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INTERIM MEASURE REPORT FOR GROUNDWATER AND INDOOR AIR ASSESSMENT AREA OF CONCERN 607 (AOC 607) BUILDING 225 ZONE F CNC CHARLESTON SC

3/15/2001

NAVFAC SOUTHERN

INTERIM MEASURE REPORT

Groundwater and Indoor Air Assessment
Area of Concern 607, Building 225, Zone F

Charleston Naval Complex
North Charleston, South Carolina

SUBMITTED TO
U.S. Navy Southern Division
Naval Facilities Engineering Command

CH2M-Jones

March 2001

Revision 0
Contract N62467-99-C-0960

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
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5090/11
Code 18B1
15 March 2001

Mr. John Litton, P.E.
Director, Division of Hazardous and Infectious Waste Management
Bureau of Land and Waste Management
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201

Subj: SUBMITTAL OF INTERIM MEASURE REPORT FOR THE GROUNDWATER AND INDOOR AIR ASSESSMENT AT AOC 607, BUILDING 225

Dear Mr. Litton,

The purpose of this letter is to submit the Interim Measure Report for the Groundwater and Indoor Air Assessment at AOC 607, Building 225 located at Naval Station Annex in Charleston, SC. The report is submitted to fulfill the requirements of condition II.C.1 of the RCRA Part B permit issued to the Navy by the South Carolina Department of Health and Environmental Control and the U.S. Environmental Protection Agency (EPA).

This document has been prepared pursuant to agreements by the CNC BRAC Cleanup Team for completing the RCRA Corrective Action process and has been distributed under separate cover letter by CH2M Hill. Appropriate certification is provided under that correspondence. We request that the Department and the EPA review this document and provide comments or approval whichever is appropriate.

If you should have any questions, please contact Matthew Humphrey or myself at (843) 743-9985 and (843) 820-5551 respectively.

Sincerely,

ROBERT A. HARRELL, JR., P.E.
Environmental Engineer
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March 14, 2001

John Litton, P.E.
Director
Division of Hazardous and Infectious Wastes
South Carolina Department of Health and
Environmental Control
Bureau of Land and Waste Management
2600 Bull Street
Columbia, SC 29201

Dear Mr. Litton:

Enclosed please find four copies of the Interim Measure Report for the Groundwater and Indoor Air Assessment at Building 225, AOC 607, Zone F, at the Charleston Naval Complex (CNC). This report has been prepared pursuant to agreements by the CNC BRAC Cleanup Team for completing the RCRA Corrective Action process.

Please contact me if you have any questions or comments.

Sincerely,

Dean Williamson
(SV)

Dean Williamson, P.E.

xc: Tony Hunt/Navy, w/att
Rob Harrell/Navy, w/att
Mihir Mehta/SCDHEC
Gary Foster/CH2M HILL, w/att

INTERIM MEASURE REPORT

Groundwater and Indoor Air Assessment

Area of Concern 607, Building 225, Zone F

Charleston Naval Complex
North Charleston, South Carolina

SUBMITTED TO
U.S. Navy Southern Division
Naval Facilities Engineering Command

PREPARED BY
CH2M-Jones

F-03200100/CNV

March 2001
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Revision 0
Contract N62467-99-C-0960

Certification Page for Interim Measure Report for AOC 607, Building 225, Zone F

Groundwater and Indoor Air Assessment

I, Dean Williamson, certify that this report has been prepared under my direct supervision. The data and information are, to the best of my knowledge, accurate and correct, and the report has been prepared in accordance with current standards of practice for engineering.

South Carolina

Temporary Permit No. T2000342

Dean Williamson, P.E.

3/9/2001

Date

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C CH2M-Jones Memorandum dated February 1, 2001. *Data Validation Summary for Charleston Naval Complex – AOC 607*
D Soil Gas and Indoor Air Analytical Results - Form 1
E Groundwater Analytical Results – Form 1
F Farmer Model Results
G Johnson-Ettinger Model Results

Acronyms and Abbreviations

AOC	area of concern
ASTM	American Society for Testing and Materials
CNC	Charleston Naval Complex
CSAP	Comprehensive Sampling and Analysis Plan
1,2-DCE	1,2-dichloroethene
DMP	Data Management Plan
DNAPL	dense non-aqueous phase liquid
DO	dissolved oxygen
EnSafe	EnSafe Inc.
EPA	U.S. Environmental Protection Agency
ERT	Environmental Response Team
ft bls	feet below land surface
HVAC	heating, ventilation, and air conditioning
IM	interim measure
µg/L	microgram per liter
µg/m^3	microgram per cubic meter
MCL	maximum contaminant level
MS	mass spectrometer
msl	mean sea level
MW	monitoring well
PCE	tetrachloroethene
PID	photoionization detector
ppm	parts per million
ppbv	parts per billion by volume
PVC	polyvinyl chloride
QAP	Quality Assurance Plan
RBC	risk-based concentration

Acronyms and Abbreviations

RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SCDHEC	South Carolina Department of Health and Environmental Control
SIM	selective ion monitoring
SOP	standard operating procedure
TCE	trichloroethene
VOC	volatile organic compound

SECTION 1.0

Introduction

1.0 Introduction

1.1 Purpose of Interim Measure Investigation

The purpose of this interim measure (IM) investigation was to characterize the groundwater quality under and around Building 225, and evaluate whether subsurface groundwater contaminants are entering the indoor air of the building. Building 225 is located immediately west of the former dry cleaning facility (Building 1189), and is potentially situated above a groundwater contaminant plume. The investigation also included an evaluation of the potential exposure risks to Building 225 occupants. Results of this analysis were used to verify that the residents are not exposed to unacceptable concentrations of volatile organic compounds (VOCs) which are related to dry cleaning fluids used by the former dry cleaning facility.

The IM investigation was conducted pursuant to correspondence between David Scaturo of the South Carolina Department of Health and Environmental Control (SCDHEC) and Matthew A. Hunt of the U.S. Navy, dated November 21, 2000, specifically requesting that an IM Work Plan for this activity be prepared. The technical approach for the IM investigation was presented in the *IM Work Plan, Building 225 Indoor Air Pathway Assessment*, dated December 13, 2000, and prepared by CH2M-Jones. The IM Work Plan was approved by SCDHEC on December 13, 2000.

The investigation was completed in a phased approach to evaluate the indoor air pathway, beginning with sampling of the indoor air and soil gas around the perimeter of Building 225. These samples were collected to evaluate the presence or absence of VOCs in indoor air or soil vapor at levels that are of potential concern for human exposure.

The second phase of the investigation further characterized the quality of the shallow groundwater adjacent to and downgradient of Building 225. New groundwater monitoring wells (MWs) were installed next to Building 225 and along the western property line. Groundwater from these wells was sampled and analyzed for the chemicals related to dry cleaning operations and other VOCs. The analytical results from shallow groundwater samples were used to characterize the extent of contamination around the building and evaluate the indoor air exposure and potential risk to human health from the groundwater VOCs that may be entering Building 225.

1.2 Site Background and Setting

Area of Concern (AOC) 607 consists of a former dry cleaning facility, Building 1189, that supported the former local seamen's housing from 1942 to 1986. Building 225 is located immediately west of AOC 607. Toward the end of its operational period, the dry cleaning facility was used as a general purpose laundry with two industrial washers and dryers. Tetrachloroethene (PCE), a typical dry-cleaning solvent, is one of the primary materials which was used, stored, or disposed of, and accidentally released at the site. Trichloroethene (TCE), 1,2-dichloroethene (DCE), and vinyl chloride, sequential dechlorination products of PCE, have also been detected in soil and groundwater samples collected at AOC 607 during the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI). Investigation activities are summarized in the *Zone F Draft RFI Report*, completed by EnSafe Inc. (EnSafe), and dated December 31, 1997.

These chlorinated solvents, which are mobile in the soils and groundwater, were found to have migrated vertically downward through fill and shallow subsurface oils, until encountering a clay confining unit at approximately 10 to 12 feet below land surface (ft bls). Once accumulated on top of and within the clay layer, a dense non-aqueous phase liquid (DNAPL) became the residual source of the dissolved phase chlorinated solvents that were contaminating the shallow groundwater.

The chlorinated solvent-impacted shallow groundwater is believed to be generally hydraulically controlled by a sanitary sewer line located southwest of Building 1189. The sanitary sewer line has created a depression in the potentiometric surface that appears to have slowed lateral contaminant migration.

Laboratory analyses of the groundwater samples collected from shallow MW 607GW006 located approximately 30 ft northeast of Building 225 indicated the presence of dissolved phase chlorinated solvents. The chemical properties associated with VOCs detected in groundwater near Building 225 served to promote their volatilization from water to air in soil gas and ultimately to ambient air, where the VOCs dilute and degrade. The rate of volatilization varies according to a compound's Henry's Law Constant, diffusivity, and vapor pressure, in addition to the moisture content and temperature of the subsurface environment. Once a compound(or compounds) form(s) a vapor above the water table it can be mobilized to the ground surface through diffusion, convection, and/or barometric pressure changes.

Exposure to VOC vapors may occur through inhalation. However, atmospheric dilution and attenuation generally limit the significance of exposure to VOCs in outdoor air. Thus,

smaller spaces (e.g., narrow basements) closer to the ground surface and with less ventilation are likely to have higher concentrations. An area which is farther from the ground surface, above contaminated groundwater, and with a high ventilation rate will have the least amount of indoor VOC concentrations, leading to lower exposure. Depending on the levels of indoor air concentrations, inhalation can be an important exposure pathway in settings where ventilation is low. Field inspection of Building 225 confirmed the lack of a basement or crawl space within the building. Rooms within this building are well ventilated under normal residential occupancy conditions.

1.3 Organization of the Interim Measure Report

This IM investigation report presents a summary of the field activities, documents the results from the samples collected during the investigation, and provides the results of the modeling used to conservatively predict the risk to human health.

The report consists of the following 12 sections, including this introductory section and appendices:

1.0 Introduction — Presents the purpose of the IM investigation and background information regarding the site.

2.0 Interim Measure Investigation Summary — Presents a brief description of the field activities completed during the investigation.

3.0 Interim Measure Investigation Results — Provides a summary of the results from the environmental samples collected during the investigation.

4.0 Interpretation of Analytical Results — Presents the results from the Farmer and Johnson-Ettinger models.

5.0 References — Lists the references used in this document.

Appendix A contains the Vadose Zone Soil Permeability Test Results.

Appendix B contains the monitoring well construction logs.

Appendix C contains the CH2M-Jones Memorandum, dated February 1, 2001, which summarizes the results of the data validation process for the samples collected during the IM investigation.

Appendix D contains the Form 1 analytical results from the soil gas and indoor air samples.

Appendix E contains the Form 1 analytical results from the groundwater samples collected from the monitoring wells installed as part of this investigation.

Appendix F contains the findings and results from the Farmer Model.

Appendix G contains the findings and results from the Johnson-Ettinger Model.

SECTION 2.0

Interim Measure Investigation Summary

2.0 Interim Measure Investigation Summary

This section summarizes the field activities completed as part of this IM, specifically addressing the approach and methodology used during the investigation in the collection of the soil gas, indoor air, and groundwater samples.

2.1 Soil Gas and Indoor Air Investigation

On December 20, 2000, 12 soil gas samples were collected from 11 locations around the perimeter of Building 225. These 11 sample locations, designated 225AS003 through 225AS011, are presented in Figure 2-1. A duplicate sample, identified as 225QS009, was collected from location 225AS009.

On December 19, 2000, one day prior to soil gas sample collection activities, a two-inch diameter hole was cored through the asphalt parking lot in each of the eight proposed sample locations surrounding Building 225, and through the concrete from the two stair well locations (225AS004 and 225AS008). Soil gas samples were not collected on this day due to a slight drop in barometric pressure stemming from a passing cold front; the barometric pressure was measured at 30 inches of mercury. However, on December 20, the barometric pressure increased to 30.4 inches of mercury and remained constant throughout the sampling event.

Eight soil gas samples were collected from within the asphalt parking area and one sample (225AS006) was collected from the vegetated area immediately south of the building through a hollow ½-inch diameter stainless steel vapor probe driven by a slide hammer to the groundwater table which lies approximately 4 ft bls. The stainless steel probe was advanced at an angle probe beneath the concrete sidewalk towards Building 225. Once the probe was advanced to approximately 4 ft bls, modeling clay was placed over the bore hole annulus at the surface to prevent atmospheric air from infiltrating the vadose zone during collection of the soil gas samples.

The vapor probe consisted of a one-foot lower section with an $^{11}/_{16}$-inch diameter swedged tip with port holes for soil gas sampling. The larger diameter swedged tip allowed for the collection of soil gas from the length of the vadose zone penetration including the uppermost portion of the vadose zone. The removable $^{3}/_{16}$-inch diameter inner rod prevented soil from entering the gas entry ports while the probe was driven to the desired

depth. Once the probe was advanced to the desired depth, the inner rod was removed, a sample port was installed at the end of the vapor probe, and ¾-inch diameter Teflon tubing was connected from the sample port to a photoionization detector (PID).

Prior to sample collection the soil vapor within the annulus was purged using a PID for approximately 60 seconds. In each soil gas boring, the PID reading peaked immediately and lowered to a stabilized ambient background level of approximately 0 to 0.18 parts per million (ppm) at the end of the 60 seconds. These peak PID concentrations are presented in Table 2-1.

The PID was disconnected and the Teflon tubing was quickly connected to a 6-liter Summa canister. The Summa canister valve was opened and the soil gas sample was collected until the constant audible filling sound was no longer heard (i.e., less than one minute). The canister was evacuated and cleaned under controlled laboratory conditions prior to receipt of the canisters. The resulting negative pressure within the canister was the driving force used to draw the soil gas into the canister during the collection process.

Immediately following the completion of soil gas sampling activities, a field test to measure the vadose zone permeability was conducted. The soil probe construction used and advanced during the soil gas sampling investigation was identical to the methodology used during the subsurface vadose zone permeability test. The soil probe was driven into the subsurface at an angle approximately 4 ft bls adjacent to soil gas sample location 225AS007.

The permeability test was conducted in accordance with the methodology outlined in the *EPA Air/Superfund National Technical Guidance Study Series, Assessing Potential Indoor Air Impacts for Superfund Sites*, dated September 1992. Permeability was calculated by measuring the gas pressure in the probe as a metered flow of air was passed through the probe and into the soil. The soil permeability test results and the calculation of the average soil permeability value are provided in Appendix A. In addition, Appendix A presents soil gas transport calculations that evaluate the primary mechanism of soil gas transport into Building 225 by either diffusion or convection.

At the conclusion of the soil gas sampling event, the soil gas borings and soil permeability test location were filled with a quick dry concrete mix.

On January 3, 2001, indoor air quality samples were collected in rooms 116 (225IS00101), 120 (225IS00202), and 122 (225IS00301), which are located on the ground floor of Building 225 and face the former dry cleaning facility. Because these unoccupied rooms are located on the first floor and face the former dry cleaning facility, they were selected to represent the

worst-case scenario for indoor air contaminant concentrations, compared to rooms on the second floor or on the opposite side or west side of Building 225. In addition, the heating, ventilation, and air conditioning (HVAC) systems were turned off in each room and the doors and windows were closed prior to and during the 8-hour sampling event to represent worst-case ventilation conditions.

Each Summa canister was placed towards the back of the room on a flat surface (i.e., table or dresser) approximately 3 to 5 ft from the floor. A metering valve calibrated in the laboratory and sent with the sample canisters was placed at the inlet value connection. Once opened, the metering valve allowed a constant flow into the canister during the 8-hour sample collection interval.

Prior to receipt, each Summa canister used in the soil gas and indoor air investigations were specially treated in the laboratory using a chemical etching process to deactivate the canister's inner surface. This deactivation process reduces, to negligible levels, the chemical deterioration of an air sample exposed to the canister's materials of construction.

The valves were tightened, the valve caps were replaced, and the sample identification tags were attached to each Summa canister prior to being packaged and delivered via overnight carrier to CH2M HILL's Applied Sciences Laboratory located in Corvallis, Oregon. The 12 soil gas samples and three indoor air samples were analyzed using EPA method TO-14A. Each constituent in the analyte list had target method detection limit of one part per billion by volume (ppbv).

In addition, five target chlorinated solvents (i.e., TCE, PCE, cis-1,2-dichloroethene, trans-1,2-dichlorethene, and vinyl chloride) were analyzed using the mass spectrometer (MS) in the selective ion monitoring (SIM) mode. By using the SIM mode the detector focuses on specific ions that are characteristic of the target compounds. This increases sensitivity and reduces interference. The method detection limit for the five chlorinated solvents using the SIM mode was 0.05 ppbv. The detection limits using the SIM are less than or equal to risk-based concentrations (RBCs) corresponding to a residential inhalation exposure.

2.2 Groundwater Investigation

An investigation was conducted to characterize the extent of chlorinated solvents in groundwater under Building 225, and to estimate the potential releases to the indoor air in the building. To evaluate the nature and extent of the chlorinated solvents under Building 225, seven permanent groundwater MWs were installed in the immediate area surrounding Building 225 on January 9 and 10, 2001. MWs 607GW022 and 607GW018 were installed on

the west side and south end of Building 225, respectively; while MWs 607GW024, 607GW023, and 607GW021 were placed along the east side of the building facing the dry cleaner facility. Finally, MWs 607GW026 and 607GW005 were installed along the western CNC property boundary to evaluate potential offsite migration impacts from the dissolved chlorinated solvent plume.

The MW installation activities were completed in accordance with the general procedures outlined in Section 5.0 of the approved Comprehensive Sampling and Analysis Plan (CSAP), prepared by EnSafe and dated July 30, 1996. In addition, well installation procedures and materials conformed to the requirements presented in the South Carolina Well Standards and Regulations (R.61-71), including the submittal and subsequent approval of the Water Well Record Form HDI (9-77) prior to initiation of MW installation activities.

The seven MWs were installed in the shallow portion of the surficial aquifer above a fine-grained, low permeability clay slit layer located a depth ranging from 8 to 12 ft bls. The wells were constructed such that the upper portion of the well screen intercepted the water table.

Monitoring wells were constructed of a 2-inch-diameter, 5-ft-long polyvinyl chloride (PVC) screen with threaded couplings and bottom plug/point, and a threaded 2-inch PVC riser pipe to reach the land surface. Each well was completed with a locking cover and cement pad, flush with grade. Appropriate sand filter pack and bentonite seal materials were installed, and the annular space was grouted to the land surface with Portland cement grout. MW construction diagrams for each of the wells installed during the IM investigation are provided in Appendix B.

Each of the newly installed wells was developed after the annular space grout was allow to cure for a minimum of 24 hours. The development procedures complied with the approved CSAP, including monitoring of development water parameters.

Groundwater samples were collected from MWs 607GW018, 607GW021, and 607GW022 on January 12, 2001. On January 15, 2001, a groundwater sample was collected from each of the four remaining newly installed MWs. As required in the IM Work Plan, the MWs were not sampled sooner than 48 hours after development to allow the groundwater to equilibrate after development, but were not sampled later than one week after the wells had been completed.

The groundwater sampling and analysis was conducted in accordance with the procedures outlined in the CSAP. The CSAP outlines all monitoring procedures to be performed during

the investigation to characterize the environmental setting, source, and releases of hazardous constituents. In addition, the CSAP includes the Quality Assurance Plan (QAP) and Data Management Plan (DMP) to verify that all information and data are valid and properly documented.

Field parameters measured and recorded during the sampling activities at each MW included the following:

- Purge volume
- Turbidity
- Dissolved oxygen (DO)
- pH
- Conductivity
- Water temperature
- Oxidation reduction potential (ORP)
- Depth to water prior to purging

The sampling strategy and procedures were performed in accordance with the Environmental Services Division *Standard Operating Procedures and Quality Assurance Manual* (ESDSOPQAM) (EPA, 1996).

The groundwater samples were delivered to General Engineering Laboratory on January 15, 2001, where they were analyzed for chlorinated solvents using EPA SW846, Method 8260B. Sample analysis was conducted in accordance with the guidance in the EPA's *Test Methods for Evaluating Solid Waste, SW-846, 3rd ed.*, Office of Solid Waste and Emergency Response (SW846) and in the EPA Environmental Services Division *Laboratory Operations and Quality Control Manual* (ESDLOQCM).

To evaluate groundwater flow direction in the area of Building 225, groundwater elevation measurements were collected from the shallow MWs located at AOC 607, including the seven wells installed in January 2001. Table 2-2 presents the groundwater elevation data from the shallow MWs collected on February 23, 2001. Figure 2-2 depicts the shallow zone potentiometric surface. The general interpretation of the potentiometric surface and direction of groundwater flow has not changed as a result of the groundwater elevation data obtained from the MWs installed during the IM investigation. The sanitary sewer line remains a depression in the potentiometric surface that appears to have slowed lateral contaminant migration.

TABLE 2-1
Soil Gas PID Measurements
IM Report, AOC 607, Building 225, Zone F, Charleston Naval Complex

Soil Gas Sample Location	Ambient Photoionization Detector Results (ppm)	Soil Gas Photoionization Detector Results (ppm)
225AS001	0.03	1.41
225AS002	0.08	2.08
225AS003	0.08	0.18
225AS004	0.09	2.52
225AS005	0.08	0.25
225AS006	0.03	2.18
225AS007	0.18	0.08
225AS008	0.10	0.19
225AS009	0.03	1.92
225AS010	0.00	0.18
225AS011	0.00	0.05

Note:

ppm parts per million

TABLE 2-2
Groundwater Elevation Data Shallow Groundwater Monitoring Wells — February 23, 2001
IM Report, AOC 607, Building 225, Zone F, Charleston Naval Complex

	Survey Information		February 23, 2001 Water Level Data	
Monitoring Well (Shallow Wells)	**Top of Casing Elevations (Feet above MSL)**	**Ground Elevation (Feet above MSL)**	**Depth to Groundwater (Feet below TOC)**	**Groundwater Elevation (Feet above MSL)**
607GW001	10.782	8.5	8.11	2.7
607GW002	8.3764	8.4	4.7	3.7
607GW003	7.9856	8.1	4.46	3.5
607GW004	10.1547	7.7	7.03	3.1
607GW006	7.49	7.5	5.52	2.0
607GW007	10.661	8.3	8.3	2.4
607GW008	7.649	7.9	4.57	3.1
607GW009	7.188	7.5	3.85	3.3
607GW010	10.34	7.33	7.27	3.1
607GW011	7.9	7.94	5.3	2.6
607GW012	8.98	9.06	5.05	3.9
607GW013	8.93	9.15	4.96	4.0
607GW014	9	9.08	4.75	4.3
607GW015	8.97	9.12	5.05	3.9
607GW016	8.9	9	5.32	3.6
607GW017	8.96	9.05	5.31	3.7
607GWE01	10.07	7.59	6.4	3.7
607GWP01	10.29	7.53	6.56	3.7
607GWP02	10.39	7.5	6.53	3.9
607GWV01	10.11	7.64	6.16	4.0
607GWV02	9.96	7.58	6.09	3.9
607GWV03	8.79	10.21	6.31	2.5
607GWV04	8.78	9.05	5.04	3.7
607GWV05	8.79	9.05	5.18	3.6

Note:
MSL mean sea level
TOC top of casing

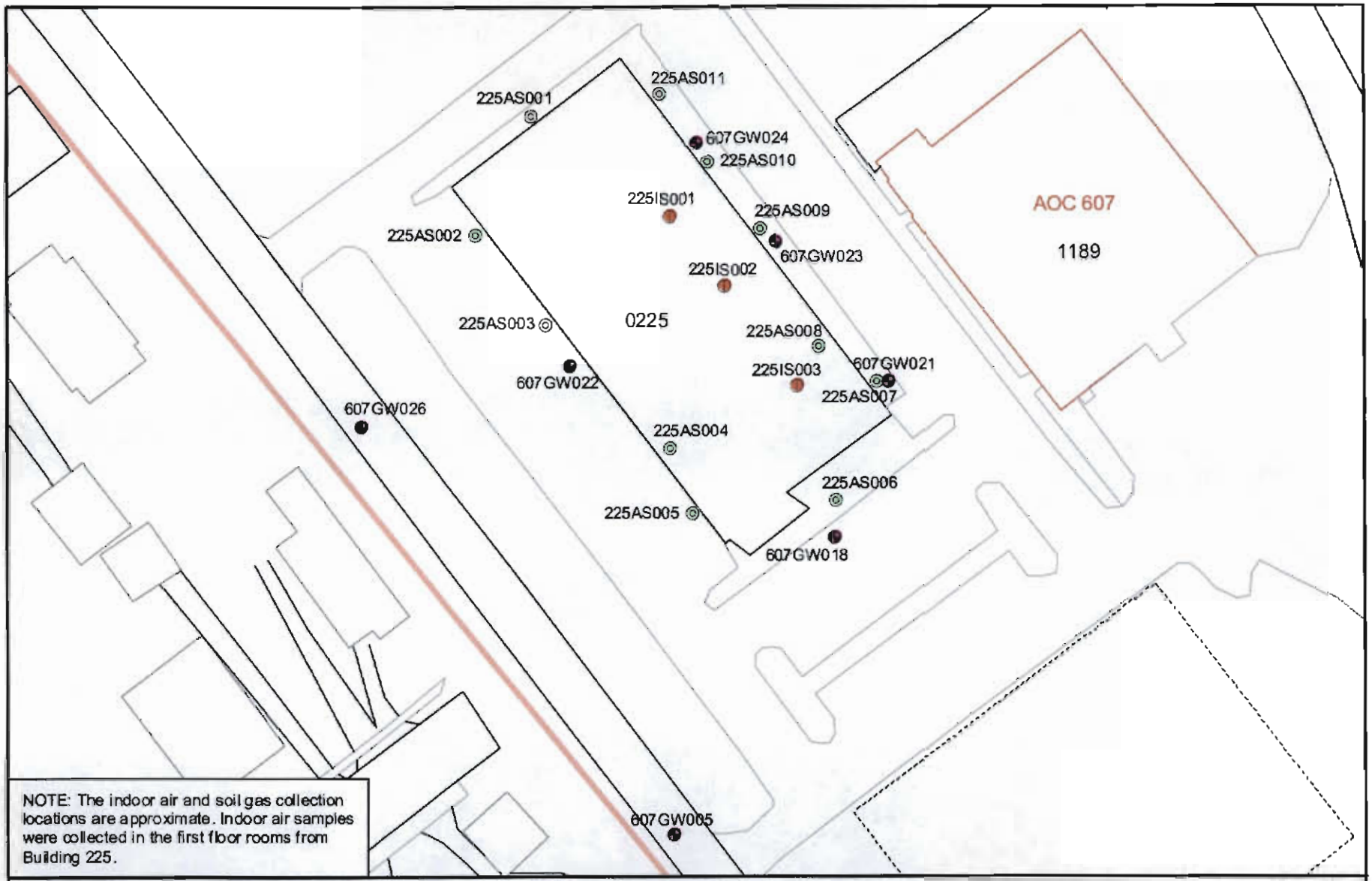

Figure 2-1
Interim Measure Sample Collection Locations
Building 225
Interim Measure Report
Zone F - AOC 607
Charleston Naval Complex

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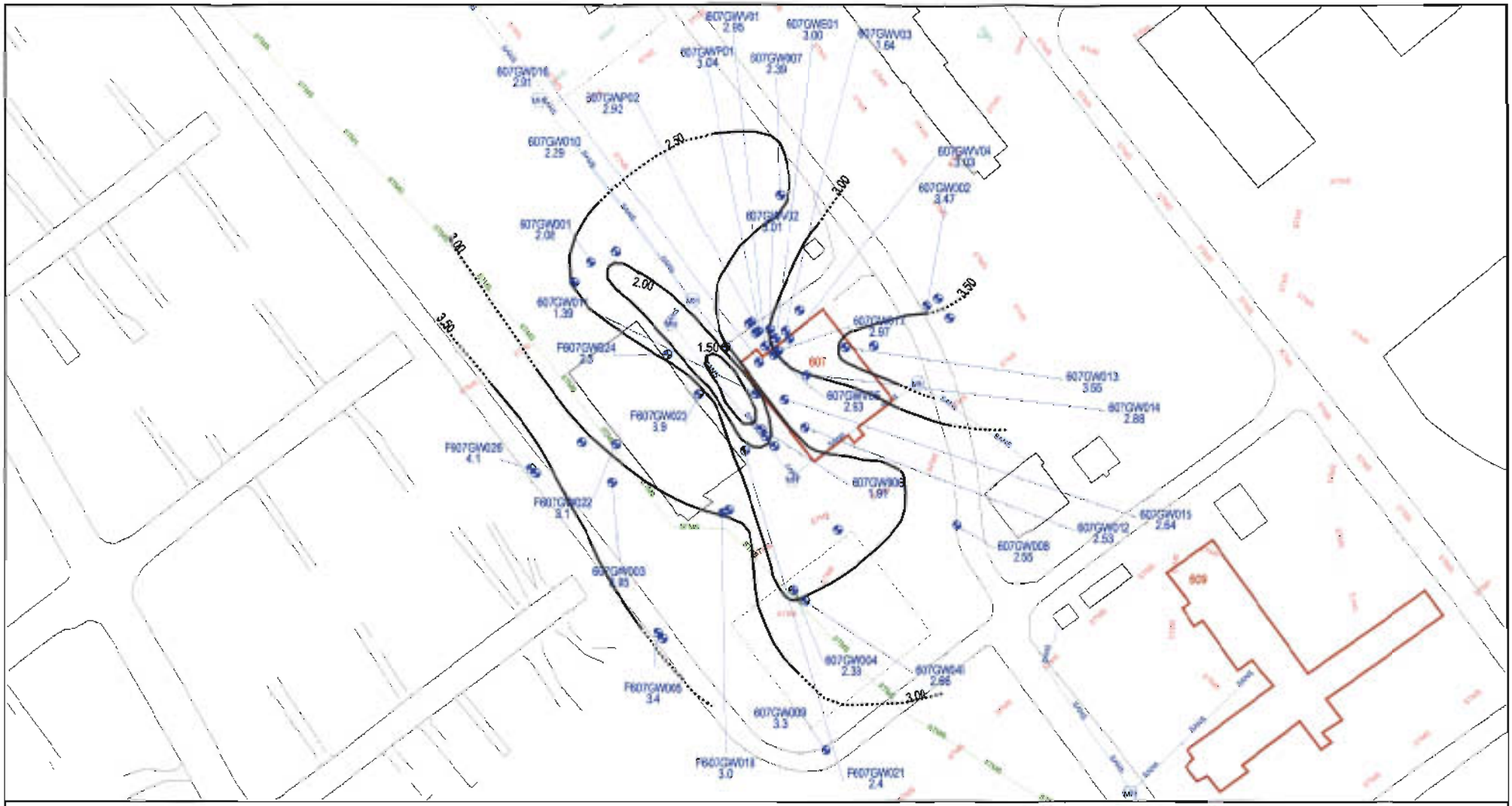

AOC Boundary
SWMU Boundary
Buildings
Groundwater Contours
Inferred
Known
Sanitary Sewer Lines (SANS)
Storm Sewer Line (STMS)

Sanitary Sewer Lines (SANS) - NS
Storm Sewer Line (STMS) - NS
Monitoring Well
3.1 = Groundwater Elevation (MSL)

N

1 inch = 85 Feet

0 40 80 120 Feet

Figure 2-2
Shallow Zone Potentiometric Surface
Building 225
Interim Measure Report
Zone F - AOC 607
Charleston Naval Complex

CH2MHILL

File Path:

SECTION 3.0

Interim Measure Investigation Results

3.0 Interim Measure Investigation Results

3.1 Soil Gas and Indoor Air Investigation Results

3.1.1 Soil Gas Sample Results

Table 3-1 presents the analytical results from the soil gas samples collected around the perimeter of Building 225. Several VOCs were detected in the 12 soil gas samples and the one laboratory duplicate identified as 225AS007DUP. A sample of the soil gas collected from sample location 225AS007 was analyzed twice by the laboratory. A field duplicate, identified as 225QS009, was collected from location 225AS009.

Three of the five target chlorinated solvent contaminants identified in the groundwater at AOC 607 were detected in the soil gas sample collected from 225AS007, located on the southeast corner of Building 225. These dry cleaning solvent-related VOCs are cis-1,2-DCE, TCE, and vinyl chloride, and were detected at concentrations of 0.578 ppbv, 1.02 ppbv, and 0.425 ppbv, respectively, in the sample collected from 225AS007.

The maximum concentrations of trans-1,2-DCE (0.86 ppbv) and PCE (11.4 ppbv) were detected in the soil gas samples collected from 225AS011 and 225AS006, respectively. Soil gas sample location 225AS011 is located on the northwest corner of Building 225 and 225AS006 is located on the south end of the facility. Except for soil gas location 225AS006, these sample locations with the maximum concentrations of chlorinated solvents are located on the side of Building 225 that faces the former dry cleaning facility. The location of the maximum soil gas concentrations correlates with the maximum concentrations of chlorinated solvents detected in the shallow portion of the surficial aquifer at AOC 607. The maximum concentrations of chlorinated solvents are present in MW 607GW006 which is located approximately 25 feet east of soil gas sample location 225AS007.

Petroleum hydrocarbon contaminants (benzene, ethylbenzene, toluene, and xylenes) were also detected in nine of the soil gas. The presence of these petroleum hydrocarbon constituents in soil gas can be attributed to potential leaking fluids from automobiles parked on the asphalt parking lot.

3.1.2 Indoor Air Sample Results

Table 3-1 presents the sampling results for the indoor air samples collected from Building 225. Trans-1,2-DCE, which was detected in the indoor air sample 225IS00101 at a

concentration of 0.11 ppbv, was the only constituent related to dry cleaning solvents that was detected in the three indoor air quality samples above the method detection limits. Chlorofluorocarbon (CFC) chemicals dichlorodifluoromethane and trichlorofluoromethane were low-level estimated at concentrations below the method detection limits in the indoor air quality samples. These CFCs are use in air conditioning and refrigiration units.

Chloromethane, which is a possible degradation chemical of freons or the dry cleaning chemicals, was estimated at a concentration of 0.6 ppbv (i.e., 1.26 micrograms per cubic meter [$\mu g/m^3$]) in each of the indoor air samples. It was the only contaminant from the three samples with a detected or estimated concentration slightly above its corresponding EPA Region IX residential RBC for air inhalation. The residential RBC for chloromethane is 1.1 $\mu g/m^3$ calculated for a 30-year exposure duration. However, using a two-year exposure duration for resident occupancy in Building 225, the residential RBC value would be 15 times greater (16.5 $\mu g/m^3$).

Table 3-1 presents a summary of the detected and estimated contaminant concentrations in the soil gas and indoor air samples. In addition, Table 3-1 presents the EPA Region IX RBC values for ambient air inhalation and the modified values based on a two-year exposure duration.

The analytical data from the soil gas and indoor air samples collected during the IM investigation were validated by CH2M-Jones. An internal memorandum, dated February 1, 2001, which presented the results of the data validation process is provided as Appendix C. Appendix D presents the soil gas and indoor air quality form 1 analytical results from the CH2M HILL Applied Sciences Laboratory.

3.2 Groundwater Investigation Results

PCE was detected in the samples collected from MWs 607GW021 and 607GW023 at concentrations of 3,880 micrograms per liter ($\mu g/L$) and 2,540 $\mu g/L$, respectively. In addition, TCE and vinyl chloride were detected in each of these samples at concentrations above their corresponding maximum contaminant level (MCL) concentrations of 5.0 $\mu g/L$ and 2.0 $\mu g/L$, respectively. The newly installed wells abut Building 225 along its east side which faces the dry cleaner facility.

PCE was the only chlorinated solvent constituent detected above laboratory detection limits in samples collected from MWs 607GW018 and 607GW022. It was detected at

concentrations of 7.1 µg/L and 23.9 µg/L, respectively, which exceeds its corresponding MCL of 5.0 µg/L.

Chlorinated solvent contaminants were not detected above laboratory detection limits in the groundwater samples collected from MWs 607GW005 and 607GW026 which were installed along the western CNC property boundary. The western property boundary is located approximately 95 ft west of Building 225. In addition, chlorinated solvent contaminants were not detected above laboratory detection limits in the sample collected from MW 607GW024. MW 607GW024 was installed at the east side of Building 225 approximately 45 feet northwest of newly installed MW 607GW023.

Elevated concentrations of chlorinated solvents detected in the samples collected from MW 607GW023 and 607GW021 indicate that the potential DNAPL in the area of MW 607GW006 has migrated to approximately 25 feet west to the perimeter of Building 225. In addition, the levels of these contaminants indicate that the existing sanitary sewer system located approximately 23 feet east of Building 225 has not completely influenced the containment of contaminant plume as originally believed. The presence of PCE in the groundwater sample collected from MW 607GW022 illustrates the potential of a localized dissolved chlorinated solvent plume under Building 225.

Table 3-2 presents the analytical results from the groundwater samples collected from the seven MWs installed during the IM investigation. Figure 3-1 presents a graphical representation of the chlorinated solvent contaminant concentrations from the samples collected during the IM investigation. Figures 3-2 and 3-3 present the nature and extent of PCE and TCE in the shallow portion of the surficial aquifer in the area of AOC 607.

The analytical data from the groundwater samples collected during the IM investigation were validated by CH2M-Jones. An internal memorandum, dated February 1, 2001, which presents the results of the data validation process is provided as Appendix C. Appendix E presents the form 1 analytical results from General Engineering Laboratory. The chain-of-custody and the form 1 analytical results associated with the sample collected from 607GW026 indicate a sample identification of 607GW003. The groundwater sample collected from the newly installed well 607GW026 was inadvertently identified as 607GW003 on the chain-of-custody.

TABLE 3-1
Soil Gas And Indoor Air Analytical Results
IM Report, AOC 607, Building 225, Zone F, Charleston Naval Complex

Parameter	Location	Concentration (ppbv)	Maximum Concentration ($\mu g/m^3$)	Maximum Indoor Air Concentration[1] ($\mu g/m^3$)	Ambient Air RBC[2] ($\mu g/m^3$)	Ratio Maximum Indoor Air Concentration/ Ambient Air RBC	Ambient Air RBC[3] Two-Year Exposure ($\mu g/m^3$)
			EPA Method TO 14A				
Benzene	225AS00301	2.2	23.7	0.195	0.25	0.78	3.75
	225AS00601	0.6J					
	225AS00701	6.8					
	(225AS00701)	**7.3**					
	225AS00901	1.7					
	225QS00901	0.8J					
	225AS01001	1 4					
	225AS01101	0.6J					
Chloroform	225AS00201	0.6J	3.5	0.036	0.084	0.43	1.26
	225AS00301	**0.7J**					
	225AS00901	0.6J					
	225QS00901	0.5J					
Chloromethane	225AS00301	**1.1**	2.3	0.029	1.1	0.03	16.5
	225AS00701	1.0J					
	(225AS00701)	1.1J					
	225AS00801	0.6J					
	225AS01001	0.8J					
	225AS01101	0.7J					
	225IS00101	**0.6J**	1.26	1.26	1.1	1.1	16 5
	225IS00202	**0.6J**					
	225IS00301	**0.6J**					
1,4-Dichlorobenzene	225AS00301	**0.6J**	3.7	0.025	0 31	0.08	4 65
Dichlorodifluoromethane	225AS00801	0.6J	3 5	0.021	210	0.0001	3,150
	225AS00901	0.6J					
	225QS00901	0.6J					
	225AS01001	**0.7J**					
	225IS00101	0.6J	3.5	3.5	210	0.017	3,150
	225IS00202	**0.7J**					
	225IS00301	0.6J					
1,1-Dichloroethene	225AS01001	**0.7J**	2.8	0.025	0.038	0.67	0.57

TABLE 3-1
Soil Gas And Indoor Air Analytical Results
IM Report, AOC 607, Building 225, Zone F, Charleston Naval Complex

Parameter	Location	Concentration (ppbv)	Maximum Concentration ($\mu g/m^3$)	Maximum Indoor Air Concentration[1] ($\mu g/m^3$)	Ambient Air RBC[2] ($\mu g/m^3$)	Ratio Maximum Indoor Air Concentration/ Ambient Air RBC	Ambient Air RBC[3] Two-Year Exposure ($\mu g/m^3$)
cis-1,2-Dichloroethene	225AS00401	0.14	2.3	0.017	37	0.0005	555
	225AS00701	**0.578**					
	225AS01001	0.2					
	225AS01101	0.11					
trans-1,2-Dichloroethene	225AS00301	0.247	3.47	0.025	73	0.0003	1,095
	225AS01101	**0.86**					
	225IS00101	**0.12**	0.48	0.48	73	0.007	1,095
Ethylbenzene	225AS00301	0 6J	7.5	0.056	1,100	0 0001	16,500
	225AS00701	**1.7J**					
	(225AS00701)	**1.7J**					
Hexachlorobutadiene	225AS00301	**2.3**	24.7	0.139	210	0.0007	3,150
Methylene Chloride	225AS00201	0.5J	6.7	0.068	4.1	0.02	61.5
	225AS00301	0.9J					
	225AS00401	1 4					
	225AS00501	0.7J					
	225AS00701	1.4J					
	(225AS00701)	1.8					
	225AS00801	0 6J					
	225AS00901	0.7J					
	225QS00901	0.7J					
	225AS01001	0 8J					
	225AS01101	**1.9**					
	225IS00101	**0.5J**	1.77	1.77	4.1	0.4	61.5
Styrene	225AS00301	0.6J	9.5	0.065	1,100	0.0001	16,500
	225AS00701	2.1					
	(225AS00701)	**2.2**					
	225AS00901	0 7J					

TABLE 3-1
Soil Gas And Indoor Air Analytical Results
IM Report, AOC 607, Building 225, Zone F, Charleston Naval Complex

Parameter	Location	Concentration (ppbv)	Maximum Concentration ($\mu g/m^3$)	Maximum Indoor Air Concentration[1] ($\mu g/m^3$)	Ambient Air RBC[2] ($\mu g/m^3$)	Ratio Maximum Indoor Air Concentration/ Ambient Air RBC	Ambient Air RBC[3] Two-Year Exposure ($\mu g/m^3$)
Tetrachloroethene	225AS00101	7.8	78.6	0.567	3.3	0.17	49.5
	225AS00201	0 27					
	225AS00301	0.237					
	225AS00401	1.3					
	225AS00501	0 121					
	225AS00601	**11.4**					
	225AS00701	0.612					
	(225AS00701)	1.0J					
	225AS01001	0.15					
	225AS01101	0.94					
Toluene	225AS00301	6.4	69	0.591	400	0.0015	6,000
	225AS00401	0.5J					
	225AS00501	2.2					
	225AS00601	1.4					
	225AS00701	17 7					
	(225AS00701)	**18.0**					
	225AS00801	0.8J					
	225AS00901	3.6					
	225QS00901	2.1					
	225AS01001	1.9					
	225AS01101	1.2					
1,2,4-Trichlorobenzene	225AS00301	**1.3**	9 8	0.0294	210	0.00014	3,150
Trichloroethene	225AS00101	0 051	5.6	0.044	1.1	0.04	16.5
	225AS00301	0.175					
	225AS00401	0.11					
	225AS00501	0.293					
	225AS00701	**1.02**					
	(225AS00701)	1.5J					
	225AS00901	0.063					
	225QS00901	0.11					
	225AS01001	0.19					
	225AS01101	0.15					
Trichlorofluoromethane	225IS00202	0.5J	4.0	4.0	730	0 0055	10,950
	225IS00301	**0.7J**					
1,2,4-Trimethylbenzene	225AS00901	**0.5J**	2 5	0.016	6.2	0.0026	93

TABLE 3-1
Soil Gas And Indoor Air Analytical Results
IM Report, AOC 607, Building 225, Zone F, Charleston Naval Complex

Parameter	Location	Concentration (ppbv)	Maximum Concentration ($\mu g/m^3$)	Maximum Indoor Air Concentration[1] ($\mu g/m^3$)	Ambient Air RBC[2] ($\mu g/m^3$)	Ratio Maximum Indoor Air Concentration/ Ambient Air RBC	Ambient Air RBC[3] Two-Year Exposure ($\mu g/m^3$)
1,1,2-Trichloro-1,2,2-Trifluoroethane	225AS00301	**0.8J**	6.2	0.018	31,000	0.000001	465,000
Vinyl Chloride	225AS00301	0.0937	1.11	0.012	0.22	0.05	3 3
	225AS00401	0.1					
	225AS00501	0 0758					
	225AS00701	**0.425**					
	225AS01001	0.27					
	225AS01101	0.1					
m,p-xylenes	225AS00301	1.5J	13.7	0.105	730	0.0001	10,950
	225AS00501	2.8					
	225AS00701	**3.1J**					
	(225AS00701)	**3.1J**					
o-xylene	225AS00301	1.2	10.2	0.088	730	0.0001	10,950
	225AS00501	0.7J					
	225AS00701	**2.3**					
	(225AS00701)	**2.3**					
	225AS01001	0.5J					

Notes:

[1] Indoor air concentration calculated using the Farmer Model (U S. Environmental Protection Agency. *Air/Superfund National Technical Guidance Study Series. Appendix A* September 1992).
[2] EPA Region IX residential RBC for ambient air.
[3] Modified EPA Region IX residential RBC for ambient air assuming exposure for 2-years (i.e., 700 days), 24 hours/day, at an inhalation rate of 20 m^3/day.

Concentration values presented in bold text indicate maximum concentrations in ppbv.

(225AS00701) is the laboratory duplicate of sample 225AS00701
225QS00901 is the sample duplicate collected at location 225AS009.

Sample 225IS00101 was collected from room 116 in Building 225.
Sample 225IS00202 was collected from room 120 in Building 225.
Sample 225IS00301 was collected from room 122 in Building 225.

$\mu g/m^3$ micrograms per cubic meter
ppbv parts per billion by volume

J Indicates an estimated value. A "J" qualifier may signify that the concentration is below the PQL, or that the "J" has been applied as a result of the data validation process, and to consider the numeric value as estimated.

TABLE 3-2
Groundwater Analytical Results
IM Report, AOC 607, Building 225, Zone F, Charleston Naval Complex

Monitoring Well Location/Contaminant	PCE (µg/L)	TCE (µg/L)	Vinyl Chloride (µg/L)	cis 1,2-DCE (µg/L)	trans 1,2-DCE (µg/L)
607GW026	1U	1U	1U	1U	1U
607GW005	1U	1U	1U	1U	1U
607GW018	7.1	1U	1U	1U	1U
607GW021	3880	174	4.8	71.6	0.81 J
607GW022	23.9	0.81J	1U	1U	1U
607GW023	2540	214	6.1	66.9	1.2
607GW024	1U	1U	1U	1U	1U

Notes:

PCE	Tetrachloroethene
TCE	Trichloroethene
cis-1,2-DCE	cis-1,2-Dichloroethene
trans-1,2-DCE	trans-1,2-Dichloroethene
µg/L	micrograms per liter
U	Contaminant was not detected above laboratory detection limit.
J	Indicates an estimated value. A "J" qualifier may signify that the concentration is below the PQL or that the "J" has been applied as a result of the data validation process, and to consider the numeric value as estimated.

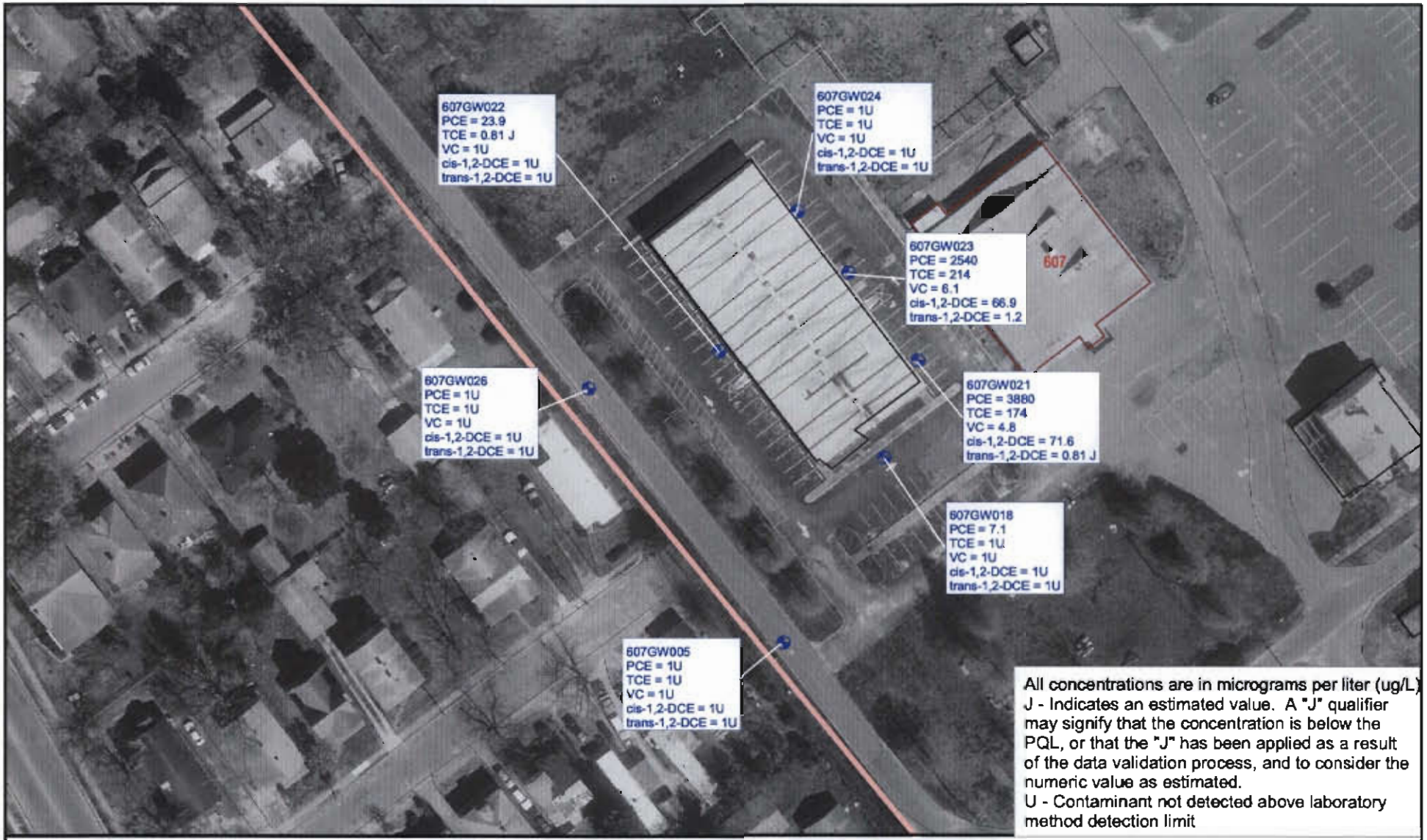

Figure 3-1
Chlorinated Solvent Contaminant Concentrations, January 2001
Building 225
Interim Measure Report
Zone F - AOC 607
Charleston Naval Complex

CH2MHILL

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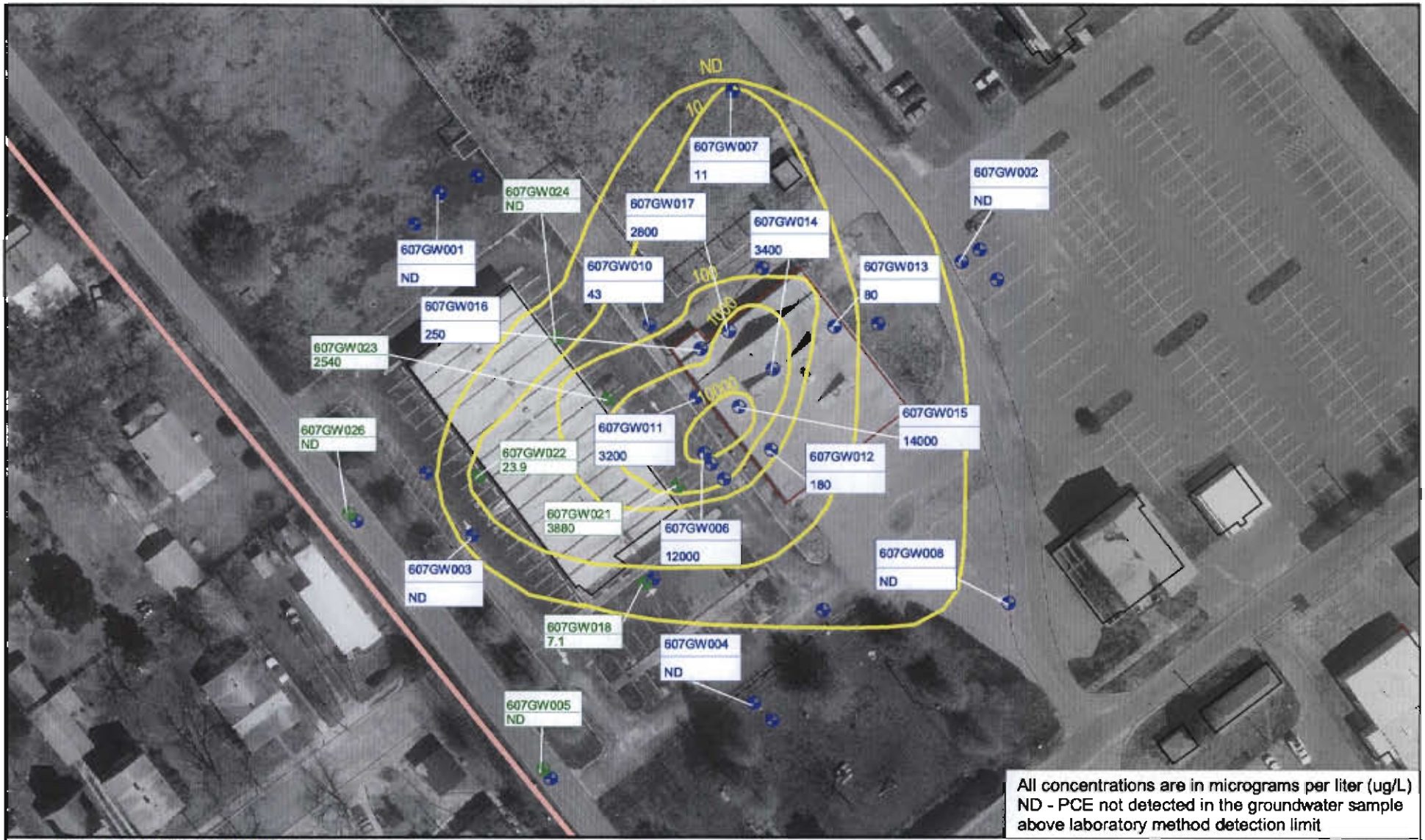

Figure 3-2
Nature and Extent of PCE in the Shallow Portion of the Surficial Aquifer
Building 225
Interim Measure Report
Zone F - AOC 607
Charleston Naval Complex

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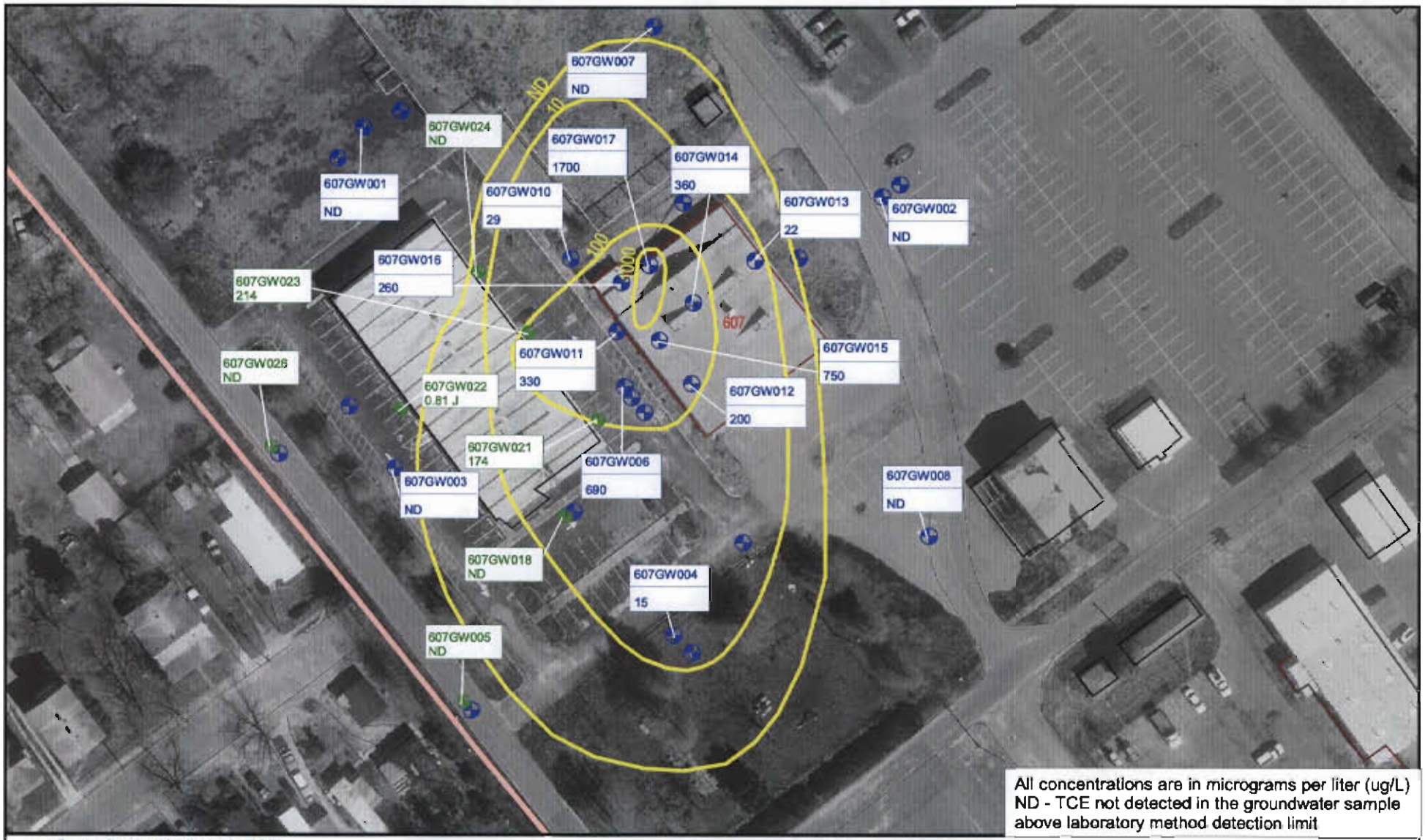

Figure 3-3
Nature and Extent of TCE in the Shallow Portion of the Surficial Aquifer
Building 225
Interim Measure Report
Zone F - AOC 607
Charleston Naval Complex

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SECTION 4.0

Interpretation of Analytical Results

4.0 Interpretation of Analytical Results

Three different types of data were collected from the perimeter and inside of Building 225. These include soil gas samples, indoor air samples, and groundwater samples. All three sets of data were evaluated to characterize potential indoor air concentrations and to verify that Building 225 residents are adequately protected from potential emissions from subsurface chlorinated solvents related to the former dry cleaning operations.

4.1 Soil Gas Results

The analytical results from the soil gas samples were used to evaluate potential indoor air chemical concentrations in Building 225. The indoor air estimates are based on two separate models. One model estimates the rate of movement of soil gas through soil to the surface (the Farmer Model). The second model estimates the entry of the airborne contamination into the building through floor cracks, dilution, and dispersion due to ventilation and air volume in the building.

The soil gas flux rate is the rate of movement of soil gas through soil into the space above the ground surface and was estimated using the Farmer Model, selected from EPA guidance (EPA, September 1992). The model estimates soil gas contaminant flux rate through the vadose zone by Fickian diffusion.

The model conservatively assumes the soil gas contaminant concentrations do not decrease by transport to the surface and the depth to the top of the pollutant source remains constant. In addition, the Farmer Model assumes complete equilibrium between contaminants in the soil gas, groundwater, and vadose zone soil and it ignores all attenuation factors such as loss due to higher air replacement rates and chemical degradation.

Once contaminant fluxes are calculated the indoor air concentrations are estimated using infiltration, dilution, and dispersion of the soil gas into the building air using a portion of the Johnson and Ettinger model for indoor air concentration estimates. These estimated indoor air concentrations were compared to the EPA Region IX residential RBC values for air inhalation. None of the estimated indoor air concentrations were above their corresponding residential RBC values for air inhalation, even when the RBC values are based on the assumption that a resident lives in the building for 30 years.

Appendix F presents the results of the Farmer Model soil gas flux calculations and the estimated indoor air concentrations. Table F-1 depicts the calculated air diffusion coefficient and the maximum and average soil gas concentration and soil gas flux value for each of the detected or estimated contaminants. Tables 4-1 and F-2 present the estimated maximum and average indoor air concentration for each of the contaminants detected or estimated in the soil gas samples and their corresponding residential RBC value for air inhalation on a basis of a 30-year exposure duration. In addition, Tables 4-1 and F-2 present a ratio of the maximum estimated air concentration to the residential RBC value for each constituent. All of these ratios were less than 1.0 for the soil gas sample constituents indicating none of the estimated indoor air concentrations exceed their corresponding residential air inhalation RBC value.

4.2 Indoor Air Sampling Results

Indoor air samples were collected to obtain measured concentrations, in lieu of calculated indoor air contaminant concentrations estimated by modeling. However, due to the potential for high variability in such measured values, and confusion with other indoor sources, the sampling was limited to three samples collected from three separate rooms located on the ground floor of Building 225 facing the dry cleaning facility. The doors to the rooms were kept closed during the sampling event to minimize ventilation and to present the most conservative sample collection scenario.

Table 4-2 presents the analytical results compared to the ambient air RBC values for residents. There were five chemicals detected, of which methylene chloride and trichlorofluoromethane are not presented in site groundwater; therefore, they may not originate from the dry cleaning operations at AOC 607. Both of the chlorofluoromethane (halomethane) compounds are typically present in refrigerants, and are not likely related to the former dry cleaning operations. Of the detected chemicals, 1,2-dichloroethene is the only chemical likely related to dry cleaning solvents. Chloromethane can be a degradation product of either freons or dry cleaning chemicals.

Of the detected chemicals, chloromethane slightly exceeds the ambient air RBC, but does not exceed a RBC value more indicative to Building 225 residents (i.e., resident occupancy of two years).

4.3 Groundwater Sampling Results

The analytical results from the groundwater samples collected from the seven newly installed wells were used to evaluate potential indoor air concentrations in Building 225 by using the Groundwater Tier 2, EPA's Johnson-Ettinger Model. The Johnson-Ettinger Model is used to estimate indoor air concentrations from subsurface groundwater dry cleaning solvent contamination. The model estimates vapor infiltration through cracks or openings in the foundation and dilution, dispersion, and replacement due to air replacement in the building. Some of the underlying assumptions of this model include the fact that contaminant source is infinite with respect to modeling time of interest (EPA, September 2000).

The indoor air concentrations were estimated for the five chlorinated solvents analyzed in the groundwater samples using both average and maximum groundwater concentrations, and the Groundwater Tier 2 assumptions (see Table G-1 in Appendix G). The indoor air results, and associated excess lifetime cancer risk (ELCR) and hazard index (HI) were estimated using the maximum concentration from the five detected chlorinated solvent contaminants. The results are presented in Table 4-3. The model assumed a two-year indoor air contaminant exposure duration. The summation of ELCR and HI from the carcinogenic constituents PCE, TCE, and vinyl chloride were compared to a cancer risk of 1E-06 (i.e., one per million residents of Building 225). The summation of these carcinogenic constituents is 1.55E-06. However, when using the average concentrations of the three constituents detected in the groundwater samples the cancer risk becomes less than 1E-06. The summation using the average concentrations is 7.76E-07 (see Table G-1, Appendix G). These estimated risks are considered acceptable, given the conservative assumptions used in risk estimates and in the Johnson-Ettinger Model.

The maximum estimated indoor air concentrations of the non-carcinogenic constituents cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride were compared to a hazard index of 1.0. The hazard index summation of these constituents is approximately four orders of magnitude less than the EPA acceptable hazard index of 1.0.

Appendix G presents the results of the Groundwater Tier 2, Johnson-Ettinger Model calculations. Table G-1 provides the maximum and average groundwater concentration for each contaminant; the maximum and average estimated indoor air concentration for each contaminant; the maximum and average excess lifetime cancer risk for the PCE, TCE, and vinyl chloride; and the hazard index for cis 1,2-DCE, trans-1,2-DCE, and vinyl chloride.

TABLE 4-1
Estimated Indoor Air Concentrations from Soil Gas Data and Comparisons with Residential RBCs
IM Report, AOC 607, Building 225, Zone F, Charleston Naval Complex

Parameter	Maximum Concentration ($\mu g/m^3$)	Average Concentration ($\mu g/m^3$)	RBC (ambient air)** ($\mu g/m^3$)	Maximum Ratio* (Maximum Conc/RBC)
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.018	0.018	31000	0.000001
1,1-Dichloroethene	0.025	0.025	0.038	0.67
1,2,4-Trichlorobenzene	0.029	0.029	210	0.00014
1,2,4-Trimethylbenzene	0.016	0.016	6.2	0.0026
1,4-Dichlorobenzene	0.025	0.025	0.31	0.08
Benzene	0.195	0.063	0.25	0.78
Chloroform	0.036	0.033	0.084	0.43
Chloromethane	0.029	0.022	1.1	0.03
Cis-1,2-Dichloroethene	0.017	0.008	37	0.0005
Dichlorodifluoromethane	0.021	0.019	210	0.0001
Ethylbenzene	0.056	0.038	1100	0.0001
Hexachlorobutadiene	0.139	0.139	210	0.0007
m,p-xylenes	0.105	0.084	730	0.0001
Methylene Chloride	0.068	0.035	4.1	0.02
o-xylene	0.088	0.045	730	0.0001
Styrene	0.065	0.035	1100	0.0001
Tetrachloroethene	0.567	0.126	3.3	0.17
Toluene	0.591	0.132	400	0.0015
Trans-1,2-Dichloroethene	0.025	0.016	73	0.0003
Trichloroethene	0.044	0.011	1.1	0.04
Vinyl Chloride	0.012	0.005	0.22	0.05

Notes:

RBC risk-based concentration
$\mu g/m^3$ micrograms per cubic meter
See Appendix F for further details.

* = Ratio >1.0 indicates exceedence of permissible exposure levels. None exceeded a value of 1.0.
** - Air Inhalation RBC value for Residents of Building 225, assuming 2 years of residence in the building will be 15 times higher than the ambient air RBCs.

TABLE 4-2
Measured Indoor Air Concentrations - Risk Evaluation
IM Report, AOC 607, Building 225, Zone F, Charleston Naval Complex

Chemical	Concentration (ug/m^3)		Ambient Air RBC* (ug/m^3)	RBC for Bldg. 225**	Ratio (Max/RBC) (<1 is acceptable)
	Maximum	Average			
Chloromethane	1.26	1.26	1.1	16.5	**1.1**
Methylene Chloride	1.77	1.77	4.1	61.5	**0.4**
Trichlorofluoromethane	5.46	4.68	730	10950	**0.007**
Dichlorodifluoromethane	3.52	3.17	210	3150	**0.017**
Trans-1,2-Dichloroethene	0.48	0.48	73	1095	**0.007**

Notes:

RBC risk-based concentration
$\mu g/m^3$ micrograms per cubic meter

Sample 225IS00101 was collected from Room 116 in Building 225.
Sample 225IS00202 was collected from Room 120 in Building 225.
Sample 225IS00301 was collected from Room 122 in Building 225.

* - Ambient RBC value is selected from EPA Region IX PRG Tables, and represents a resident living in the same location for 30 years.
** - Air Inhalation RBC value for residents of Building 225, assuming 2 years of residence in the building.

TABLE 4-3
Summary of EPA's Johnson-Ettinger Indoor Air Model Output for Bldg. 225 – Groundwater Data
IM Report, AOC 607, Building 225, Zone F, Charleston Naval Complex

Chemical	Cas. No.	Maximum Groundwater Concentration (µg/L)	Est. Maximum Indoor Air Concentration ($\mu g/m^3$)	Maximum ELCR	Maximum HI
Tetrachloroethene	127184	3880.0	87.1	1.38E-06	--
Trichloroethene	79016	214.0	2.9	1.35E-07	--
Vinyl chloride	75014	6.1	0.27	3.28E-08	0.00017
cis-1,2-dichloroehthene	156592	71.6	0.37	--	0.000680404
trans-1,2-dichloroethene	156605	1.2	0.014	--	0.00001
Total:				**1.55E-06**	**0.00087**

Notes:

C Carcinogen
NC Non-carcinogen
ELCR Excess Lifetime Cancer Risk
HI Hazard Index

µg/L micorgrams per liter
$\mu g/m^3$ micrograms per cubic meter

Cancer risk (ELCR) within 1 in a million level, and HI at or below 1.0 is considered acceptable.
Appendix G includes all individual Johnson-Ettinger Model scenarios.

SECTION 5.0

References

5.0 References

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EPA. Test Methods for Evaluating Solid Waste. EPA-SW-846, 3rd Revision. 1997.

EPA. *Method TO-14 "Determination of Volatile Organic Compounds (VOCs) in Ambient Air Using Summa Passivated Canister Sampling and Gas Chromatographic Analysis."* 1998.

APPENDIX A

Vadose Zone Soil Permeability Test Results

APPENDIX A
SOIL PERMEABILITY CALCULATIONS
Building 225, AOC 607 - Zone F
Charleston Naval Complex, North Charleston, South Carolina

OBJECTIVE: Calculate soil permeability around Building 225, Zone F, using data obtained during field permeability test. Use soil permeability to evaluate main transport mechanism of soil gas into a building.

Section 1: Soil Permeability Calculations

Assuming Darcy flow, soil permeability can be calculated from the following equation (as described in Section B.1.4 of the Air/Superfund National Technical Guidance Study Series, Assessing Potential Indoor Air Impacts for Superfund Sites [USEPA, 1992]):

$$K_v = \frac{Q\mu}{4\pi r^2 P}$$

Where,
K_v = Permeability (m^2)
Q = Air Flow Rate (m^3/s)
μ = Viscosity of Air (kg/m-s)
r = Internal Radius of Probe (m)
P = Probe Pressure (Pa)

Given:

Q_1 = 100 cc/min =	1.67E-06 m^3/s
Q_2 = 50 cc/min =	8.33E-07 m^3/s
Q_3 = 25 cc/min =	4.17E-07 m^3/s
P_1 = 500 Pa	
P_2 = 390 Pa	
P_3 = 300 Pa	
μ = 1.83 *10^5 kg/m-s	
r = 0.1875 in =	0.0047625 m

Calculations:

i	Q_i (m^3/s)	P_i (Pa)	$K_{v,i}$ (m^2)	$K_{v,i}$ (cm^2)
1	1.67E-06	500	2.14	21,400
2	8.33E-07	390	1.37	13,700
3	4.17E-07	300	0.89	8,900
Geometric Mean			**1.38**	**13,800**

Section 2: Peclet Number Calculation

The Peclet number is a dimensionless number that can be used to measure the relationship between transport through advection and transport through diffusion or dispersion. The following equation is used:

$$Pe = \frac{v_x d}{D_d}$$

Where,
Pe = Peclet number
V_x = Average Linear Velocity (m/s)
d = Average Grain Size (m)
D_d = Molecular Diffusion Coefficient

APPENDIX A (CONTINUED)
SOIL PERMEABILITY CALCULATIONS
Building 225, AOC 607 - Zone F
Charleston Naval Complex, North Charleston, South Carolina

Part (A):

$$V_x = \frac{Q}{nA}$$

Where, Q = Air Flow Rate (m^3/s)
n = Effective Soil Porosity
A = Area of Probe (m^2)

Given: Q = 8.3E-7 m^3/s (Geometric mean of 3 flow rates listed above)
$A = \pi * r^2 = 7.1E\text{-}5\ m^2$

Assume: n = 0.533 (Average porosity, shelby tube analyses, shallow zone - AOC 607, Zone F RFI, EnSafe, 1997)

Calculations: V_x = 2.19E-02 m/s

Part (B): **Assume** that d is a relationship of the hydraulic conductivity.
Conductivity can be calculated from the following equation:

$$K = Kv\frac{\rho g}{\mu}$$

Where, K = Hydraulic Conductivity (m/s)
ρ = Density of Air
g = Gravity Constant

Given: ρ = 1.29 kg/m^3
g = 9.8 m/s^2
μ = 1.83 *10^5 kg/m-s
Kv = 1.38 m^2

Calculations: K = 9.53E-05 m/s

Consequently, d is estimated using the following relationship (for Channel Deposits):

$$K\ (ft/day) = 450d\ (mm)^{1.65}$$ (Fetter, 1994)

Which implies: d = 9.02E-08 m

Part (C): **Assume** Dd is the geometric average of the effective diffusion coefficient, for all parameters listed in Farmer Model Calculations.

This implies Dd can be estimated with following equation

$$D_d = \frac{D_A P_a^{10/3}}{P_T^2}$$

Where, D_A = Air Diffusion coefficient (Area/Time)
P_a = Air Filled Soil Porosity
P_T = Total Soil Porosity

APPENDIX A (CONTINUED)
SOIL PERMEABILITY CALCULATIONS
Building 225, AOC 607 - Zone F
Charleston Naval Complex, North Charleston, South Carolina

Given: Refer to Farmer Model soil gas calculations for input.

Calculations: Dd = 3.2E-06 m^2/s

Part (D): **Conclusions**

Using the equation listed above, the Peclet number was calculated as:

Pe = 6.18E-04

Since the Peclet number is very small (>>1), it implies that diffusion dominates convection as a transport mechanism. This indicates that any soil gas flux calculations may be overestimated.

APPENDIX B

Monitoring Well Construction Logs

CH2MHILL

PROJECT NUMBER	WELL NUMBER	
158814	F607GW021	SHEET 1 OF 1

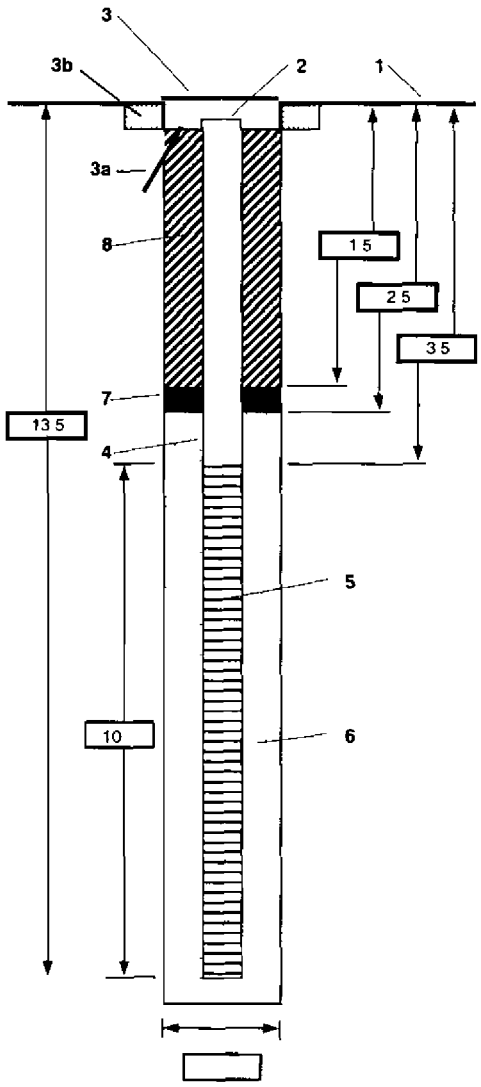
WELL COMPLETION DIAGRAM

PROJECT Charleston Naval Complex, AOC 607 LOCATION Charleston, SC

DRILLING CONTRACTOR Environmental Enterprise Goup

DRILLING METHOD AND EQUIPMENT USE Hollow Stem Auger

WATER LEVELS 6 5 START 01/09/2001 END 01/09/2001 LOGGER Darryl Gates



1- Ground elevation at well	8.0270
2- Top of casing elevation	
3- Wellhead protection cover type	Flush
a) drain tube?	Yes
b) concrete pad dimensions	24'x24'
4- Dia /type of well casing	2 inch PVC schedule 40
5- Type/slot size of screen	2 inch PVC schedule 40, 0 01 slot screen
6- Type screen filter	20/30 silica
a) Quantity used	5 - 50 lb bags of sand
7- Type of seal	Bentonite
a) Quantity used	
8- Grout	
a) Grout mix used	
b) Method of placement	Trimie Pipe
c) Vol of well casing grout	
Development method	Surge Block
Development time	
Estimated purge volume	

Comments Grout weight =

Total Depth (BTOC) =

Final field parameters collected during well development ( )

pH =

conductivity =

temperature =

Note: Diagram not to scale.

CH2MHILL

PROJECT NUMBER	WELL NUMBER	
158814	F607GW022	SHEET 1 OF 1

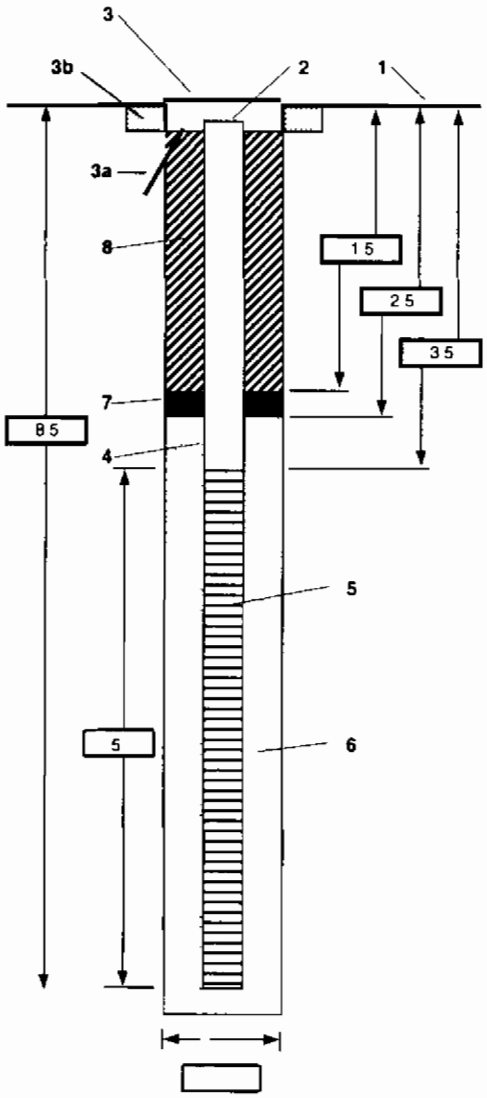
WELL COMPLETION DIAGRAM

PROJECT Charleston Naval Complex, AOC 607 LOCATION Charleston, SC

DRILLING CONTRACTOR Environmental Enterprise Goup

DRILLING METHOD AND EQUIPMENT USED Hollow Stem Auger

WATER LEVELS 5 5 START 01/09/2001 END 01/09/2001 LOGGER Darryl Gates



1- Ground elevation at well	8 2122
2- Top of casing elevation	
3- Wellhead protection cover type	Flush
a) drain tube?	Yes
b) concrete pad dimensions	24'x24'
4- Dia /type of well casing	2 inch PVC schedule 40
5- Type/slot size of screen	2 inch PVC schedule 40, 0 01 slot screen
6- Type screen filter	20/30 silica
a) Quantity used	4 - 50 lb bags of sand
7- Type of seal	bentonite
a) Quantity used	
8- Grout	
a) Grout mix used	
b) Method of placement	Tremie Pipe
c) Vol of well casing grout	
Development method	Surge Block
Development time	
Estimated purge volume	

Comments Grout weight =

Total Depth (BTOC) =

Final field parameters collected during well development (

pH =

conductivity =

temperature =

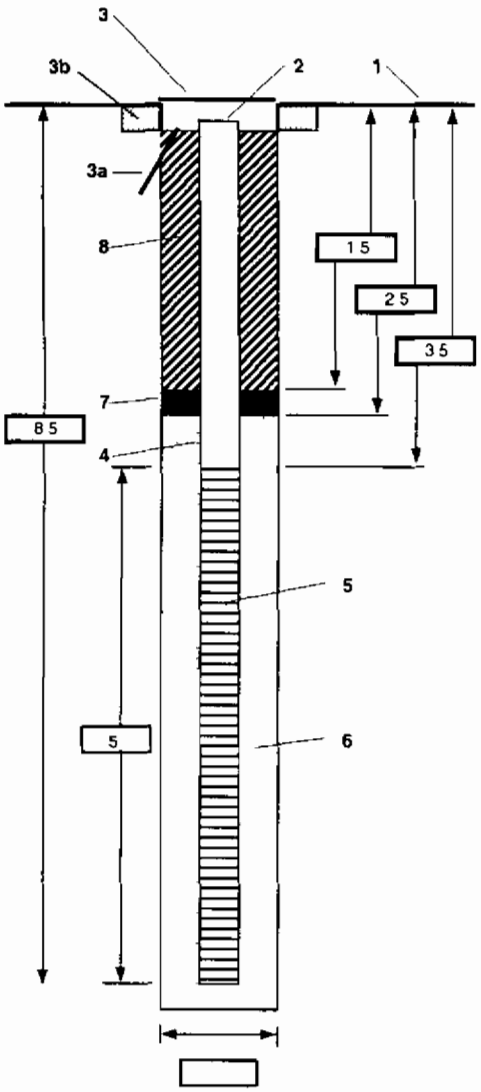
Note: Diagram not to scale.

CH2MHILL

PROJECT NUMBER	WELL NUMBER	
158814	F607GW018	SHEET 1 OF 1

WELL COMPLETION DIAGRAM

PROJECT Charleston Naval Complex, AOC 607 LOCATION Charleston, SC
DRILLING CONTRACTOR Environmental Enterprise Goup
DRILLING METHOD AND EQUIPMENT USED Hollow Stem Auger
WATER LEVELS 6 START 01/09/2001 END 01/09/2001 LOGGER Darryl Gates



1- Ground elevation at well	7.8129
2- Top of casing elevation	
3- Wellhead protection cover type	Flush
a) drain tube?	Yes
b) concrete pad dimensions	24'x24'
4- Dia /type of well casing	2 inch PVC schedule 40
5- Type/slot size of screen	2 inch PVC schedule 40, 0 01 slot screen
6- Type screen filter	20/30 silica
a) Quantity used	4 - 50 lb bags of sand
7- Type of seal	bentonite
a) Quantity used	
8- Grout	
a) Grout mix used	
b) Method of placement	Tremie Pipe
c) Vol of well casing grout	
Development method	Surge Block
Development time	
Estimated purge volume	

Comments Grout weight =
Total Depth (BTOC) =
Final field parameters collected during well development ( )
pH =
conductivity =
temperature =

Note: Diagram not to scale.

CH2MHILL

PROJECT NUMBER	WELL NUMBER	
158814	F607GW023	SHEET 1 OF 1

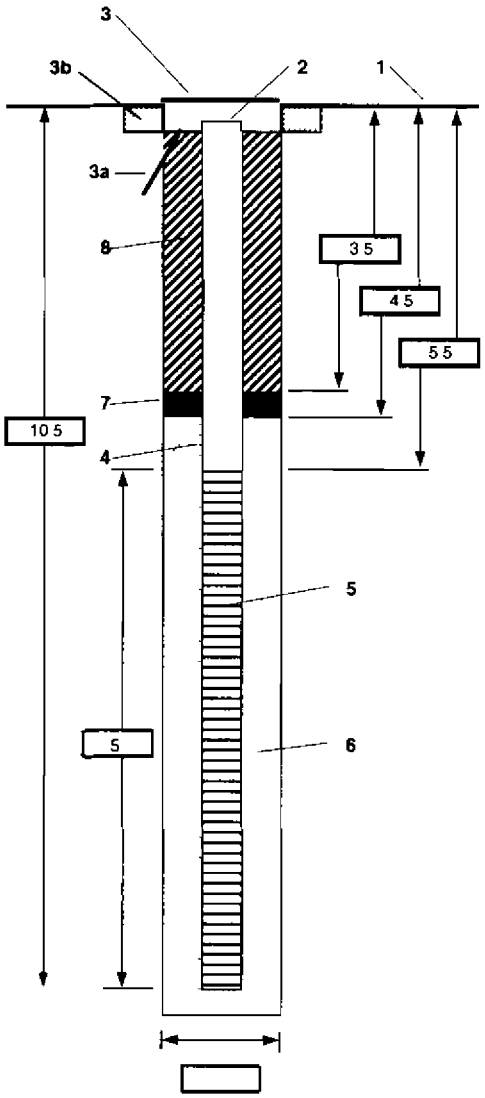
WELL COMPLETION DIAGRAM

PROJECT Charleston Naval Complex, AOC 607 LOCATION Charleston, SC

DRILLING CONTRACTOR Environmental Enterprise Goup

DRILLING METHOD AND EQUIPMENT USED · Hollow Stem Auger

WATER LEVELS 8 5 START 01/10/2001 END 01/10/2001 LOGGER · Darryl Gates



1- Ground elevation at well	7 9766
2- Top of casing elevation	
3- Wellhead protection cover type	Flush
a) drain tube?	Yes
b) concrete pad dimensions	24'x24'
4- Dia /type of well casing	2 inch PVC schedule 40
5- Type/slot size of screen	2 inch PVC schedule 40, 0 01 slot screen
6- Type screen filter	20/30 silica
a) Quantity used	4 - 50 lb bags of sand
7- Type of seal	bentonite
a) Quantity used	
8- Grout	
a) Grout mix used	
b) Method of placement	Trimie Pipe
c) Vol of well casing grout	
Development method	Surge Block
Development time	
Estimated purge volume	

Comments Grout weight =

Total Depth (BTOC) =

Final field parameters collected during well development ( )

pH =

conductivity =

temperature =

Note: Diagram not to scale.

CH2MHILL

PROJECT NUMBER	WELL NUMBER	
158814	F607GW024	SHEET 1 OF 1

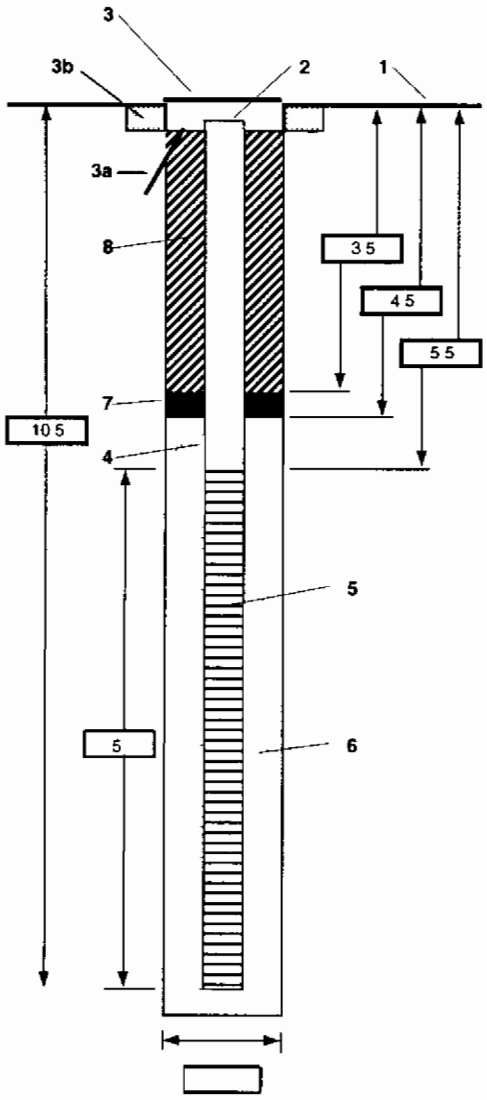
WELL COMPLETION DIAGRAM

PROJECT Charleston Naval Complex, AOC 607 LOCATION Charleston, SC

DRILLING CONTRACTOR Environmental Enterprise Goup

DRILLING METHOD AND EQUIPMENT USED Hollow Stem Auger

WATER LEVELS 8 START 01/10/2001 END 01/10/2001 LOGGER · Darryl Gates



1- Ground elevation at well	7.4980
2- Top of casing elevation	
3- Wellhead protection cover type	Flush
a) drain tube?	Yes
b) concrete pad dimensions	24'x24'
4- Dia /type of well casing	2 inch PVC schedule 40
5- Type/slot size of screen	2 inch PVC schedule 40, 0 01 slot screen
6- Type screen filter	20/30 silica
a) Quantity used	4 bags of sand
7- Type of seal	bentonite
a) Quantity used	
8- Grout	
a) Grout mix used	
b) Method of placement	Tnmie Pipe
c) Vol of well casing grout	
Development method	Surge Block
Development time	
Estimated purge volume	

Comments Grout weight =

Total Depth (BTOC) =

Final field parameters collected dunng well development ( )

pH =

conductivity =

temperature =

Note: Diagram not to scale.

CH2MHILL

PROJECT NUMBER	WELL NUMBER	
158814	F607GW026	SHEET 1 OF 1

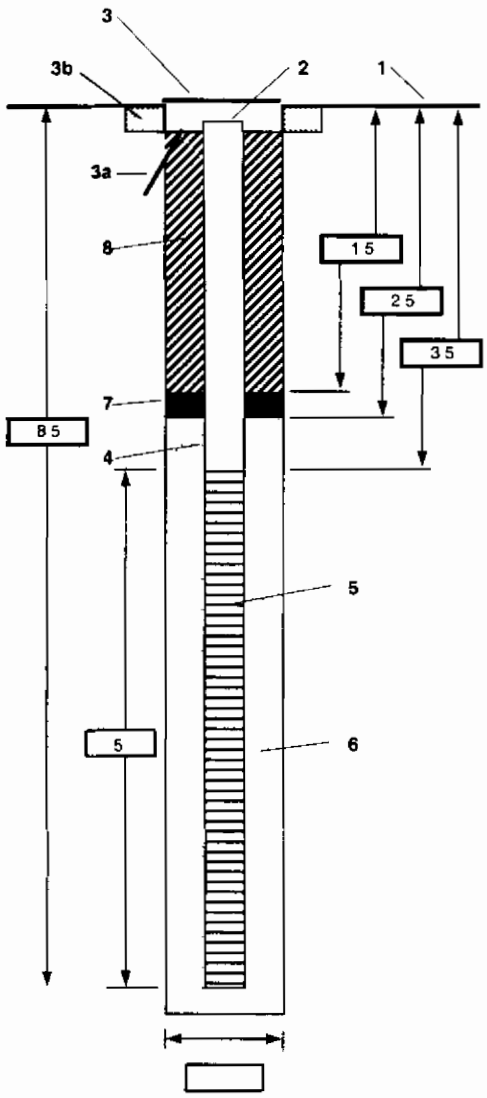
WELL COMPLETION DIAGRAM

PROJECT Charleston Naval Complex, AOC 607 LOCATION Charleston, SC

DRILLING CONTRACTOR Environmental Enterprise Goup

DRILLING METHOD AND EQUIPMENT USED Hollow Stem Auger

WATER LEVELS 5 START 01/10/2001 END 01/10/2001 LOGGER Darryl Gates



1- Ground elevation at well	7 1051
2- Top of casing elevation	
3- Wellhead protection cover type	Flush
a) drain tube?	Yes
b) concrete pad dimensions	24'x24'
4- Dia /type of well casing	2 inch PVC schedule 40
5- Type/slot size of screen	2 inch PVC schedule 40, 0 01 slot screen
6- Type screen filter	20/30 silica
a) Quantity used	
7- Type of seal	bentonite
a) Quantity used	
8- Grout	
a) Grout mix used	
b) Method of placement	Tremie Pipe
c) Vol of well casing grout	
Development method	Surge Block
Development time	
Estimated purge volume	

Comments Grout weight =

Total Depth (BTOC) =

Final field parameters collected during well development ( )

pH =

conductivity =

temperature =

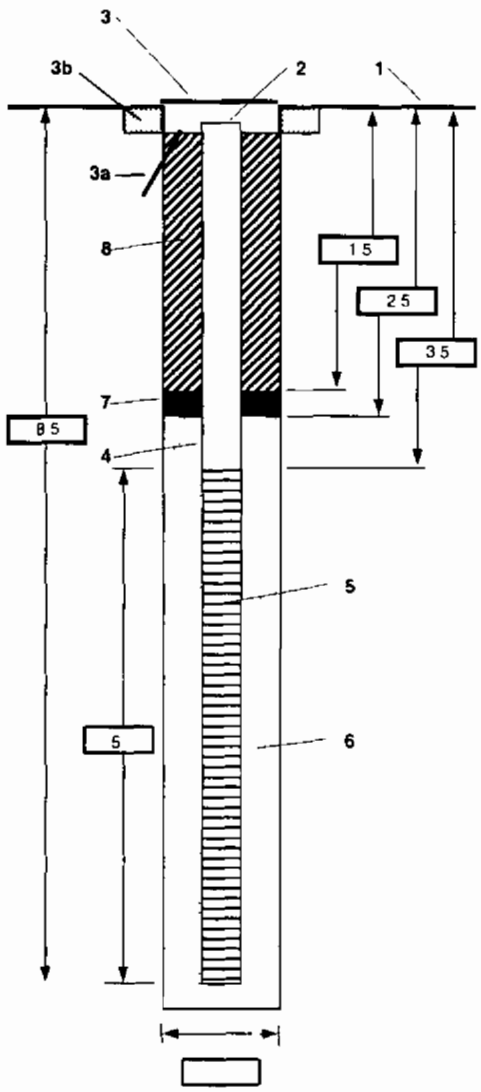
Note: Diagram not to scale.

CH2MHILL

PROJECT NUMBER	WELL NUMBER	
158814	F607GW005	SHEET 1 OF 1

WELL COMPLETION DIAGRAM

PROJECT Charleston Naval Complex, AOC 607 LOCATION Charleston, SC
DRILLING CONTRACTOR Environmental Enterprise Goup
DRILLING METHOD AND EQUIPMENT USED Hollow Stem Auger
WATER LEVELS 5 START 01/10/2001 END 01/10/2001 LOGGER Darryl Gates



1- Ground elevation at well	7.1109
2- Top of casing elevation	
3- Wellhead protection cover type	Flush
a) drain tube?	Yes
b) concrete pad dimensions	24'x24'
4- Dia /type of well casing	2 inch PVC schedule 40
5- Type/slot size of screen	2 inch PVC schedule 40, 0.01 slot screen
6- Type screen filter	20/30 silica
a) Quantity used	4 bags of sand
7- Type of seal	bentonite
a) Quantity used	
8- Grout	
a) Grout mix used	
b) Method of placement	Trimie Pipe
c) Vol of well casing grout	
Development method	Surge Block
Development time	
Estimated purge volume	

Comments Grout weight =
Total Depth (BTOC) =
Final field parameters collected during well development ( )
pH =
conductivity =
temperature =

Note: Diagram not to scale.

APPENDIX C

Data Validation Summary for Charleston Naval Complex - AOC 607

Data Validation Summary for Charleston Naval Complex - AOC 607

TO: Tom Beisel/CH2M HILL/ATL
Dean Williamson/CH2M HILL/GNV

FROM: Herb Kelly/CH2M HILL/GNV

DATE: February 1, 2001

The purpose of this memorandum is to present the results of the data validation process for the groundwater samples collected at the Charleston Naval Complex, Zone F, AOC 607. Air and soil gas samples were also collected in Summa canisters at Building 225. Each area was reviewed and the findings are documented within each subsection that follows. These data were validated for compliance with the analytical method requirements. The process also included a review of the data to assess the accuracy, precision, and completeness following procedures described in the EPA guidance document *National Functional Guidelines for Data Review* (EPA, October 1999). Quality assurance/quality control (QA/QC) summary forms and data reports were reviewed.

A total of 13 groundwater samples were submitted to General Engineering Laboratories, Inc., in Charleston, South Carolina, for SW-846 8260 analysis - Volatile Organic Compounds (VOCs) by Gas Chromatography/Mass Spectrometry (GC/MS). Included in this number were a field duplicate sample, two equipment blank samples, one trip blank sample, and two additional aliquots for a matrix spike/matrix spike duplicate set.

Fifteen Summa canisters were submitted to CH2M HILL Applied Sciences Group in Corvallis, Oregon, for EPA TO-14 analysis - Determination of VOCs In Ambient Air Using SUMMA(R) Passivated Canister Sampling And Gas Chromatographic Analysis. The canisters were first analyzed for a full list of VOCs using GC/MS instrumentation operating in the full-scan mode. A secondary analysis for selected chlorinated VOCs was performed with the GC/MS instrumentation operating in the selected-ion monitoring (SIM) mode.

Sample results that were below the reporting limit or were not within the acceptance limits were appended with a qualifying flag, which consisted of a single- or double-letter code that indicated a possible problem with the data. The qualifying flags originated during the data review and validation processes. These also include the secondary, or the two-digit "sub-qualifier" flags. The secondary qualifiers provide the reasoning behind the assignment of a qualifier flag to the data. The secondary qualifiers are presented and defined in Table 1. The following primary flags were used to qualify the data:

- U Undetected. Samples were analyzed for this analyte, but it was not detected above the method detection limit (MDL) or instrument detection limit (IDL).

- **UJ** Detection limit estimated. Samples were analyzed for this analyte, but the results were qualified as not detected. The result is estimated.
- **J** Estimated. The analyte was present, but the reported value may not be accurate or precise.
- **R** Rejected. The data are unusable. (NOTE: Analyte/compound may or may not be present.)
- = Detected. Target parameter detected at the concentration reported.

Quality Control Review

The following list represents the QA/QC measures that were reviewed during the data validation process.

- Holding Times – The holding times are evaluated to verify that samples were extracted and analyzed within holding times.
- Blank samples – Laboratory method blanks, equipment blanks, and trip blanks were provided for this project. Blank samples enable the reviewer to determine if an analyte may be attributed to sampling or laboratory procedures, rather than environmental contamination from site activities.
- Surrogates – Surrogates are added to each sample and are used to monitor lab performance and possible matrix interference.
- Lab Control Sample (LCS) – This sample is a "controlled matrix," either laboratory reagent water or Ottawa sand, in which target compounds have been added prior to extraction/analysis. The recoveries serve as a monitor of the overall performance of each step during the analysis, including sample preparation.
- Field Duplicate Samples – These samples are collected to determine precision between a native and its duplicate. This information can only be determined when target compounds are detected.
- Laboratory Duplicate Samples – A duplicate analysis is performed at the laboratory to determine precision between analytical runs. This information can only be determined when target compounds are detected.
- Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples – Spike recovery is used to evaluate potential matrix interferences, as well as accuracy. Precision information is also determined by calculating the reproducibility between the recoveries of each spiked parameter.
- GC/MS Tuning – The mass spectrum of the tuning compound is evaluated for method compliance. The criteria are established to verify the proper mass assignment and mass resolution.
- Initial Calibration – The initial calibration ensures that the instrument is capable of producing acceptable qualitative and quantitative data for the compounds of interest.

- Continuing Calibration – The continuing calibration checks satisfactory performance of the instrument and its predicted response to the target compounds.
- Internal Standards – The internal standards (retention time and response) are evaluated for method compliance. The internal standards are used in quantitation of the target parameters and monitor the instrument sensitivity and response for stability during each analysis.

Groundwater - VOC Analyses

The QA/QC parameters for VOC analyses for all of the samples were within acceptable control limits, except as noted below:

- Three samples, 607GMW2101, 607 GMW2301, and 607HMW2501, were analyzed at dilutions, due to the high concentration of target parameters detected. The results for all parameters from the lowest dilution were used, except for those parameters exceeding the calibration range. The results for those parameters exceeding the calibration range in the initial analysis, were then reported from the diluted analysis.
- Therefore, the parameters that were not used in the original or diluted analyses, were qualified "R," as rejected, as there can only be one valid result for each parameter per sample.

Summa Canister - VOC Analyses

The QA/QC parameters for VOC analyses for all of the samples were within acceptable control limits, except as noted below:

- The concentration of tetrachloroethene exceeded the calibration range of the instrument in the SIM analysis of samples 225AS00101 and 225AS00601. These results were qualified as "R," rejected. The laboratory did not reanalyze the sample, as a full-scan analysis had already been performed. The results for tetrachloroethene from the full-scan analysis should be used.

Conclusion

Data qualifiers were applied in the VOC analyses of the Summa canisters and groundwater samples, with respect to compounds exceeding the calibration range of the instrument.

The data can be used in the project decision-making process, with the exception of the parameters qualified as discussed above.

TABLE 1
Secondary Data Validation Qualifiers

Code	Definition
2S	Second Source
BL	Blank
BS	Blank Spike/LCS
CC	Continuing Calibration
DL	Dilution
FD	Field Duplicate
HT	Holding Time
IB	In-Between (metals - Bs → Js)
IC	Initial Calibration
IS	Internal Standard
LD	Lab Duplicate
MD	MS/MSD or LCS/LCSD Precision
MS	Matrix Spike/Matrix Spike Duplicate
OT	Other (see DV worksheet)
PD	Pesticide Degradation
PS	Post Spike
RE	Re-extraction/Re-analysis
SD	Serial Dilution
SS	Spiked Surrogate
TN	Tune

APPENDIX D

Soil Gas and Indoor Air Analytical Results - Form 1

Data Review and Validation for: GC/MS Volatile Organic Compounds (VOCs) - Air Samples

Project Name & Task:	CNC	Zone F, AOC 607, BLDG 225	
Project # & Case/SDG:	158814.ZF.PR.15	5028	
Methods:	☑ TO-14 ☐ SW-846 ☐ EPA Method ☐ Other:		
Program:	☐ AFCEE ☐ NFESC ☐ Other	**Number of Samples:** 12	
Field QC Samples:	2/16 - MATE. DUP, 7 - MS/MSD		
Reviewed by & Date:	N. Kelly	1/29/2001	
Matrix:	☐ Tedlar Bag ☑ Summa Canister ☐ Other		

Quality Control	Form #	Requirements	Check (If No* checked, see comments)	Flags Applied (see comments)
Data Pkg Complete (DP)	Pkg	All required deliverables in pkg.	☑ OK ☐ No* ☐ Not provided	☐ Flags Applied
	COC	All samples on COC reported	☑ OK ☐ No*	☐ Flags Applied
Holding Times (HT)	1	Tedlar Bags (72 hours)	☐ OK ☐ No*	☐ Flags Applied
	COC	Summa Canisters (30 days)	☐ OK ☑ No*	☐ Flags Applied
		Other:	☐ OK ☐ No*	☐ Flags Applied
Surrogates (SS)	2	Method surrogates used	☑ OK ☐ No* ☐ Not provided	☐ Flags Applied
		Recovery Limits: ☑ Lab ☐ Meth	☑ OK ☐ No* ☐ Diluted out	
MS/MSD or MS/LD	3	Matrix Spikes Provided	☐ MS/MSD ☐ MS/LD ☑ None*	☐ Flags Applied
		Correct Spike Used	☐ OK ☐ No*	
		Acceptance Limits: ☐ Lab ☐ Meth	☐ OK ☐ No* ☐ Diluted out	
LCS (BS) ☐ LCS only ☐ LCS/LCSD	3	LCS per prep. batch	☐ OK ☐ No*	☐ Flags Applied
		Acceptance criteria met	☐ OK ☐ No* NA	
Blanks (MB,TB,EB, FB/AB)	1	Detects (> MDL or RL/CRQL)	☑ All ND ☐ see blnk wksht	☐ Flags Applied
Method/Lab Blank (MB)	5	Meth Blnk per ~~12~~ hr shift 24hr	☑ OK ☐ No*	
Tune - BFB (TN) prior to sample analysis	5	Initial & Begin of ~~12~~-hr shift 24hr	☑ OK ☐ No*	☐ Flags Applied
		Mass Assignment Correct	☑ OK ☐ No*	
		Ion Abundance Criteria met	☑ OK ☐ No*	
Initial Calibration (IC)	6	Minimum of 5 levels	☑ OK ☐ No*	☐ Flags Applied
		Linearity criteria met	☑ OK ☐ No* ☐ see cal wksht	
		Minimum RRF criteria met	☑ OK ☐ No* ☐ see cal wksht	
Continuing Calib. Verif. (CC) prior to sample analysis	7	Analyzed at begin of ~~12~~-hr shift 24	☐ OK ☐ No* NA	☐ Flags Applied
		%diff or %drift criteria met	☐ OK ☐ No* ☐ see cal wksht	
		Minimum RRF criteria met	☐ OK ☐ No* ☐ see cal wksht	
	8	Int. Std. RT/Area criteria met	☐ OK ☐ No*	
Internal Standards (IS)	8	Sample IS area criteria met	☑ OK ☐ No*	☐ Flags Applied
Sample Evaluation	1	All hits within cal. Range	☑ OK ☐ No* ☐ All ND	☐ Flags Applied
laboratory duplicate	5	Samples w/in ~~12~~-hr clock 24hr	☑ OK ☐ No*	
	raw	Manual Integration performed	☐ No ☐ see comments	
Field Duplicate (FD)	1	Precision of native vs Field Dup	☑ OK ☐ No* ☐ N/A	☐ Flags Applied

This sheet is applicable to multiple methods. All requirement items may not apply to every analytical method.

Case Narrative Comments: NO EXCEPTIONS NOTED

QC Item	Comments
HT	14 days w/all QC guidance. Analyses performed within 21 days.
IC	All < 25% RSD - OK

Applied Science Lab

Project Name: Charleston Navy Complex	**Site Name:** Zone F, AOC 607, Bldg. 225
Project Number: 158814.ZF.PR.15	**TAT:** As per instructions
Project Manager: Casey Hudson/Orlando	**Level:** III
Address: CHS: 2470 Mall Dr. Suite B, N. Charleston, SC 29406	
GNV: 3011 SW Williston Rd., Gainesville, FL 32605	
Send Report To: Casey Hudson/Orlando	**EDD:**

Sample ID	Station ID	Depth Begin	Depth End	Date & Time Collected	Matrix	# of containers	summa canister TO 14 A/sim,pce,tce,sis1,									Comments	
225AI00101	F225AI001																
225AI00202	F225AI002																
225AI00301	F225AI003																
225AS00101	F225AS001			12-20-2000 / 1146	air	1										-1	5
225AS00201	F225AS002			12-20-2000 / 1210	air	1										-2	6
225AS00301	F225AS003			12-20-2000 / 1225	air	1										-3	5(
225AS00401	F225AS004			12-20-2000 / 1245	air	1										-4	5(
225AS00501	F225AS005			12-20-2000 / 1305	air	1										-5	57
225AS00601	F225AS006			12-20-2000 / 1325	air	1										-6	70
225AS00701	F225AS007			12-20-2000 / 1345	air	1										-7	63
225AS00801	F225AS008			12-20-2000 / 1400	air	1										-8	6(
225QS00901	F225AS009			12-20-2000 / 1410	air	1										-9	6(
225AS00901	F225AS009			12-20-2000 / 1410	air	1										-10	6(
225AS01001	F225AS010			12-20-2000 / 1430	air	1										-11	55
225AS01101	F225AS011			12-20-2000 / 1445	air	1										-12	52

Sampled By: Darrell Butts / Jenna Chinden Date/Time: 12-20-00

Relinquished by: Darrell Butts Date/Time: 12-21-00 / 1000

Additional Samplers:

Received By Lab: Kathy McKinley Date/Time: 12/26/00 1130

Relinquished by: Date/Time

Received By: Date/Time

Shipped Via: UPS FedEx Hand Other

Remarks: Temperature:

1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AS00101

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5028 SAS No.: 011001 SDG No.: 5028

Matrix: (air/soil/water) Air

Level: (low/med) LOW

GC Column: DB-VRX ID: 0.25 (mm)

Lab Sample ID: 502801

Lab File ID: 502801R2.D

Date Received: 12/26/00

Date Analyzed: 01/10/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPBV	Q
75-71-8	Dichlorodifluoromethane	1.0	U
74-87-3	Chloromethane	1.0	U
76-14-2	1,2-Dichloro,1,1,2,2-tetrafluoroethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
74-83-9	Bromomethane	1.0	U
75-00-3	Chloroethane	1.0	U
75-69-4	Trichlorofluoromethane	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-09-2	Methylene chloride	1.0	U
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
156-59-2	cis-1,2-Dichloroethene	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
71-43-2	Benzene	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
79-01-6	Trichloroethene	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
108-88-3	Toluene	1.0	U
106-93-4	1,2-Dibromoethane	1.0	U
127-18-4	Tetrachloroethene	7.8	
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
1330-20-7	m,p-Xylenes	2.0	U
100-42-5	Styrene	1.0	U
95-47-6	o-Xylene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U
108-67-8	1,3,5-Trimethylbenzene	1.0	U
95-63-6	1,2,4-Trimethylbenzene	1.0	U
541-73-1	1,3-Dichlorobenzene	1.0	U
106-46-7	1,4-Dichlorobenzene	1.0	U
95-50-1	1,2-Dichlorobenzene	1.0	U
120-82-1	1,2,4-Trichlorobenzene	1.0	U
87-68-3	Hexachlorobutadiene	1.0	U

11/29/01

1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AS00201

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5028 SAS No.: 011001 SDG No.: 5028

Matrix: (air/soil/water) Air Lab Sample ID: 502802

Level: (low/med) LOW Lab File ID: 502802R2.D

GC Column: DB-VRX ID: 0.25 (mm) Date Received: 12/26/00

Date Analyzed: 01/10/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPBV	Q
75-71-8	Dichlorodifluoromethane	1.0	U
74-87-3	Chloromethane	1.0	U
76-14-2	1,2-Dichloro,1,1,2,2-tetrafluoroethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
74-83-9	Bromomethane	1.0	U
75-00-3	Chloroethane	1.0	U
75-69-4	Trichlorofluoromethane	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-09-2	Methylene chloride	0.5	J
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
156-59-2	cis-1,2-Dichloroethene	1.0	U
67-66-3	Chloroform	0.6	J
107-06-2	1,2-Dichloroethane	1.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
71-43-2	Benzene	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
79-01-6	Trichloroethene	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
108-88-3	Toluene	1.0	U
106-93-4	1,2-Dibromoethane	1.0	U
127-18-4	Tetrachloroethene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
1330-20-7	m,p-Xylenes	2.0	U
100-42-5	Styrene	1.0	U
95-47-6	o-Xylene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U
108-67-8	1,3,5-Trimethylbenzene	1.0	U
95-63-6	1,2,4-Trimethylbenzene	1.0	U
541-73-1	1,3-Dichlorobenzene	1.0	U
106-46-7	1,4-Dichlorobenzene	1.0	U
95-50-1	1,2-Dichlorobenzene	1.0	U
120-82-1	1,2,4-Trichlorobenzene	1.0	U
87-68-3	Hexachlorobutadiene	1.0	U

1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AS00301

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5028 SAS No.: 011001 SDG No.: 5028

Matrix: (air/soil/water) Air Lab Sample ID: 502803

Level: (low/med) LOW Lab File ID: 502803R3.D

GC Column: DB-VRX ID: 0.25 (mm) Date Received: 12/26/00

Date Analyzed: 01/10/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPBV	Q
75-71-8	Dichlorodifluoromethane	1.0	U
74-87-3	Chloromethane	1.1	
76-14-2	1,2-Dichloro,1,1,2,2-tetrafluoroethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
74-83-9	Bromomethane	1.0	U
75-00-3	Chloroethane	1.0	U
75-69-4	Trichlorofluoromethane	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-09-2	Methylene chloride	0.9	J
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	0.8	J
75-34-3	1,1-Dichloroethane	1.0	U
156-59-2	cis-1,2-Dichloroethene	1.0	U
67-66-3	Chloroform	0.7	J
107-06-2	1,2-Dichloroethane	1.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
71-43-2	Benzene	2.2	
78-87-5	1,2-Dichloropropane	1.0	U
79-01-6	Trichloroethene	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
108-88-3	Toluene	6.4	
106-93-4	1,2-Dibromoethane	1.0	U
127-18-4	Tetrachloroethene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	0.6	J
1330-20-7	m,p-Xylenes	1.5	J
100-42-5	Styrene	0.6	J
95-47-6	o-Xylene	1.2	
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U
108-67-8	1,3,5-Trimethylbenzene	1.0	U
95-63-6	1,2,4-Trimethylbenzene	1.0	U
541-73-1	1,3-Dichlorobenzene	1.0	U
106-46-7	1,4-Dichlorobenzene	0.6	J
95-50-1	1,2-Dichlorobenzene	1.0	U
120-82-1	1,2,4-Trichlorobenzene	1.3	
87-68-3	Hexachlorobutadiene	2.3	

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1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

225AS00401

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5028 SAS No.: 011001 SDG No.: 5028

Matrix: (air/soil/water) Air

Level: (low/med) LOW

GC Column: DB-VRX ID: 0.25 (mm)

Lab Sample ID: 502804

Lab File ID: 502804RS.D

Date Received: 12/26/00

Date Analyzed: 01/11/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPBV	Q
75-71-8	Dichlorodifluoromethane	1.0	U
74-87-3	Chloromethane	1.0	U
76-14-2	1,2-Dichloro,1,1,2,2-tetrafluoroethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
74-83-9	Bromomethane	1.0	U
75-00-3	Chloroethane	1.0	U
75-69-4	Trichlorofluoromethane	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-09-2	Methylene chloride	1.4	
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
156-59-2	cis-1,2-Dichloroethene	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
71-43-2	Benzene	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
79-01-6	Trichloroethene	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
108-88-3	Toluene	0.5	J
106-93-4	1,2-Dibromoethane	1.0	U
127-18-4	Tetrachloroethene	1.3	
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
1330-20-7	m,p-Xylenes	2.0	U
100-42-5	Styrene	1.0	U
95-47-6	o-Xylene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U
108-67-8	1,3,5-Trimethylbenzene	1.0	U
95-63-6	1,2,4-Trimethylbenzene	1.0	U
541-73-1	1,3-Dichlorobenzene	1.0	U
106-46-7	1,4-Dichlorobenzene	1.0	U
95-50-1	1,2-Dichlorobenzene	1.0	U
120-82-1	1,2,4-Trichlorobenzene	1.0	U
87-68-3	Hexachlorobutadiene	1.0	U

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1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AS00501

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5028 SAS No.: 011001 SDG No.: 5028

Matrix: (air/soil/water) Air Lab Sample ID: 502805

Level: (low/med) LOW Lab File ID: 502805R.D

GC Column: DB-VRX ID: 0.25 (mm) Date Received: 12/26/00

Date Analyzed: 01/11/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPBV	Q
75-71-8	Dichlorodifluoromethane	1.0	U
74-87-3	Chloromethane	1.0	U
76-14-2	1,2-Dichloro,1,1,2,2-tetrafluoroethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
74-83-9	Bromomethane	1.0	U
75-00-3	Chloroethane	1.0	U
75-69-4	Trichlorofluoromethane	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-09-2	Methylene chloride	0.7	J
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
156-59-2	cis-1,2-Dichloroethene	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
71-43-2	Benzene	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
79-01-6	Trichloroethene	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
108-88-3	Toluene	2.2	
106-93-4	1,2-Dibromoethane	1.0	U
127-18-4	Tetrachloroethene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
1330-20-7	m,p-Xylenes	2.8	
100-42-5	Styrene	1.0	U
95-47-6	o-Xylene	0.7	J
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U
108-67-8	1,3,5-Trimethylbenzene	1.0	U
95-63-6	1,2,4-Trimethylbenzene	1.0	U
541-73-1	1,3-Dichlorobenzene	1.0	U
106-46-7	1,4-Dichlorobenzene	1.0	U
95-50-1	1,2-Dichlorobenzene	1.0	U
120-82-1	1,2,4-Trichlorobenzene	1.0	U
87-68-3	Hexachlorobutadiene	1.0	U

1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AS00601

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5028 SAS No.: 011001 SDG No.: 5028

Matrix: (air/soil/water) Air Lab Sample ID: 502806

Level: (low/med) LOW Lab File ID: 502806R.D

GC Column: DB-VRX ID: 0.25 (mm) Date Received: 12/26/00

Date Analyzed: 01/11/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPBV	Q
75-71-8	Dichlorodifluoromethane	1.0	U
74-87-3	Chloromethane	1.0	U
76-14-2	1,2-Dichloro,1,1,2,2-tetrafluoroethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
74-83-9	Bromomethane	1.0	U
75-00-3	Chloroethane	1.0	U
75-69-4	Trichlorofluoromethane	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-09-2	Methylene chloride	1.0	U
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
156-59-2	cis-1,2-Dichloroethene	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
71-43-2	Benzene	0.6	J
78-87-5	1,2-Dichloropropane	1.0	U
79-01-6	Trichloroethene	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
108-88-3	Toluene	1.4	
106-93-4	1,2-Dibromoethane	1.0	U
127-18-4	Tetrachloroethene	11.4	
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
1330-20-7	m,p-Xylenes	2.0	U
100-42-5	Styrene	1.0	U
95-47-6	o-Xylene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U
108-67-8	1,3,5-Trimethylbenzene	1.0	U
95-63-6	1,2,4-Trimethylbenzene	1.0	U
541-73-1	1,3-Dichlorobenzene	1.0	U
106-46-7	1,4-Dichlorobenzene	1.0	U
95-50-1	1,2-Dichlorobenzene	1.0	U
120-82-1	1,2,4-Trichlorobenzene	1.0	U
87-68-3	Hexachlorobutadiene	1.0	U

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1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AS00701

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5028 SAS No.: 011001 SDG No.: 5028

Matrix: (air/soil/water) Air Lab Sample ID: 502807

Level: (low/med) LOW Lab File ID: 502807R.D

GC Column: DB-VRX ID: 0.25 (mm) Date Received: 12/26/00

Date Analyzed: 01/11/01

Dilution Factor: 2

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPBV	Q
75-71-8	Dichlorodifluoromethane	1.7	U
74-87-3	Chloromethane	1.0	J
76-14-2	1,2-Dichloro,1,1,2,2-tetrafluoroethane	1.7	U
75-01-4	Vinyl chloride	1.7	U
74-83-9	Bromomethane	1.7	U
75-00-3	Chloroethane	1.7	U
75-69-4	Trichlorofluoromethane	1.7	U
75-35-4	1,1-Dichloroethene	1.7	U
75-09-2	Methylene chloride	1.4	J
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	1.7	U
75-34-3	1,1-Dichloroethane	1.7	U
156-59-2	cis-1,2-Dichloroethene	1.7	U
67-66-3	Chloroform	1.7	U
107-06-2	1,2-Dichloroethane	1.7	U
71-55-6	1,1,1-Trichloroethane	1.7	U
56-23-5	Carbon tetrachloride	1.7	U
71-43-2	Benzene	6.8	
78-87-5	1,2-Dichloropropane	1.7	U
79-01-6	Trichloroethene	1.5	J
10061-01-5	cis-1,3-Dichloropropene	1.7	U
10061-02-6	trans-1,3-Dichloropropene	1.7	U
79-00-5	1,1,2-Trichloroethane	1.7	U
108-88-3	Toluene	17.7	
106-93-4	1,2-Dibromoethane	1.7	U
127-18-4	Tetrachloroethene	0.9	J
108-90-7	Chlorobenzene	1.7	U
100-41-4	Ethylbenzene	1.7	J
1330-20-7	m,p-Xylenes	3.1	J
100-42-5	Styrene	2.1	
95-47-6	o-Xylene	2.3	
79-34-5	1,1,2,2-Tetrachloroethane	1.7	U
108-67-8	1,3,5-Trimethylbenzene	1.7	U
95-63-6	1,2,4-Trimethylbenzene	1.7	U
541-73-1	1,3-Dichlorobenzene	1.7	U
106-46-7	1,4-Dichlorobenzene	1.7	U
95-50-1	1,2-Dichlorobenzene	1.7	U
120-82-1	1,2,4-Trichlorobenzene	1.7	U
87-68-3	Hexachlorobutadiene	1.7	U

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1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AS00701DUP

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5028 SAS No.: 011001 SDG No.: 5028

Matrix: (air/soil/water) Air Lab Sample ID: 502807D

Level: (low/med) LOW Lab File ID: 502807D.D

GC Column: DB-VRX ID: 0.25 (mm) Date Received: 12/26/00

Date Analyzed: 01/11/01

Dilution Factor: 2

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPBV	Q
75-71-8	Dichlorodifluoromethane	1.7	U
74-87-3	Chloromethane	1.1	J
76-14-2	1,2-Dichloro,1,1,2,2-tetrafluoroethane	1.7	U
75-01-4	Vinyl chloride	1.7	U
74-83-9	Bromomethane	1.7	U
75-00-3	Chloroethane	1.7	U
75-69-4	Trichlorofluoromethane	1.7	U
75-35-4	1,1-Dichloroethene	1.7	U
75-09-2	Methylene chloride	1.8	
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	1.7	U
75-34-3	1,1-Dichloroethane	1.7	U
156-59-2	cis-1,2-Dichloroethene	1.7	U
67-66-3	Chloroform	1.7	U
107-06-2	1,2-Dichloroethane	1.7	U
71-55-6	1,1,1-Trichloroethane	1.7	U
56-23-5	Carbon tetrachloride	1.7	U
71-43-2	Benzene	7.3	
78-87-5	1,2-Dichloropropane	1.7	U
79-01-6	Trichloroethene	1.5	J
10061-01-5	cis-1,3-Dichloropropene	1.7	U
10061-02-6	trans-1,3-Dichloropropene	1.7	U
79-00-5	1,1,2-Trichloroethane	1.7	U
108-88-3	Toluene	18.0	
106-93-4	1,2-Dibromoethane	1.7	U
127-18-4	Tetrachloroethene	1.0	J
108-90-7	Chlorobenzene	1.7	U
100-41-4	Ethylbenzene	1.7	J
1330-20-7	m,p-Xylenes	3.1	J
100-42-5	Styrene	2.2	
95-47-6	o-Xylene	2.3	
79-34-5	1,1,2,2-Tetrachloroethane	1.7	U
108-67-8	1,3,5-Trimethylbenzene	1.7	U
95-63-6	1,2,4-Trimethylbenzene	1.7	U
541-73-1	1,3-Dichlorobenzene	1.7	U
106-46-7	1,4-Dichlorobenzene	1.7	U
95-50-1	1,2-Dichlorobenzene	1.7	U
120-82-1	1,2,4-Trichlorobenzene	1.7	U
87-68-3	Hexachlorobutadiene	1.7	U

1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AS00801

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5028 SAS No.: 011001 SDG No.: 5028

Matrix: (air/soil/water) Air

Level: (low/med) LOW

GC Column: DB-VRX ID: 0.25 (mm)

Lab Sample ID: 502808

Lab File ID: 502808R.D

Date Received: 12/26/00

Date Analyzed: 01/11/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPBV	Q
75-71-8	Dichlorodifluoromethane	0.6	J
74-87-3	Chloromethane	0.6	J
76-14-2	1,2-Dichloro,1,1,2,2-tetrafluoroethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
74-83-9	Bromomethane	1.0	U
75-00-3	Chloroethane	1.0	U
75-69-4	Trichlorofluoromethane	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-09-2	Methylene chloride	0.6	J
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
156-59-2	cis-1,2-Dichloroethene	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
71-43-2	Benzene	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
79-01-6	Trichloroethene	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
108-88-3	Toluene	0.8	J
106-93-4	1,2-Dibromoethane	1.0	U
127-18-4	Tetrachloroethene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
1330-20-7	m,p-Xylenes	2.0	U
100-42-5	Styrene	1.0	U
95-47-6	o-Xylene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U
108-67-8	1,3,5-Trimethylbenzene	1.0	U
95-63-6	1,2,4-Trimethylbenzene	1.0	U
541-73-1	1,3-Dichlorobenzene	1.0	U
106-46-7	1,4-Dichlorobenzene	1.0	U
95-50-1	1,2-Dichlorobenzene	1.0	U
120-82-1	1,2,4-Trichlorobenzene	1.0	U
87-68-3	Hexachlorobutadiene	1.0	U

1/11/01

1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225QS00901

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5028 SAS No.: 011001 SDG No.: 5028

Matrix: (air/soil/water) Air Lab Sample ID: 502809

Level: (low/med) LOW Lab File ID: 502809R.D

GC Column: DB-VRX ID: 0.25 (mm) Date Received: 12/26/00

Date Analyzed: 01/11/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPBV	Q
75-71-8	Dichlorodifluoromethane	0.6	J
74-87-3	Chloromethane	1.0	U
76-14-2	1,2-Dichloro,1,1,2,2-tetrafluoroethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
74-83-9	Bromomethane	1.0	U
75-00-3	Chloroethane	1.0	U
75-69-4	Trichlorofluoromethane	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-09-2	Methylene chloride	0.7	J
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
156-59-2	cis-1,2-Dichloroethene	1.0	U
67-66-3	Chloroform	0.5	J
107-06-2	1,2-Dichloroethane	1.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
71-43-2	Benzene	0.8	J
78-87-5	1,2-Dichloropropane	1.0	U
79-01-6	Trichloroethene	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
108-88-3	Toluene	2.1	
106-93-4	1,2-Dibromoethane	1.0	U
127-18-4	Tetrachloroethene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
1330-20-7	m,p-Xylenes	2.0	U
100-42-5	Styrene	1.0	U
95-47-6	o-Xylene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U
108-67-8	1,3,5-Trimethylbenzene	1.0	U
95-63-6	1,2,4-Trimethylbenzene	1.0	U
541-73-1	1,3-Dichlorobenzene	1.0	U
106-46-7	1,4-Dichlorobenzene	1.0	U
95-50-1	1,2-Dichlorobenzene	1.0	U
120-82-1	1,2,4-Trichlorobenzene	1.0	U
87-68-3	Hexachlorobutadiene	1.0	U

1/29

1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AS00901

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5028 SAS No.: 011001 SDG No.: 5028

Matrix: (air/soil/water) Air

Level: (low/med) LOW

GC Column: DB-VRX ID: 0.25 (mm)

Lab Sample ID: 502810

Lab File ID: 502810R.D

Date Received: 12/26/00

Date Analyzed: 01/10/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPBV	Q
75-71-8	Dichlorodifluoromethane	0.6	J
74-87-3	Chloromethane	1.0	U
76-14-2	1,2-Dichloro,1,1,2,2-tetrafluoroethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
74-83-9	Bromomethane	1.0	U
75-00-3	Chloroethane	1.0	U
75-69-4	Trichlorofluoromethane	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-09-2	Methylene chloride	0.7	J
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
156-59-2	cis-1,2-Dichloroethene	1.0	U
67-66-3	Chloroform	0.6	J
107-06-2	1,2-Dichloroethane	1.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
71-43-2	Benzene	1.7	
78-87-5	1,2-Dichloropropane	1.0	U
79-01-6	Trichloroethene	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
108-88-3	Toluene	3.6	
106-93-4	1,2-Dibromoethane	1.0	U
127-18-4	Tetrachloroethene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
1330-20-7	m,p-Xylenes	2.0	U
100-42-5	Styrene	0.7	J
95-47-6	o-Xylene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U
108-67-8	1,3,5-Trimethylbenzene	1.0	U
95-63-6	1,2,4-Trimethylbenzene	0.5	J
541-73-1	1,3-Dichlorobenzene	1.0	U
106-46-7	1,4-Dichlorobenzene	1.0	U
95-50-1	1,2-Dichlorobenzene	1.0	U
120-82-1	1,2,4-Trichlorobenzene	1.0	U
87-68-3	Hexachlorobutadiene	1.0	U

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1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AS01001

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5028 SAS No.: 011001 SDG No.: 5028

Matrix: (air/soil/water) Air Lab Sample ID: 502811

Level: (low/med) LOW Lab File ID: 502811R3.D

GC Column: DB-VRX ID: 0.25 (mm) Date Received: 12/26/00

Date Analyzed: 01/11/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPBV	Q
75-71-8	Dichlorodifluoromethane	0.7	J
74-87-3	Chloromethane	0.8	J
76-14-2	1,2-Dichloro,1,1,2,2-tetrafluoroethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
74-83-9	Bromomethane	1.0	U
75-00-3	Chloroethane	1.0	U
75-69-4	Trichlorofluoromethane	1.0	U
75-35-4	1,1-Dichloroethene	0.7	J
75-09-2	Methylene chloride	0.8	J
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
156-59-2	cis-1,2-Dichloroethene	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
71-43-2	Benzene	1.4	
78-87-5	1,2-Dichloropropane	1.0	U
79-01-6	Trichloroethene	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
108-88-3	Toluene	1.9	
106-93-4	1,2-Dibromoethane	1.0	U
127-18-4	Tetrachloroethene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
1330-20-7	m,p-Xylenes	2.0	U
100-42-5	Styrene	1.0	U
95-47-6	o-Xylene	0.5	J
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U
108-67-8	1,3,5-Trimethylbenzene	1.0	U
95-63-6	1,2,4-Trimethylbenzene	1.0	U
541-73-1	1,3-Dichlorobenzene	1.0	U
106-46-7	1,4-Dichlorobenzene	1.0	U
95-50-1	1,2-Dichlorobenzene	1.0	U
120-82-1	1,2,4-Trichlorobenzene	1.0	U
87-68-3	Hexachlorobutadiene	1.0	U

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1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AS01101

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5028 SAS No.: 011001 SDG No.: 5028

Matrix: (air/soil/water) Air

Level: (low/med) LOW

GC Column: DB-VRX ID: 0.25 (mm)

Lab Sample ID: 502812

Lab File ID: 502812R2.D

Date Received: 12/26/00

Date Analyzed: 01/11/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPBV	Q
75-71-8	Dichlorodifluoromethane	1.0	U
74-87-3	Chloromethane	0.7	J
76-14-2	1,2-Dichloro,1,1,2,2-tetrafluoroethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
74-83-9	Bromomethane	1.0	U
75-00-3	Chloroethane	1.0	U
75-69-4	Trichlorofluoromethane	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-09-2	Methylene chloride	1.9	
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
156-59-2	cis-1,2-Dichloroethene	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
71-43-2	Benzene	0.6	J
78-87-5	1,2-Dichloropropane	1.0	U
79-01-6	Trichloroethene	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
108-88-3	Toluene	1.2	
106-93-4	1,2-Dibromoethane	1.0	U
127-18-4	Tetrachloroethene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
1330-20-7	m,p-Xylenes	2.0	U
100-42-5	Styrene	1.0	U
95-47-6	o-Xylene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U
108-67-8	1,3,5-Trimethylbenzene	1.0	U
95-63-6	1,2,4-Trimethylbenzene	1.0	U
541-73-1	1,3-Dichlorobenzene	1.0	U
106-46-7	1,4-Dichlorobenzene	1.0	U
95-50-1	1,2-Dichlorobenzene	1.0	U
120-82-1	1,2,4-Trichlorobenzene	1.0	U
87-68-3	Hexachlorobutadiene	1.0	U

1/29

Data Review and Validation for: GC/MS Volatile Organic Compounds (VOCs) - Air Samples

Project Name & Task:	CNC	Zone F, AOC 607, BLDG 225	
Project # & Case/SDG:	158814.ZF.PR.15	5028	
Methods:	☑ TO- 14 ☐ SW-846 ☐ EPA Method	☑ Other: Low-level SIM	
Program:	☐ AFCEE ☐ NFESC ☐ Other	**Number of Samples:** 12	
Field QC Samples:	9/10 - J. Nap		
Reviewed by & Date:	A. Gallup	11/29/2001	
Matrix:	☐ Tedlar Bag ☑ Summa Cannister ☐ Other		

Quality Control	Form #	Requirements	Check (If No* checked, see comments)	Flags Applied (see comments)
Data Pkg Complete (DP)	Pkg	All required deliverables in pkg	☑ OK ☐ No* ☐ Not provided	☐ Flags Applied
	COC	All samples on COC reported	☑ OK ☐ No*	☐ Flags Applied
Holding Times (HT)	1	Tedlar Bags (72 hours)	☐ OK ☐ No*	☐ Flags Applied
	COC	Summa Canisters (14 days)	☐ OK ☑ No*	☐ Flags Applied
		Other:	☐ OK ☐ No*	☐ Flags Applied
Surrogates (SS)	2	Method surrogates used	☑ OK ☐ No* ☐ Not provided	☐ Flags Applied
		Recovery Limits: ☑ Lab ☐ Meth	☑ OK ☐ No* ☐ Diluted out	
MS/MSD or MS/LD	3	Matrix Spikes Provided	☐ MS/MSD ☐ MS/LD ☑ None*	☐ Flags Applied
		Correct Spike Used	☐ OK ☐ No*	
		Acceptance Limits: ☐ Lab ☐ Meth	☐ OK ☐ No* ☐ Diluted out	
LCS (BS) ☐ LCS only ☐ LCS/LCSD	3	LCS per prep. batch	☐ OK ☐ No*	☐ Flags Applied
		Acceptance criteria met	☐ OK ☐ No* NA	
Blanks (MB,TB,EB, FB/AB)	1	Detects (> MDL or RL/CRQL)	☐ All ND ☐ see blnk wksht	☐ Flags Applied
Method/Lab Blank (MB)	5	Meth Blnk per ~~12-hr~~ shift 24	☐ OK ☐ No*	
Tune - BFB (TN) prior to sample analysis	5	Initial & Begin of ~~12-hr~~ shift 24	☑ OK ☐ No* SIM	☐ Flags Applied
		Mass Assignment Correct	☑ OK ☐ No* validated	
		Ion Abundance Criteria met	☑ OK ☐ No* CAL-685	
Initial Calibration (IC)	6	Minimum of 5 levels	☑ OK ☐ No*	☐ Flags Applied
		Linearity criteria met	☑ OK ☐ No* ☐ see cal wksht	
		Minimum RRF criteria met	☑ OK ☐ No* ☐ see cal wksht	
Continuing Calib. Verif. (CC) prior to sample analysis	7	Analyzed at begin of ~~12-hr~~ shift 24	☐ OK ☐ No*	☐ Flags Applied
		%diff or %drift criteria met	☐ OK ☐ No* ☐ see cal wksht	
		Minimum RRF criteria met	☐ OK ☐ No* ☐ see cal wksht	
	8	Int. Std. RT/Area criteria met	☐ OK ☐ No*	
Internal Standards (IS)	8	Sample IS area criteria met	☑ OK ☐ No*	☐ Flags Applied
Sample Evaluation	1	All hits within cal. Range	☐ OK ☑ No* ☐ All ND	☐ Flags Applied
	5	Samples w/in ~~12-hr~~ clock 24hr	☐ OK ☐ No*	
	raw	Manual Integration performed	☐ No ☐ see comments	
Field Duplicate (FD)	1	Precision of native vs Field Dup	☑ OK ☐ No* ☐ N/A	☐ Flags Applied

This sheet is applicable to multiple methods. All requirement items may not apply to every analytical method.

Case Narrative Comments: NO EXCEPTIONS NOTED

QC Item	Comments
HT	14 Days used as Guidance. Analysis within 23 days.
Sample E.	Tetrachloroethene exceeded calibration range

Data Review and Validation for: GC/MS Volatile Organic Compounds (VOCs) - Air Samples

Project Name & Task:	CNC	ZONE F, AOC 607, BLDG 225	
Project # & Case/SDG:	158814.ZF.PR.15	5028	
Methods:	☒ TO-14 ☐ SW-846 ☐ EPA Method	☐ Other Low Level - SIM	
Program:	☐ AFCEE ☐ NFESC ☐ Other	**Number of Samples:**	12
Field QC Samples:	9/10 - MS/MSD		
Reviewed by & Date:	A. Kelly	1/29/2001	
Matrix:	☐ Tedlar Bag ☒ Summa Canister ☐ Other		

Sample Man.

for samples #1 & #6. The samples were not re-analyzed because a full-scan analysis had also been performed. Flagged results "R" → LR.

1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AS00101

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5028 SAS No.: 011200 SDG No.: 5028

Matrix: (air/soil/water) Air Lab Sample ID: 502801

Level: (low/med) LOW Lab File ID: 502801R3.D

GC Column: DB-VRX ID: 0.25 (mm) Date Received: 12/26/00

Date Analyzed: 01/12/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPTV	Q
75-01-4	Vinyl chloride	50.0	U
156-60-5	trans-1,2-Dichloroethene	50.0	U
156-59-2	cis-1,2-Dichloroethene	50.0	U
79-01-6	Trichloroethene	51.0	
127-18-4	Tetrachloroethene	4190	~~E~~ R

LR

1/29/2001

1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AS00201

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5028 SAS No.: 011200 SDG No.: 5028

Matrix: (air/soil/water) Air Lab Sample ID: 502802

Level: (low/med) LOW Lab File ID: 502802R3.D

GC Column: DB-VRX ID: 0.25 (mm) Date Received: 12/26/00

Date Analyzed: 01/12/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPTV	Q
75-01-4	Vinyl chloride	50.0	U
156-60-5	trans-1,2-Dichloroethene	50.0	U
156-59-2	cis-1,2-Dichloroethene	50.0	U
79-01-6	Trichloroethene	50.0	U
127-18-4	Tetrachloroethene	270	

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1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AS00301

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5028 SAS No.: 011200 SDG No.: 5028

Matrix: (air/soil/water) Air

Level: (low/med) LOW

GC Column: DB-VRX ID: 0.25 (mm)

Lab Sample ID: 502803

Lab File ID: 502803R4.D

Date Received: 12/26/00

Date Analyzed: 01/12/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPTV	Q
75-01-4	Vinyl chloride	93.7	
156-60-5	trans-1,2-Dichloroethene	247	
156-59-2	cis-1,2-Dichloroethene	51.5	U
79-01-6	Trichloroethene	175	
127-18-4	Tetrachloroethene	237	

1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AS00401

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5028 SAS No.: 011200 SDG No.: 5028

Matrix: (air/soil/water) Air Lab Sample ID: 502804

Level: (low/med) LOW Lab File ID: 502804R3.D

GC Column: DB-VRX ID: 0.25 (mm) Date Received: 12/26/00

Date Analyzed: 01/12/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPTV	Q
75-01-4	Vinyl chloride	100	
156-60-5	trans-1,2-Dichloroethene	50.0	U
156-59-2	cis-1,2-Dichloroethene	140	
79-01-6	Trichloroethene	110	
127-18-4	Tetrachloroethene	690	

1/29

1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AS00501

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5028 SAS No.: 011200 SDG No.: 5028

Matrix: (air/soil/water) Air Lab Sample ID: 502805

Level: (low/med) LOW Lab File ID: 502805R2.D

GC Column: DB-VRX ID: 0.25 (mm). Date Received: 12/26/00

Date Analyzed: 01/12/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPTV	Q
75-01-4	Vinyl chloride	75.8	
156-60-5	trans-1,2-Dichloroethene	50.5	U
156-59-2	cis-1,2-Dichloroethene	50.5	U
79-01-6	Trichloroethene	293	
127-18-4	Tetrachloroethene	121	

1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AS00601

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5028 SAS No.: 011200 SDG No.: 5028

Matrix: (air/soil/water) Air

Level: (low/med) LOW

GC Column: DB-VRX ID: 0.25 (mm)

Lab Sample ID: 502806

Lab File ID: 502806R2.D

Date Received: 12/26/00

Date Analyzed: 01/12/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPTV	Q
75-01-4	Vinyl chloride	50.0	U
156-60-5	trans-1,2-Dichloroethene	50.0	U
156-59-2	cis-1,2-Dichloroethene	50.0	U
79-01-6	Trichloroethene	50.0	U
127-18-4	Tetrachloroethene	5930	~~E~~

R - LR

1/29

1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AS00701

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5028 SAS No.: 011200 SDG No.: 5028

Matrix: (air/soil/water) Air

Level: (low/med) LOW

GC Column: DB-VRX ID: 0.25 (mm)

Lab Sample ID: 502807

Lab File ID: 502807R2.D

Date Received: 12/26/00

Date Analyzed: 01/12/01

Dilution Factor: 2

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPTV	Q
75-01-4	Vinyl chloride	425	
156-60-5	trans-1,2-Dichloroethene	85.0	U
156-59-2	cis-1,2-Dichloroethene	578	
79-01-6	Trichloroethene	1020	
127-18-4	Tetrachloroethene	612	

1/29

1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AS00801

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5028 SAS No.: 011200 SDG No.: 5028

Matrix: (air/soil/water) Air

Level: (low/med) LOW

GC Column: DB-VRX ID: 0.25 (mm)

Lab Sample ID: 502808

Lab File ID: 502808R2.D

Date Received: 12/26/00

Date Analyzed: 01/12/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPTV	Q
75-01-4	Vinyl chloride	50.0	U
156-60-5	trans-1,2-Dichloroethene	50.0	U
156-59-2	cis-1,2-Dichloroethene	50.0	U
79-01-6	Trichloroethene	50.0	U
127-18-4	Tetrachloroethene	50.0	U

1/29

1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225QS00901

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5028 SAS No.: 011200 SDG No.: 5028

Matrix: (air/soil/water) Air Lab Sample ID: 502809

Level: (low/med) LOW Lab File ID: 502809R2.D

GC Column: DB-VRX ID: 0.25 (mm) Date Received: 12/26/00

Date Analyzed: 01/12/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPTV	Q
75-01-4	Vinyl chloride	50.0	U
156-60-5	trans-1,2-Dichloroethene	50.0	U
156-59-2	cis-1,2-Dichloroethene	50.0	U
79-01-6	Trichloroethene	110	
127-18-4	Tetrachloroethene	50.0	U

1/29

1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AS00901

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5028 SAS No.: 011200 SDG No.: 5028

Matrix: (air/soil/water) Air

Level: (low/med) LOW

GC Column: DB-VRX ID: 0.25 (mm)

Lab Sample ID: 502810

Lab File ID: 502810R2.D

Date Received: 12/26/00

Date Analyzed: 01/12/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPTV	Q
75-01-4	Vinyl chloride	50.0	U
156-60-5	trans-1,2-Dichloroethene	50.0	U
156-59-2	cis-1,2-Dichloroethene	50.0	U
79-01-6	Trichloroethene	63.0	
127-18-4	Tetrachloroethene	50.0	U

1/29

1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AS01001

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5028 SAS No.: 011200 SDG No.: 5028

Matrix: (air/soil/water) Air

Level: (low/med) LOW

GC Column: DB-VRX ID: 0.25 (mm)

Lab Sample ID: 502811

Lab File ID: 502811R4.D

Date Received: 12/26/00

Date Analyzed: 01/12/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPTV	Q
75-01-4	Vinyl chloride	270	
156-60-5	trans-1,2-Dichloroethene	50.0	U
156-59-2	cis-1,2-Dichloroethene	200	
79-01-6	Trichloroethene	190	
127-18-4	Tetrachloroethene	150	

1/29

1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AS01101

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5028 SAS No.: 011200 SDG No.: 5028

Matrix: (air/soil/water) Air

Level: (low/med) LOW

GC Column: DB-VRX ID: 0.25 (mm)

Lab Sample ID: 502812

Lab File ID: 502812R3.D

Date Received: 12/26/00

Date Analyzed: 01/13/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPTV	Q
75-01-4	Vinyl chloride	100	
156-60-5	trans-1,2-Dichloroethene	860	
156-59-2	cis-1,2-Dichloroethene	110	
79-01-6	Trichloroethene	150	
127-18-4	Tetrachloroethene	940	

1/29

Data Review and Validation for: GC/MS Volatile Organic Compounds (VOCs) - Air Samples

Project Name & Task:	CNC	Zone F, AOC 607, BLDG 225	
Project # & Case/SDG:	158814.ZF.PR.15	5044	
Methods:	☑ TO-14 ☐ SW-846 ☐ EPA Method ☐ Other:		
Program:	☐ AFCEE ☐ NFESC ☐ Other	**Number of Samples:**	3
Field QC Samples:			
Reviewed by & Date:	H. Kelly	11/30/2001	
Matrix:	☐ Tedlar Bag ☑ Summa Canister ☐ Other		

Quality Control	Form #	Requirements	Check (If No* checked, see comments)	Flags Applied (see comments)
Data Pkg Complete (DP)	Pkg	All required deliverables in pkg.	☑ OK ☐ No* ☐ Not provided	☐ Flags Applied
	COC	All samples on COC reported	☑ OK ☐ No*	☐ Flags Applied
Holding Times (HT)	1	Tedlar Bags (72 hours)	☐ OK ☐ No*	☐ Flags Applied
	COC	Summa Canisters (~~7~~ days) 14	☑ OK ☐ No*	☐ Flags Applied
		Other:	☐ OK ☐ No*	☐ Flags Applied
Surrogates (SS)	2	Method surrogates used	☑ OK ☐ No* ☐ Not provided	☐ Flags Applied
		Recovery Limits: ☑ Lab ☐ Meth	☑ OK ☐ No* ☐ Diluted out	
MS/MSD or MS/LD	3	Matrix Spikes Provided	☐ MS/MSD ☐ MS/LD ☑ None*	☐ Flags Applied
		Correct Spike Used	☐ OK ☐ No*	
		Acceptance Limits: ☐ Lab ☐ Met	☐ OK ☐ No* ☐ Diluted out	
LCS (BS) ☐ LCS only ☐ LCS/LCSD	3	LCS per prep. batch	☐ OK ☐ No*	☐ Flags Applied
		Acceptance criteria met	☐ OK ☐ No* NA	
Blanks (MB,TB,EB, FB/AB)	1	Detects (> MDL or RL/CRQL)	☑ All ND ☐ see blnk wksht	☐ Flags Applied
Method/Lab Blank (MB)	5	Meth Blnk per ~~12-hr~~ shift 24	☑ OK ☐ No*	
Tune - BFB (TN)	5	Initial & Begin of ~~12-hr~~ shift 24	☑ OK ☐ No*	☐ Flags Applied
prior to sample analysis		Mass Assignment Correct	☑ OK ☐ No*	
		Ion Abundance Criteria met	☑ OK ☐ No*	
Initial Calibration (IC)	6	Minimum of 5 levels	☑ OK ☐ No*	☐ Flags Applied
		Linearity criteria met	☑ OK ☐ No* ☐ see cal wksht	
		Minimum RRF criteria met	☑ OK ☐ No* ☐ see cal wksht	
Continuing Calib. Verif. (CC)	7	Analyzed at begin of ~~12-hr~~ shift 24	☑ OK ☐ No*	☐ Flags Applied
prior to sample analysis		%diff or %drift criteria met	☐ OK ☑ No* ☐ see cal wksht	
		Minimum RRF criteria met	☑ OK ☐ No* ☐ see cal wksht	
	8	Int. Std. RT/Area criteria met	☑ OK ☐ No*	
Internal Standards (IS)	8	Sample IS area criteria met	☑ OK ☐ No*	☐ Flags Applied
Sample Evaluation	1	All hits within cal. Range	☑ OK ☐ No* ☐ All ND	☐ Flags Applied
	5	Samples w/in ~~12-hr~~ clock 24	☑ OK ☐ No*	
	raw	Manual Integration performed	☐ No ☐ see comments	
Field Duplicate (FD)	1	Precision of native vs Field Dup	☐ OK ☐ No* ☑ N/A	☐ Flags Applied

This sheet is applicable to multiple methods. All requirement items may not apply to every analytical method.

Case Narrative Comments: CCV

QC Item	Comments
CC	1,2-Dichloro-1,1,2,2-Tetrafluoroethane = 37.4% D (high) compound NOT DETECTED - NO Flags applied

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CHEMHILL Applied Sciences Lab
CVO 2300 NW Walnut Boulevard
Corvallis, OR 97330-3638
(541) 752-4271 FAX (541) 752-0276

COC # _____

Project # 158814, ZF, PA: 15	**Purchase Order #**
Project Name Charleston Naval Complex / ZONE F, AOC 607, Bldg 235	
Company Name CHEMHILL / Dr. Jones	
Project Manager or Contact & Phone # Dean Williamson 335-952-7491	**Report Copy to:**
Requested Completion Date:	**Site ID** AOC 607, Bldg. 225
Sample Disposal: Dispose ☐ Return ☐	

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	LAB QC	TOTAL # OF CONTAINERS	Requested Analytical Method # (TO 14A; Sim, PCE, TCE, cis 1,2 DCE; Trans 1,2 DCE; Vinyl Chloride)	Preservative	Alternate Description	Lab ID
1-3-01	752 1992					X	025IA00010	11	1			116	-1
1-3-01	755 1605					X	025IA00020	2	1			120	-2
1-3-01	757 1551					X	025IA00030	1	1			122	-3

THIS AREA FOR LAB USE ONLY

Lab # 3044	Page 1 of 1
Lab PM	Custody Review
Log In	LIMS Verification
pH	Custody Seals Y N
	Ice Y N
QC Level 1 2 3 Other _____	
Cooler Temperature	

Relinquished By	Date/Time	Received By	Empty Bottles	Date/Time
Chris Blundy Chris Blundy	1-3-01 1630			
Sampled By and Title (Please sign and print name) Chris Blundy Chris Blundy	1-3-01 1650	Relinquished By (Please sign and print name)		Date/Time
Received By (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)		Date/Time
Received By (Please sign and print name)	Date/Time	**Shipped Via** UPS ☐ Fed-Ex Other _____	**Shipping #**	

Special Instructions:
133 538 598. 232 188. 224

1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AI00101

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5044 SAS No.: 011001 SDG No.: 5044

Matrix: (air/soil/water) Air

Level: (low/med) LOW

GC Column: DB-VRX ID: 0.25 (mm)

Lab Sample ID: 504401

Lab File ID: 504401.D

Date Received: 01/04/01

Date Analyzed: 01/11/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPBV	Q
75-71-8	Dichlorodifluoromethane	0.6	J
74-87-3	Chloromethane	0.6	J
76-14-2	1,2-Dichloro,1,1,2,2-tetrafluoroethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
74-83-9	Bromomethane	1.0	U
75-00-3	Chloroethane	1.0	U
75-69-4	Trichlorofluoromethane	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-09-2	Methylene chloride	0.5	J
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
156-59-2	cis-1,2-Dichloroethene	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
71-43-2	Benzene	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
79-01-6	Trichloroethene	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
108-88-3	Toluene	1.0	U
106-93-4	1,2-Dibromoethane	1.0	U
127-18-4	Tetrachloroethene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
1330-20-7	m,p-Xylenes	2.0	U
100-42-5	Styrene	1.0	U
95-47-6	o-Xylene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U
108-67-8	1,3,5-Trimethylbenzene	1.0	U
95-63-6	1,2,4-Trimethylbenzene	1.0	U
541-73-1	1,3-Dichlorobenzene	1.0	U
106-46-7	1,4-Dichlorobenzene	1.0	U
95-50-1	1,2-Dichlorobenzene	1.0	U
120-82-1	1,2,4-Trichlorobenzene	1.0	U
87-68-3	Hexachlorobutadiene	1.0	U

1/20/01

1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AI00202

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5044 SAS No.: 011001 SDG No.: 5044

Matrix: (air/soil/water) Air

Level: (low/med) LOW

GC Column: DB-VRX ID: 0.25 (mm)

Lab Sample ID: 504402

Lab File ID: 504402.D

Date Received: 01/04/01

Date Analyzed: 01/11/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPBV	Q
75-71-8	Dichlorodifluoromethane	0.7	J
74-87-3	Chloromethane	0.6	J
76-14-2	1,2-Dichloro,1,1,2,2-tetrafluoroethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
74-83-9	Bromomethane	1.0	U
75-00-3	Chloroethane	1.0	U
75-69-4	Trichlorofluoromethane	0.5	J
75-35-4	1,1-Dichloroethene	1.0	U
75-09-2	Methylene chloride	1.0	U
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
156-59-2	cis-1,2-Dichloroethene	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
71-43-2	Benzene	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
79-01-6	Trichloroethene	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
108-88-3	Toluene	1.0	U
106-93-4	1,2-Dibromoethane	1.0	U
127-18-4	Tetrachloroethene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
1330-20-7	m,p-Xylenes	2.0	U
100-42-5	Styrene	1.0	U
95-47-6	o-Xylene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U
108-67-8	1,3,5-Trimethylbenzene	1.0	U
95-63-6	1,2,4-Trimethylbenzene	1.0	U
541-73-1	1,3-Dichlorobenzene	1.0	U
106-46-7	1,4-Dichlorobenzene	1.0	U
95-50-1	1,2-Dichlorobenzene	1.0	U
120-82-1	1,2,4-Trichlorobenzene	1.0	U
87-68-3	Hexachlorobutadiene	1.0	U

1/11/30

1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AI00301

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5044 SAS No.: 011001 SDG No.: 5044

Matrix: (air/soil/water) Air Lab Sample ID: 504403

Level: (low/med) LOW Lab File ID: 504403.D

GC Column: DB-VRX ID: 0.25 (mm) Date Received: 01/04/01

Date Analyzed: 01/11/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPBV	Q
75-71-8	Dichlorodifluoromethane	0.6	J
74-87-3	Chloromethane	0.6	J
76-14-2	1,2-Dichloro,1,1,2,2-tetrafluoroethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
74-83-9	Bromomethane	1.0	U
75-00-3	Chloroethane	1.0	U
75-69-4	Trichlorofluoromethane	0.7	J
75-35-4	1,1-Dichloroethene	1.0	U
75-09-2	Methylene chloride	1.0	U
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
156-59-2	cis-1,2-Dichloroethene	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
71-43-2	Benzene	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
79-01-6	Trichloroethene	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
108-88-3	Toluene	1.0	U
106-93-4	1,2-Dibromoethane	1.0	U
127-18-4	Tetrachloroethene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
1330-20-7	m,p-Xylenes	2.0	U
100-42-5	Styrene	1.0	U
95-47-6	o-Xylene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U
108-67-8	1,3,5-Trimethylbenzene	1.0	U
95-63-6	1,2,4-Trimethylbenzene	1.0	U
541-73-1	1,3-Dichlorobenzene	1.0	U
106-46-7	1,4-Dichlorobenzene	1.0	U
95-50-1	1,2-Dichlorobenzene	1.0	U
120-82-1	1,2,4-Trichlorobenzene	1.0	U
87-68-3	Hexachlorobutadiene	1.0	U

1/30

Data Review and Validation for: GC/MS Volatile Organic Compounds (VOCs) - Air Samples

Project Name & Task:	CNC	Zone F, AOC 607, BLDG 225	
Project # & Case/SDG:	158814.ZF.PR.15	5044	
Methods:	☑ TO- 14 ☐ SW-846 ☐ EPA Method ☐ Other: Low level - SIM		
Program:	☐ AFCEE ☐ NFESC ☐ Other	**Number of Samples:** 3	
Field QC Samples:			
Reviewed by & Date:	K. Kelley	1/30/2001	
Matrix:	☐ Tedlar Bag ☑ Summa Canister ☐ Other		

Quality Control	Form #	Requirements	Check (If No* checked, see comments)	Flags Applied (see comments)
Data Pkg Complete (DP)	Pkg	All required deliverables in pkg.	☑ OK ☐ No* ☐ Not provided	☐ Flags Applied
	COC	All samples on COC reported	☑ OK ☐ No*	☐ Flags Applied
Holding Times (HT)	1	Tedlar Bags (72 hours)	☐ OK ☐ No*	☐ Flags Applied
	COC	Summa Canisters (7 days) 14	☑ OK ☐ No*	☐ Flags Applied
		Other:	☐ OK ☐ No*	☐ Flags Applied
Surrogates (SS)	2	Method surrogates used	☑ OK ☐ No* ☐ Not provided	☐ Flags Applied
		Recovery Limits: ☑ Lab ☐ Meth	☑ OK ☐ No* ☐ Diluted out	
MS/MSD or MS/LD	3	Matrix Spikes Provided	☐ MS/MSD ☐ MS/LD ☑ None*	☐ Flags Applied
		Correct Spike Used	☐ OK ☐ No*	
		Acceptance Limits: ☐ Lab ☐ Met	☐ OK ☐ No* ☐ Diluted out	
LCS (BS) ☐ LCS only ☐ LCS/LCSD	3	LCS per prep. batch	☐ OK ☐ No* NA	☐ Flags Applied
		Acceptance criteria met	☐ OK ☐ No*	
Blanks (MB,TB,EB, FB/AB)	1	Detects (> MDL or RL/CRQL)	☑ All ND ☐ see blnk wksht	☐ Flags Applied
Method/Lab Blank (MB)	5	Meth Blnk per ~~12~~ hr shift 24	☑ OK ☐ No*	
Tune - BFB (TN) prior to sample analysis	5	Initial & Begin of ~~12~~-hr shift 24	☑ OK ☐ No* SIM -	☐ Flags Applied
		Mass Assignment Correct	☑ OK ☐ No* also check	
		Ion Abundance Criteria met	☑ OK ☐ No* CAL. GAS	
Initial Calibration (IC)	6	Minimum of 5 levels	☑ OK ☐ No*	☐ Flags Applied
		Linearity criteria met	☑ OK ☐ No* ☐ see cal wksht	
		Minimum RRF criteria met	☑ OK ☐ No* ☐ see cal wksht	
Continuing Calib. Verif. (CC) prior to sample analysis	7	Analyzed at begin of ~~12~~-hr shift 24	☐ OK ☐ No*	☐ Flags Applied
		%diff or %drift criteria met	☐ OK ☐ No* ☐ see cal wksht	
		Minimum RRF criteria met	☐ OK ☐ No* ☐ see cal wksht	
	8	Int. Std. RT/Area criteria met	☑ OK ☐ No*	
Internal Standards (IS)	8	Sample IS area criteria met	☑ OK ☐ No*	☐ Flags Applied
Sample Evaluation	1	All hits within cal. Range	☑ OK ☐ No* ☐ All ND	☐ Flags Applied
	5	Samples w/in ~~12~~-hr clock 24	☑ OK ☐ No*	
Lab	raw	Manual Integration performed	☐ No ☐ see comments	
~~Field~~ Duplicate (FD)	1	Precision of native vs Field Dup	☑ OK ☐ No* ☐ N/A	☐ Flags Applied

This sheet is applicable to multiple methods. All requirement items may not apply to every analytical method.

Case Narrative Comments: NO EXCEPTIONS NOTED

QC Item	Comments
	NO Flags applied

1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AI00101

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5044 SAS No.: 011200 SDG No.: 5044

Matrix: (air/soil/water) Air Lab Sample ID: 504401

Level: (low/med) LOW Lab File ID: 504401R.D

GC Column: DB-VRX ID: 0.25 (mm) Date Received: 01/04/01

Date Analyzed: 01/12/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPTV	Q
75-01-4	Vinyl chloride	50.0	U
156-60-5	trans-1,2-Dichloroethene	120	
156-59-2	cis-1,2-Dichloroethene	50.0	U
79-01-6	Trichloroethene	50.0	U
127-18-4	Tetrachloroethene	50.0	U

1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AI00202

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5044 SAS No.: 011200 SDG No.: 5044

Matrix: (air/soil/water) Air Lab Sample ID: 504402

Level: (low/med) LOW Lab File ID: 504402R.D

GC Column: DB-VRX ID: 0.25 (mm) Date Received: 01/04/01

Date Analyzed: 01/12/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPTV	Q
75-01-4	Vinyl chloride	50.0	U
156-60-5	trans-1,2-Dichloroethene	50.0	U
156-59-2	cis-1,2-Dichloroethene	50.0	U
79-01-6	Trichloroethene	50.0	U
127-18-4	Tetrachloroethene	50.0	U

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AI00301

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5044 SAS No.: 011200 SDG No.: 5044

Matrix: (air/soil/water) Air

Level: (low/med) LOW

GC Column: DB-VRX ID: 0.25 (mm)

Lab Sample ID: 504403

Lab File ID: 504403R.D

Date Received: 01/04/01

Date Analyzed: 01/12/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPTV	Q
75-01-4	Vinyl chloride	50.0	U
156-60-5	trans-1,2-Dichloroethene	50.0	U
156-59-2	cis-1,2-Dichloroethene	50.0	U
79-01-6	Trichloroethene	50.0	U
127-18-4	Tetrachloroethene	50.0	U

1A

EPA SAMPLE NO.

VOLATILE ORGANICS ANALYSIS DATA SHEET

225AI00301DUP

Lab Name: CH2M HILL ASL Contract: 158814.ZF.PR.15

Lab Code: CVO Case No.: 5044 SAS No.: 011200 SDG No.: 5044

Matrix: (air/soil/water) Air

Level: (low/med) LOW

GC Column: DB-VRX ID: 0.25 (mm)

Lab Sample ID: 504403D

Lab File ID: 504403D.D

Date Received: 01/04/01

Date Analyzed: 01/12/01

Dilution Factor: 1

CONCENTRATION UNITS:

CAS NO.	COMPOUND	PPTV	Q
75-01-4	Vinyl chloride	50.0	U
156-60-5	trans-1,2-Dichloroethene	50.0	U
156-59-2	cis-1,2-Dichloroethene	50.0	U
79-01-6	Trichloroethene	50.0	U
127-18-4	Tetrachloroethene	50.0	U

APPENDIX E

Groundwater Analytical Results - Form 1

Data Review and Validation for: GC/MS Volatiles

Project Name & Task:	CHARLESTON	NAVAL SHIPYARD
Project # & Case/SDG:	158814.PM.01	36474
Methods:	☐ OLM03.2 ☑ SW-846 8260B ☐ EPA 624 ☐ Other:	
Program:	☐ AFCEE ☐ NFESC ☐ Other	**Number of Samples:** 11 + MS/MSD
Field QC Samples:	# 7-MS/MSD, 4/8-MB/FD, 9-EB1, 11-EB2, 10-TB	
Reviewed by & Date:	H. KELLY	1/30/2001
Matrix:	☑ Water ☐ Soil ☐ Other	

Quality Control	Form #	Requirements	Check (If No* checked, see comments)	Flags Applied (see comments)
Data Pkg Complete (DP)	Pkg	All required deliverables in pkg.	☑ OK ☐ No* ☐ Not provided	☐ Flags Applied
	COC	All samples on COC reported	☑ OK ☐ No*	☐ Flags Applied
Holding Times (HT)	1	Water 7/14d (unpres/pres)	☑ OK ☐ No*	☐ Flags Applied
	COC	Soil 14d (low)	☐ OK ☐ No*	☐ Flags Applied
		Soil (med/high)	☐ OK ☐ No*	☐ Flags Applied
Surrogates (SS)	2	Method surrogates used	☑ OK ☐ No* ☐ Not provided	☐ Flags Applied
		Recovery Limits: ☑ Lab ☐ Meth	☑ OK ☐ No* ☐ Diluted out	
MS/MSD or MS/LD	3	Matrix Spikes Provided	☑ MS/MSD ☐ MS/LD ☐ None*	☐ Flags Applied
		Correct Spike Used	☑ OK ☐ No*	
		Acceptance Limits: ☑ Lab ☐ Meth	☑ OK ☐ No* ☐ Diluted out	
LCS (BS) ☑ LCS only ☐ LCS/LCSD	3	LCS per prep. batch	☑ OK ☐ No*	☐ Flags Applied
		Acceptance criteria met	☑ OK ☐ No*	
Blanks (MB,TB,EB, FB/AB)	1	Detects (> MDL or RL/CRQL)	☑ All ND ☐ see blnk wksht	☐ Flags Applied
Method/Lab Blank (MB)	5	Meth Blnk per 12 hr shift	☑ OK ☐ No*	
Tune - BFB (TN) prior to sample analysis	5	Initial & Begin of 12-hr shift	☑ OK ☐ No*	☐ Flags Applied
		Mass Assignment Correct	☑ OK ☐ No*	
		Ion Abundance Criteria met	☑ OK ☐ No*	
Initial Calibration (IC)	6	Minimum of 5 levels	☑ OK ☐ No*	☐ Flags Applied
		Linearity criteria met	☑ OK ☐ No* ☐ see cal wksht	
		Minimum RRF criteria met	☑ OK ☐ No* ☐ see cal wksht	
Continuing Calib. Verif. (CC) prior to sample analysis	7	Analyzed at begin of 12-hr shift	☑ OK ☐ No*	☐ Flags Applied
		%diff or %drift criteria met	☑ OK ☐ No* ☐ see cal wksht	
		Minimum RRF criteria met	☑ OK ☐ No* ☐ see cal wksht	
	8	Int. Std. RT/Area criteria met	☑ OK ☐ No*	
Internal Standards (IS)	8	Sample IS area criteria met	☑ OK ☐ No*	☐ Flags Applied
Sample Evaluation	1	All hits within cal. Range	☐ OK ☑ No* ☐ All ND	☐ Flags Applied
	5	Samples w/in 12-hr clock	☑ OK ☐ No*	
	raw	Manual Integration performed	☐ No ☐ see comments	
Field Duplicate (FD)	1	Precision of native vs Field Dup	☑ OK ☐ No* ☐ N/A	☐ Flags Applied

This sheet is applicable to multiple methods. All requirement items may not apply to every analytical method.

Case Narrative Comments: Dilutions - #4,6,8

QC Item	Comments
S.Eval	Dilutions on Samples #4,6,8 due to high concentration of target analytes. Flag results for compounds exceeding calibration range in original analysis as "E", use results from diluted re-analysis.

Data Review and Validation for: GC/MS Volatiles

Project Name & Task:	CHARLESTON	NAVAL SHIPYARD
Project # & Case/SDG:	158814.PM.01	36474
Methods:	☐ OLM03.2 ☑ SW-846 8260B ☐ EPA 624 ☐ Other:	
Program:	☐ AFCEE ☐ NFESC ☐ Other	**Number of Samples:** 11 + MS/MSD
Field QC Samples:	#7-MS/MSD, 4/8-WATER/FD, 9-EB1, 4-EB-2, 10-TB	
Reviewed by & Date:	A. Kelly	1/30/2001
Matrix:	☑ Water ☐ Soil ☐ Other	

F. Dup #4 / #8 = NATIVE / F. Duplicate

	#4	#8	
V. Chloride	4.8	4.0	
E-1,2-DCE	0.81 J	0.68 J	
CIS-1,2-DCE	76.6	63.2	
TCE	174	162	
PCE	3880	2830	(31%D)

High DF = 1:50 No Flags applied

Ch f Custody/ Laboratory Analysis Form

Lab Batch/SDG ID: _____ 1 of 1

Laboratory:	GEL, Charleston, SC
Project Name:	Charleston Navy Complex
Site Name:	AOC 607
Project Number:	
TAT:	7 days
Project Manager:	Tom Beisel/ATL
Level:	EPA Level 3
Address:	ATL: 115 Perimater Center Pl. NE, Suite 700, Atlanta, GA 30346-1278
	GNV: 3011 SW Williston Road, Gainesville, FL 32608-3928
Send Report To:	see back of COC
EDD:	CNC format

	Sample ID	Station ID	Depth Begin	Depth End	Date & Time Collected	Matrix	# of containers	3V VOCs (SW8260)	2L SVOCs (SW8270)	1Q ASTM-D1385 (Hydrazine)	3L Pes/PCB (SW8081/8082)	2H Metals (SW6010/7000 series)	Hexavelent Chromium					Comments
001	607GMW0301	F607GW003			1-15-01/ 1105	WG	3	x										
002	607GMW0501	F607GW005			1-15-01/ 1140	WG	3	x										
003	607GMW1801	F607GW018			1-12-01/ 1235	WG	3	x										
004	607GMW2101	F607GW021	-	-	1-12-01/ 1140	WG	3	x										
006	607GMW2201	F607GW022			1-12-01/ 1320	WG	3	x										
007	607GMW2301	F607GW023			1-15-01/ 0940	WG	3	x										
	607GMW2401	F607GW024			1-15-01/ 1020	WG	3	x										
008	607KMW2401	F607GW024			1-15-01/1020	WG	3	x										MS
	607XMW2401	F607GW024			1-15-01/1020	WG	3	x										MSD
009	607HMW2501	F607GW021			1-12-01/1140	WG	3	x										[redacted]
005	607EMW2101	F607EMW21			1-12-01/ 1350	WQ	3	x										EB
010	607TMW2101	F607TMW21			1-8-01 1725	WQ	3	x										TB
011	607EMW2102	F607EMW22			1-15-01/1110													EB-2

Sampled By: Darryl Gates Date/Time: 1-12-01/

Additional Samplers: Chris Blundy

Received By Lab: Mike Kinsloe Date/Time: 1/15/01 1:20

Received By: Date/Time

Relinquished by: Chris Blundy Date/Time: 1-15-01 1320

Relinquished by: Date/Time

Shipped Via: UPS FedEx Hand Other _____

Remarks: VOC list on back of COC.

36474%

Page 1 of 2

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

607GMW0301

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 36474

Matrix: (soil/water) WATER Lab Sample ID: 36474001

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 8S610

Level: (low/med) LOW Date Received: 01/16/01

% Moisture: not dec. _____ Date Analyzed: 01/20/01

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
75-01-4	Vinyl chloride	1.0	U
156-60-5	trans-1,2-Dichloroethylene	1.0	U
156-59-2	cis-1,2-Dichloroethylene	1.0	U
79-01-6	Trichloroethylene	1.0	U
127-18-4	Tetrachloroethylene	1.0	U

1/20/2001

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

607GMW0501

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 36474

Matrix: (soil/water) WATER Lab Sample ID: 36474002

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 8S611

Level: (low/med) LOW Date Received: 01/16/01

% Moisture: not dec. _____ Date Analyzed: 01/20/01

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
75-01-4	Vinyl chloride	1.0	U
156-60-5	trans-1,2-Dichloroethylene	1.0	U
156-59-2	cis-1,2-Dichloroethylene	1.0	U
79-01-6	Trichloroethylene	1.0	U
127-18-4	Tetrachloroethylene	1.0	U

1/30

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

607GMW1801

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 36474

Matrix: (soil/water) WATER Lab Sample ID: 36474003

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 8S612

Level: (low/med) LOW Date Received: 01/16/01

% Moisture: not dec. _____ Date Analyzed: 01/20/01

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
75-01-4	Vinyl chloride	1.0	U
156-60-5	trans-1,2-Dichloroethylene	1.0	U
156-59-2	cis-1,2-Dichloroethylene	1.0	U
79-01-6	Trichloroethylene	1.0	U
127-18-4	Tetrachloroethylene	7.1	

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

607GMW2101

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 36474

Matrix: (soil/water) WATER Lab Sample ID: 36474004

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 8S513

Level: (low/med) LOW Date Received: 01/16/01

% Moisture: not dec. _____ Date Analyzed: 01/19/01

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q		
75-01-4	Vinyl chloride	4.8			
156-60-5	trans-1,2-Dichloroethylene	0.81	J		
156-59-2	cis-1,2-Dichloroethylene	71.6			
79-01-6	Trichloroethylene	202	~~B~~	R	LR
127-18-4	Tetrachloroethylene	2930	~~B~~	R	LR

1/30

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

607GMW2101DL

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 36474

Matrix: (soil/water) WATER Lab Sample ID: 36474004

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 8S615

Level: (low/med) LOW Date Received: 01/16/01

% Moisture: not dec. _____ Date Analyzed: 01/20/01

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 50.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
75-01-4	Vinyl chloride	50.0	U
156-60-5	trans-1,2-Dichloroethylene	50.0	U
156-59-2	cis-1,2-Dichloroethylene	53.2	D
79-01-6	Trichloroethylene	174	D
127-18-4	Tetrachloroethylene	3880	D

1/30

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

607GMW2201

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 36474

Matrix: (soil/water) WATER Lab Sample ID: 36474005

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 8S613

Level: (low/med) LOW Date Received: 01/16/01

% Moisture: not dec. _____ Date Analyzed: 01/20/01

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
75-01-4	Vinyl chloride	1.0	U
156-60-5	trans-1,2-Dichloroethylene	1.0	U
156-59-2	cis-1,2-Dichloroethylene	1.0	U
79-01-6	Trichloroethylene	0.81	J
127-18-4	Tetrachloroethylene	23.9	

11/30

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

607GMW2301

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 36474

Matrix: (soil/water) WATER Lab Sample ID: 36474006

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 8S511

Level: (low/med) LOW Date Received: 01/16/01

% Moisture: not dec. _____ Date Analyzed: 01/19/01

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
75-01-4	Vinyl chloride	6.1	
156-60-5	trans-1,2-Dichloroethylene	1.2	
156-59-2	cis-1,2-Dichloroethylene	107	E
79-01-6	Trichloroethylene	329	E
127-18-4	Tetrachloroethylene	2820	E

1/30

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

607GMW2301DL

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 36474

Matrix: (soil/water) WATER Lab Sample ID: 36474006

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 8S616

Level: (low/med) LOW Date Received: 01/16/01

% Moisture: not dec. _____ Date Analyzed: 01/20/01

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 50.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
75-01-4	Vinyl chloride	50.0	U
156-60-5	trans-1,2-Dichloroethylene	50.0	U
156-59-2	cis-1,2-Dichloroethylene	66.9	D
79-01-6	Trichloroethylene	214	D
127-18-4	Tetrachloroethylene	2540	D

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R DC
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1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

607GMW2401

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 36474

Matrix: (soil/water) WATER Lab Sample ID: 36474007

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 8S614

Level: (low/med) LOW Date Received: 01/16/01

% Moisture: not dec. _____ Date Analyzed: 01/20/01

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
75-01-4	Vinyl chloride	1.0	U
156-60-5	trans-1,2-Dichloroethylene	1.0	U
156-59-2	cis-1,2-Dichloroethylene	1.0	U
79-01-6	Trichloroethylene	1.0	U
127-18-4	Tetrachloroethylene	1.0	U

1/30

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

607HMW2501

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 36474

Matrix: (soil/water) WATER Lab Sample ID: 36474008

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 8S509

Level: (low/med) LOW Date Received: 01/16/01

% Moisture: not dec. _____ Date Analyzed: 01/19/01

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q	
75-01-4	Vinyl chloride	4.0		
156-60-5	trans-1,2-Dichloroethylene	0.68	J	
156-59-2	cis-1,2-Dichloroethylene	63.2		
79-01-6	Trichloroethylene	172	E	R
127-18-4	Tetrachloroethylene	2560	E	R

1/30

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

607HMW2501DL

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 36474

Matrix: (soil/water) WATER Lab Sample ID: 36474008

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 8S527

Level: (low/med) LOW Date Received: 01/16/01

% Moisture: not dec. _____ Date Analyzed: 01/19/01

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 50.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
75-01-4	Vinyl chloride	50.0	U
156-60-5	trans-1,2-Dichloroethylene	50.0	U
156-59-2	cis-1,2-Dichloroethylene	50.5	D
79-01-6	Trichloroethylene	162	D
127-18-4	Tetrachloroethylene	2830	D

1/30

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

607EMW2101

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 36474

Matrix: (soil/water) WATER Lab Sample ID: 36474009

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 8S508

Level: (low/med) LOW Date Received: 01/16/01

% Moisture: not dec. _____ Date Analyzed: 01/19/01

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

EB1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
75-01-4	Vinyl chloride	1.0	U
156-60-5	trans-1,2-Dichloroethylene	1.0	U
156-59-2	cis-1,2-Dichloroethylene	1.0	U
79-01-6	Trichloroethylene	1.0	U
127-18-4	Tetrachloroethylene	1.0	U

1/30

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

607TMW2101

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 36474

Matrix: (soil/water) WATER Lab Sample ID: 36474010

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 8S507

Level: (low/med) LOW Date Received: 01/16/01

% Moisture: not dec. _____ Date Analyzed: 01/19/01

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
75-01-4	Vinyl chloride	1.0	U
156-60-5	trans-1,2-Dichloroethylene	1.0	U
156-59-2	cis-1,2-Dichloroethylene	1.0	U
79-01-6	Trichloroethylene	1.0	U
127-18-4	Tetrachloroethylene	1.0	U

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

607EMW2102

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 36474

Matrix: (soil/water) WATER Lab Sample ID: 36474011

Sample wt/vol: 5.000 (g/ml) ML Lab File ID: 8S506

Level: (low/med) LOW Date Received: 01/16/01

% Moisture: not dec. _____ Date Analyzed: 01/19/01

GC Column: DB-624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(uL) Soil Aliquot Volume: _____(uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
75-01-4	Vinyl chloride	1.0	U
156-60-5	trans-1,2-Dichloroethylene	1.0	U
156-59-2	cis-1,2-Dichloroethylene	1.0	U
79-01-6	Trichloroethylene	1.0	U
127-18-4	Tetrachloroethylene	1.0	U

APPENDIX F

Farmer Model Results

APPENDIX F
SOIL GAS CALCULATIONS
Building 225, AOC 607 - Zone F
Charleston Naval Complex, North Charleston, South Carolina

OBJECTIVE: To estimate indoor air concentrations at Building 225, AOC 607 of the Charleston Naval Complex (CNC). Eleven soil gas samples were collected around the edge of the building on December 20, 2000. Analytical soil gas concentrations were converted to a soil gas emission rate using the Farmer Model. The average and maximum soil gas concentrations for each compound were used. These emission rates were then used to estimate indoor air concentrations using typical simplified assumptions. The Farmer model and these calculations are described in detail in Appendix A of the Air/Superfund National Technical Guidance Study Series (EPA, September 1992).

Section 1: ***Farmer Model Calculations***

The Farmer model is a simple screening tool, which uses the following equation is used to estimate steady-state contaminant flux (from soil gas to ambient air):

$$J = \frac{D_A(C_g - C_a)P_a^{10/3}}{LP_T^2}$$

Where,

D_A = Air Diffusion coefficient (Area/Time)

P_a = Air Filled Soil Porosity

P_T = Total Soil Porosity

C_g = Soil Gas Concentration (Mass/Volume)

C_a = Ambient Air Concentration (Mass/Volume)

L = Distance from source to point of exit (Length)

Given:

$C_{g,i}$ = Average and Maximum soil gas concentrations of compound i measured at Building 225 between all 11 soil gas samples.**

D_A = Obtained from CHEMDAT8 model user's manual (USEPA, 1994)

L = 3.4 feet = 1.04 m

(Average Depth to Shallow GW - Zone F RFI, Ensafe, 1997)

Assume:

Soil Gas Concentrations near the building are at steady state.

Contaminants are uniformly distributed throughout the soil.

Ambient air concentrations for all parameters are non-detect and given a value of zero in equation. This will calculate the maximum flux and be most conservative; Ca = 0

$P_T = P_a$ = 0.533

(Average porosity, shelby tube analyses, shallow zone - AOC 607, Zone F RFI, EnSafe, 1997)

APPENDIX F (CONTINUED)
SOIL GAS CALCULATIONS
Building 225, AOC 607 - Zone F
Charleston Naval Complex, North Charleston, South Carolina

Calculations:

Table F-1

Parameter	D_A (m^2/s)	Maximum $C_{g,MAX}$ ($\mu g/m^3$)	Maximum J_{MAX} ($\mu g/(s*m^2)$)	Average $C_{g,AVE}$ ($\mu g/m^3$)	Average J_{AVE} ($\mu g/(s*m^2)$)
1,1,2-Trichloro-1,2,2-Trifluoroethane	2.88E-06	6.24	7.49E-06	6.24	7.49E-06
1,1-Dichloroethene	9.00E-06	2.82	1.06E-05	2.82	1.06E-05
1,2,4-Trichlorobenzene	3.00E-06	9.81	1.23E-05	9.81	1.23E-05
1,2,4-Trimethylbenzene	6.40E-06	2.50	6.67E-06	2.50	6.67E-06
1,4-Dichlorobenzene	6.90E-06	3.67	1.06E-05	3.67	1.06E-05
Benzene	8.80E-06	22.10	8.11E-05	7.20	2.64E-05
Chloroform	1.04E-05	3.48	1.51E-05	3.15	1.36E-05
Chloromethane	1.26E-05	2.31	1.21E-05	1.76	9.27E-06
cis-1,2-Dichloroethene	7.36E-06	2.33	7.15E-06	1.04	3.18E-06
Dichlorodifluoromethane	6.03E-06	3.52	8.85E-06	3.19	8.01E-06
Ethylbenzene	7.50E-06	7.51	2.35E-05	5.08	1.59E-05
Hexachlorobutadiene	5.61E-06	24.67	5.77E-05	24.67	5.77E-05
m,p-xylenes	7.69E-06	13.69	4.39E-05	10.89	3.49E-05
Methylene Chloride	1.01E-05	6.71	2.83E-05	3.49	1.47E-05
o-xylene	8.70E-06	10.16	3.69E-05	5.19	1.88E-05
Styrene	7.10E-06	9.10	2.69E-05	4.91	1.45E-05
Tetrachloroethene	7.20E-06	78.64	2.36E-04	17.50	5.25E-05
Toluene	8.70E-06	67.85	2.46E-04	15.21	5.52E-05
trans-1,2-Dichloroethene	7.07E-06	3.47	1.02E-05	2.23	6.58E-06
Trichloroethene	7.90E-06	5.57	1.84E-05	1.40	4.62E-06
Vinyl Chloride	1.06E-05	1.11	4.88E-06	0.46	2.04E-06

Section 2: ***Indoor Air Calculations***

To estimate indoor air concentrations, the following set of equations can be used:

$$C_{in} = \frac{E}{Q}$$

$$E = J * A * F$$

$$Q = \frac{ACH}{3600} * V$$

Where,

C_{in} = Indoor air concentration (Mass/Volume)
E = Contaminant Infiltration Rate
Q = Building Ventilation Rate
A = Area of Building Floor
F = Fraction of floor through which soil gas can enter
ACH = Building air changes per hour
V = Volume of Building

APPENDIX F (CONTINUED)
SOIL GAS CALCULATIONS
Building 225, AOC 607 - Zone F
Charleston Naval Complex, North Charleston, South Carolina

Given: J = Calculated Steady State Contaminant Flux Values from Section 1.

Assume: Capillary fringe effects are not present.
All soil gas enters building to be conservative; F = 1
ACH = 0.5 (Typical Single Family House Default - Conservative)
V/A = Height of Interior building room (First Floor)= Constant = 3 m

Calculations:

Table F-2

Parameter	Maximum C_{in} ($\mu g/m^3$)	Average C_{in} ($\mu g/m^3$)	Region IX Ambient Air RBC ($\mu g/m^3$)	Ratio Max. C_{in} / RBC
1,1,2-Trichloro-1,2,2-Trifluoroethane	0.018	0.018	31,000	5.80E-07
1,1-Dichloroethene	0.025	0.025	0.038	6.69E-01
1,2,4-Trichlorobenzene	0.029	0.029	210	1.40E-04
1,2,4-Trimethylbenzene	0.016	0.016	6.2	2.58E-03
1,4-Dichlorobenzene	0.025	0.025	0.31	8.17E-02
Benzene	0.195	0.063	0.25	7.79E-01
Chloroform	0.036	0.033	0.084	4.31E-01
Chloromethane	0.029	0.022	1.1	2.65E-02
cis-1,2-Dichloroethene	0.017	0.008	37	4.64E-04
Dichlorodifluoromethane	0.021	0.019	210	1.01E-04
Ethylbenzene	0.056	0.038	1,100	5.12E-05
Hexachlorobutadiene	0.139	0.139	210	6.60E-04
m,p-xylenes	0.105	0.084	730	1.44E-04
Methylene Chloride	0.068	0.035	4.1	1.66E-02
o-xylene	0.088	0.045	730	1.21E-04
Styrene	0.065	0.035	1,100	5.88E-05
Tetrachloroethene	0.567	0.126	3.3	1.72E-01
Toluene	0.591	0.132	400	1.48E-03
trans-1,2-Dichloroethene	0.025	0.016	73	3.36E-04
Trichloroethene	0.044	0.011	1.1	4.00E-02
Vinyl Chloride	0.012	0.005	0.22	5.33E-02

**Calculations are based on detections (J or = qualifier) only. Parameters, 1,1,2-Trichloro-1,2,2-Trifluoroethane; 1,1-Dichloroethene; 1,2,4-Trichlorobenzene; 1,2,4-Trimethylbenzene; 1,4-Dichlorobenzene; and Hexachlorobutadiene were only detected on one soil gas sample out of the eleven.

APPENDIX G

Johnson-Ettinger Model Results

APPENDIX G
TABLE G-1
Johnson-Ettinger Indoor Air Model Output Summary
Building 225, AOC 607 - Zone F
Charleston Naval Complex, North Charleston, South Carolina

Chemical	Cas. No.	Max Groundwater Concentration (ug/L)	Estimated Max Indoor Air Concentration (ug/m^3)	Max ELCR	Max HI	Average Groundwater Concentration (ug/L)	Estimated Average Indoor Air Concentration (ug/m^3)	Avg ELCR	Avg HI	Risk Based Groundwater Target Concentration (ug/L)	Basis
Tetrachloroethene	127184	3880.0	87.1	1.38E-06	--	1856	42	6 62E-07	--	2802	C
Trichloroethene	79016	214.0	2.9	1.35E-07	--	138	1.9	8.70E-08	--	1583	C
Vinyl Chloride	75014	6.1	0.27	3.28E-08	0.00017	5	0.22	2.67E-08	0 00014	186	C
cis-1,2-Dichloroehthene	156592	71.6	0.37	--	0.00068	67	0 35	--	0.00064	105232	NC
trans-1,2-Dichloroethene	156605	1.2	0 014	--	0.00001	0.9	0 010	--	0.00001	93738	NC
Total:				**1.55E-06**	**0.00087**			**7.76E-07**	**0.00079**		

Foot Note:

C = Carcinogen

NC = Non-carcinogen

ELCR = Excess Lifetime Cancer Risk

HI = Hazard Index

Max = Maximum, Avg = Average

Assumptions/Input Factors:	Value	Basis
Avg GW temp =	23^0 C	Site-specific Measured by EnSafe
Soil Type =	Sandy loam	Site-specific from Soil Boring Logs
Depth to GW (cm) =	152.4	Site-Specific
Slab thickness (cm) =	31	Site-Specific
Slab below grade (cm) =	15	Site-Specific
Soil water filled porosity (cm^3/cm^3) =	0.3	Default value in J-E
Soil-bldg pressure differential ΔP (g/cm-s^2) =	40	Default value in J-E
Exposure Duration (years) =	2	Site-Specific