detection Limits

The symbol (*) indicates that quality control criteria were met for this parameter. Problems affecting data quality are discussed below; documentation supporting these findings is presented in Appendix C. Qualified Analytical results are presented in Appendix A. Results as reported by the laboratory are presented in Appendix B.

SELECT VOC

The following contaminant was detected in the method blanks at the following maximum concentrations:

Analyte	Maximum Concentration	Action Level
Methylene Chloride(1)	0.45 ug/M^3	4.5 ug/M^3
Methylene Chloride(2)	0.38 ug/M^3	3.8 ug/M^3

1 – Maximum concentration found in method blank VL0516ABL affecting all samples except 146-AS-SS-20.
2 - Maximum concentration found in method blank VL0520ABL affecting sample 146-AS-SS-20.

An action level of 10X the maximum contaminant level for methylene chloride has been used to evaluate sample data for blank contamination. Sample aliquot and dilution factors, if applicable, were taken into consideration when evaluating for blank contamination. Results less than the action level have been qualified (U) due to blank contamination.

The field duplicate precision exceeded the 50% relative percent difference (RPD) quality control limit for tetrachloroethene in the field duplicate pair 146-AS-SS-20 / FD051414-01. Detected results for tetrachloroethene were qualified as estimated (J) in samples 146-AS-SS-20 / FD051414-01.

The internal standard chlorobenzene-d5 had a percent recovery less than the 50% quality control limit for sample 146-AS-SS-18. The nondetected 1,1,2,2-tetrachloroethane result for sample 146-AS-SS-18 has been qualified as estimated (UJ).

Samples 146-AS-SS-18, 146-AS-SS-19, 146-AS-SS-20, and FD051414-01 were analyzed at dilutions due to concentrations greater than the linear calibration range of the instrument for trichloroethane. Only trichloroethane was reported from the dilution. All other compounds were reported using the undiluted analysis.

ADDITIONAL COMMENTS

The laboratory EDD and PDF summary Form1s did not match for the nondetected values for 1,1,2,2-tetrachloroethane. The laboratory was contacted and the summary Form1s were re-submitted by the laboratory.

Detected results reported greater than the method detection limit (MDL) but below the limit of quantitation (LOQ) were qualified as estimated, (J).

Nondetected results were reported to the limit of detection (LOD).

EXECUTIVE SUMMARY

Laboratory Performance Issues: Blank contamination resulted in the qualification of methylene chloride data.

Other factors affecting data quality: Internal standard percent recovery noncompliance resulted in the qualification of one 1,1,2,2-tetrachloroethane result. Field duplicate imprecision resulted in the qualification of data for tetrachloroethene. Detected results reported greater than the MDL but below the LOQ were qualified as estimated.

The data for these analyses were reviewed with reference to the EPA Compendium Method TO-15 (Jan. 1999), USEPA National Functional Guidelines for Organic Data Validation (June 2008), and the Department of Defense (DoD) document entitled "Quality Systems Manual (QSM) for Environmental Laboratories" (July 2013).

The text of this report has been formulated to address only those problem areas affecting data quality.

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